A417 Missing Link
TR010056

6.4 Environmental Statement
Appendix 9.3 Ground Investigation Factual Report
Part 2 of 5

Planning Act 2008

APFP Regulation 5(2)(a)
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

May 2021

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A417 Missing Link

Development Consent Order 202[x]

6.4 Environmental Statement
Appendix 9.3 Ground Investigation Factual Report
Part 2 of 5

Regulation Number:	5(2)(a)
Planning Inspectorate Scheme Reference	TR010056
Application Document Reference	6.4
Author:	A417 Missing Link

Version	Date	Status of Version
C01	May 2021	Application Submission

EUROPEAN GEOPHYSICAL SERVICES

REPORT ON THE

GEOPHYSICAL LOGGING

OF

SEVENTEEN BOREHOLES

AT

THE A417

BIRDLIP

Prepared For:

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NOV 2020/GENG1901_A417_35560_Nov20_rpt/SO91

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Checked by:	M/ Kynaston	27.11.2020
Revision1:	D. Hingley	07.12.2020

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1.0 INTRODUCTION

At the request of Geotechnical Engineering Ltd., borehole imaging and geophysical logging was carried out in seventeen boreholes for the A417 project near Birdlip, Gloucestershire.

The following report details phase the work completed by European Geophysical Services up until November 2020.

2.0 THE GEOPHYSICAL LOGGING METHODS

The Equipment and Field Procedure

A fully digital logging system with a 600m capacity motorised winch mounted in a 4x4 van was used.

All logging data was recorded digitally for reprocessing and archiving purposes.

The optical imager survey was carried out first to avoid the disturbance of the fluid by the geophysical logs which may affect water clarity.

Natural Gamma (Gam)

The tool measures the naturally occurring gamma radiation found in rocks and sediments. It is mainly used to detect the clays that contain potassium K^{40}, though the U^{238} series of elements and the Th^{232} series of elements also emit gamma radiation.

The higher the concentration of these clay minerals the greater the responses on the natural gamma log.

Acoustic Borehole Imager (ABI)

This tool scans the borehole wall through 360 degrees and records the acoustic reflection of the resulting signal in terms of amplitude and transit time (the travel time from the tool to the borehole wall). This technique requires a fluid filled borehole with a minimum of suspended solids, polymers or mud within the fluid column.

This sensitive technique responds to small diameter changes, rugosity and the acoustic nature of the borehole wall. It is primarily used for detecting fractures and other discontinuities. The resultant images are orientated (to magnetic North) 0° through 90°, 180° and 270° back to 0°.

The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is viewed on the way down the borehole to allow fine tuning of the acquisition parameters. The settings are then adjusted and the image recorded on the way up the borehole which ensures a constant line speed during acquisition.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore data within approximately one metre of magnetic steel casing is un-orientated.

2.0 THE GEOPHYSICAL LOGGING METHODS

Optical Borehole Imager (Optical)

A precision-machined prism and CCD camera assembly permits a high definition video image of the borehole wall to be captured in a variety of horizontal and vertical resolutions. The resulting image is digitised in the sonde for transmission to the surface acquisition system.

The image is then orientated to Magnetic North and displayed as an unwrapped image log. This enables a detailed structural interpretation to be made if required.

For the best results the optical imager should be run above the water level or in clean, clear fluid. The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is recorded on the way down the borehole to limit disturbance to the clarity of the water in the borehole by the logging tool.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage.

Focused Resistivity Log (Deep and Shallow)

The Focused Resistivity tool uses Guard Electrodes to focus the current into the formation. This gives excellent vertical resolution and good penetration, especially in highly conductive borehole fluids where a Normal Resistivity Sonde would not be as effective.

The tool has two electrode spacing’s to allow a deep and shallow depth of investigation.

The response of this log is a function of porosity, type of formation / mineralogy and its pore water quality. These logs aid in the identification of strata and quality of the pore water

Caliper (Cal)

This tool measures the mean diameter of the borehole. It is used to check the integrity of the borehole lining, and where the borehole is unlined to identify zones of washout, breakout or fissures.

2.0 THE GEOPHYSICAL LOGGING METHODS

Fluid Temperature (T)

There is a natural geothermal gradient of increasing temperature with depth. This gradient varies with the thermal conductivity of the geological formation and is modified by water flowing in, out or vertically though the borehole.

This log is used to determine flow patterns within the borehole and to identify flow zones.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Fluid Conductivity (EC or EC25)

The electrical conductivity (EC) of the water is related to its salinity and dissolved solids and is therefore a measure of the quality of the borehole water. The shape of the log trace can indicate zones of inflow.

Using data from the temperature log the electrical conductivity is corrected to 25°C (EC25).

This log is used to identify different zones of water quality.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Impeller Flowmeter (FV)

This log is used to determine any flow pattern within the borehole and identify flow zones. The tool uses an impeller and is normally run at a constant logging speed against the anticipated flow for the best response. The data is corrected for logging speed and a fluid velocity (FV) log is produced.

3.0 SITE DETAILS

Site
A417 Birdlip

OS Grid Ref: SO 9320 1556

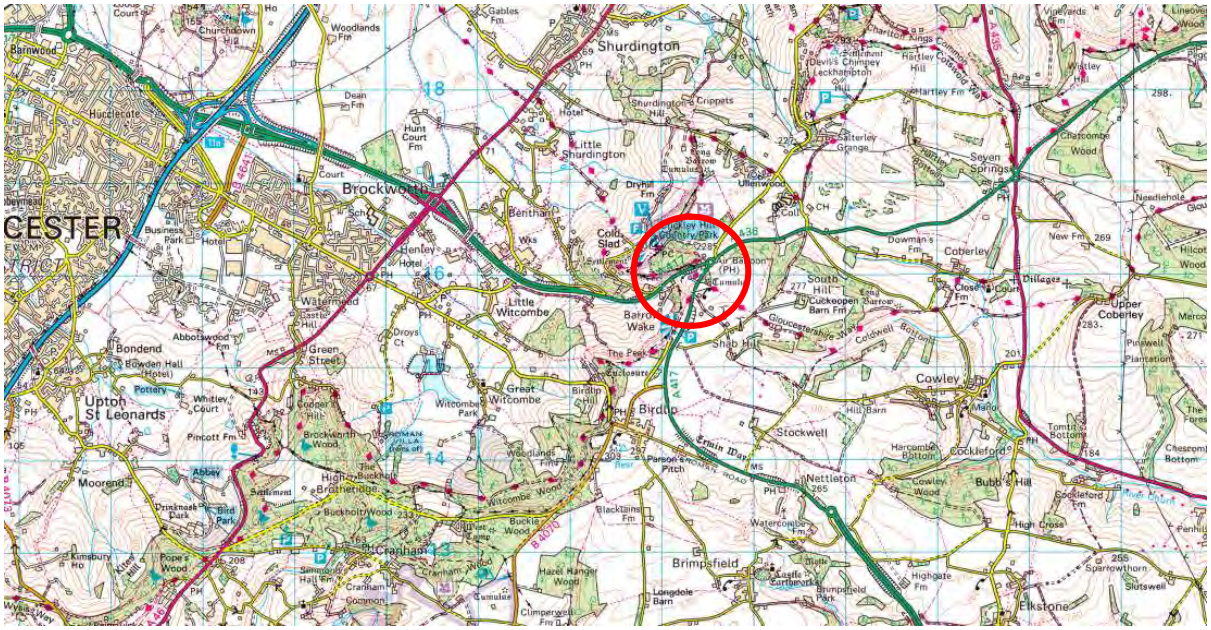


Figure 3.1 Location map showing site location highlighted by red circle. © Bing Maps 2020.

Figure 3.2 Aerial image showing approximate compound position. © Bing Maps 2020.

4.0 PROCESSING AND PRESENTATION OF IMAGER RESULTS

Detailed logs of the imager data have been produced at a vertical scale of 1:10.

Constructional details and information on each borehole are given in the headers of each log.

All images have been referenced to Magnetic North.

The borehole's azimuth and tilt are plotted alongside the images.

The image of the borehole wall is presented in an unwrapped form with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structural features and discontinuities have been picked from the images in the form of colour coded sinusoidal projections - see Appendix 1 for details. This 'Discontinuities' log is also presented with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structure picking is not a definitive analysis of all the features within a borehole. Only the discontinuities that have a linear dip and direction are 'picked' and used in the analysis of the discontinuities. Features that do not have a regular sinusoidal shape do not have a linear dip and direction, 'best fit' picking of these features is done if approximately 80% coverage of the sinusoid can be achieved. Below this percentage the inaccuracy of the picking is too great and if included in any structural analysis may adversely skew the results. Vughs, solution holes, and angular break outs are examples of features not picked.

The apparent azimuth and apparent dip (i.e. relative to the borehole's azimuth and tilt) of the discontinuities are calculated using the diameter of the borehole and the geometric parameters of the sinusoids overlaid on the discontinuities. The final processing stage is to correct these apparent values to true azimuth (in relation to Magnetic North) and true dip (from horizontal) by correcting for the borehole's azimuth and tilt.

The final results are presented as a 'tadpole' plot (Discontinuities - True°). The horizontal position of the tadpole's head gives the defect's true dip angle and its tail points in the direction of the defect's azimuth. These logs are presented with a horizontal scale in degrees. By convention the top of the page is North (Magnetic) and the right hand edge of the paper is East.

The true structural data has been presented in digital format as an excel file (xls).

5.0 BOREHOLE LOGGING CONSTRAINTS

- **Vehicle access restrictions**
  4x4 vehicle required

- **Tool access restrictions**
  None

- **Borehole conditions / risk to equipment**
  Multiple borehole withstability issues; some logged in stages due to collapse and/or risk to tools. See individual log headers for details.
- **Lack of fluid filled column / cloudy fluid**
  - Where there was insufficient fluid in the borehole, fluid logs (Fluid Temperature, Conductivity, Resistivity) could not be run.
  - In all boreholes the suspended sediment was too great to successfully run the flow logs. Multiple attempts were made, however not presentable data was obtained.

- **Time constraint**
  Onsite working hours prohibited working past 1700.

- **Borehole construction / casing**
  All boreholes cased to stable ground.

Appendix 1

Discontinuity Classification.

Discontinuity	Colour	Classification Parameters
Major Fracture or Fissure	Blue	An open break in the formation, that is **continuous** across the entire image.
Minor Fracture or Fissure	Turquoise	A thin or closed break in the formation, that is **continuous or discontinuous** across the image.
Vein	Green	That may be **continuous or discontinuous** across the entire image.
Fabric	Red	Defines a feature generally metamorphic, igneous or sedimentary in origin that may be **continuous or discontinuous** across the image, such as bedding and cross-bedding, schistosity or gneissosity.
Intrusions	Purple	Intrusive features such as dykes and sills, generally **continuous** across the image
Unknown	Black	Faint features which **can not** be classified.

Appendix 2

Geophysical Logs

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **CP217**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **392647.6E 215875.3N** Elevation: **194.95m**

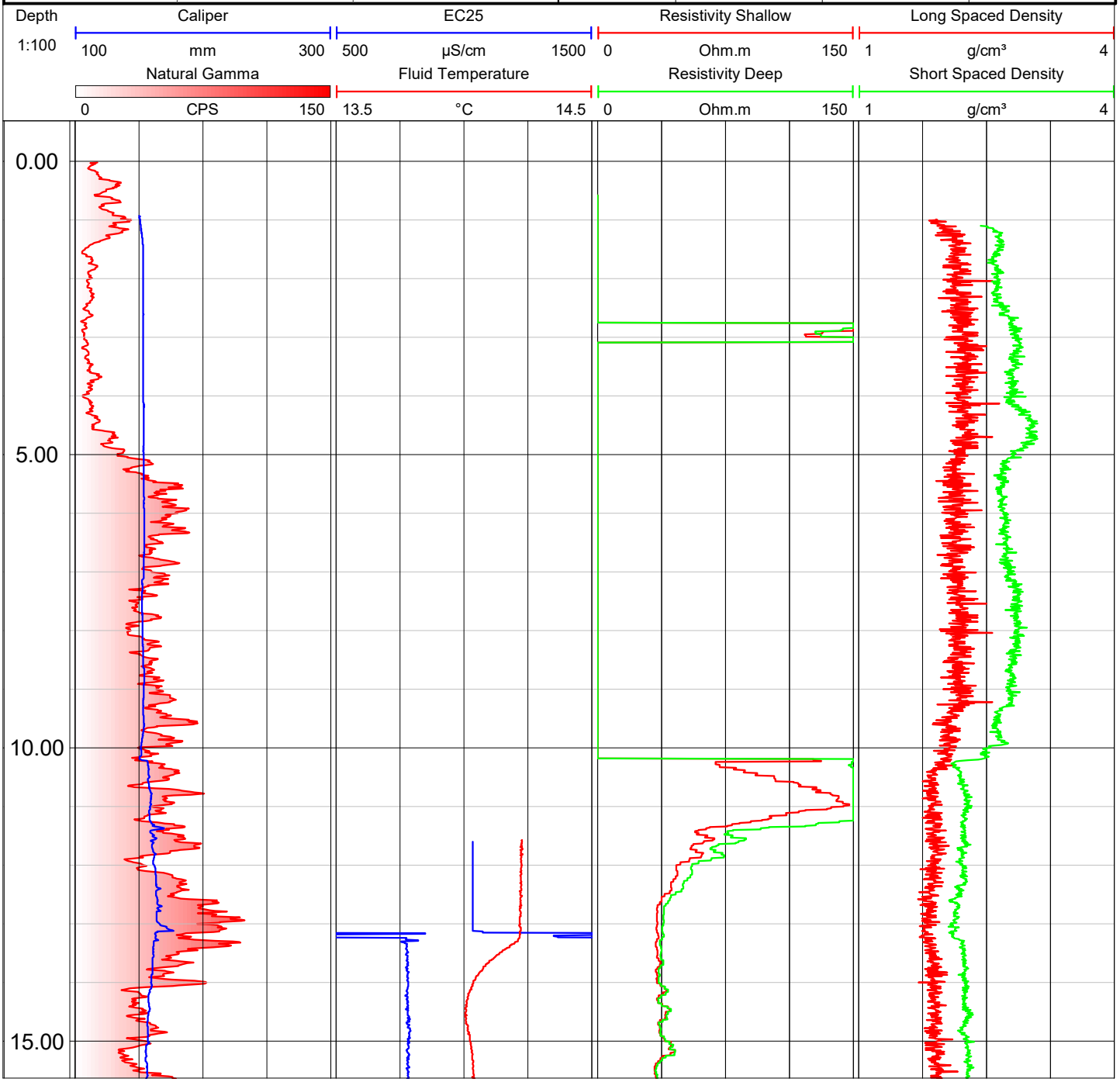
Drilled Depth: (m)	**33.6**	Date:	**9th August 2019**
Logged Depth: (m)	**33.6**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Logging completed immediately after drilling completed. Unable to run Optical Imager and flow logs. Water level dropping during logging.
Logged Interval: (m)	**1.0 - 33.6**		
Fluid Level: (m)	**8.1 - 13.0**		

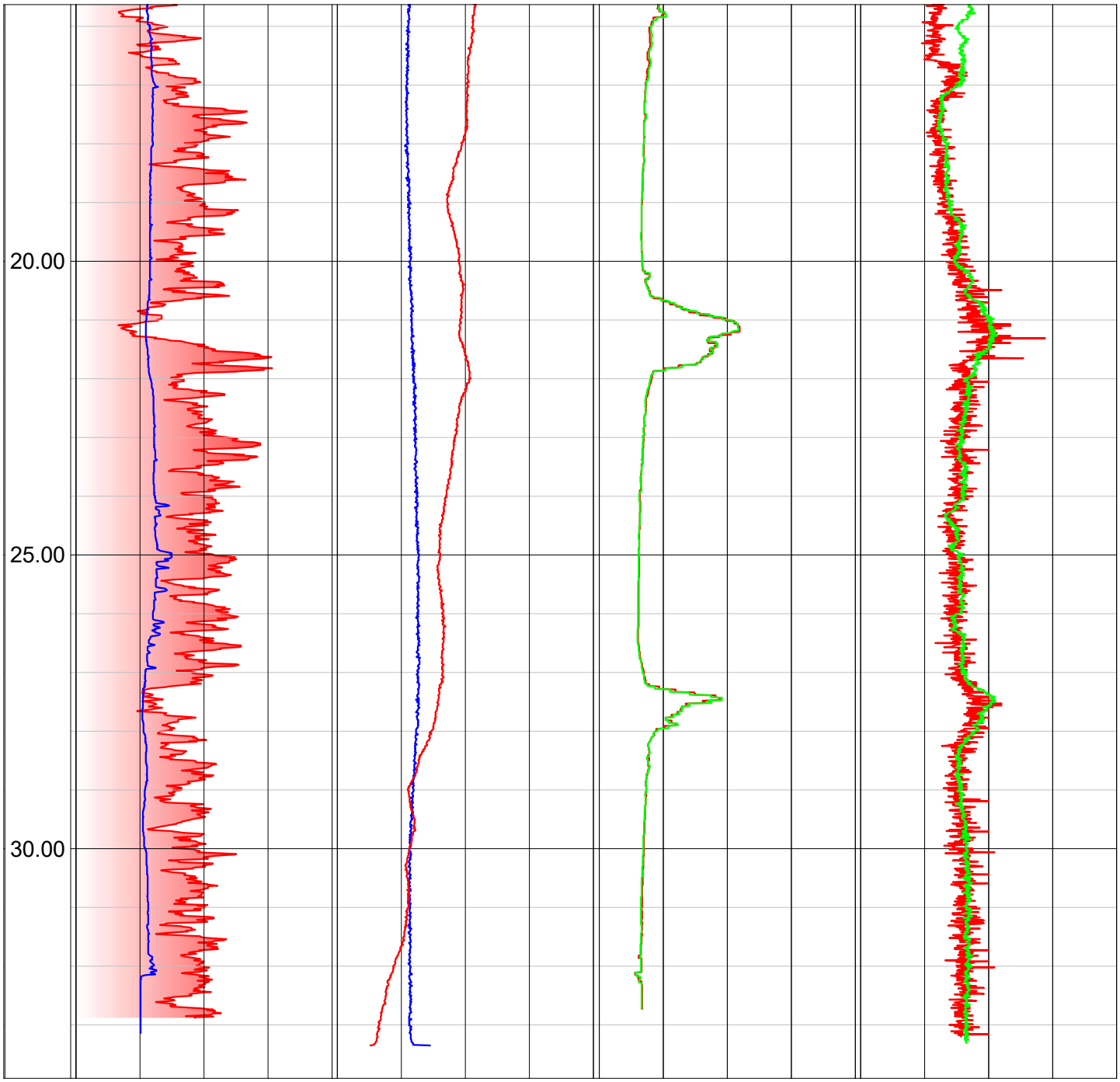
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
Geo	**0.0**	**33.6**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**geo**	**-0.7**	**10.3**

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30.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **CP217**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **392647.6E 215875.3N** Elevation: **194.95m**

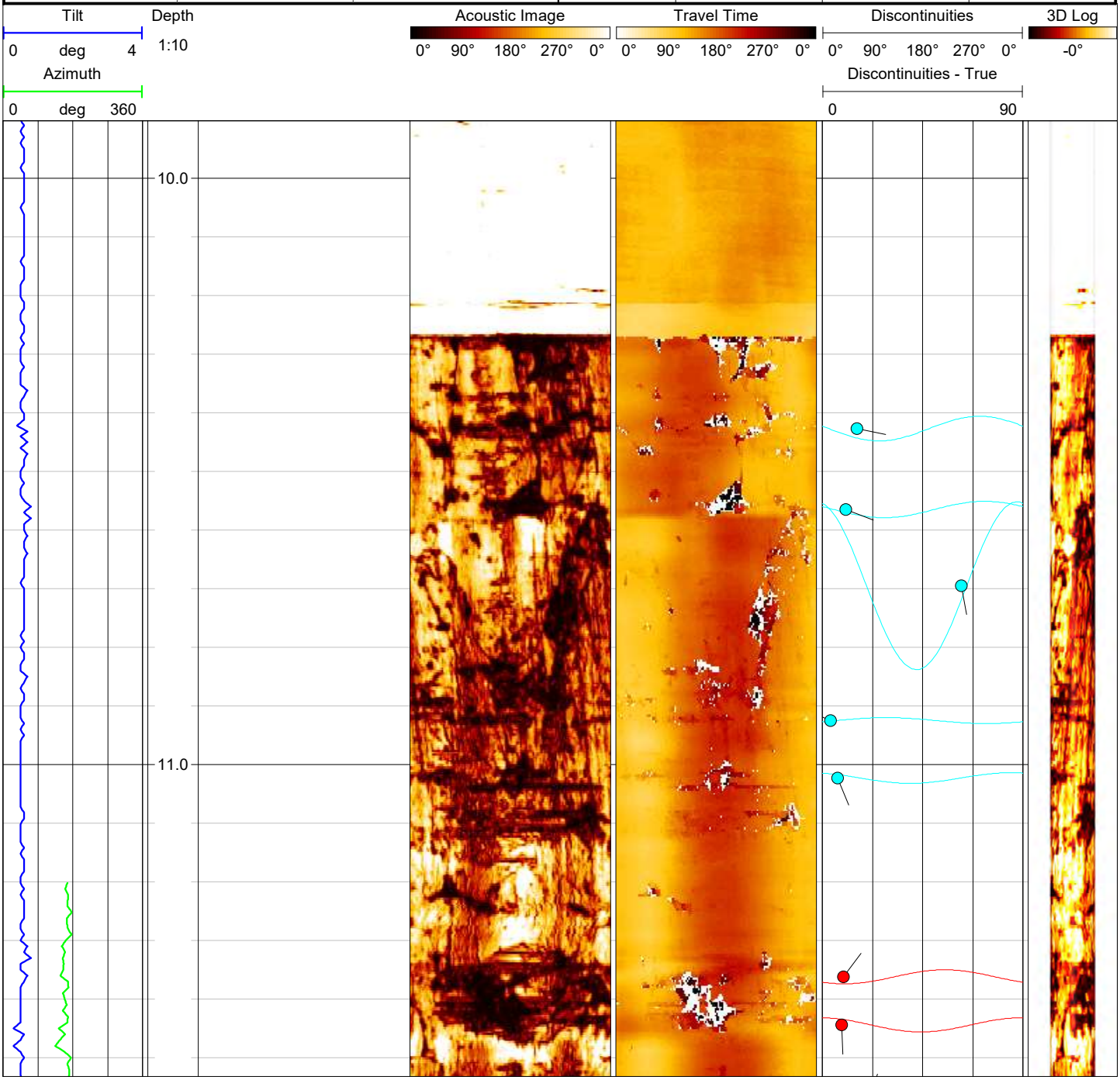
Drilled Depth: (m)	**33.6**	Date:	**9th August 2019**
Logged Depth: (m)	**33.6**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Logging completed immediately after drilling completed. Unable to run Optical Imager and flow logs. Water level dropping during logging.
Logged Interval: (m)	**10.3 - 33.6**		
Fluid Level: (m)	**~8.1**		

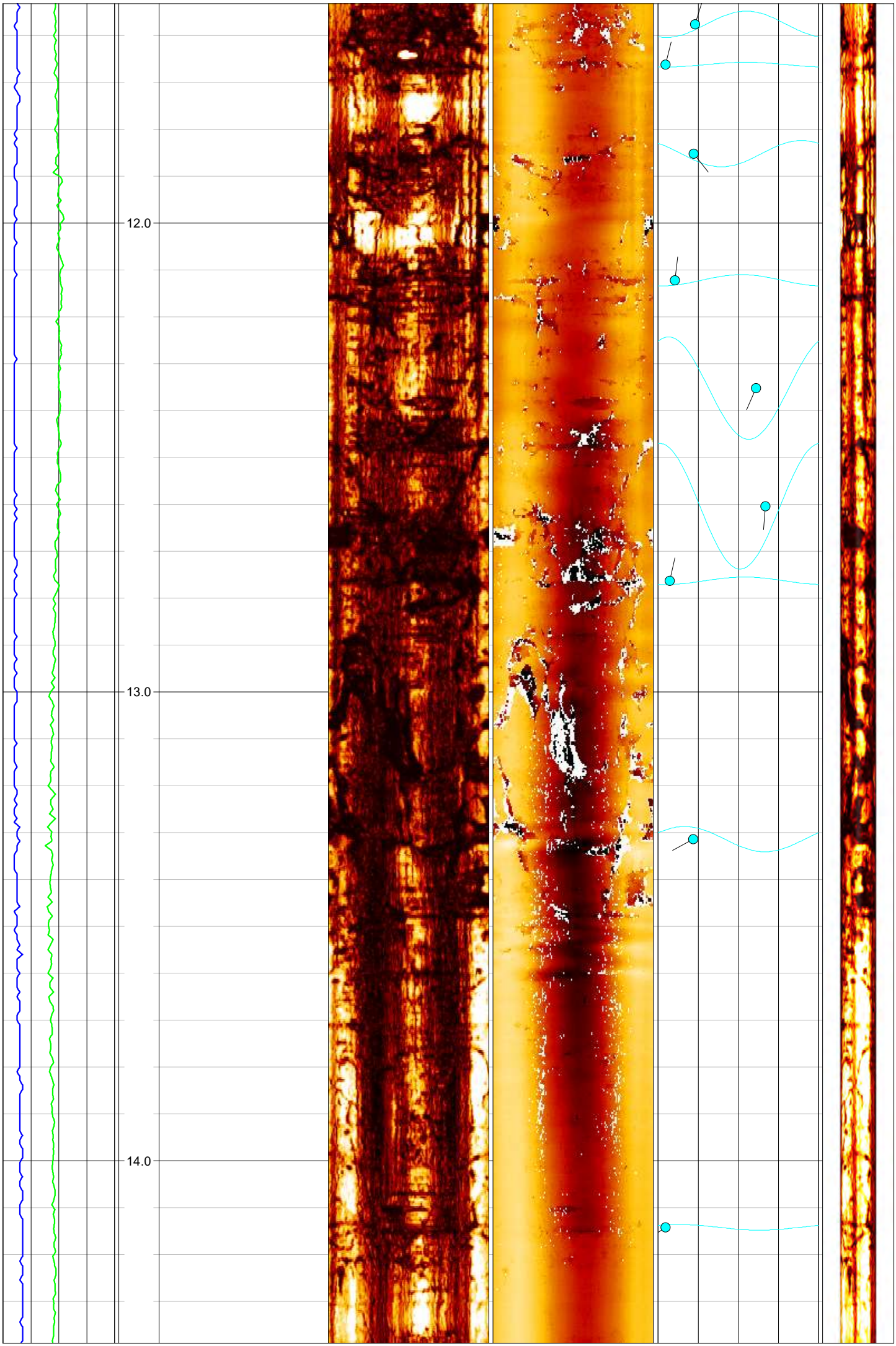
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
Geo	**0.0**	**33.6**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**geo**	**-0.7**	**10.3**

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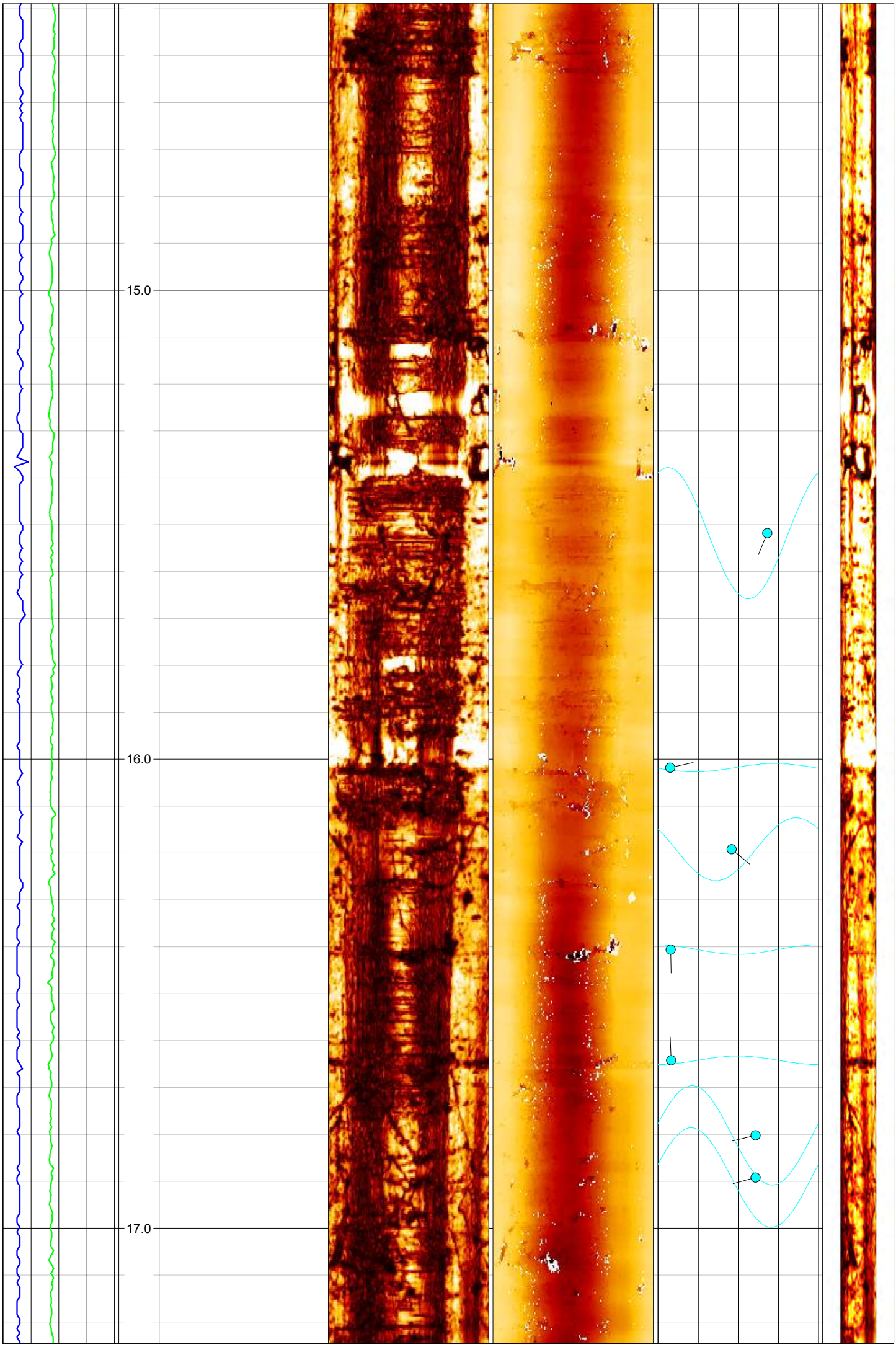
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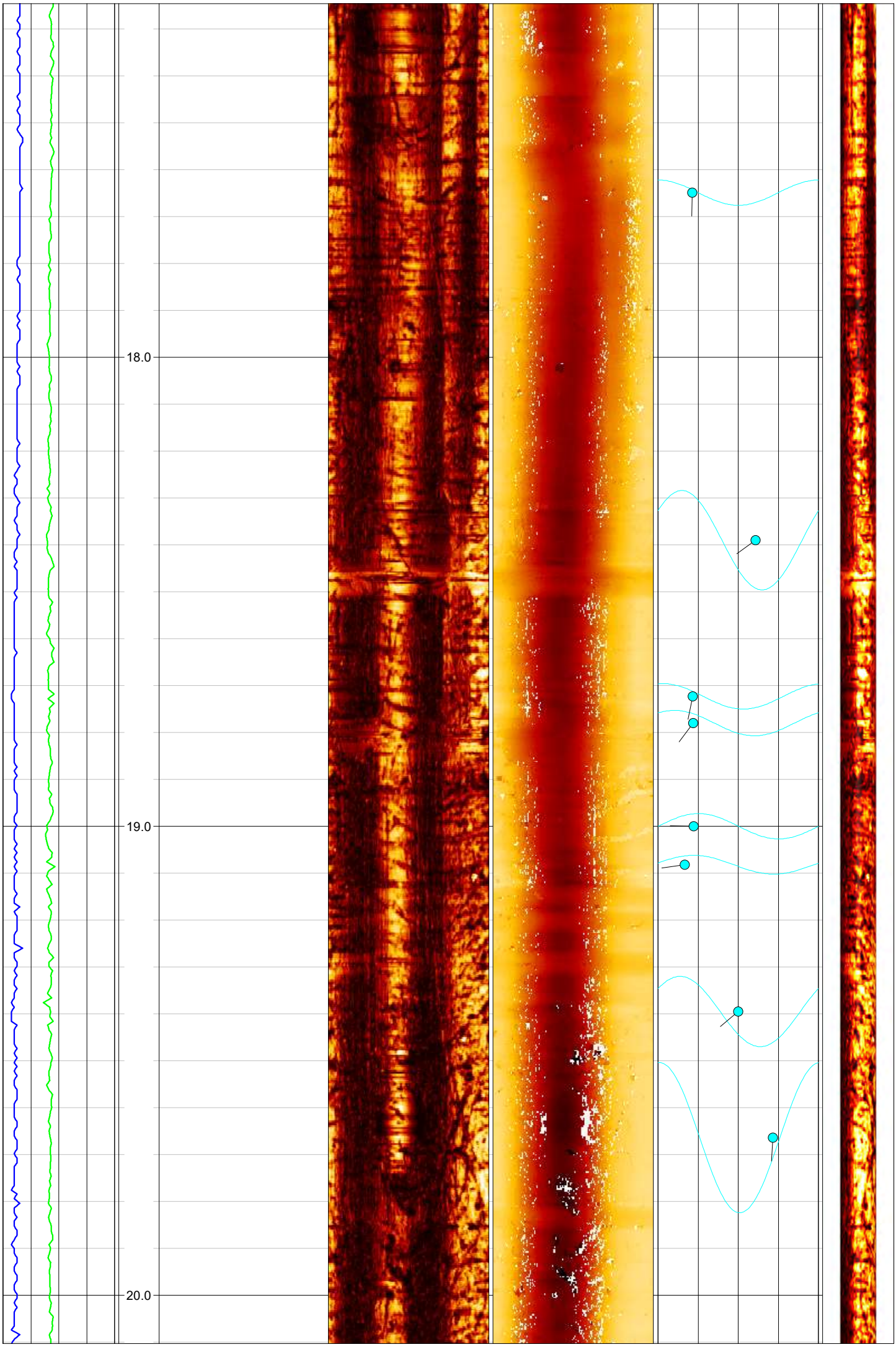
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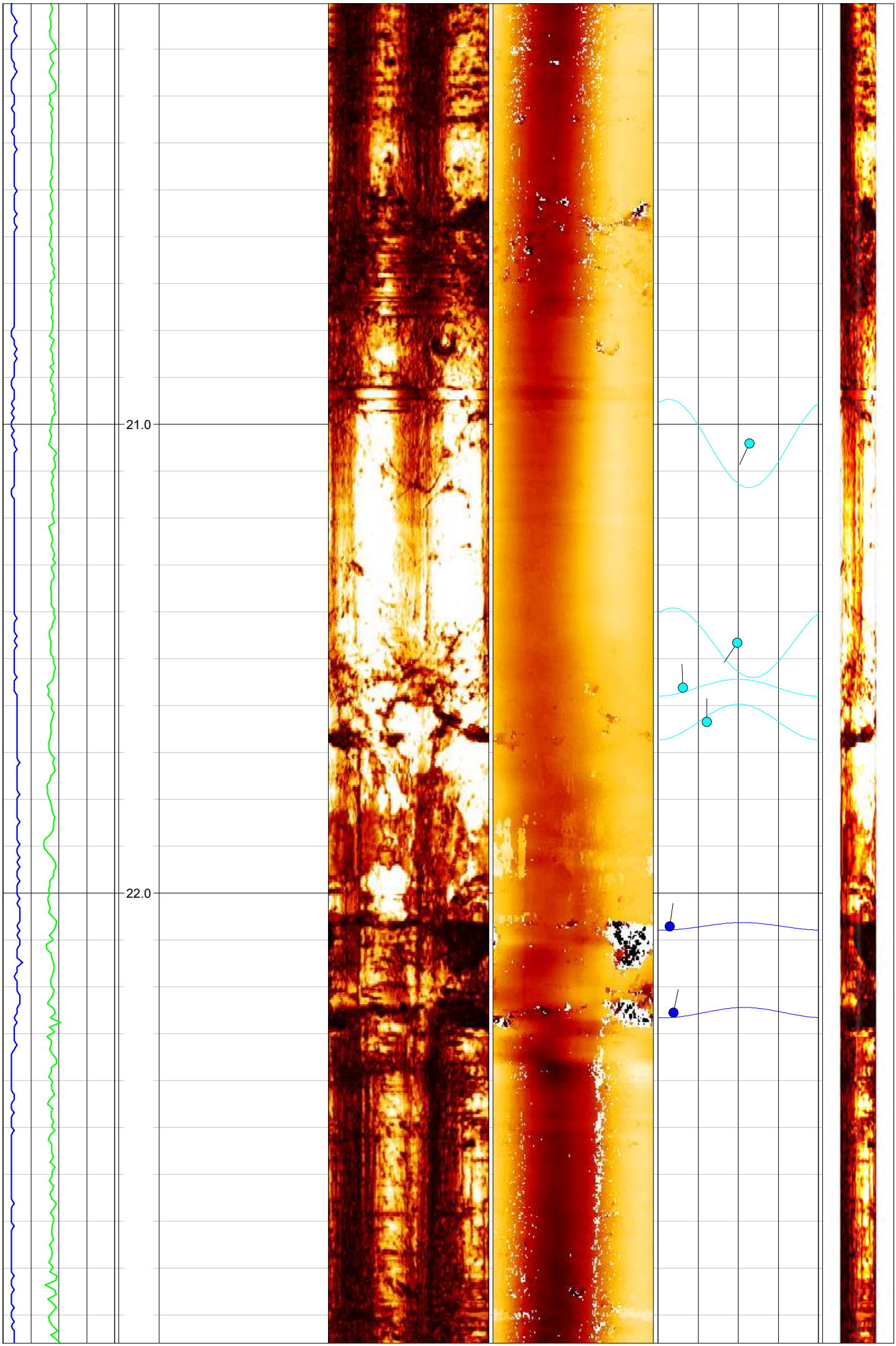
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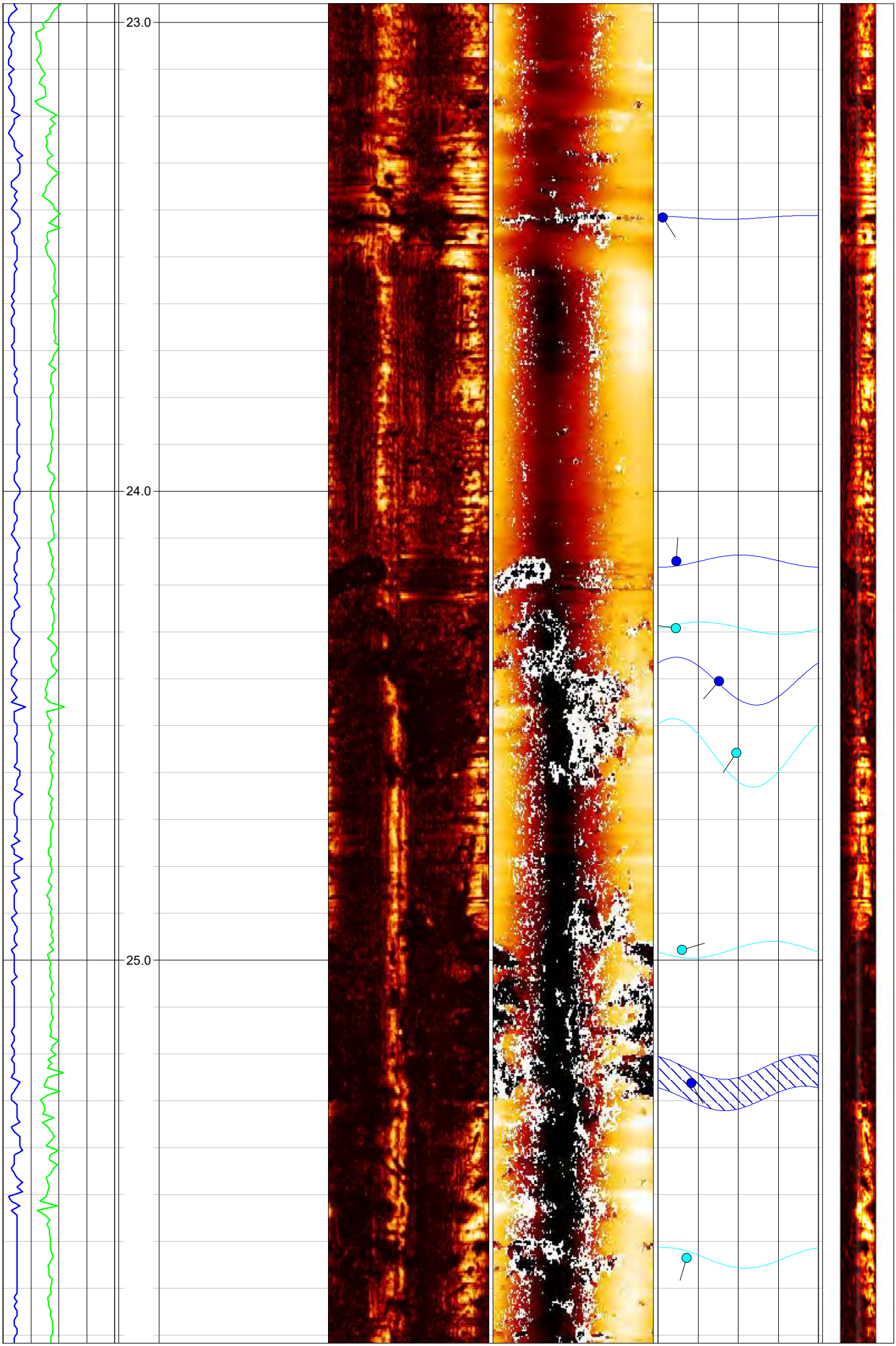
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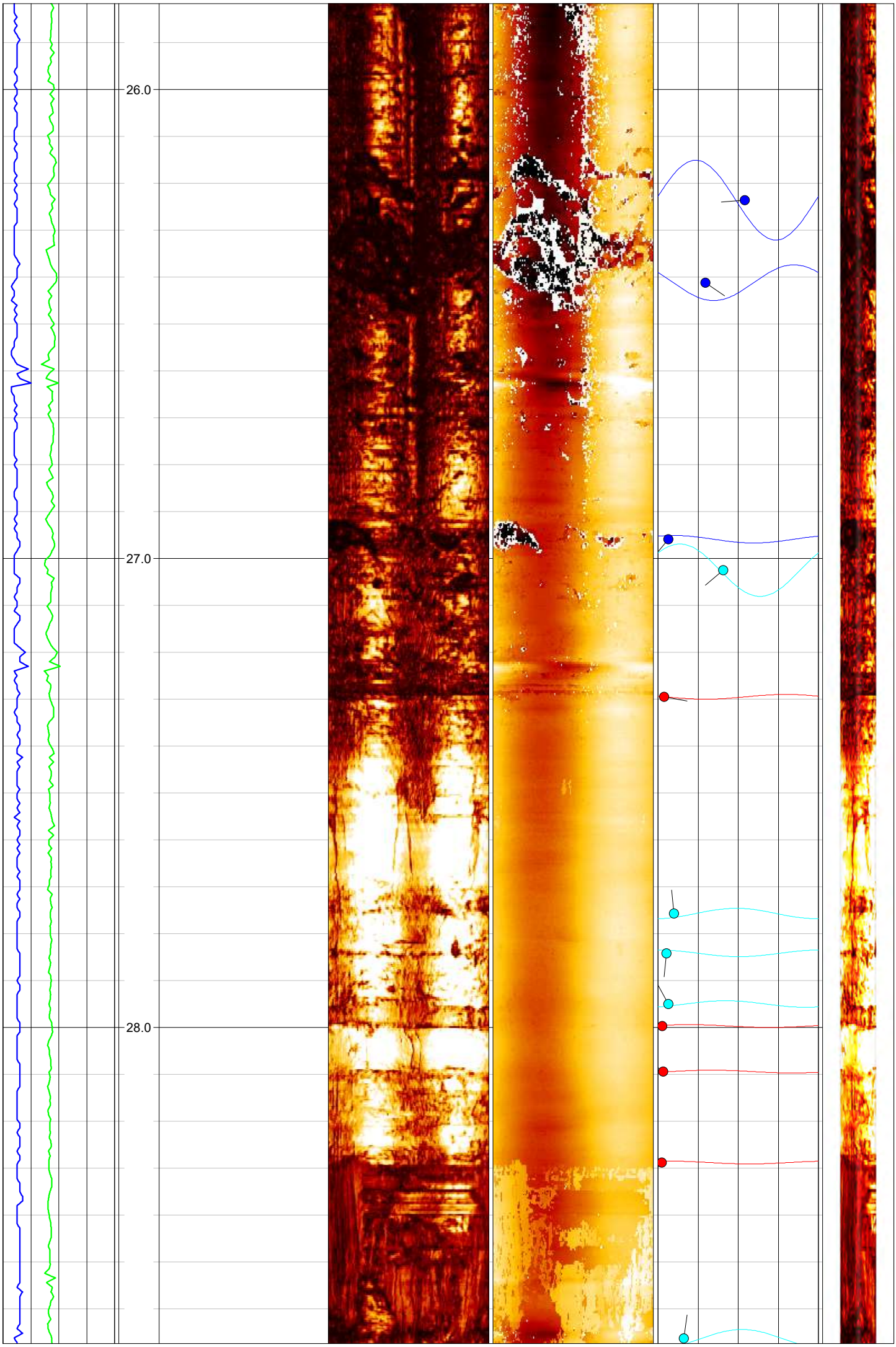
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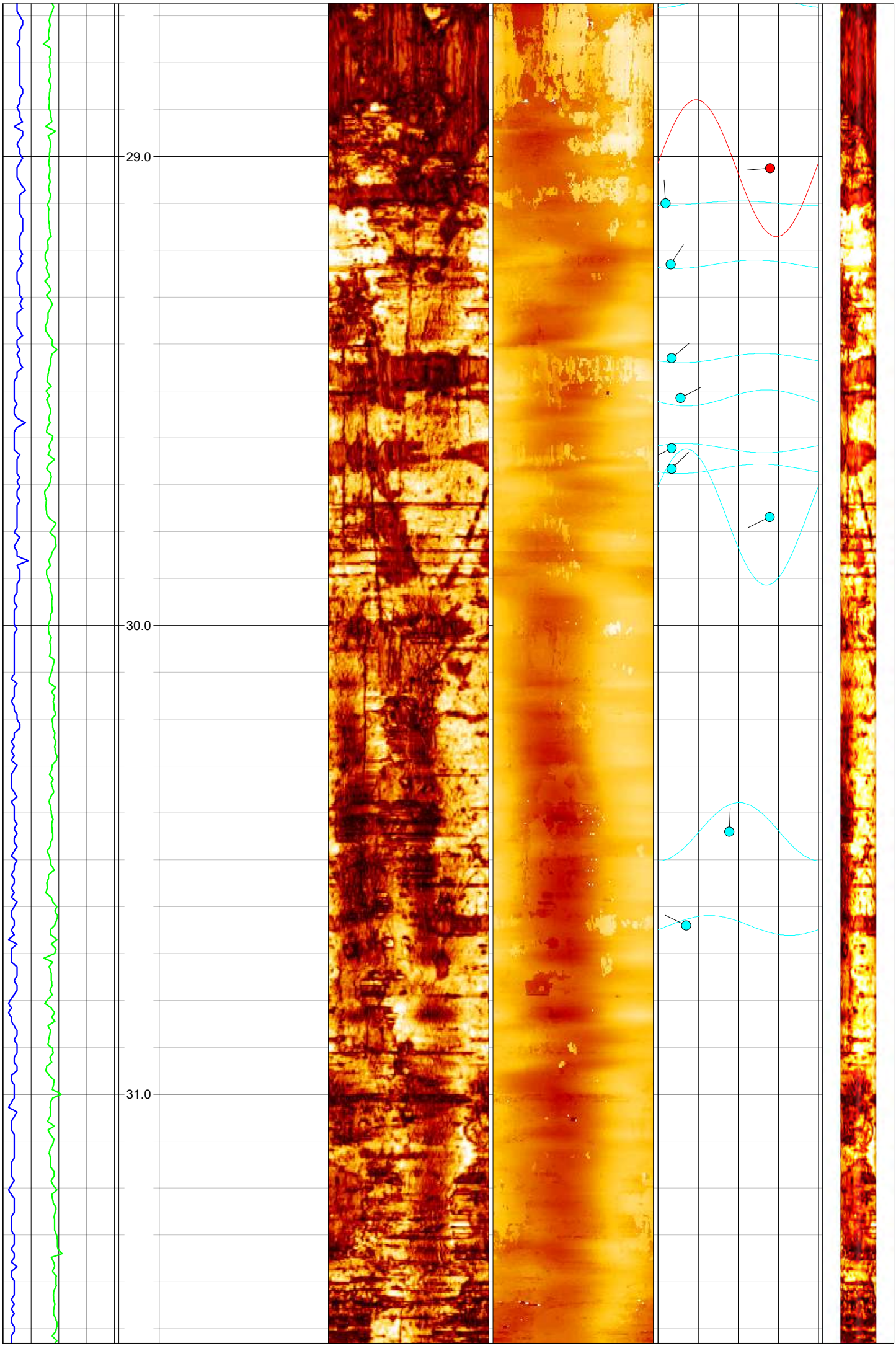
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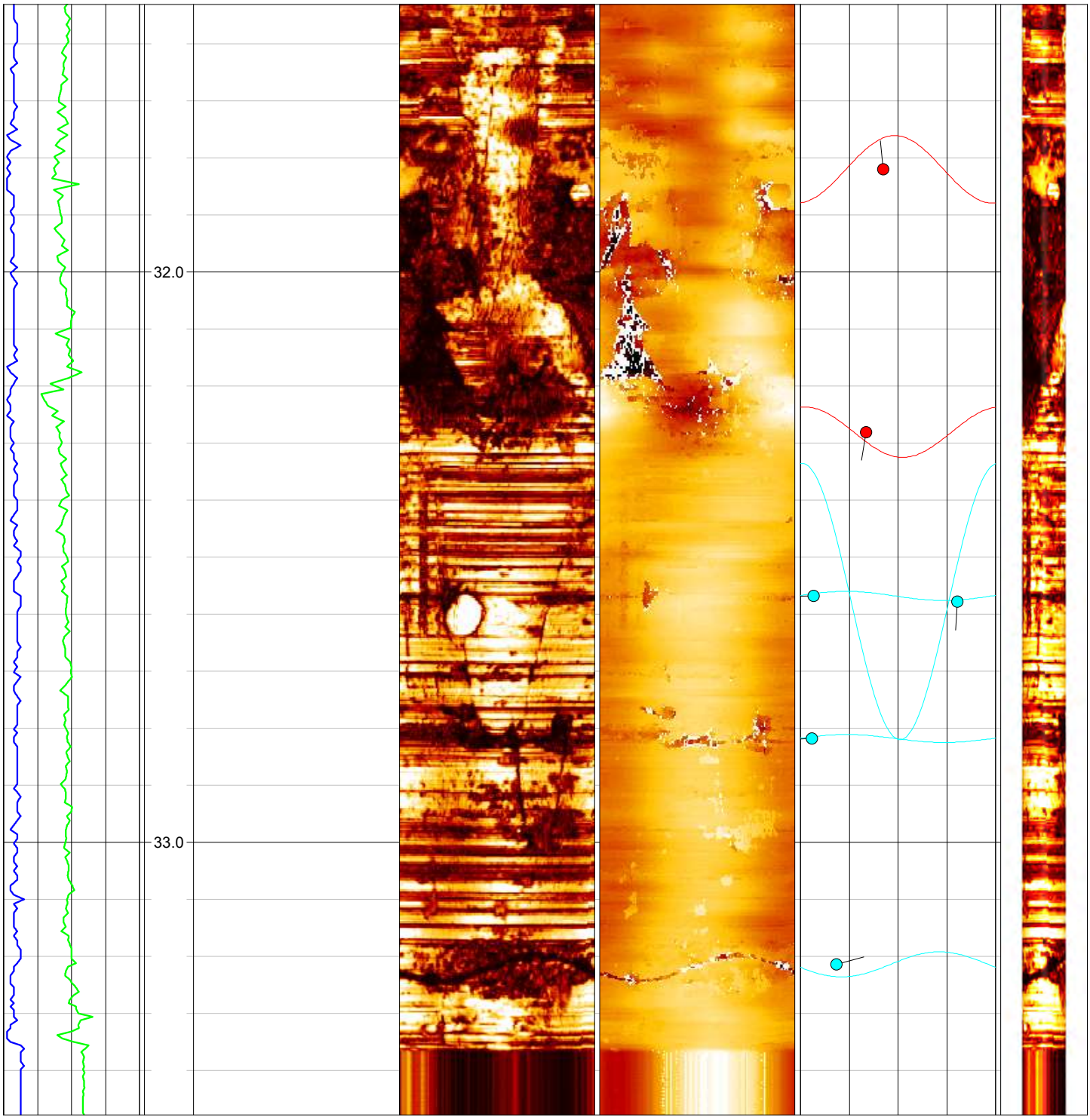
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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC109**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **393208.0E 215995.1N** Elevation: **233.00m**

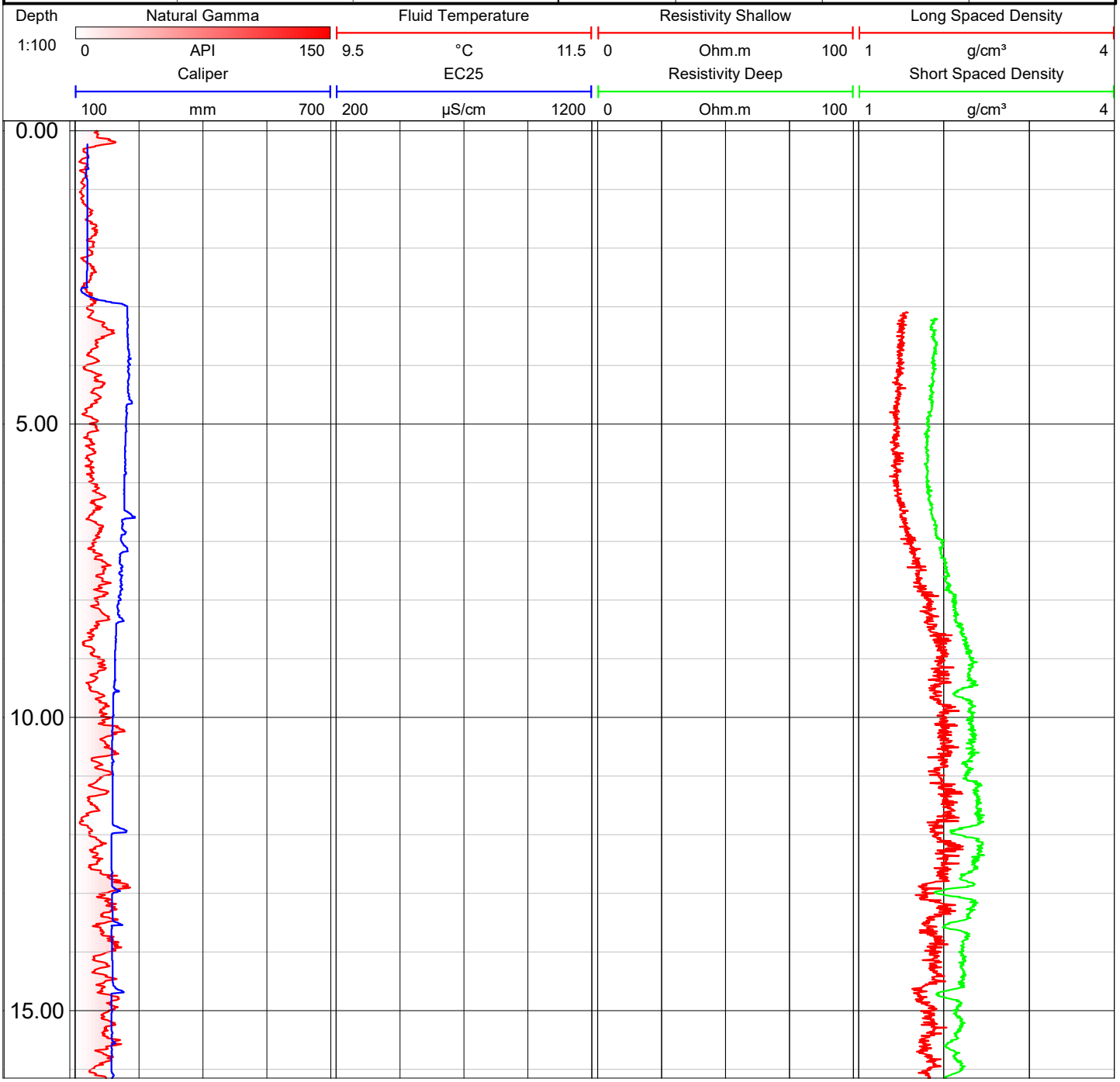
Drilled Depth: (m)	**105.0**	Date:	**8th & 11th November 2019**
Logged Depth: (m)	**100.2***	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Borehole silting up during logging; borehole logged in two stages. Unable to run impellor flow meter due to high suspended sediment
Logged Interval: (m)	**0.0 - 100.2***		
Fluid Level: (m)	**24.9**		

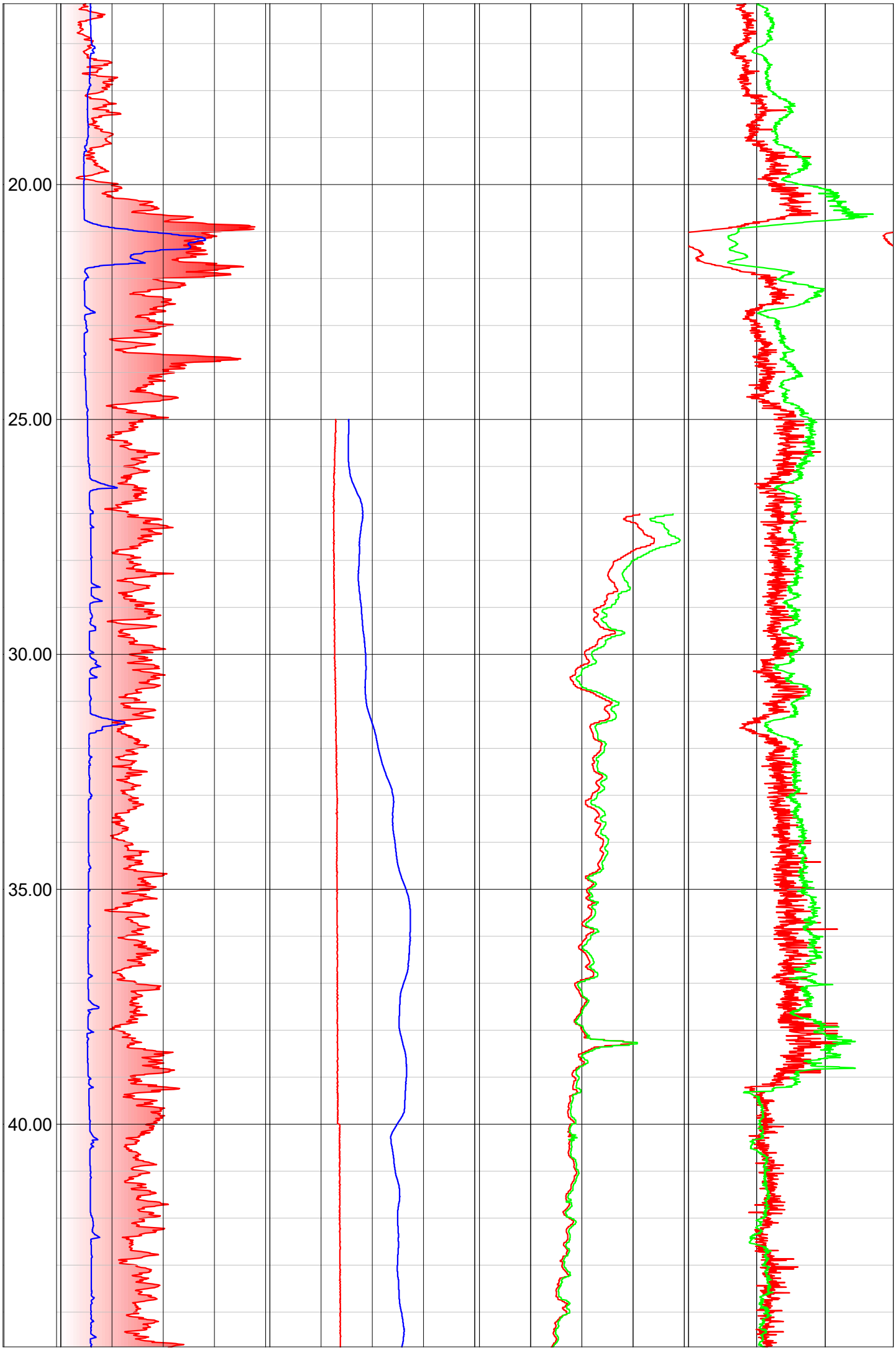
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
		105.0

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**125**	**-0.8**	**39.5**
steel	**125**	**-0.8**	**3.0**

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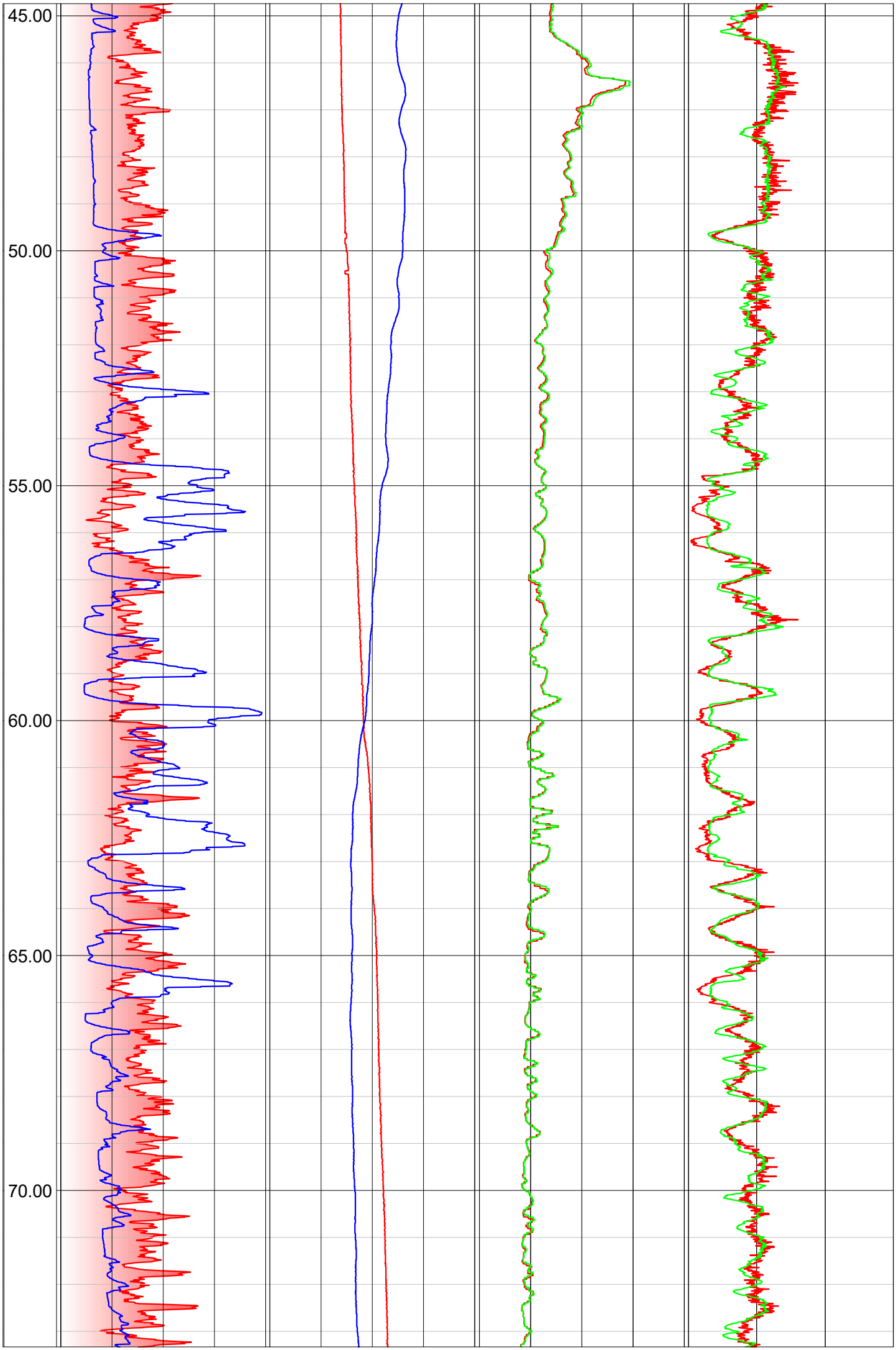
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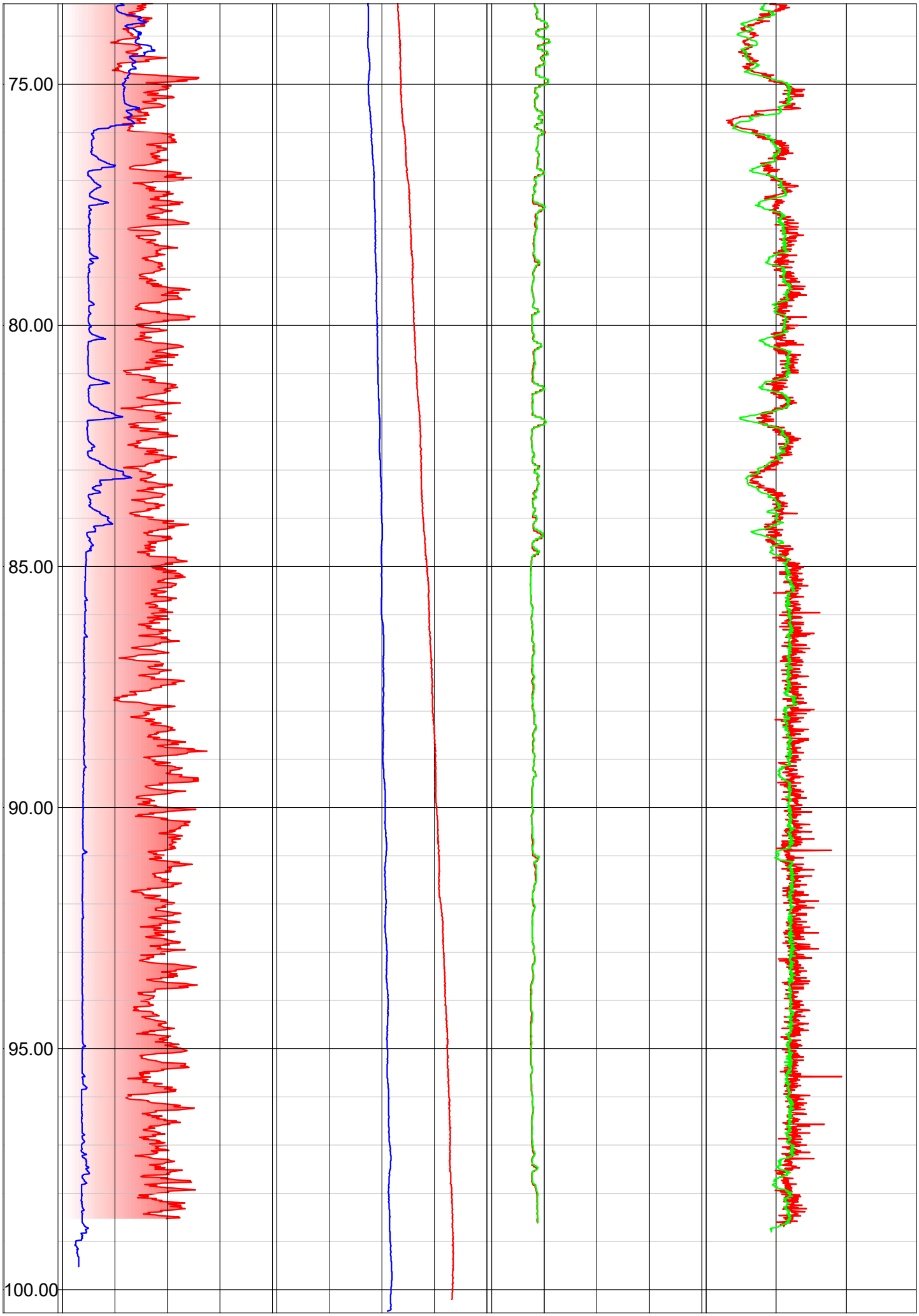
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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC109**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **393208.0E 215995.1N** Elevation: **233.00m**

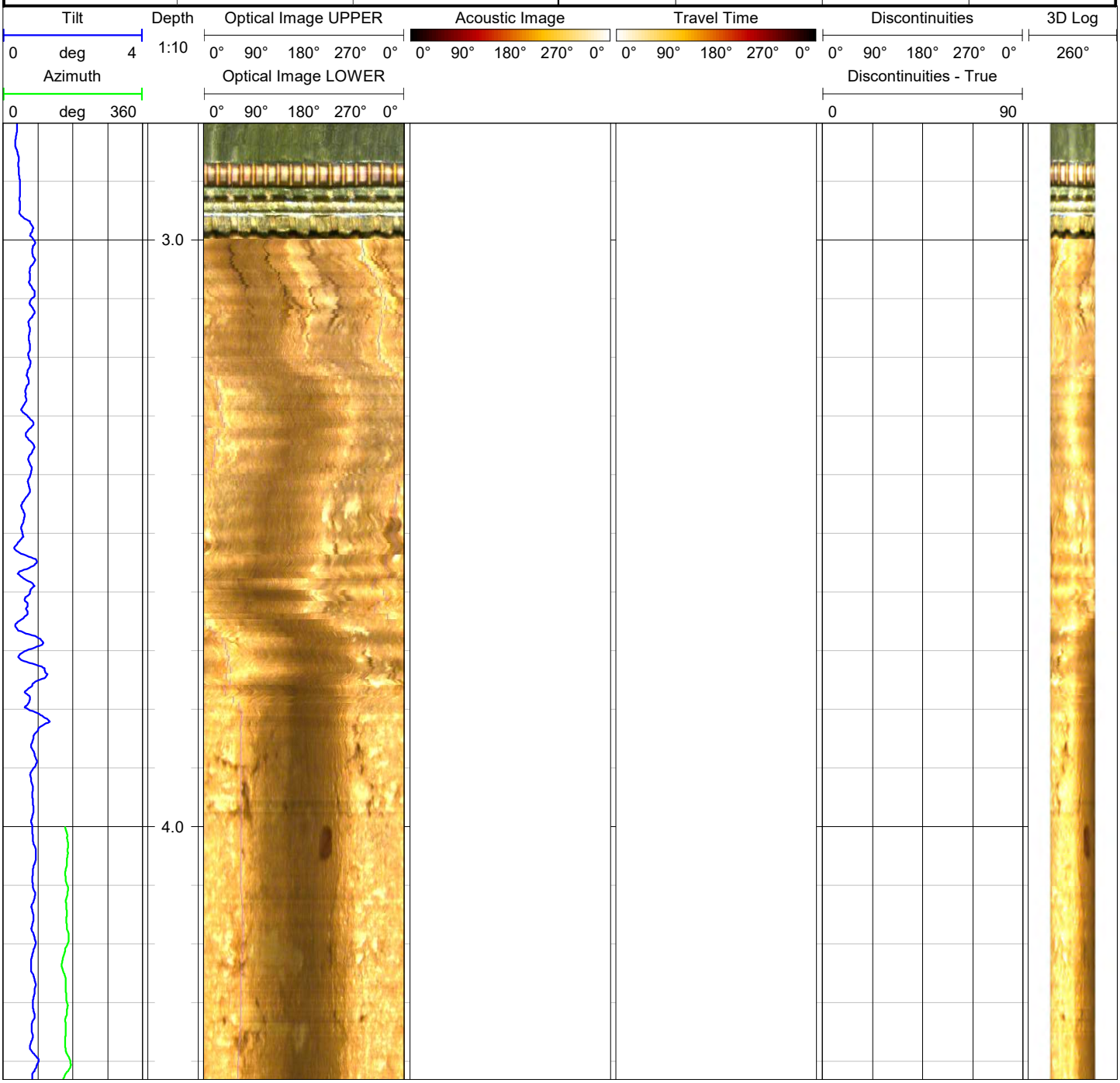
Drilled Depth: (m)	**105.0**	Date:	**8th & 11th November 2019**
Logged Depth: (m)	**100.5**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Borehole silting up during logging. Borehole logged in two stages.
Logged Interval: (m)	**3.0 - 100.5**		
Fluid Level: (m)	**24.9**		

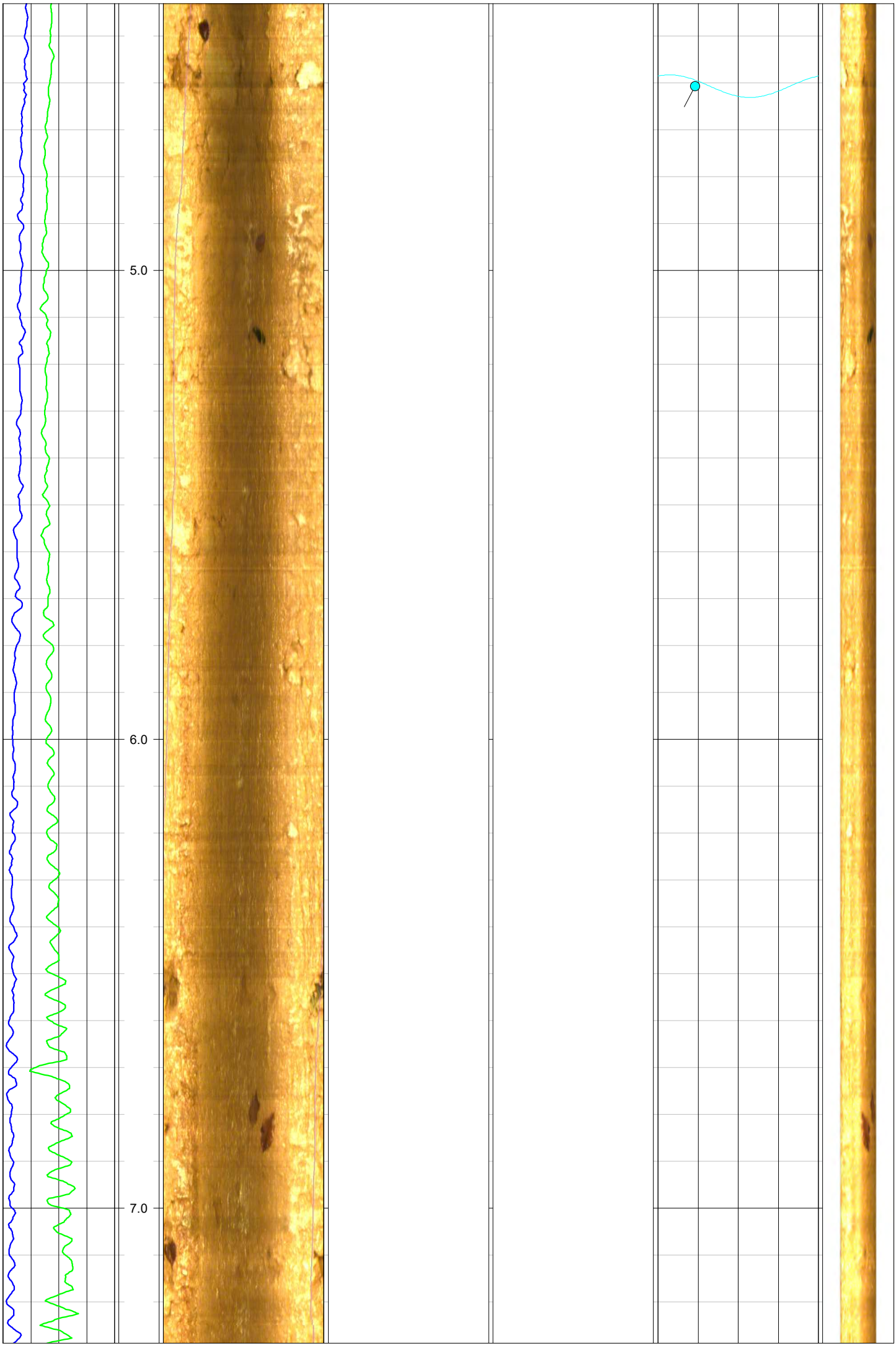
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
		105.0

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**125**	**-0.8**	**39.5**
steel	**125**	**-0.8**	**3.0**

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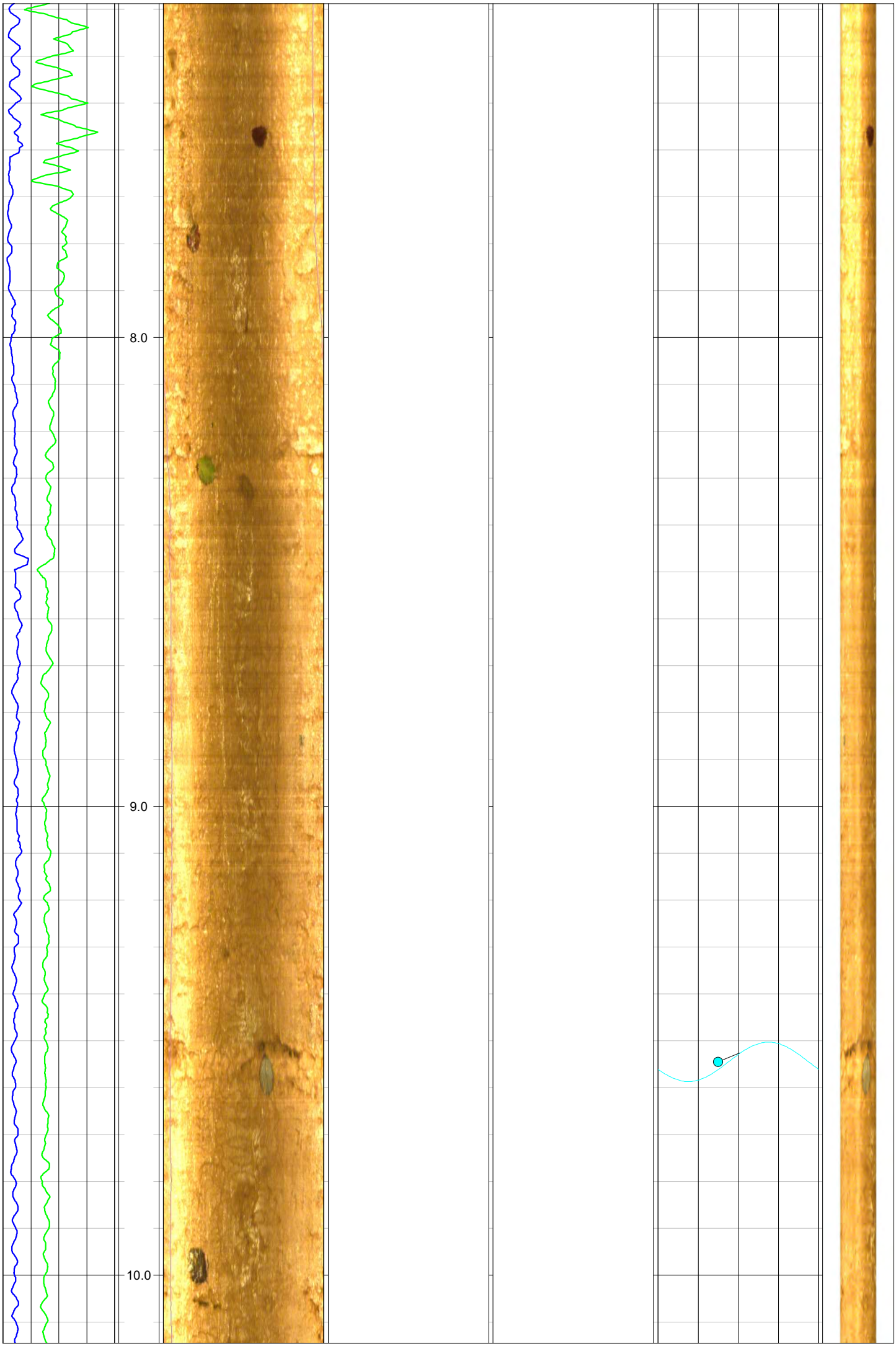
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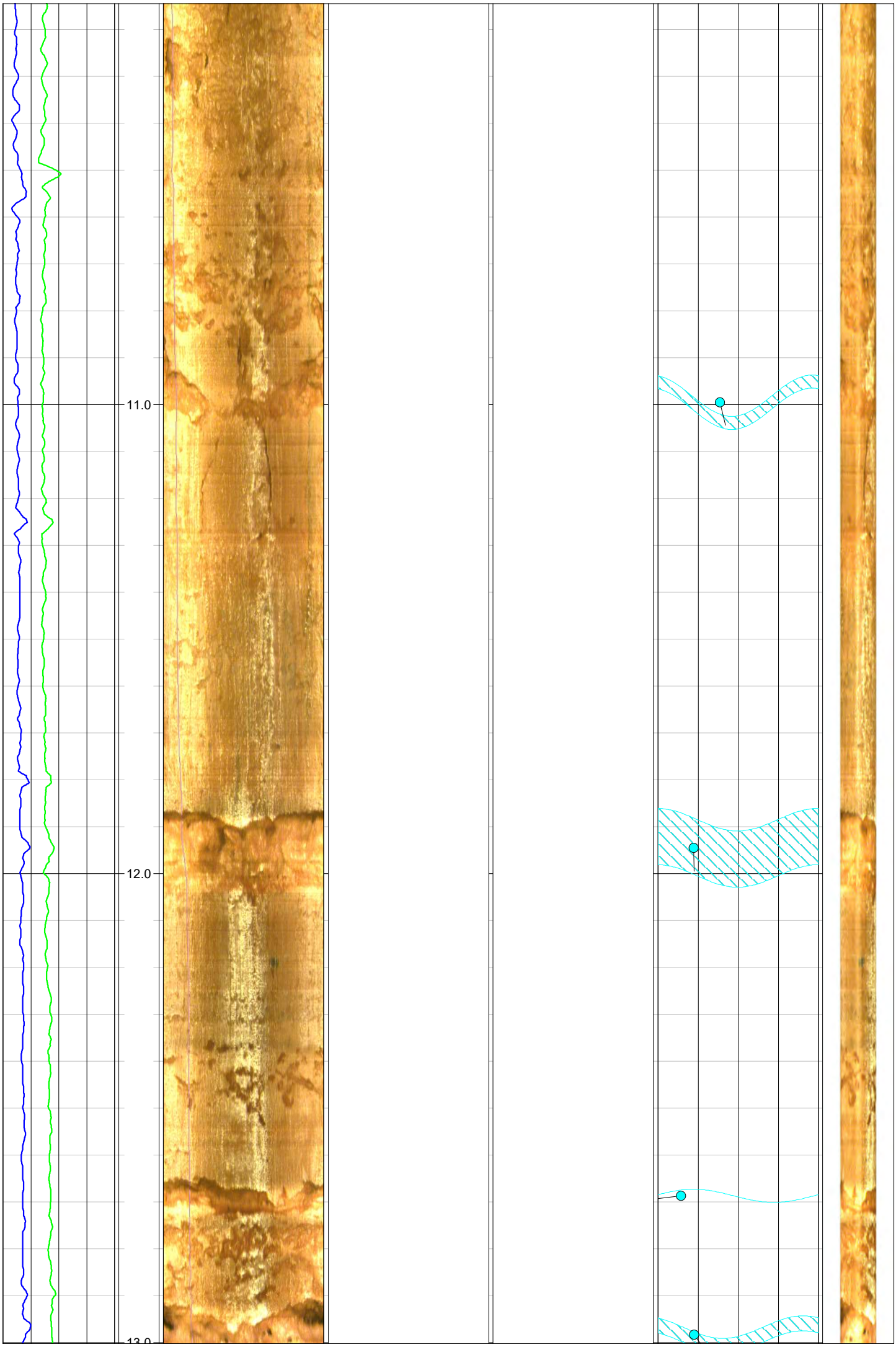
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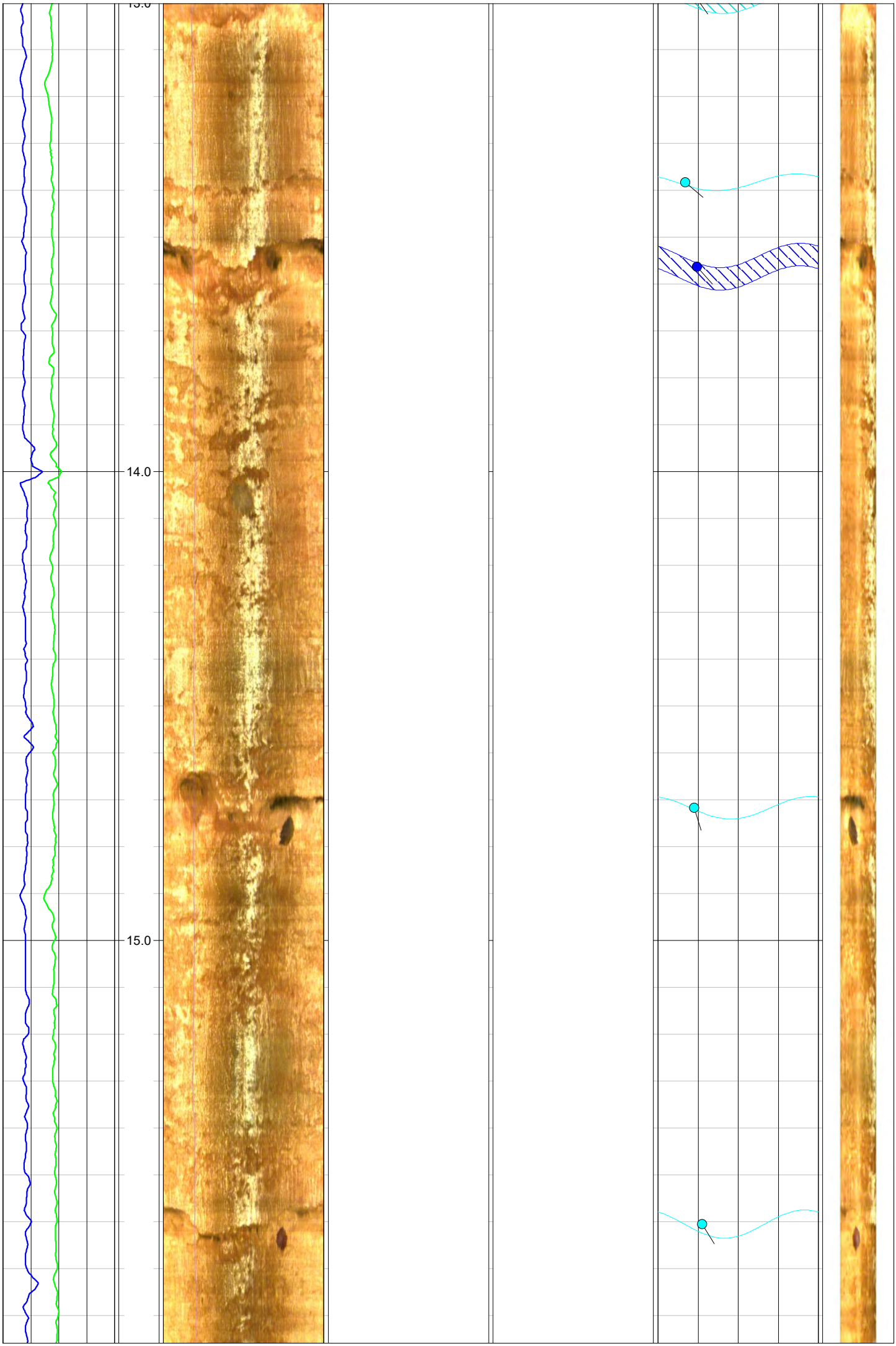
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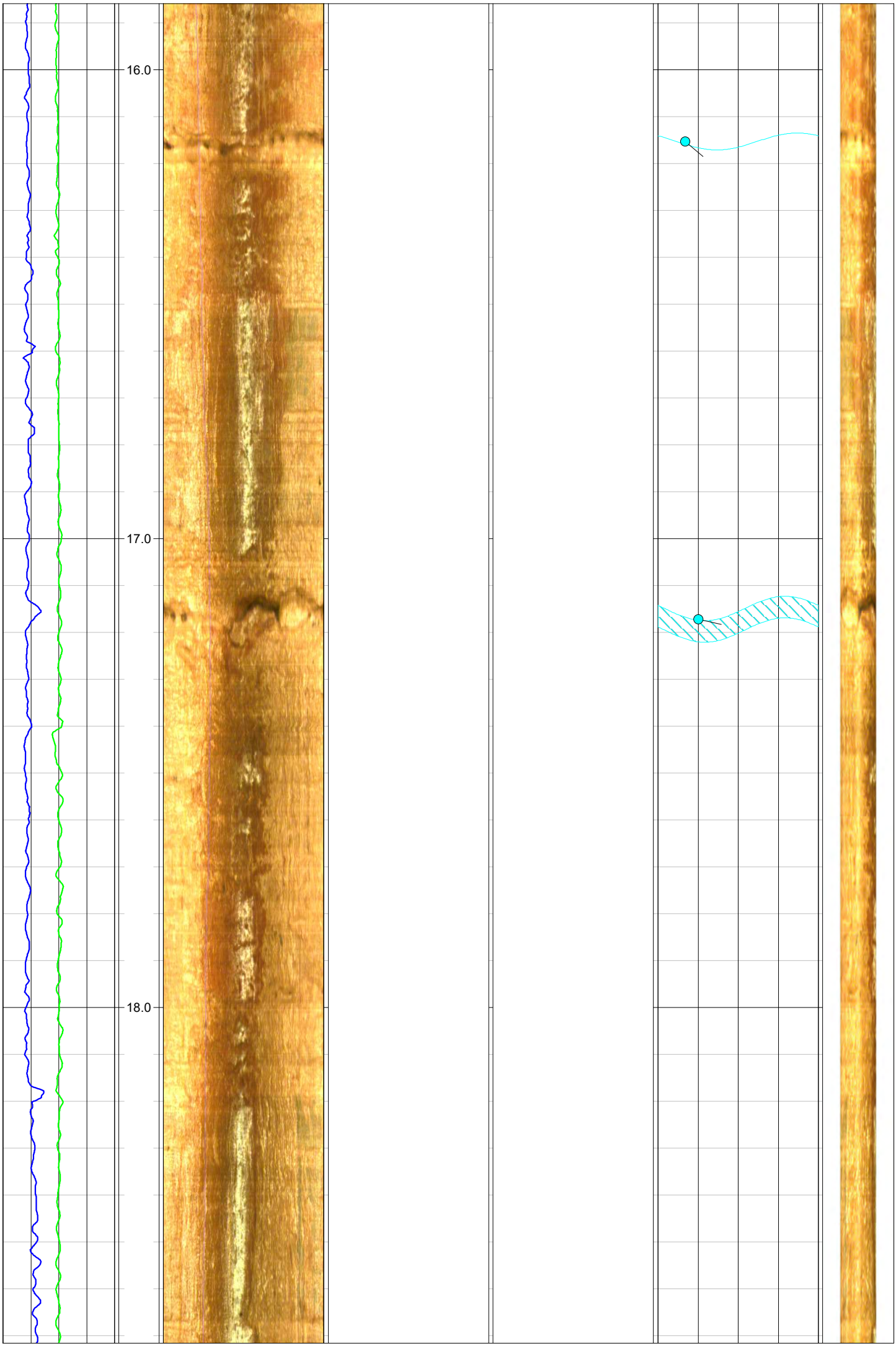
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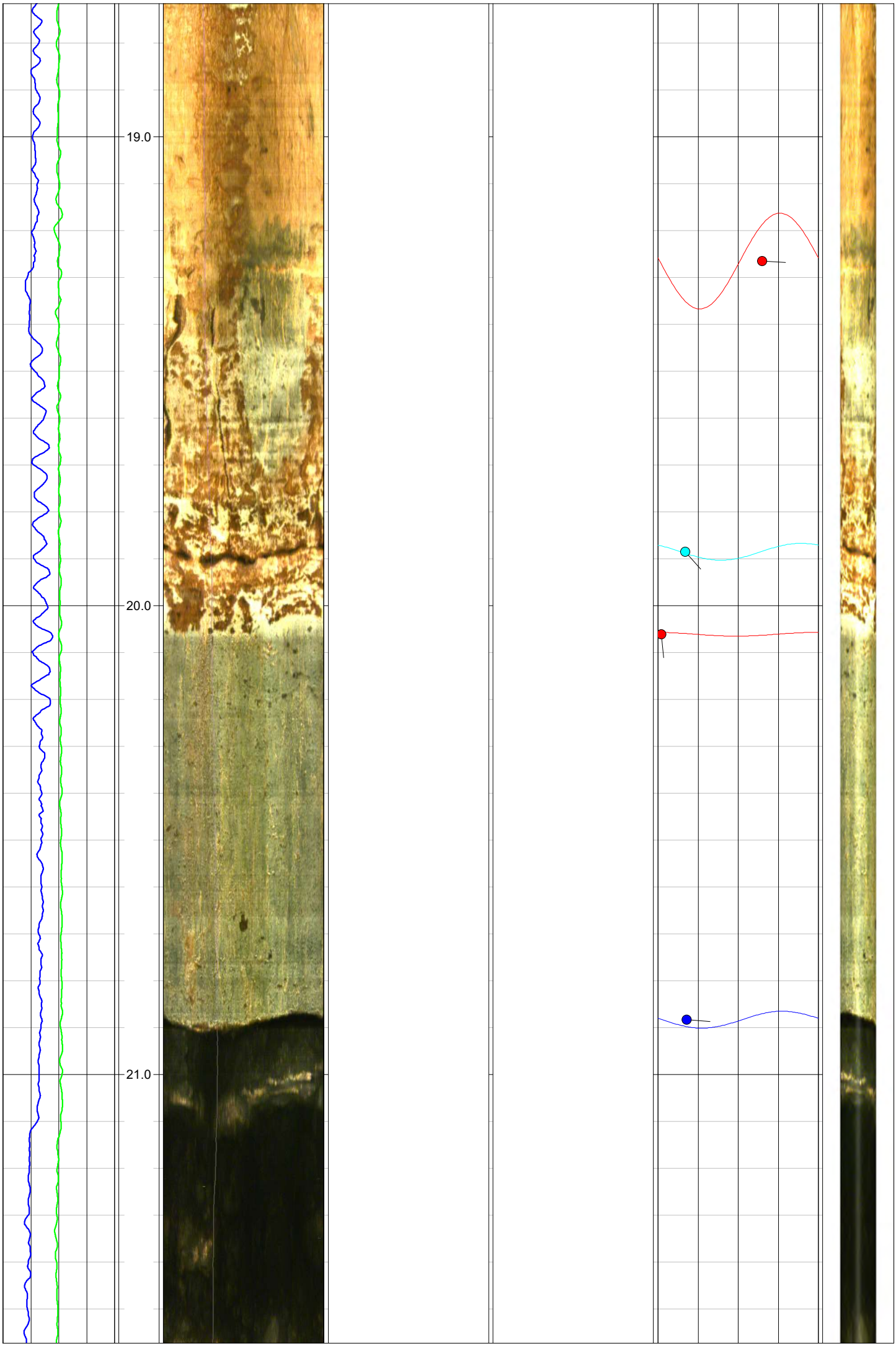
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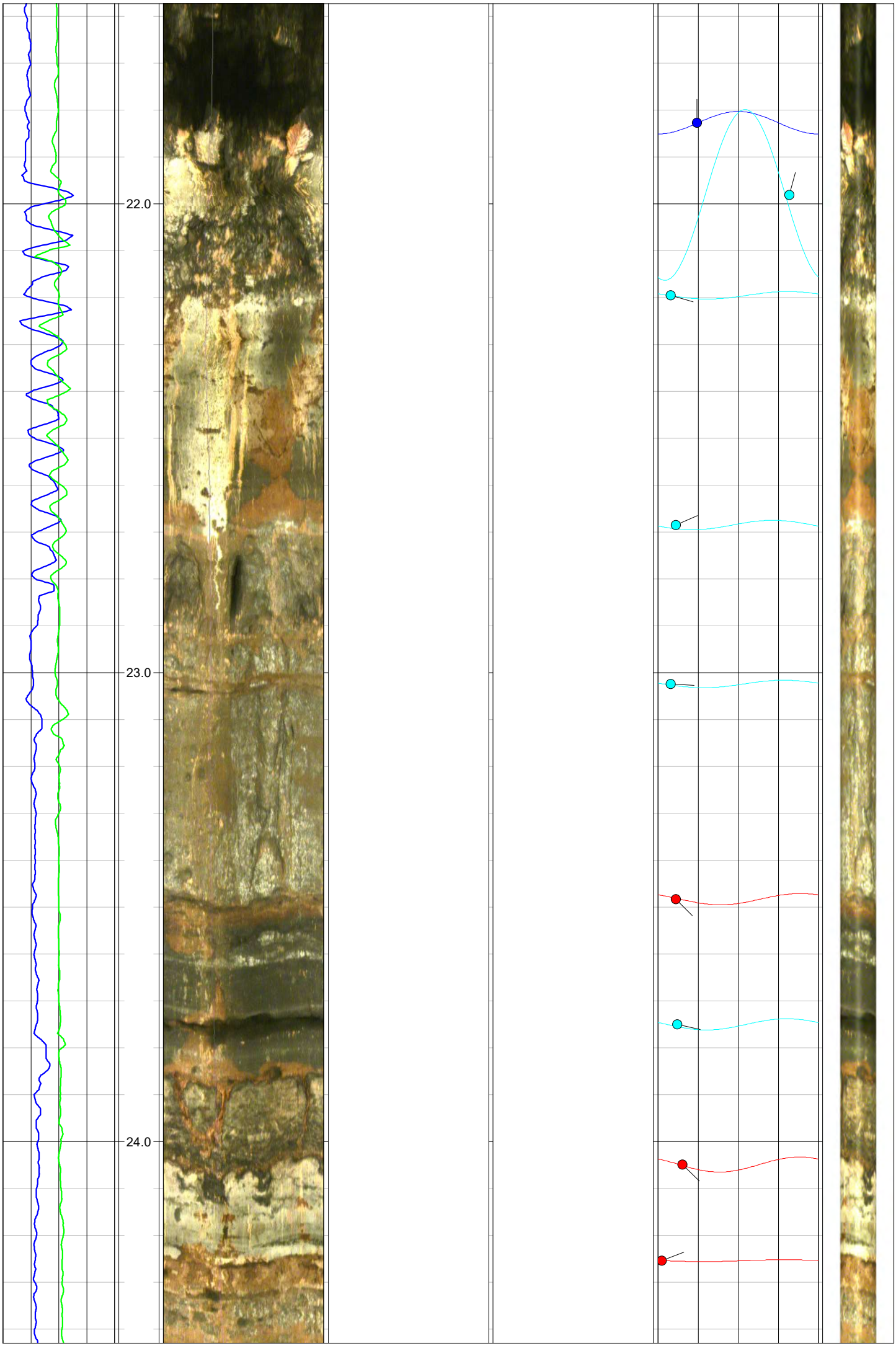
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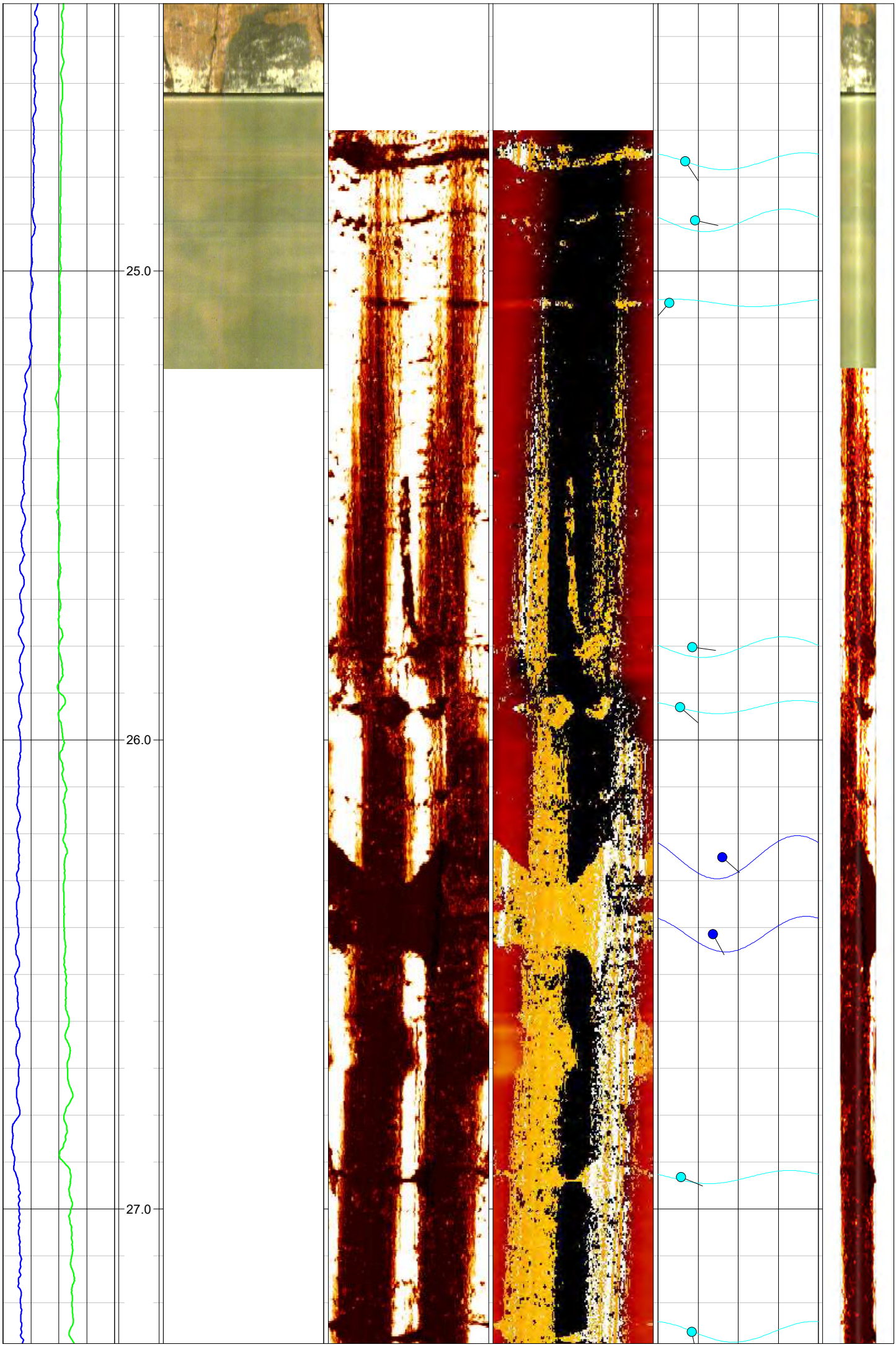
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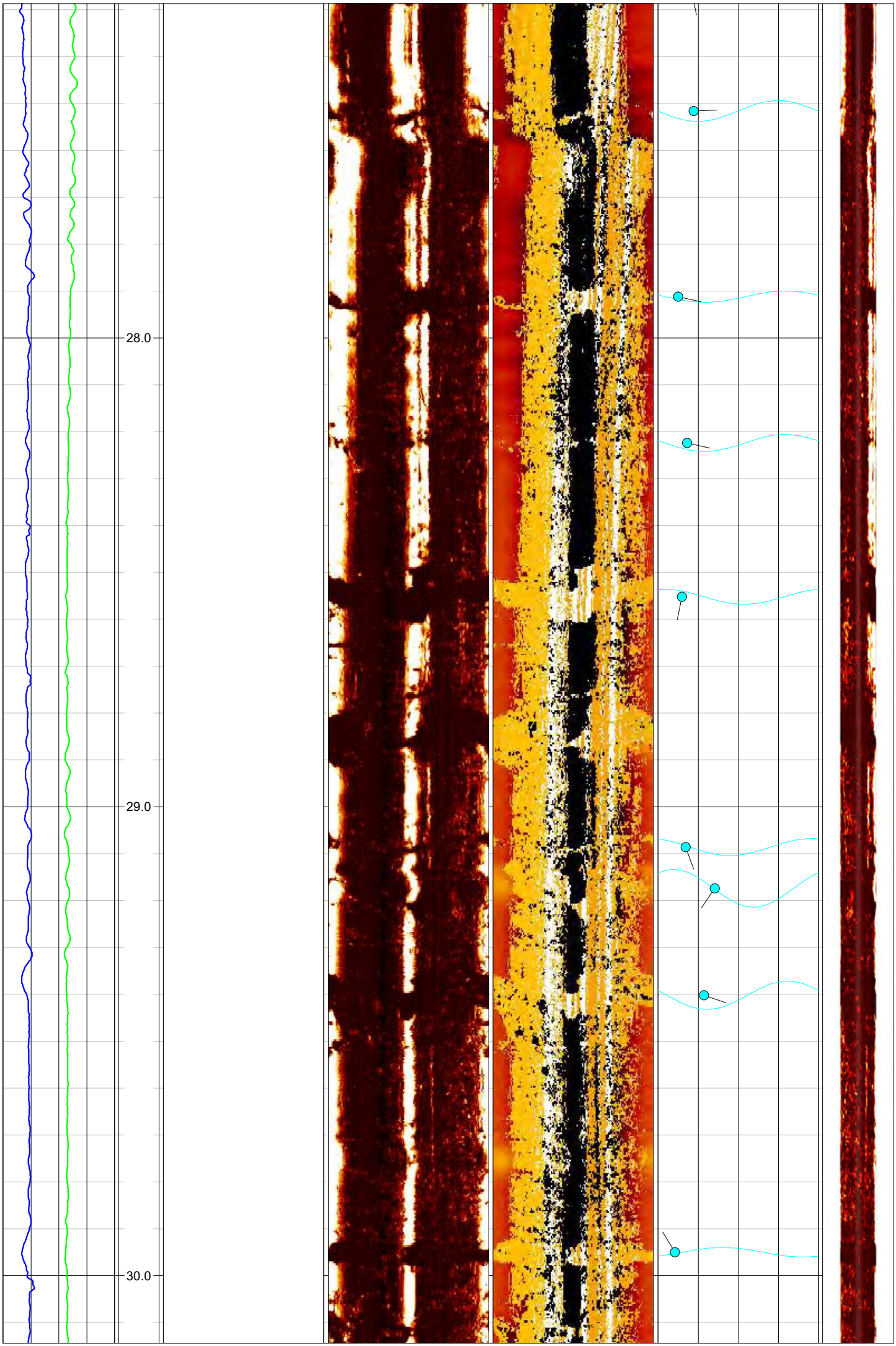
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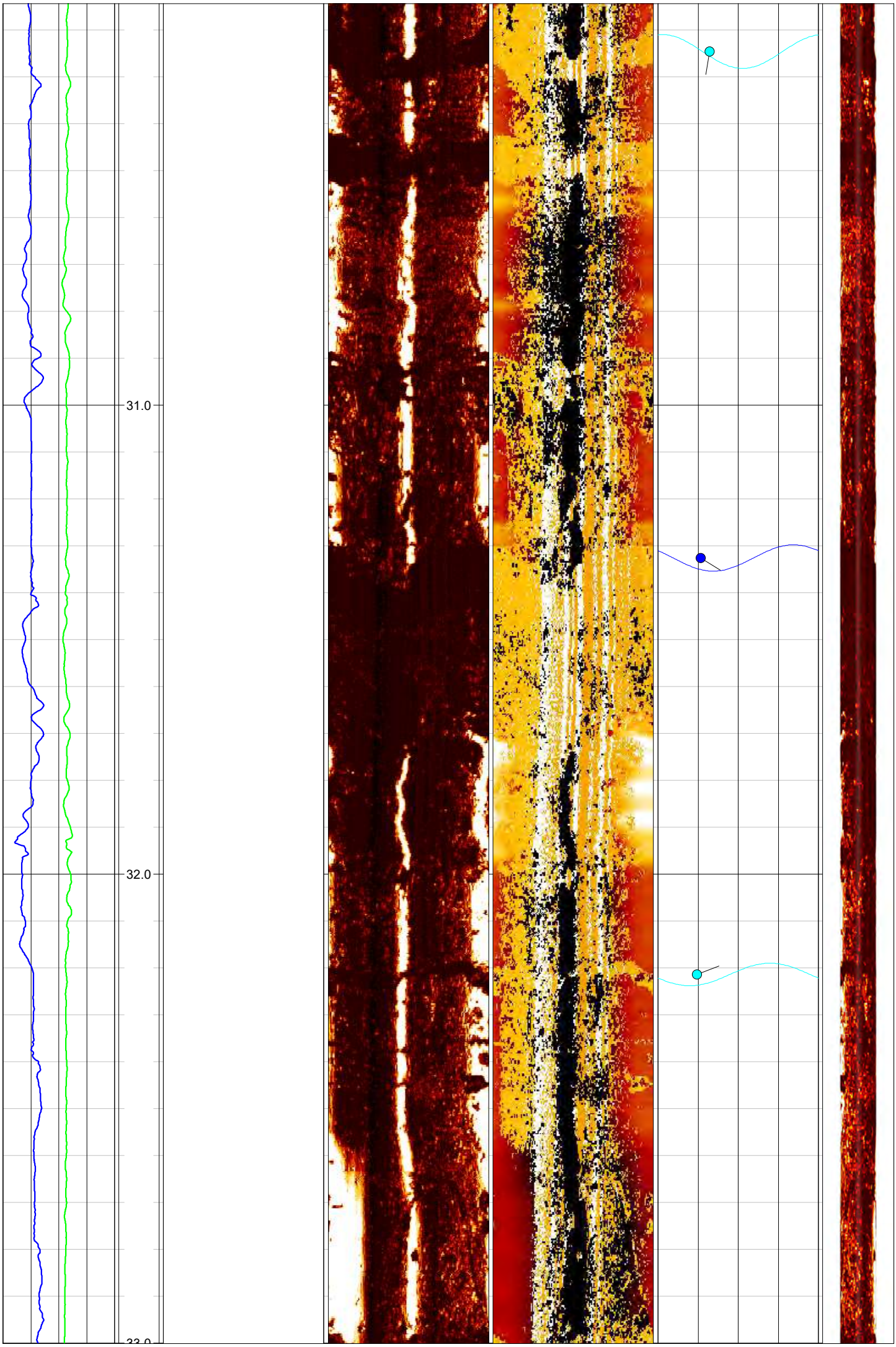
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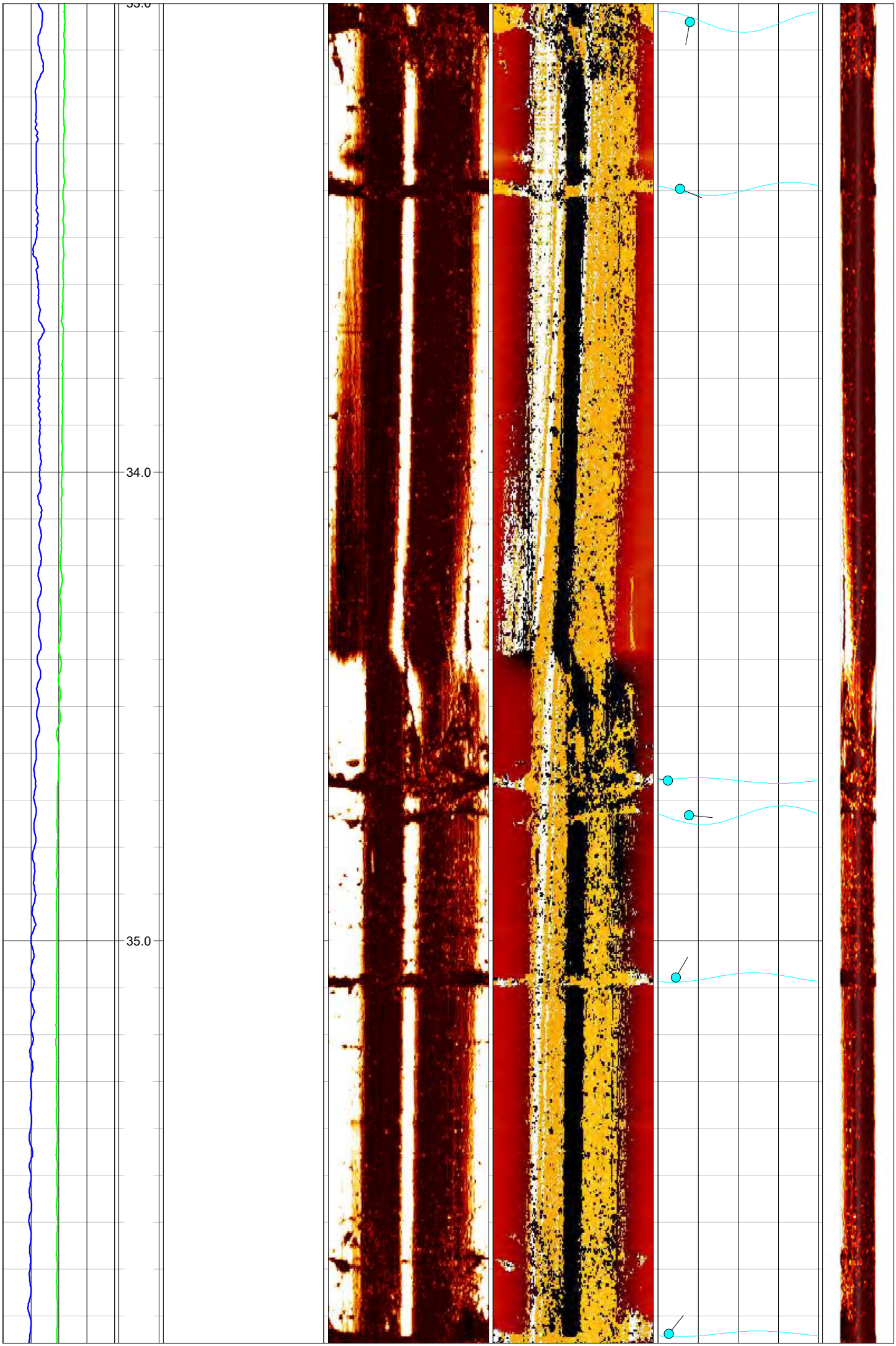
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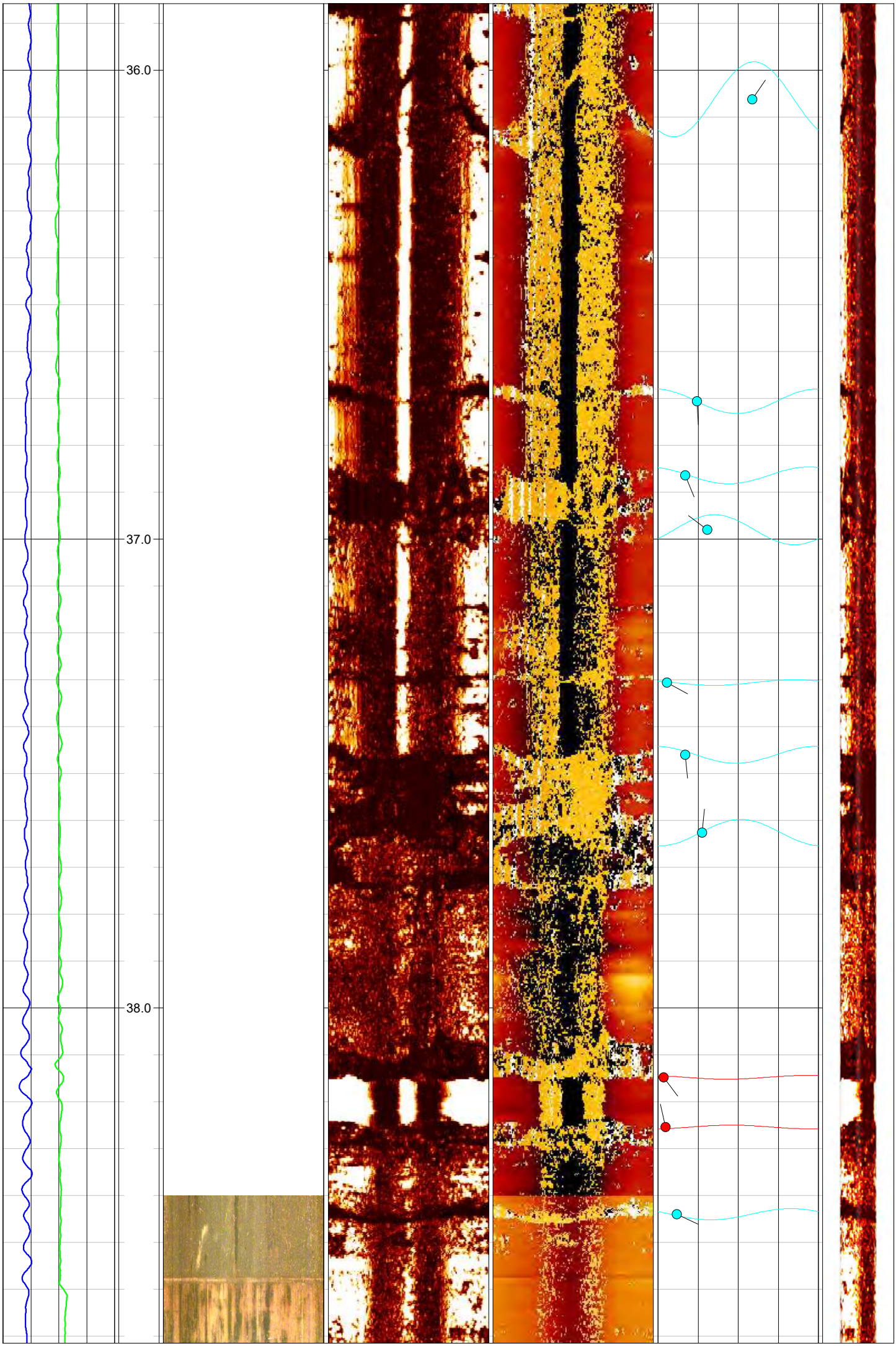
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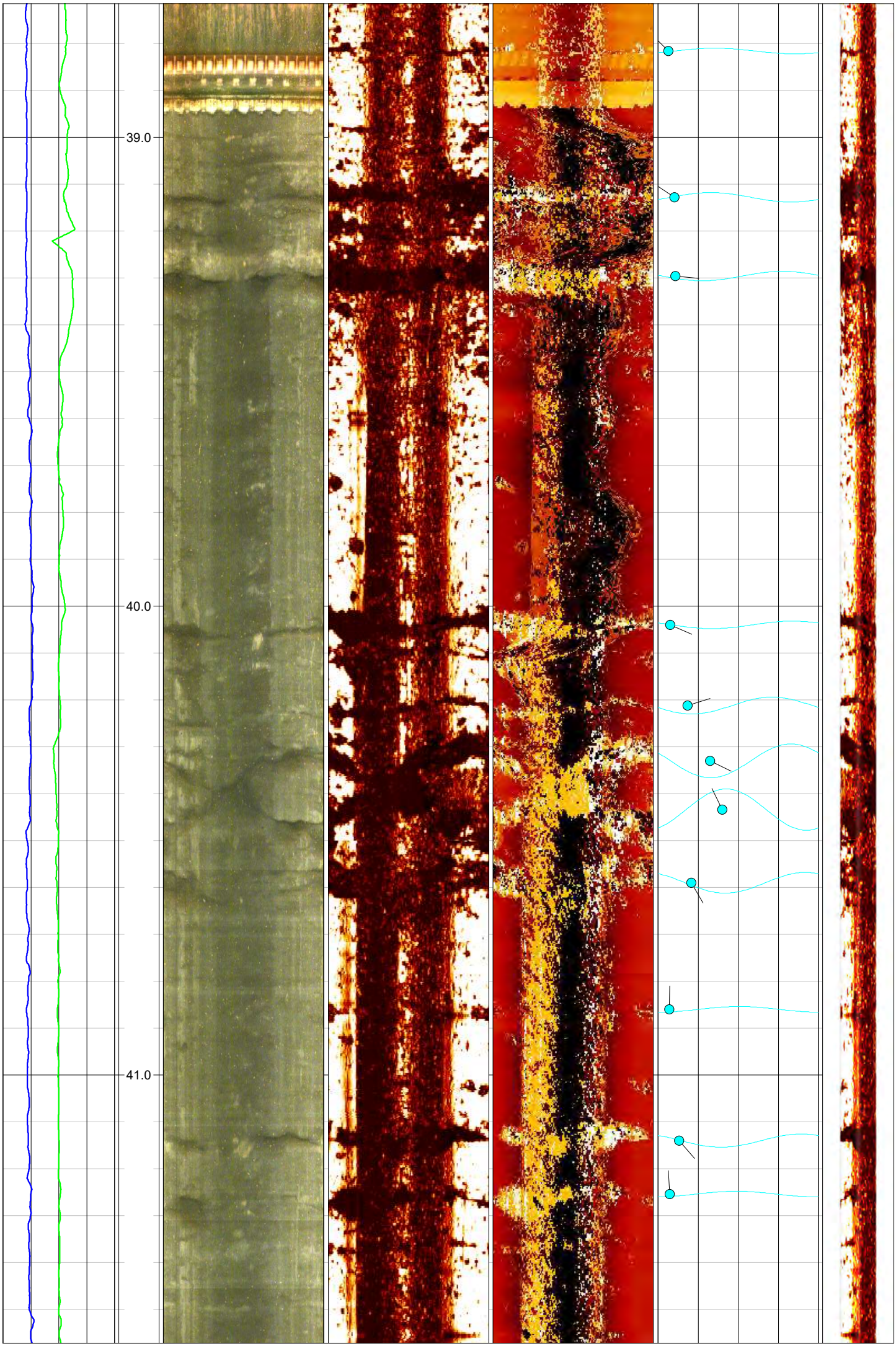
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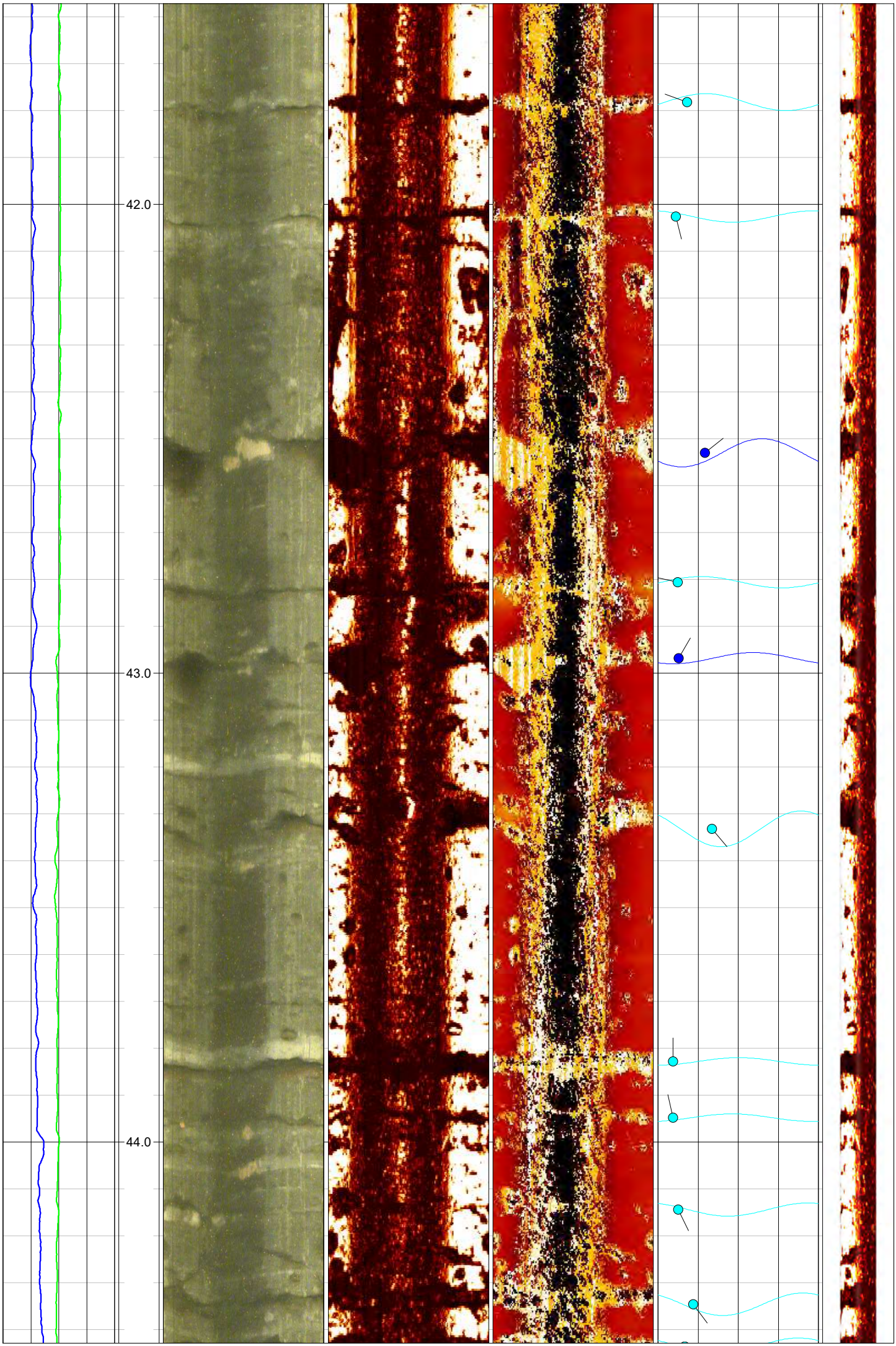
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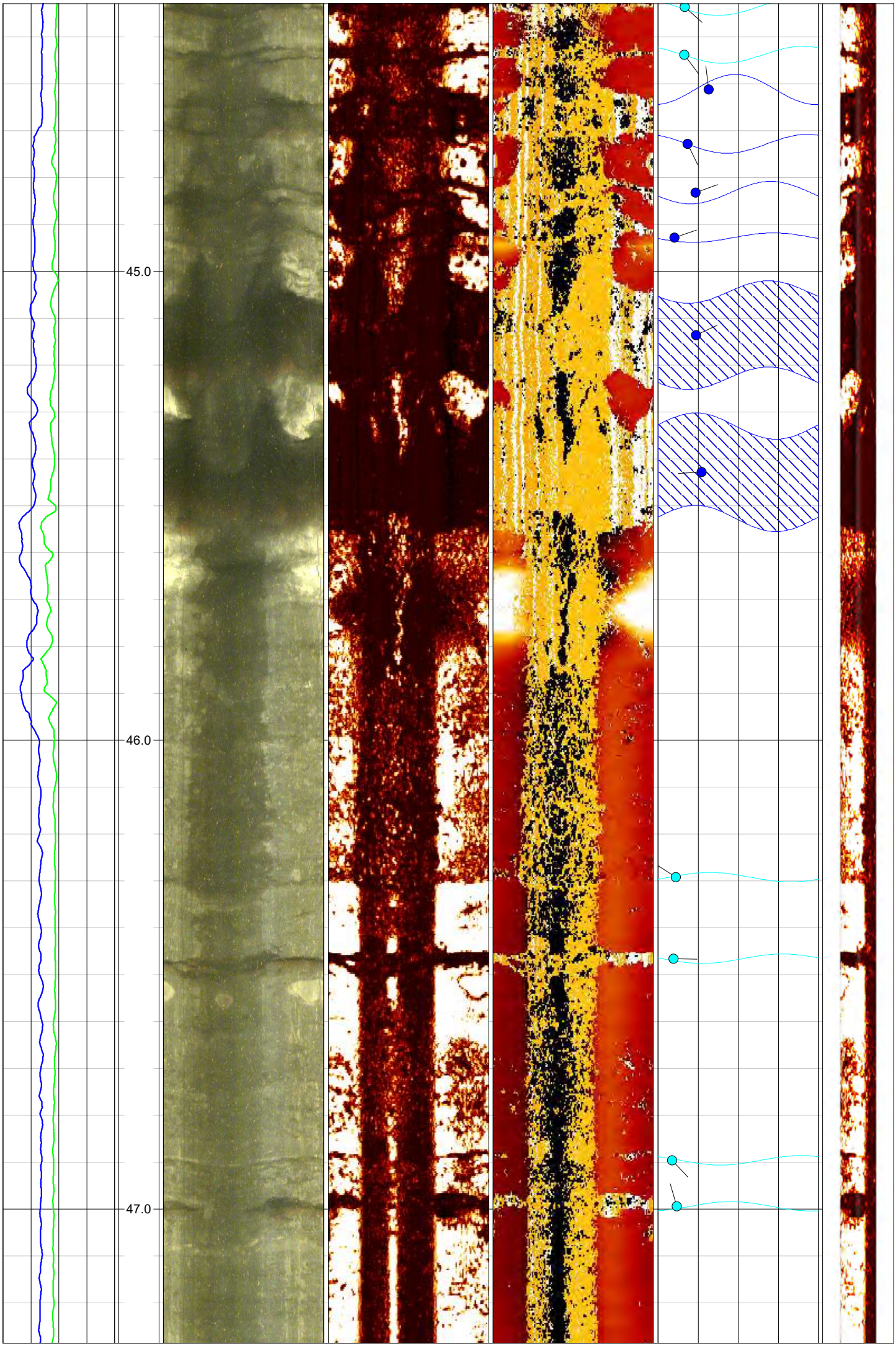
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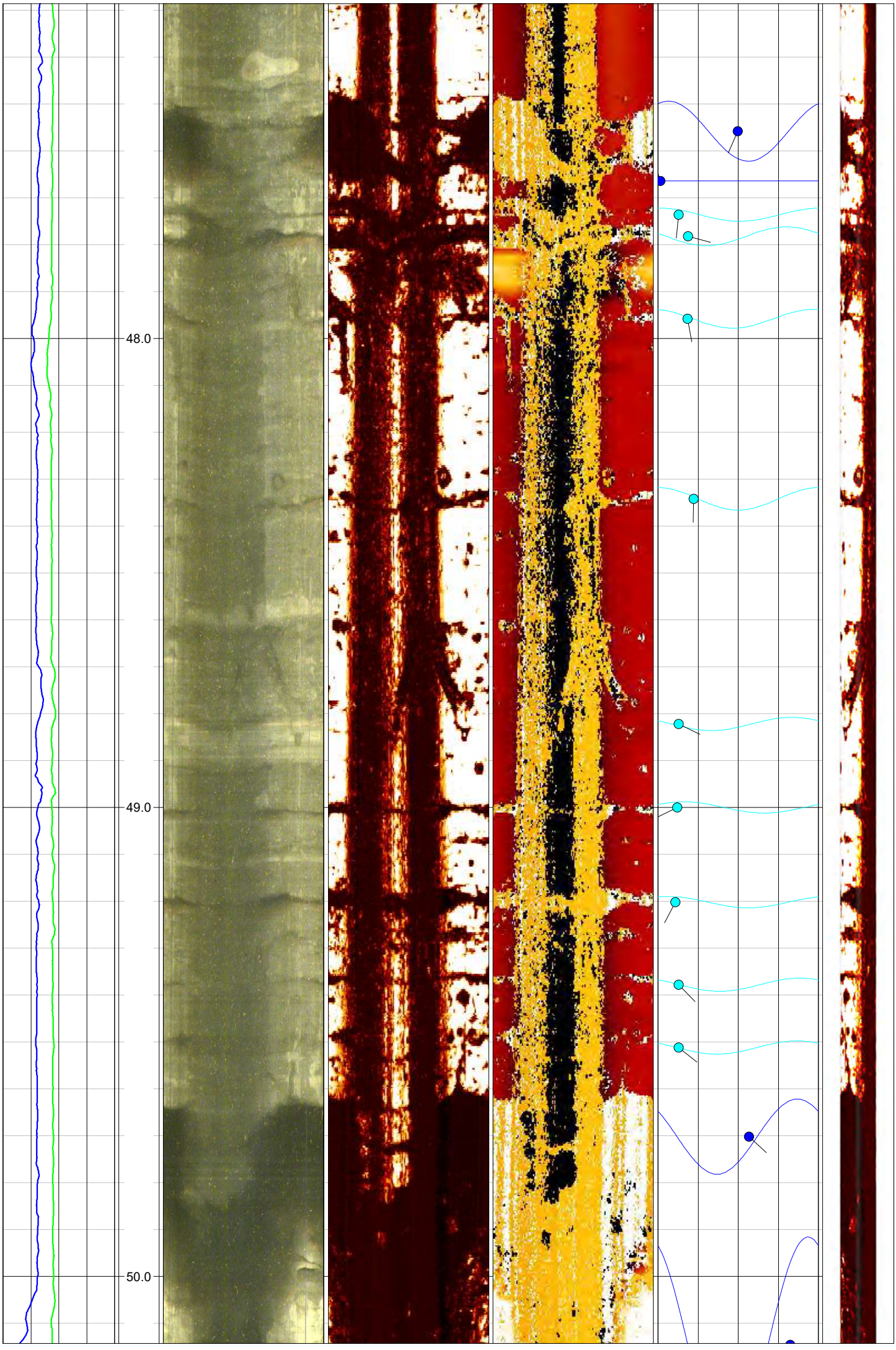
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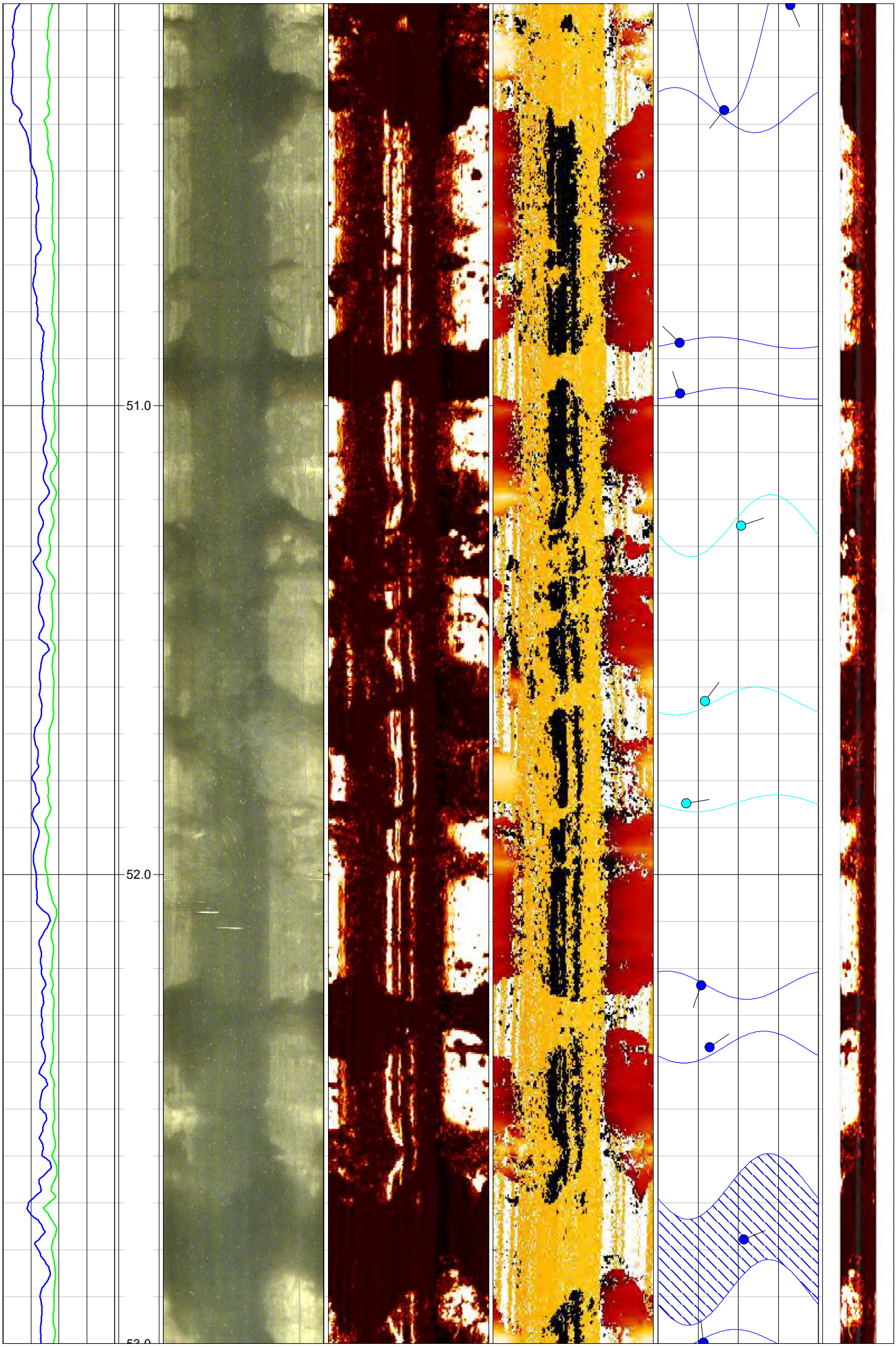
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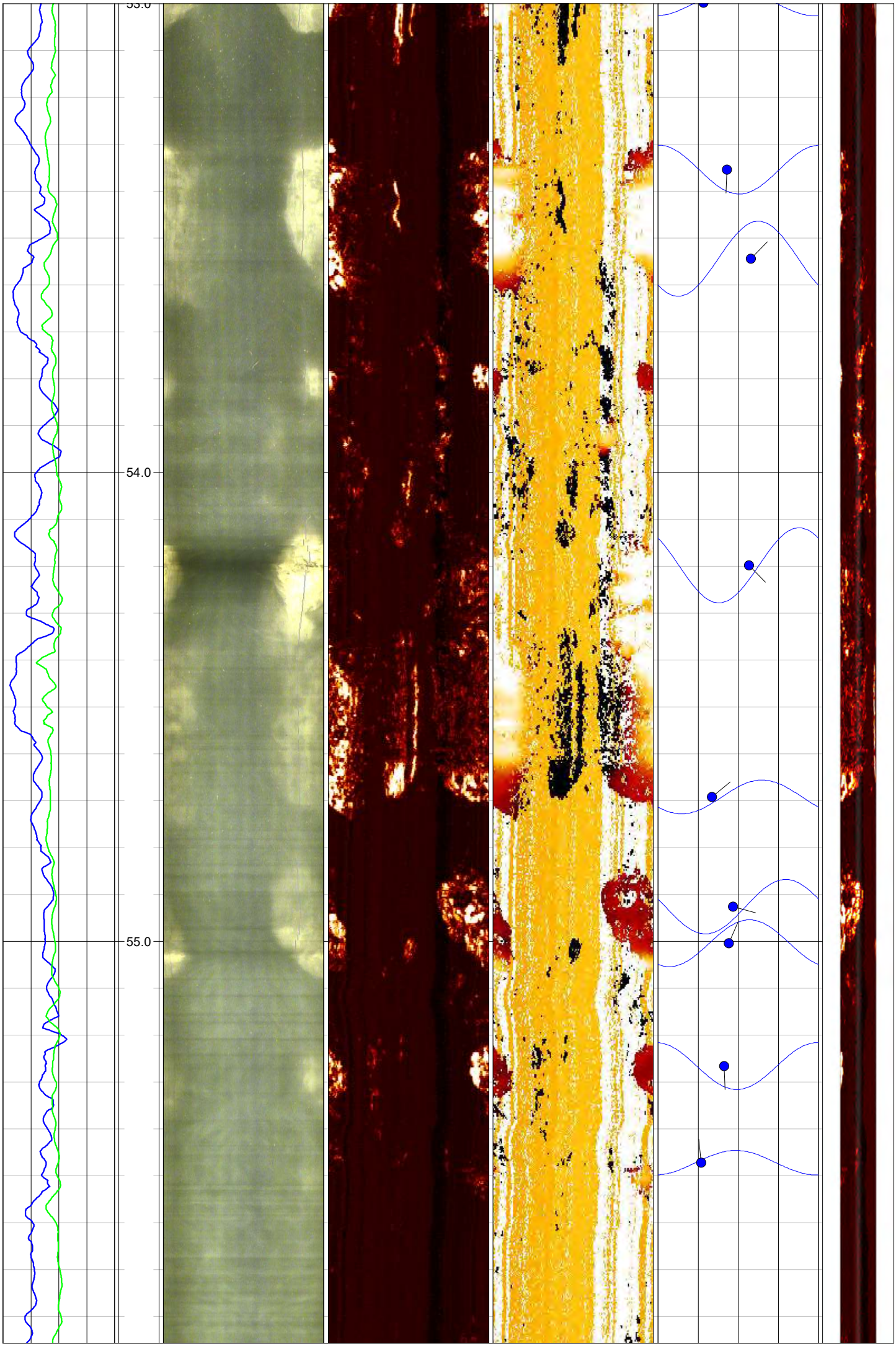
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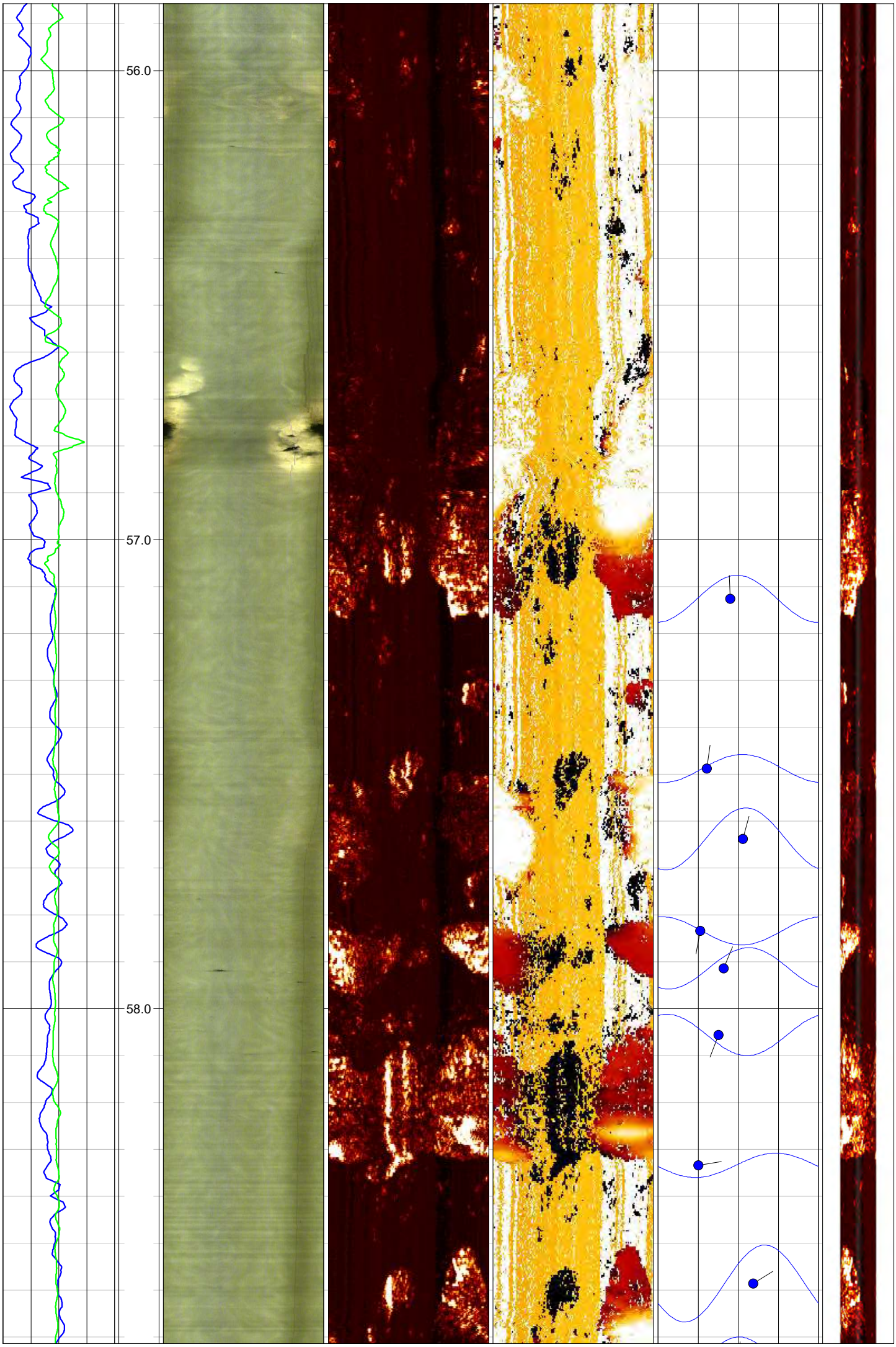
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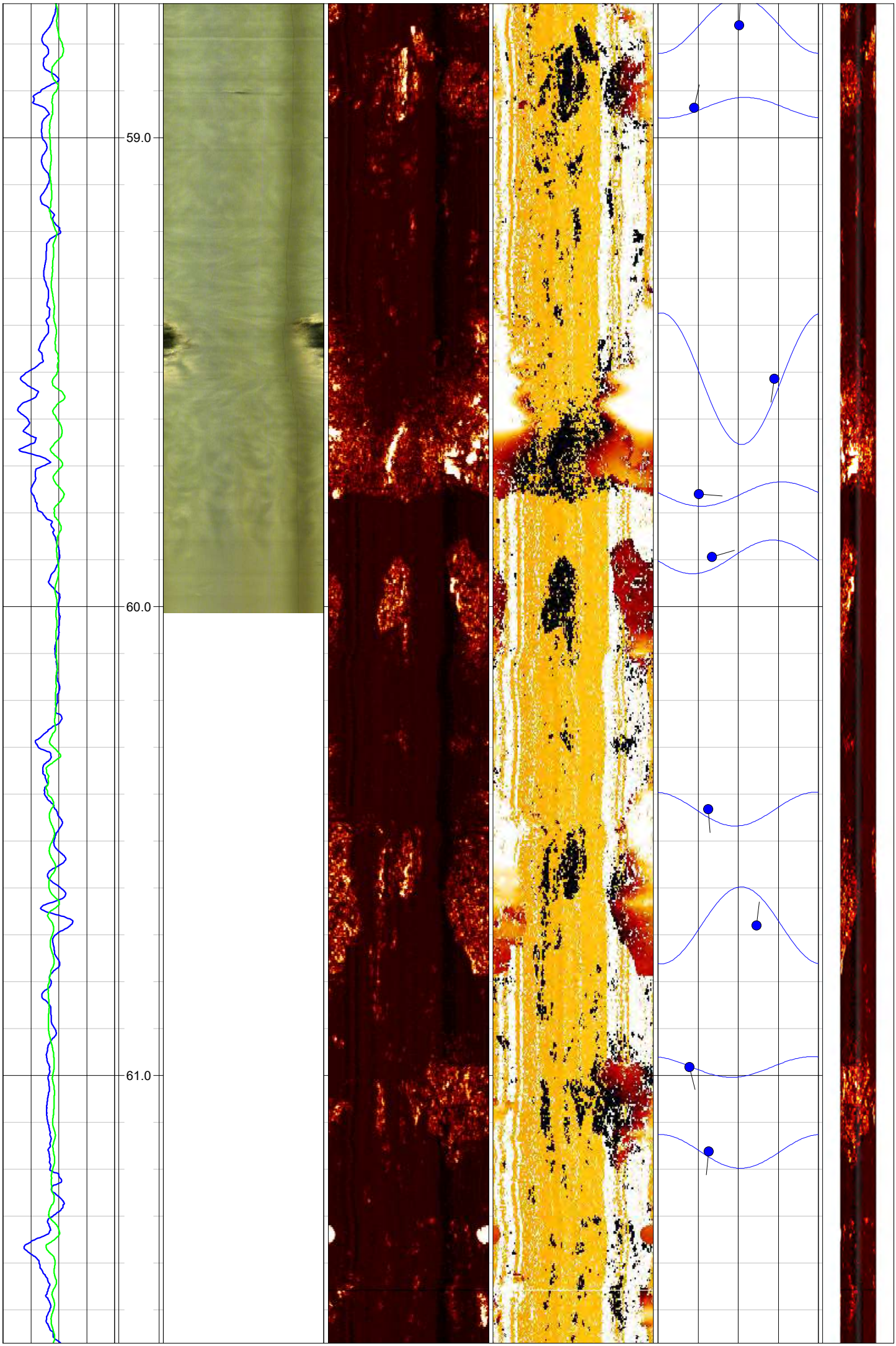
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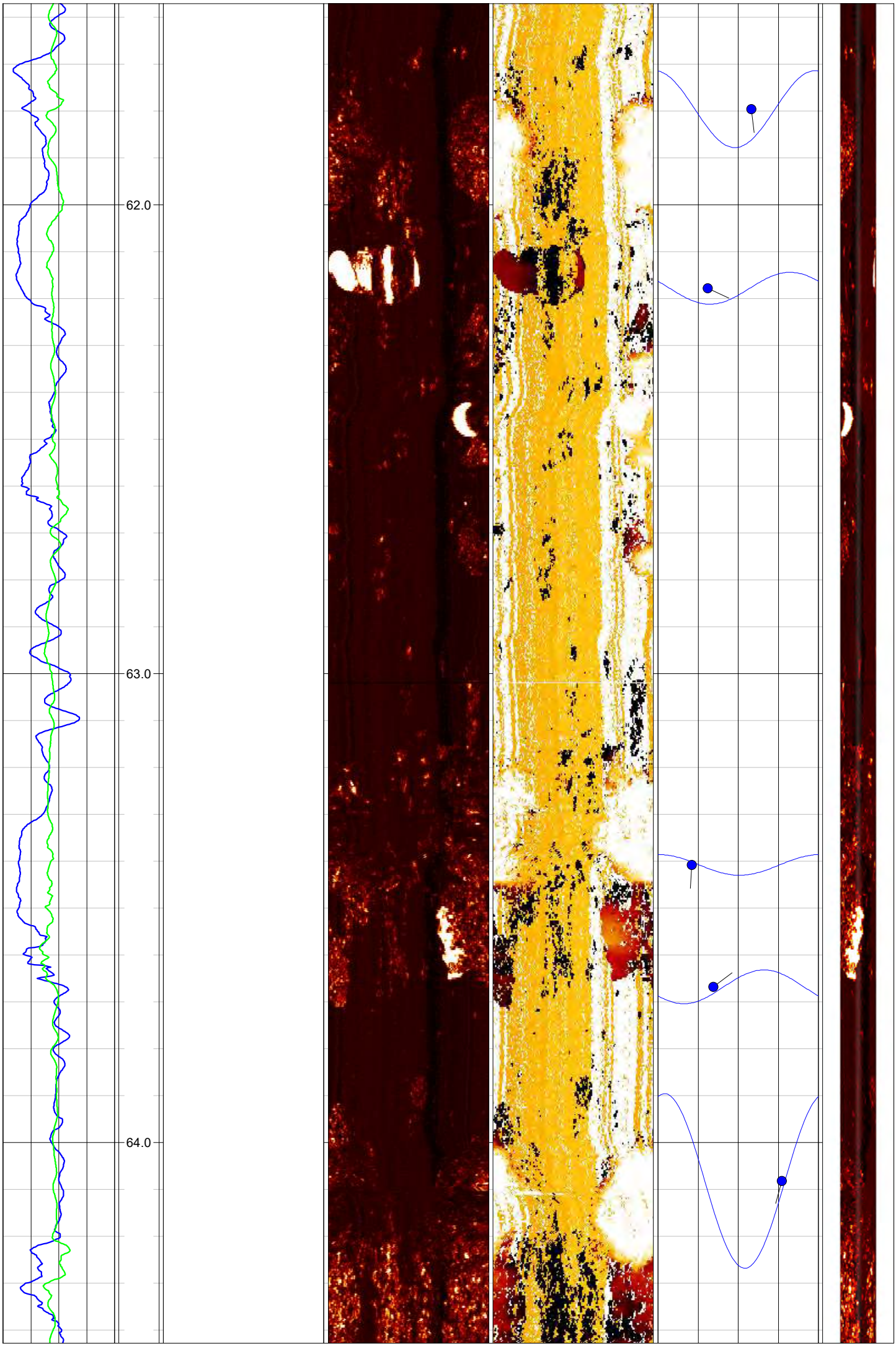
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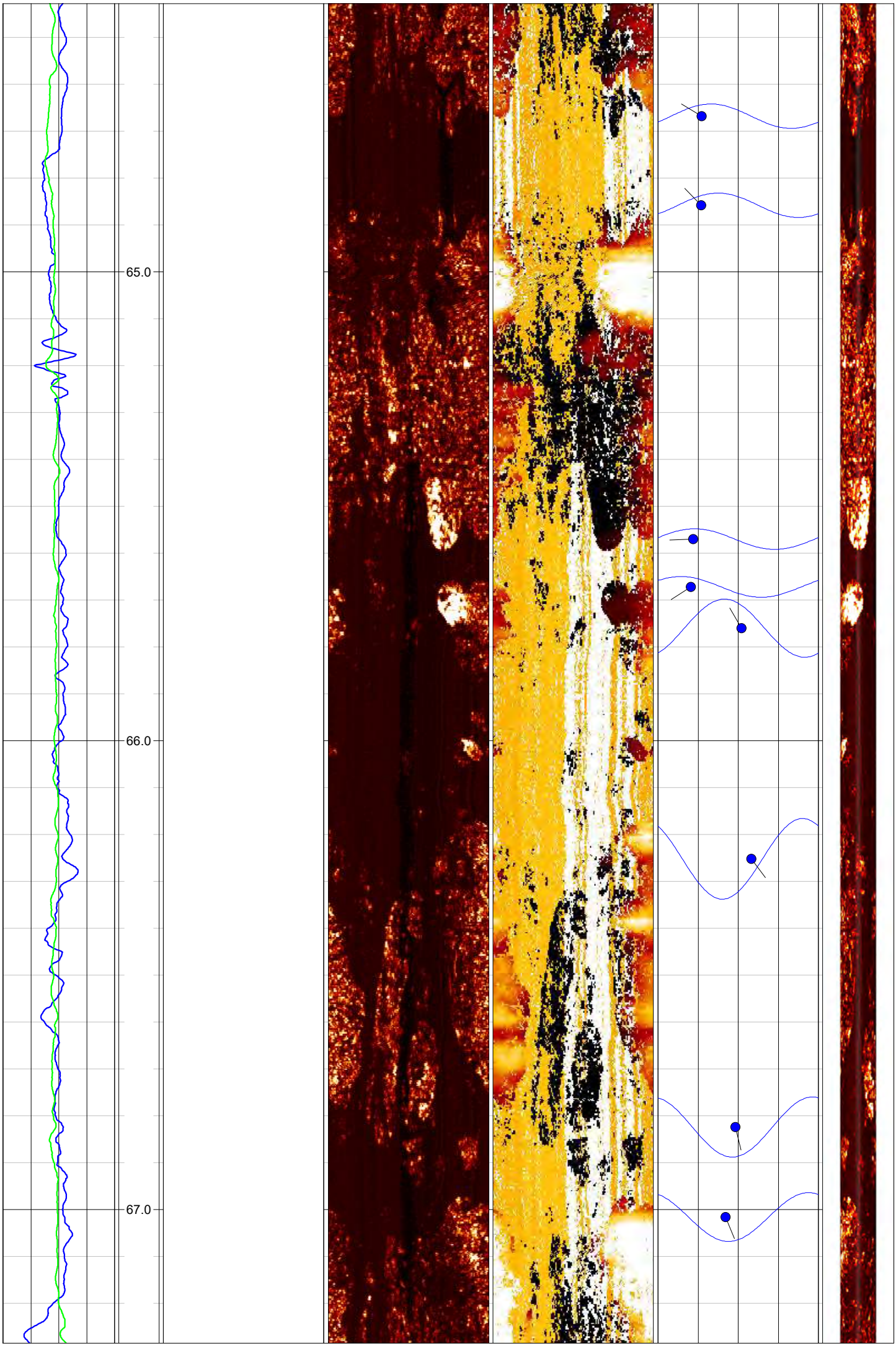
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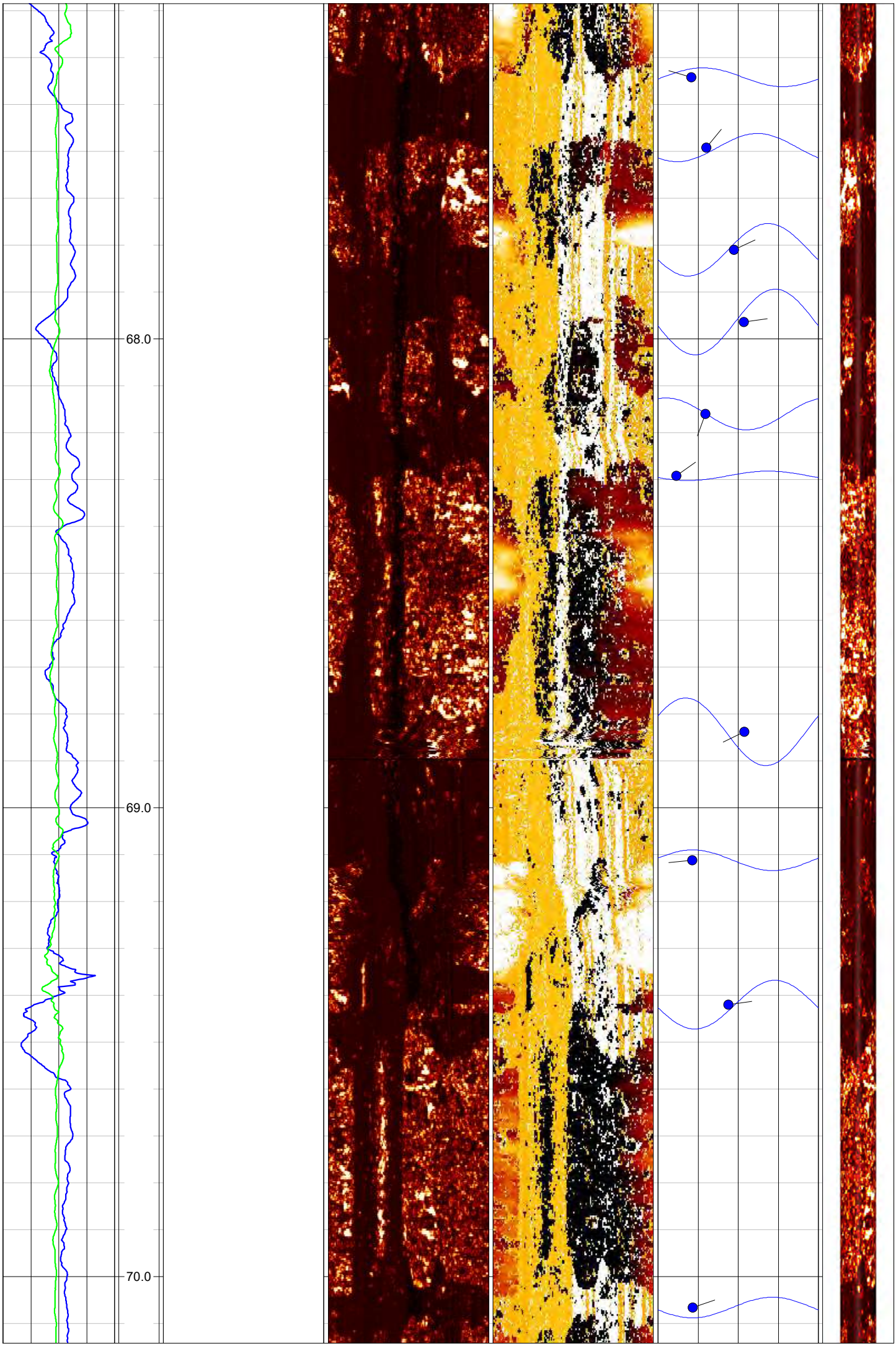
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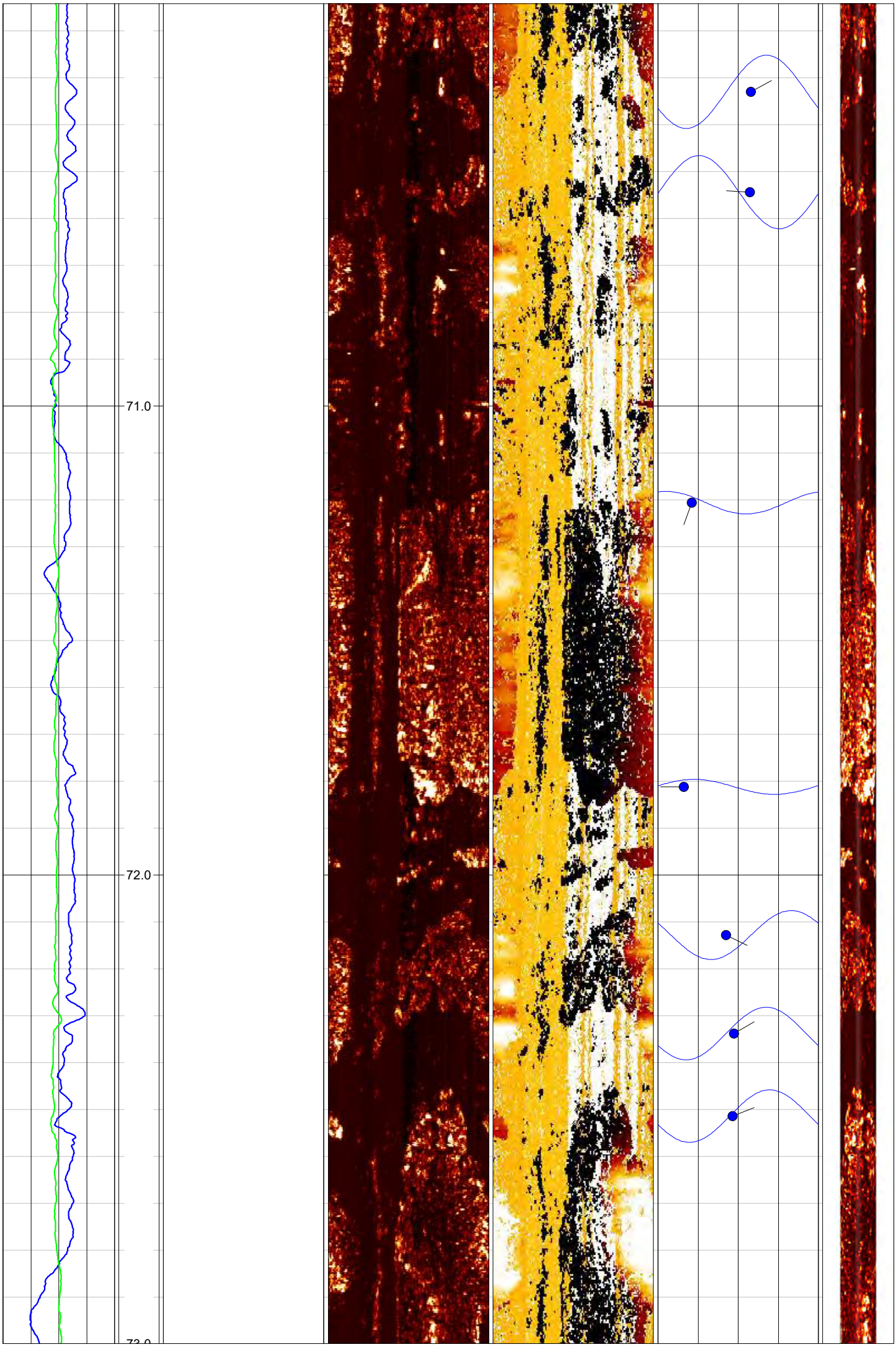
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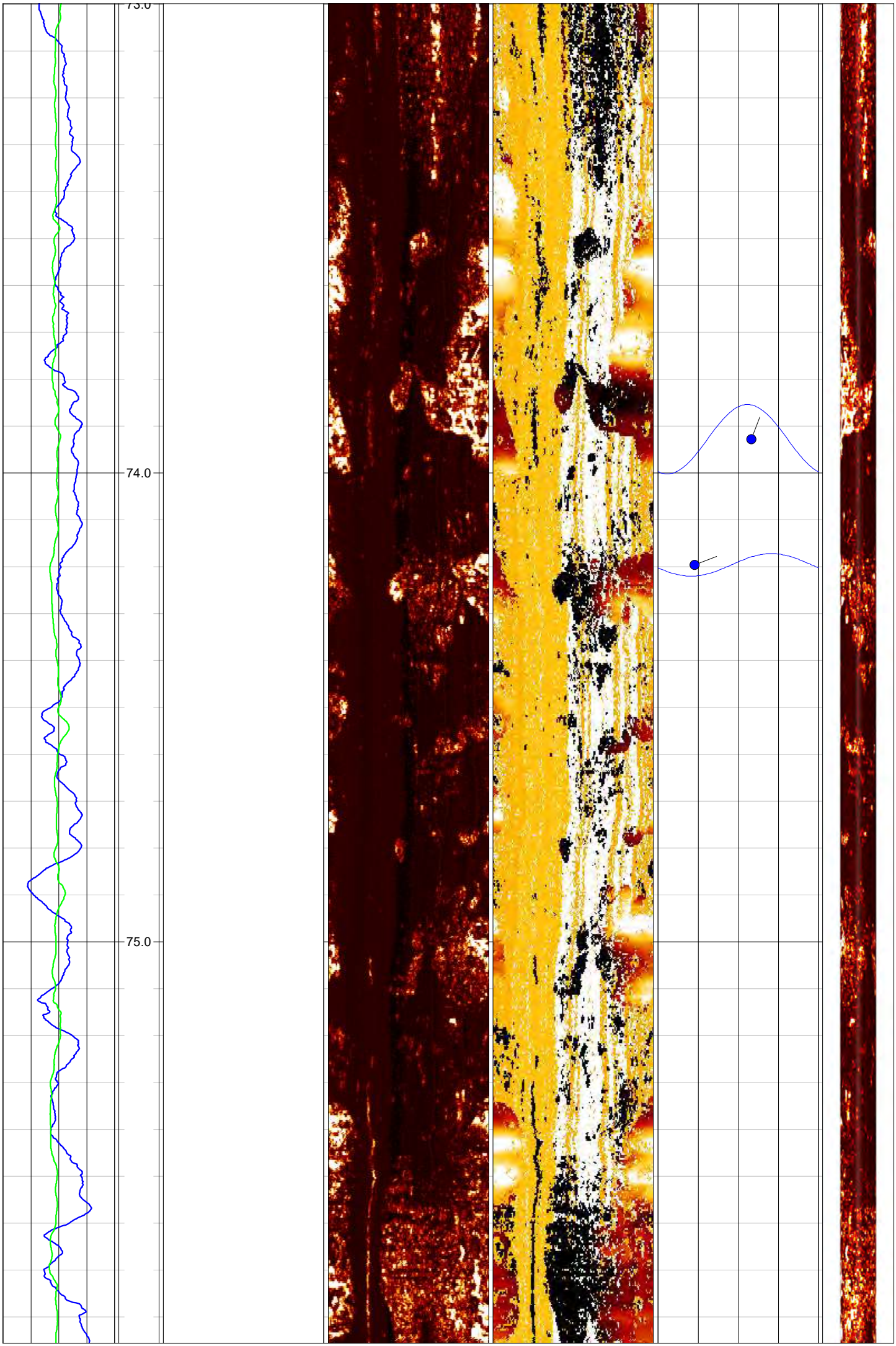
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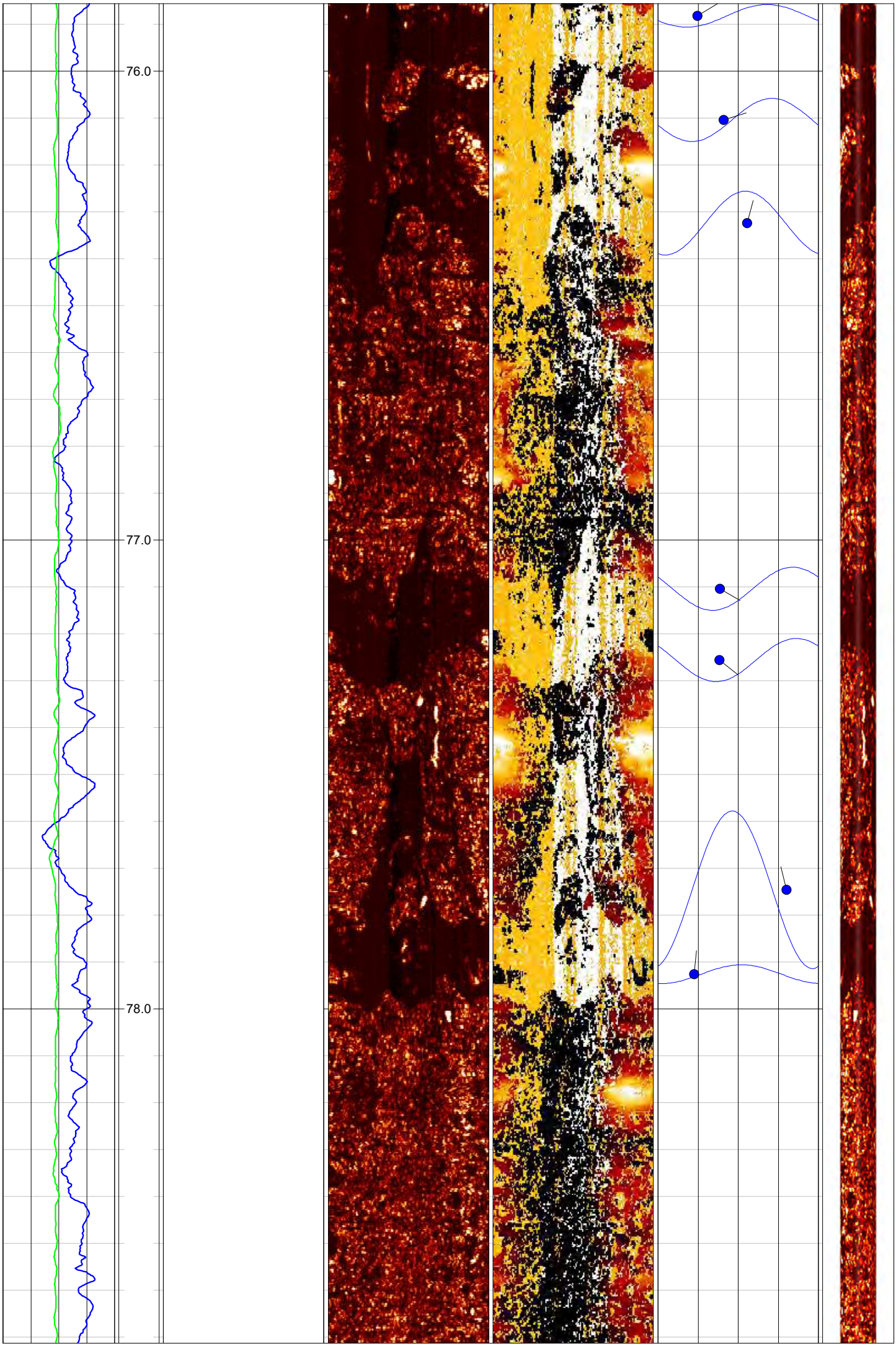
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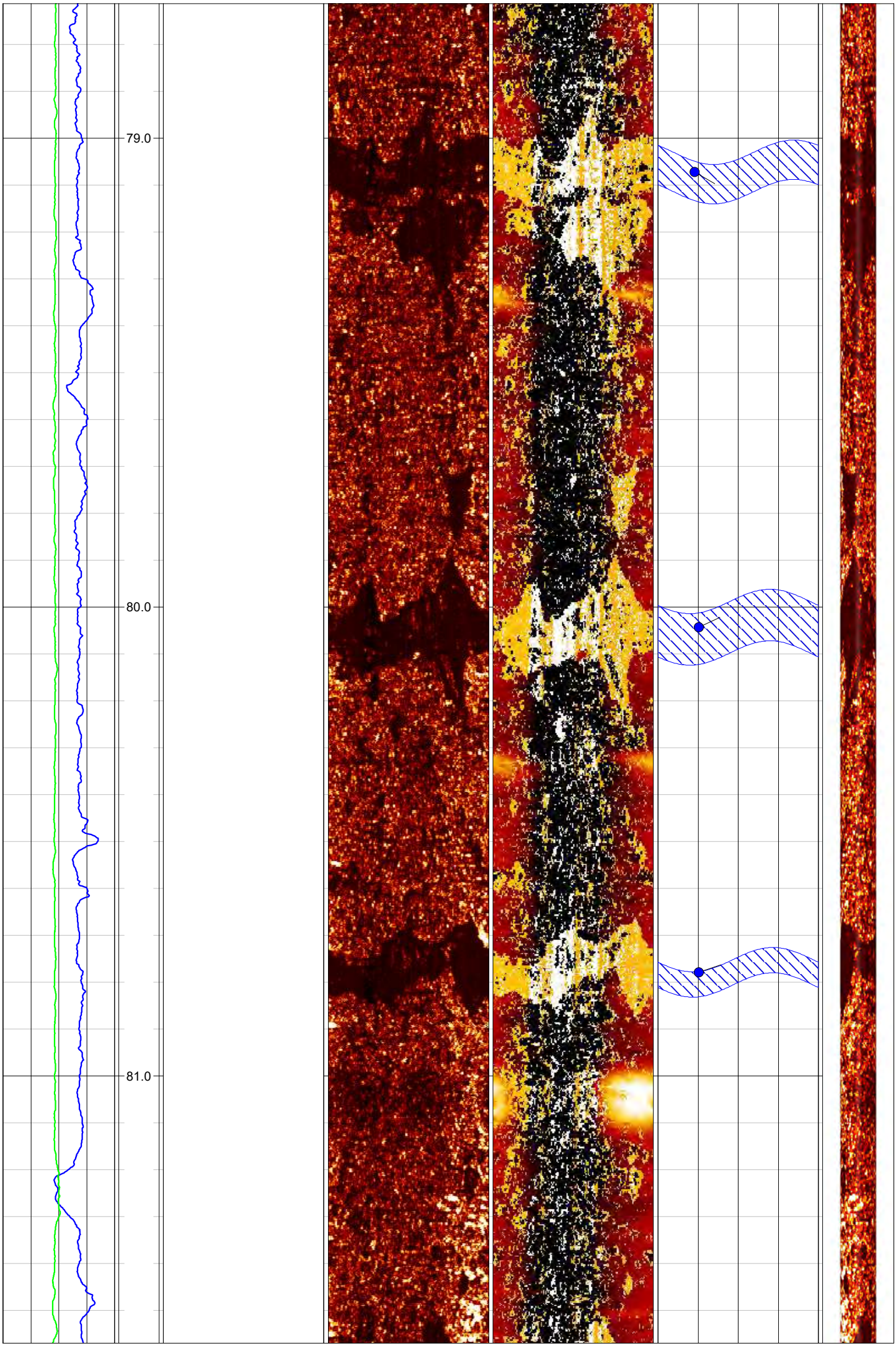
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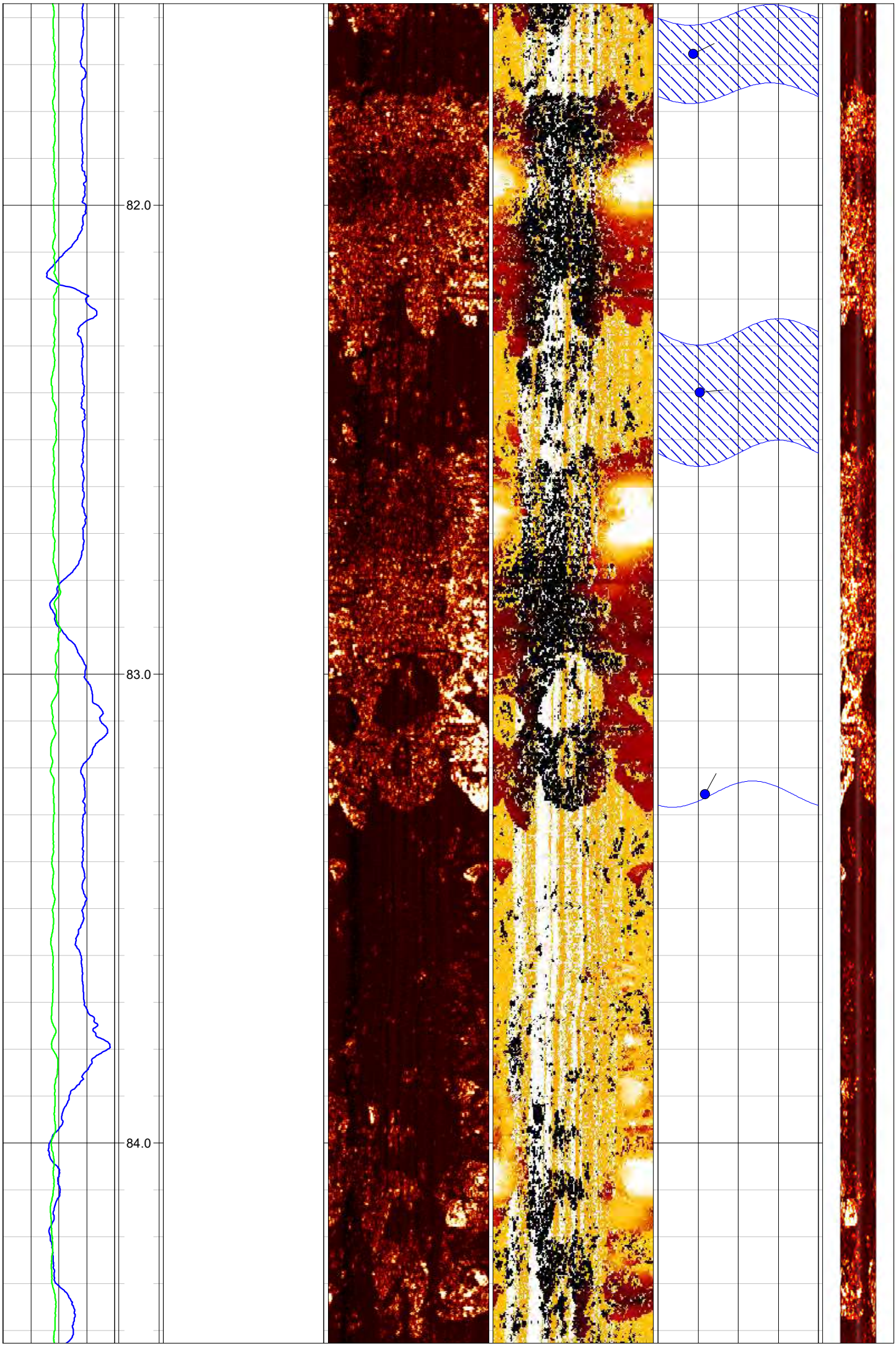
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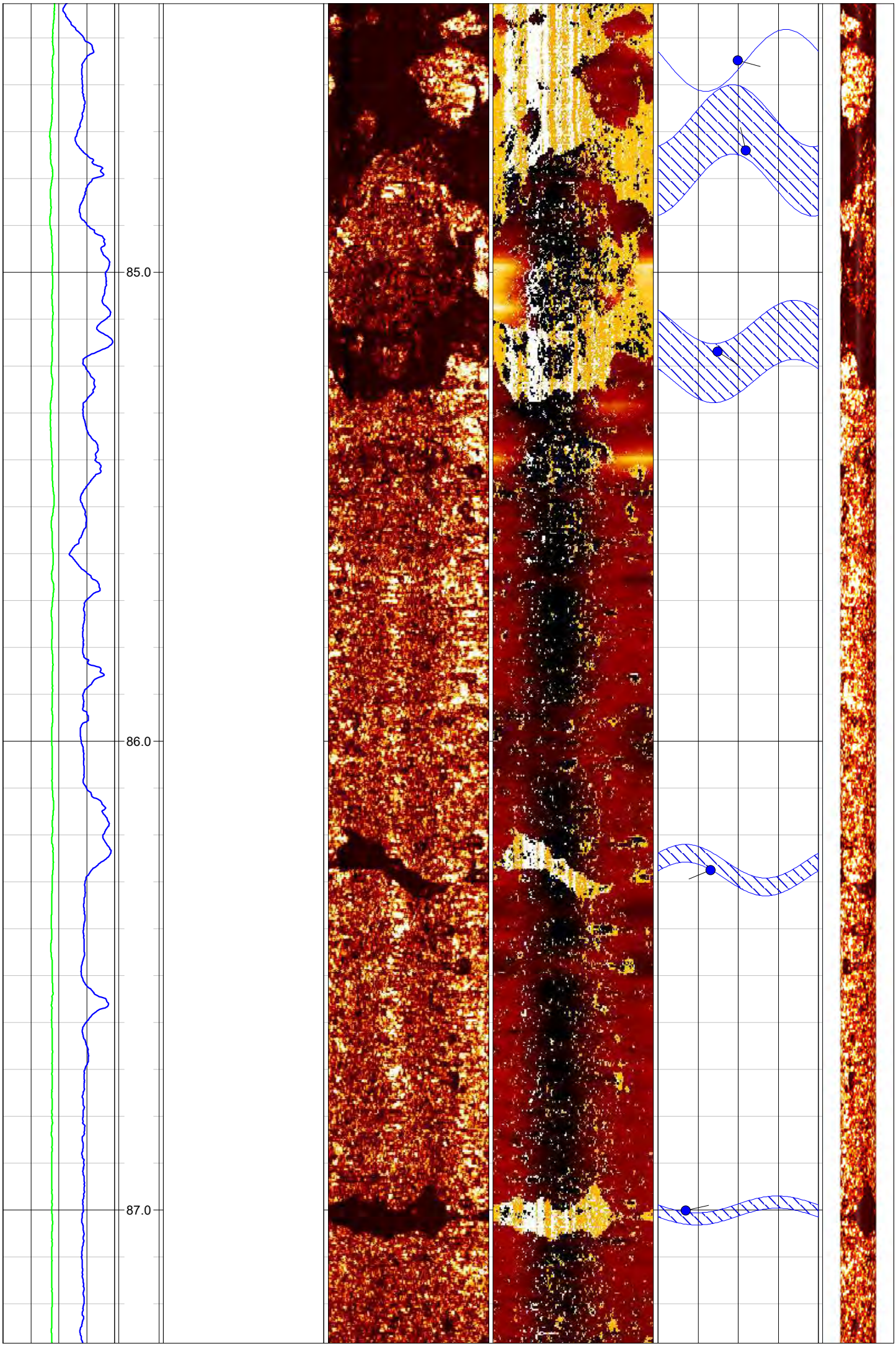
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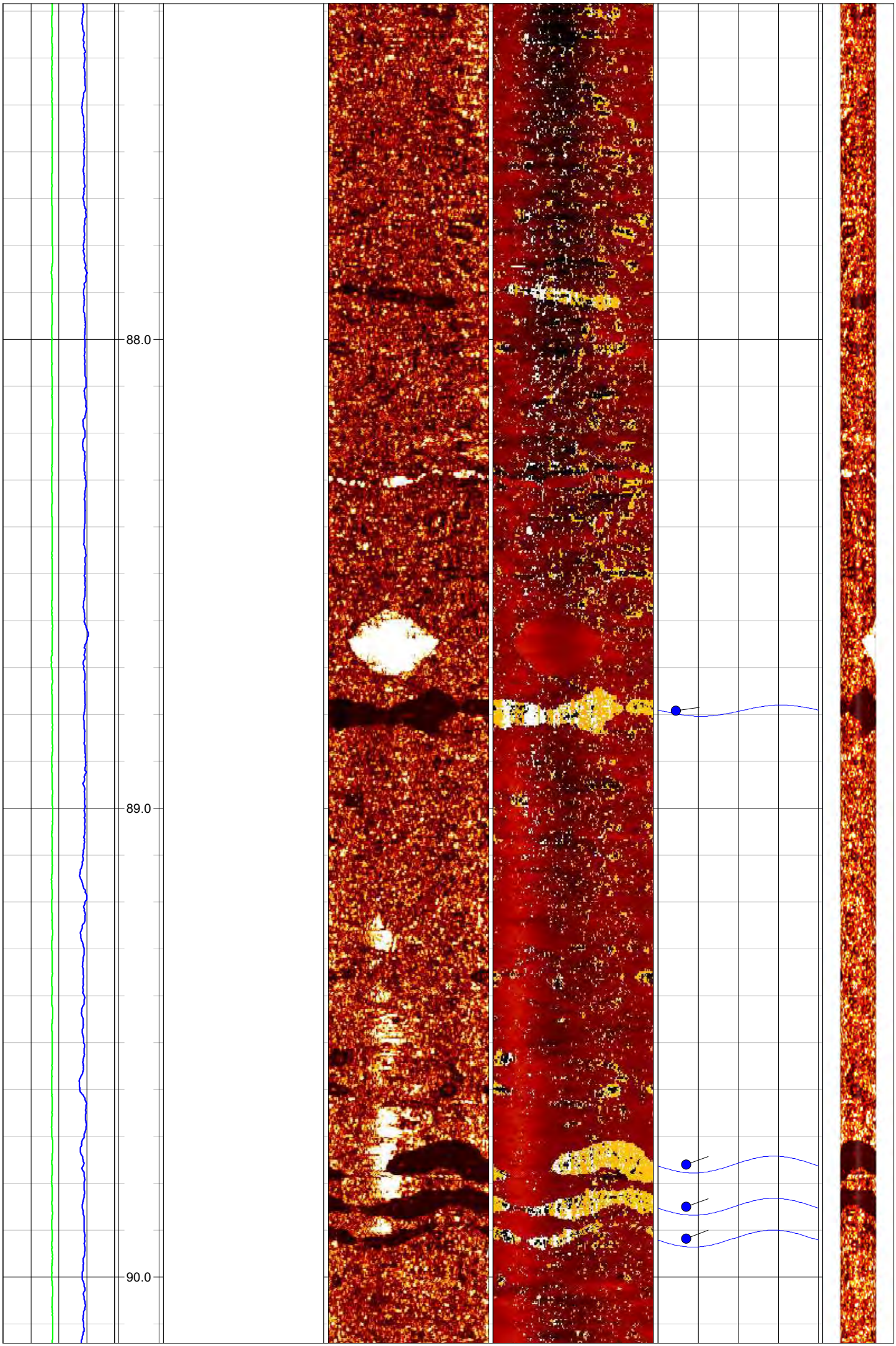
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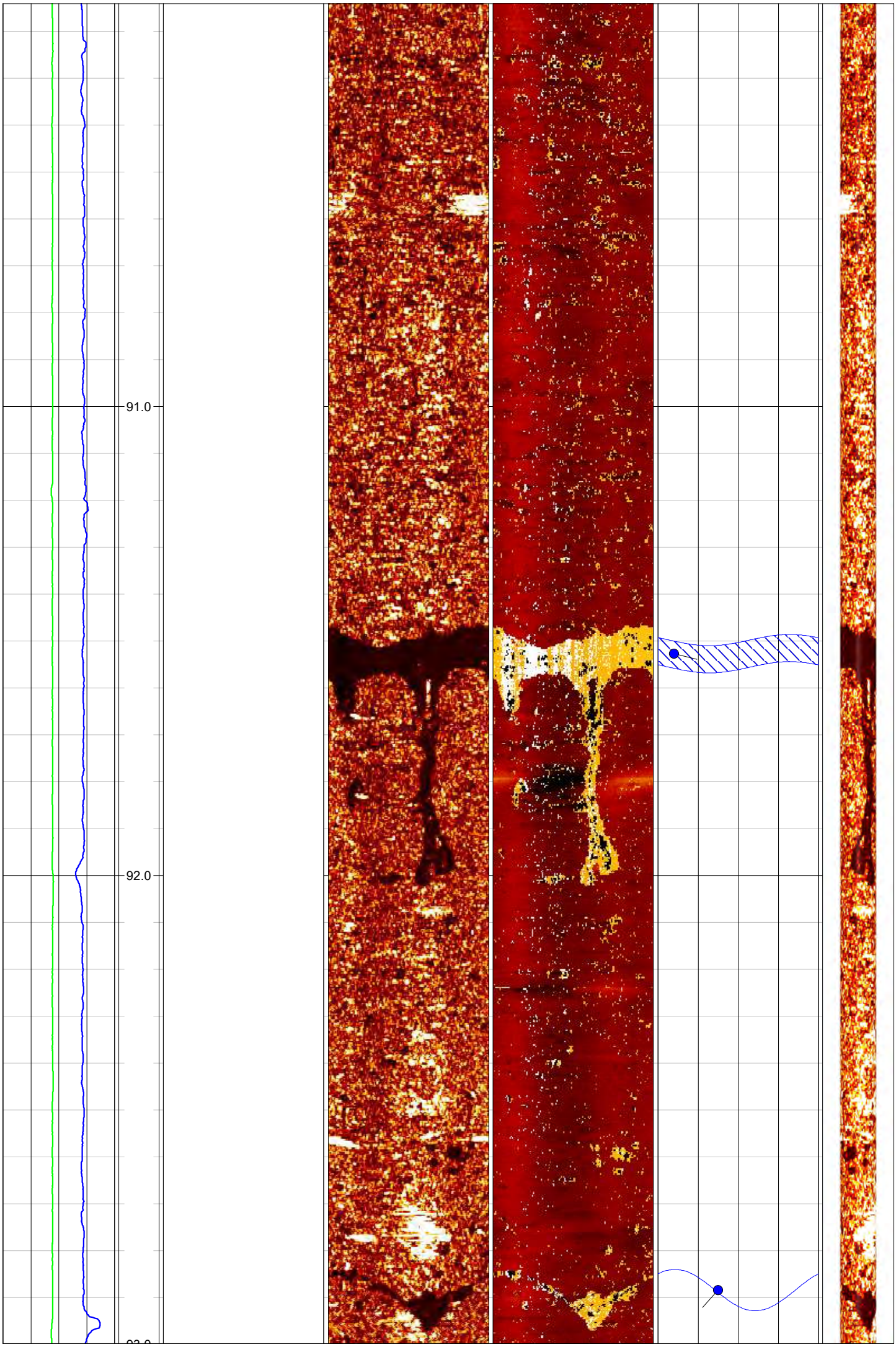
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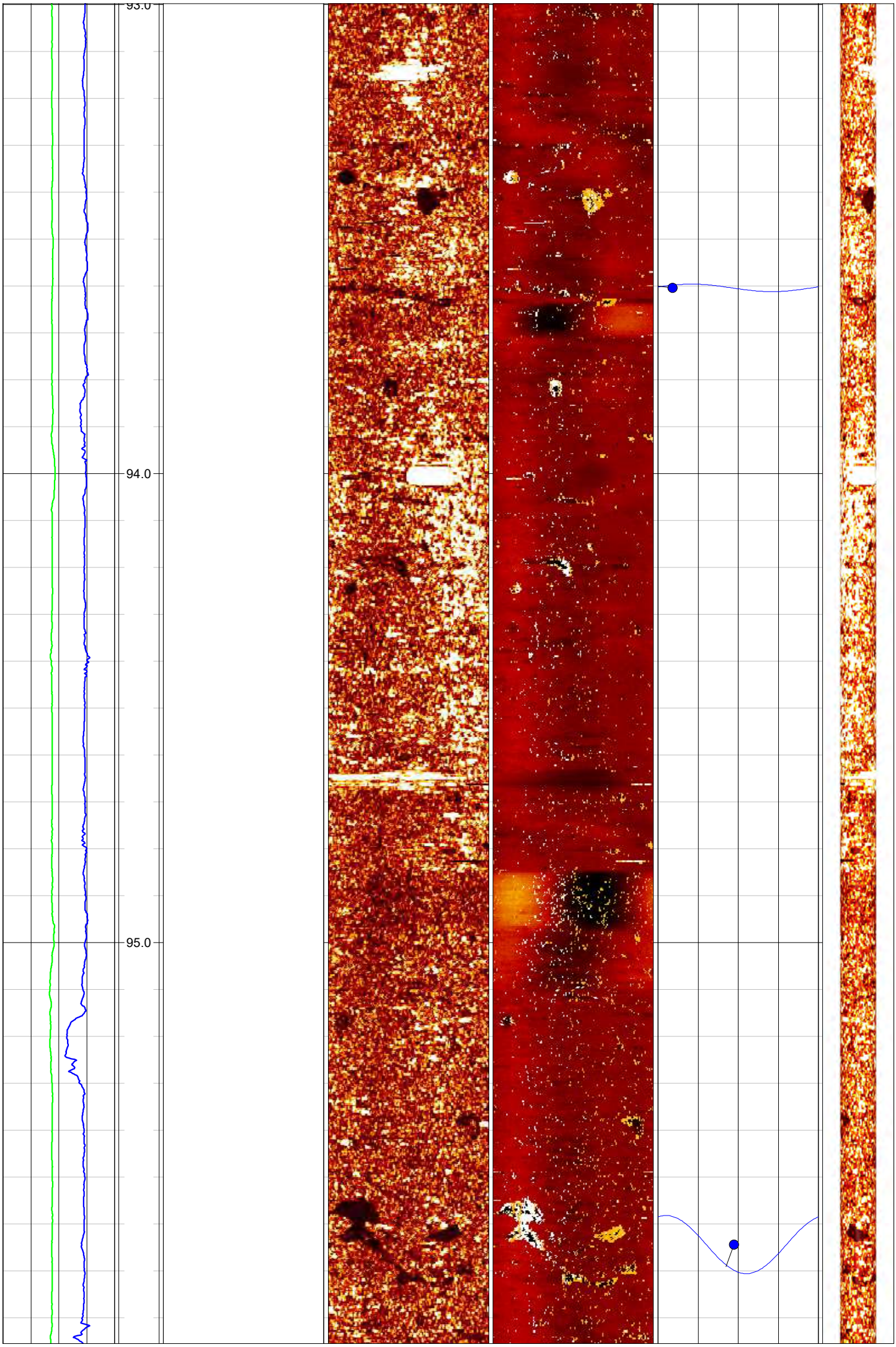
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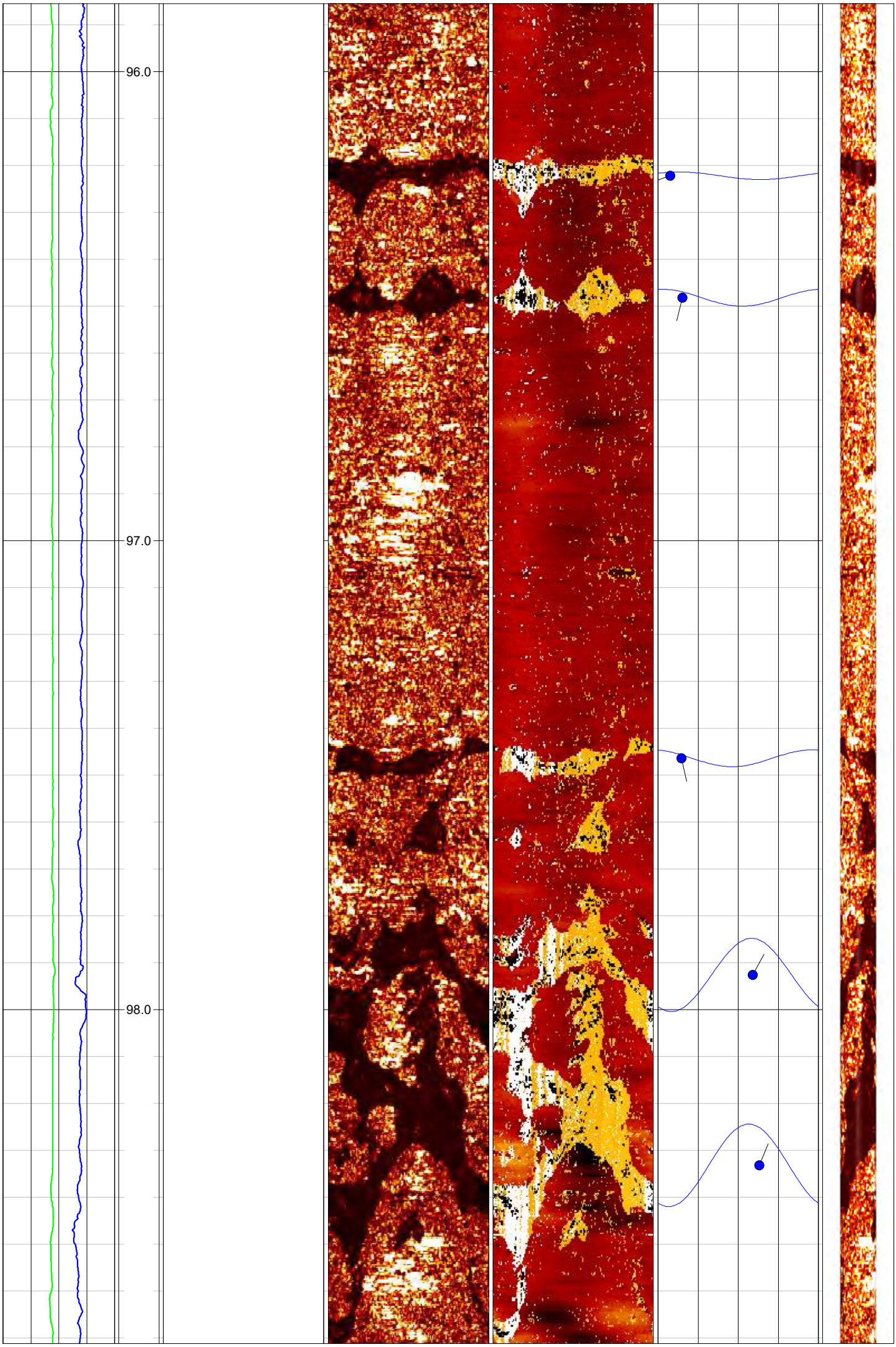
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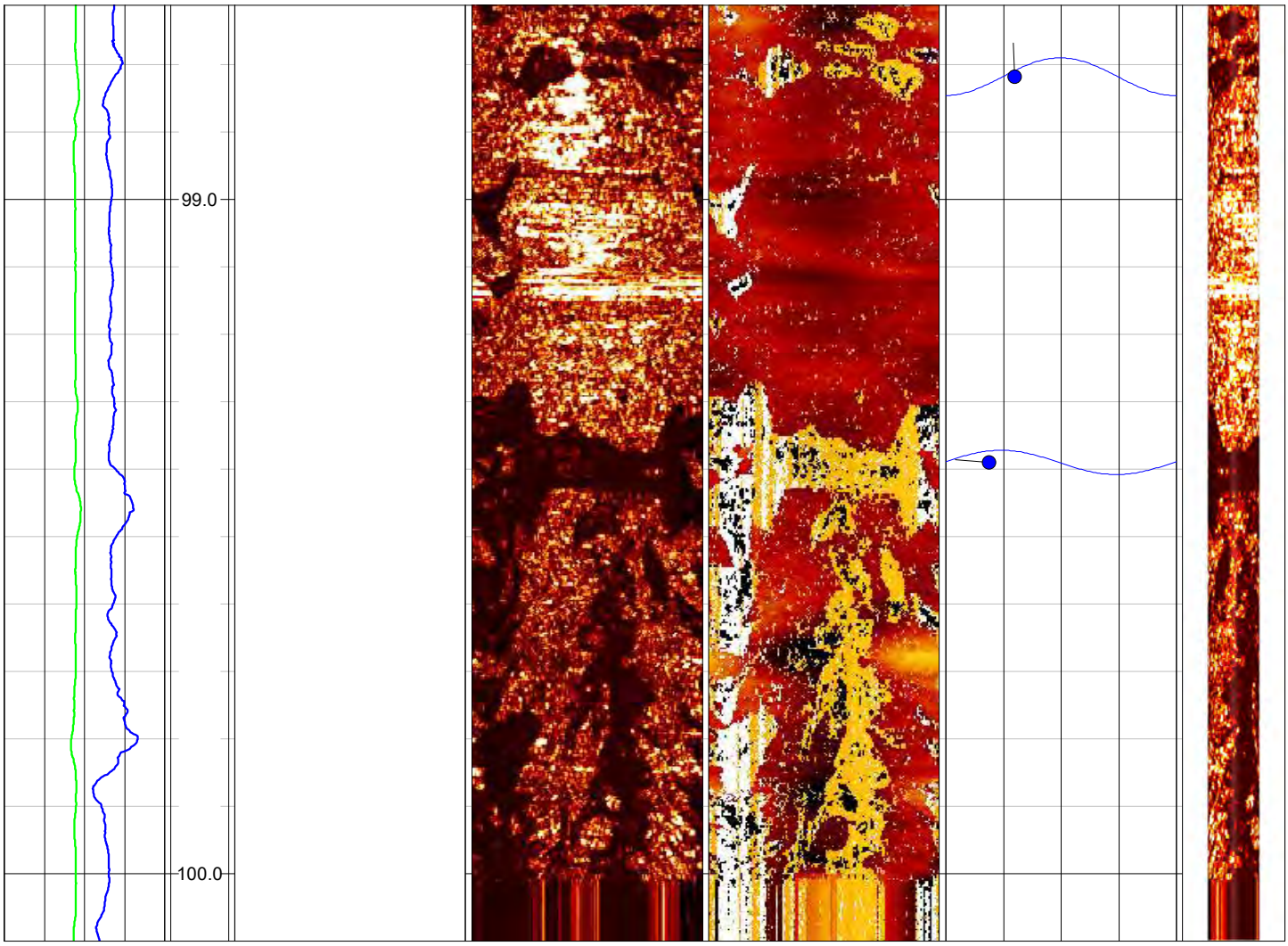

99.0
100.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC218**

Log Type: ***Composite***

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394126.0E 214739.0N** Elevation: **285.65m**

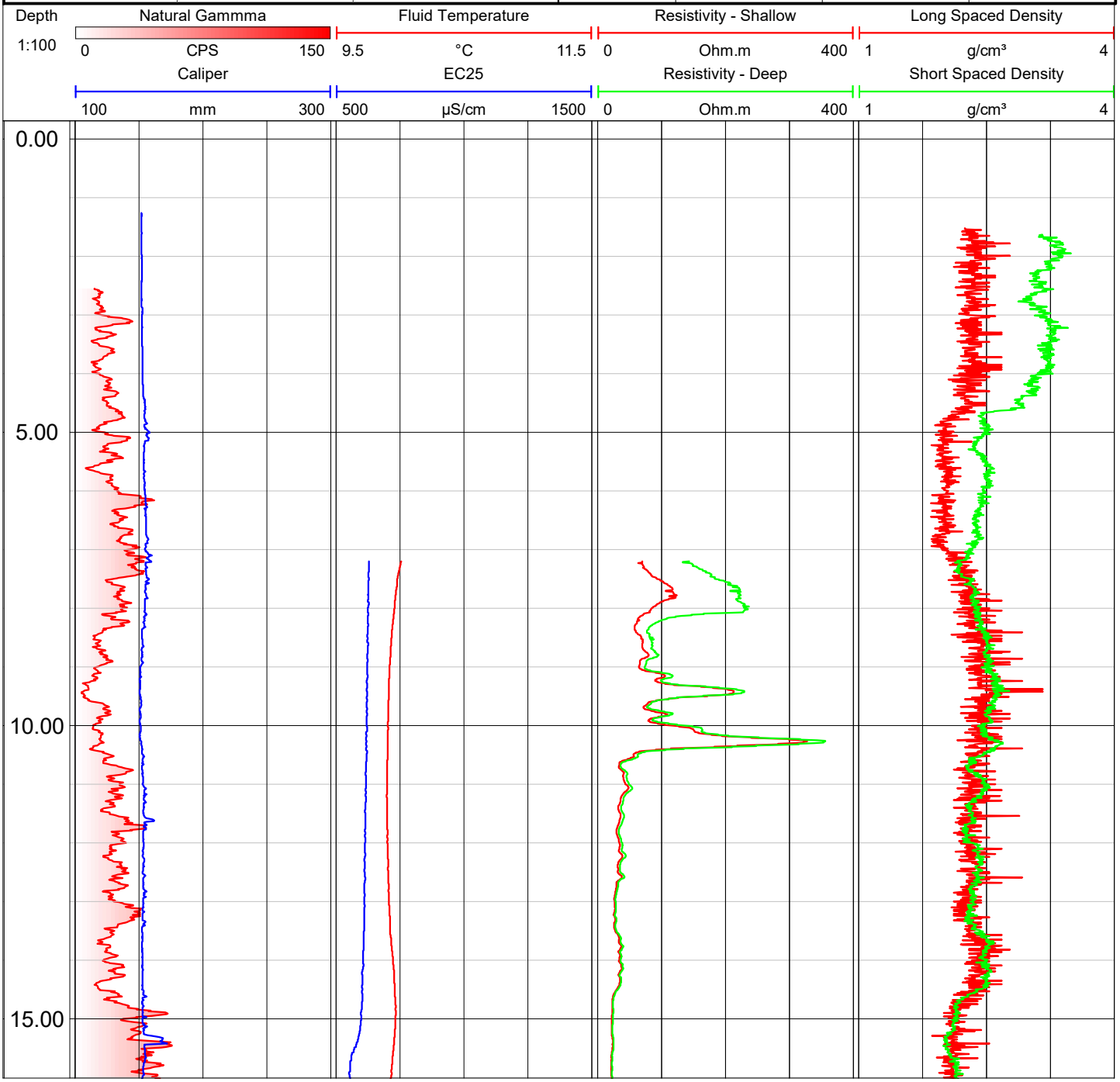
Drilled Depth: (m)	**25.0**	Date:	**26.9.2019**
Logged Depth: (m)	**24.9**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	No fluid logs below 22m due to heavy mud present.
Logged Interval: (m)	**4.5 - 24.9**		
Fluid Level: (m)	**7.1**		

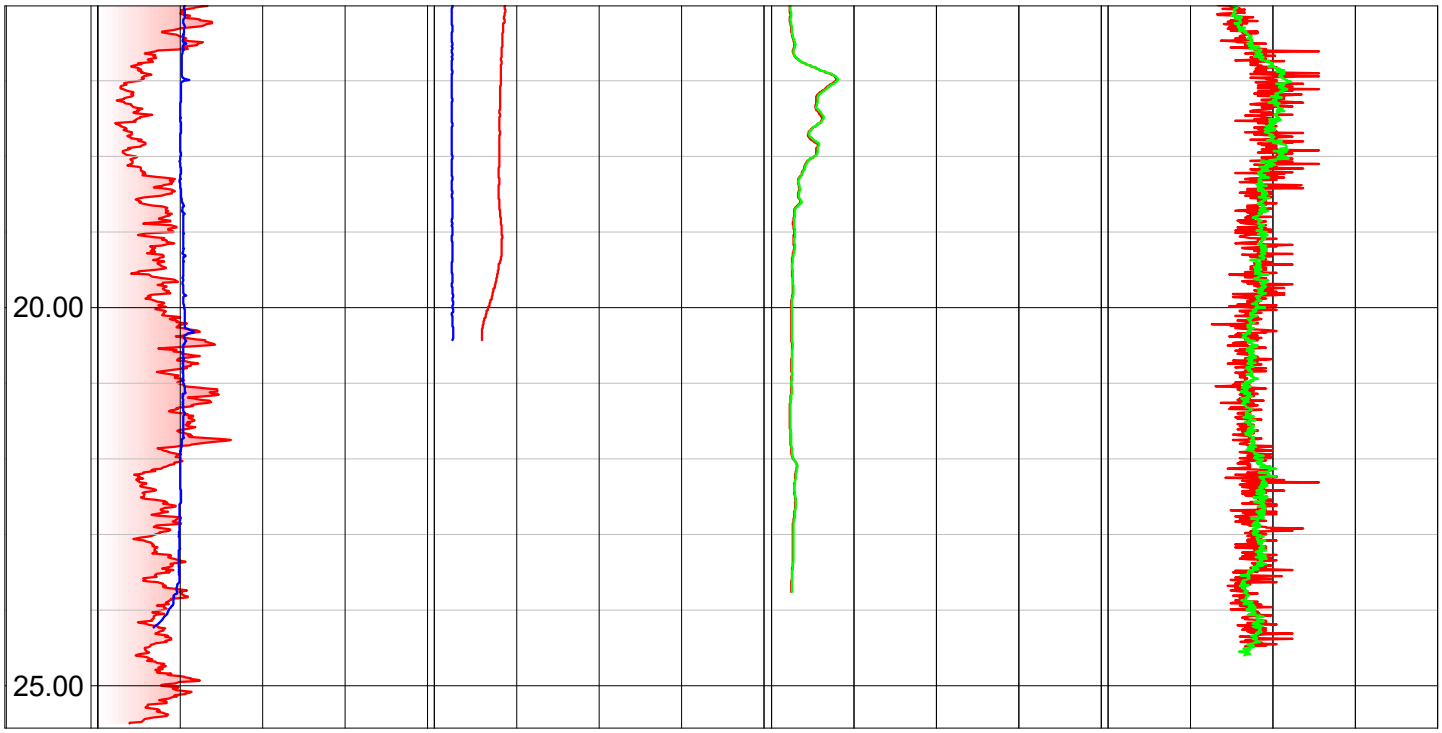
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**4.5**	**25.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**4.5**




20.00
25.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Log Type: ***Image***

Borehole: **DSRC218**

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394126.0E 214739.0N** Elevation: **285.65m**

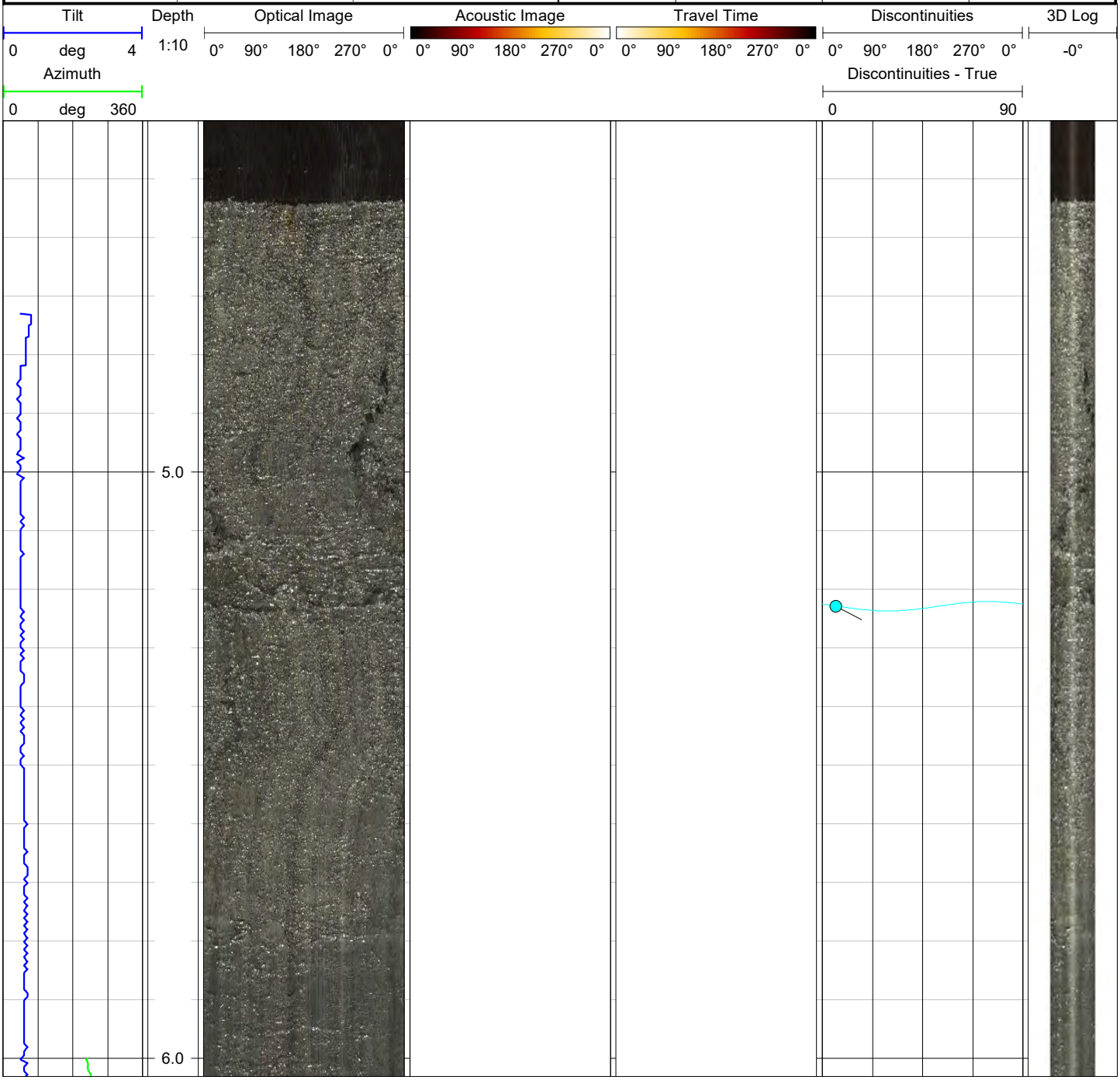
Drilled Depth: (m)	**25.0**	Date:	**26.9.2019**
Logged Depth: (m)	**24.9**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole fluid cloudy below 15.7m.
Logged Interval: (m)	**4.5 - 24.9**		
Fluid Level: (m)	**7.1**		

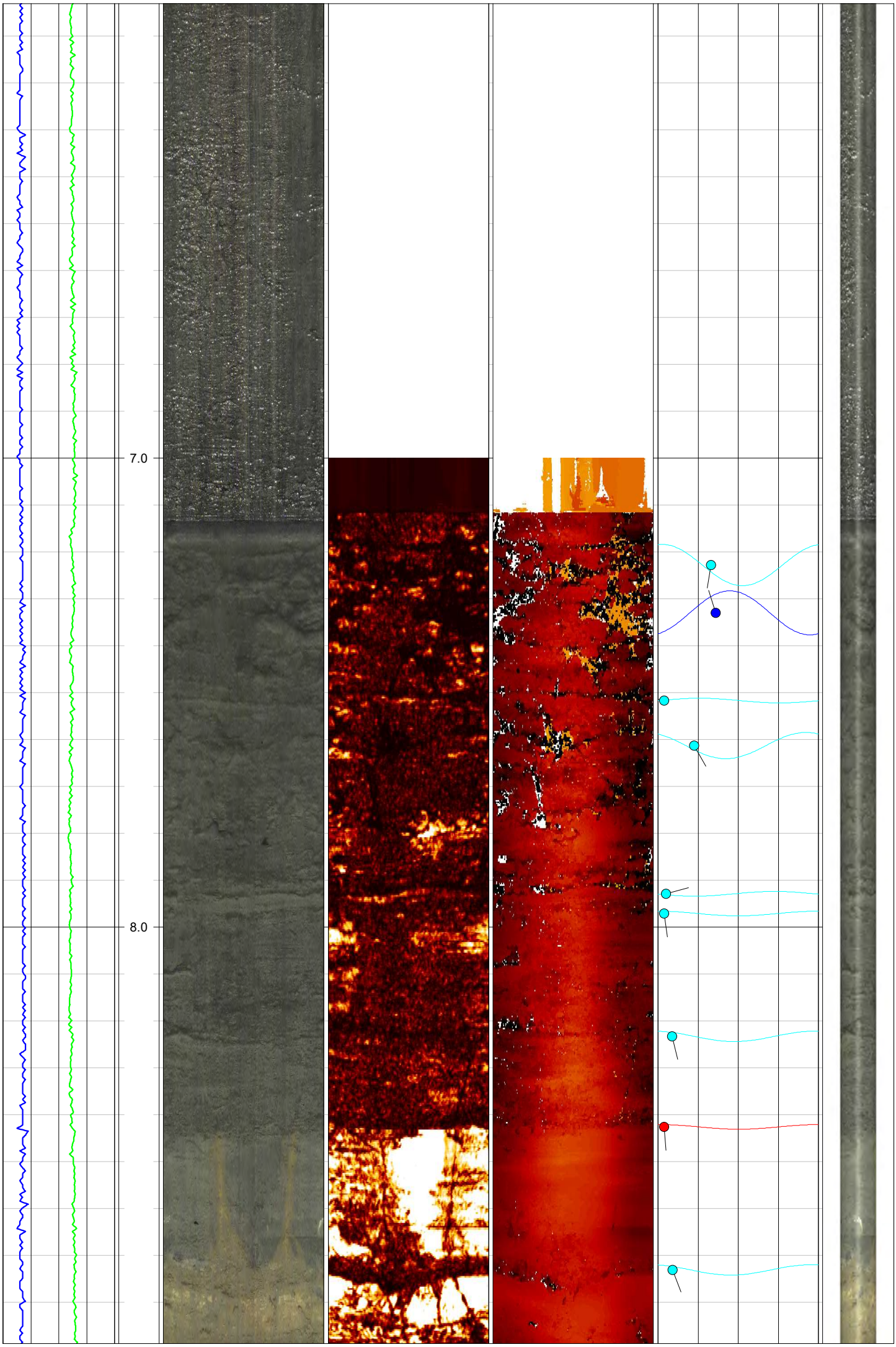
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**4.5**	**25.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**4.5**

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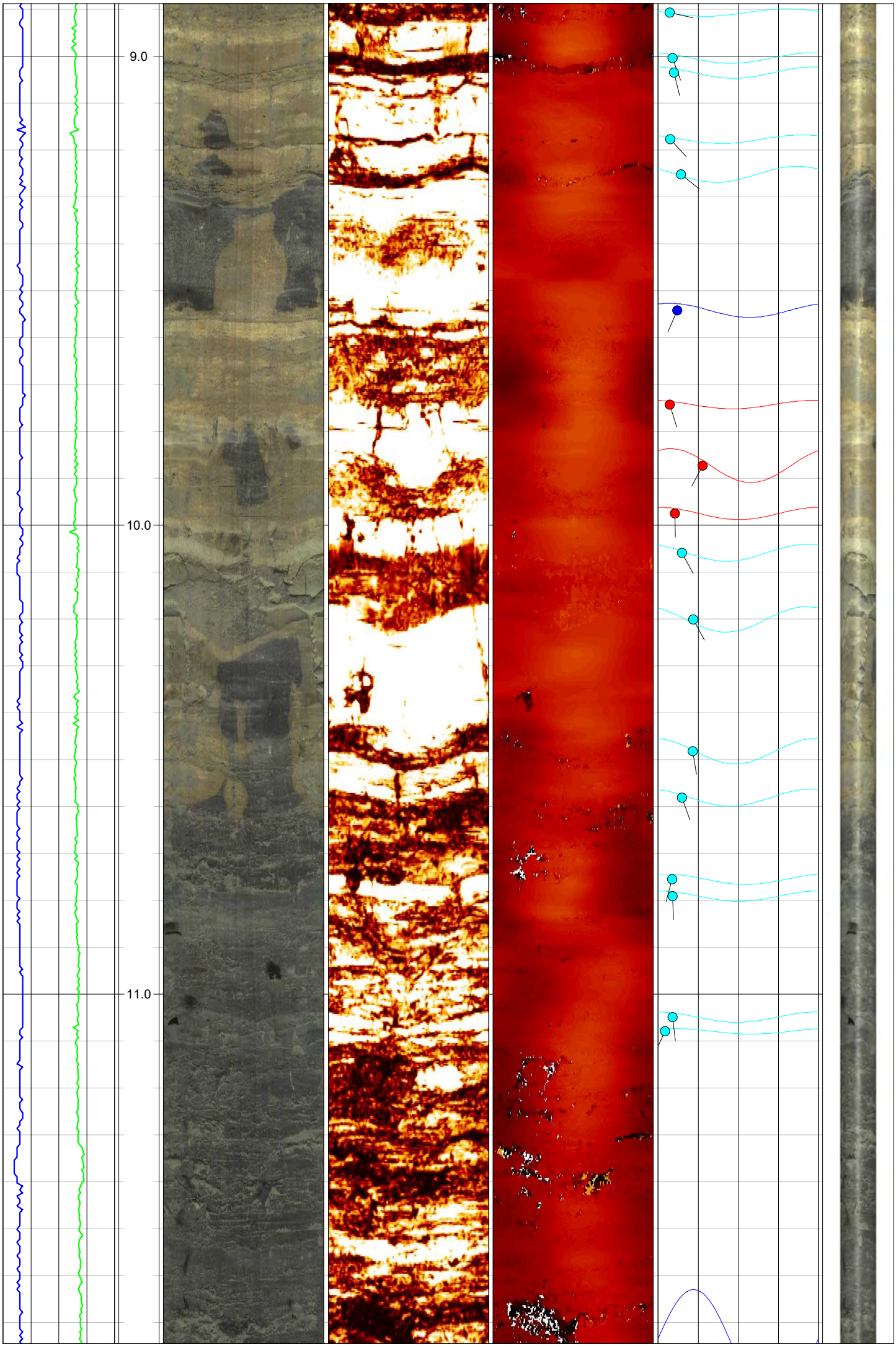
9.0
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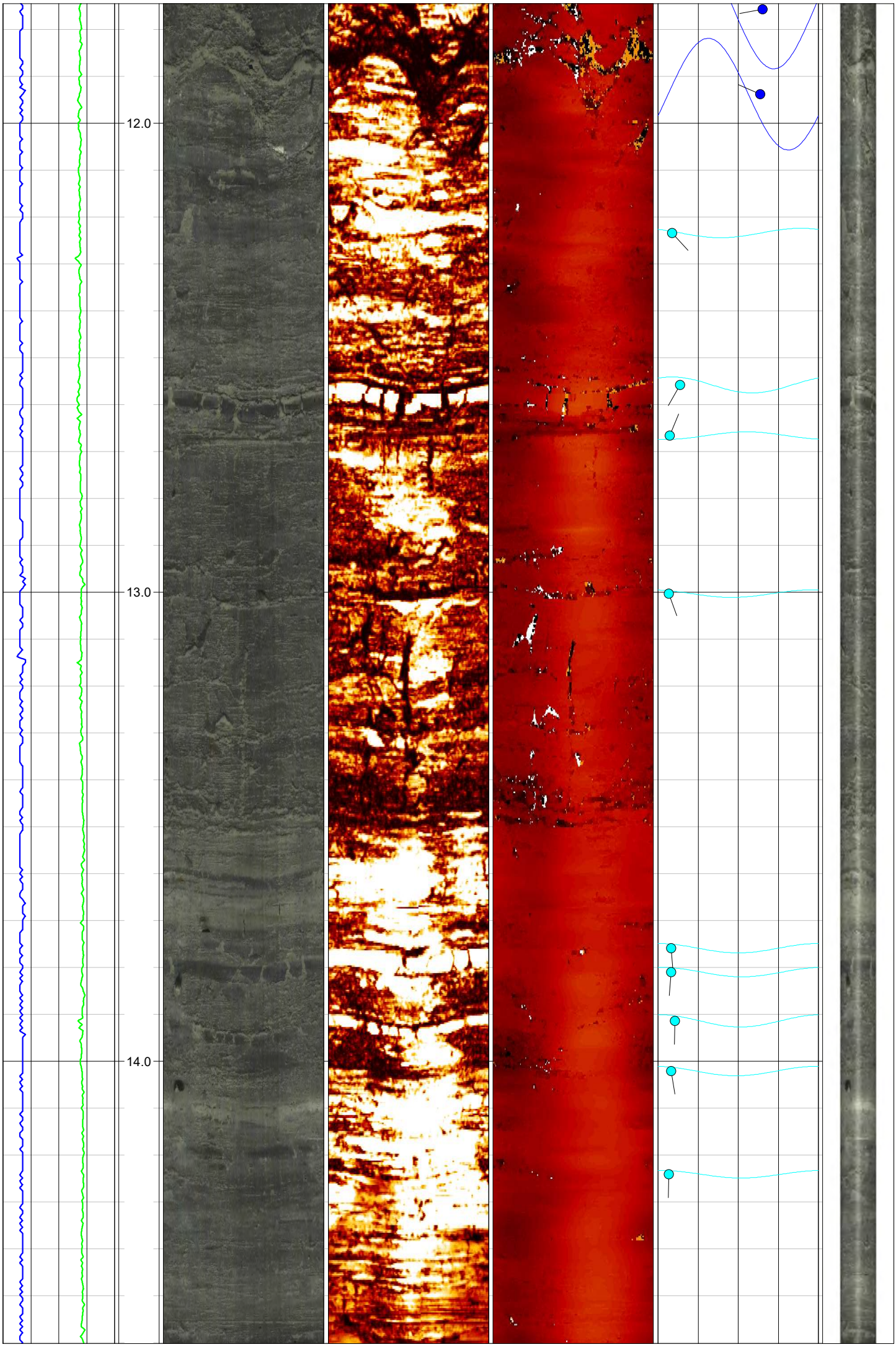
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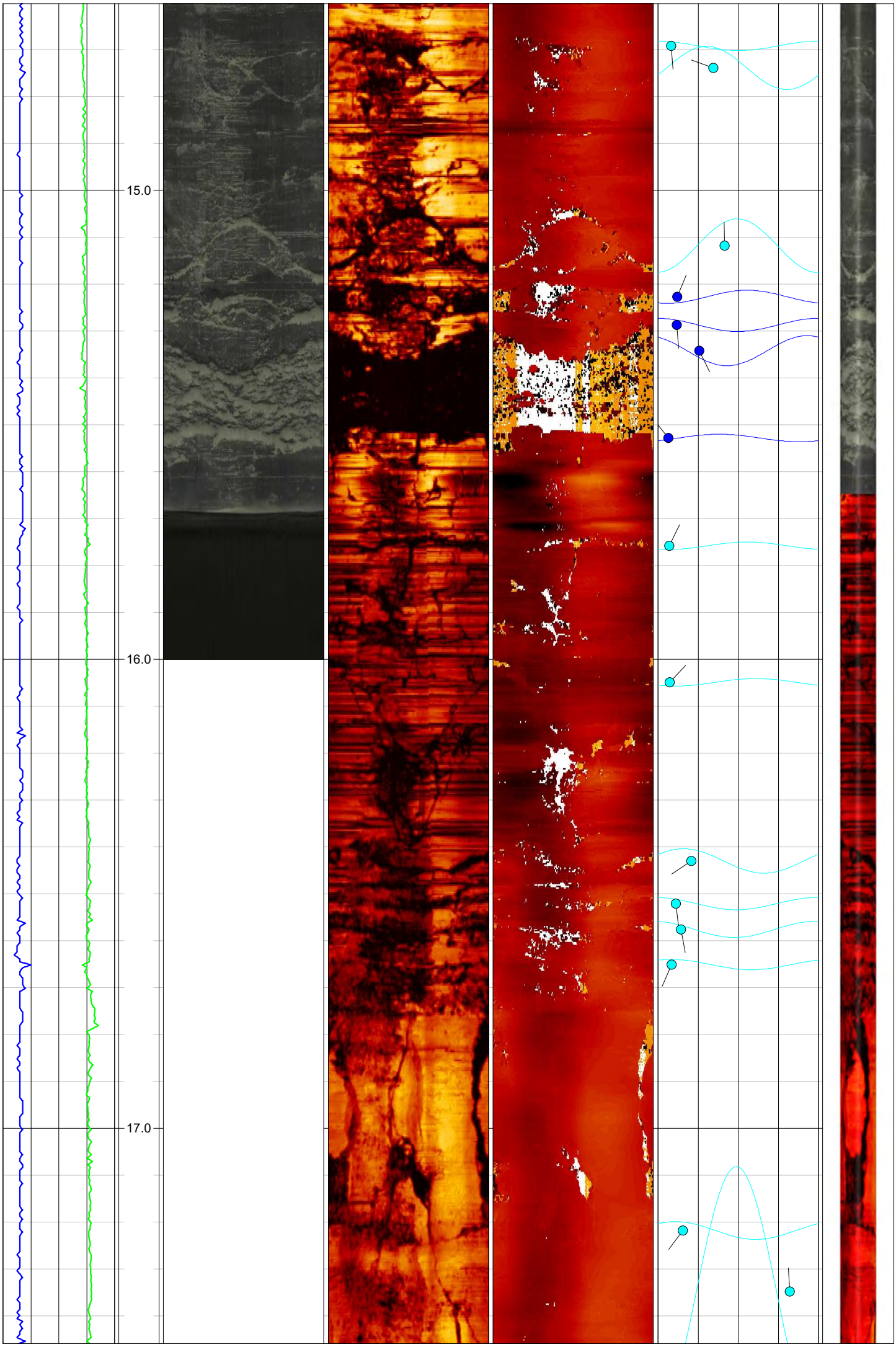
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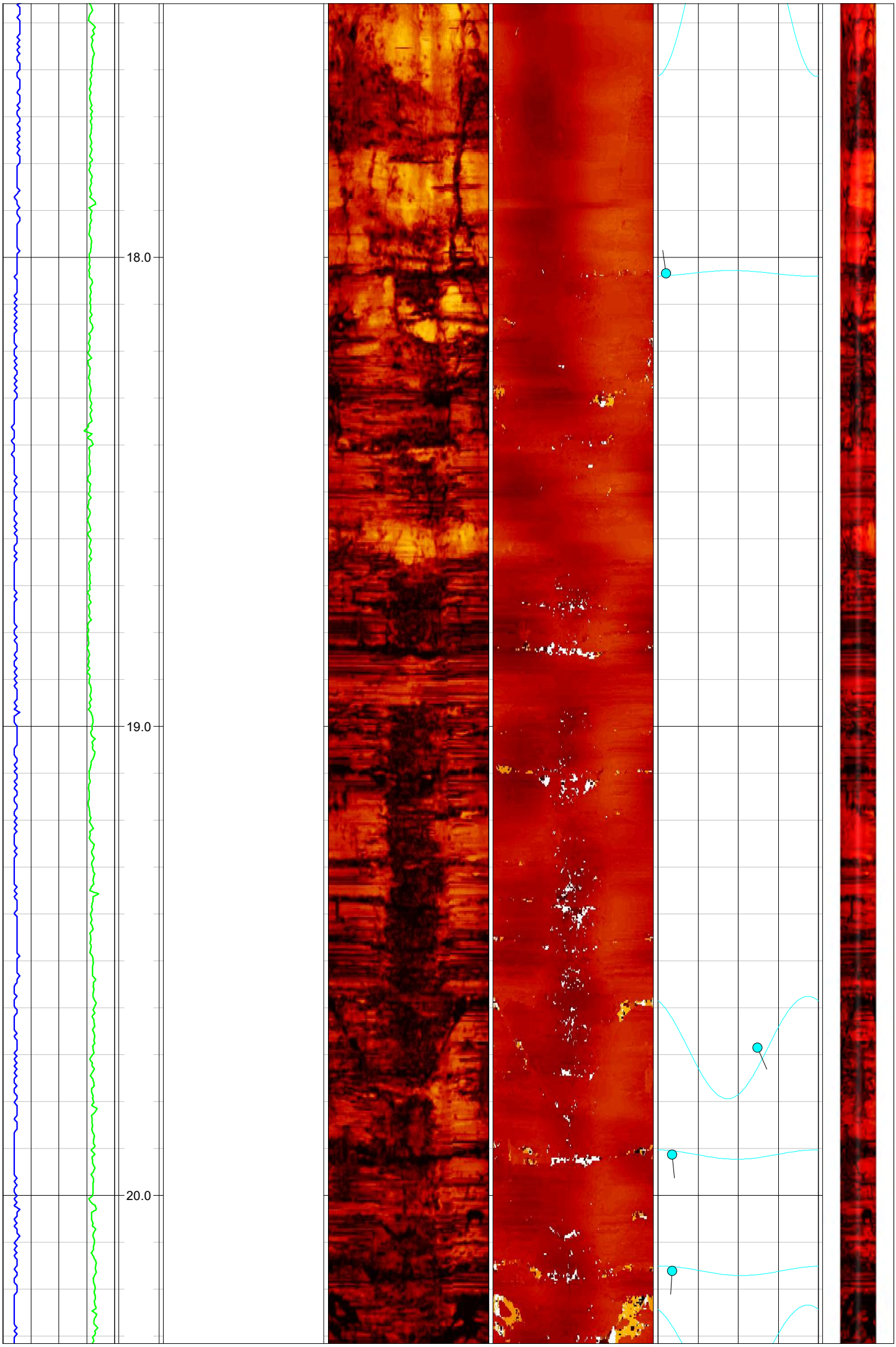
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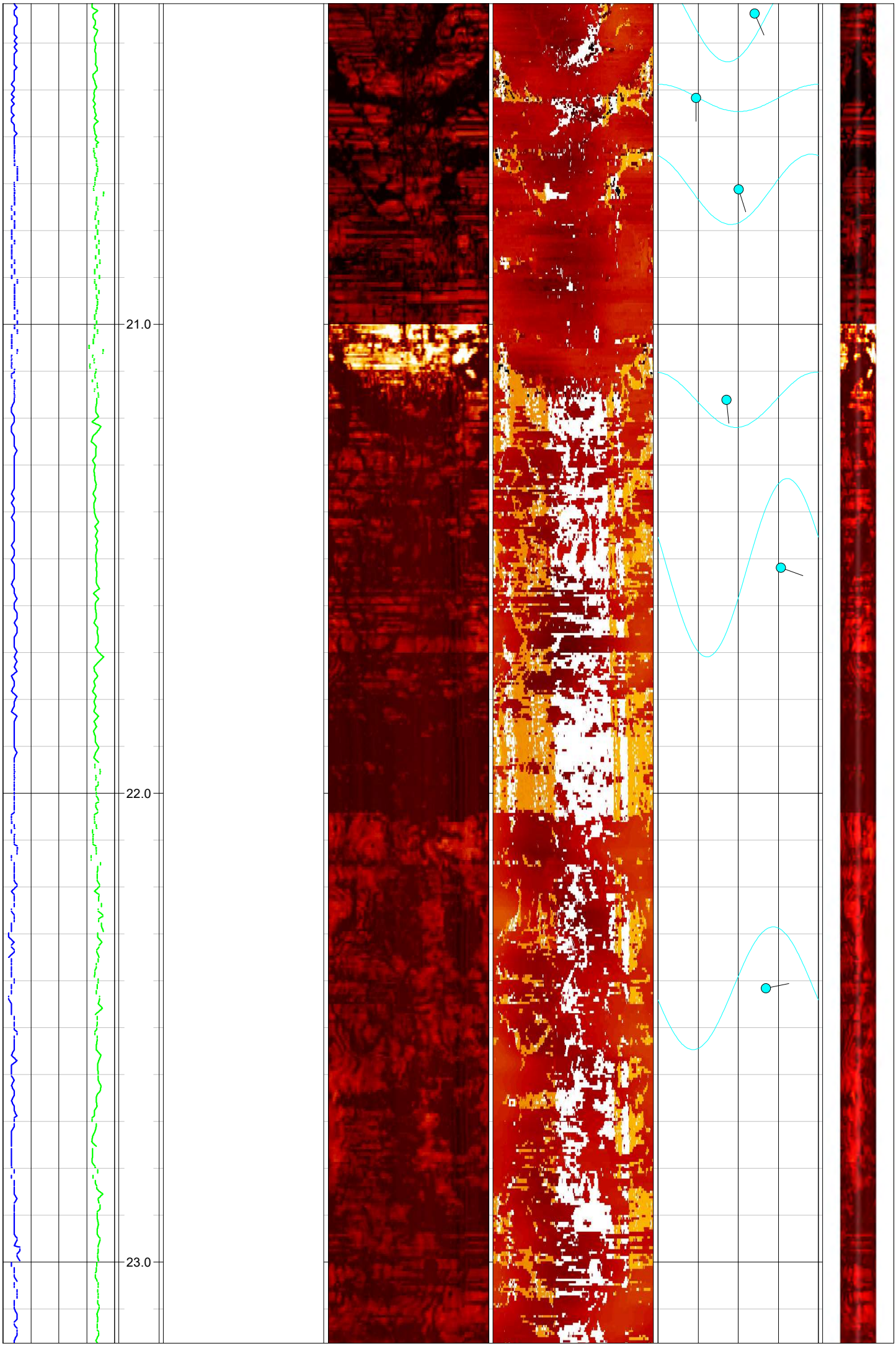
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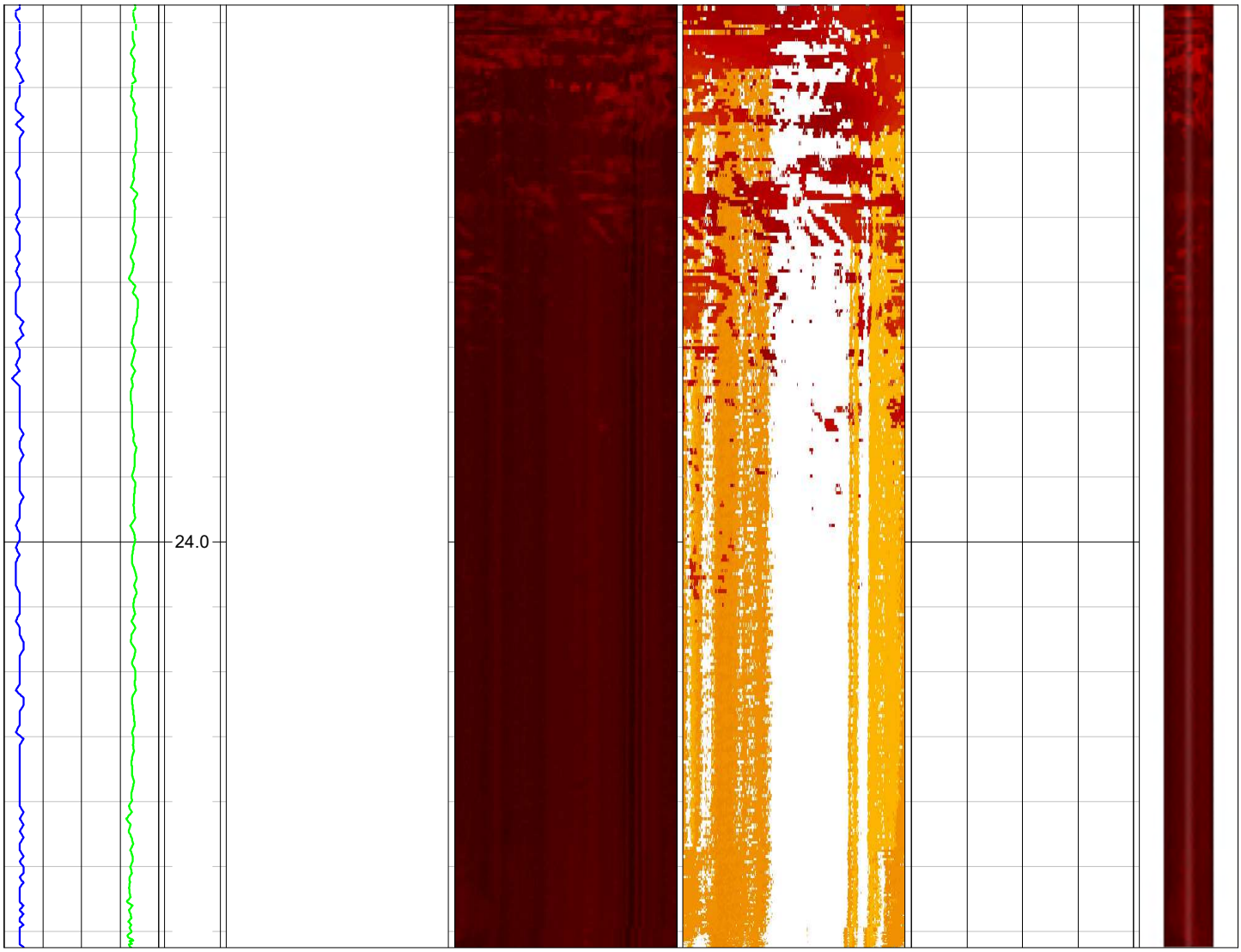

24.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC220**

Log Type: ***Composite***

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394379.0E 214500.9N** Elevation: **278.85m**

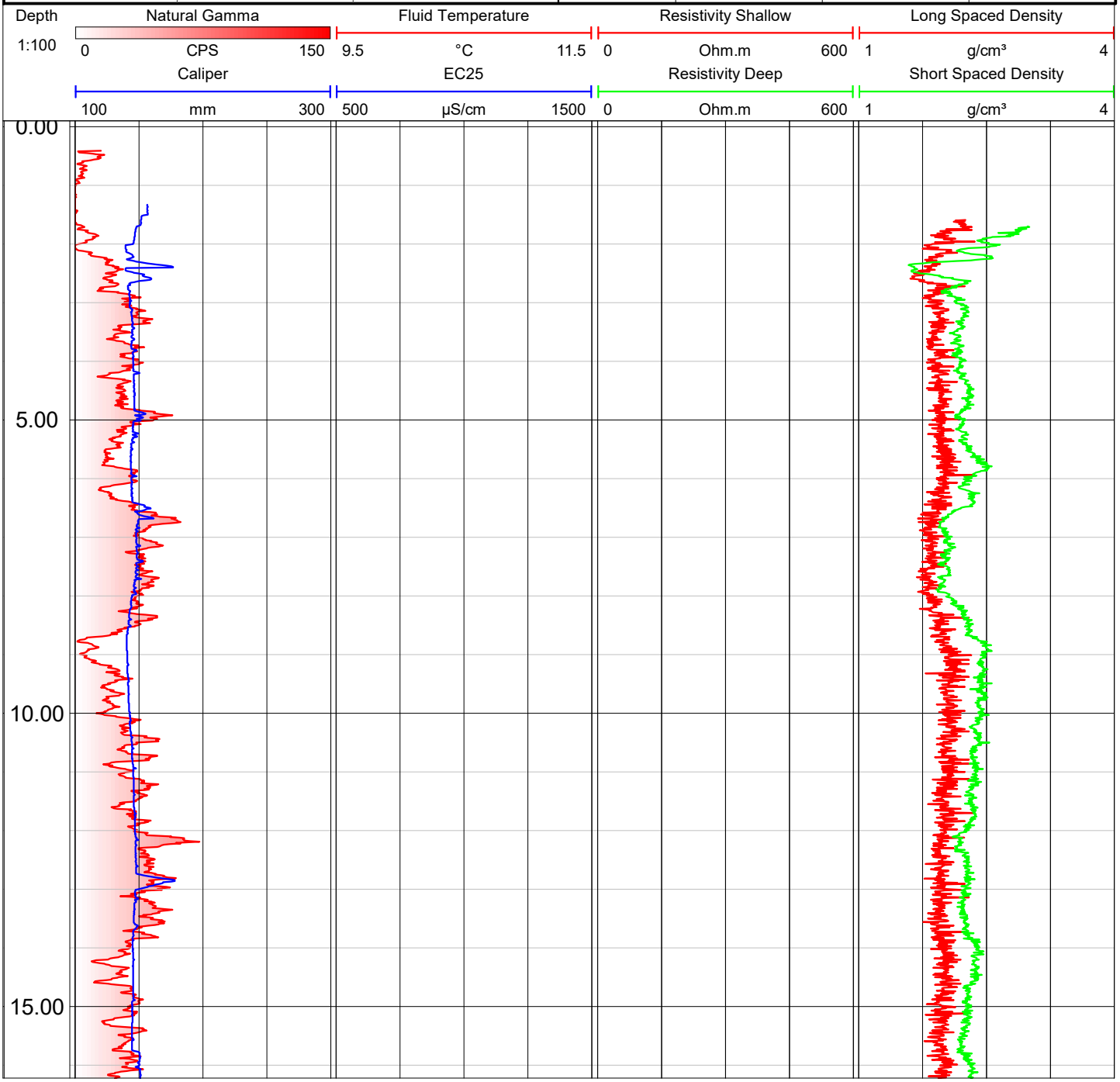
Drilled Depth: (m)	**31.2**	Date:	**27.09.2019**
Logged Depth: (m)	**31.2**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Insufficient fluid level for flowmeter
Logged Interval: (m)	**2.2 - 31.2**		
Fluid Level: (m)	**28.0**		

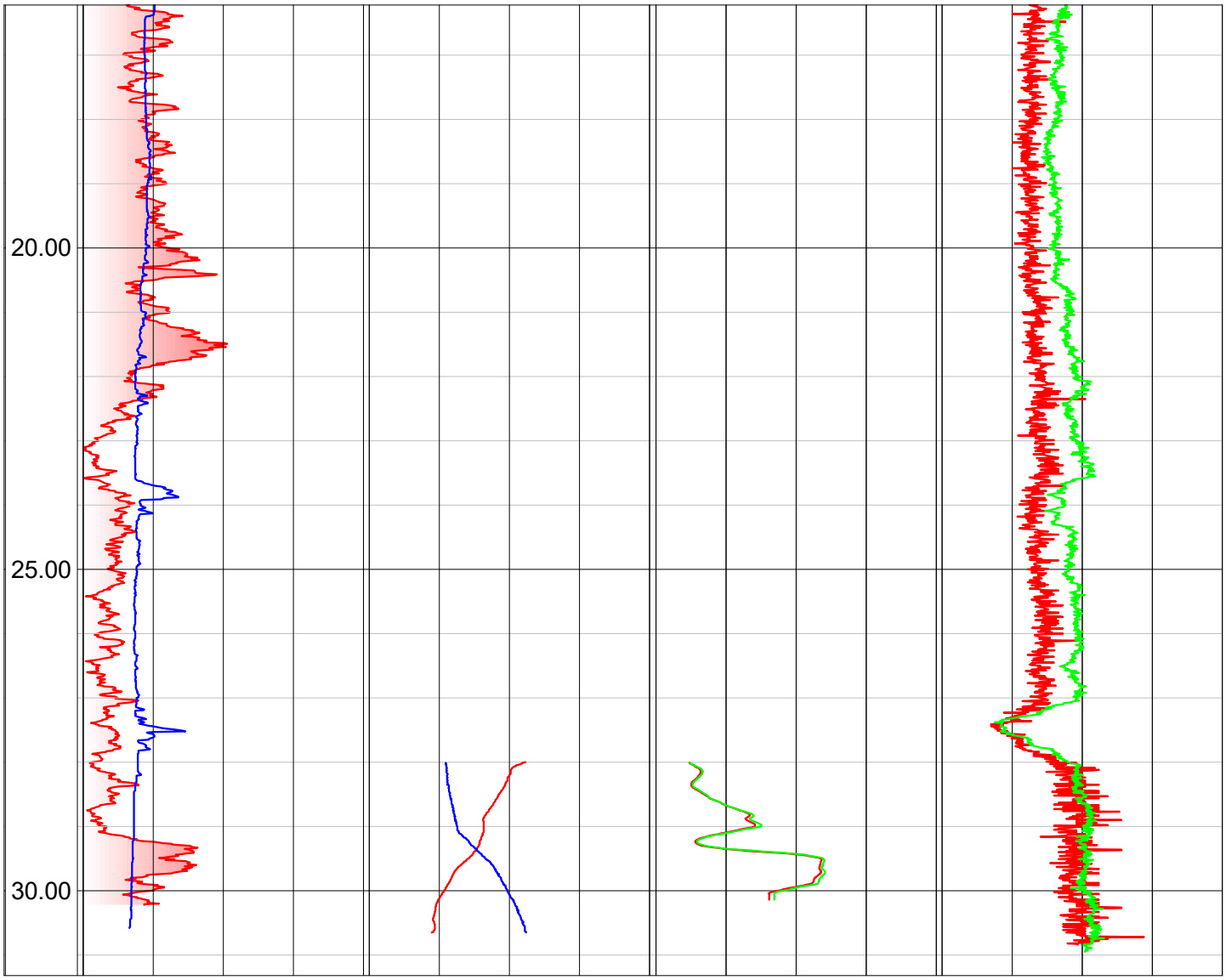
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**2.2**




20.00
25.00
30.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Log Type: ***Image***

Borehole: **DSRC220**

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394379.0E 214500.9N** Elevation: **278.85m**

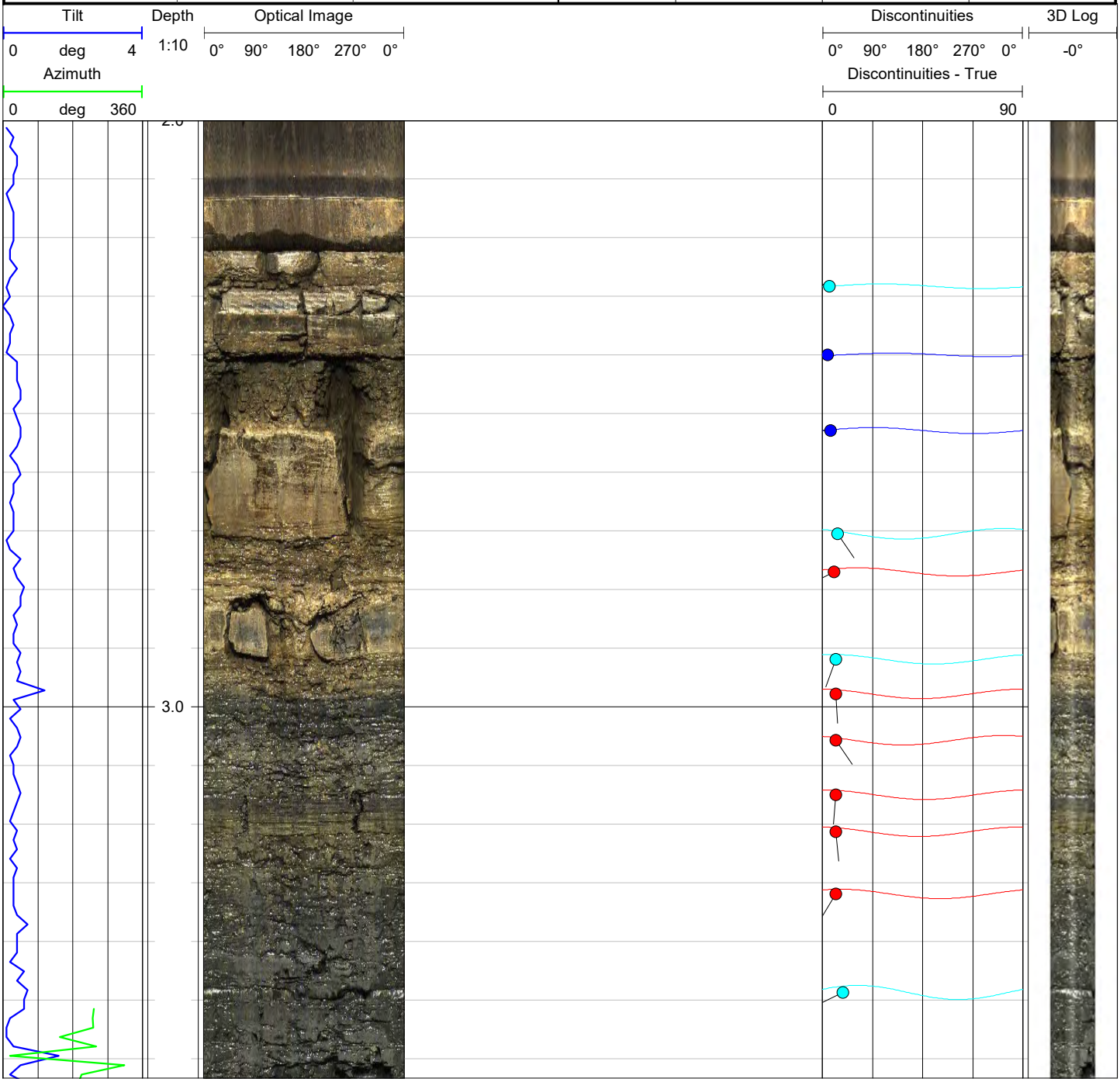
Drilled Depth: (m)	**31.2**	Date:	**27.09.2019**
Logged Depth: (m)	**31.2**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**2.2 - 31.2**		
Fluid Level: (m)	**28.0**		

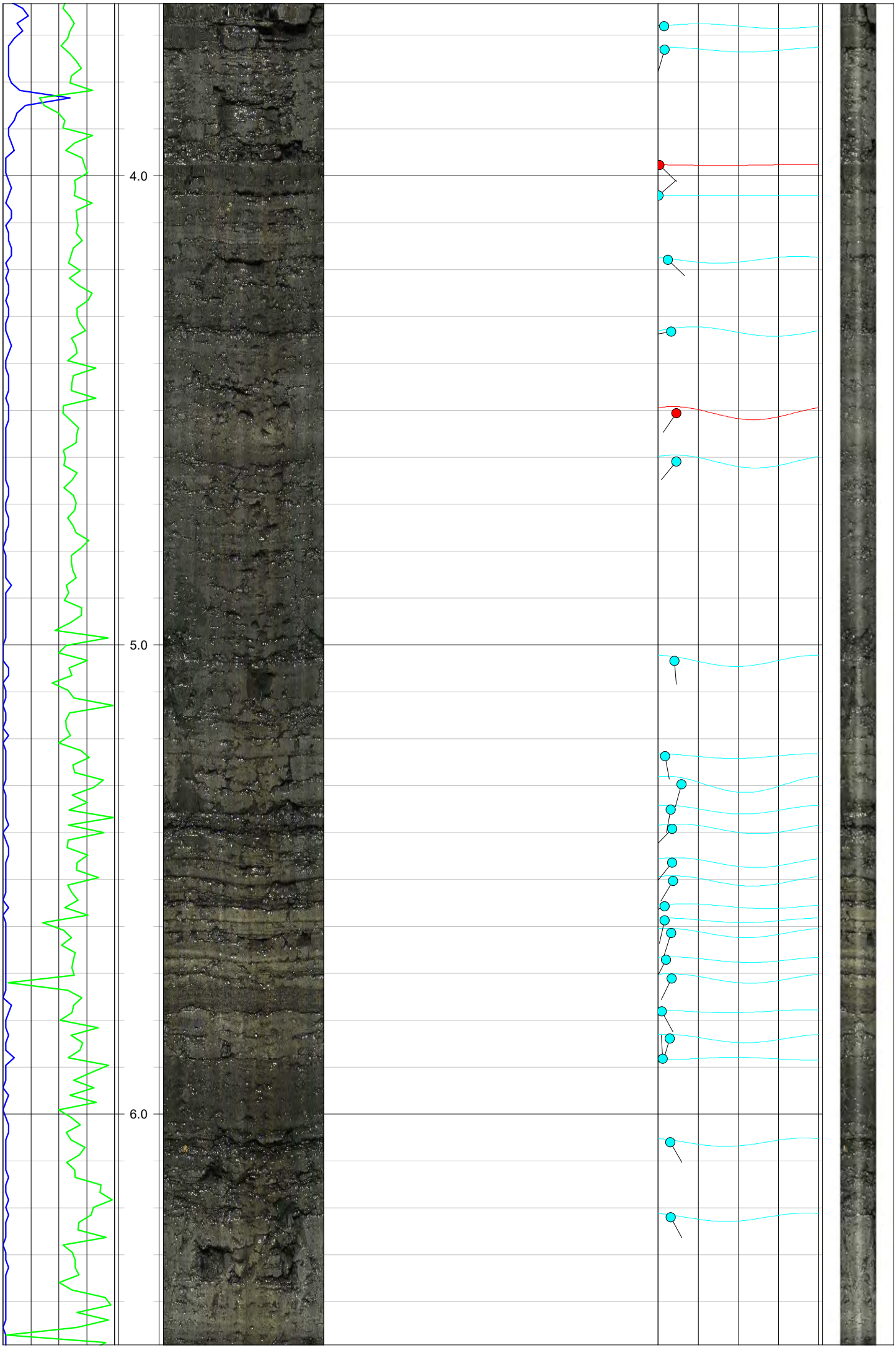
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**2.2**

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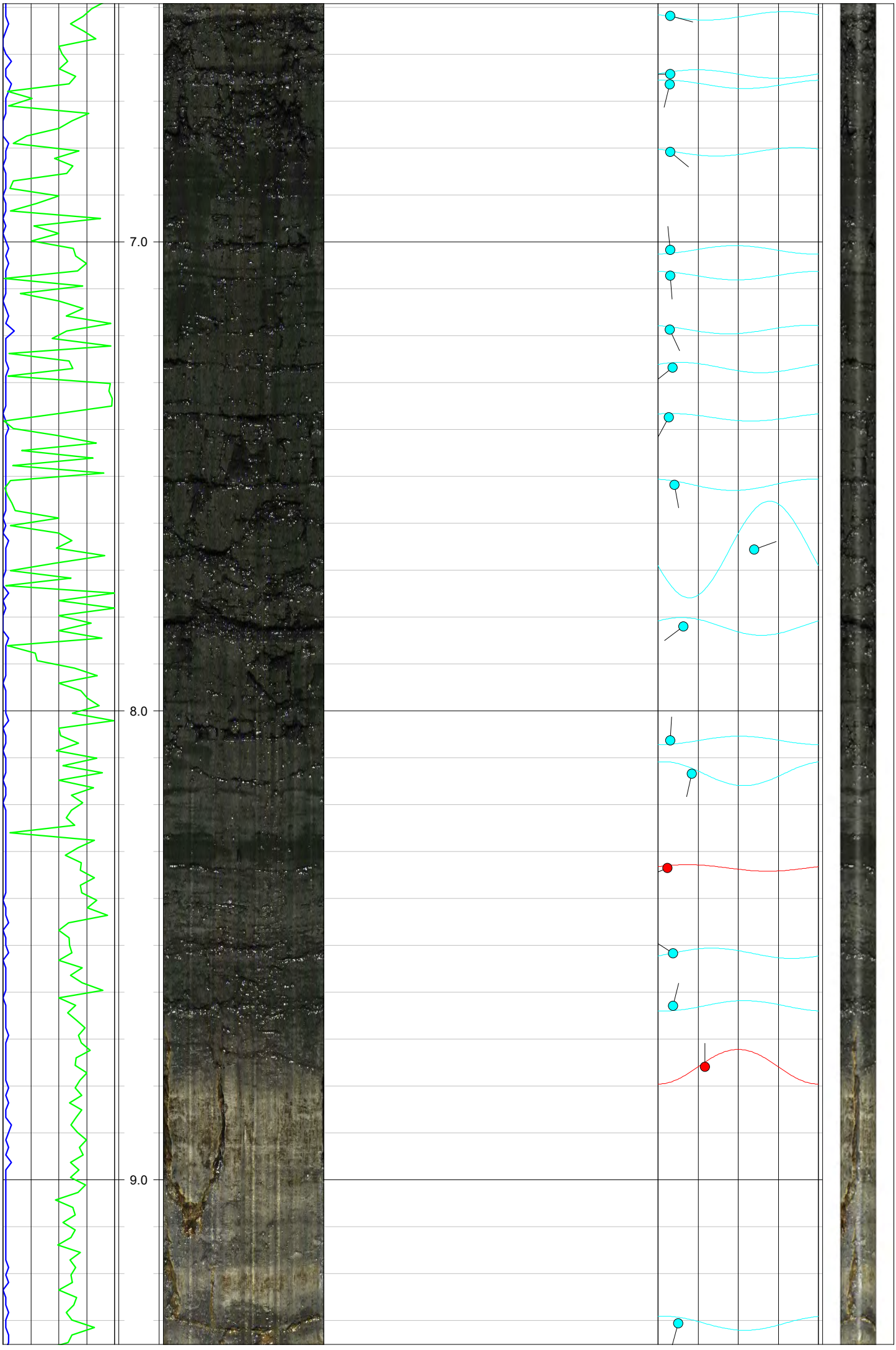
5.0
6.0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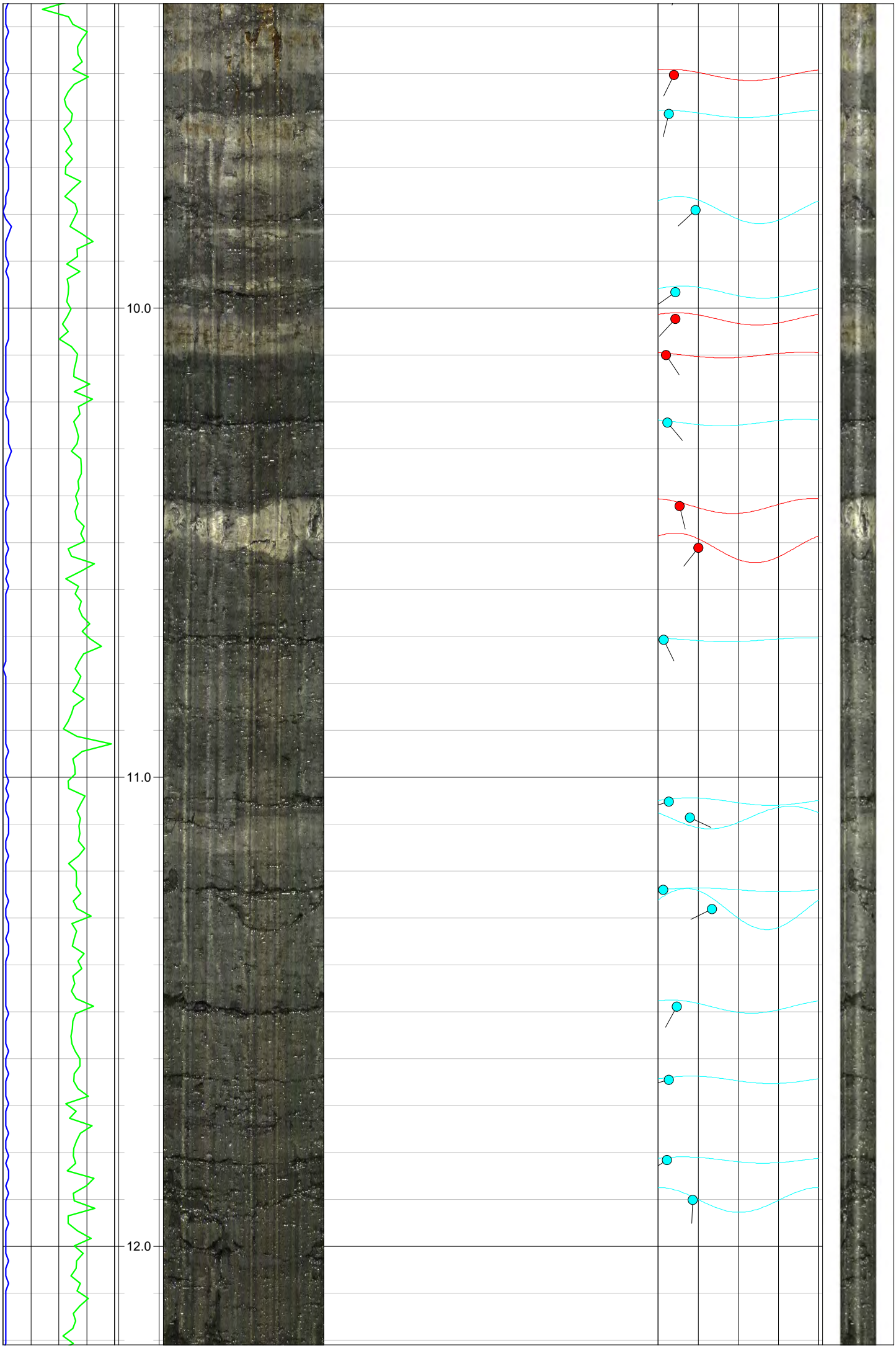
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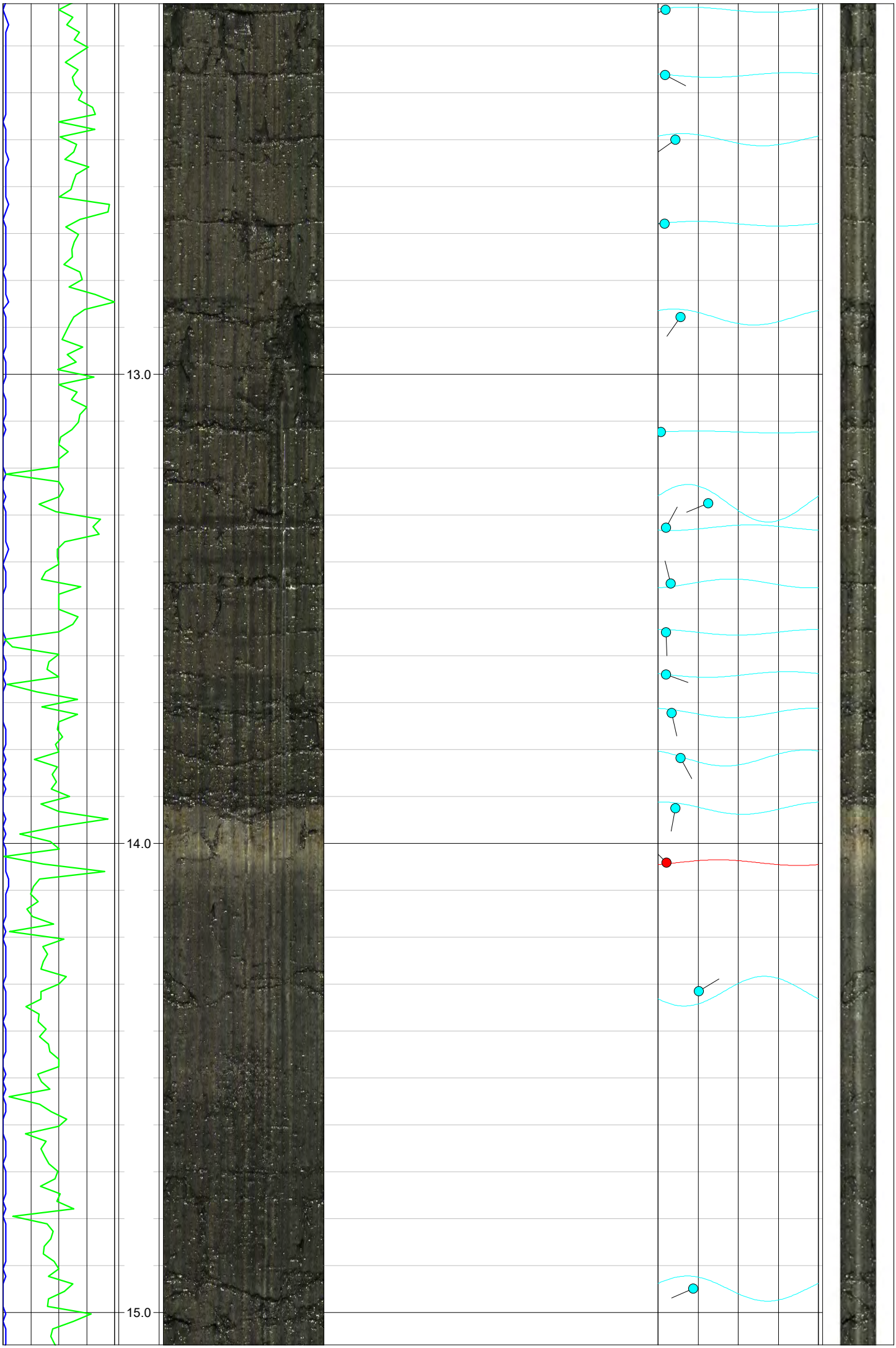
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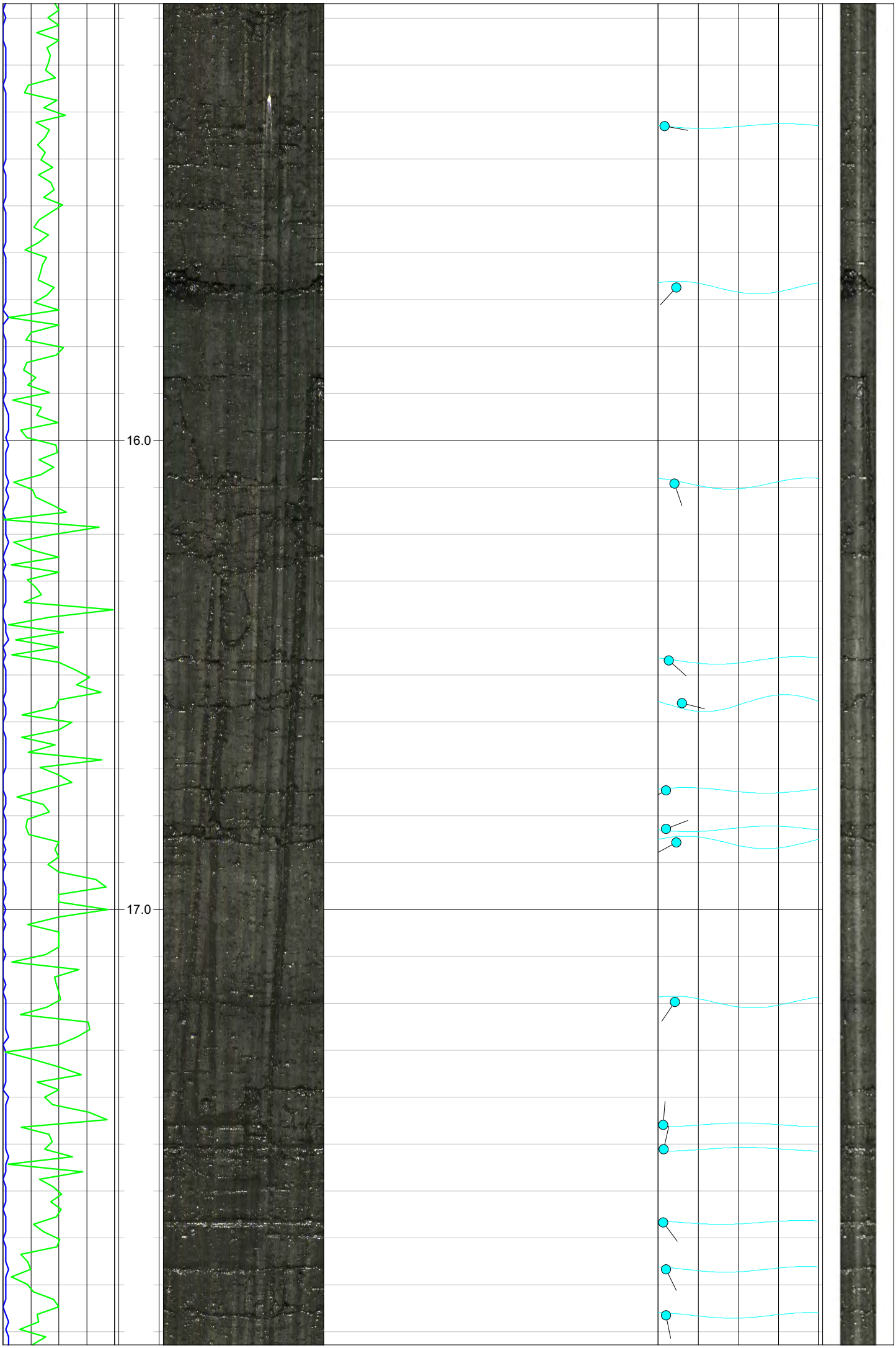
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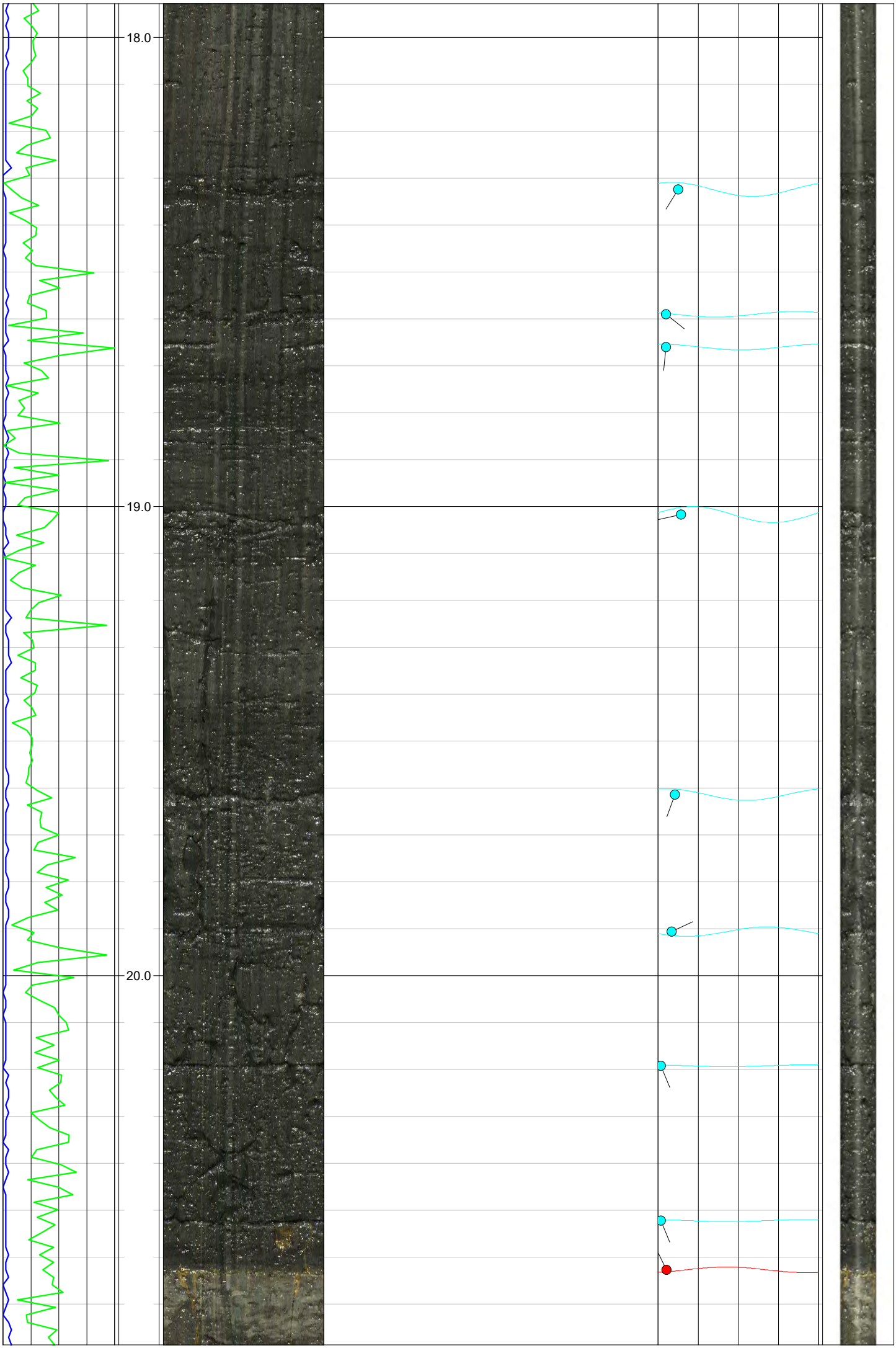
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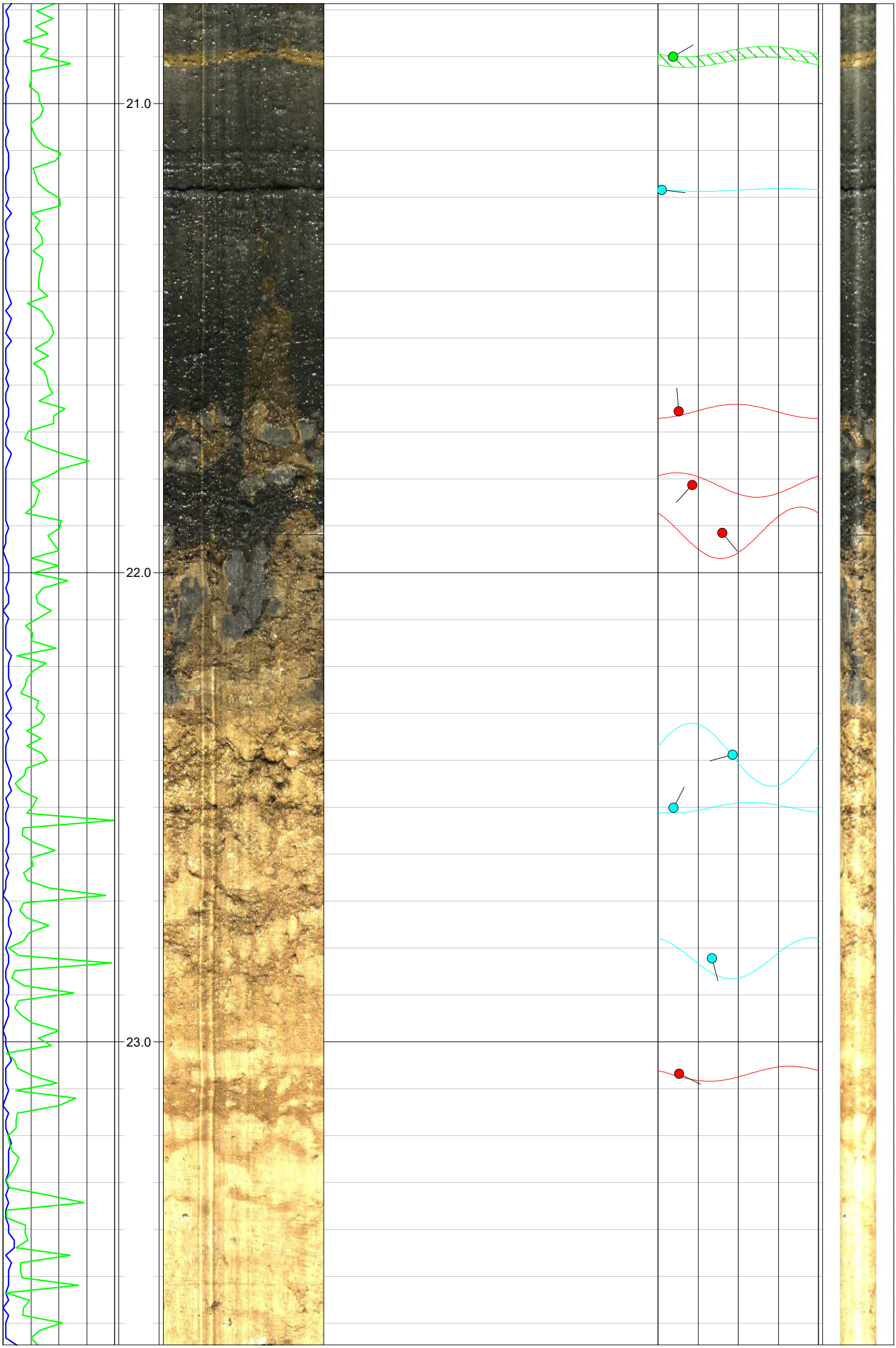
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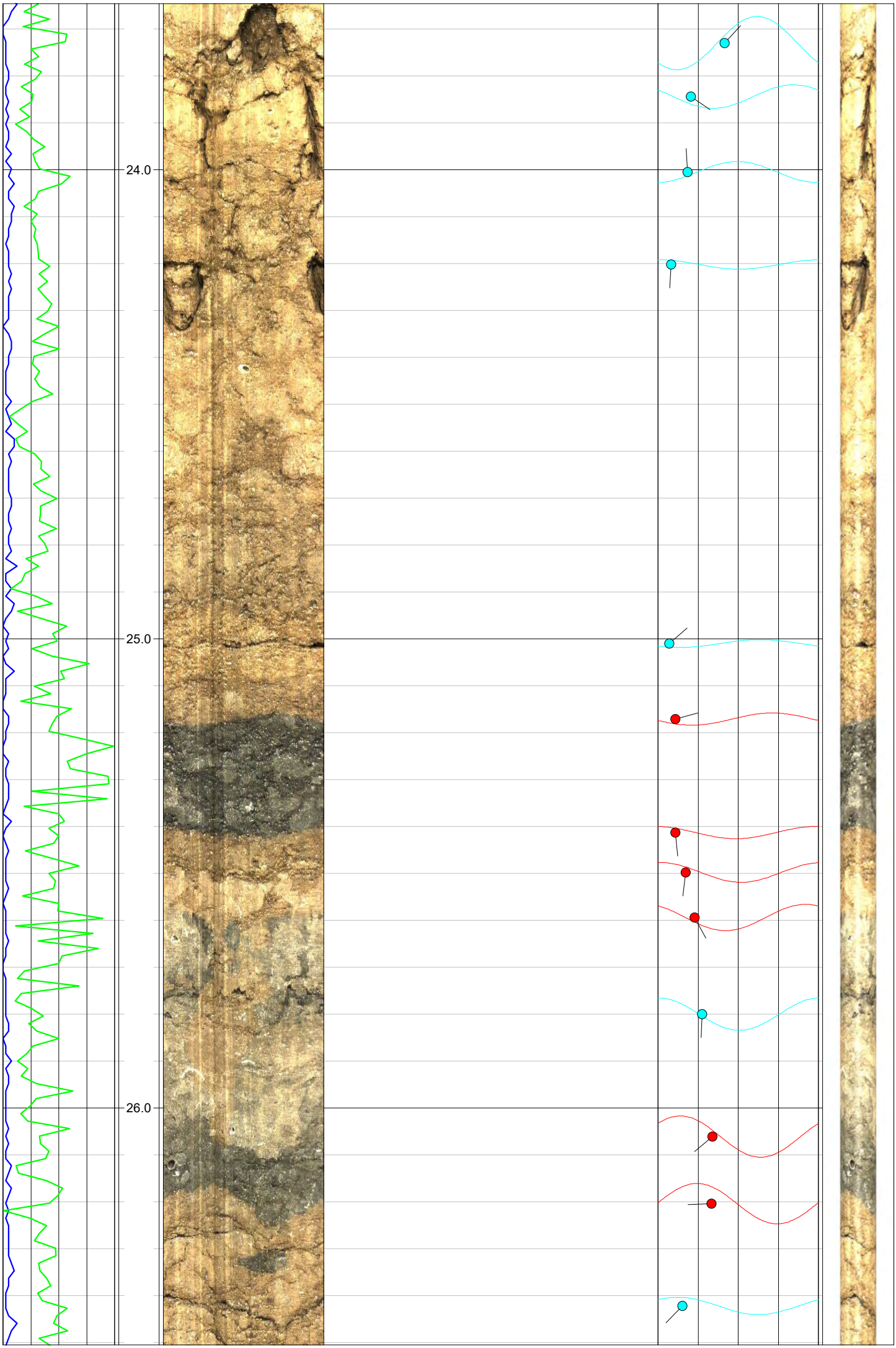
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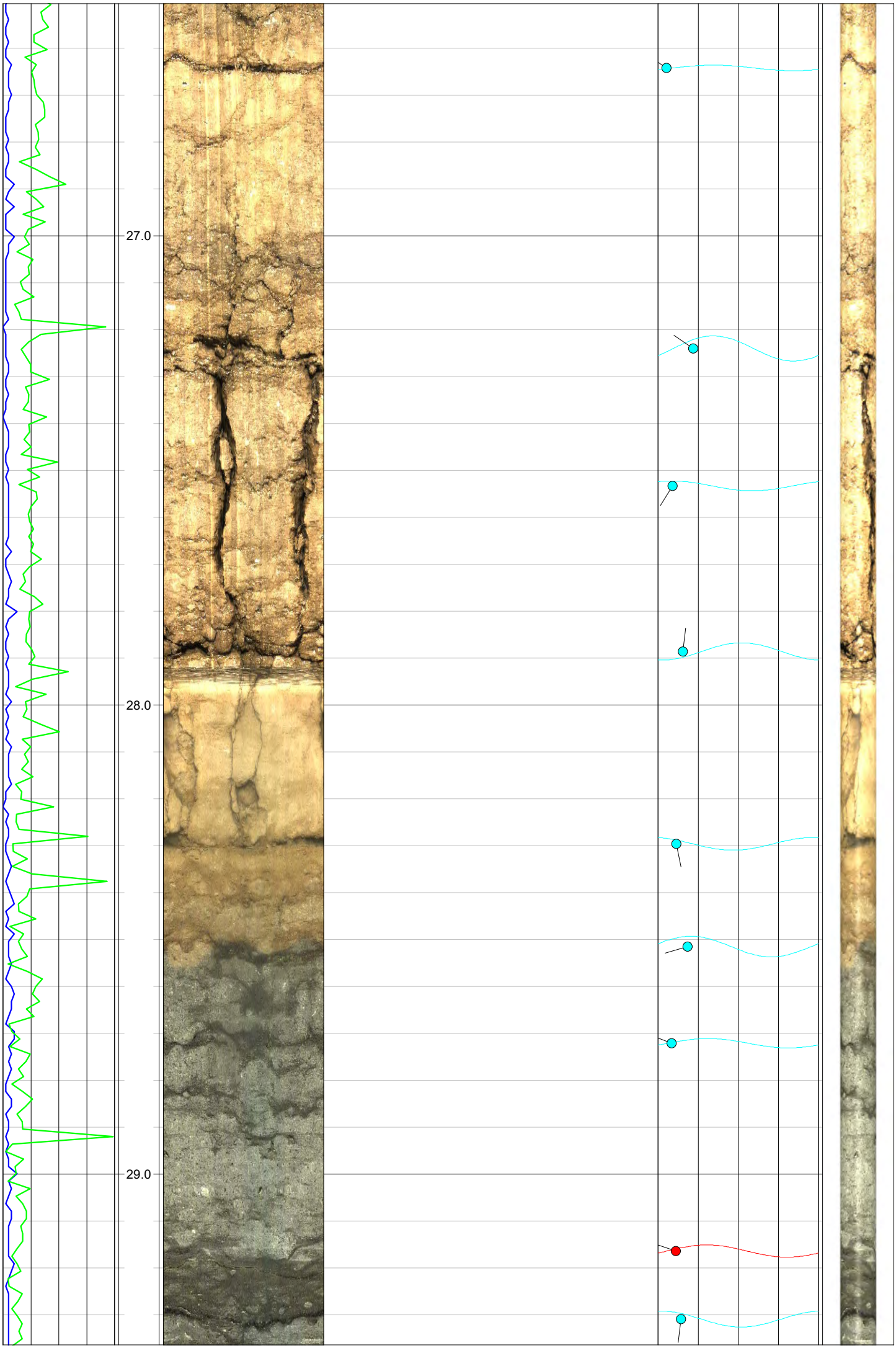
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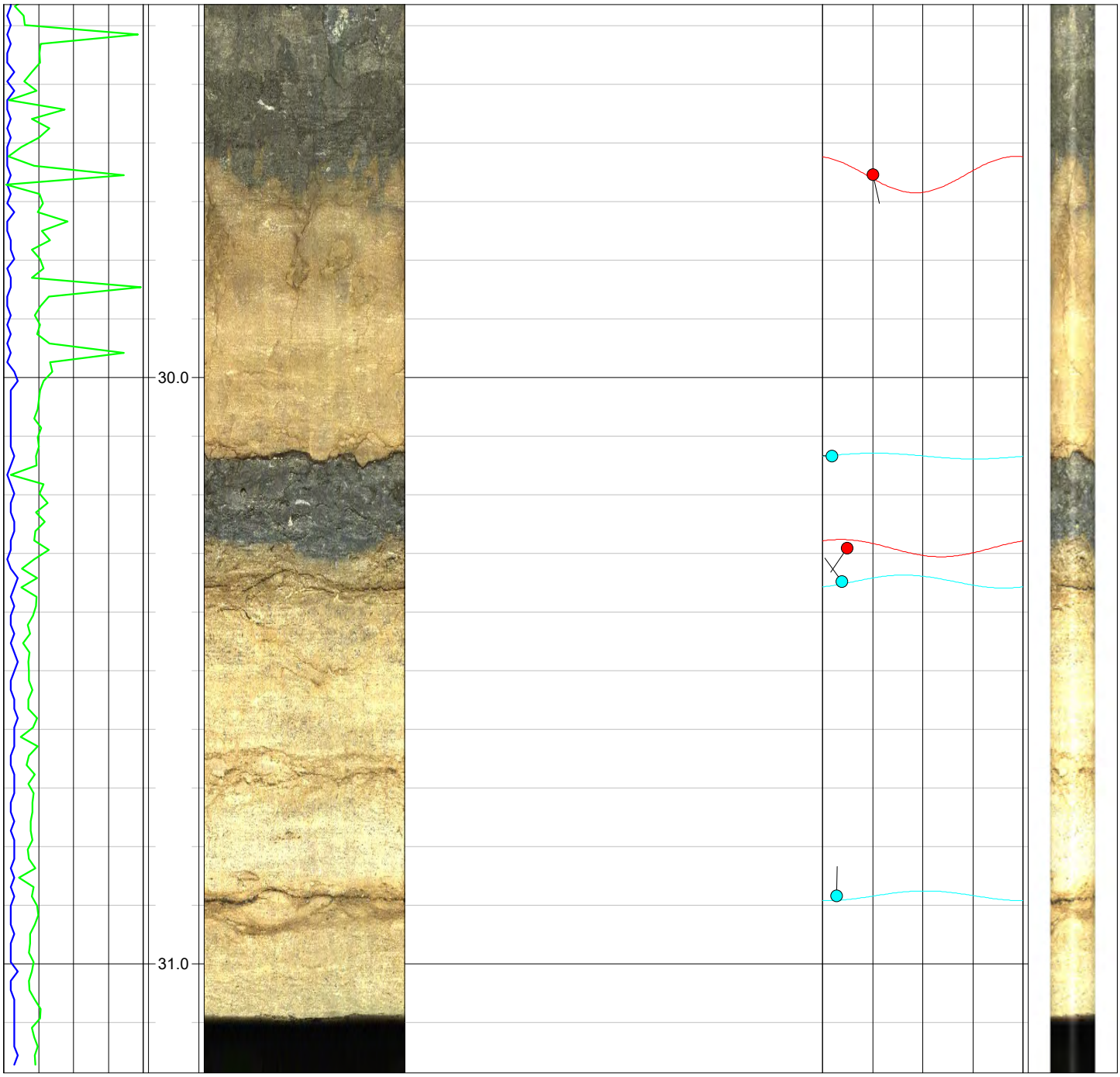

30.0
31.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC301**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **393184.6E 215961.8N** Elevation: **234.20m**

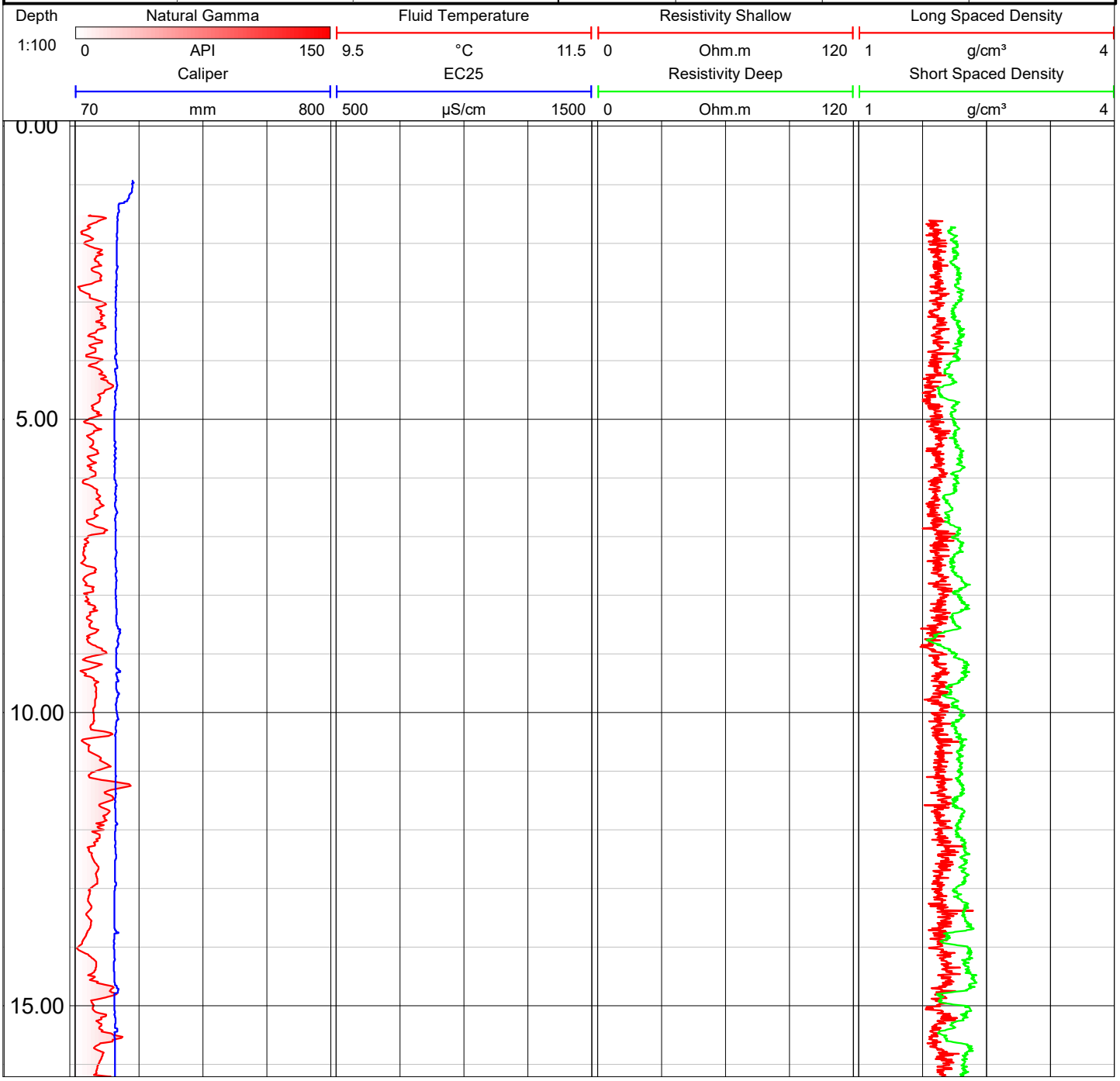
Drilled Depth: (m)	**105.0***	Date:	**1.11.19**
Logged Depth: (m)	**65.5**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	No casing in hole; unable to run flow logs due to BH conditions
Logged Interval: (m)	**0.0 - 65.5**		
Fluid Level: (m)	**28.3**		

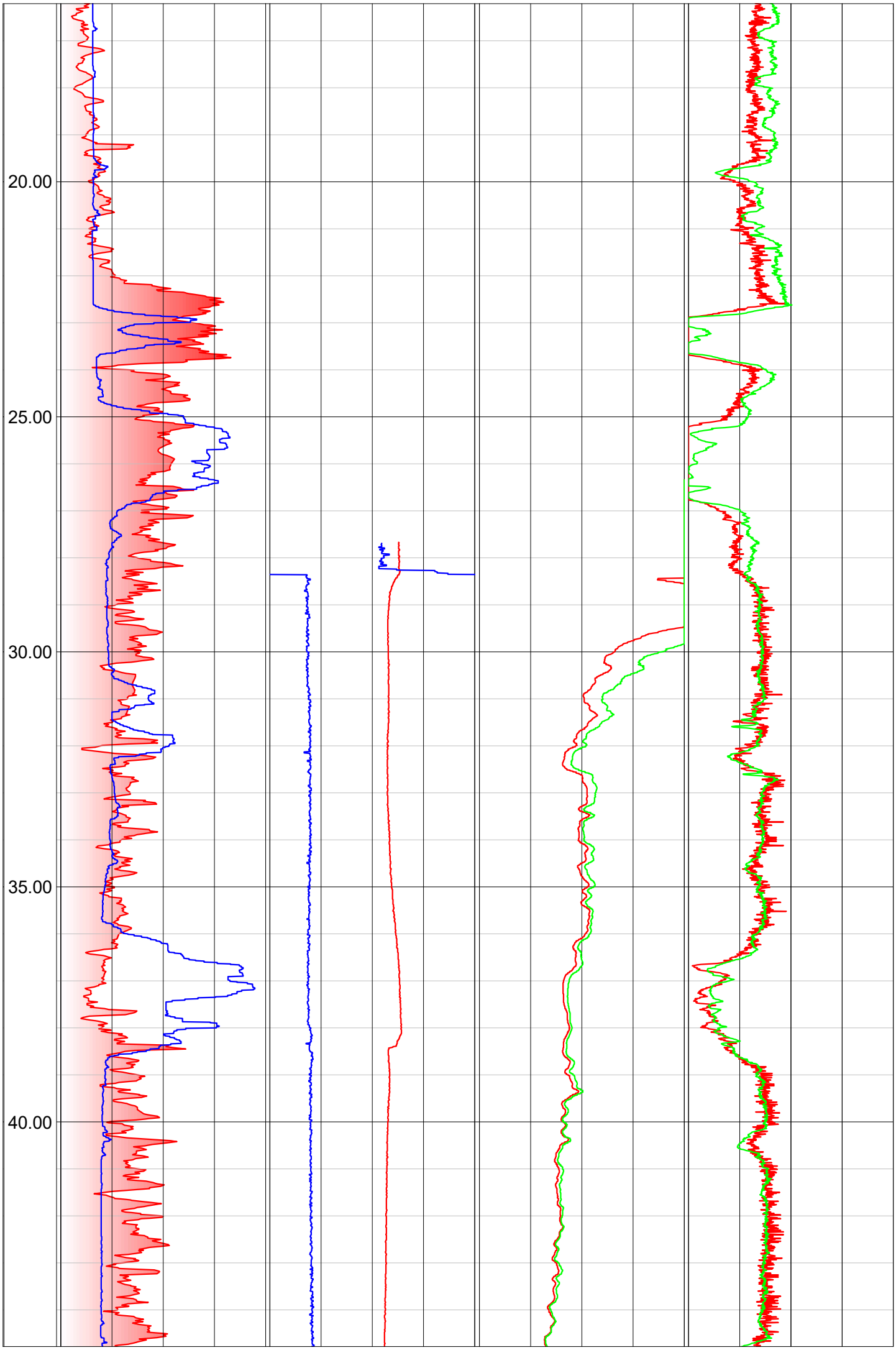
BOREHOLE RECORD

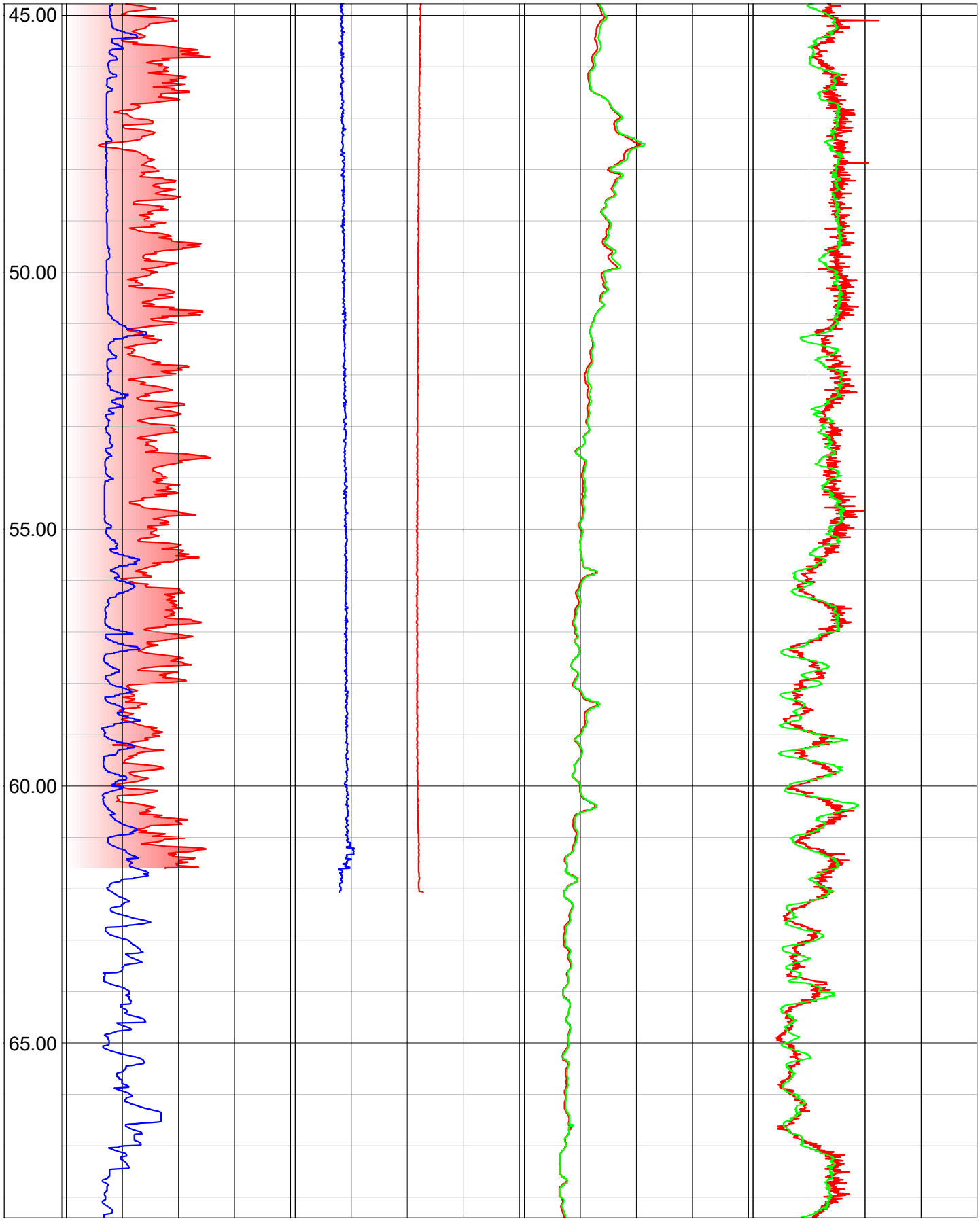
Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)




20.00
25.00
30.00
35.00
40.00


45.00
50.00
55.00
60.00
65.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC301**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **393184.6E 215961.8N** Elevation: **234.20m**

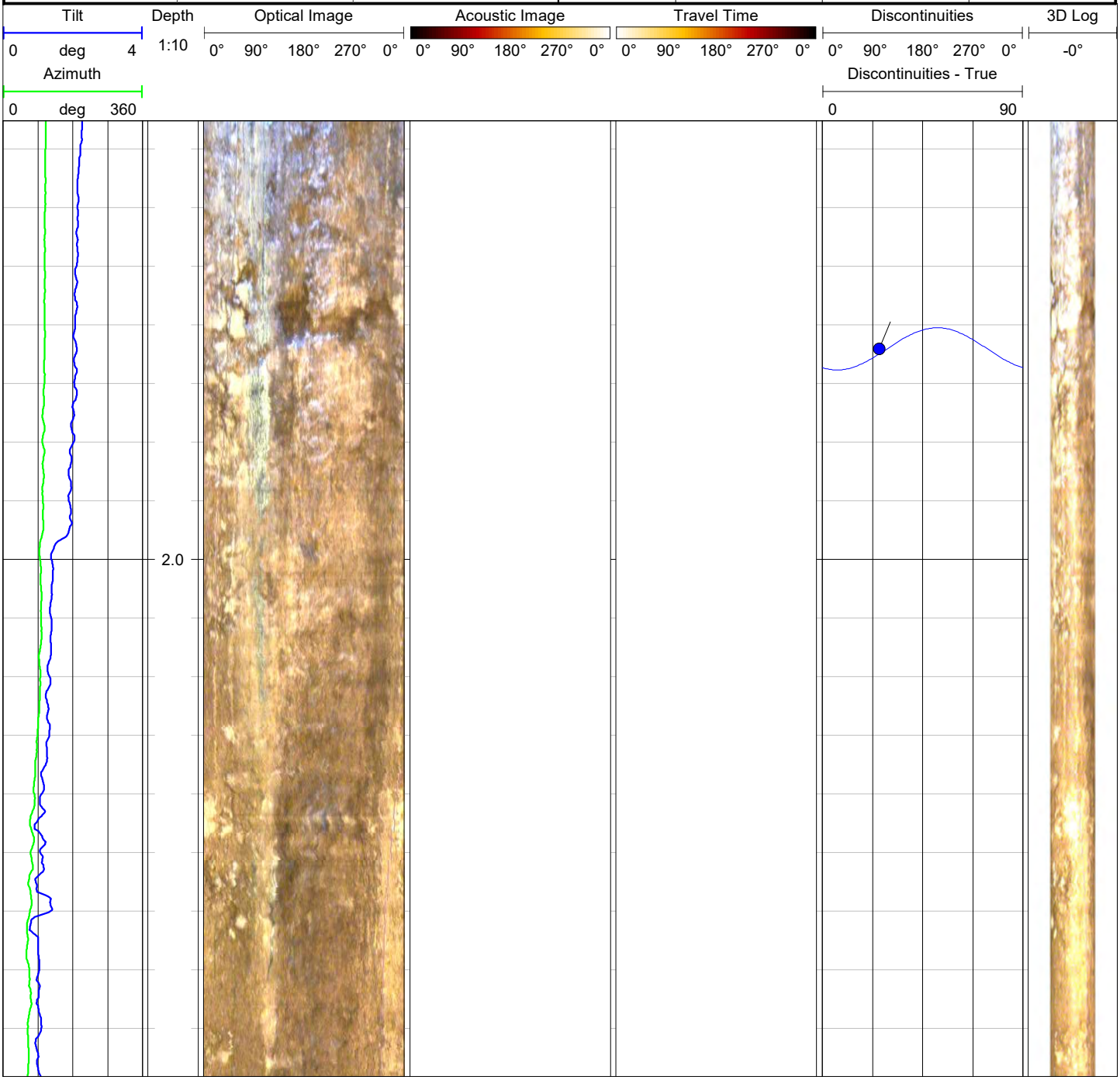
Drilled Depth: (m)	**105.0***	Date:	**01.11.19**
Logged Depth: (m)	**65.5**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	No casing in hole; unable to run flow logs due to BH conditions
Logged Interval: (m)	**0.0 - 65.5**		
Fluid Level: (m)			

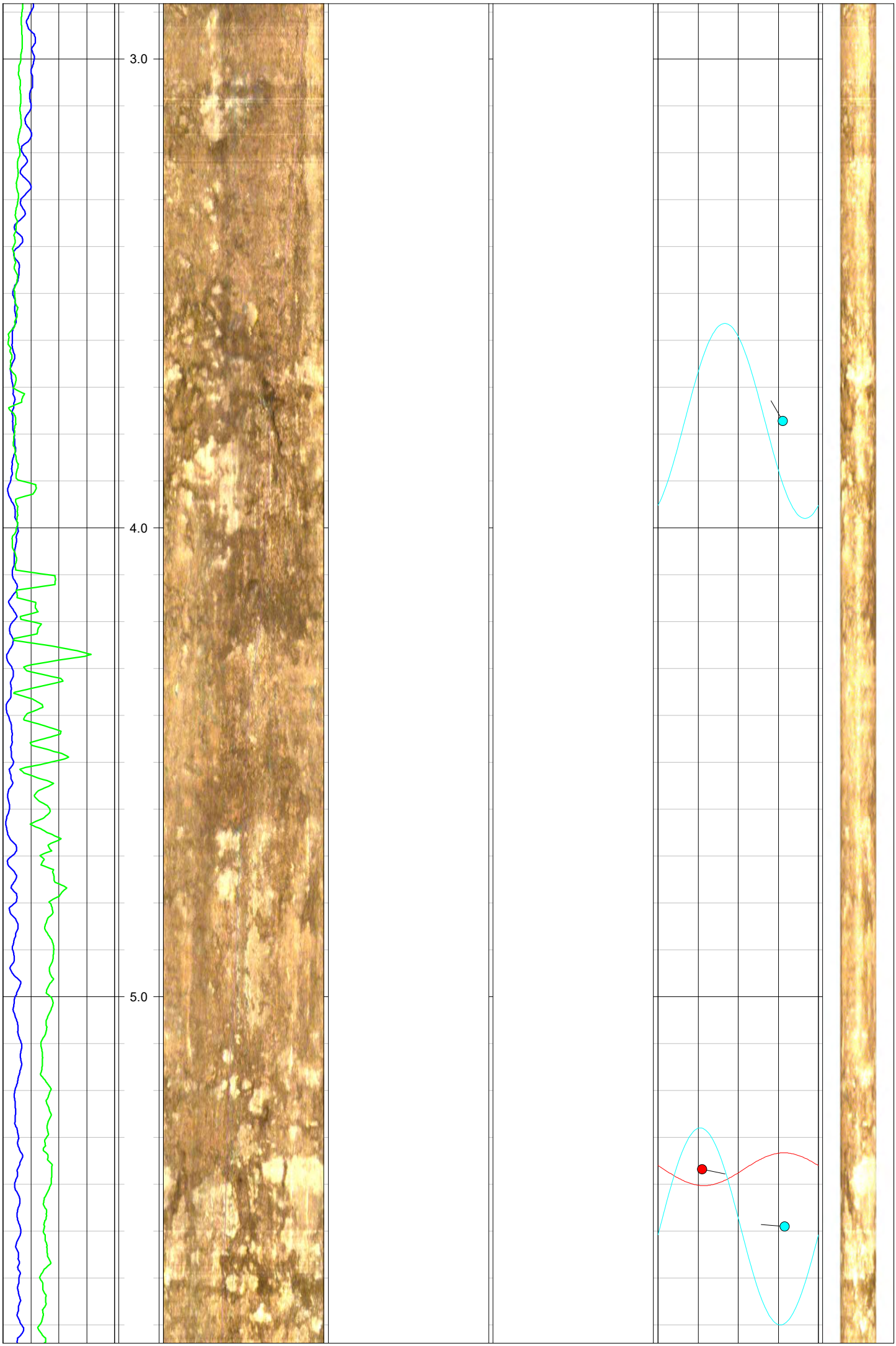
BOREHOLE RECORD

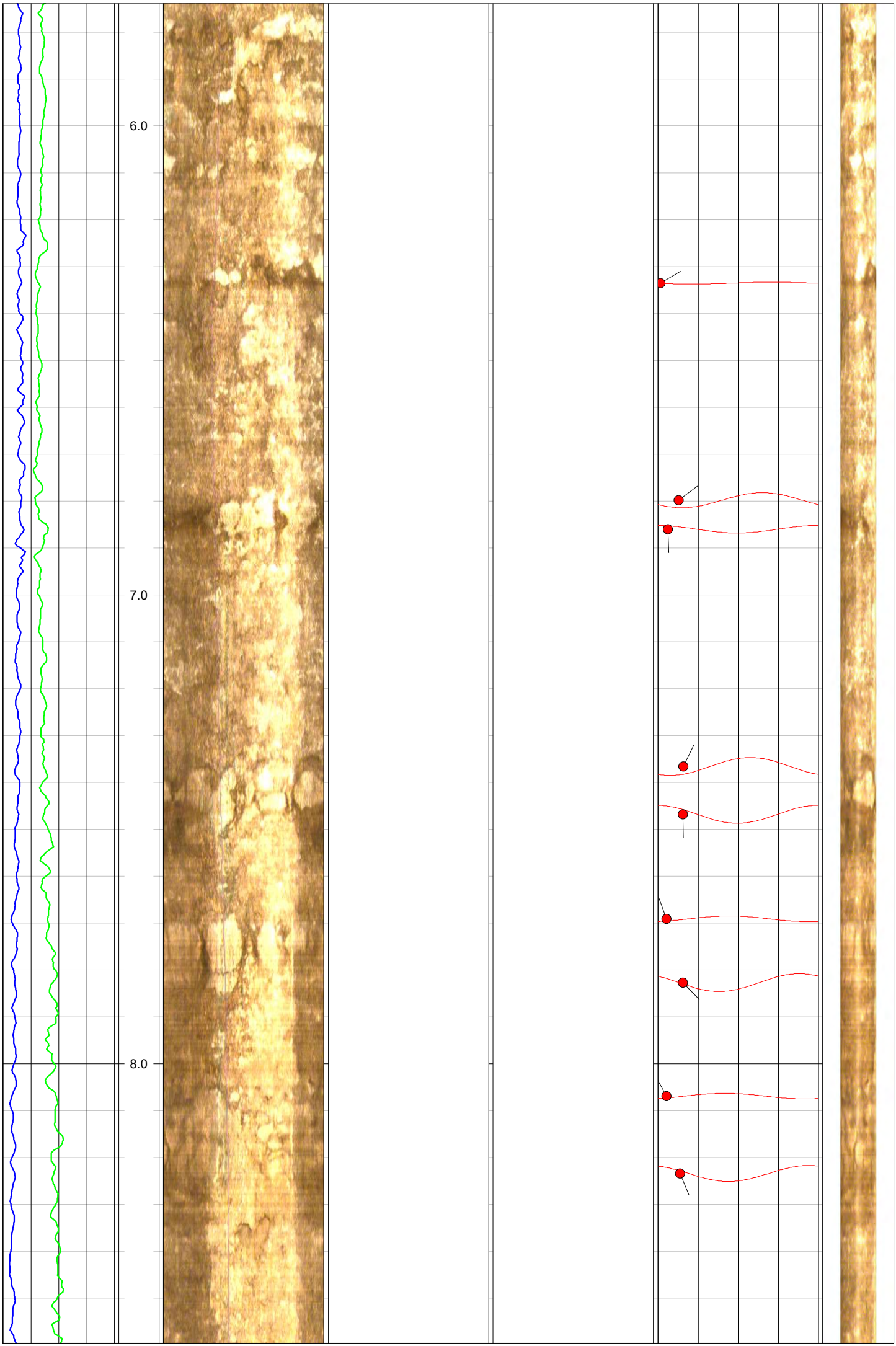
Bit: (mm)	From: (m)	To: (m)

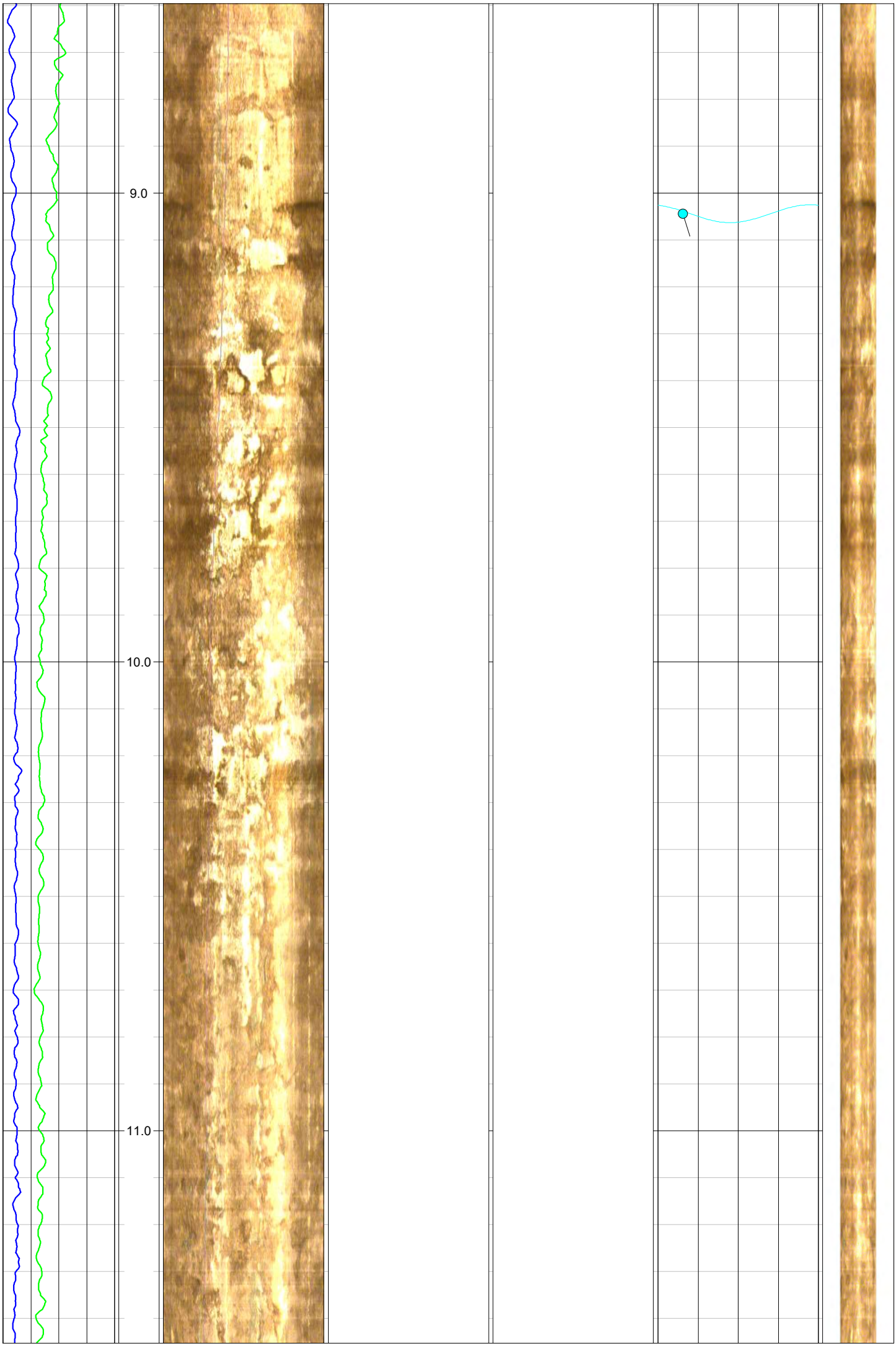
CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)




3.0
4.0
5.0


6.0
7.0
8.0


9.0
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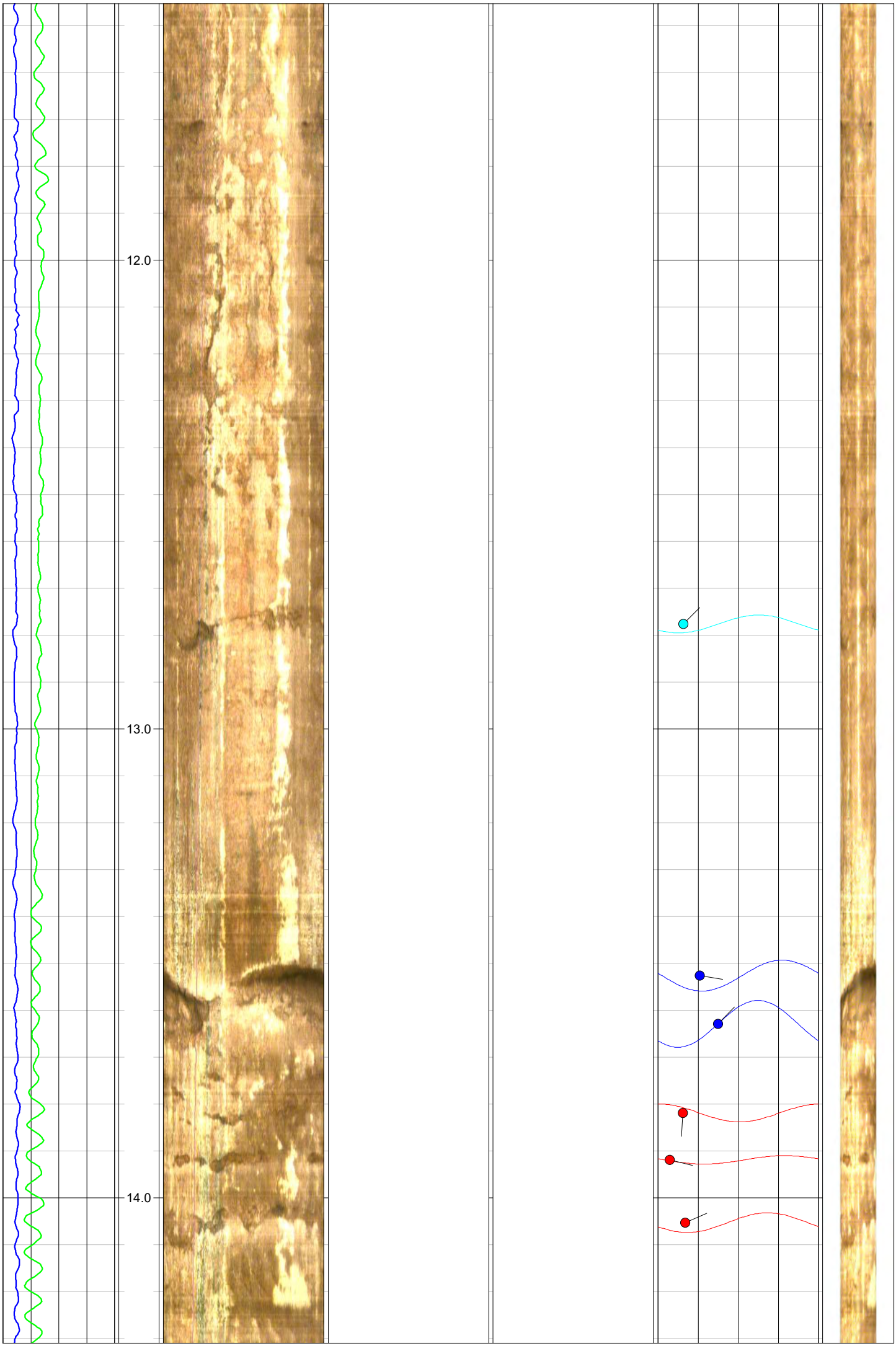
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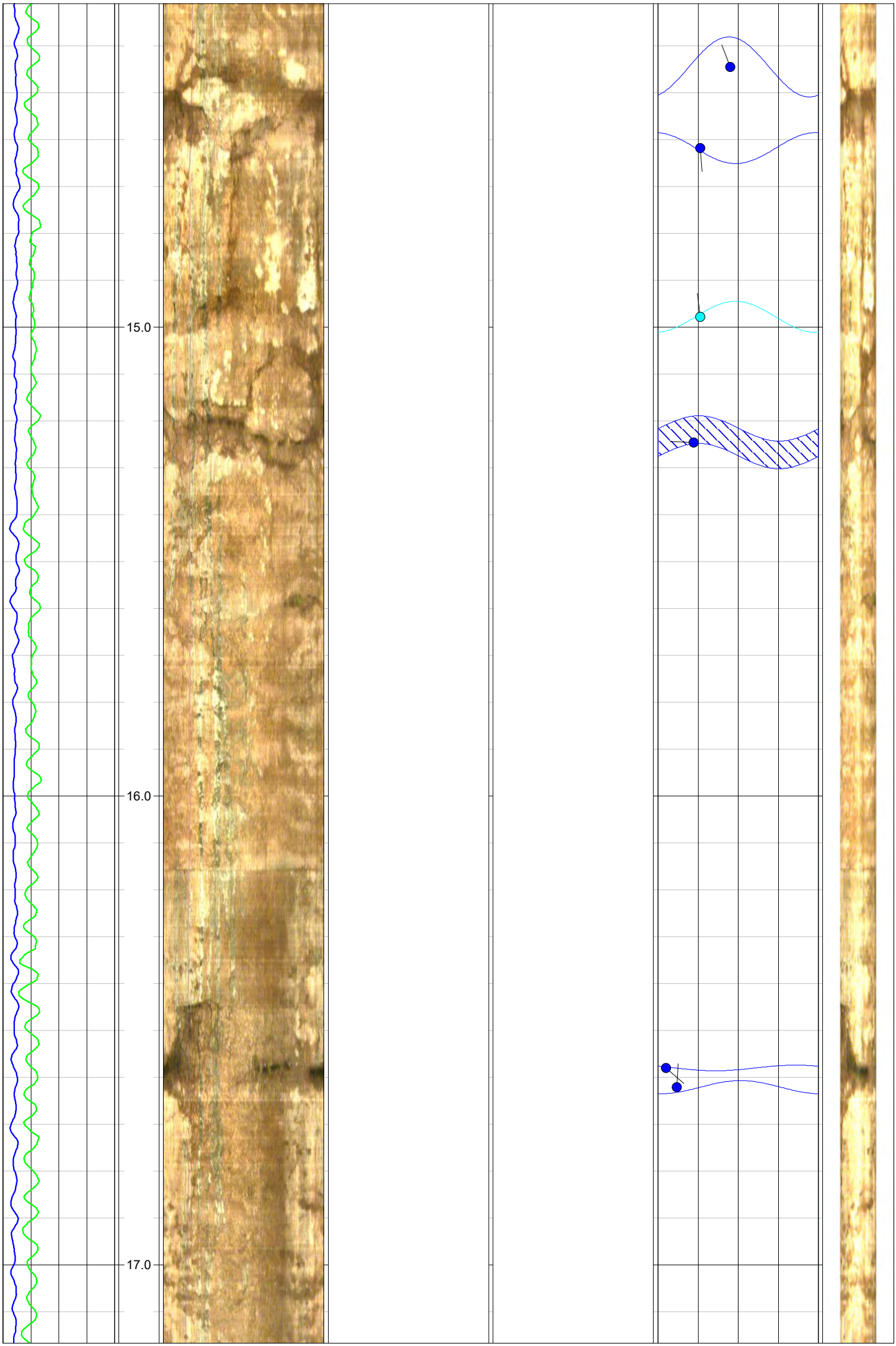
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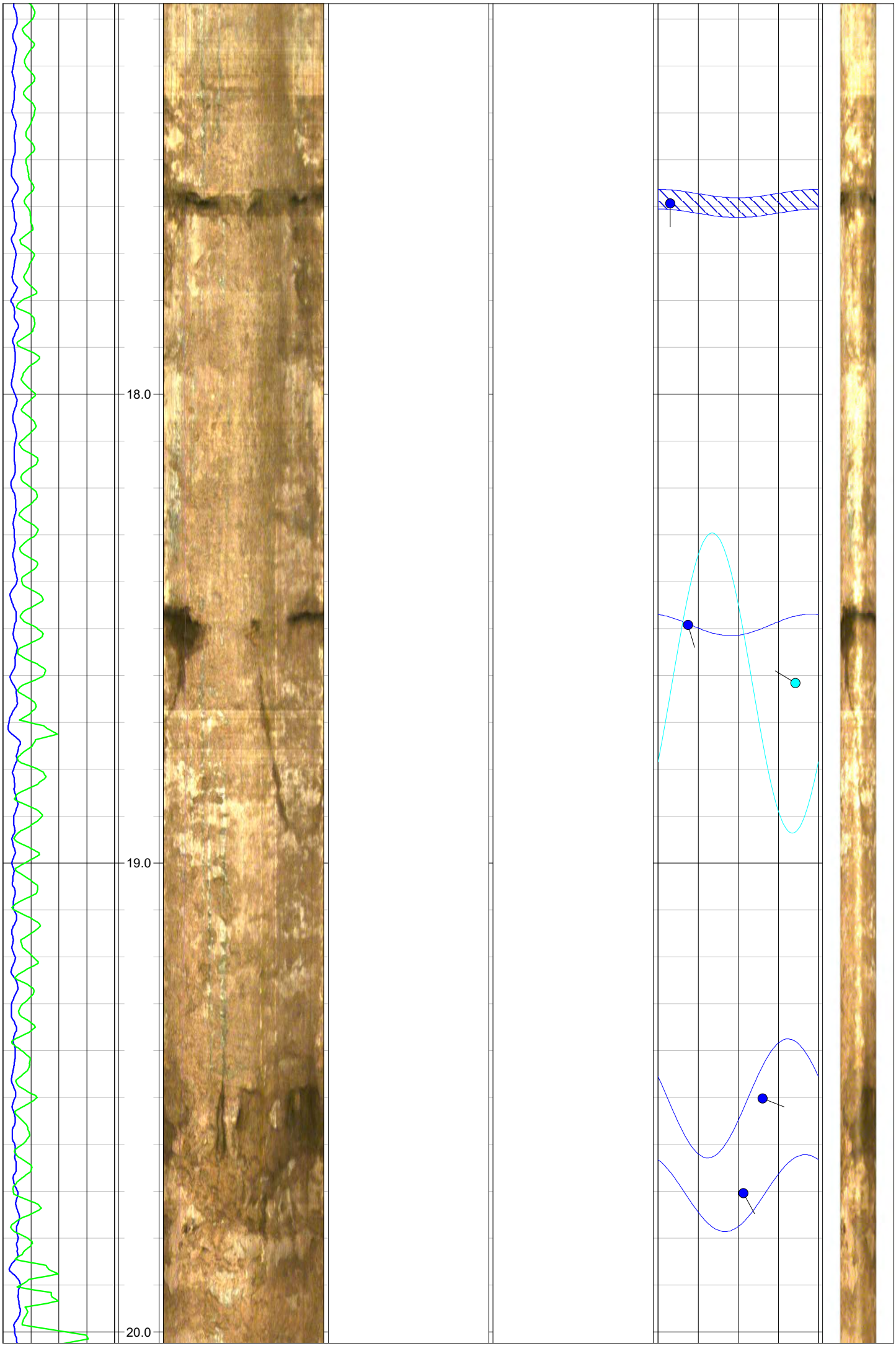
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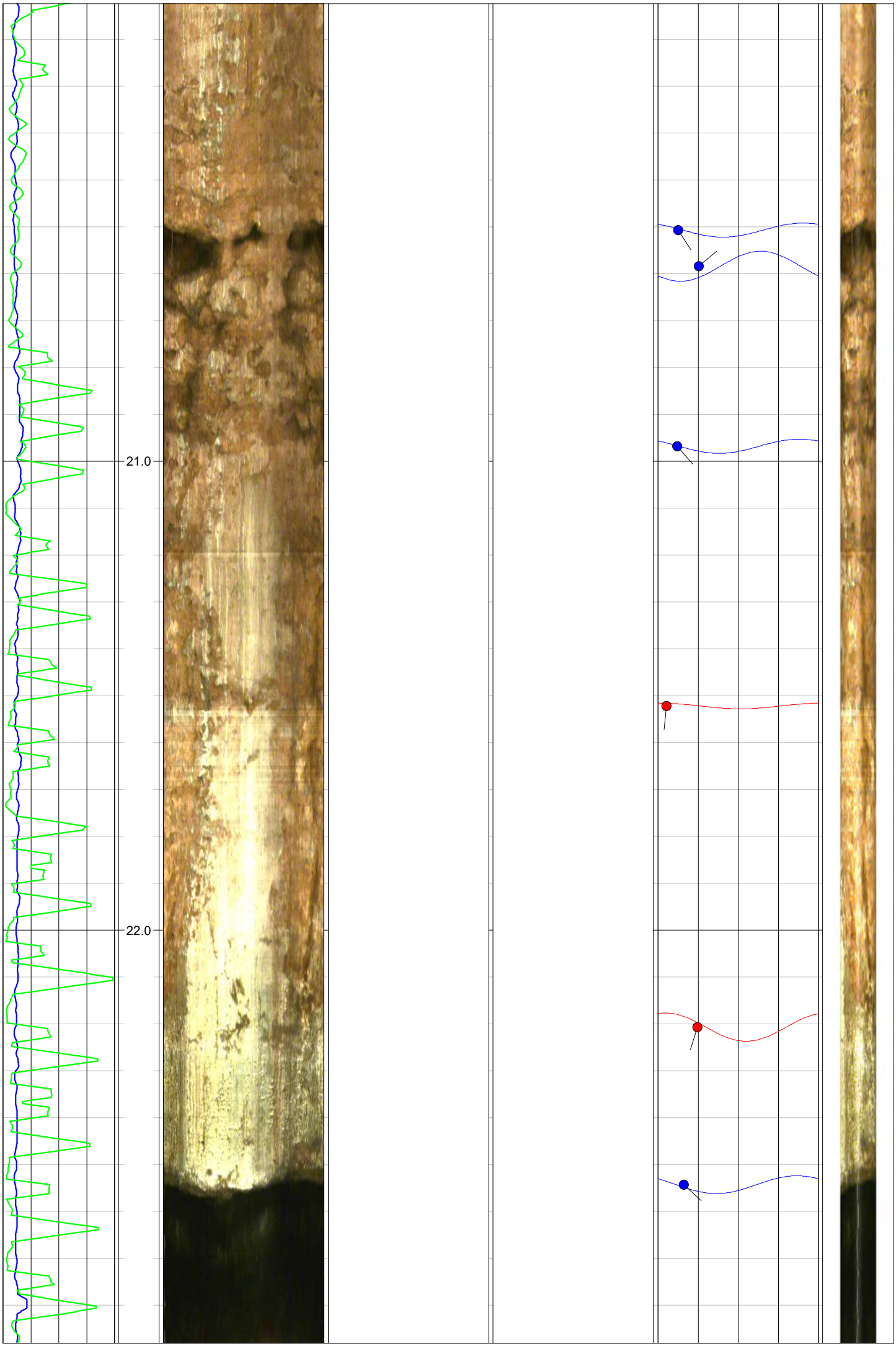
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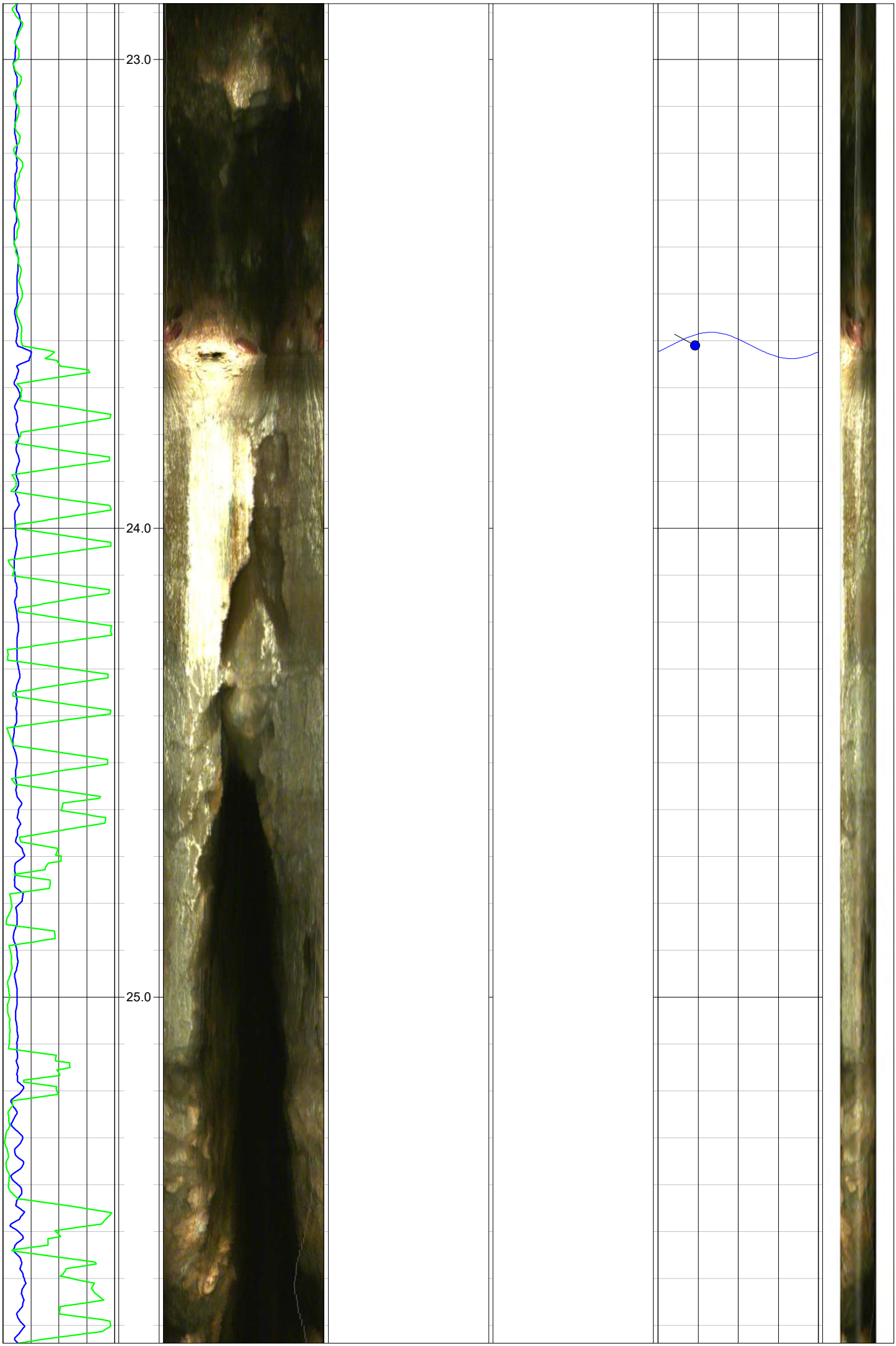
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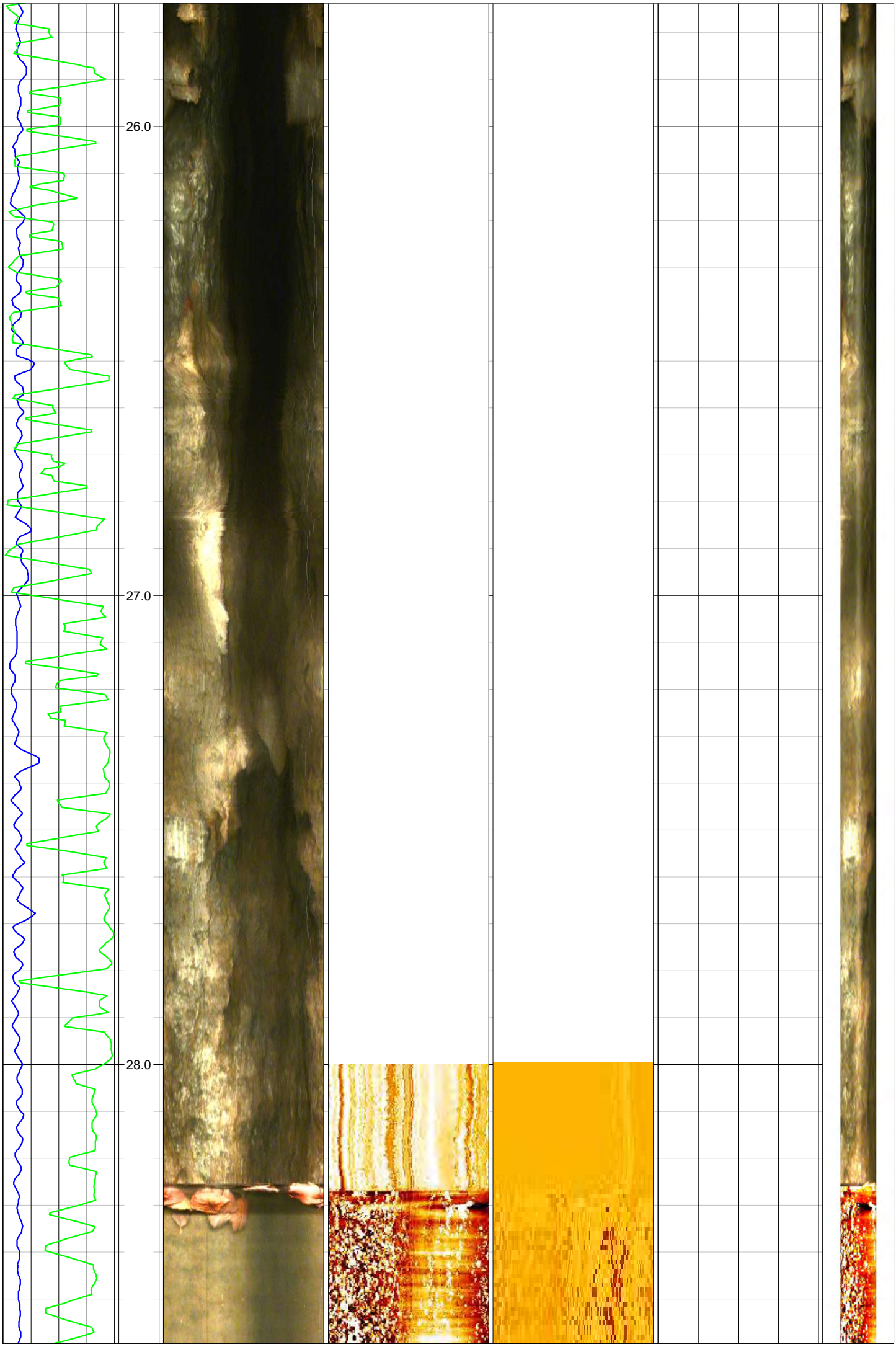
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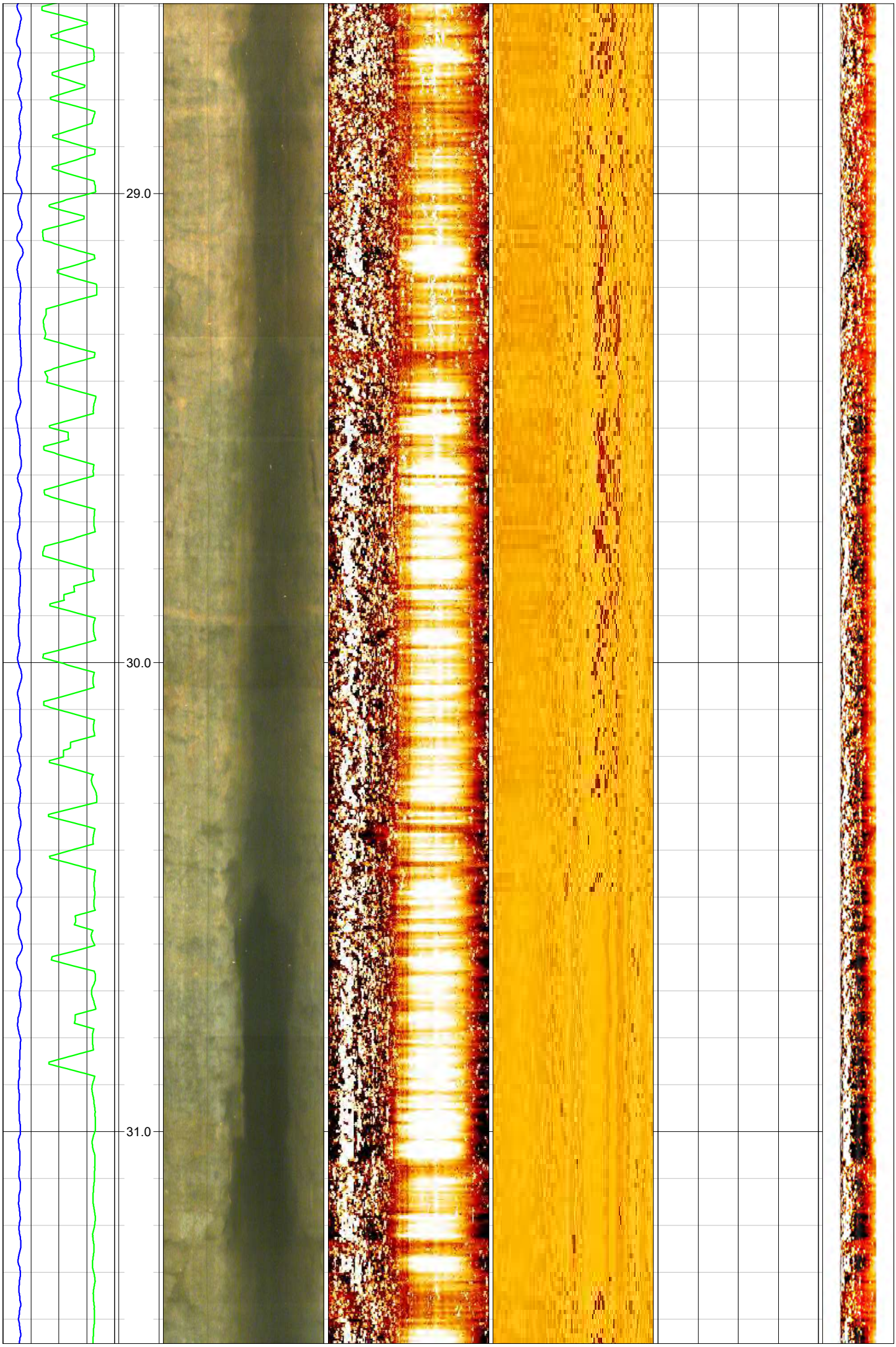
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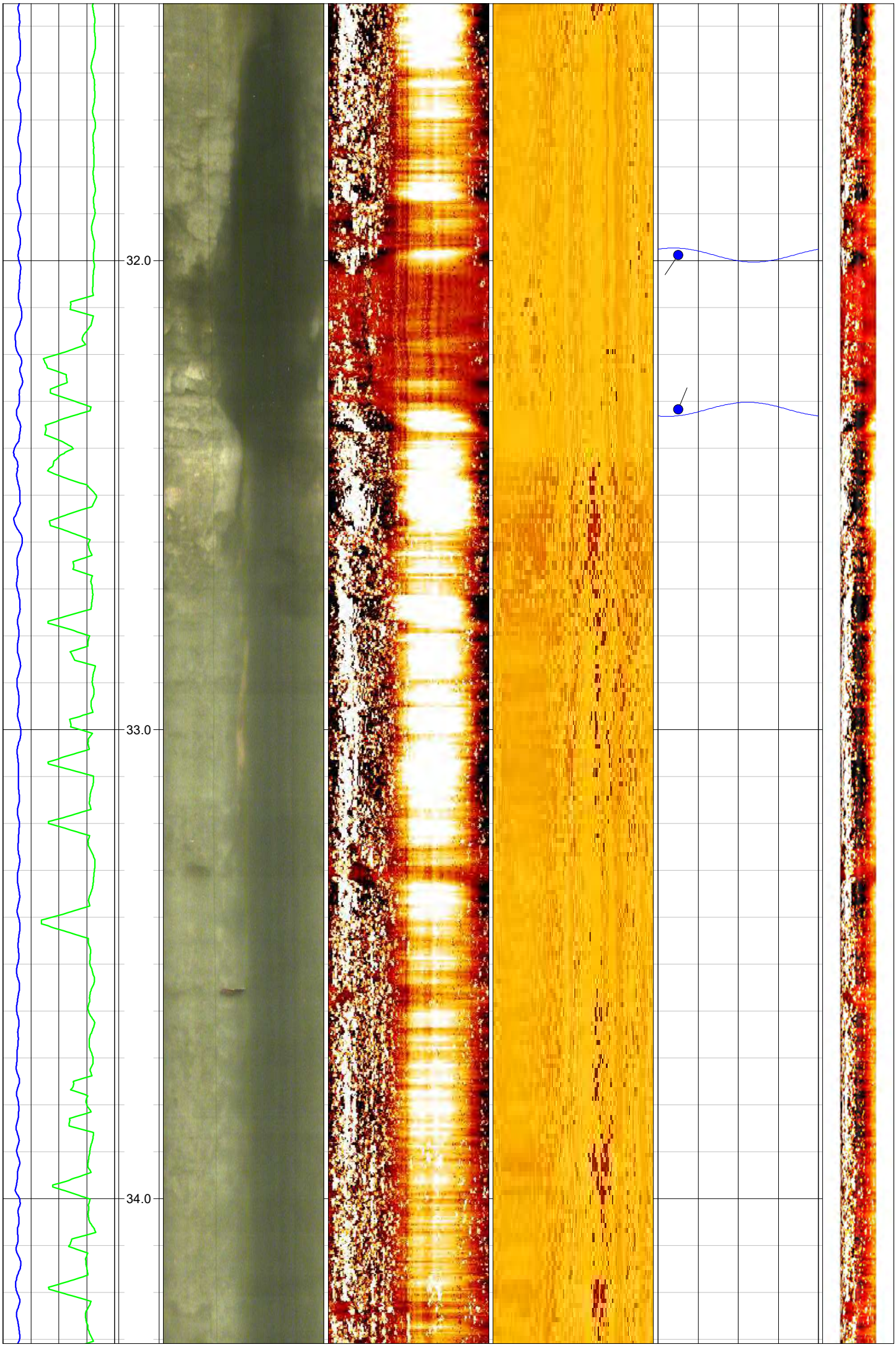
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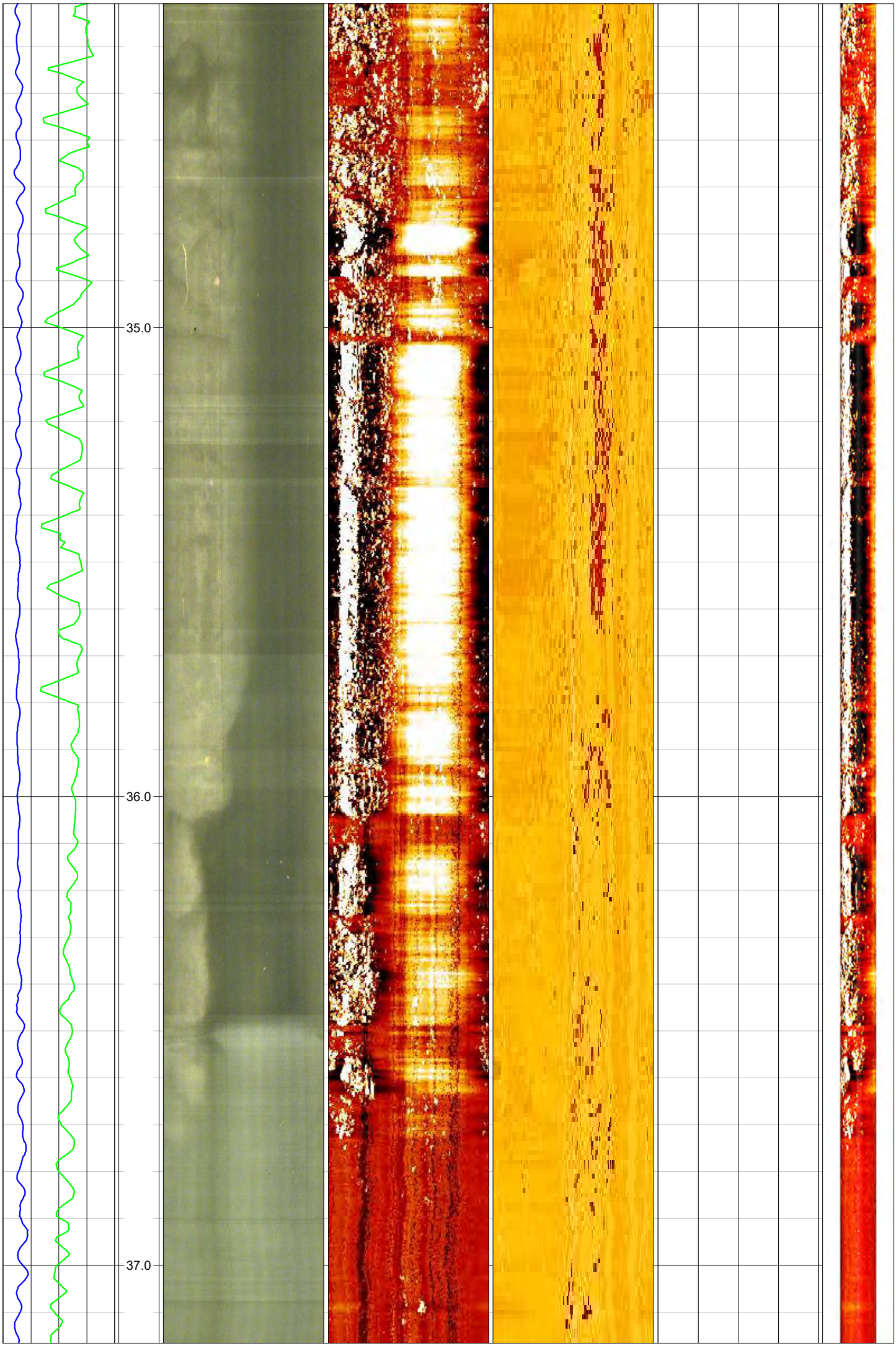
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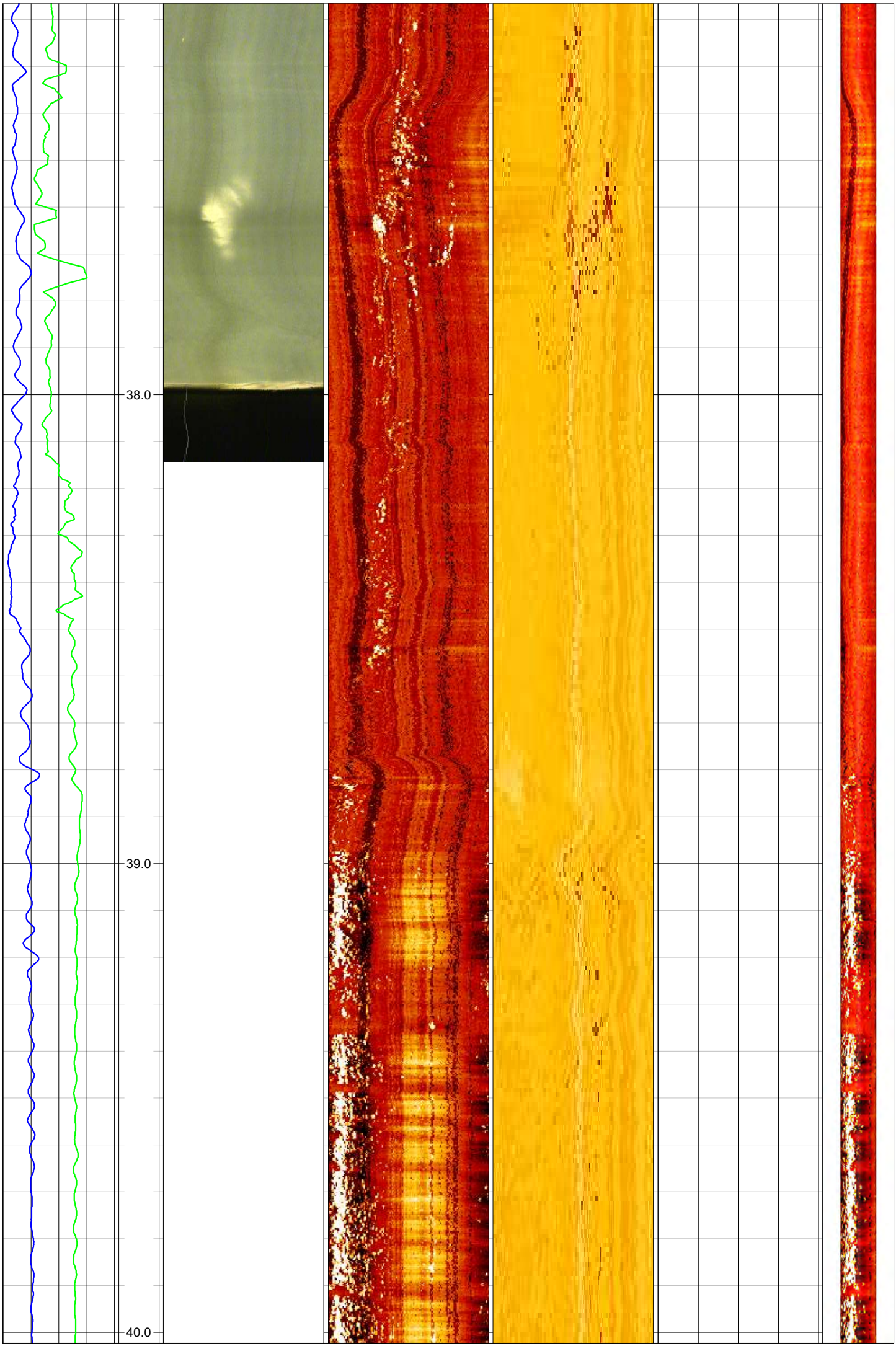
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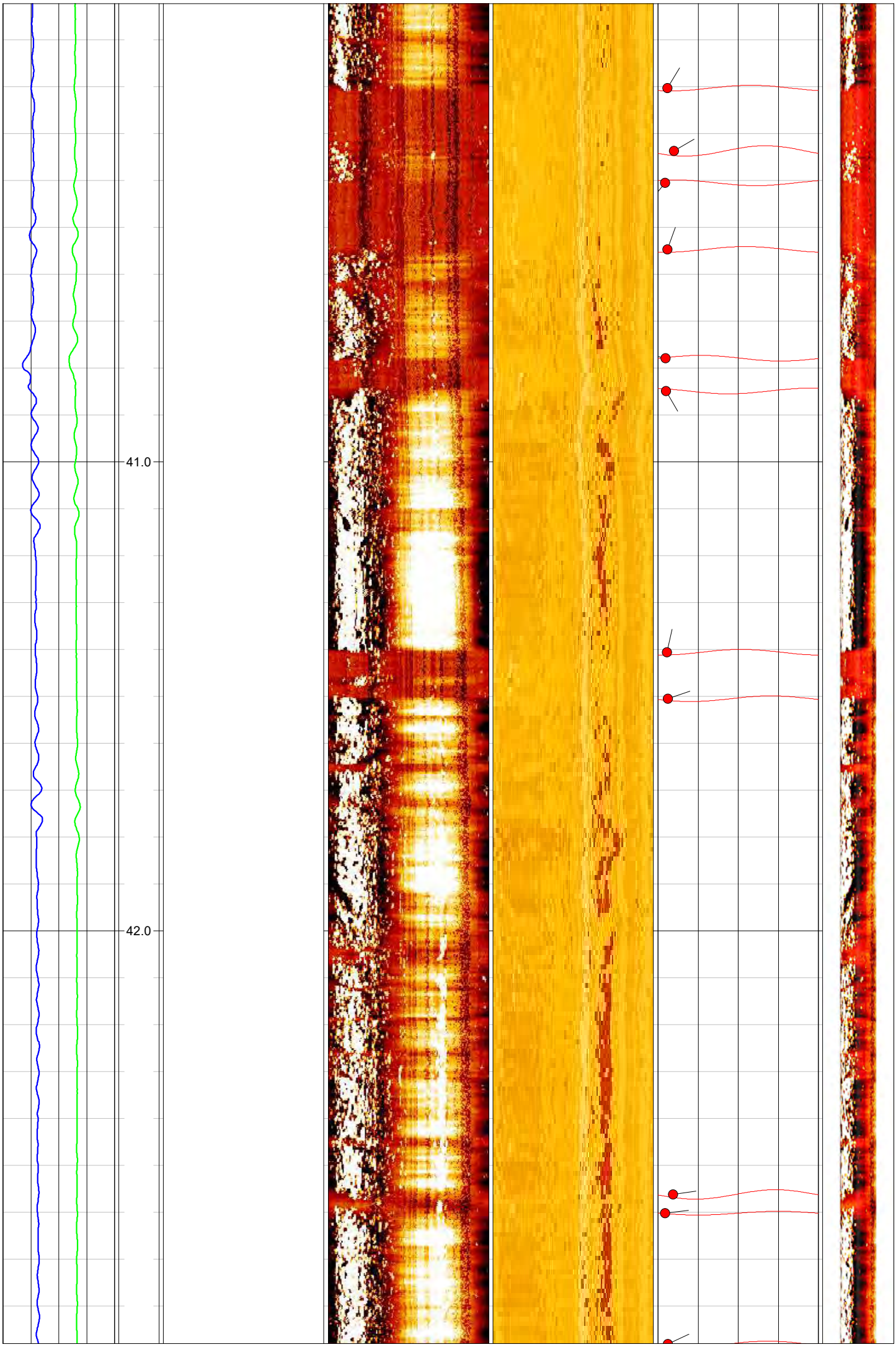
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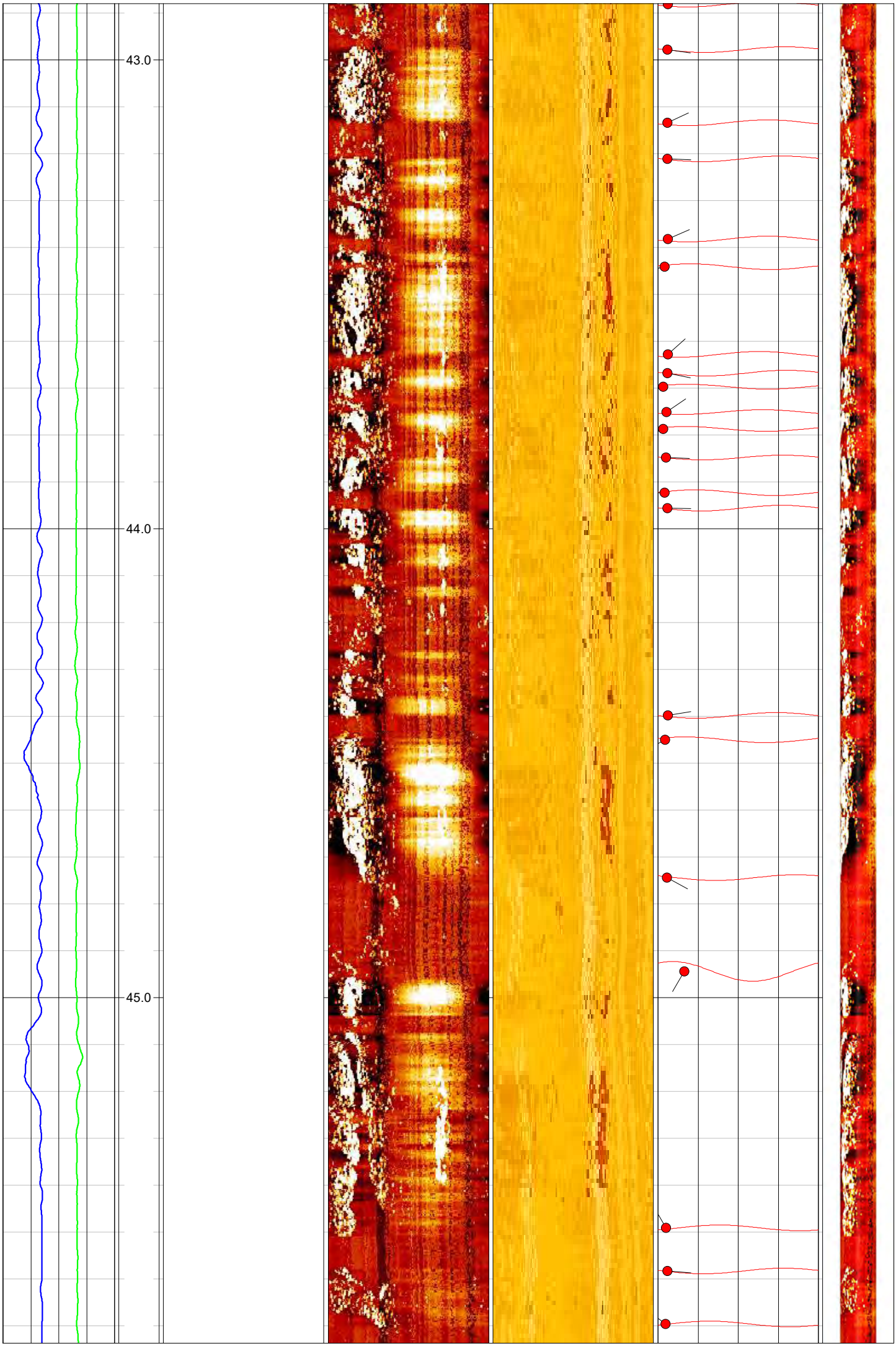
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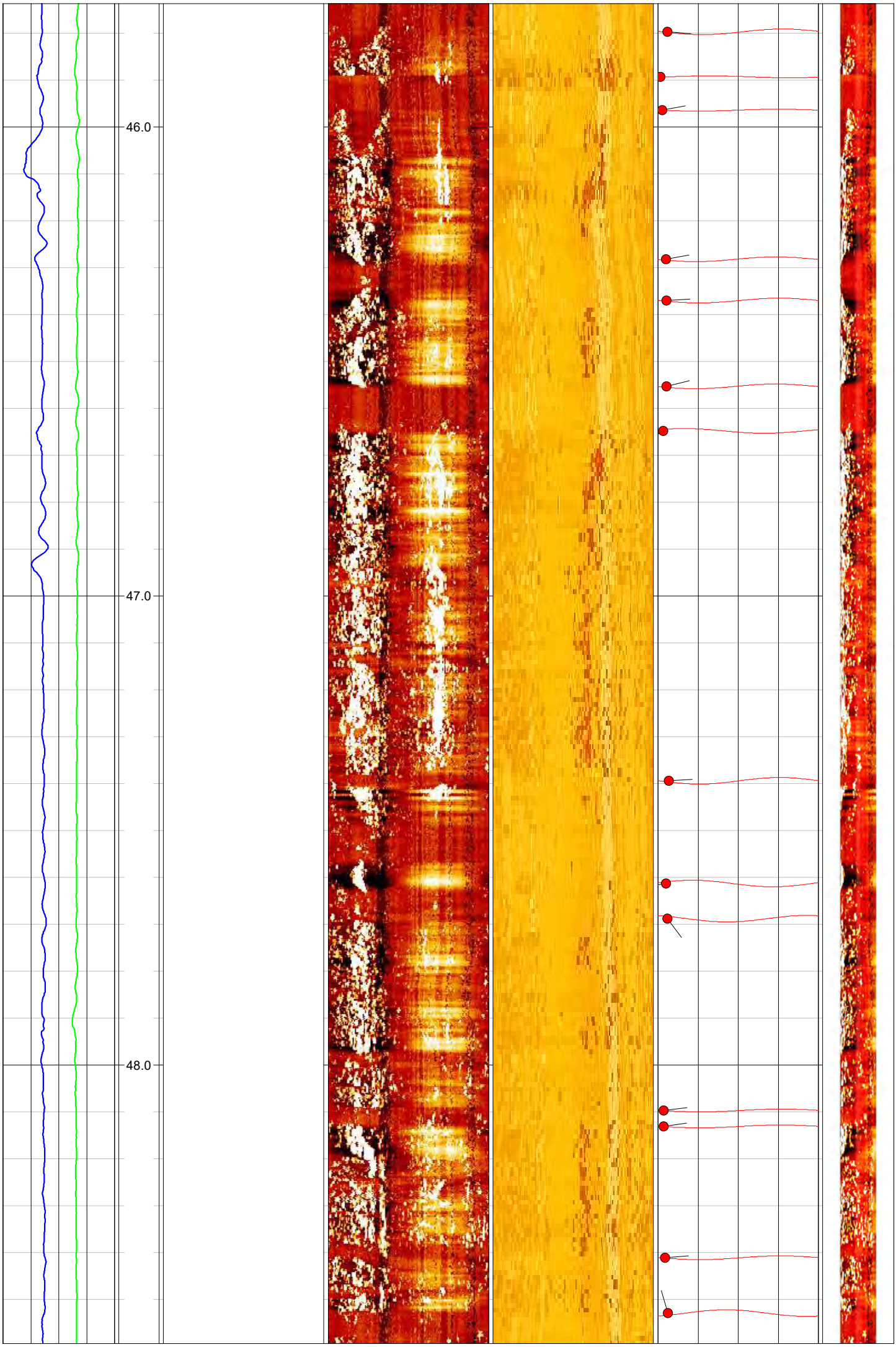
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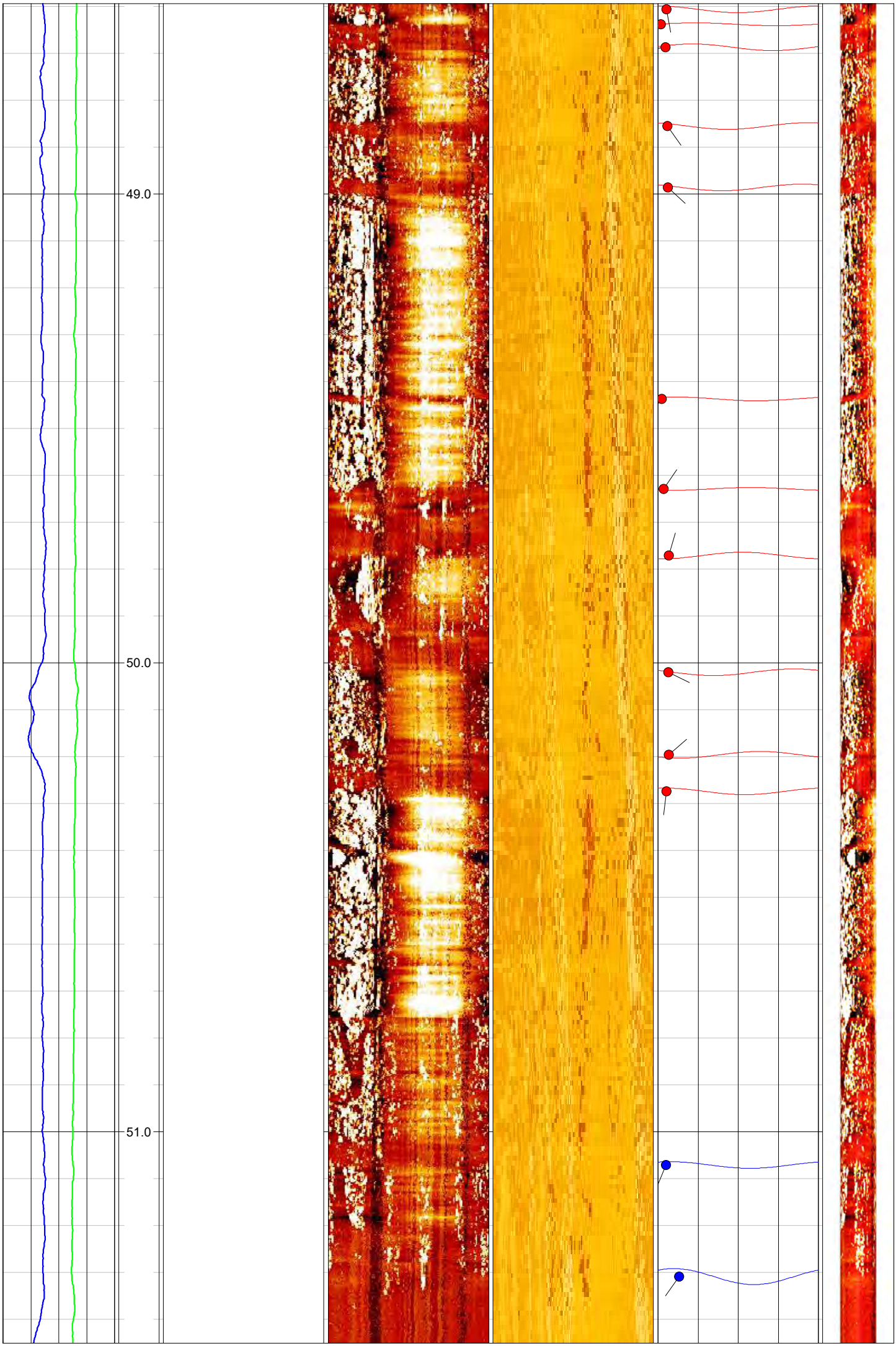
48.0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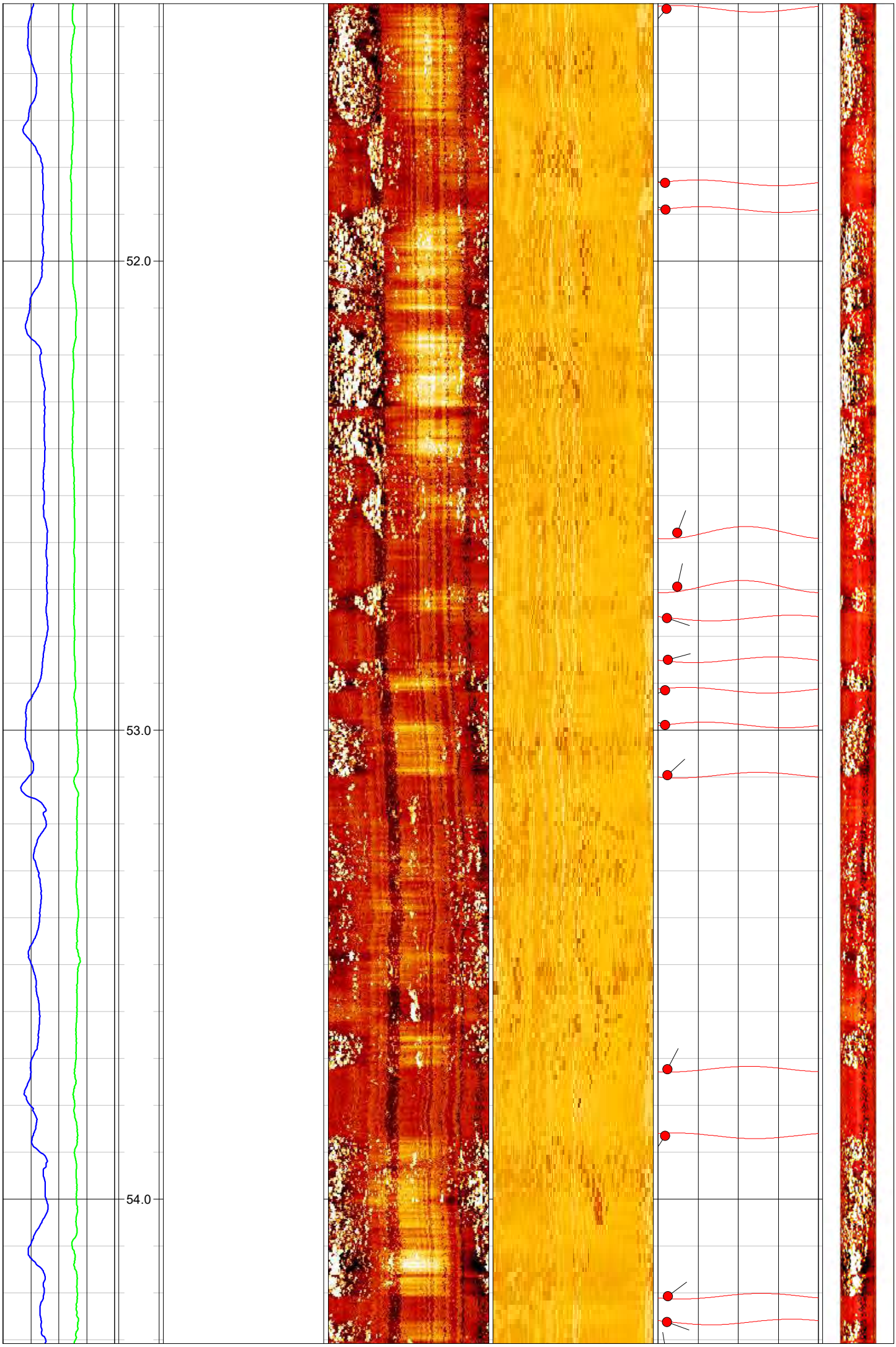
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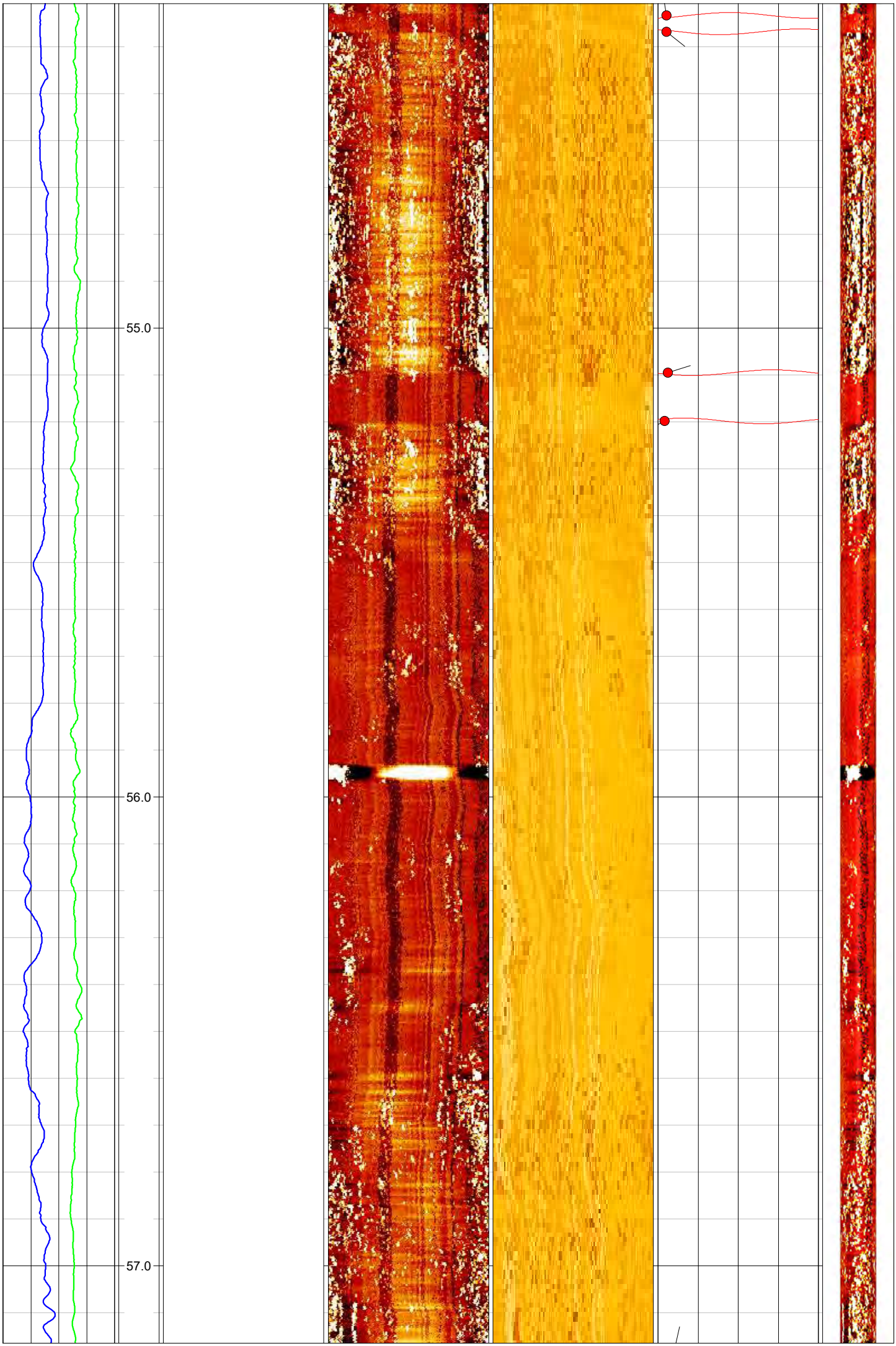
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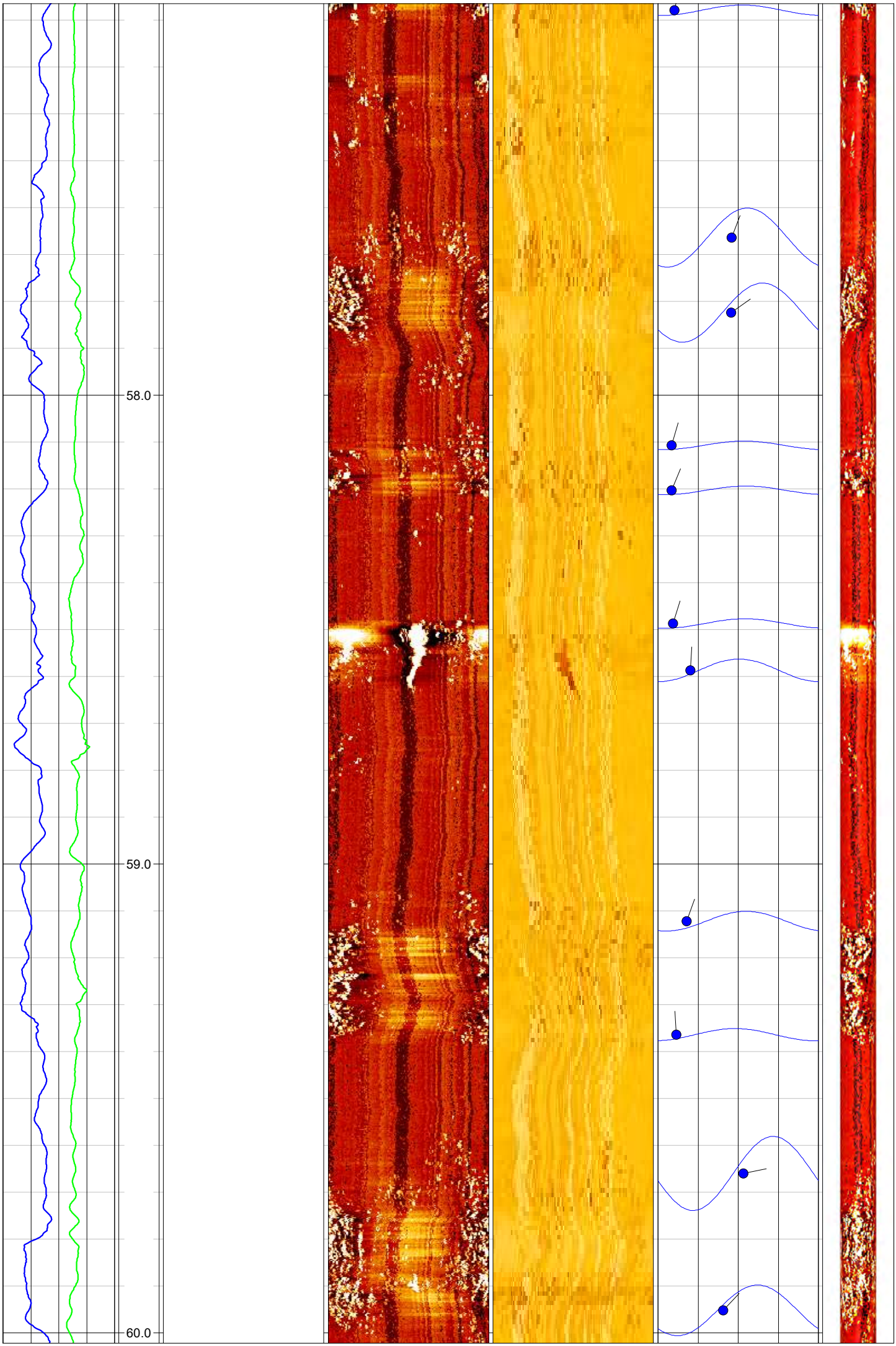
57.0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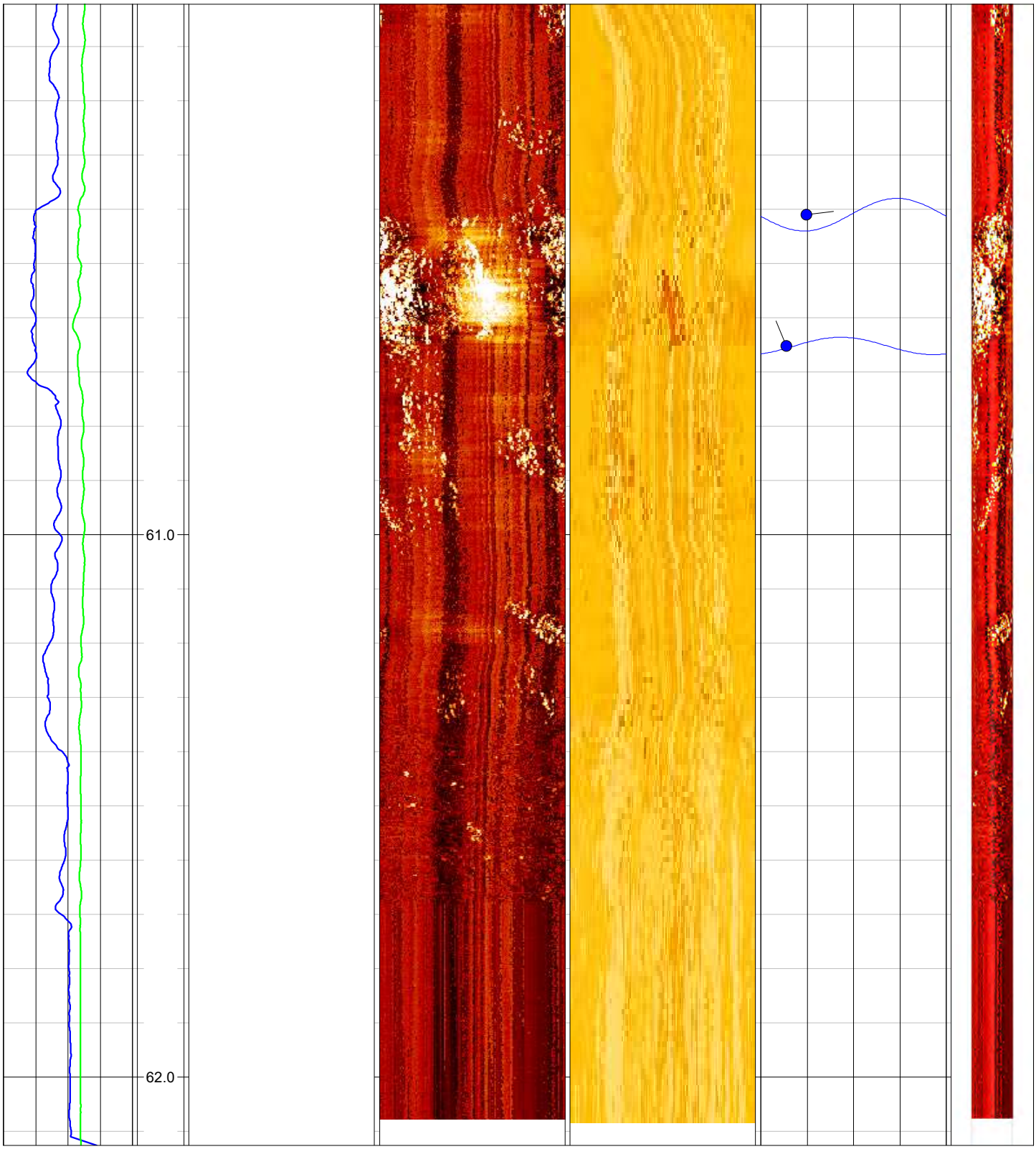

61.0
62.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC308**

Log Type: ***Composite***

Location: **Mendel** Area: **A417** Grid Ref: **393999.2E 215766.9N** Elevation: **271.34m**

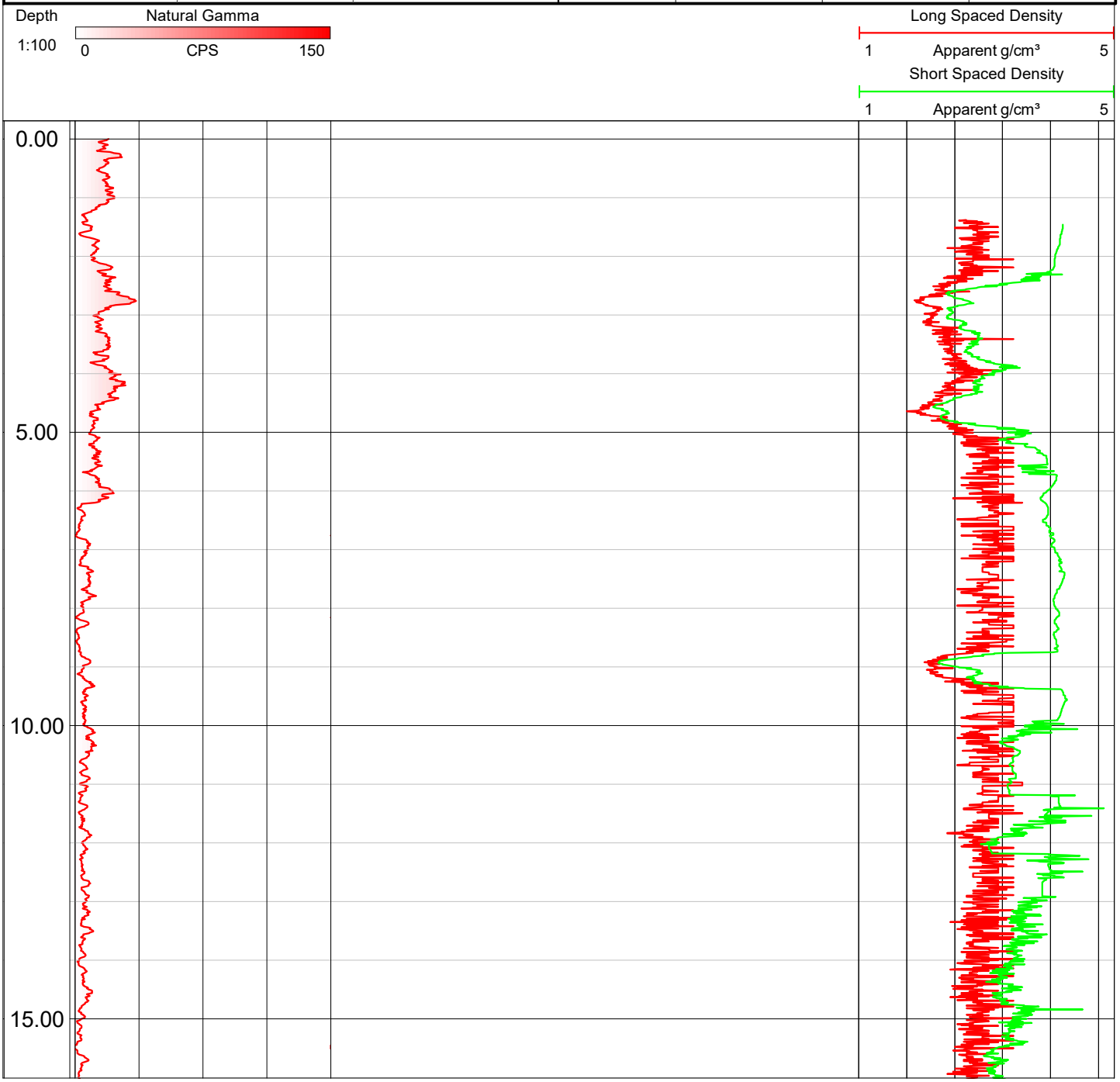
Drilled Depth: (m)	**70.0***	Date:	**19.12.19**
Logged Depth: (m)	**70.3**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Cased suite only - all logs presented as quantative due to prescence of steel casing
Logged Interval: (m)	**1.0**		
Fluid Level: (m)	**Unknown**		

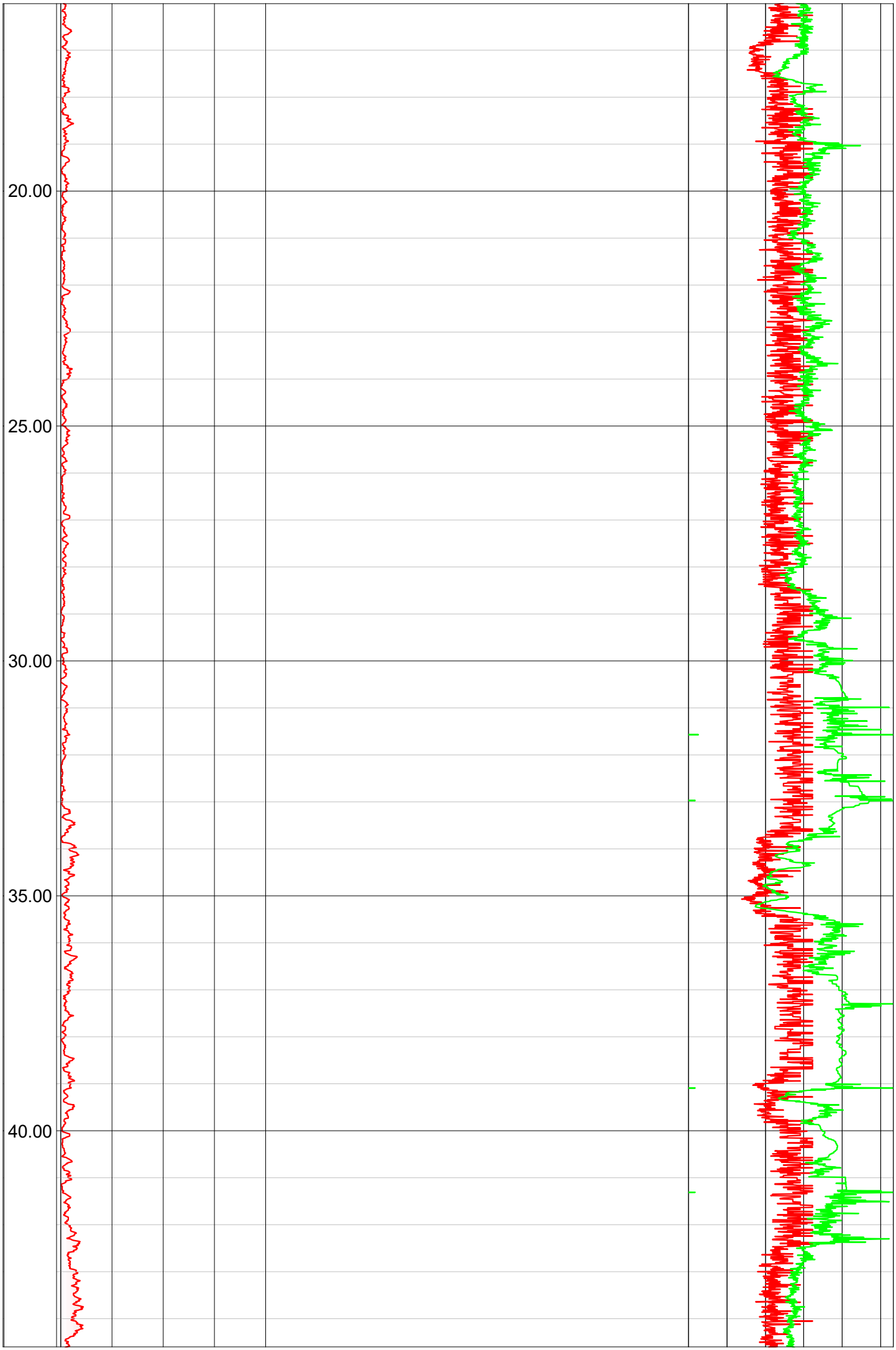
BOREHOLE RECORD

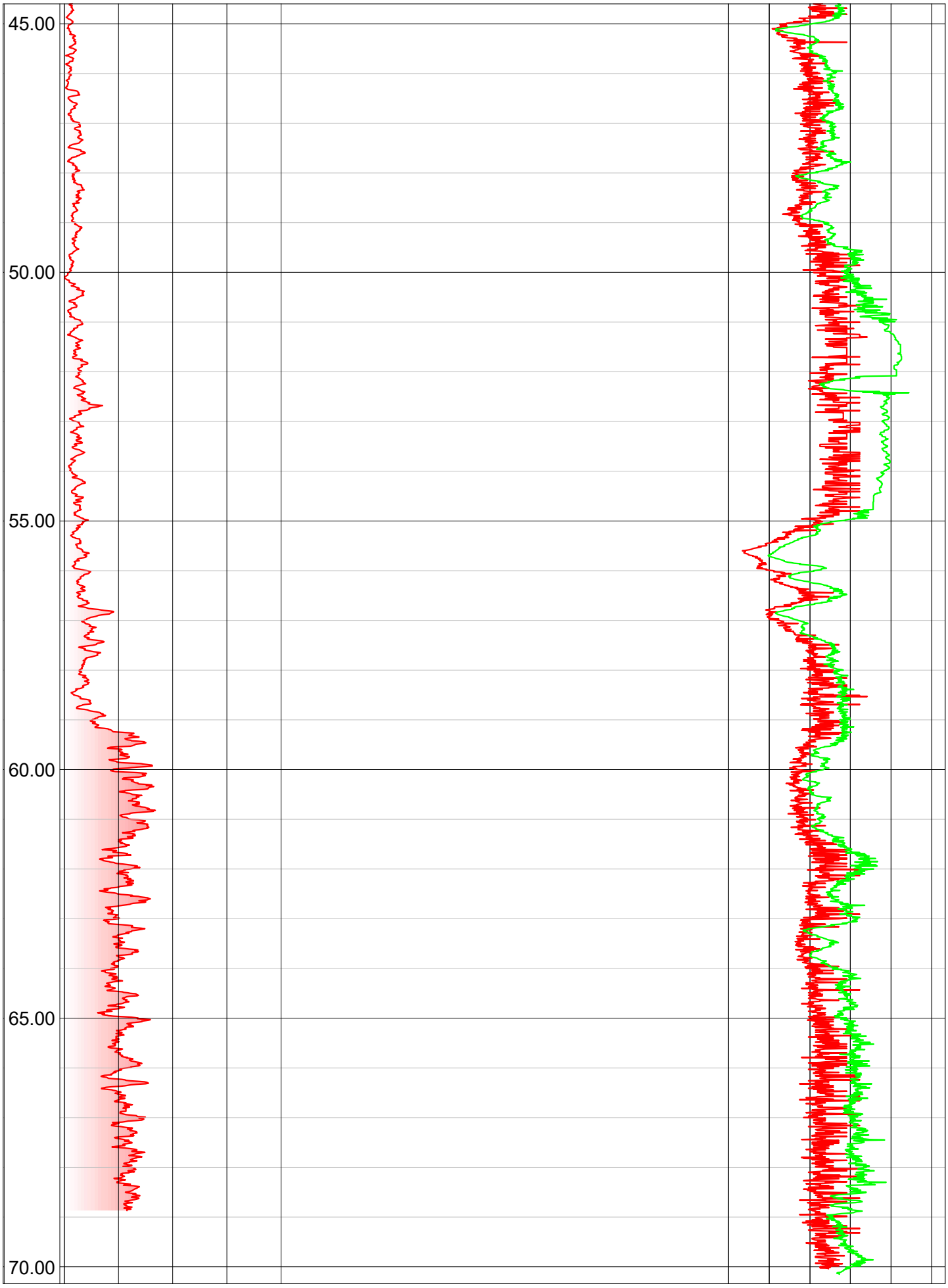
Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**125**	**-0.8**	**70.0**




20.00
25.00
30.00
35.00
40.00


45.00
50.00
55.00
60.00
65.00
70.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC308a**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **393990.5E 215759.1N** Elevation: **271.85m**

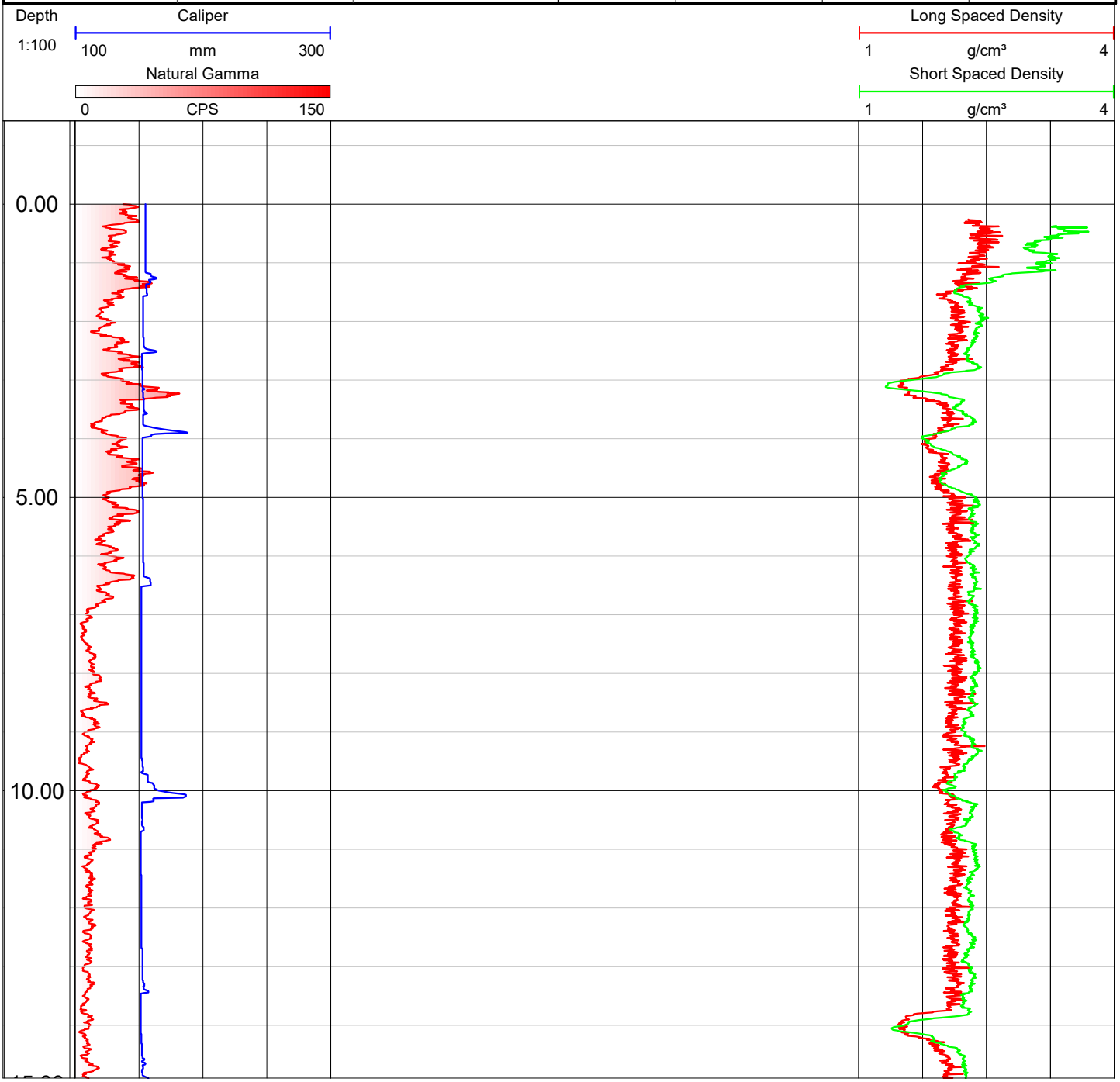
Drilled Depth: (m)	**18.1**	Date:	**17.01.2020**
Logged Depth: (m)	**18.0**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**1.2 - 18.0**		
Fluid Level: (m)	**Dry**		

BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**148**	**-0.3**	**1.2**




15.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC308a**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **393990.5E 215759.1N** Elevation: **271.85m**

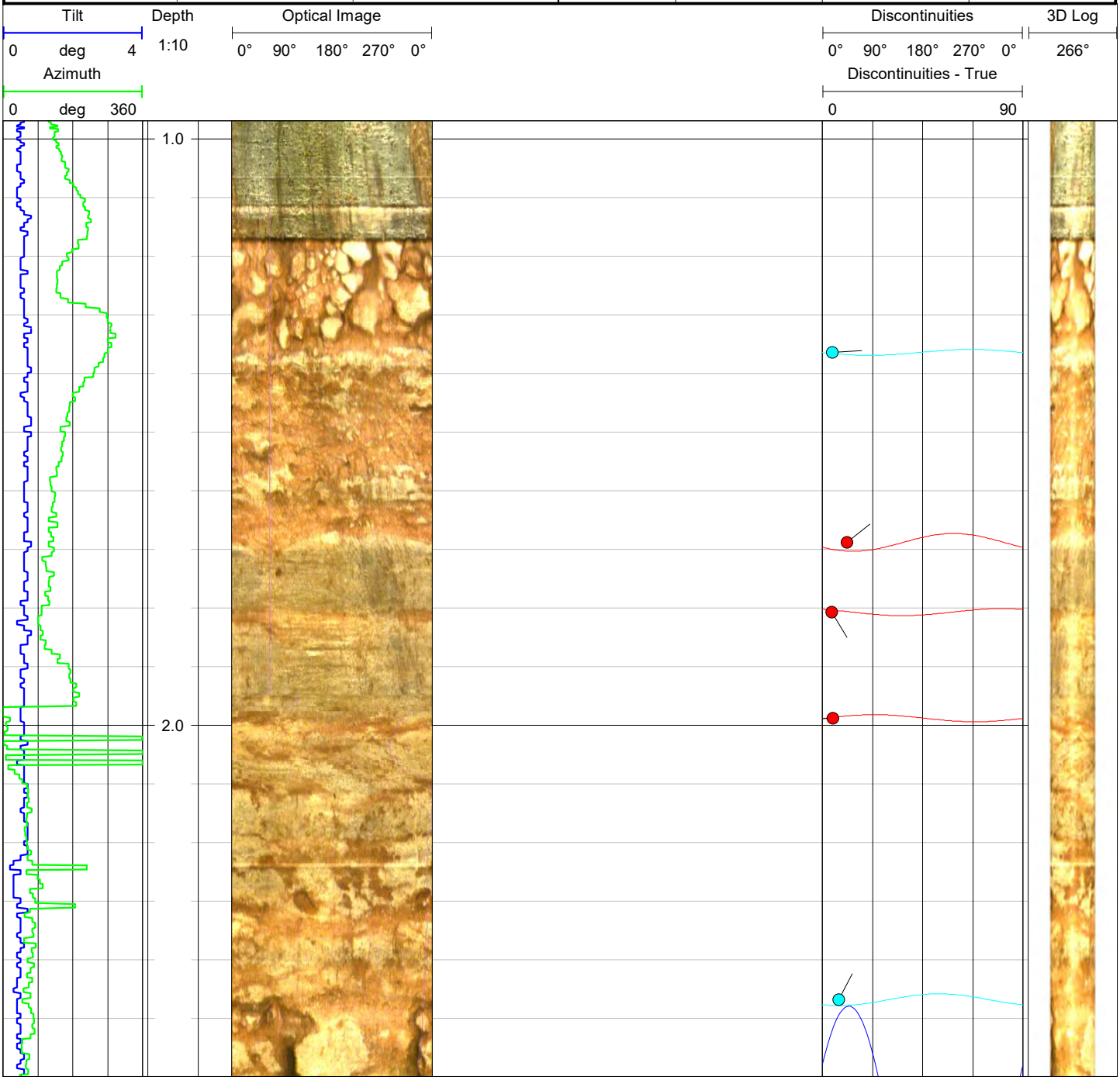
Drilled Depth: (m)	**18.1**	Date:	**17.01.2020**
Logged Depth: (m)	**18.0**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**1.2 - 18.0**		
Fluid Level: (m)	**Dry**		

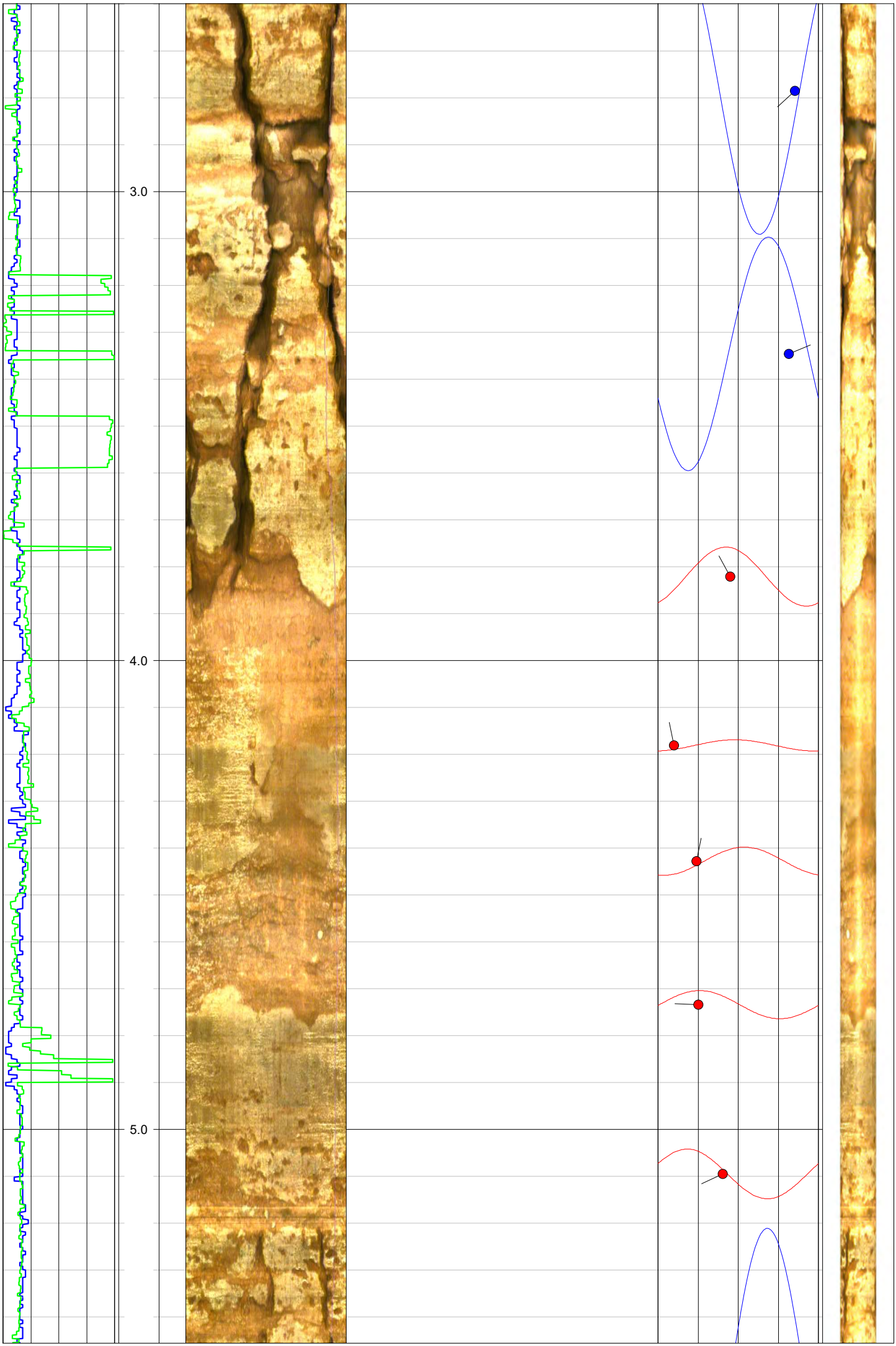
BOREHOLE RECORD

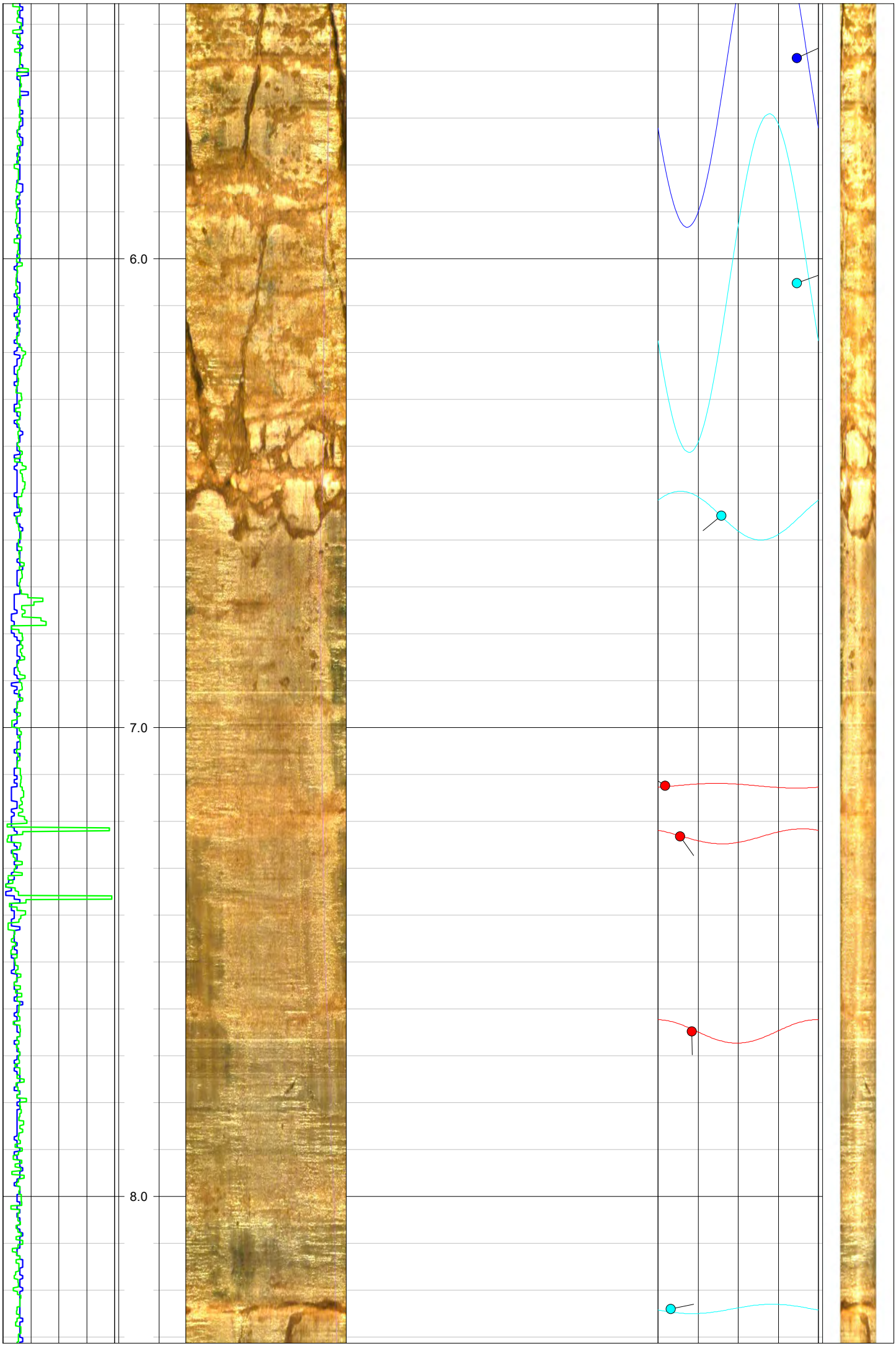
Bit: (mm)	From: (m)	To: (m)

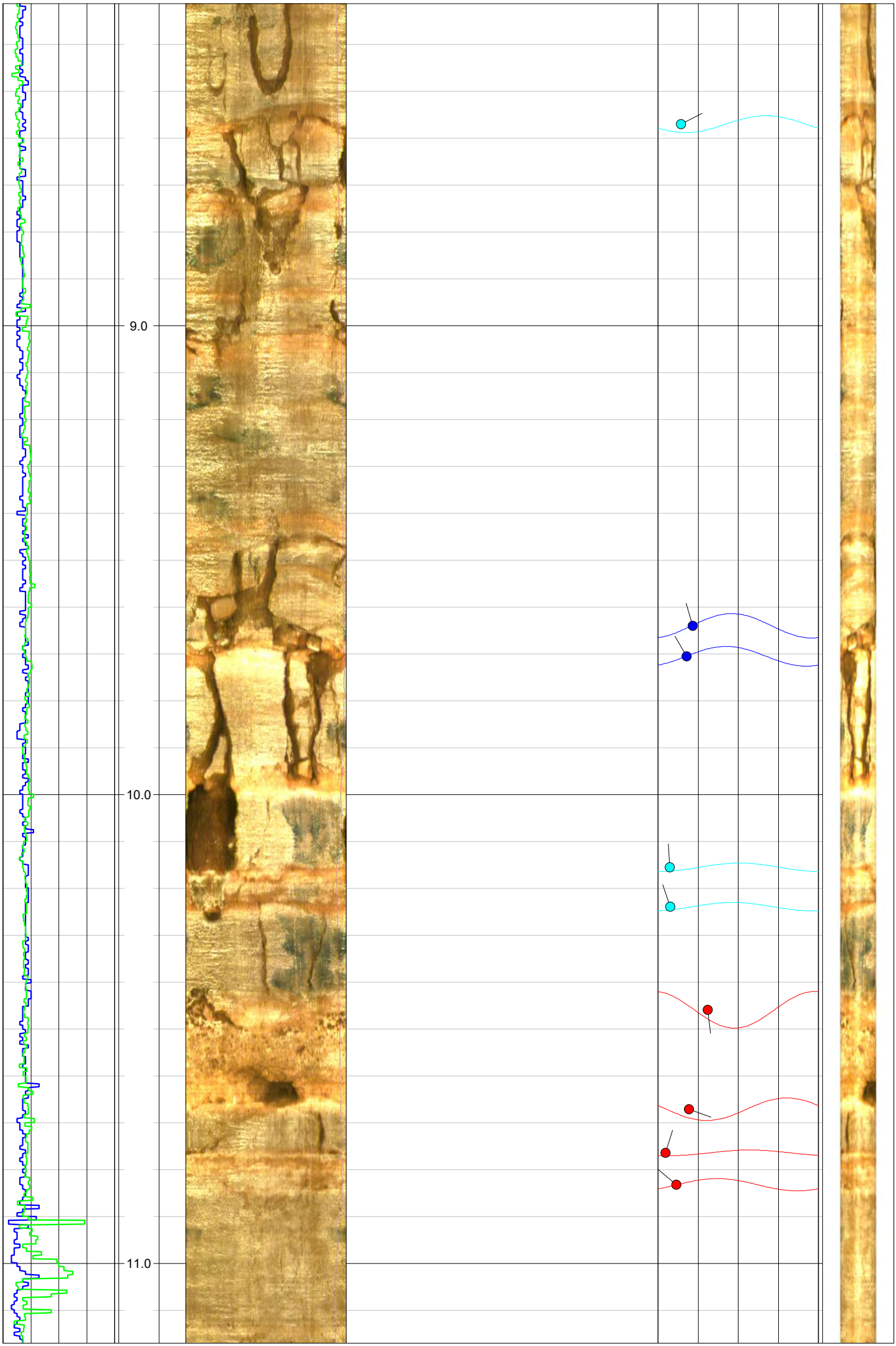
CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**148**	**-0.3**	**1.2**




3.0
4.0
5.0


6.0
7.0
8.0


9.0
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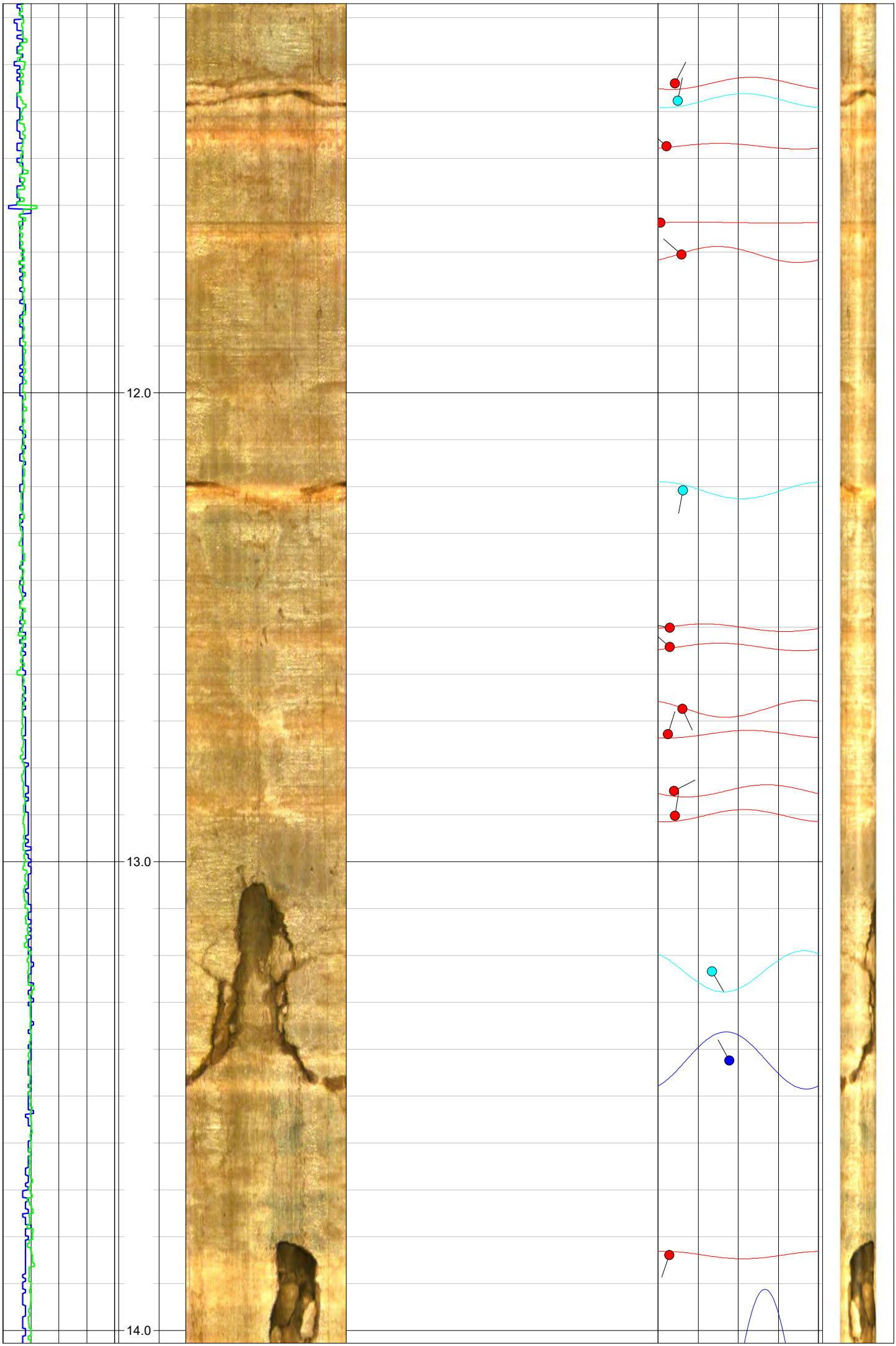
12.0
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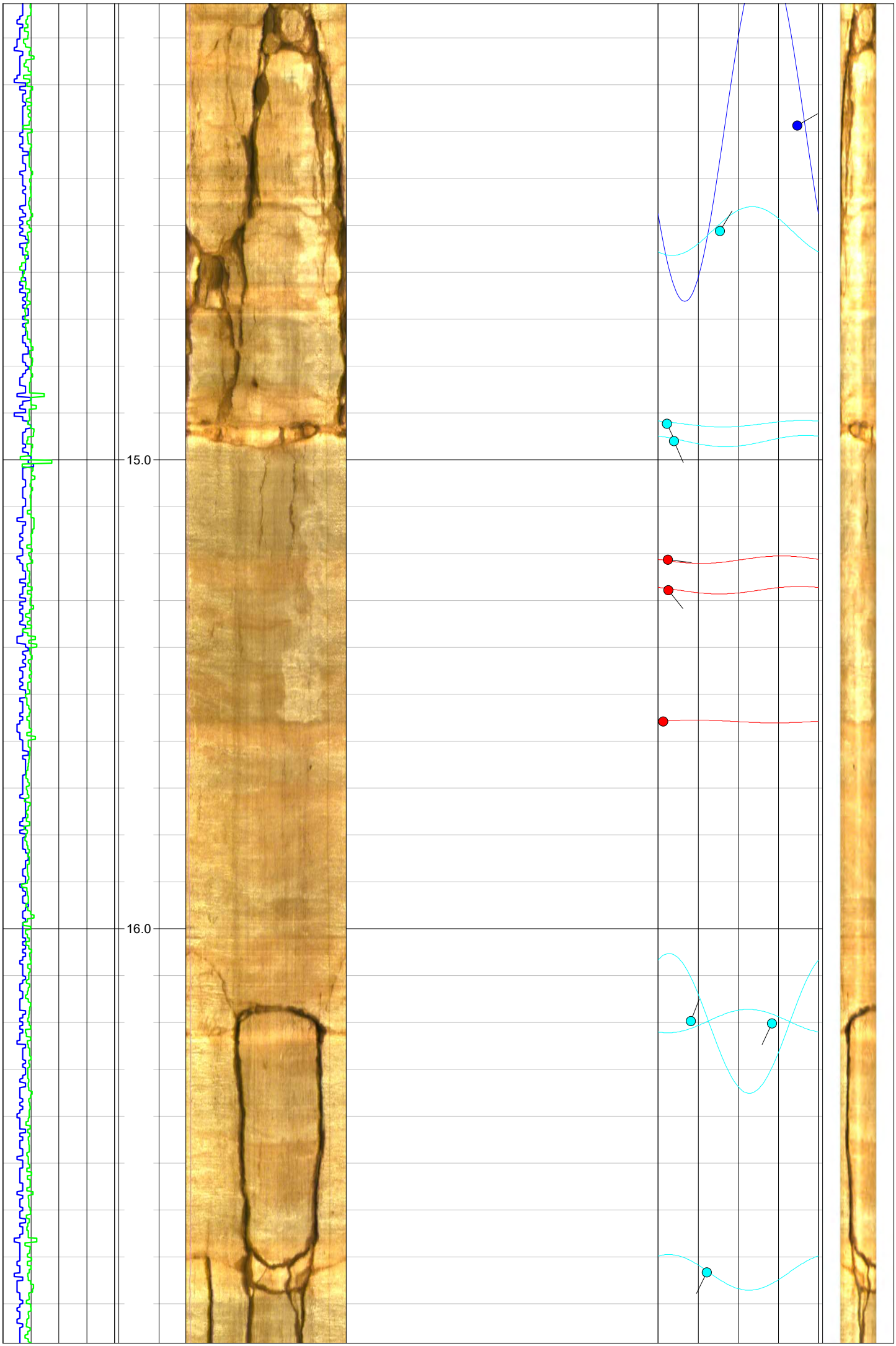
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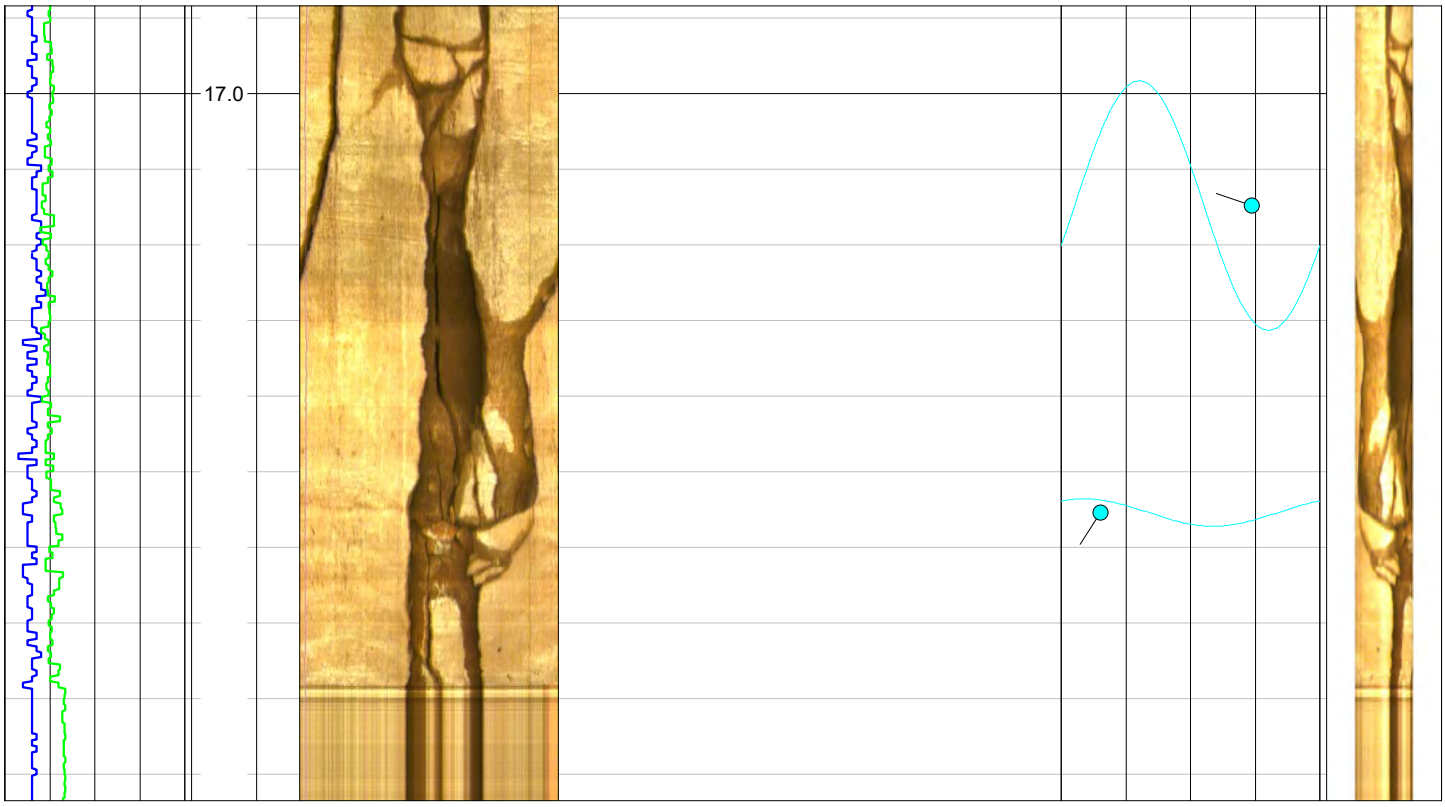

17.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC312**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **393779.7E 215300.8N** Elevation: **282.15m**

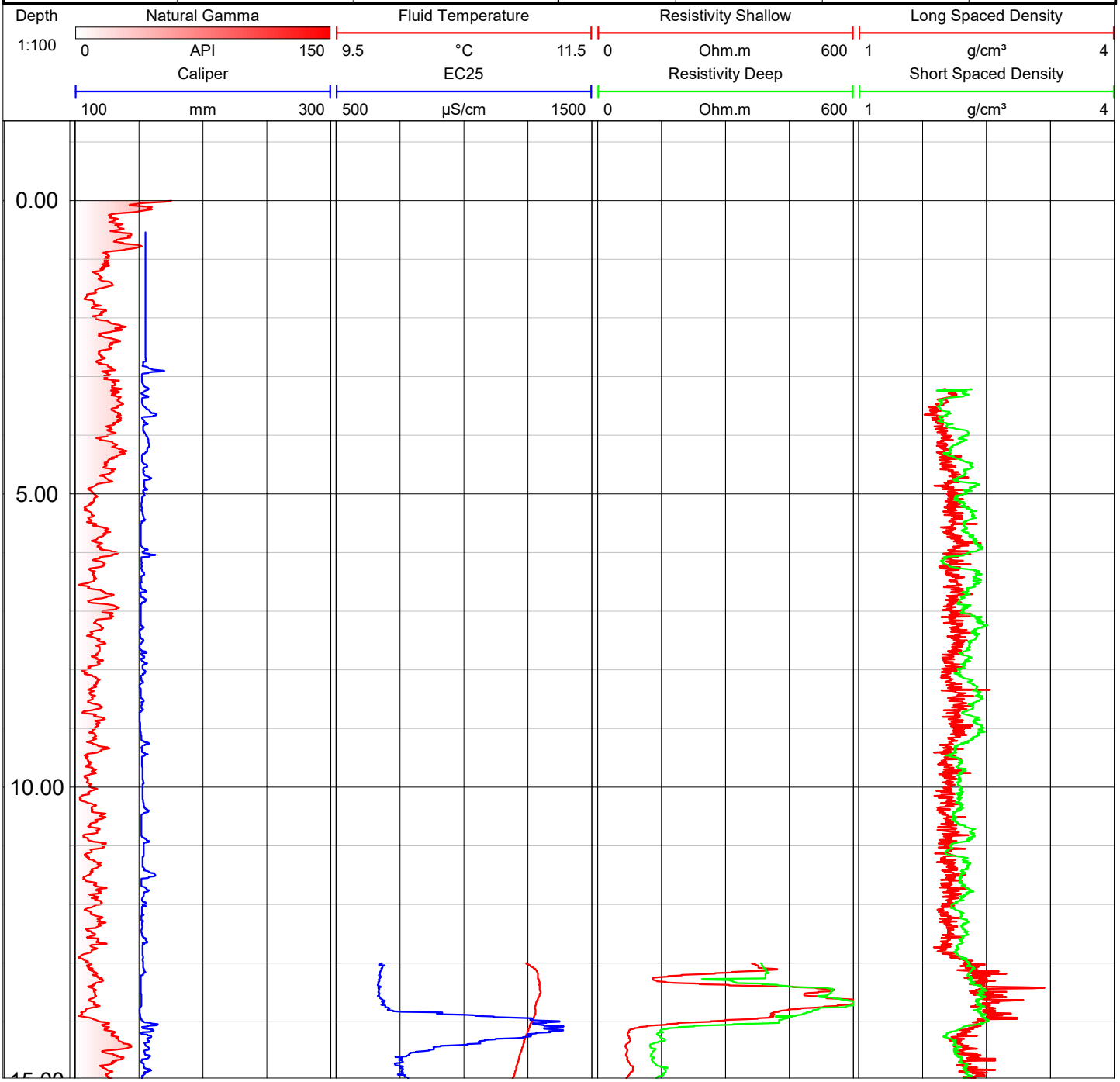
Drilled Depth: (m)	**25.0**	Date:	**22.05.20**
Logged Depth: (m)	**23.9**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.0 - 23.9**		
Fluid Level: (m)	**13.1**		

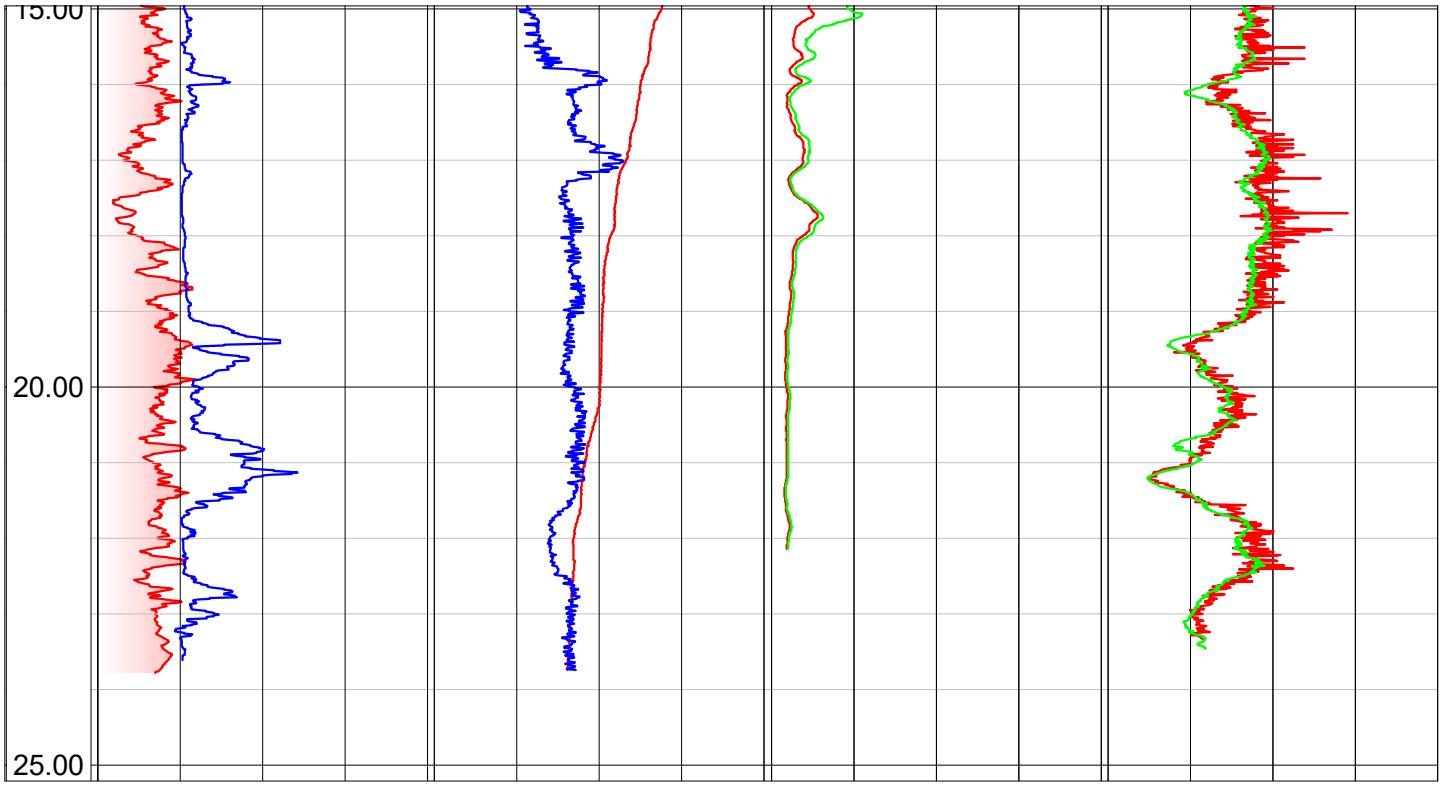
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**146**	**-0.5**	**3.1**




15.00
20.00
25.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC312**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **393779.7E 215300.8N** Elevation: **282.15m**

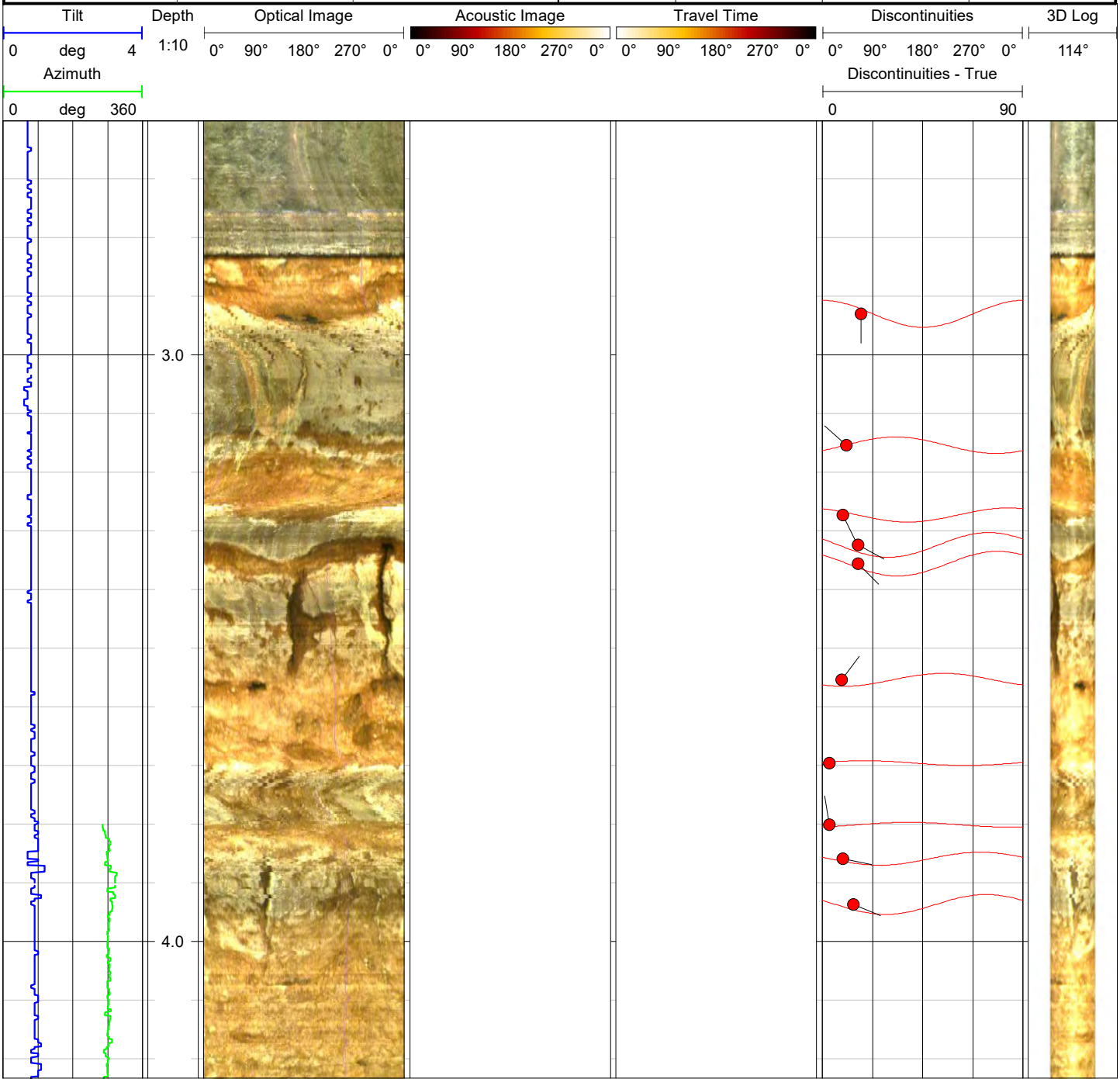
Drilled Depth: (m)	**25.0**	Date:	**22.05.20**
Logged Depth: (m)	**23.6**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**3.1 - 23.6**		
Fluid Level: (m)	**13.1**		

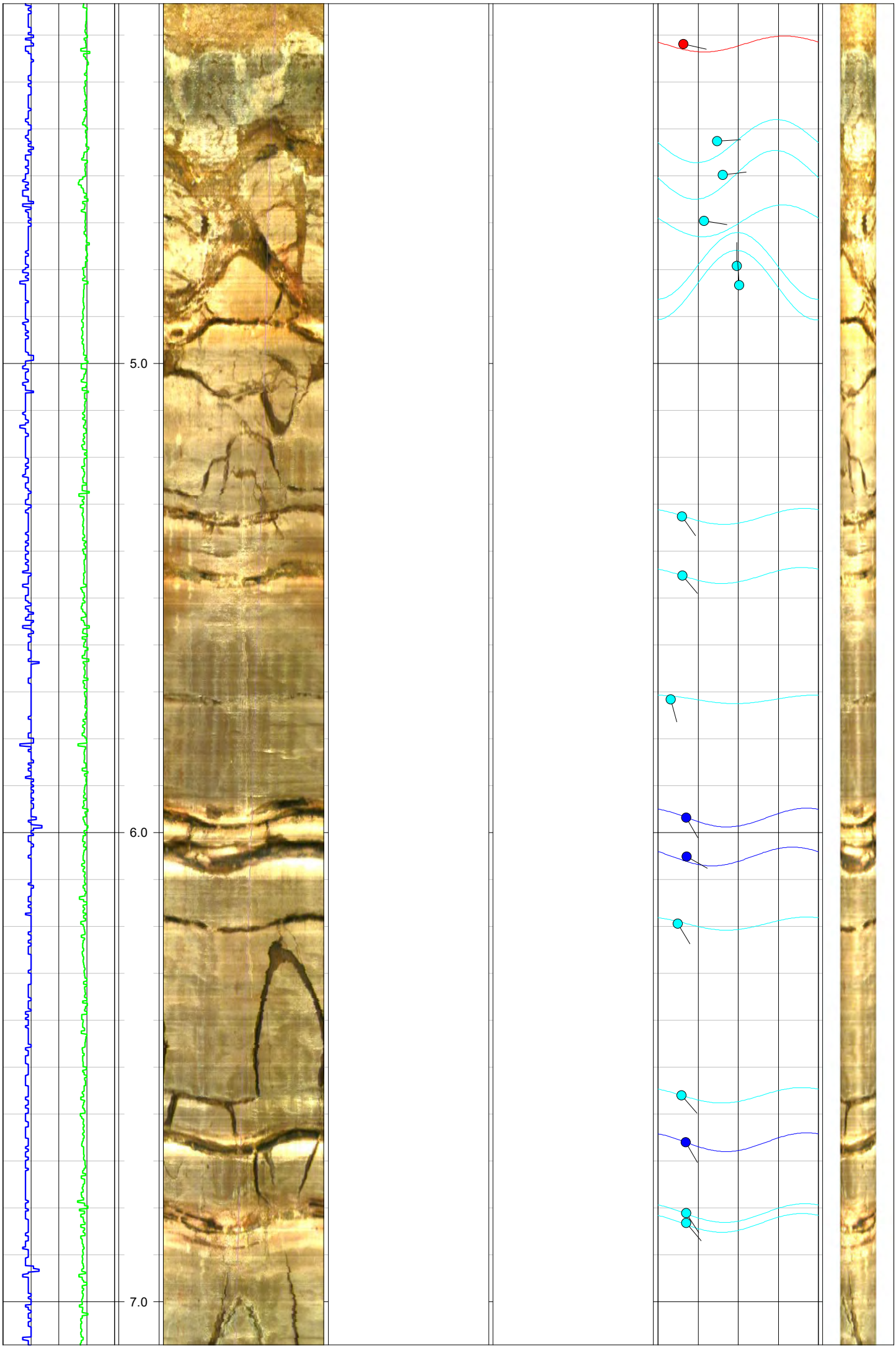
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**146**	**-0.5**	**3.1**

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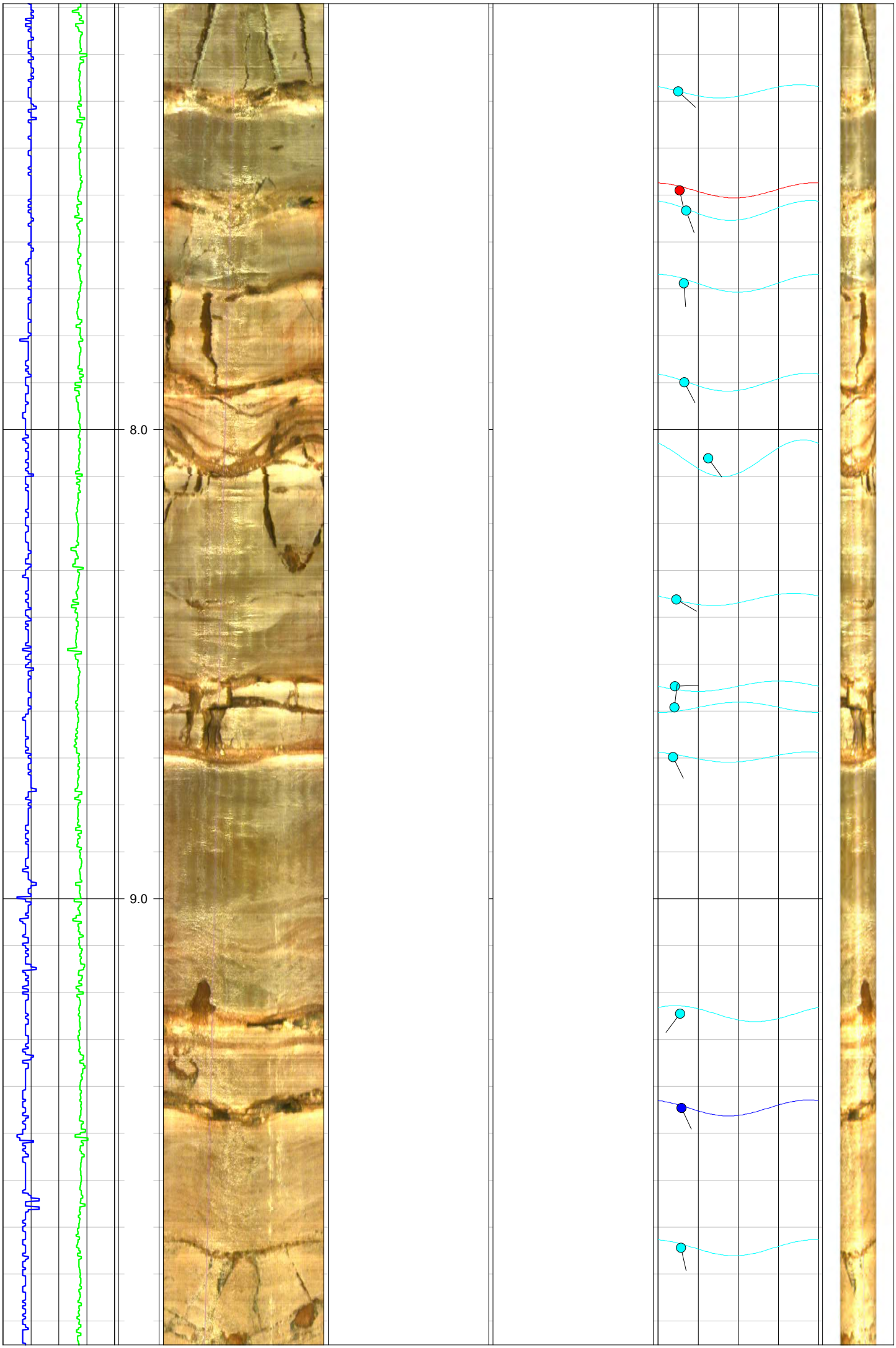
6.0
7.0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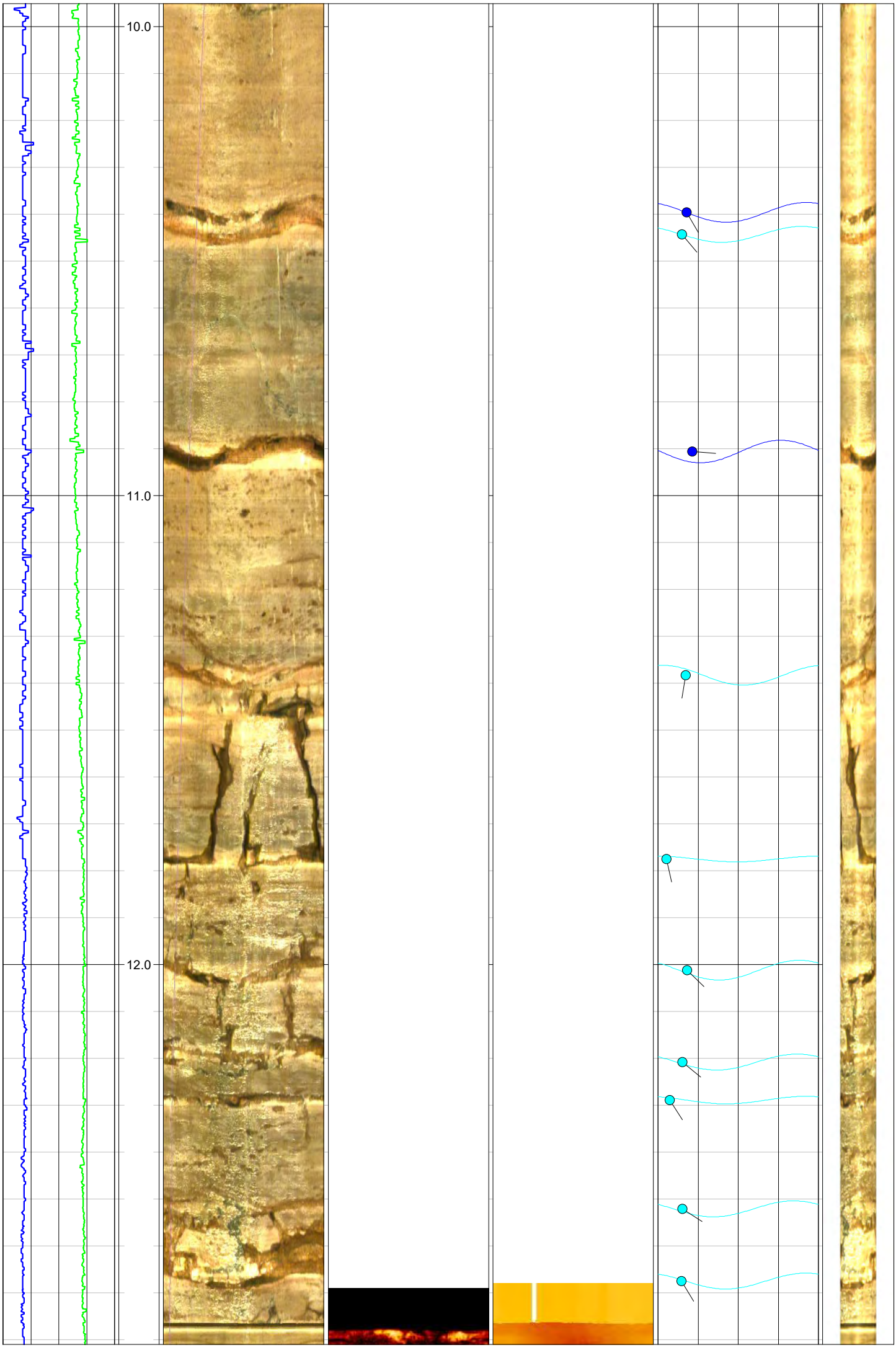
9.0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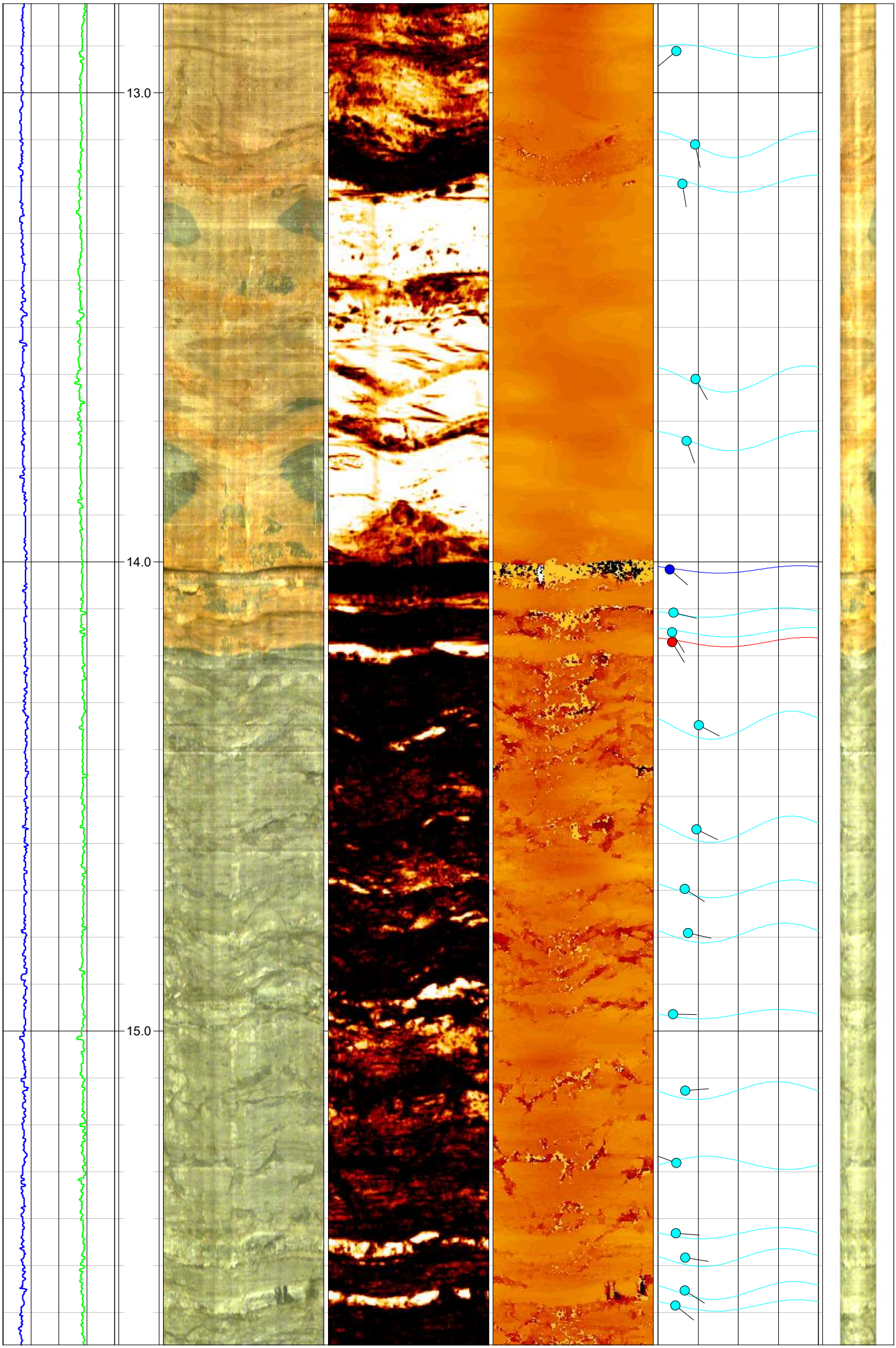
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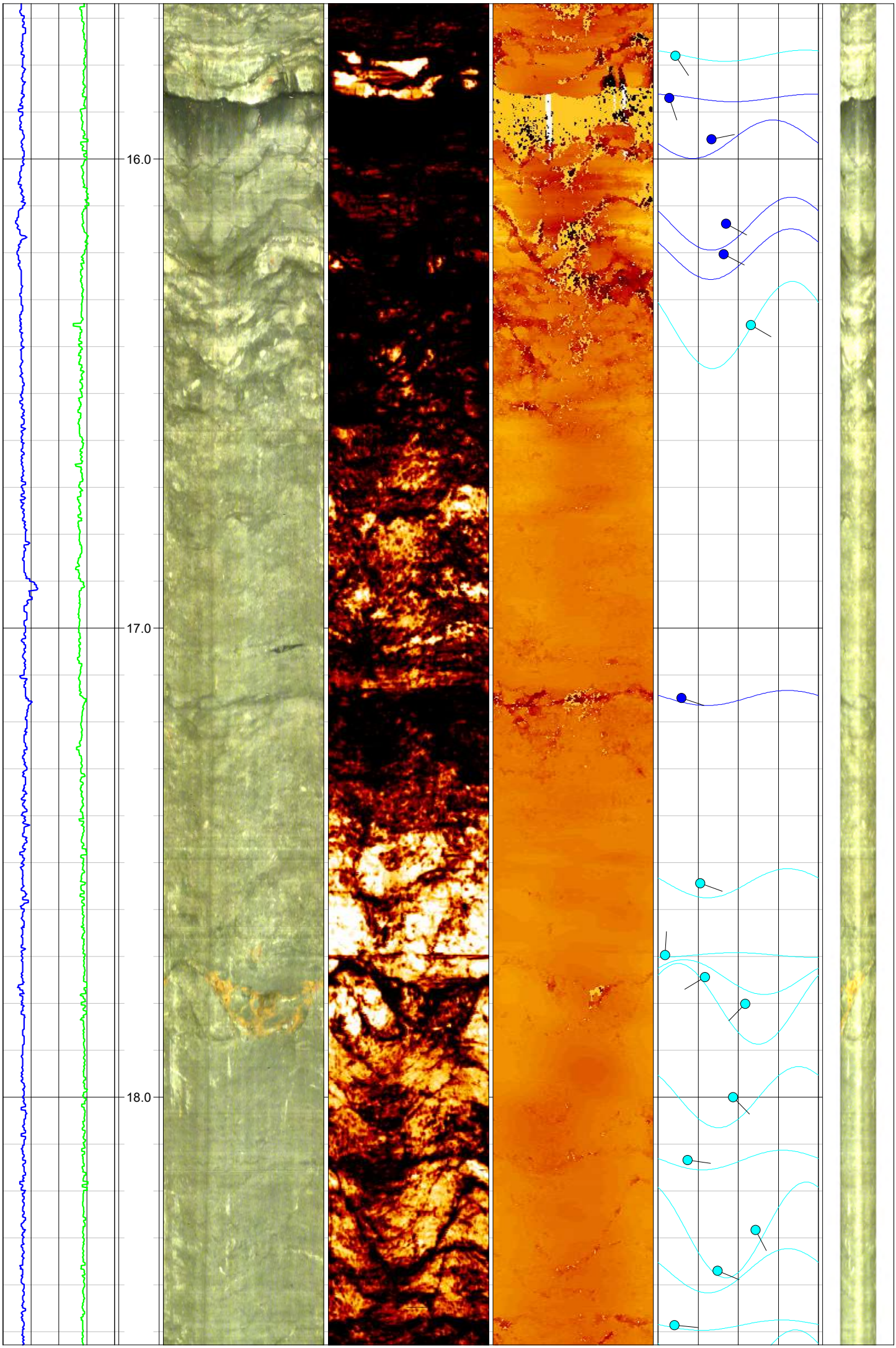
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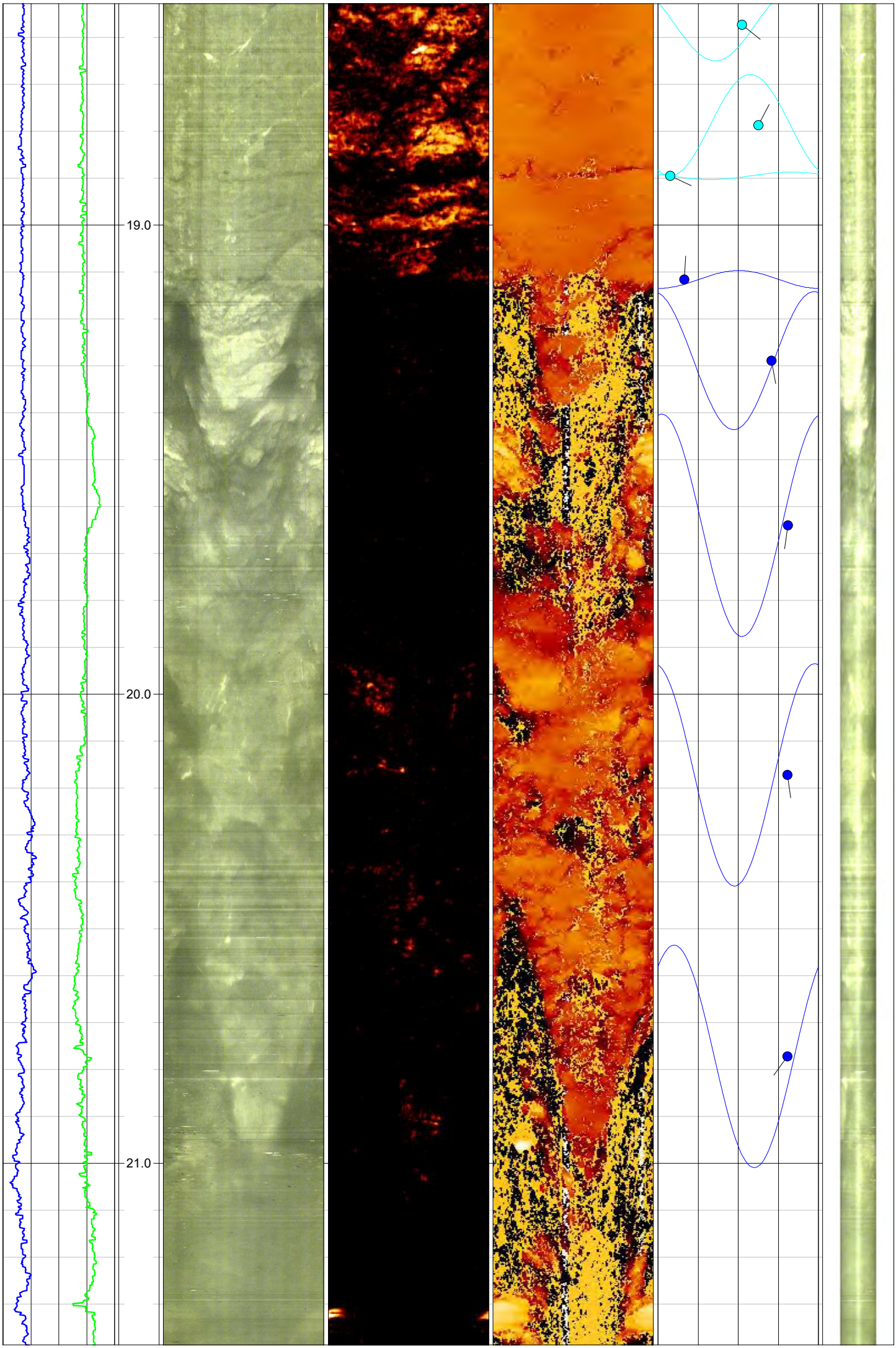
19.0
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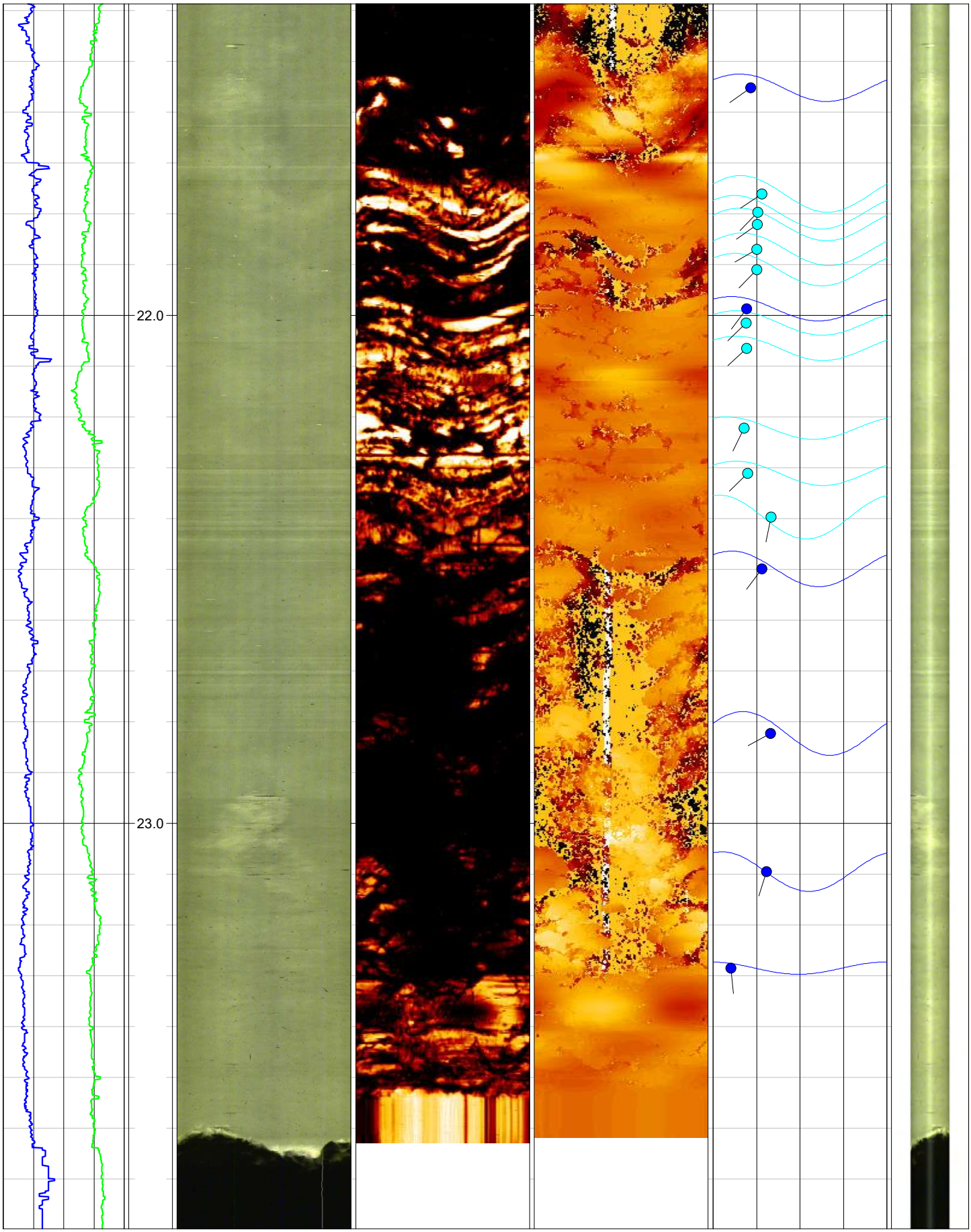
21.0


22.0
23.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC314**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **393256.0E 215193.1N** Elevation: **293.10m**

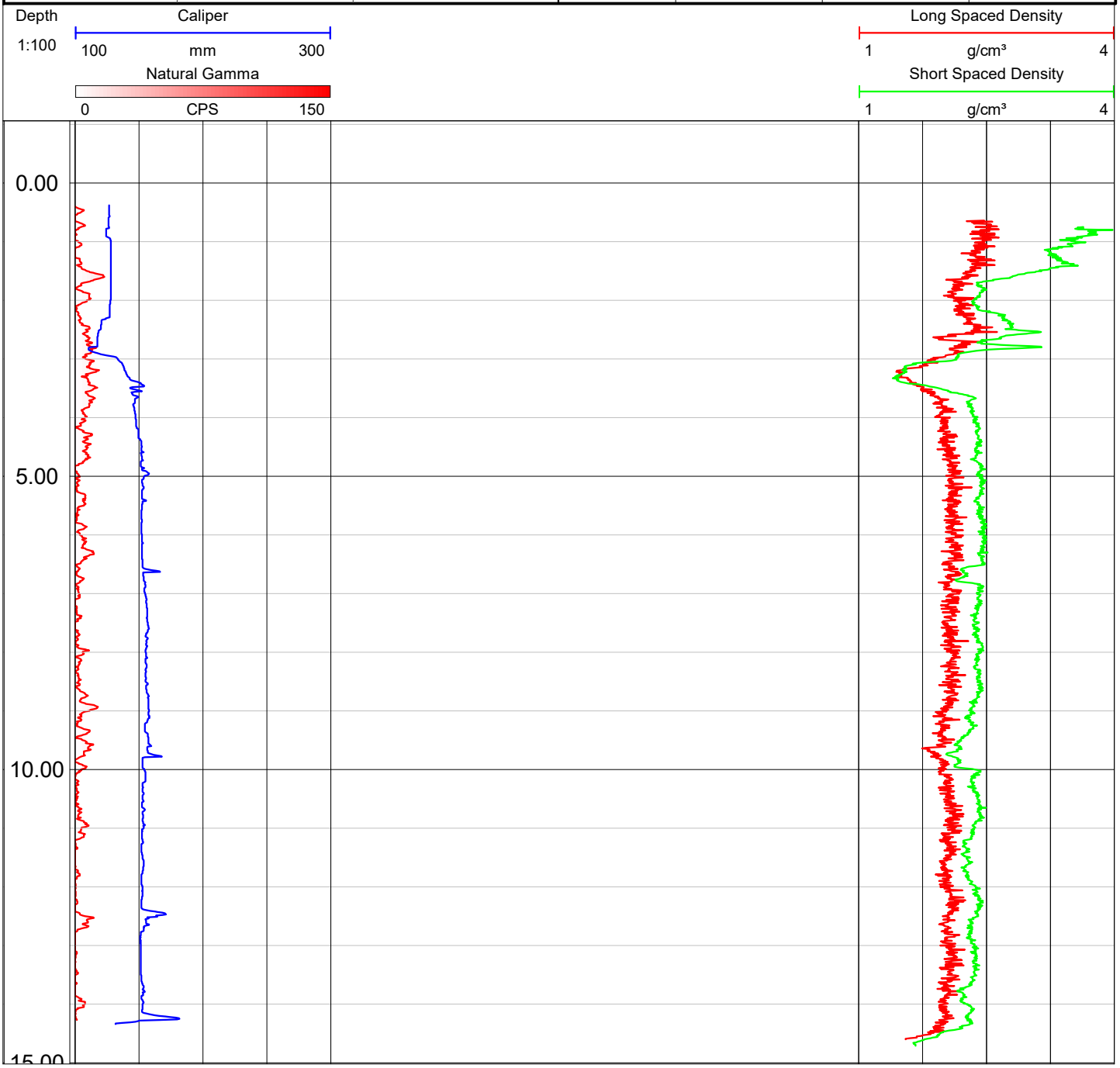
Drilled Depth: (m)	**15.0**	Date:	**18.09.20**
Logged Depth: (m)	**14.9**	Recorded By:	**Mike Hand**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**2.4-14.9**		
Fluid Level: (m)	**Dry**		

BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**146**	**-1**	**2.9**



EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC314**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **393256.0E 215193.1N** Elevation: **293.10m**

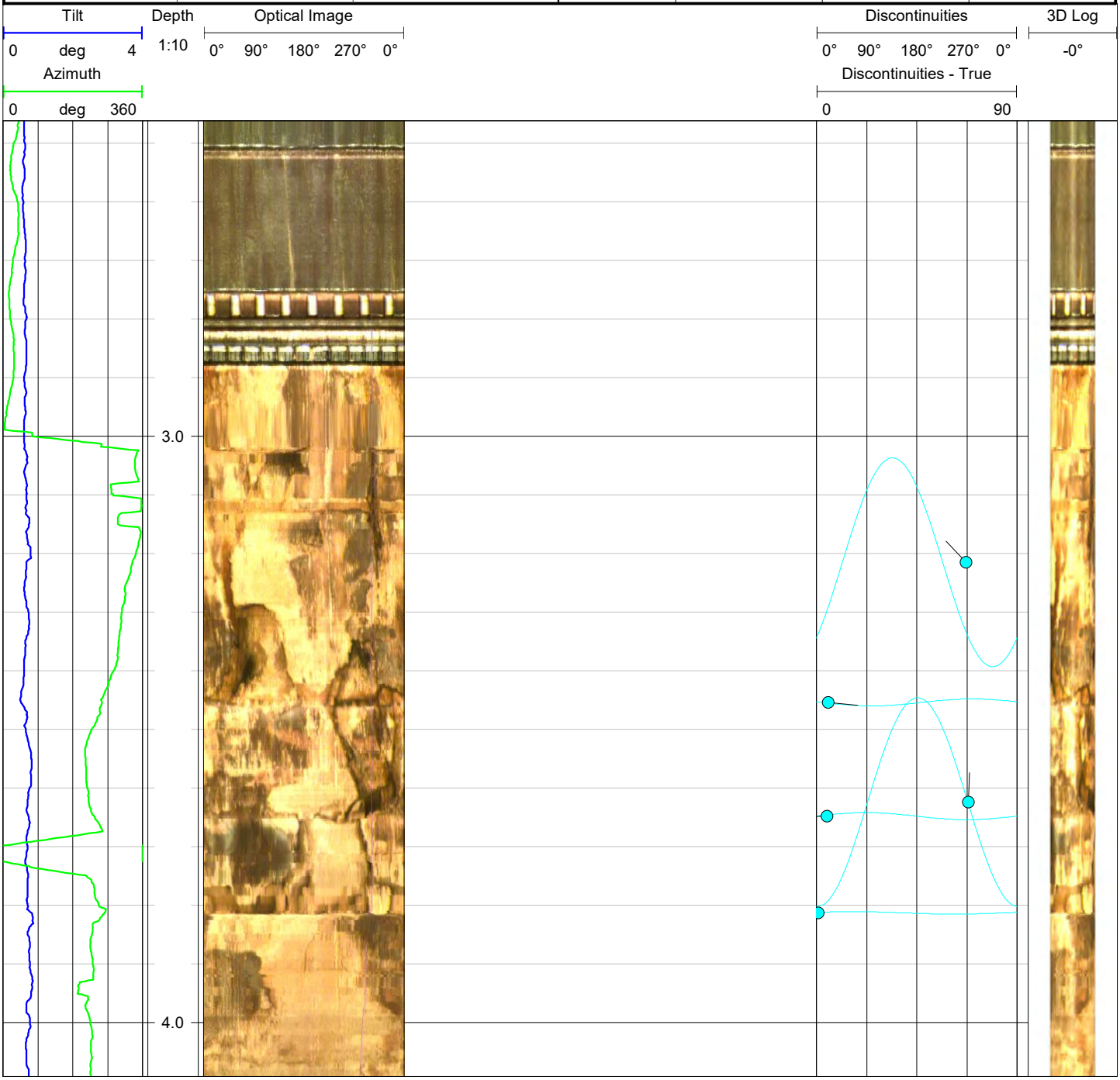
Drilled Depth: (m)	**15.0**	Date:	**18.09.20**
Logged Depth: (m)	**14.9**	Recorded By:	**Mike Hand**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**2.4-14.9**		
Fluid Level: (m)	**Dry**		

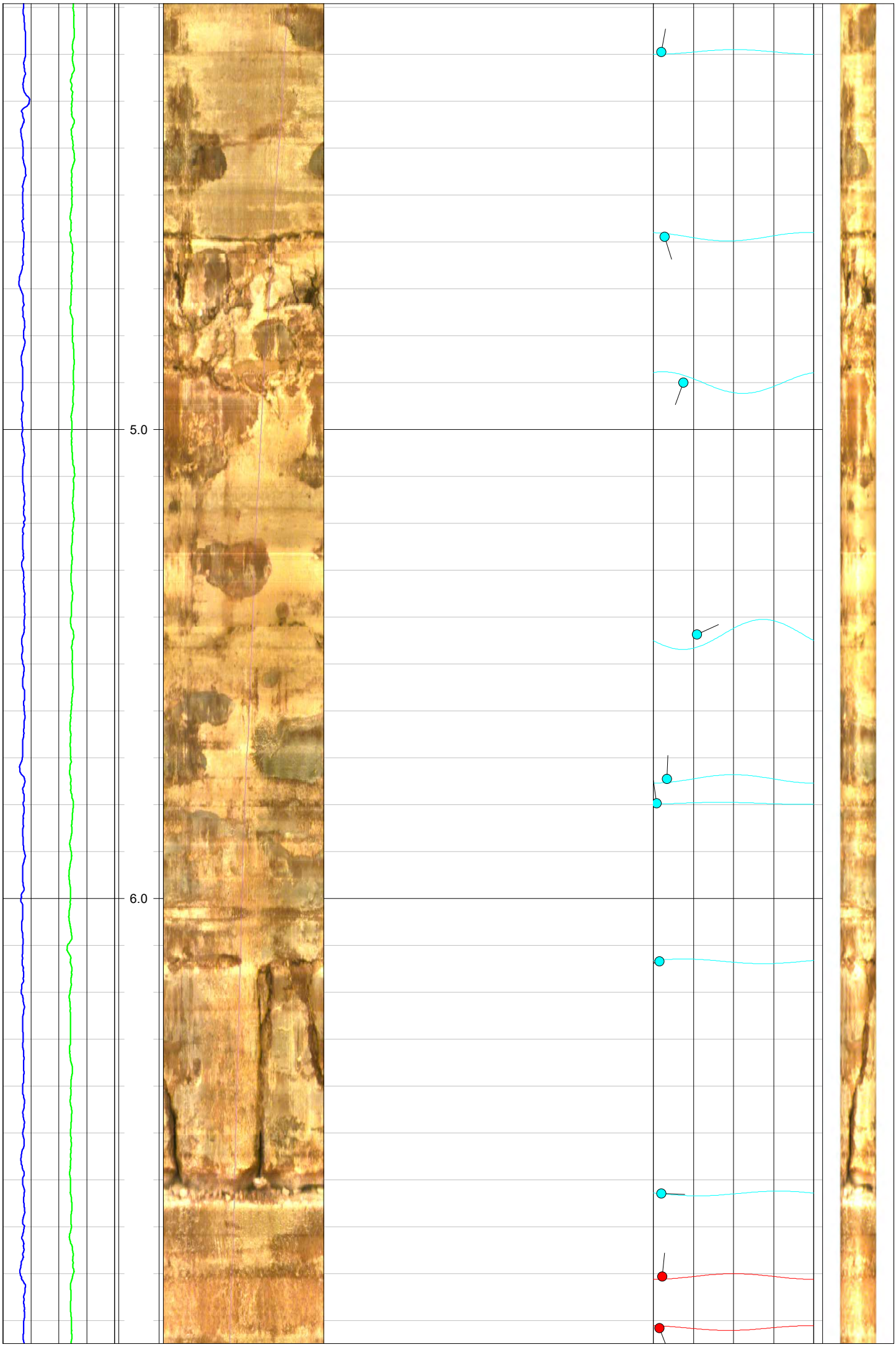
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**146**	**-1**	**2.9**

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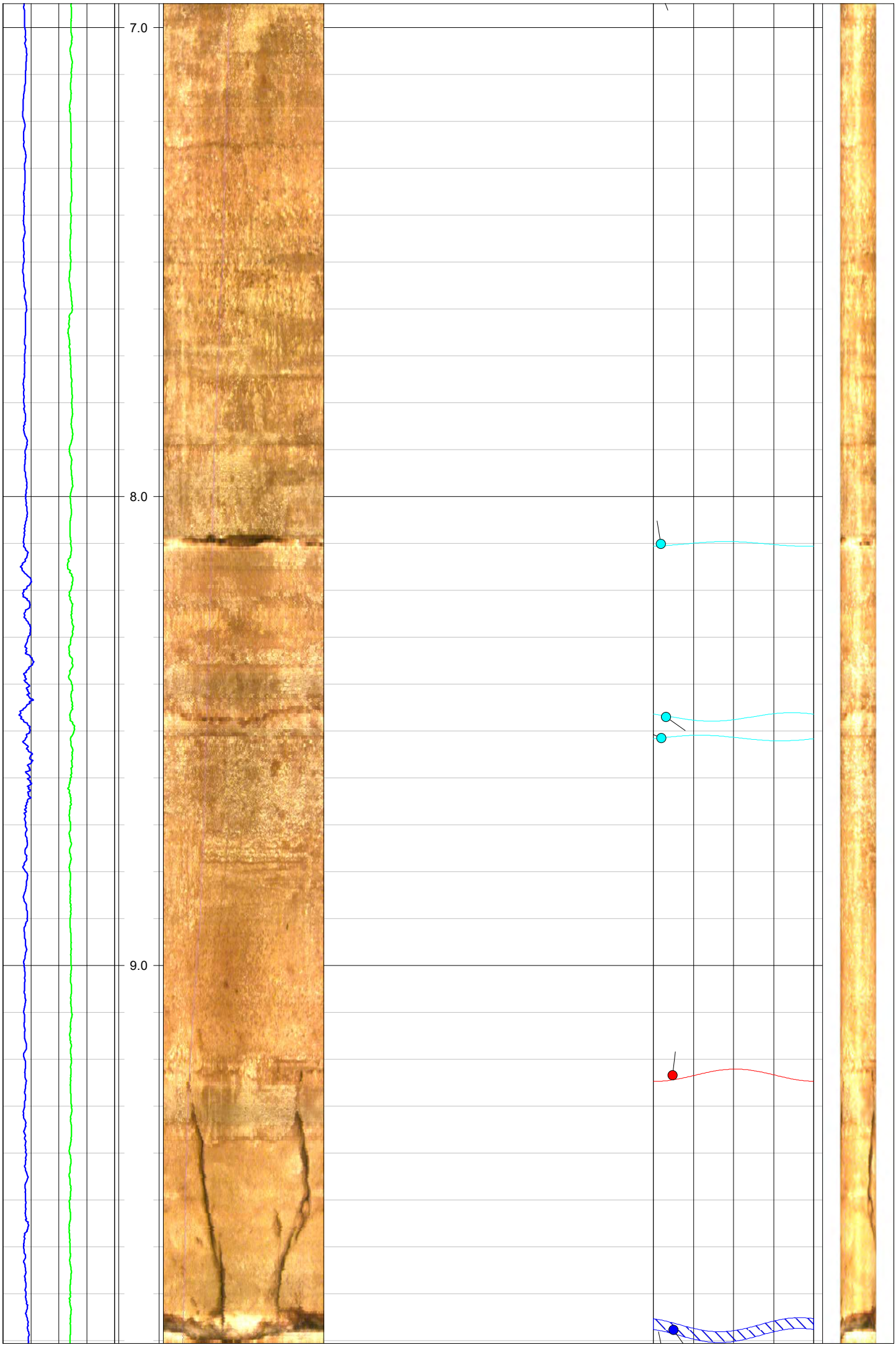
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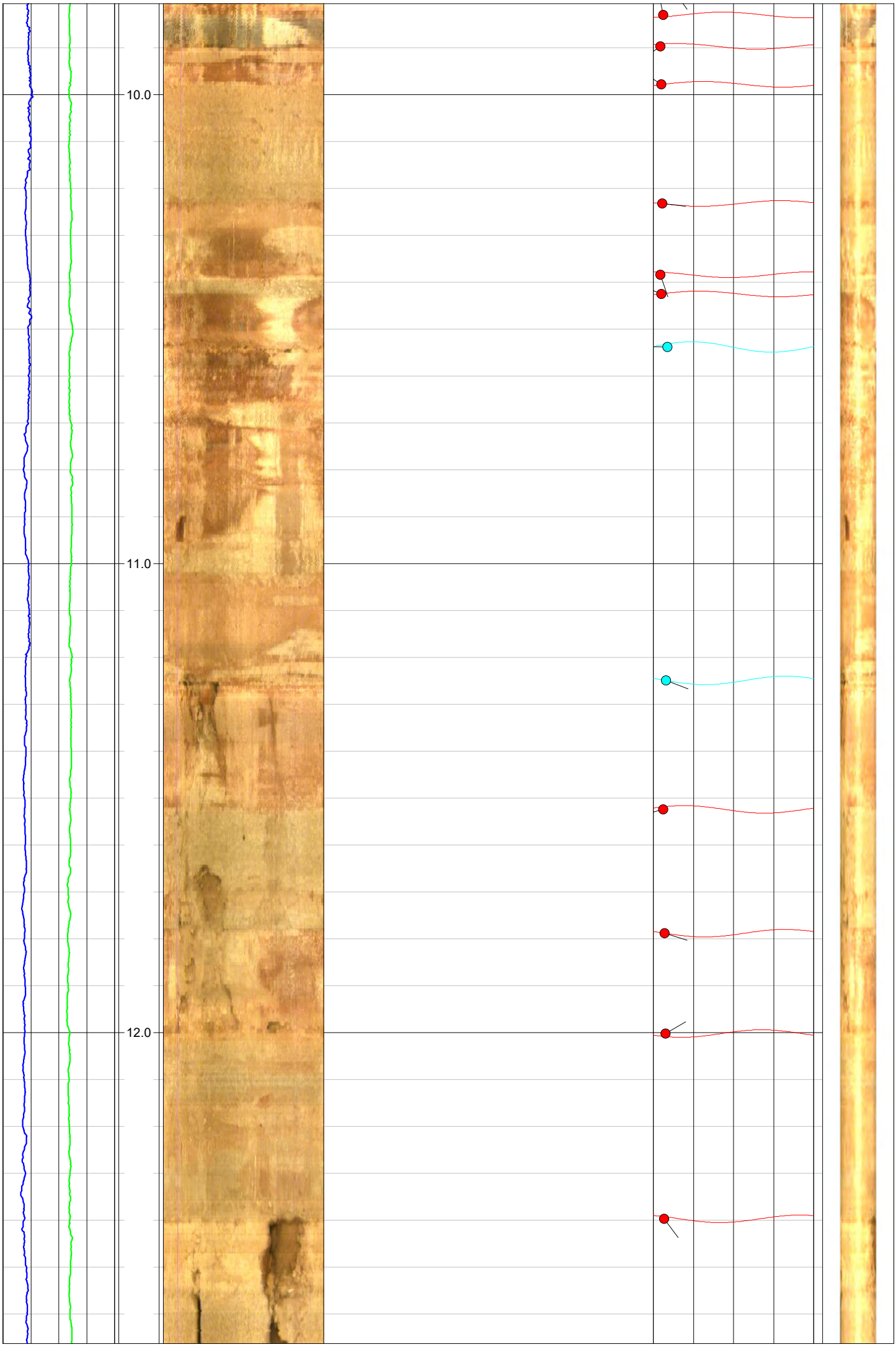
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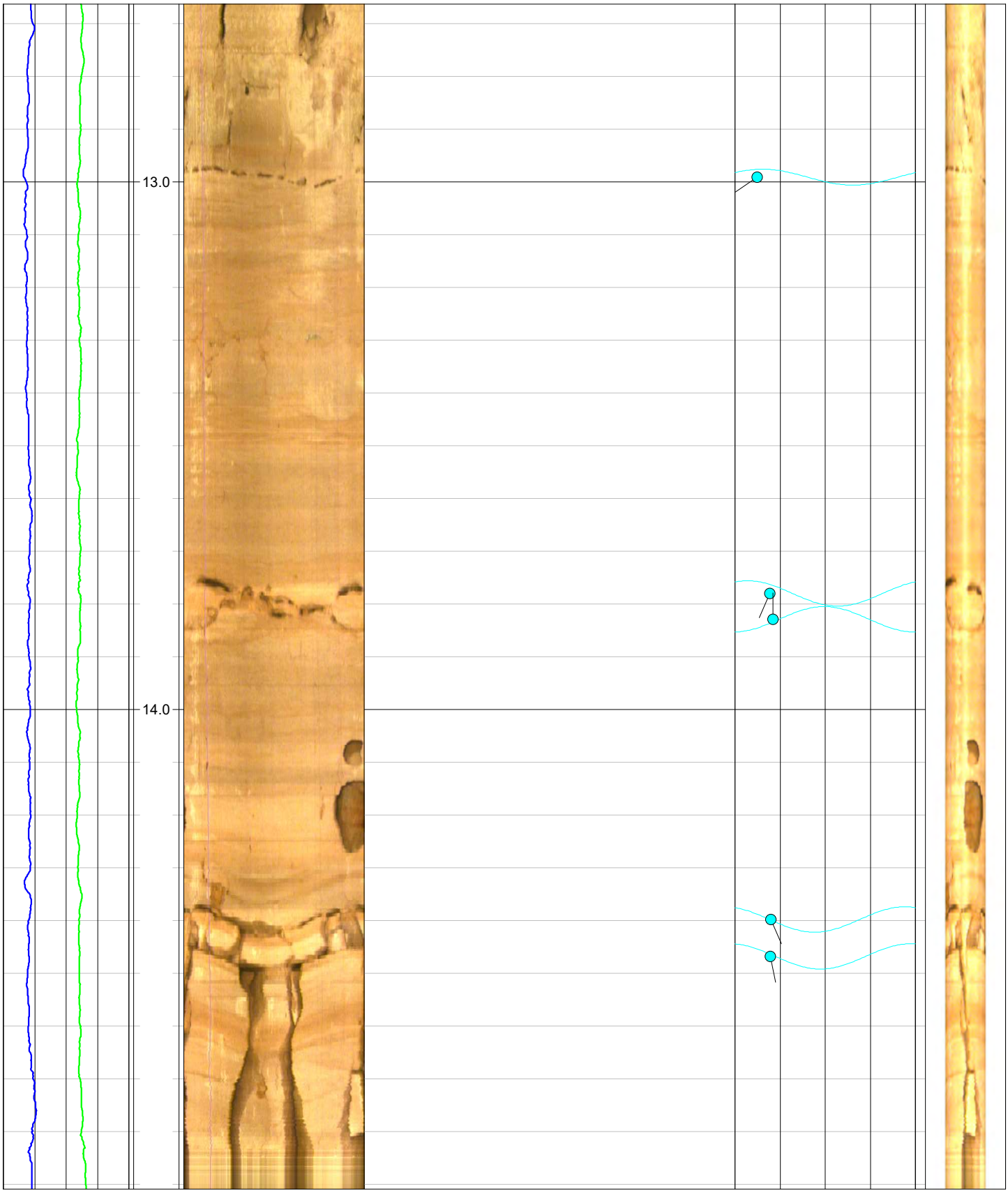

13.0
14.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC319**

Log Type: ***Composite***

Location: **A417, Birdlip** Area: **Crickley Hill** Grid Ref: **393248.8E 216080.1N** Elevation: **231.85m**

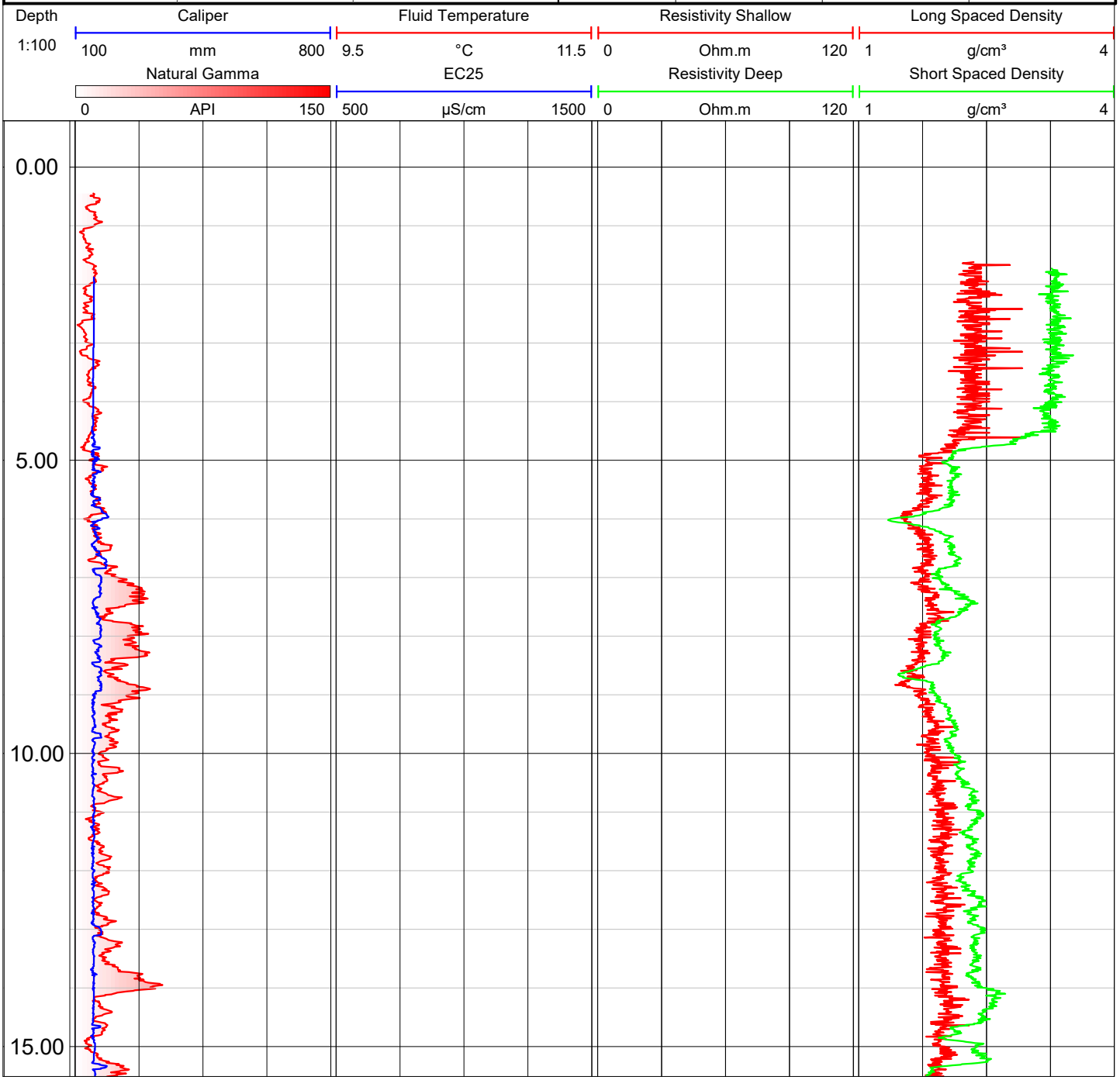
Drilled Depth: (m)	**65.0**	Date:	**10.03.2020**
Logged Depth: (m)	**61.1**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole initially blocked at 23.0m. Logged top section, then cleared and cased with geobore to 24.2m, and lower section logged.
Logged Interval: (m)	**0 - 61.1**		
Fluid Level: (m)	**20.9**		

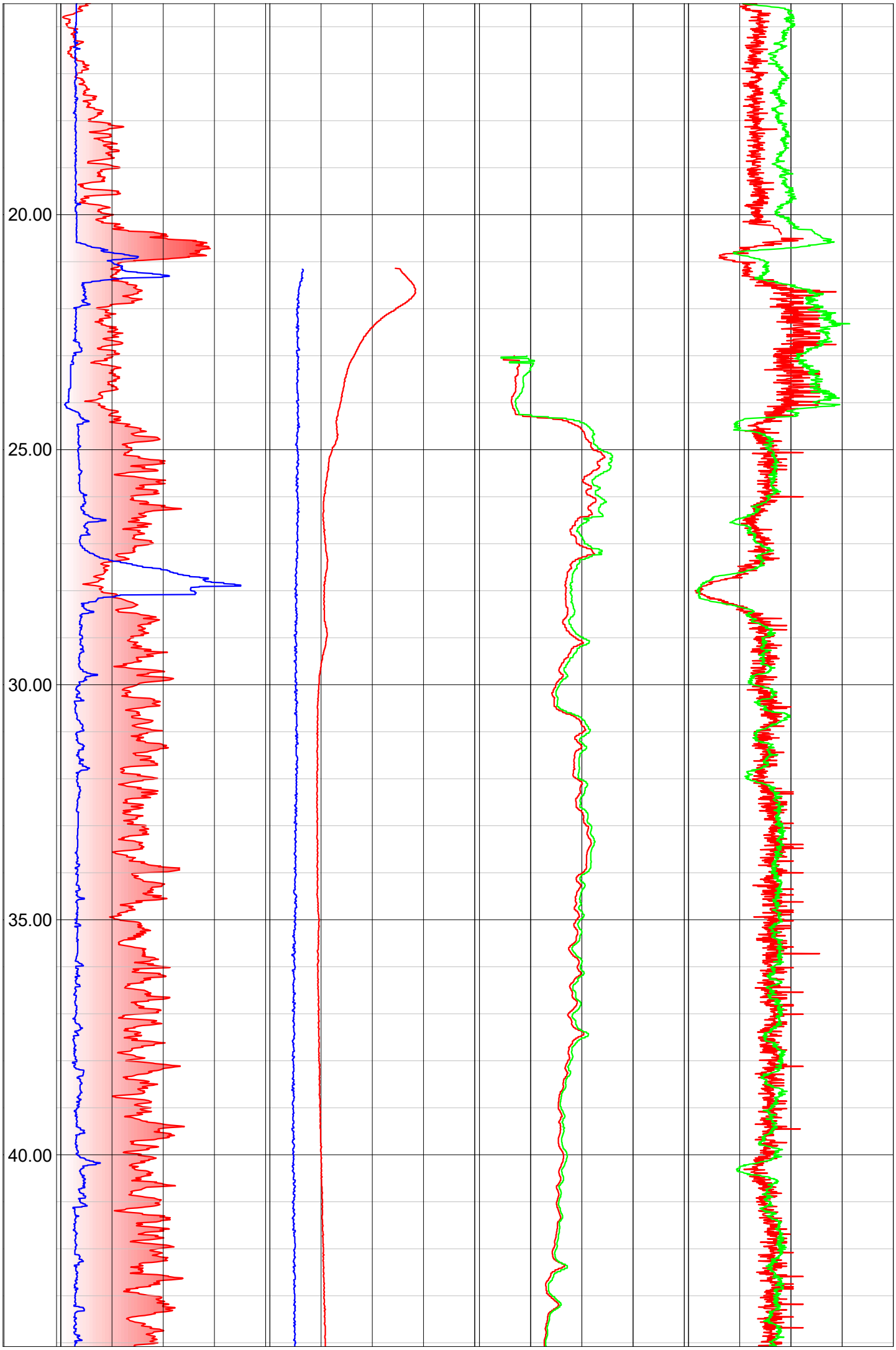
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**4.7**	**65.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**4.7**
Geobore	**127**	**0.0**	**24.15**

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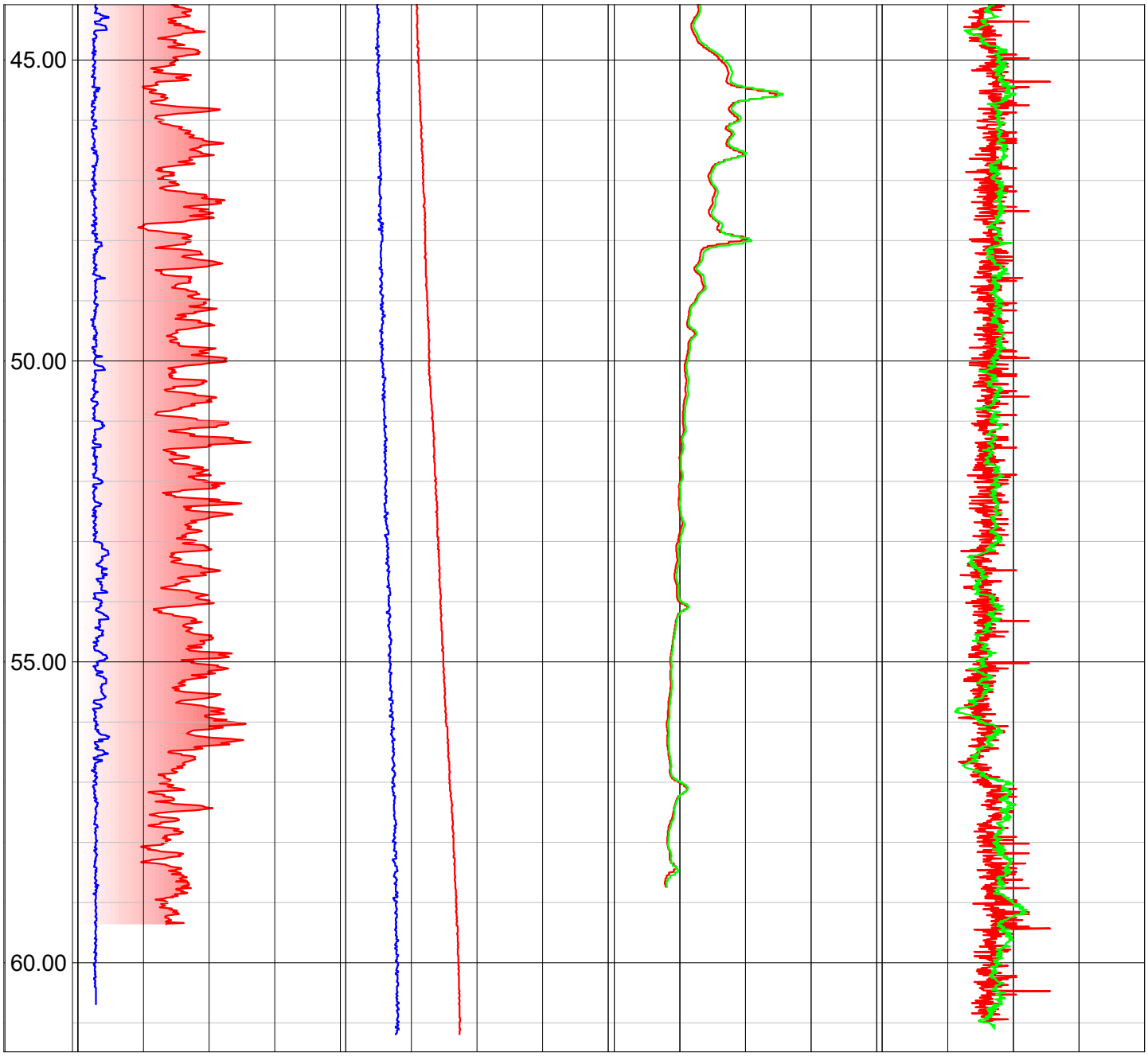

45.00
50.00
55.00
60.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC319**

Log Type: ***Image***

Location: **A417, Birdlip** Area: **Crickley Hill** Grid Ref: **393248.8E 216080.1N** Elevation: **231.85m**

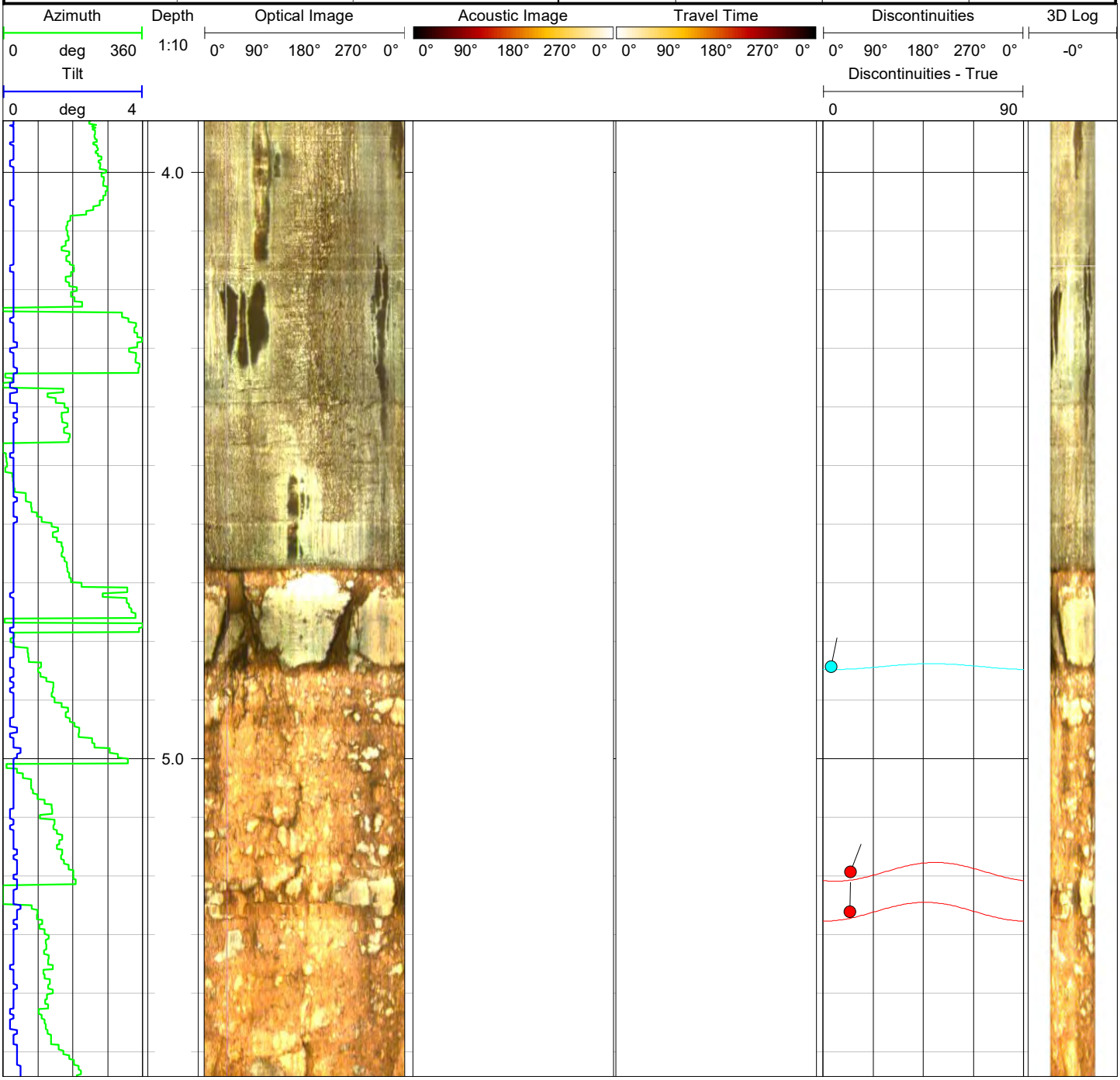
Drilled Depth: (m)	**65.0**	Date:	**10.03.2020**
Logged Depth: (m)	**61.1**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole initially blocked at 23.0m. Logged top section, then cleared and cased with geobore to 24.2m, and lower section logged.
Logged Interval: (m)	**4.7 - 61.1**		
Fluid Level: (m)	**20.9**		

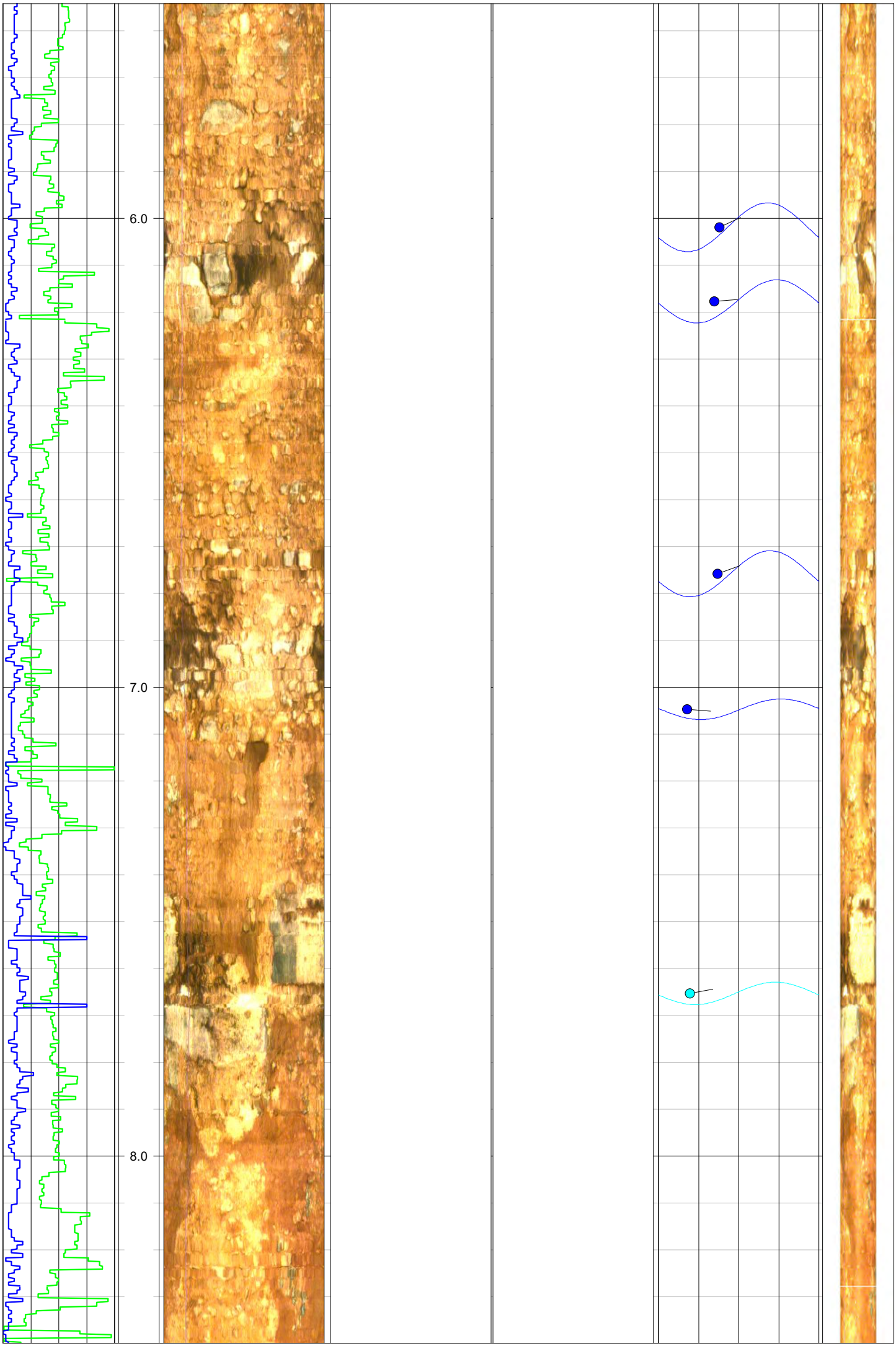
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**4.7**	**65.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**4.7**
Geobore	**127**	**0.0**	**24.15**

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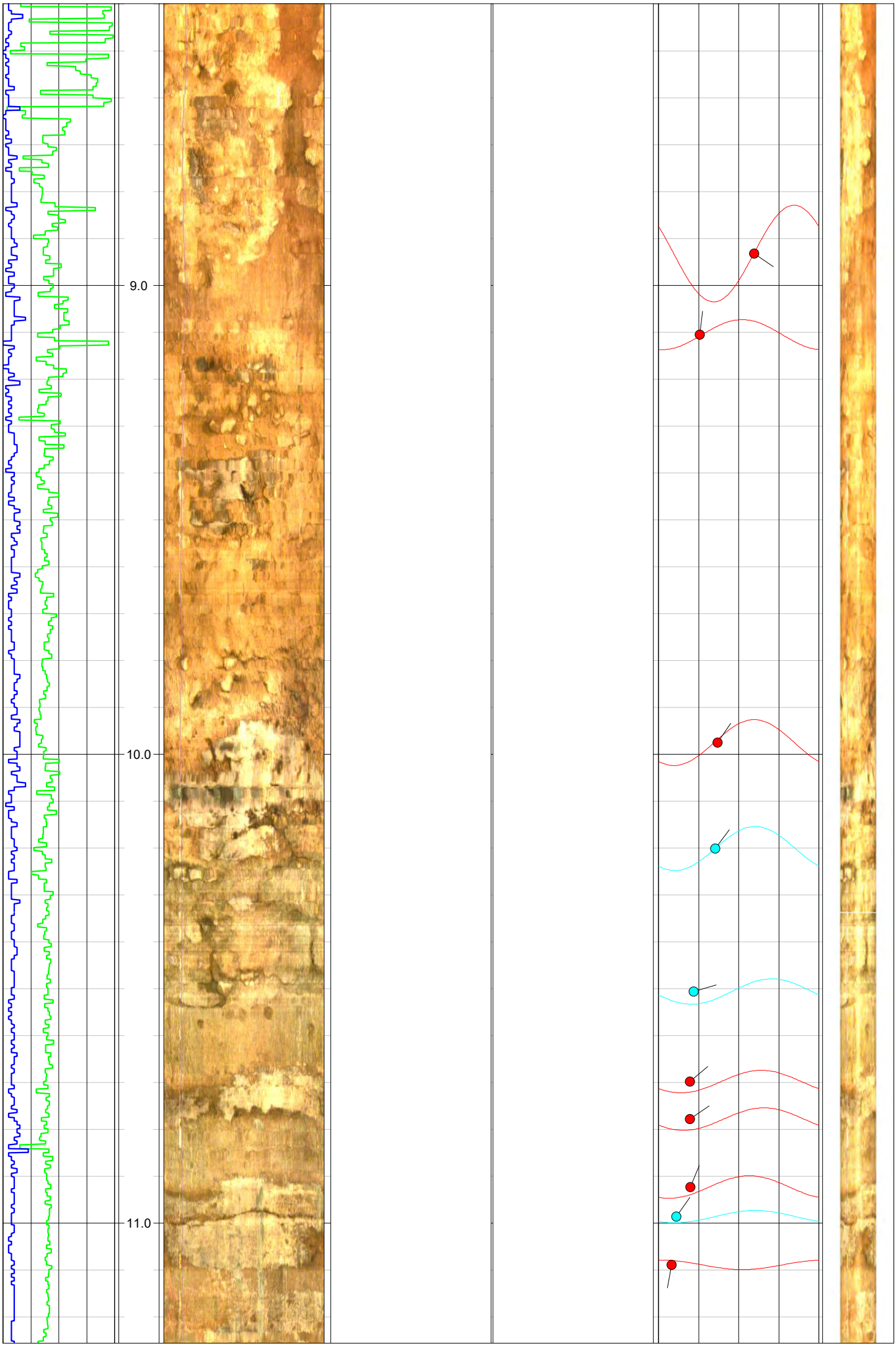
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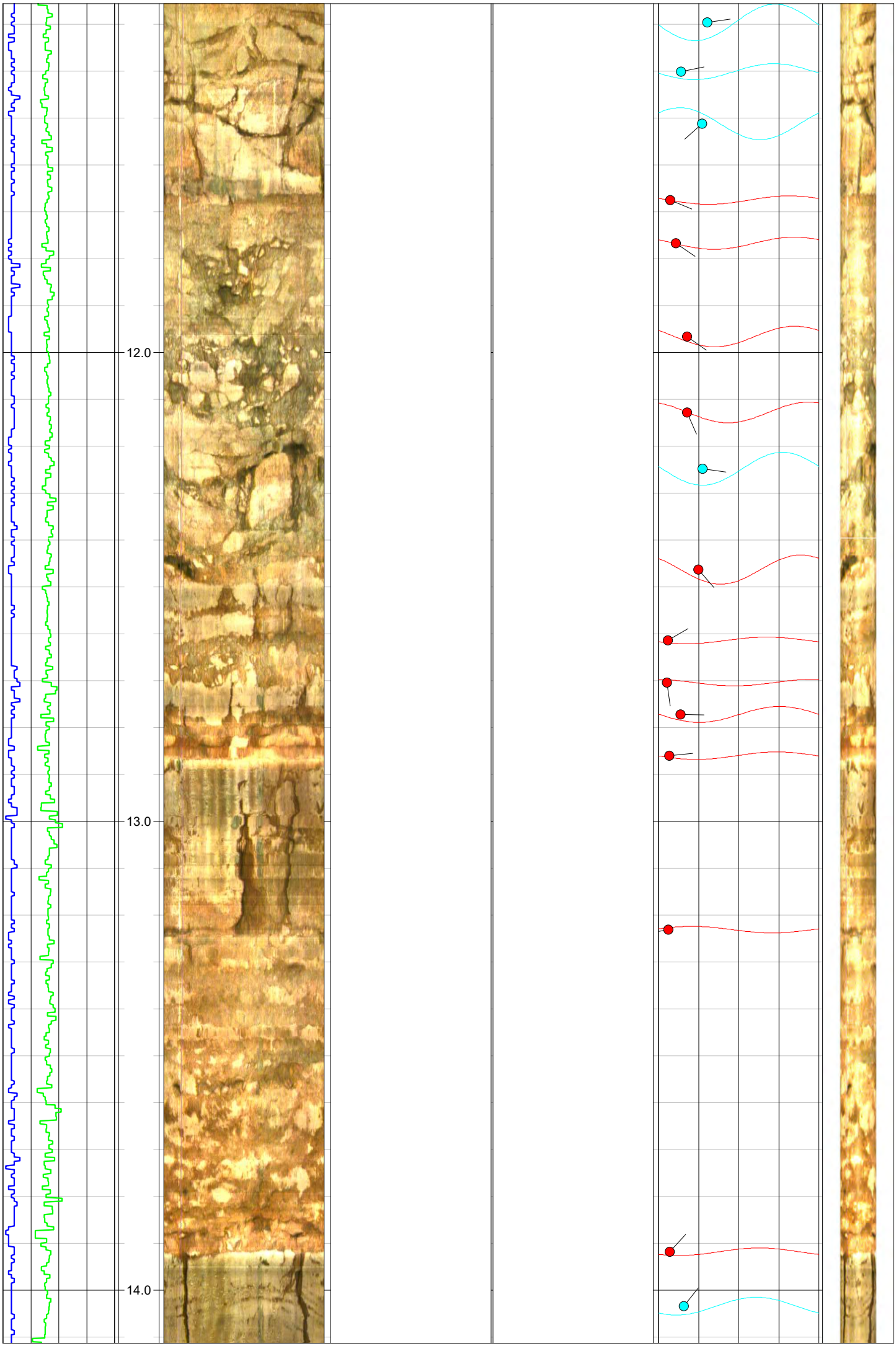
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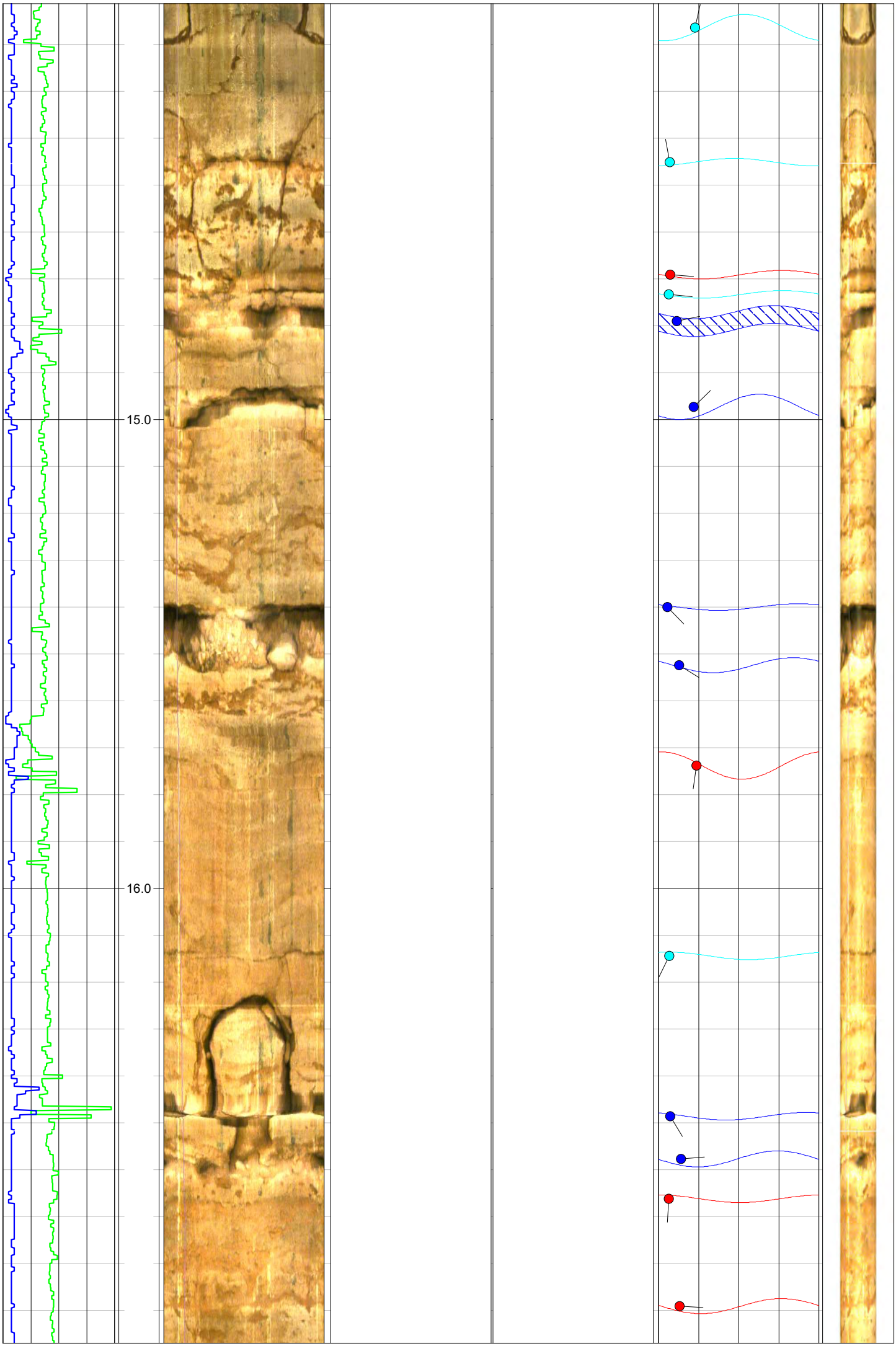
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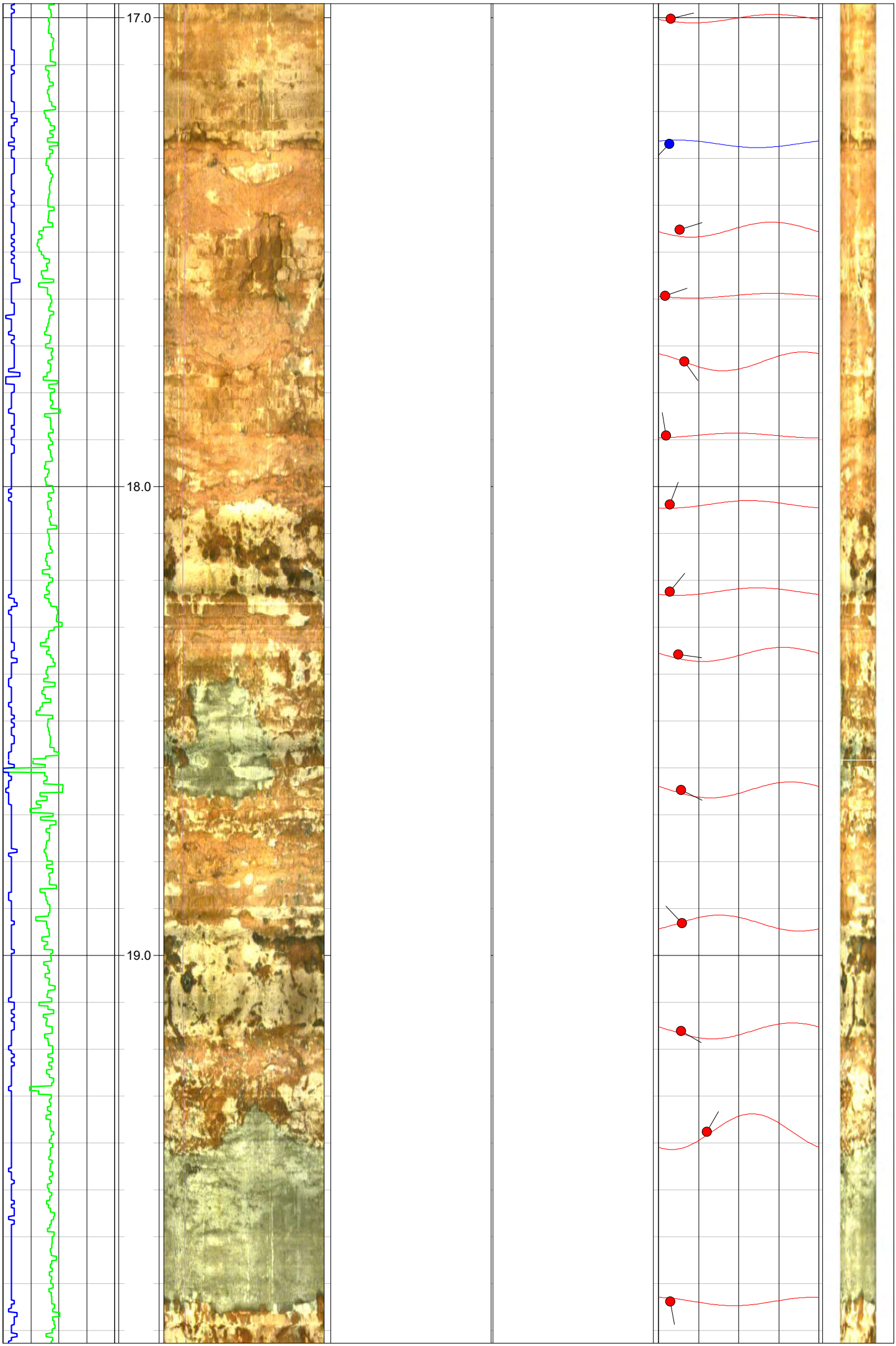
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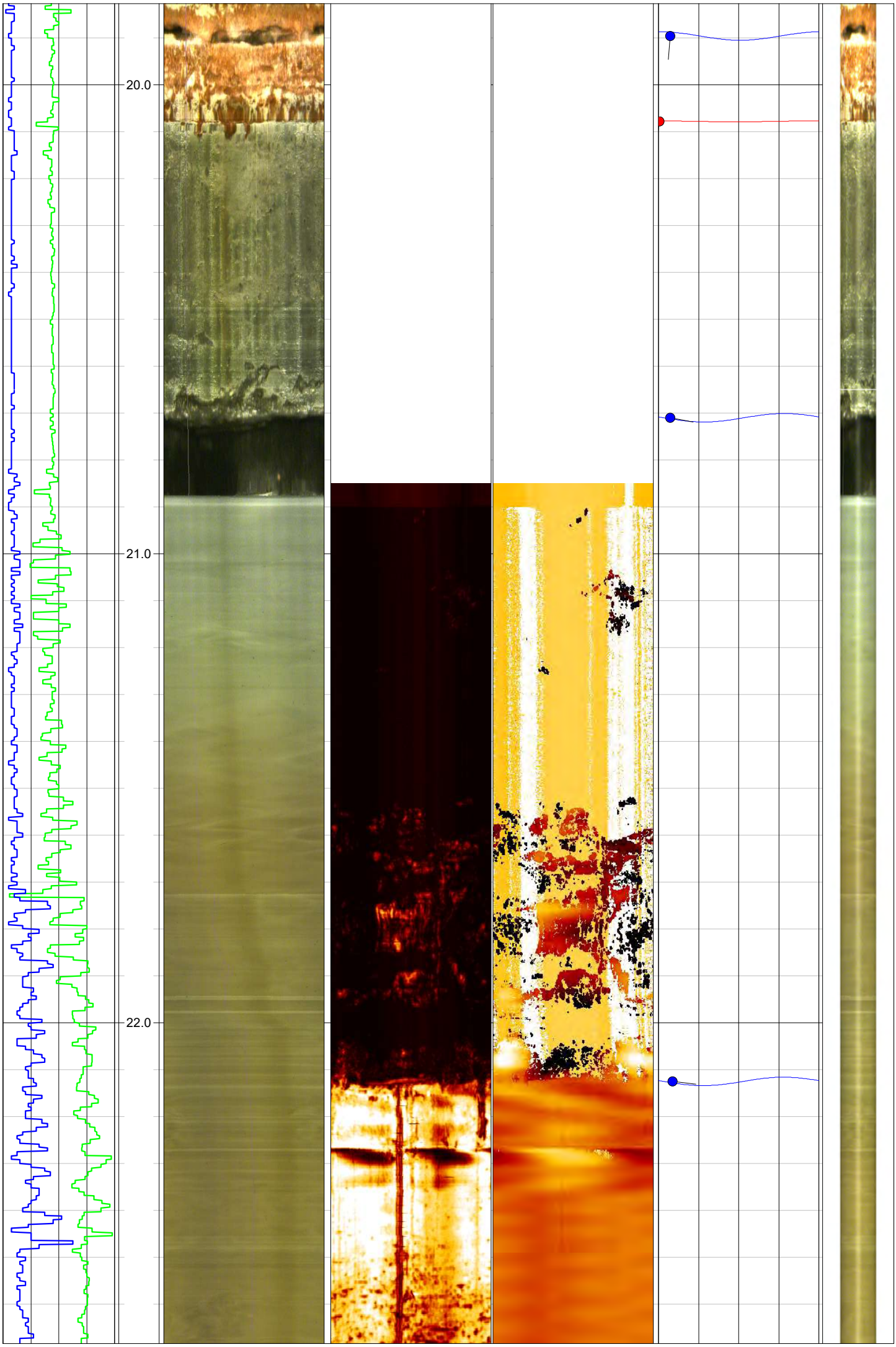
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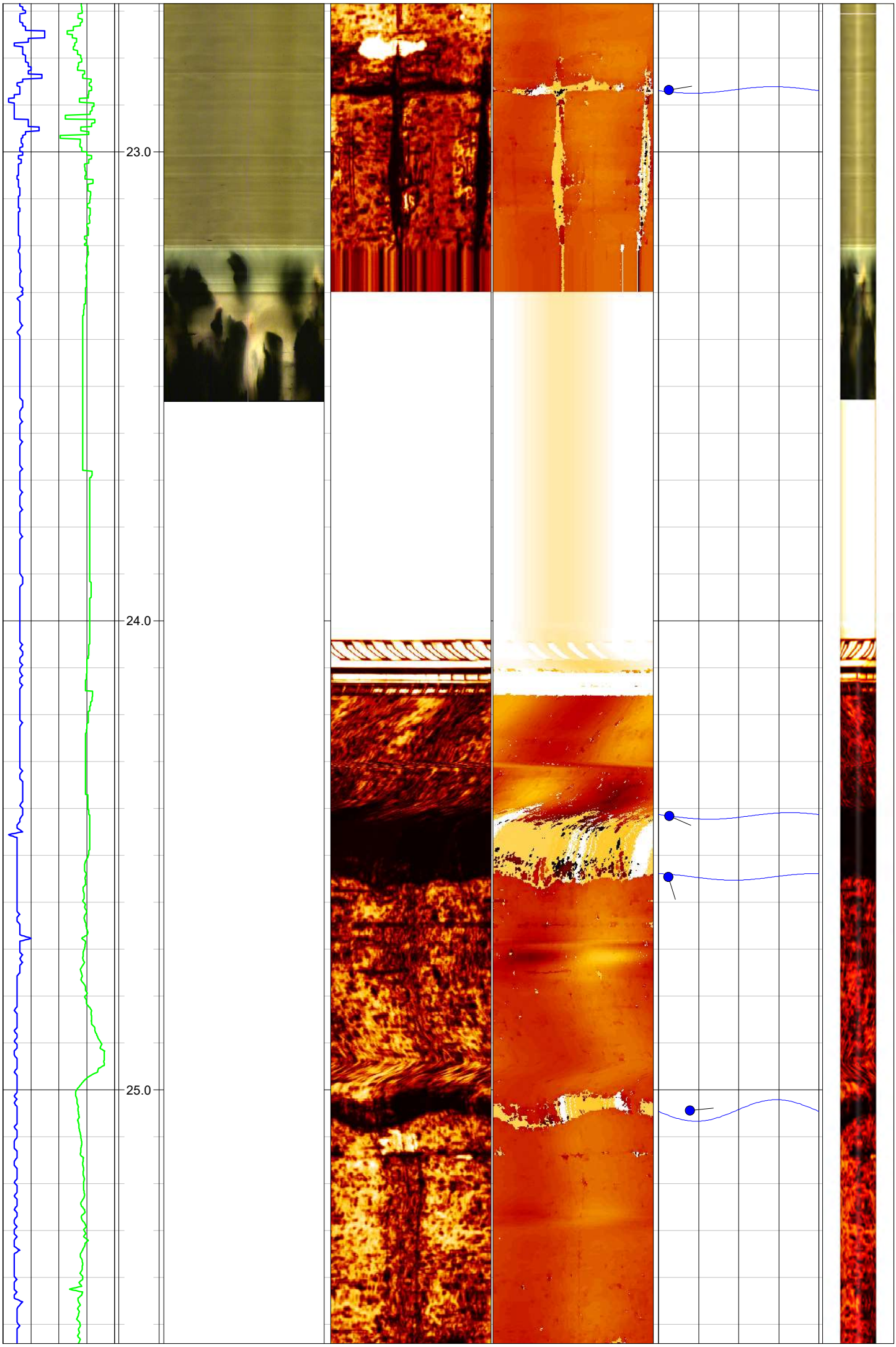
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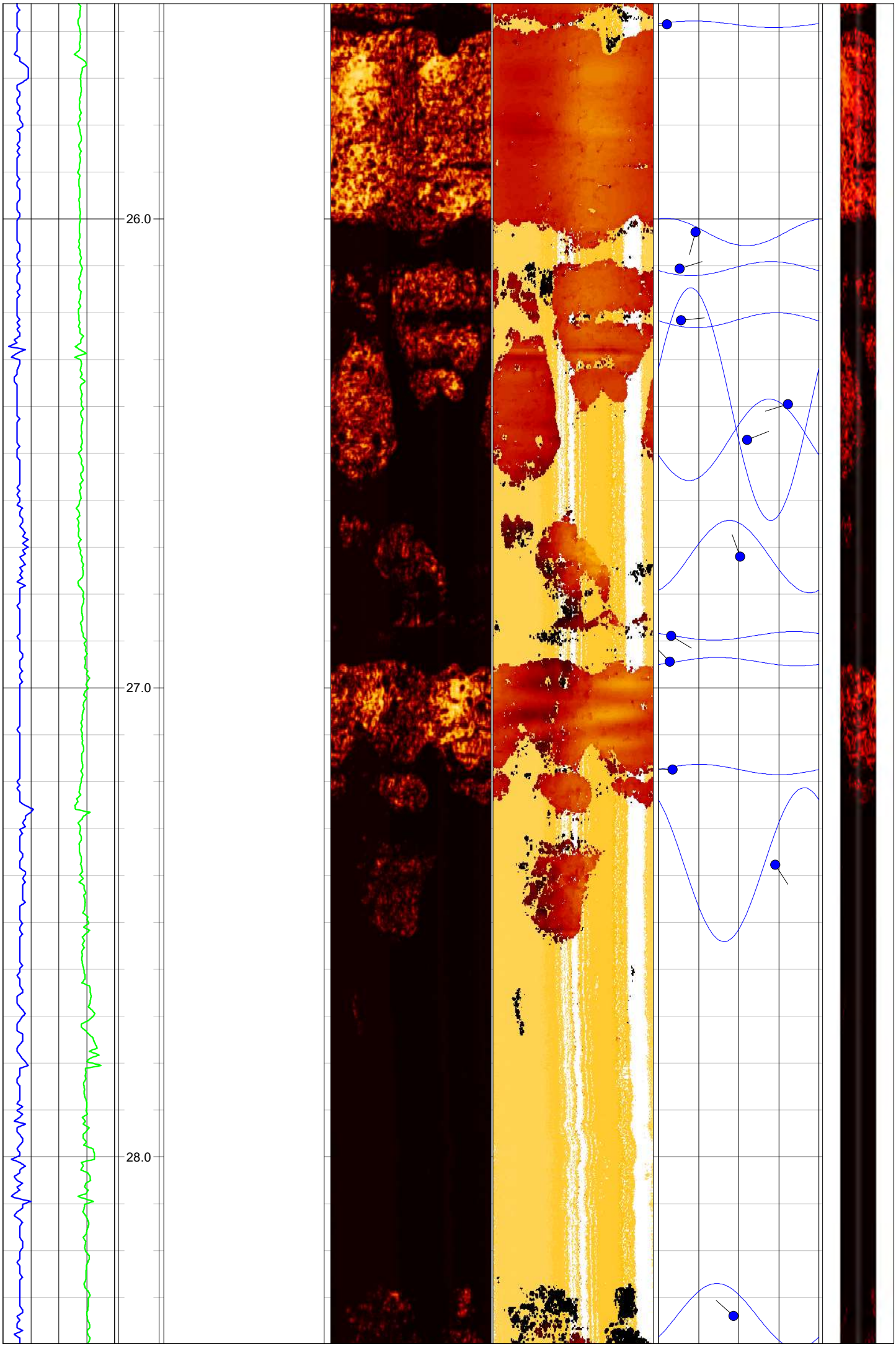
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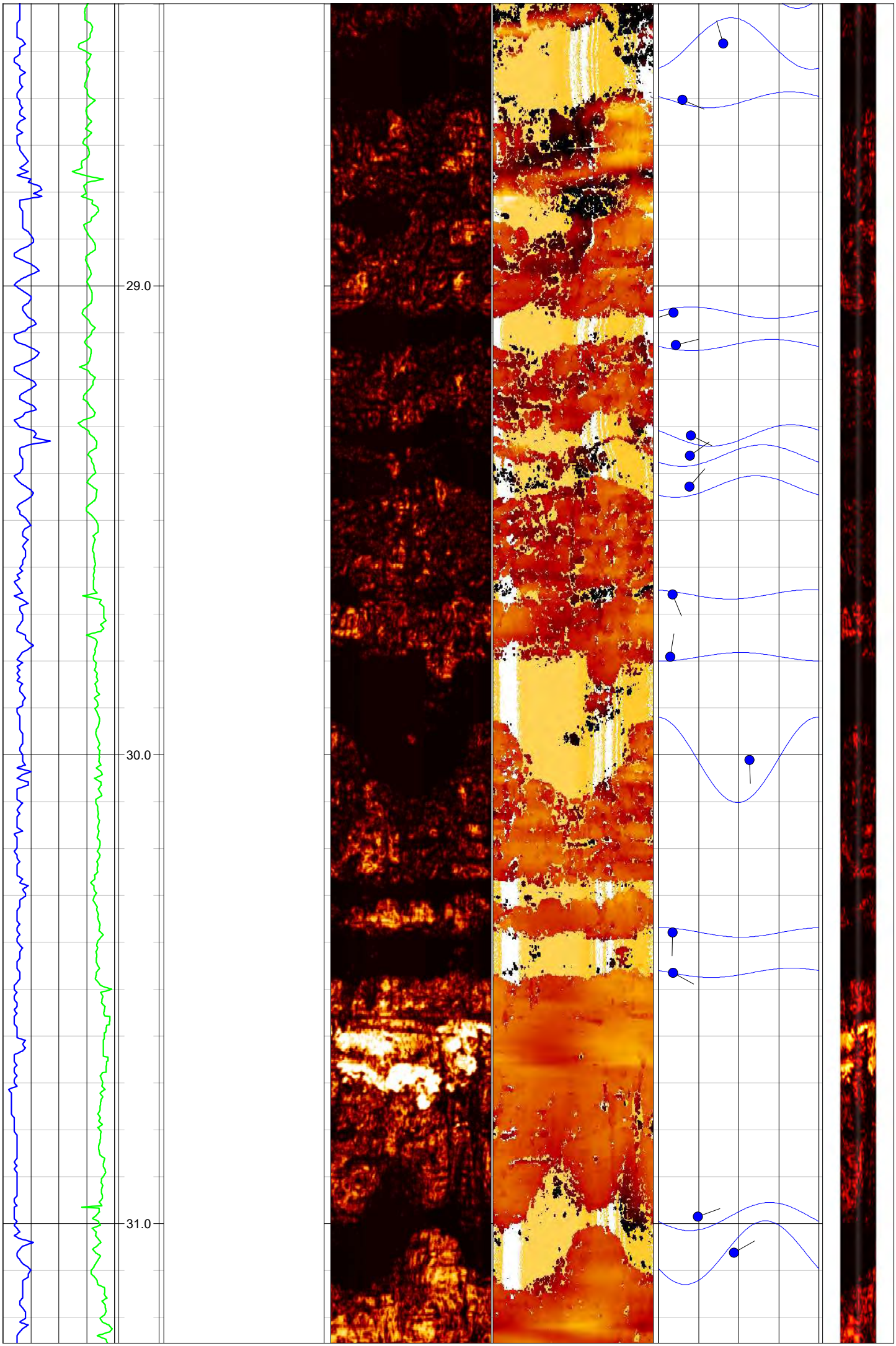
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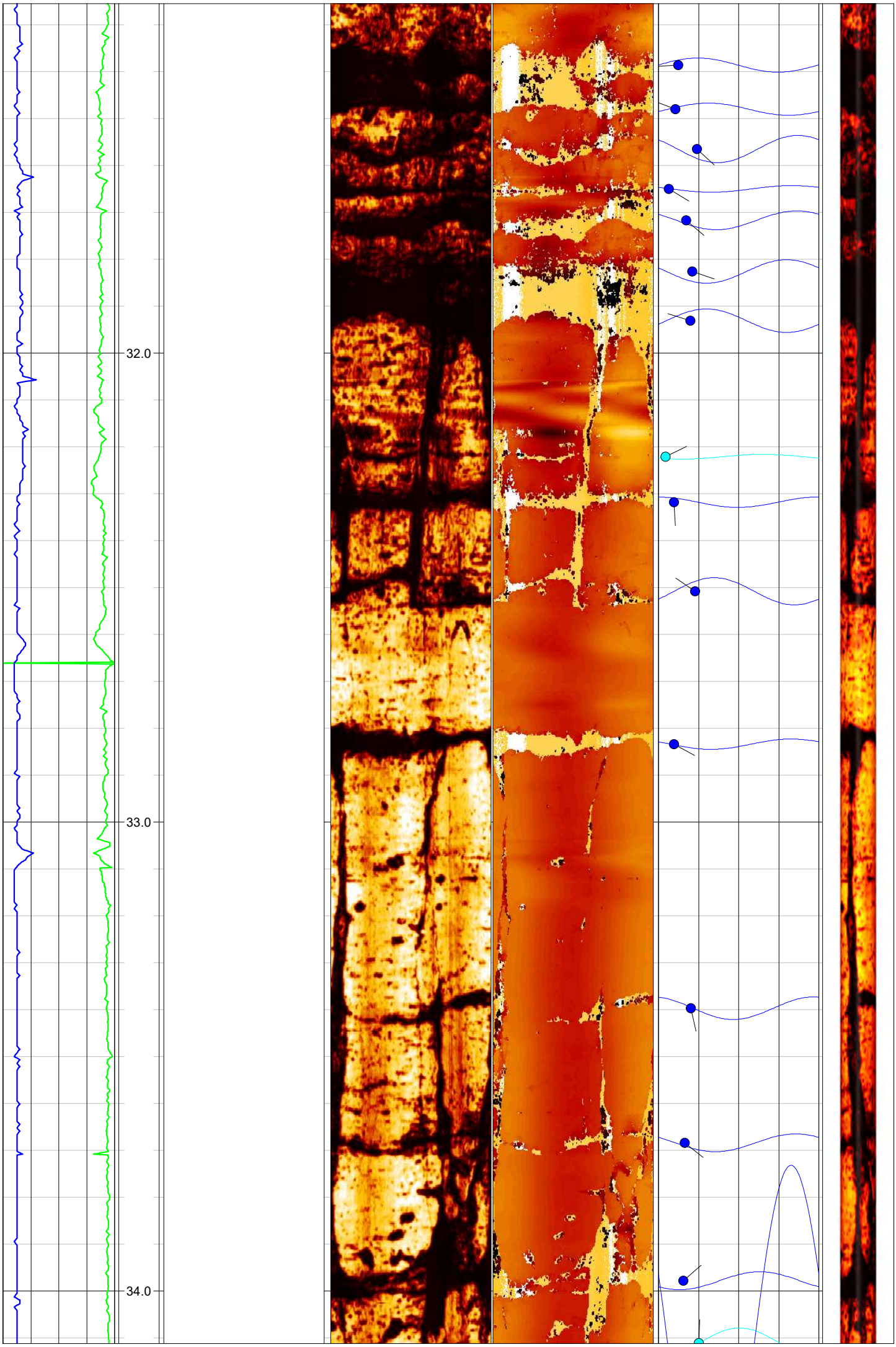
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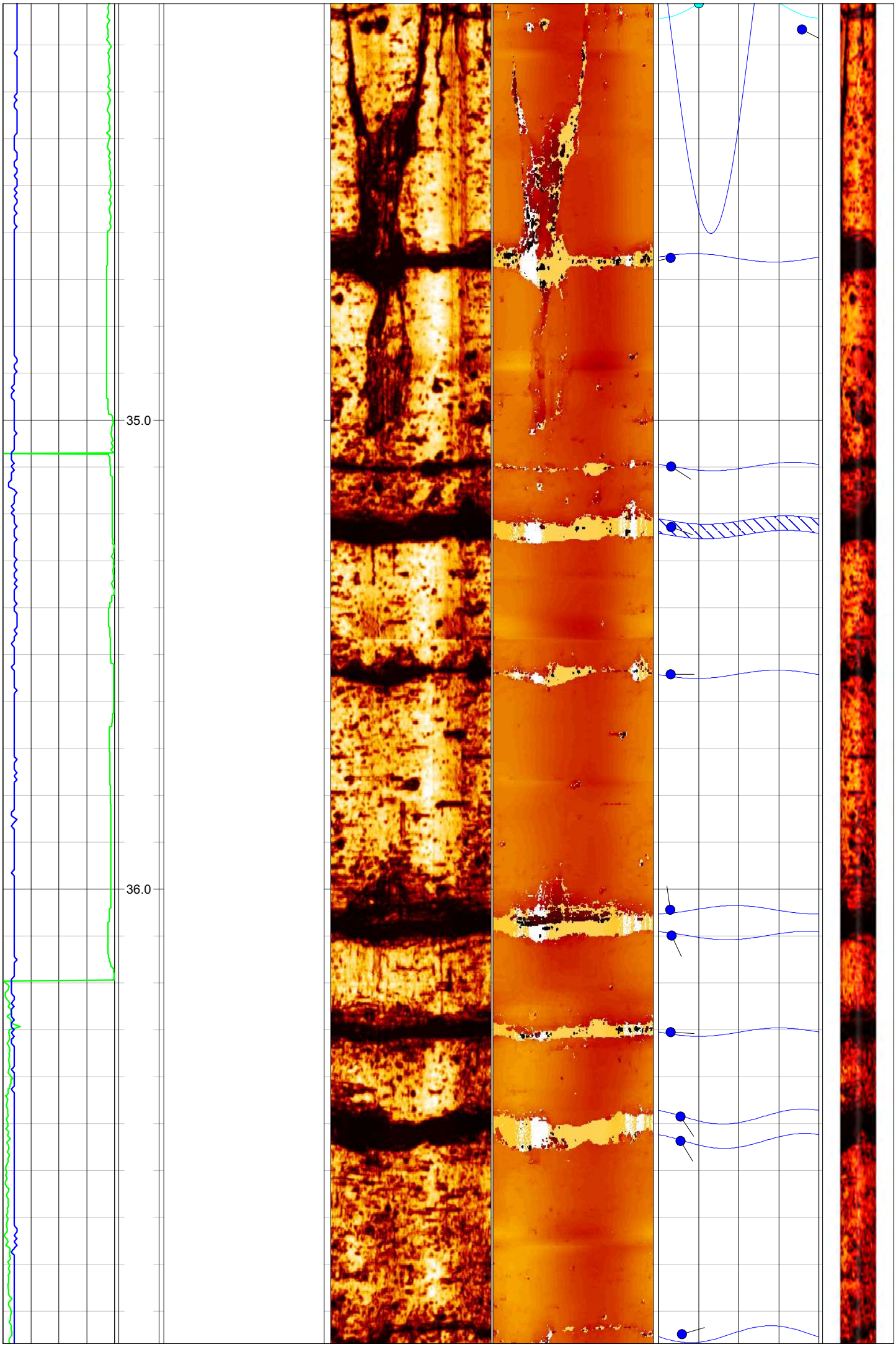
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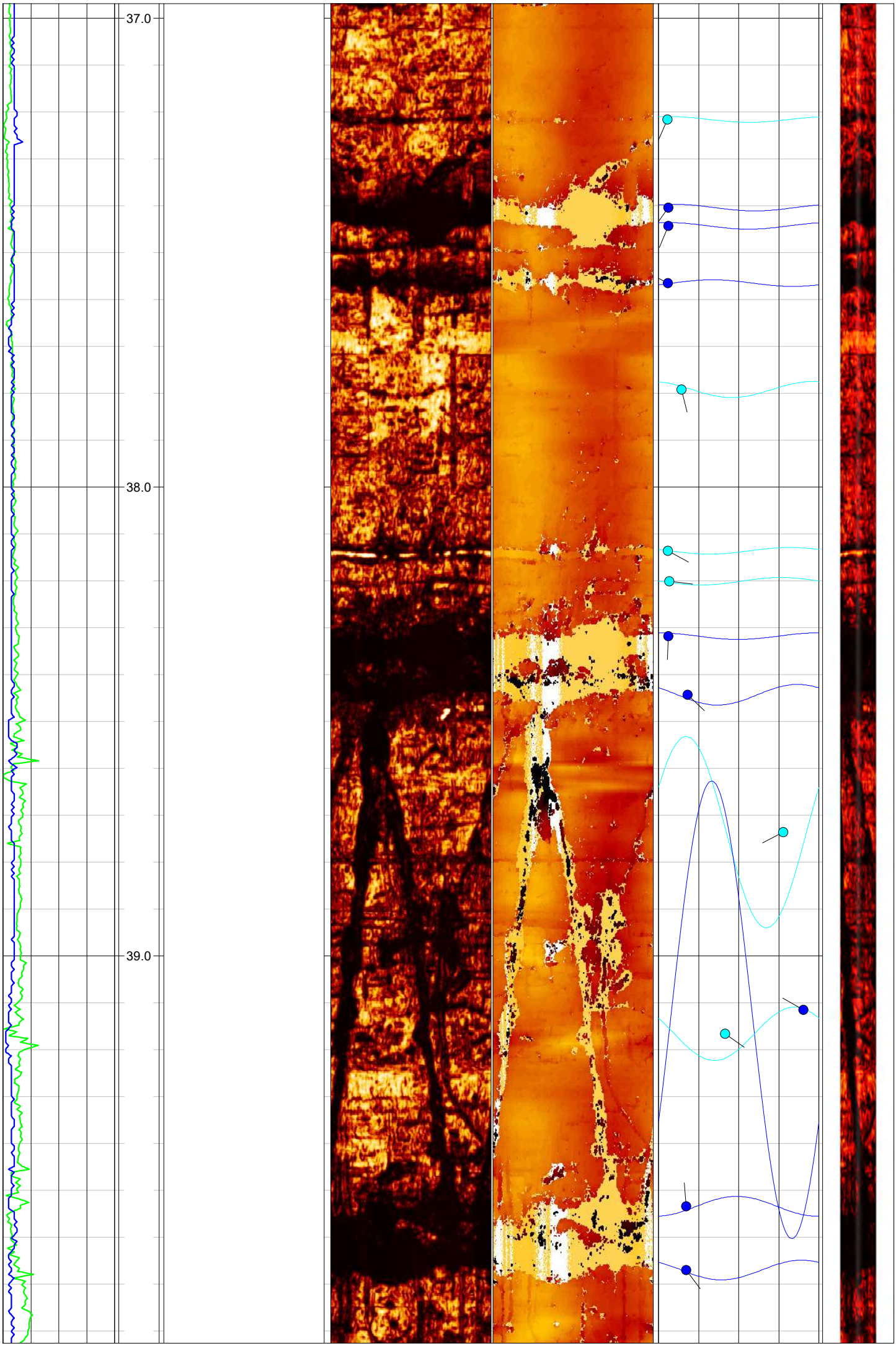
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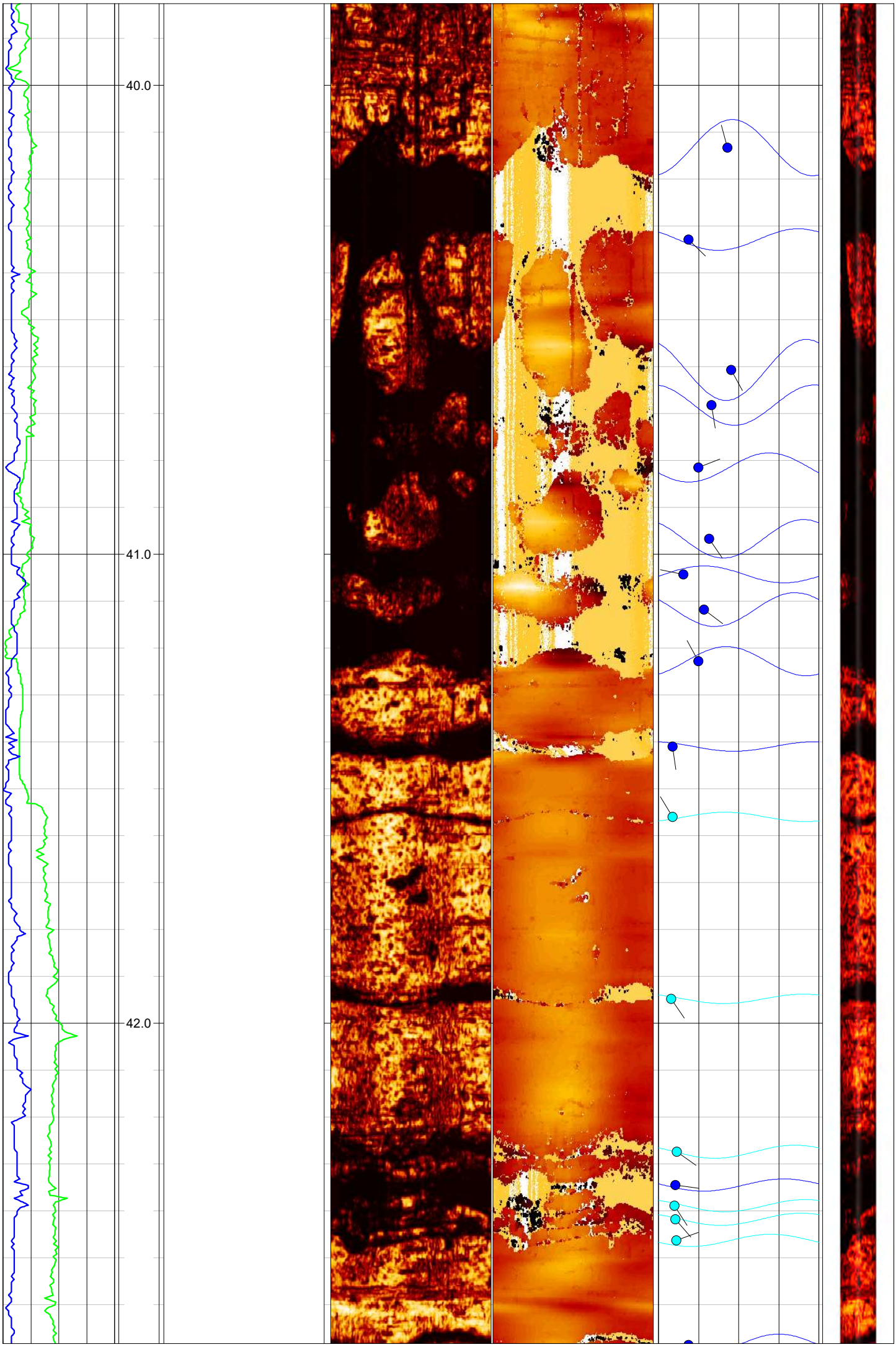
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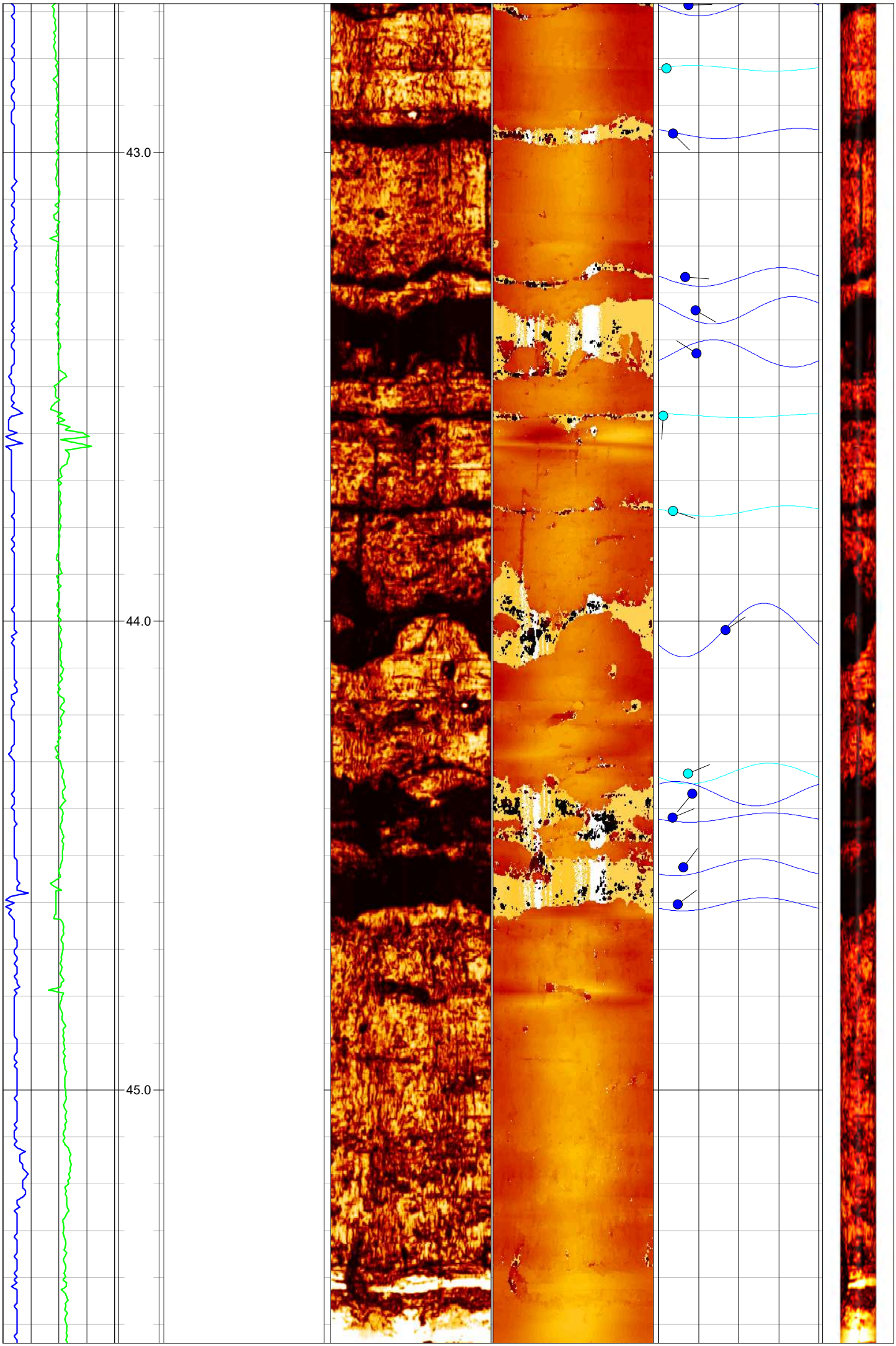
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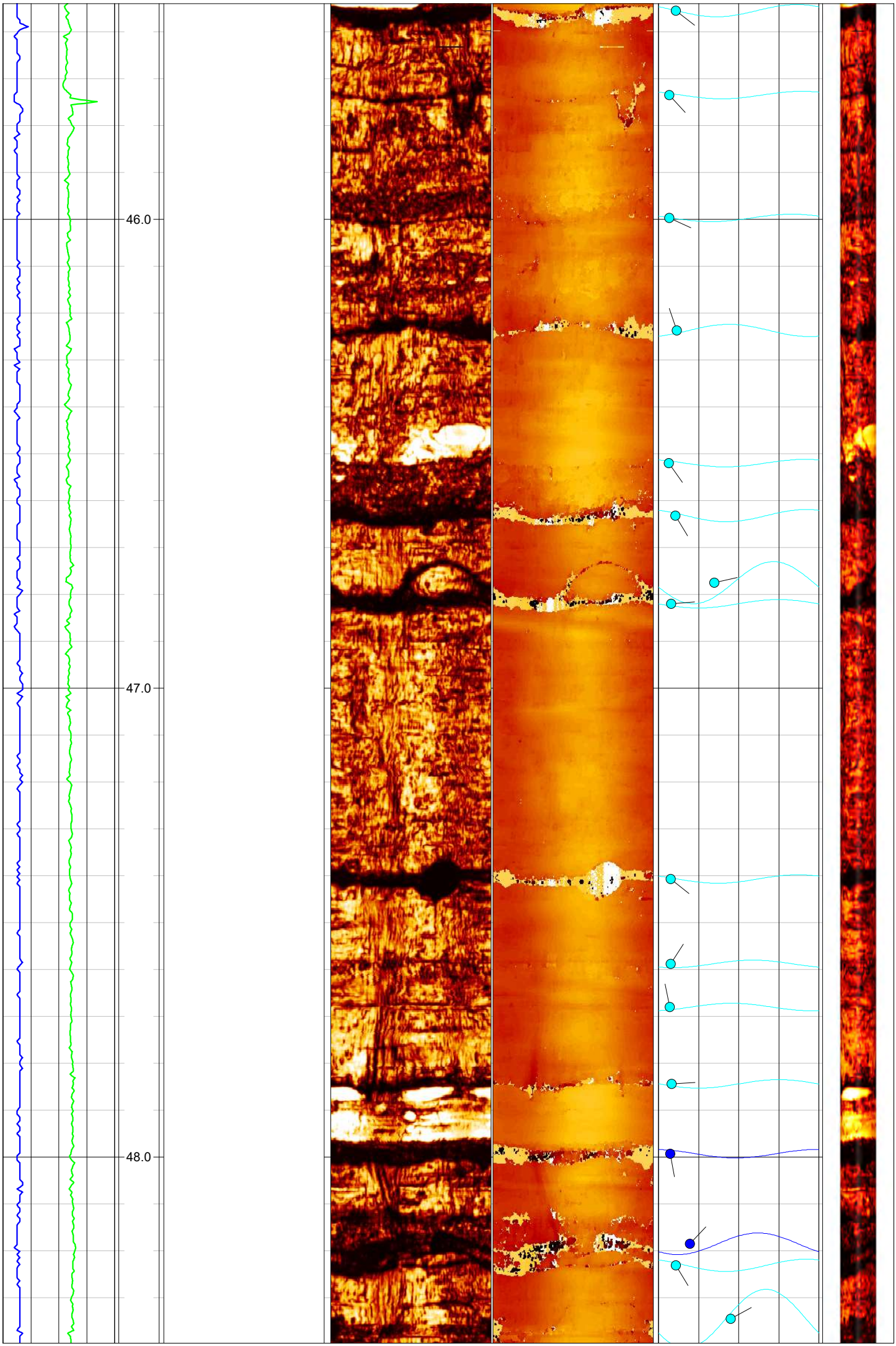
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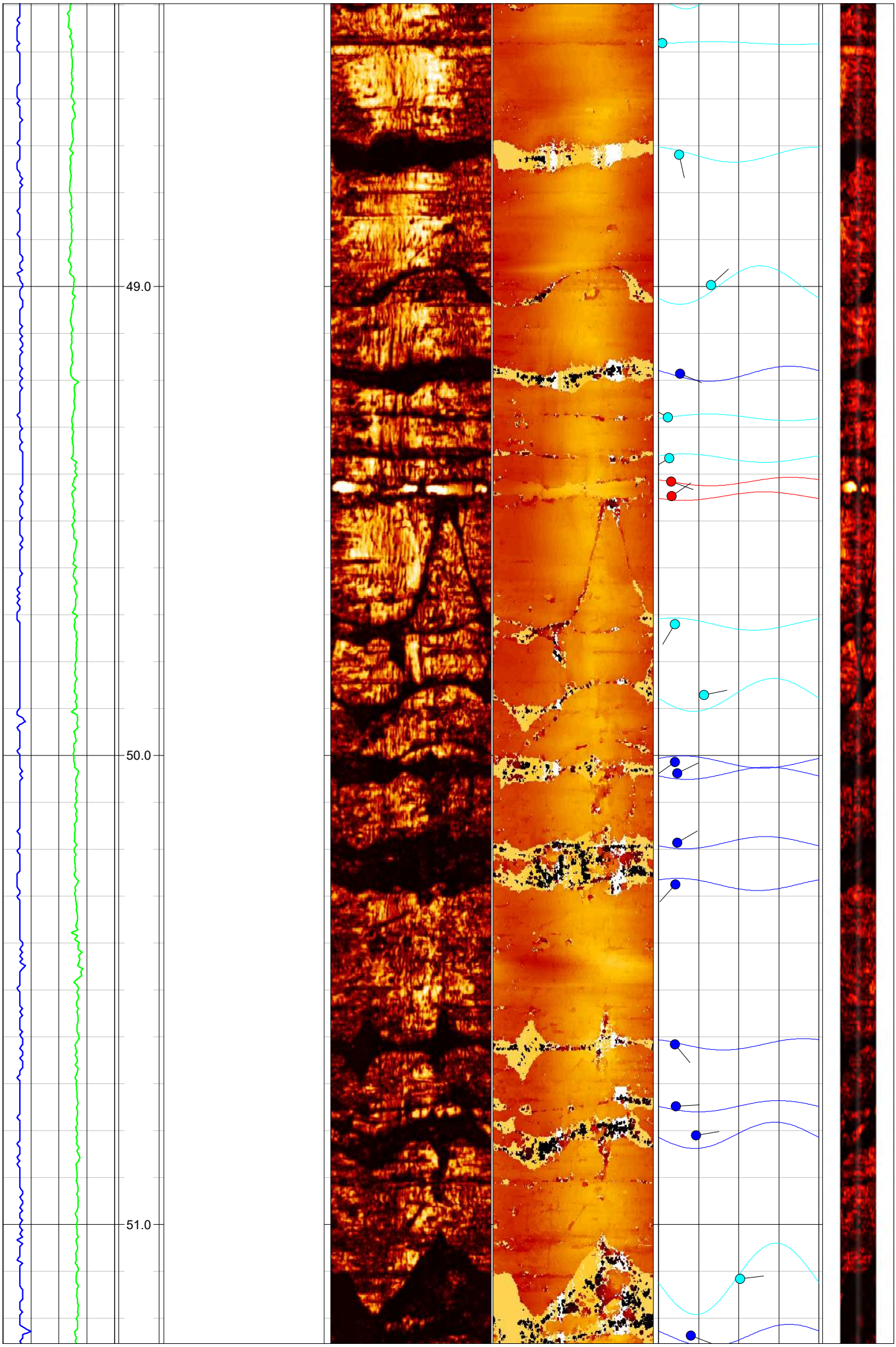
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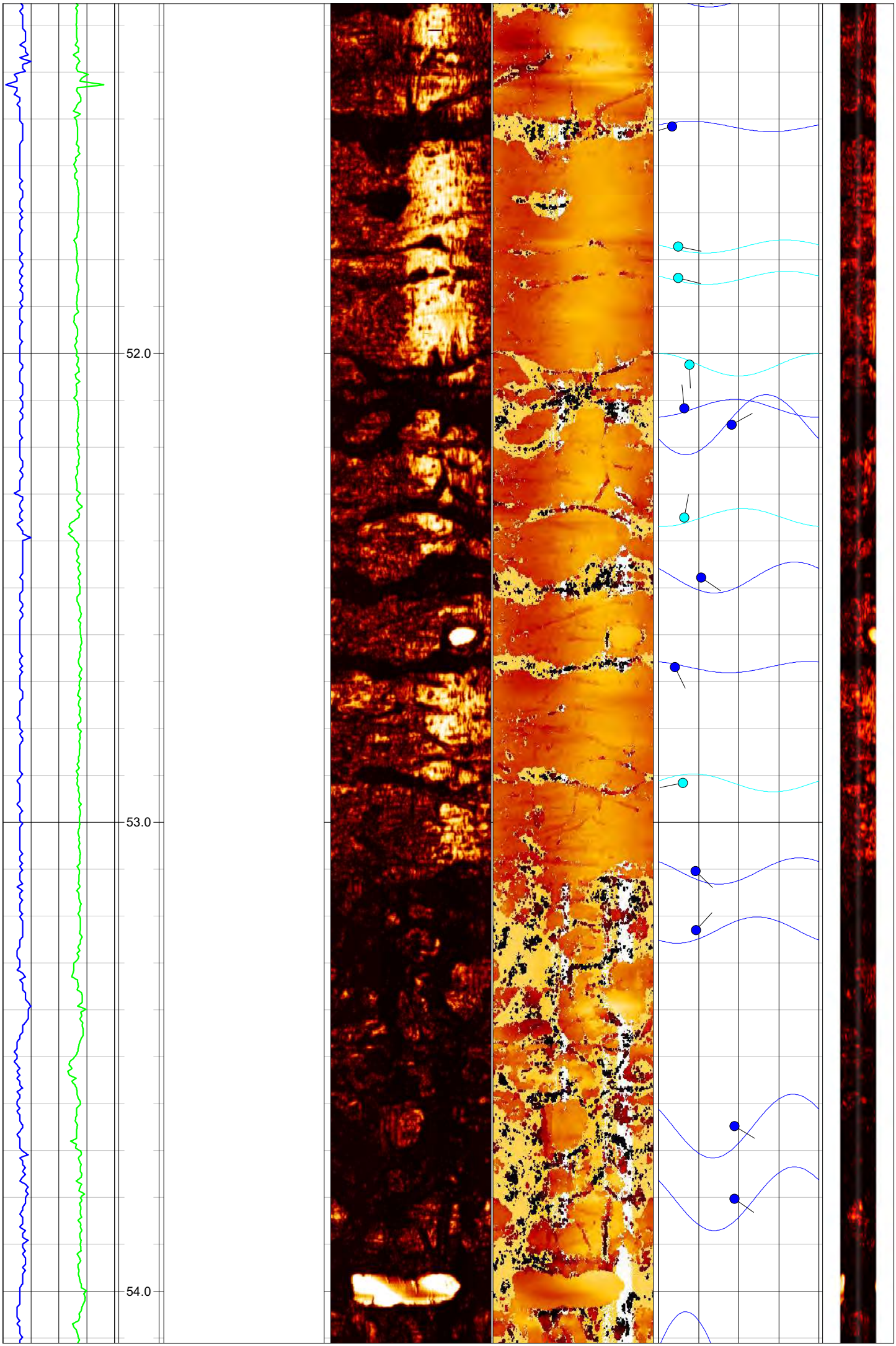
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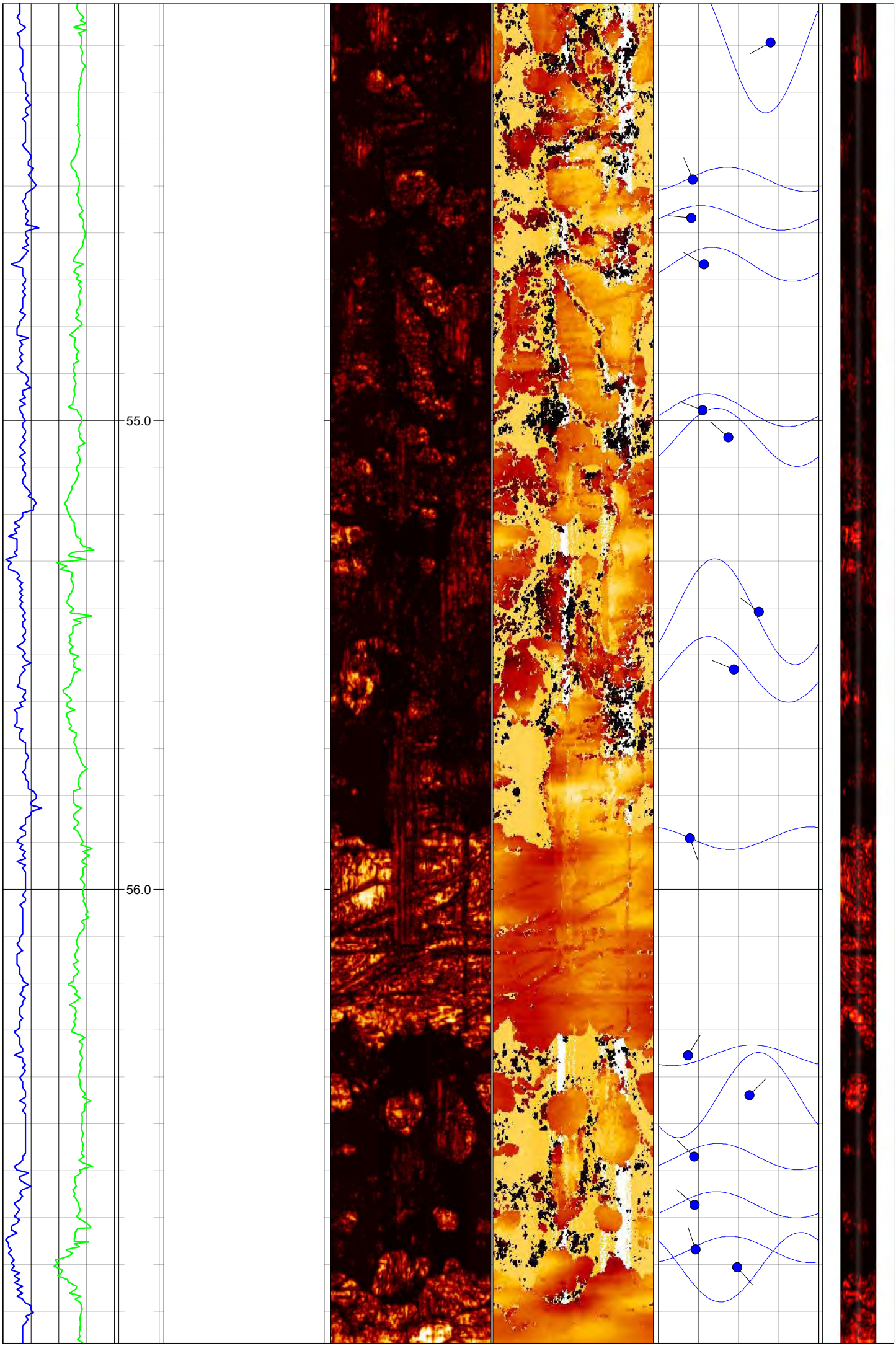
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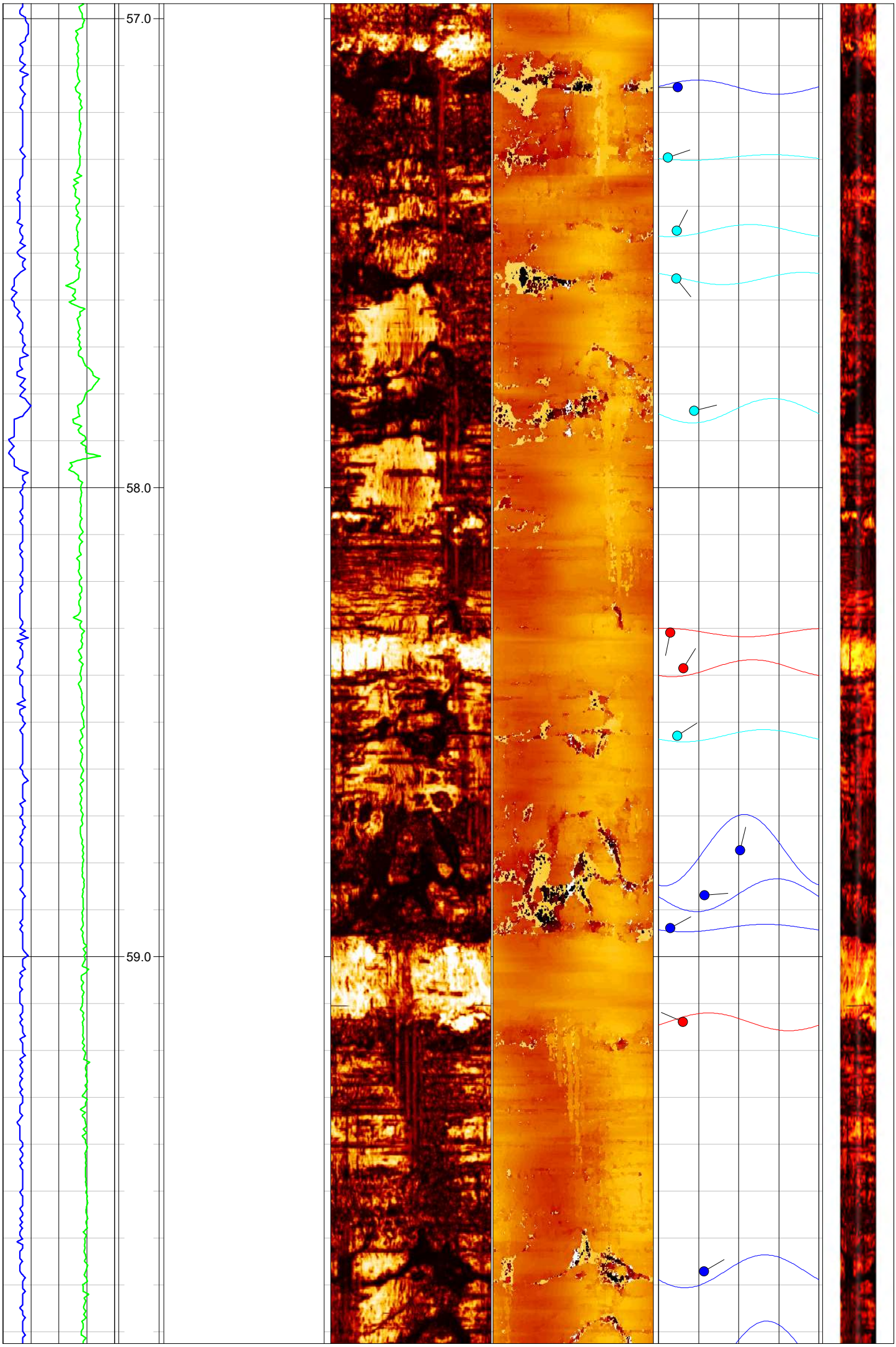
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58.0
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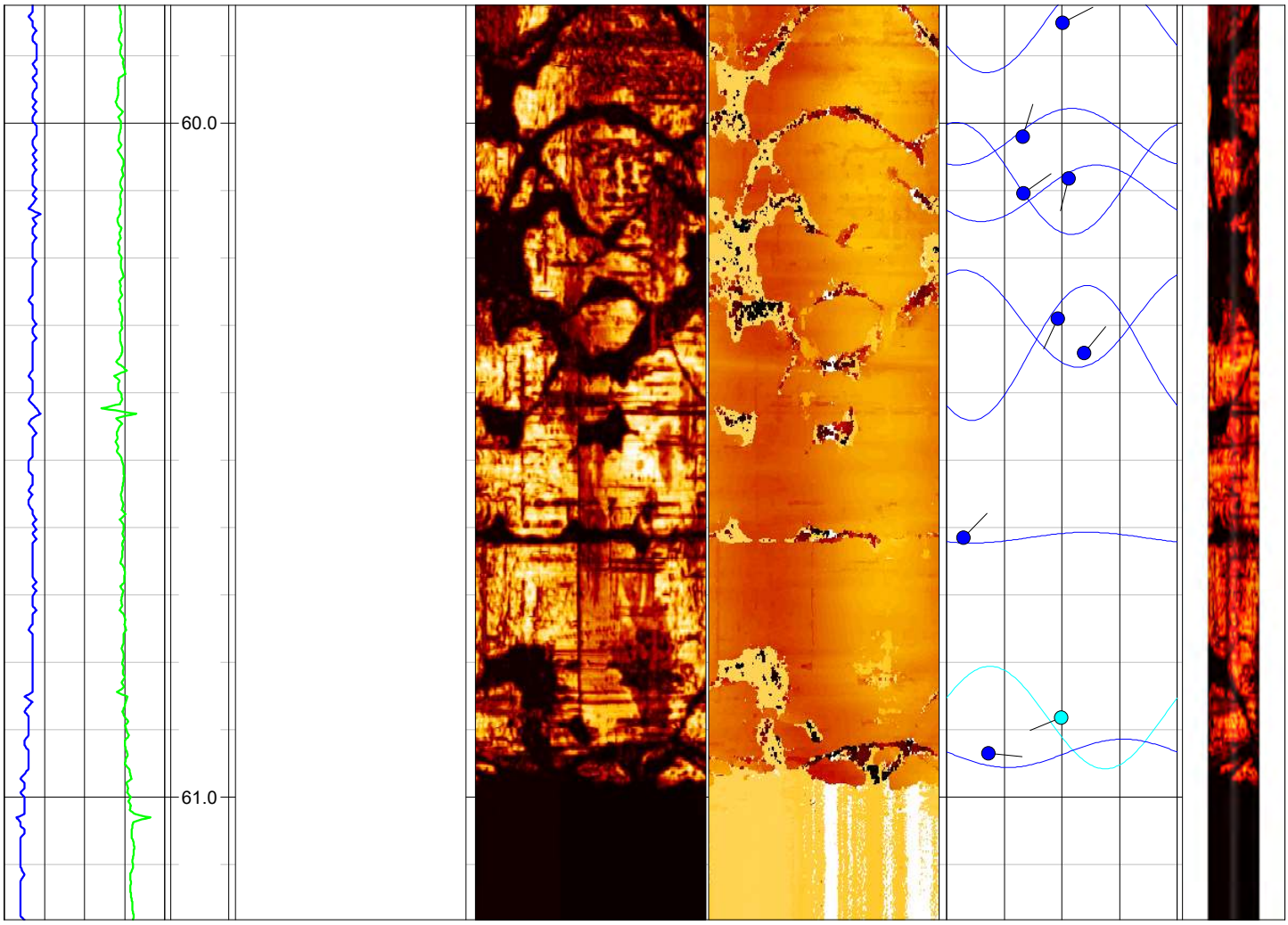

60.0
61.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC403**

Log Type: ***Composite***

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394937.6E 213164.4N** Elevation: **247.65m**

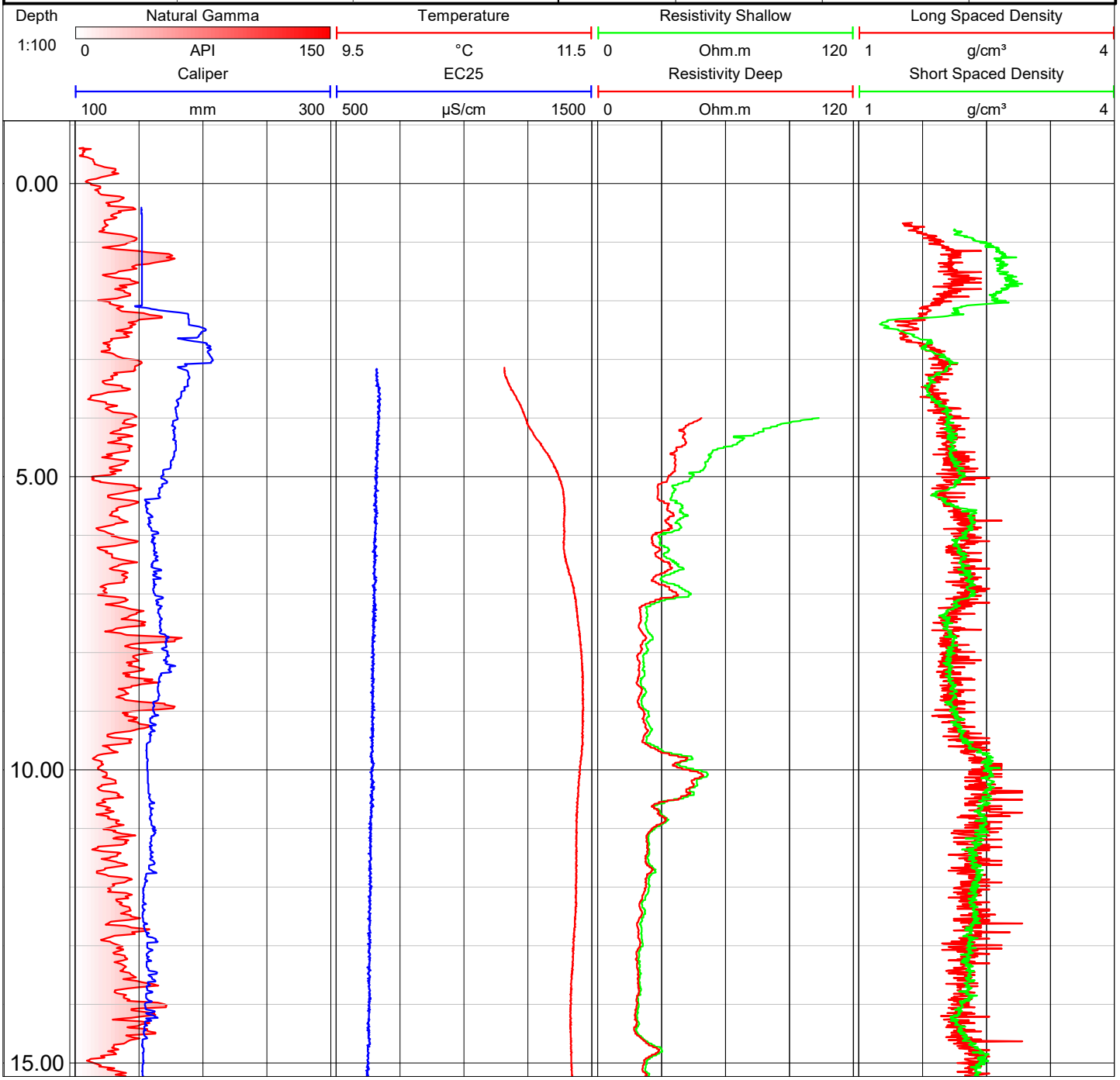
Drilled Depth: (m)	**20.0**	Date:	**11.03.2020**
Logged Depth: (m)	**20.0**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Fluid Velocity logs attempted but not possible due to high volume of suspended sediment. See optical image.
Logged Interval: (m)	**0 - 20.0**		
Fluid Level: (m)	**2.7**		

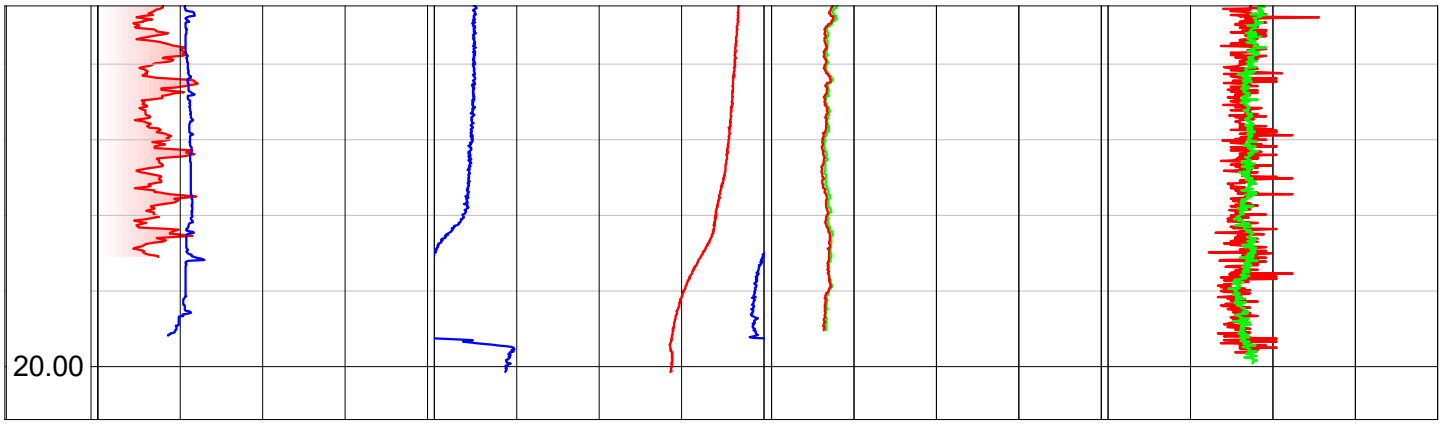
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**2.25**	**20.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**150**	**0.0**	**2.25**




20.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC403**

Log Type: ***Image***

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394937.6E 213164.4N** Elevation: **247.65m**

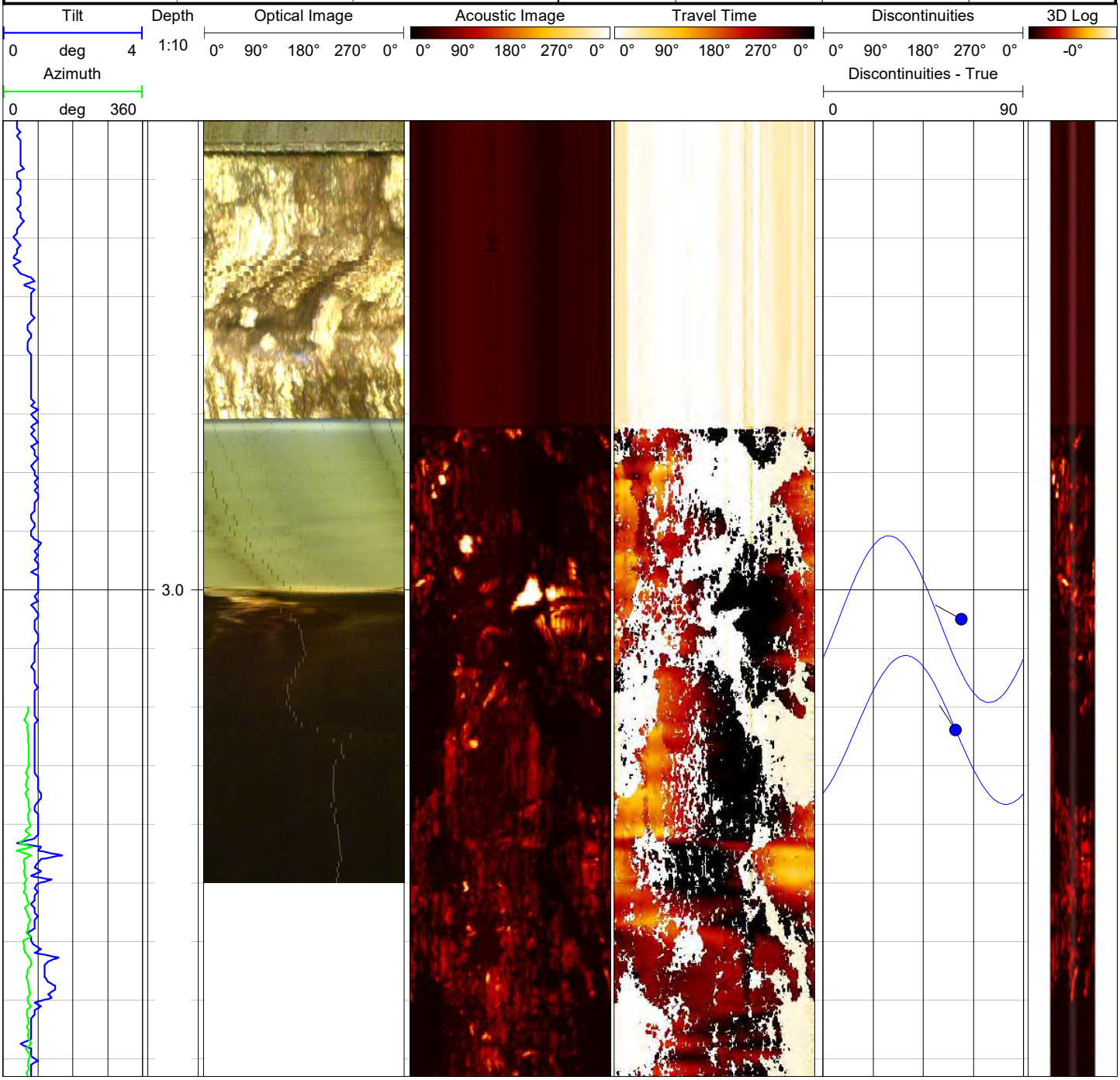
Drilled Depth: (m)	**20.0**	Date:	**11.03.2020**
Logged Depth: (m)	**20.0**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole fluid cloudy.
Logged Interval: (m)	**2.25 - 20.0**		
Fluid Level: (m)	**2.7**		

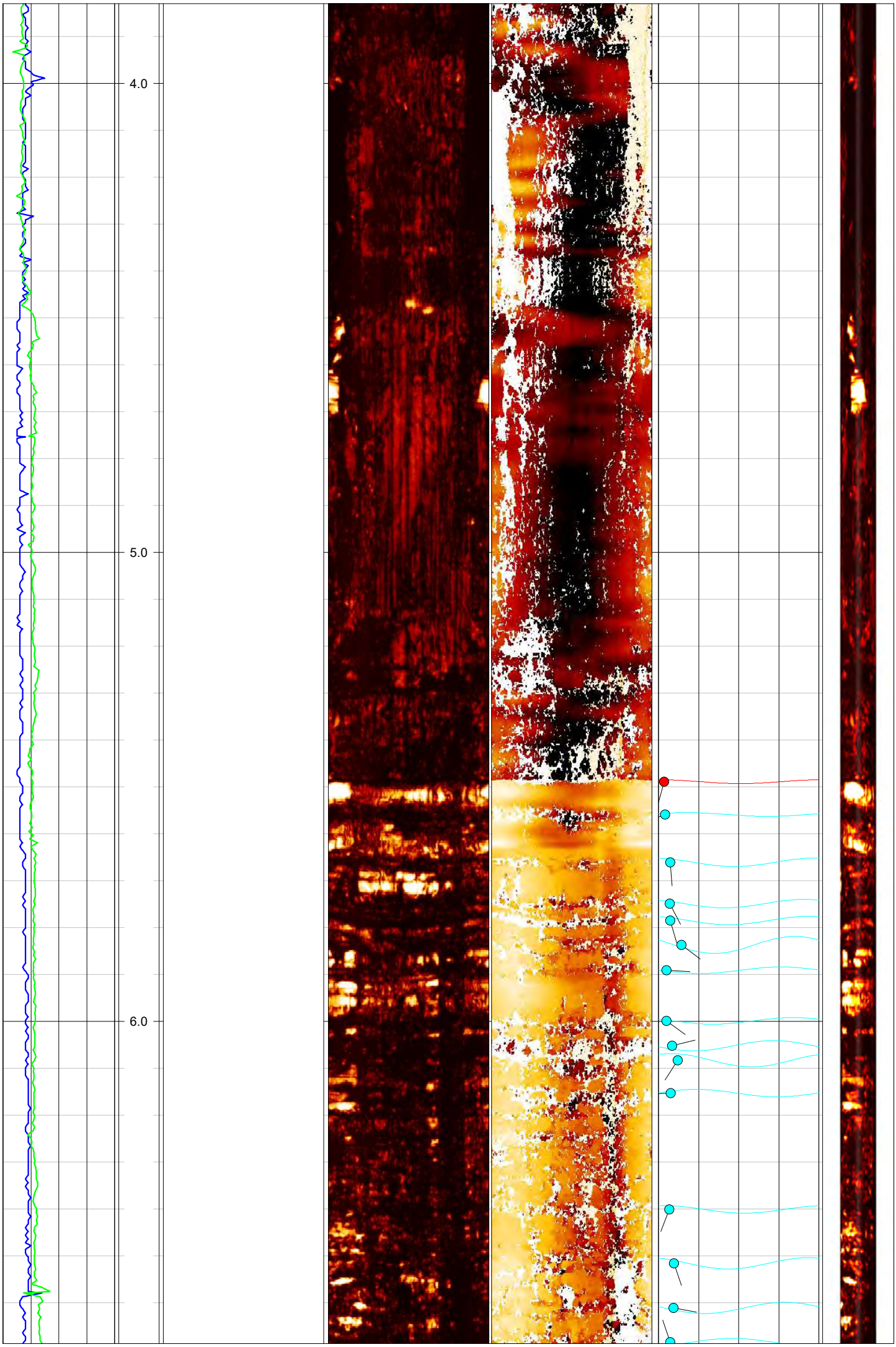
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**2.25**	**20.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**150**	**0.0**	**2.25**




4.0
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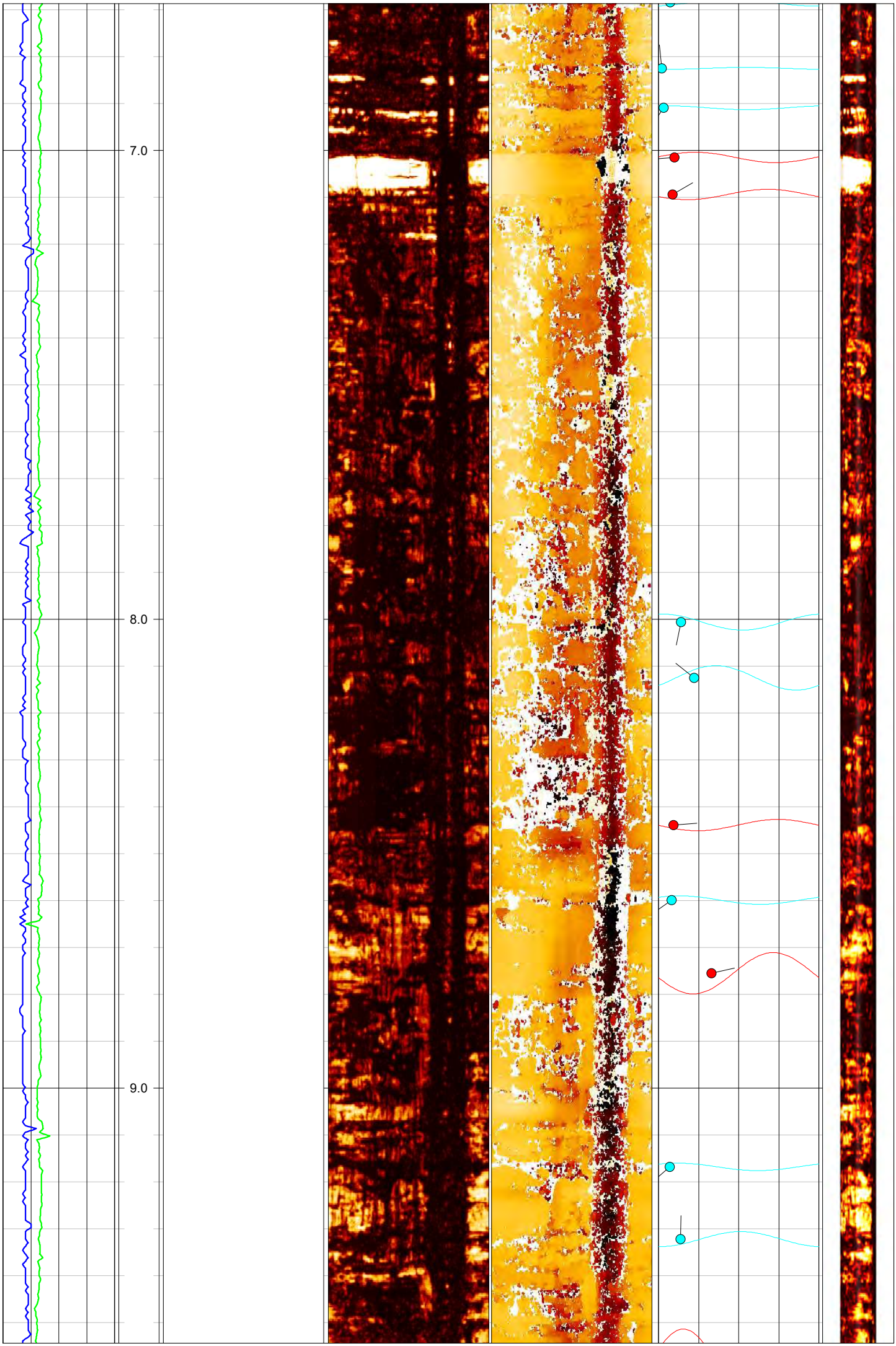
6.0


7.0
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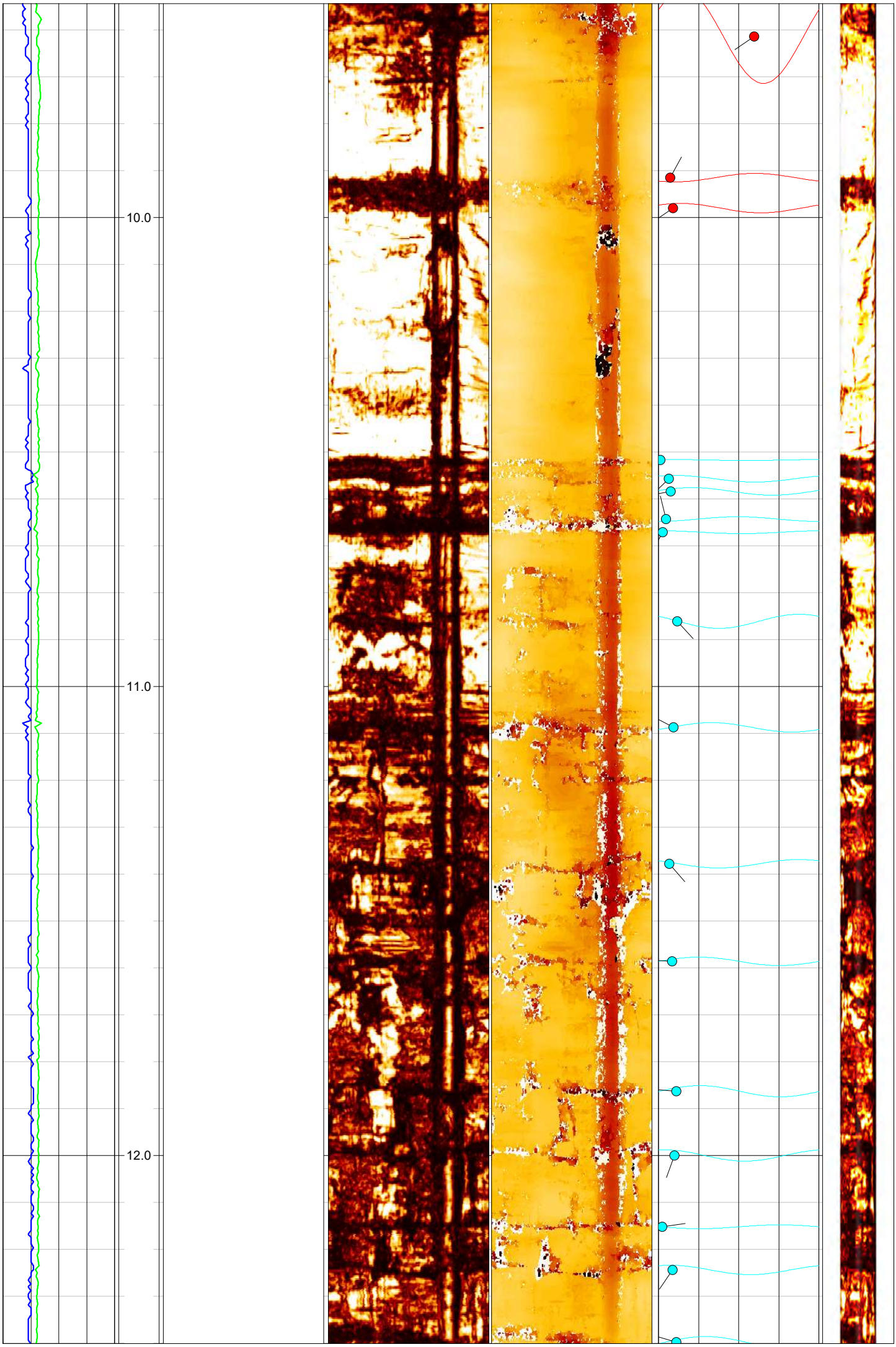
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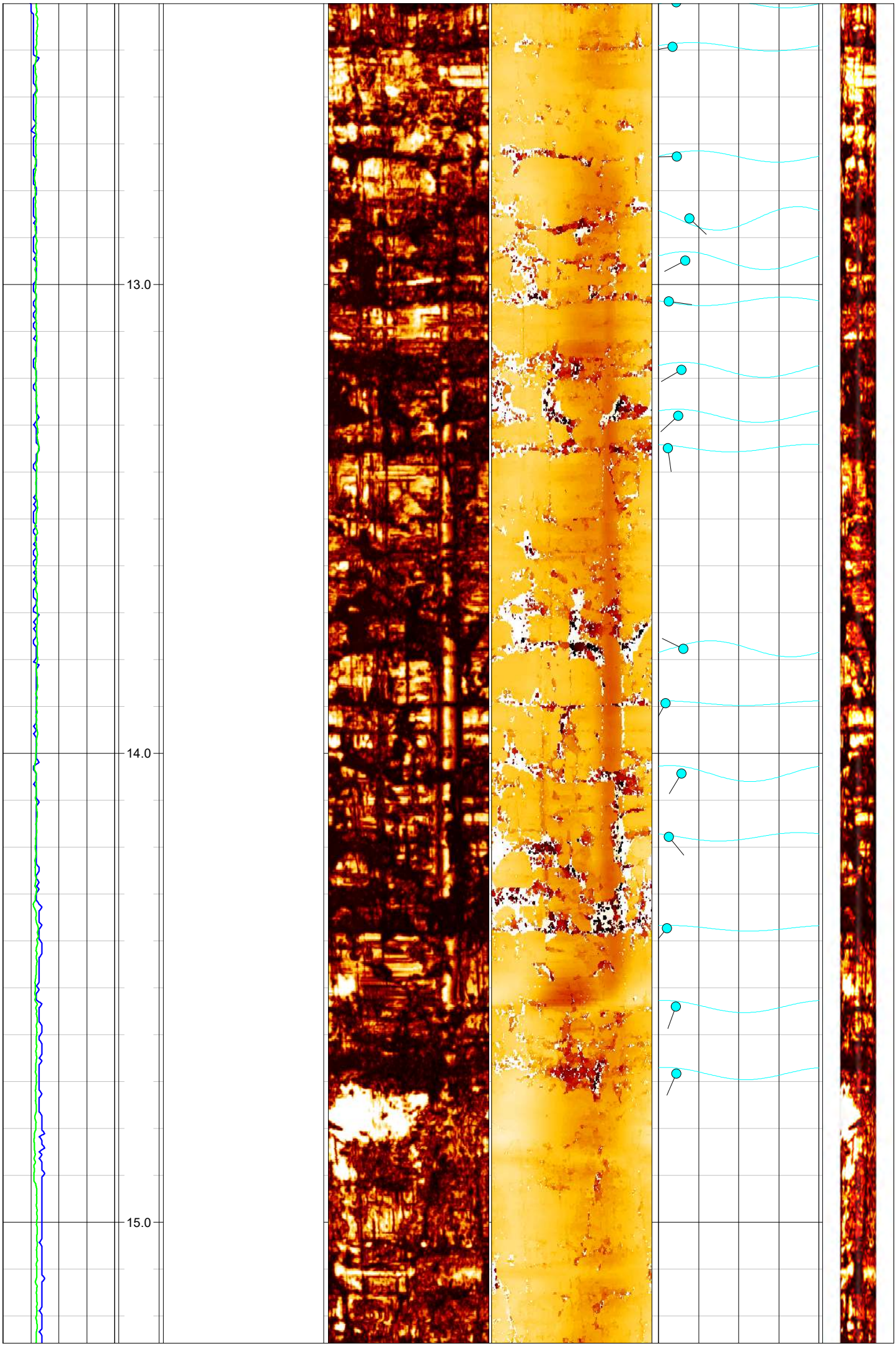
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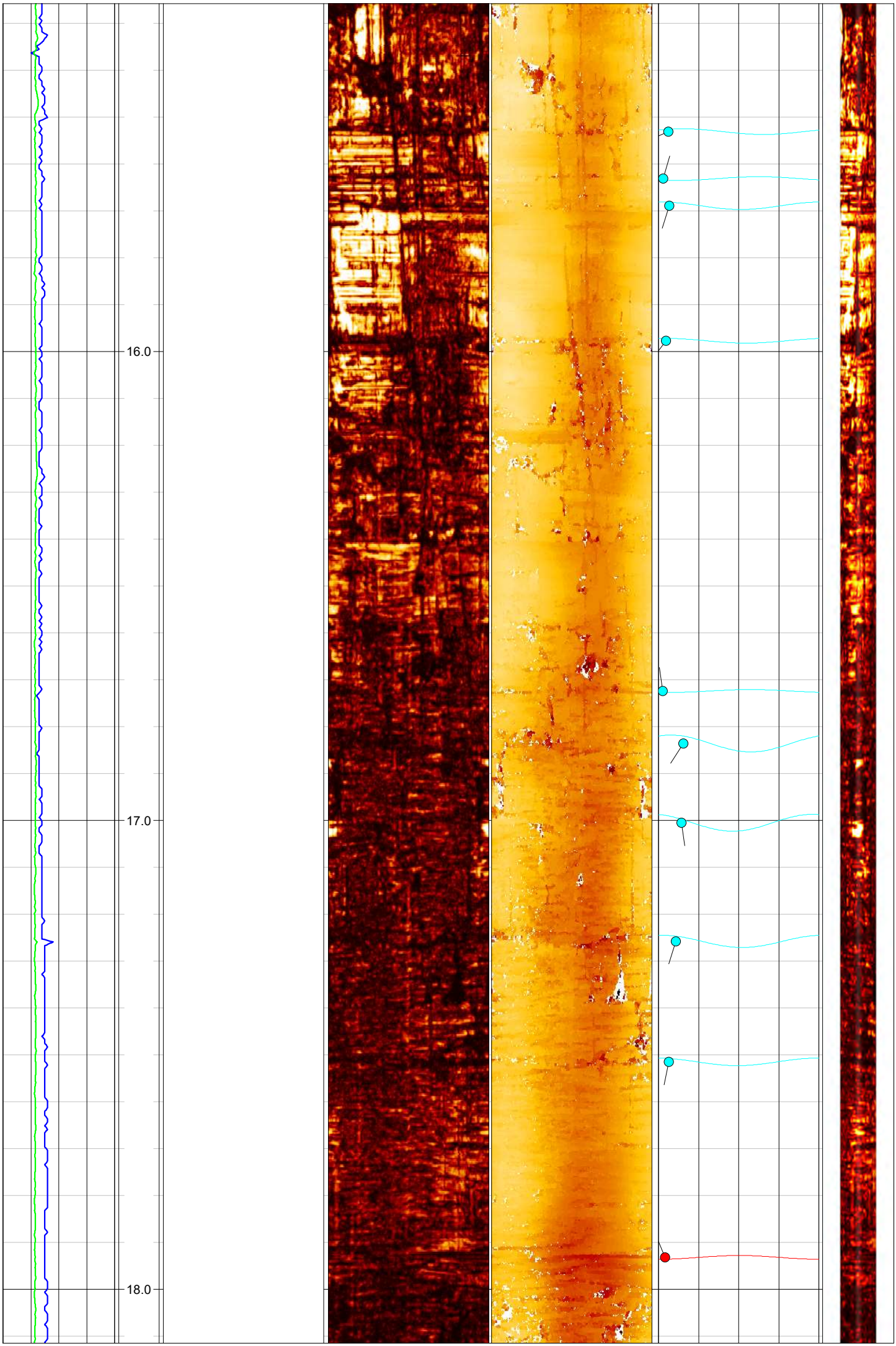
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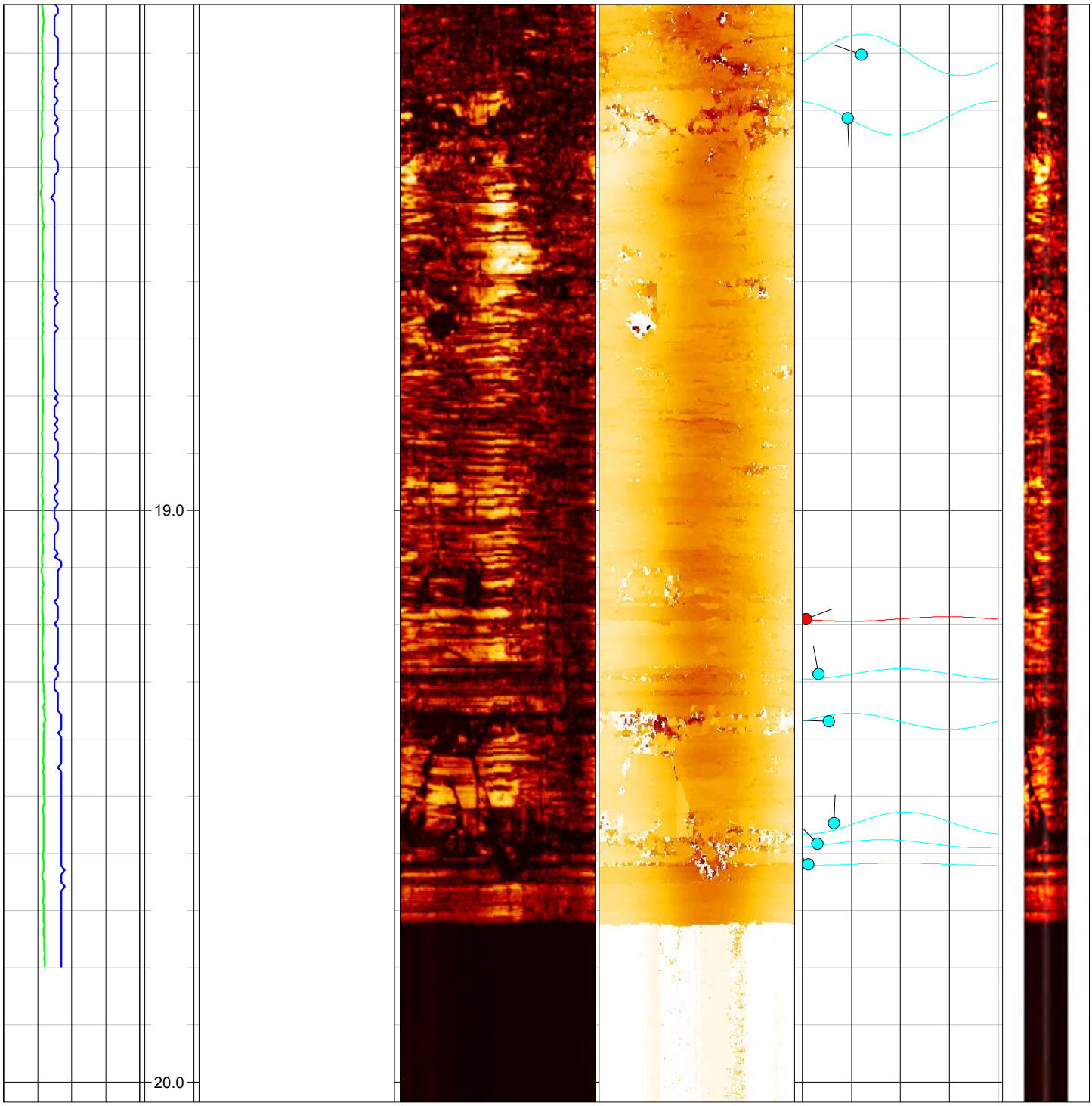

19.0
20.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC418**

Log Type: ***Composite***

Location: **A417** Area: Grid Ref: **393131.8E 216418.8N** Elevation: **272.25m**

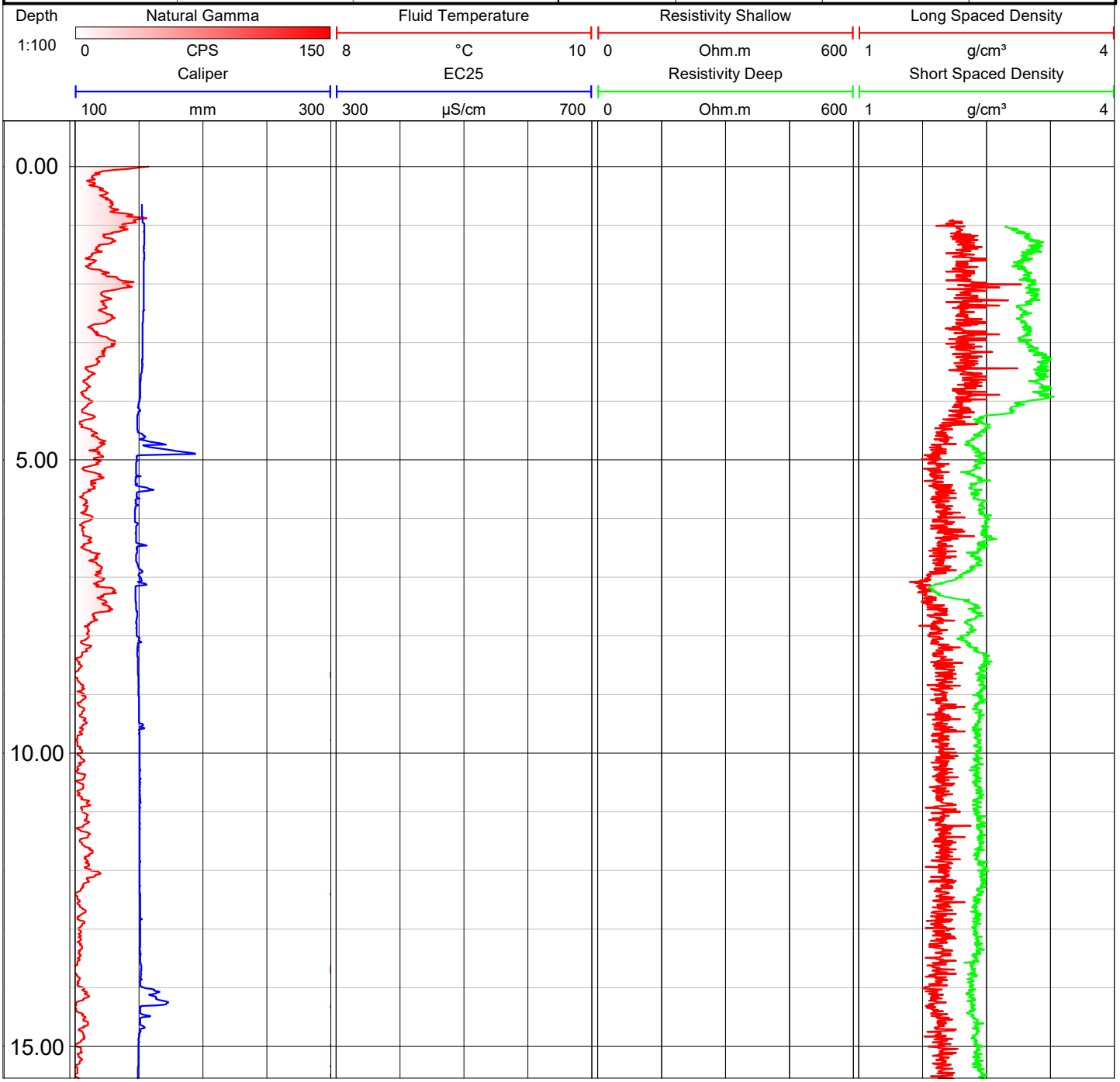
Drilled Depth: (m)	**60.0**	Date:	**25.11.19**
Logged Depth: (m)	**59.2**	Recorded By:	**M. Magill**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0 - 59.2**		
Fluid Level: (m)	**56.4**		

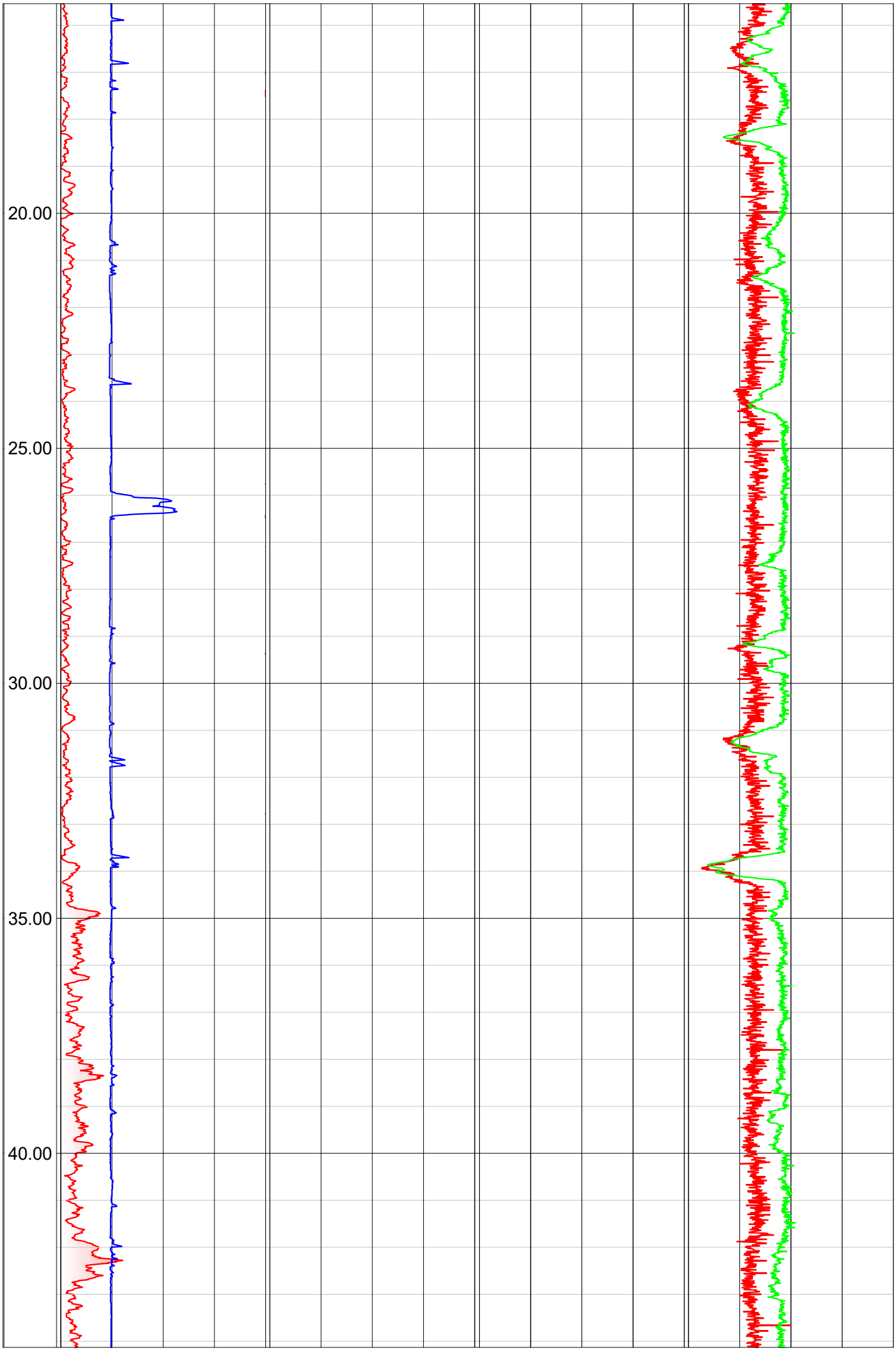
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
147	**4.2**	**59.2**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**150**	**-0.6**	**4.2**




20.00
25.00
30.00
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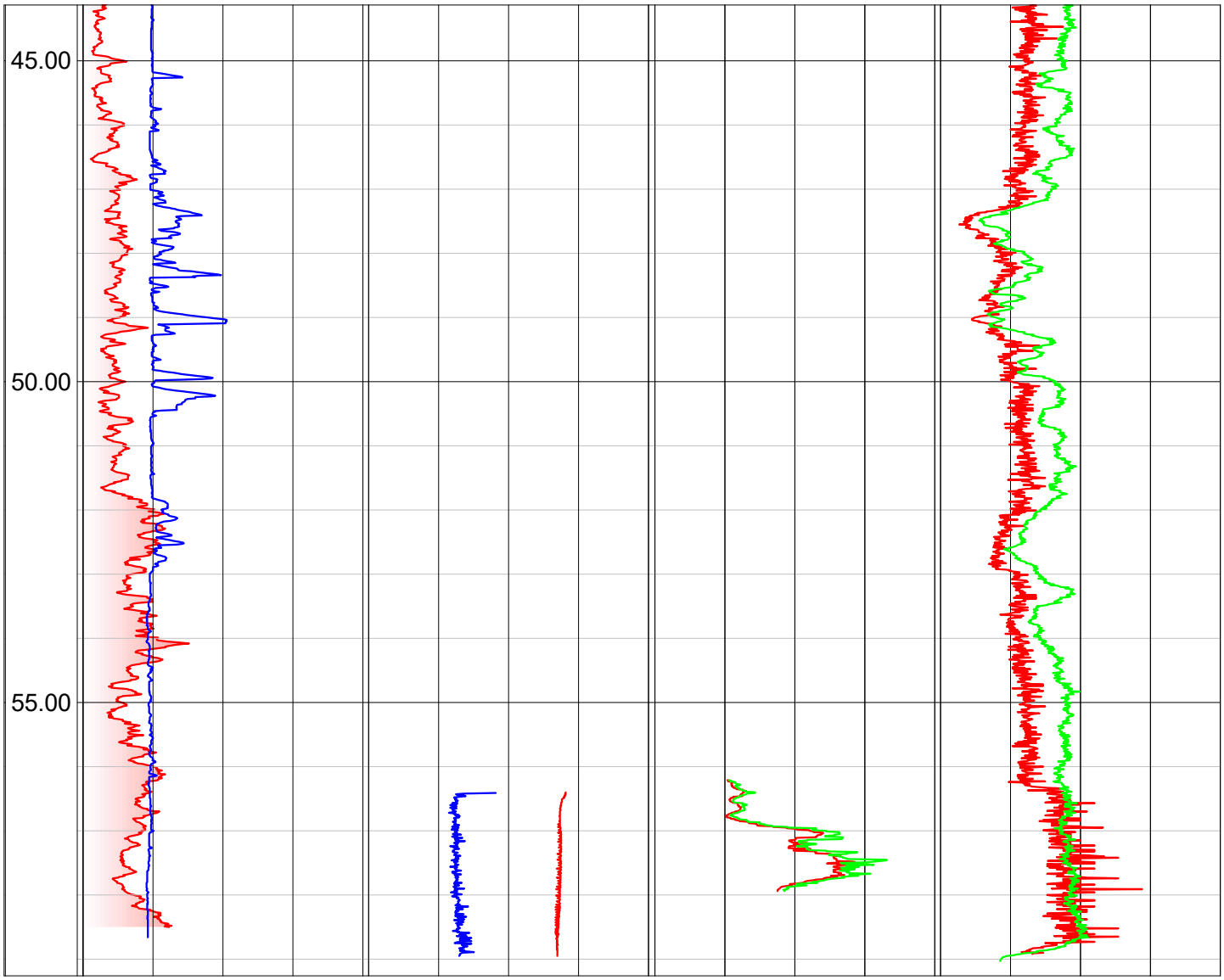

45.00
50.00
55.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRC418**

Log Type: ***Image***

Location: **A417** Area: Grid Ref: **393131.8E 216418.8N** Elevation: **272.25m**

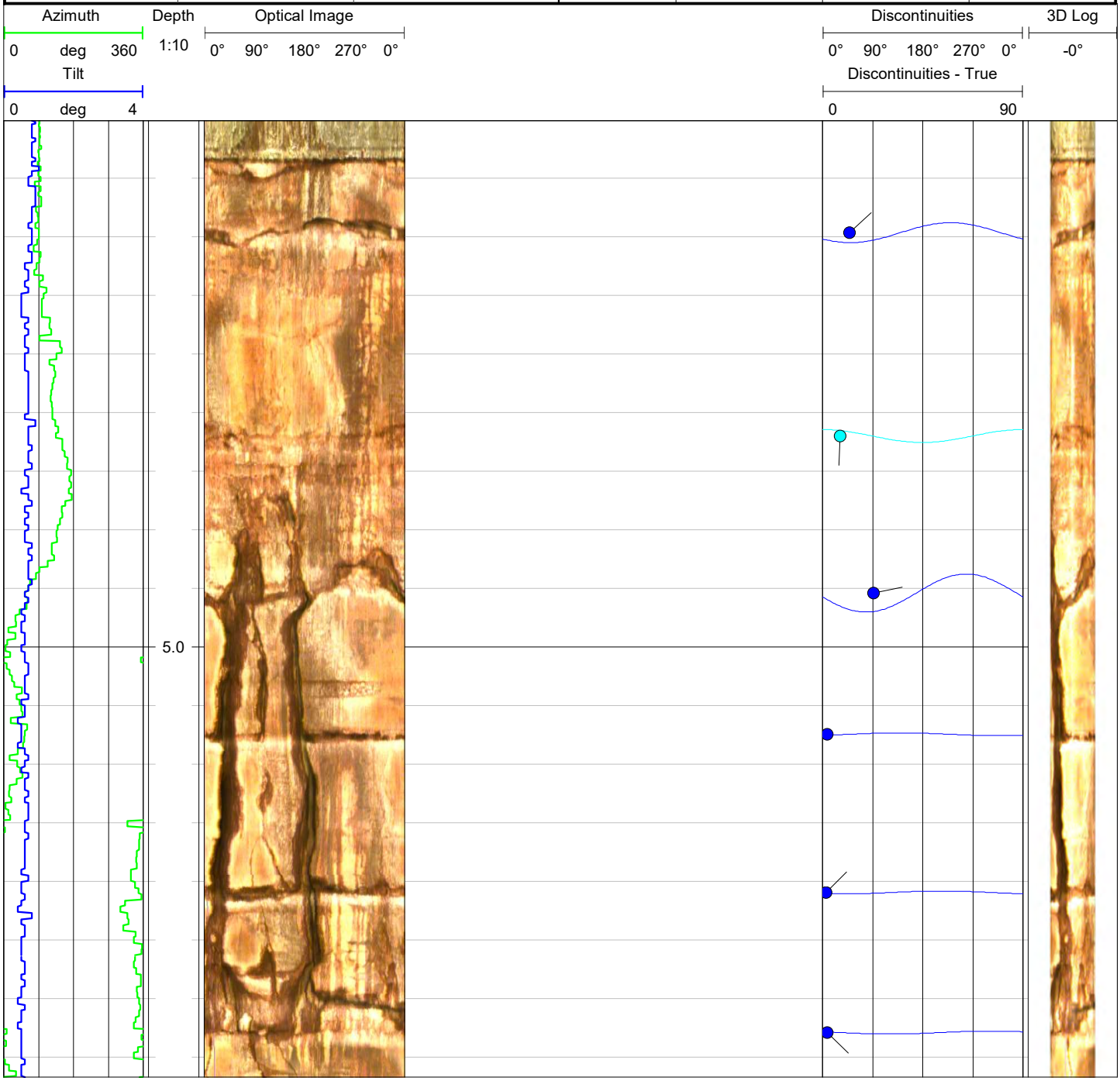
Drilled Depth: (m)	**60.0**	Date:	**25.11.19**
Logged Depth: (m)	**59.2**	Recorded By:	**M. Magill**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**4.2 - 59.2**		
Fluid Level: (m)	**56.4**		

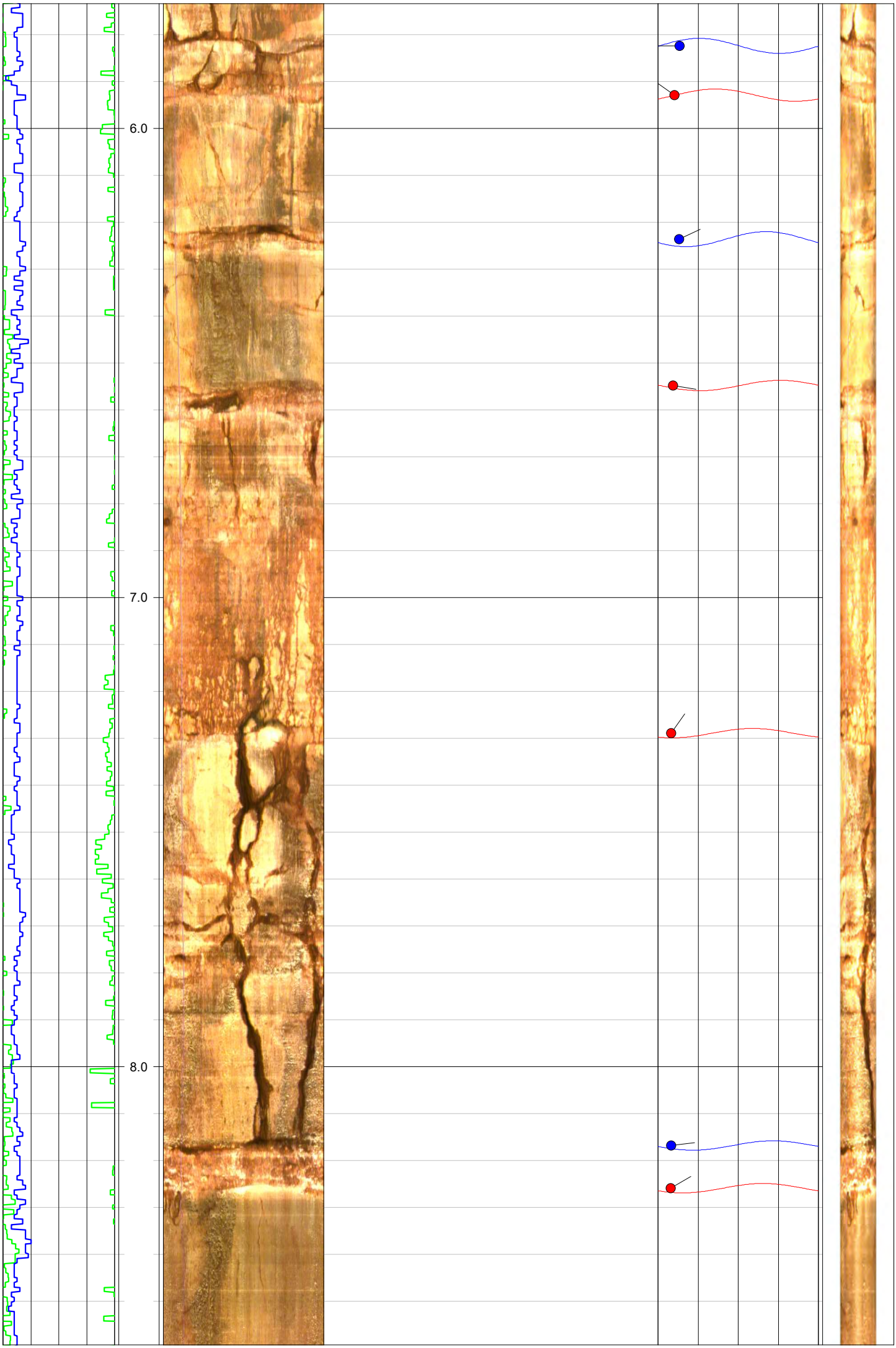
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
?	**4.2**	**59.2**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**-0.6**	**4.2**

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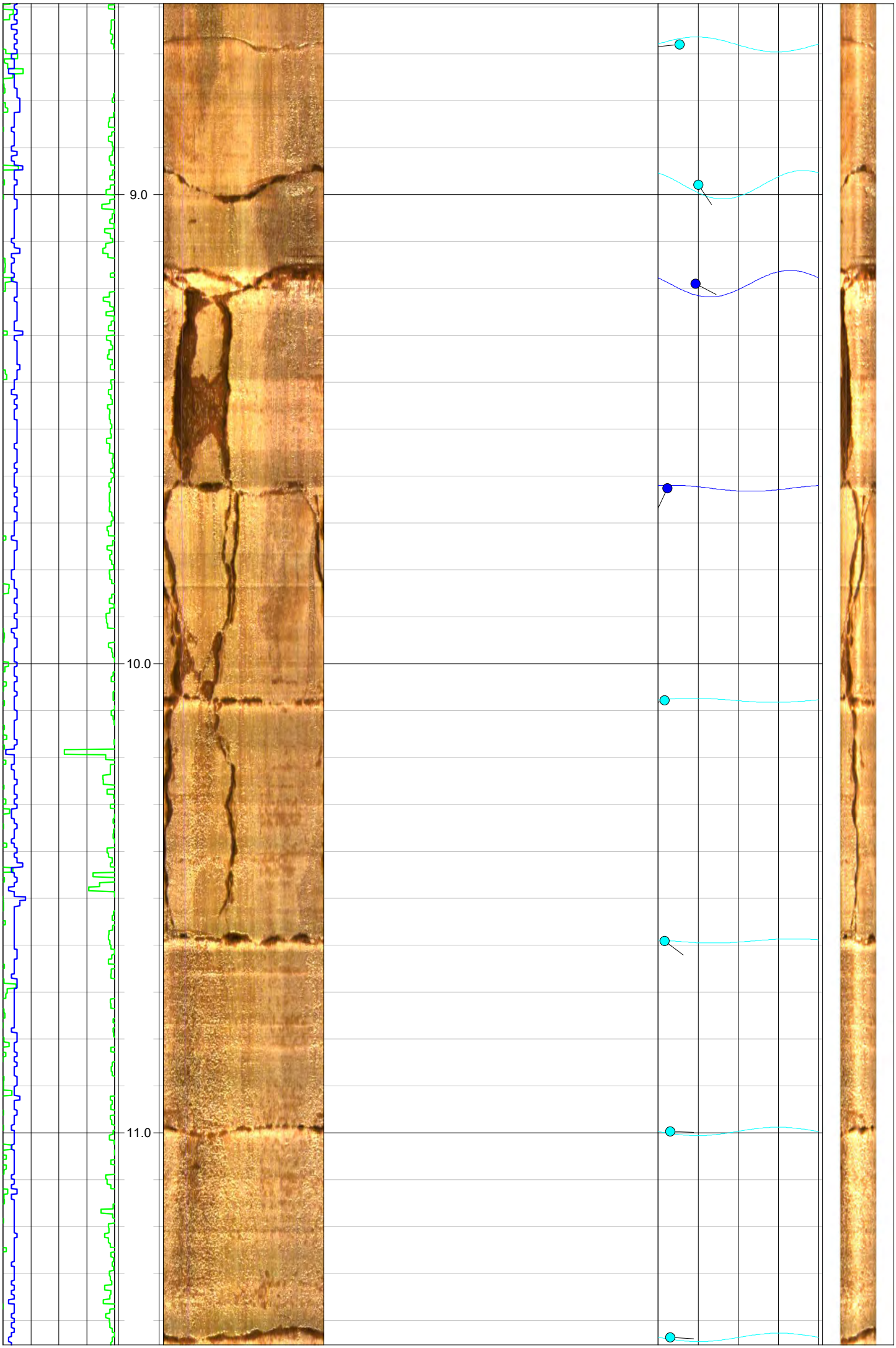
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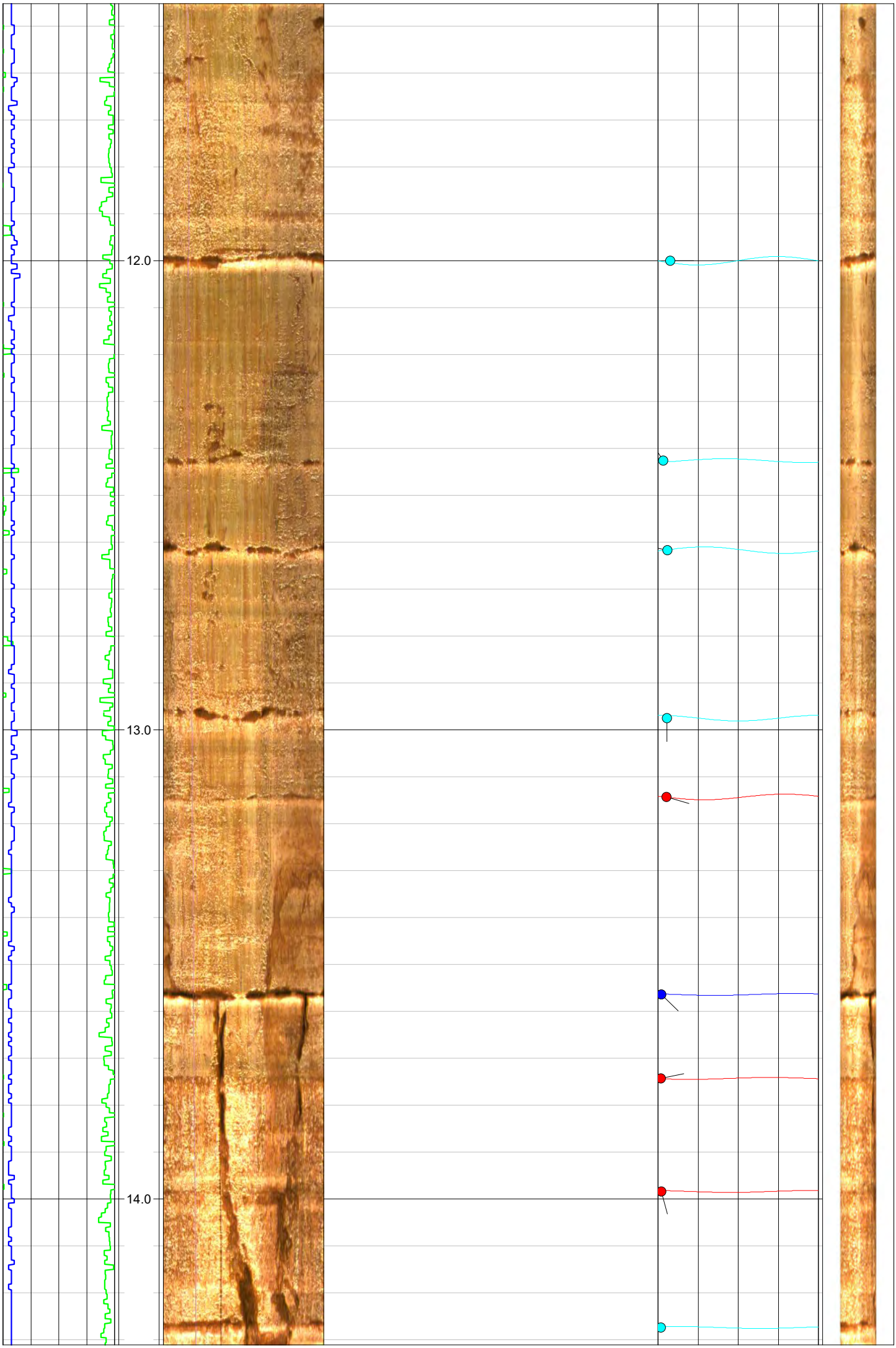
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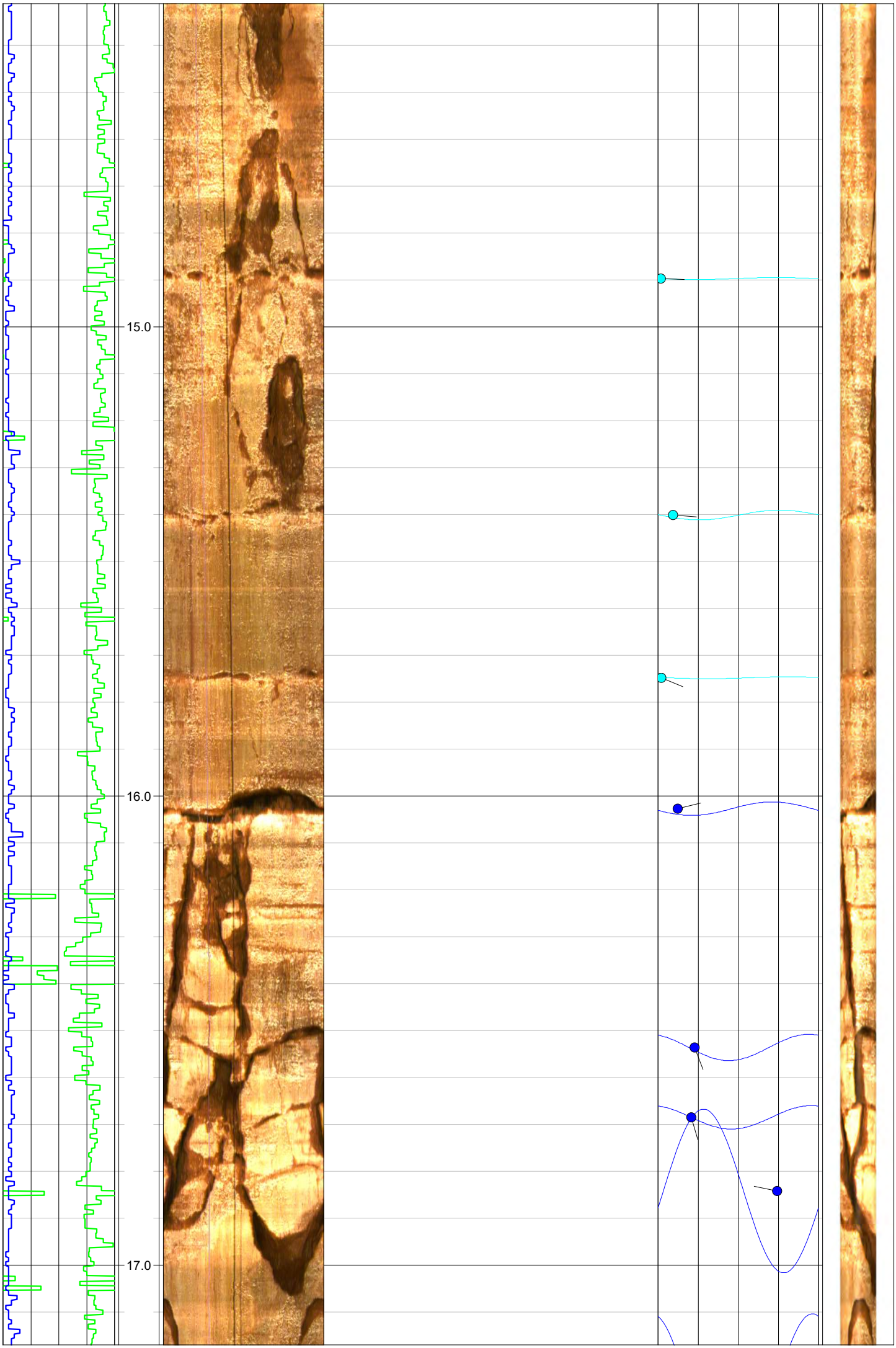
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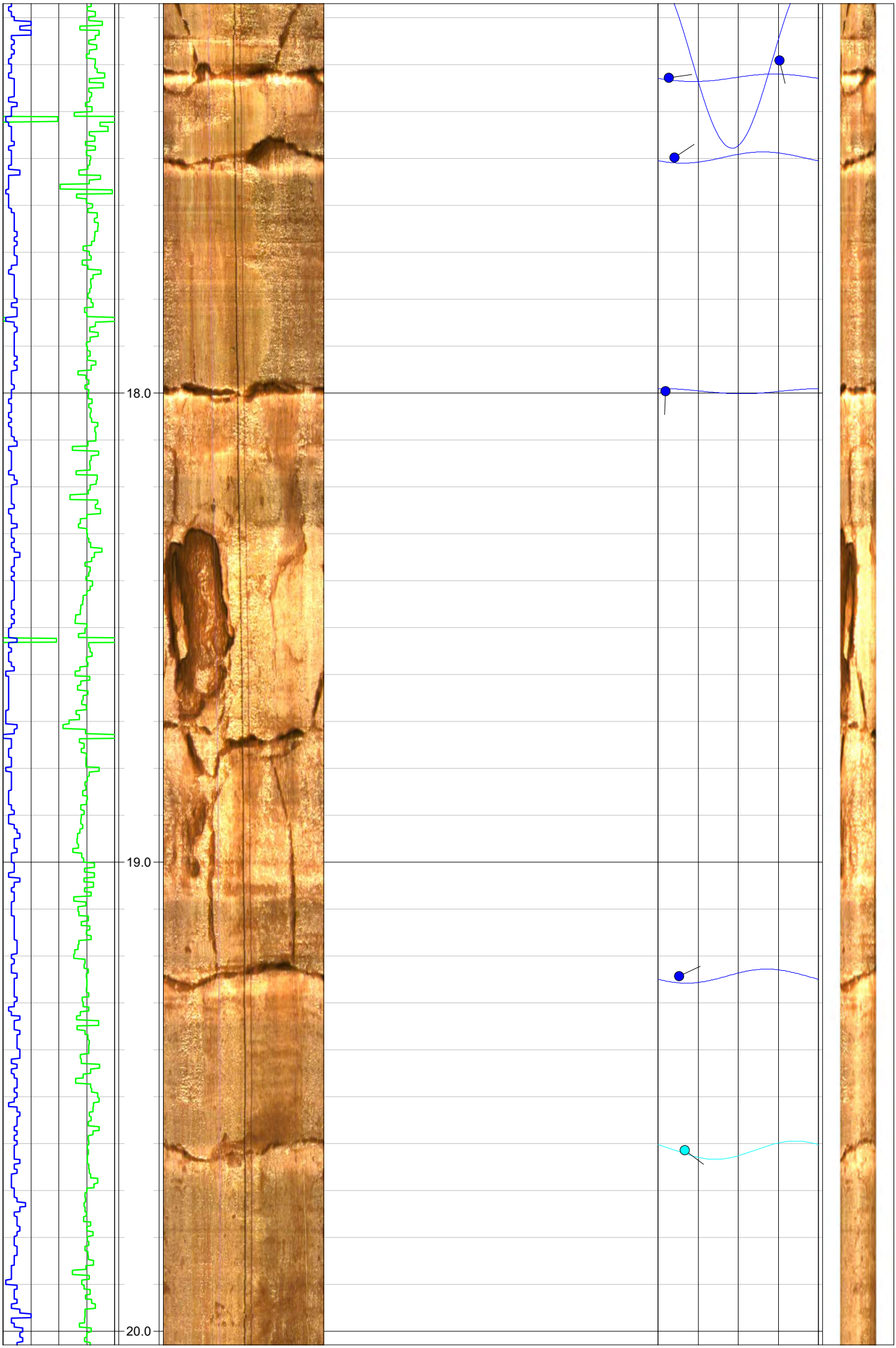
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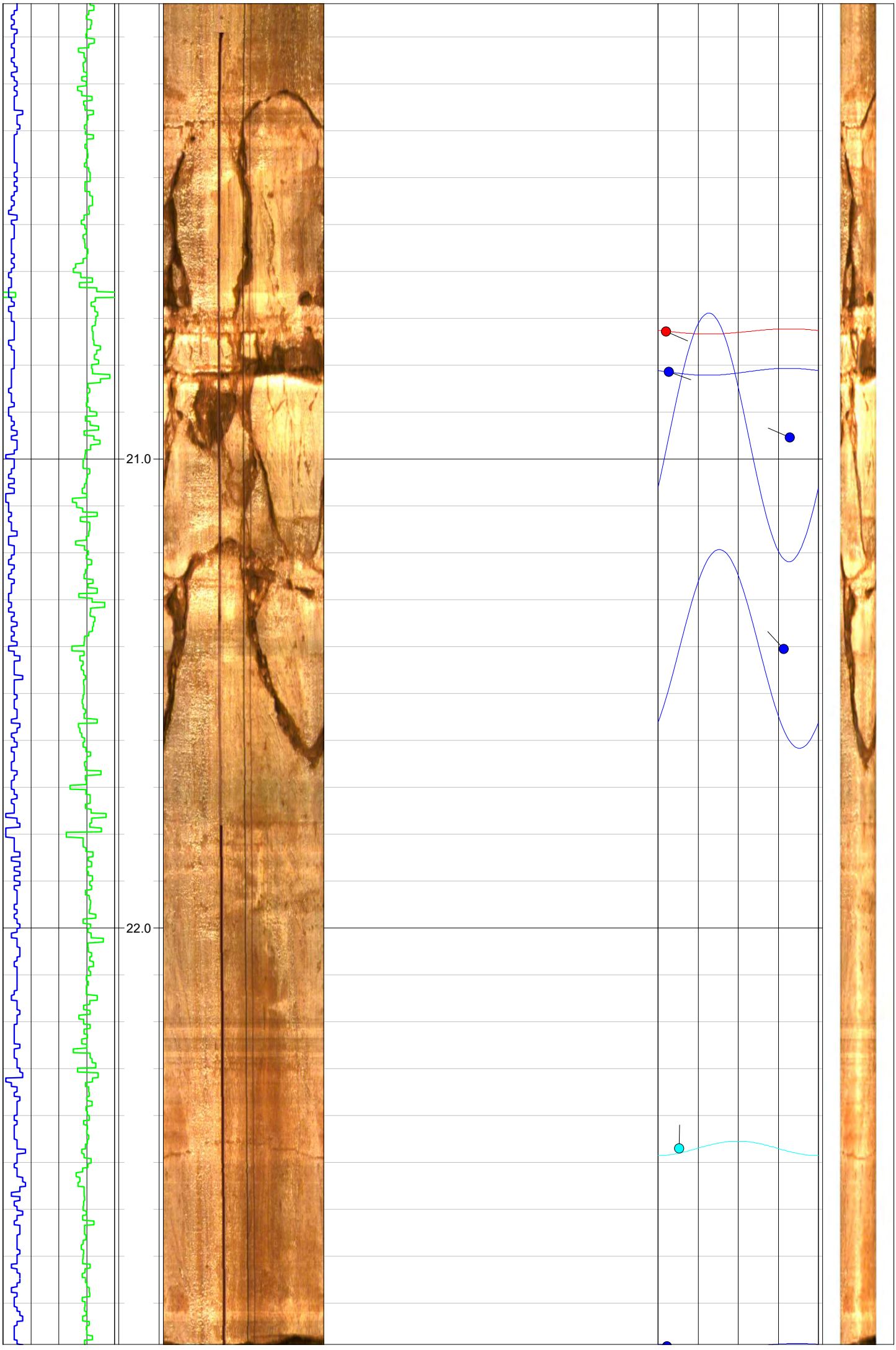
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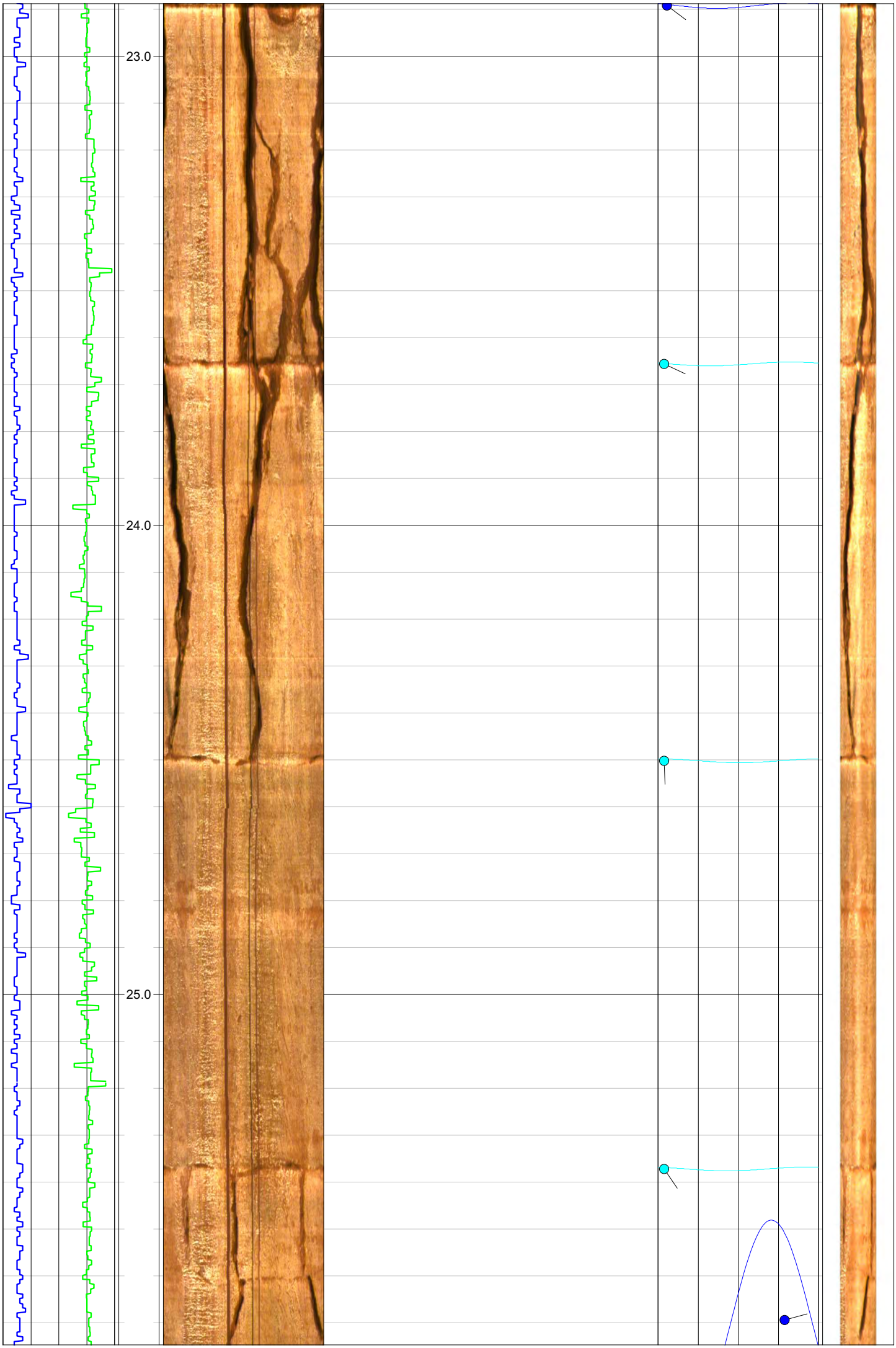
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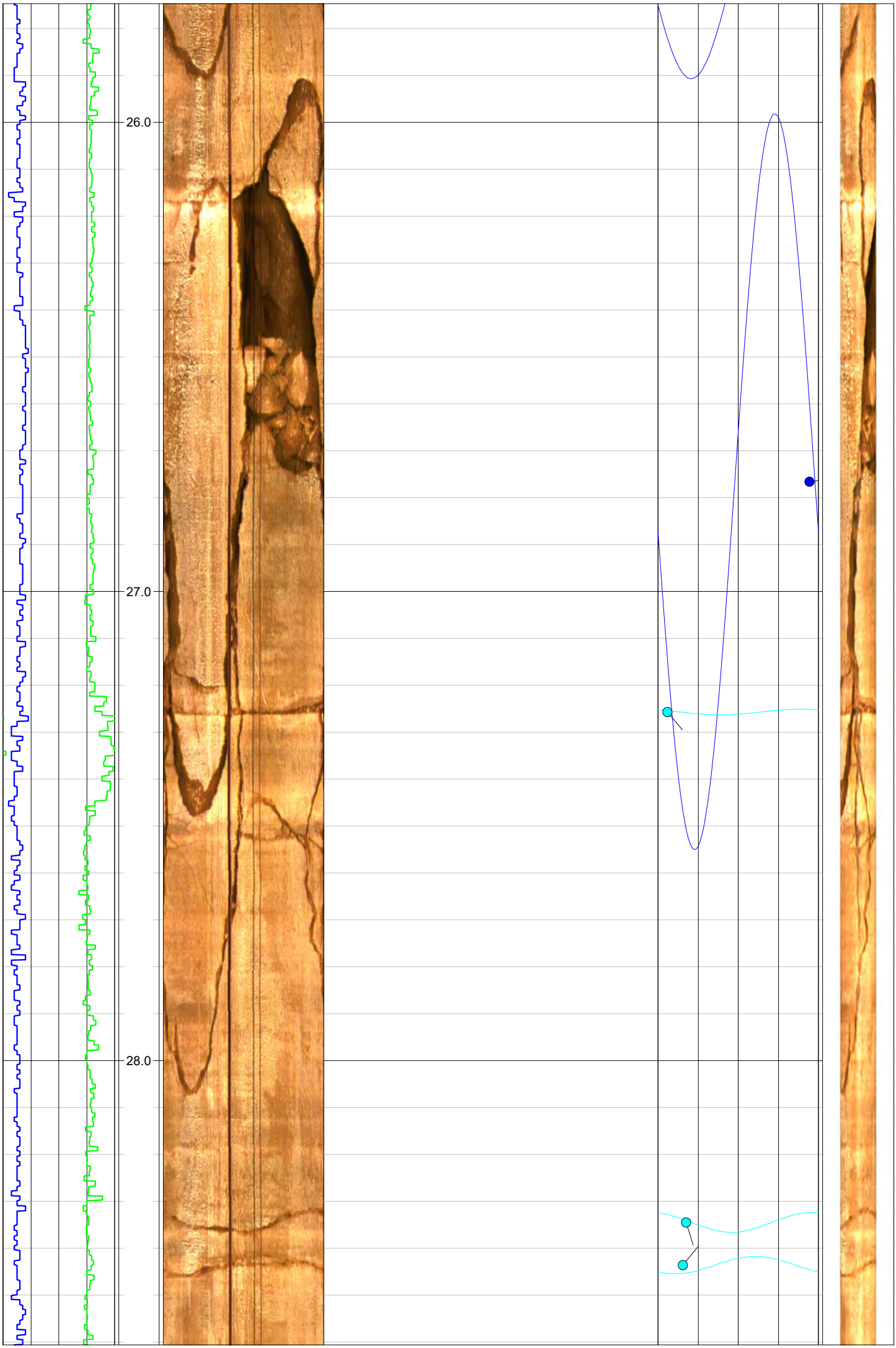
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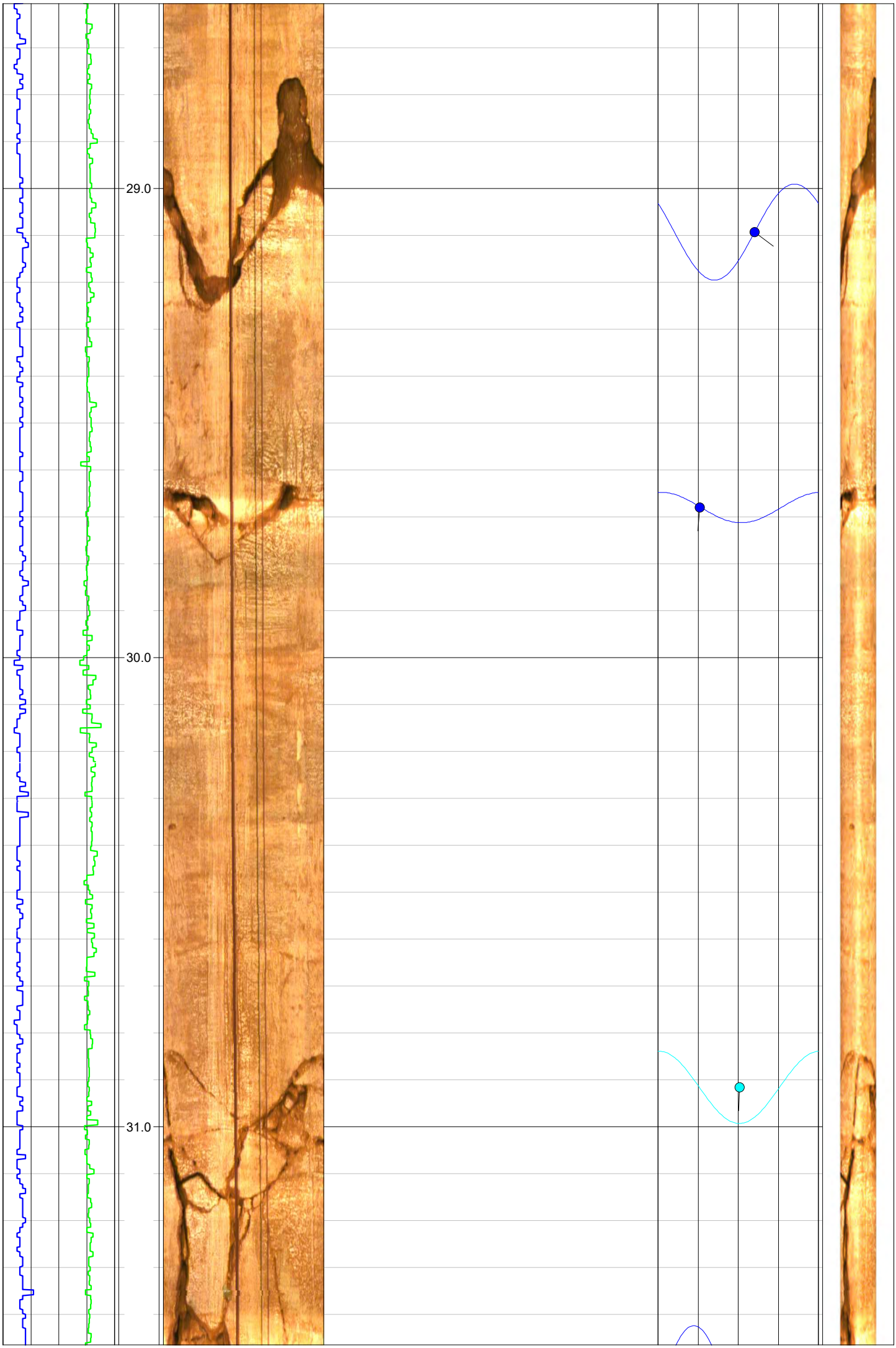
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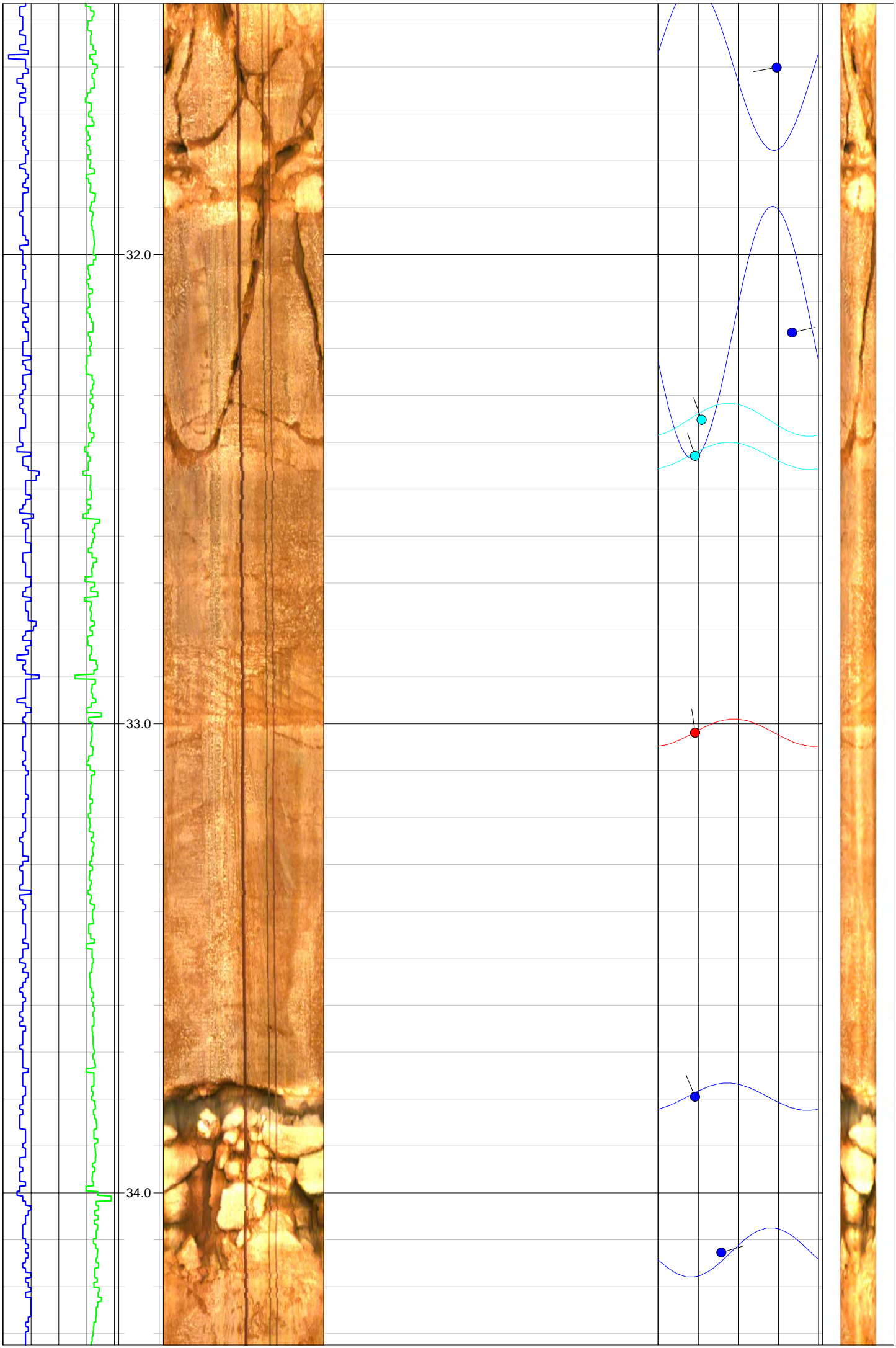
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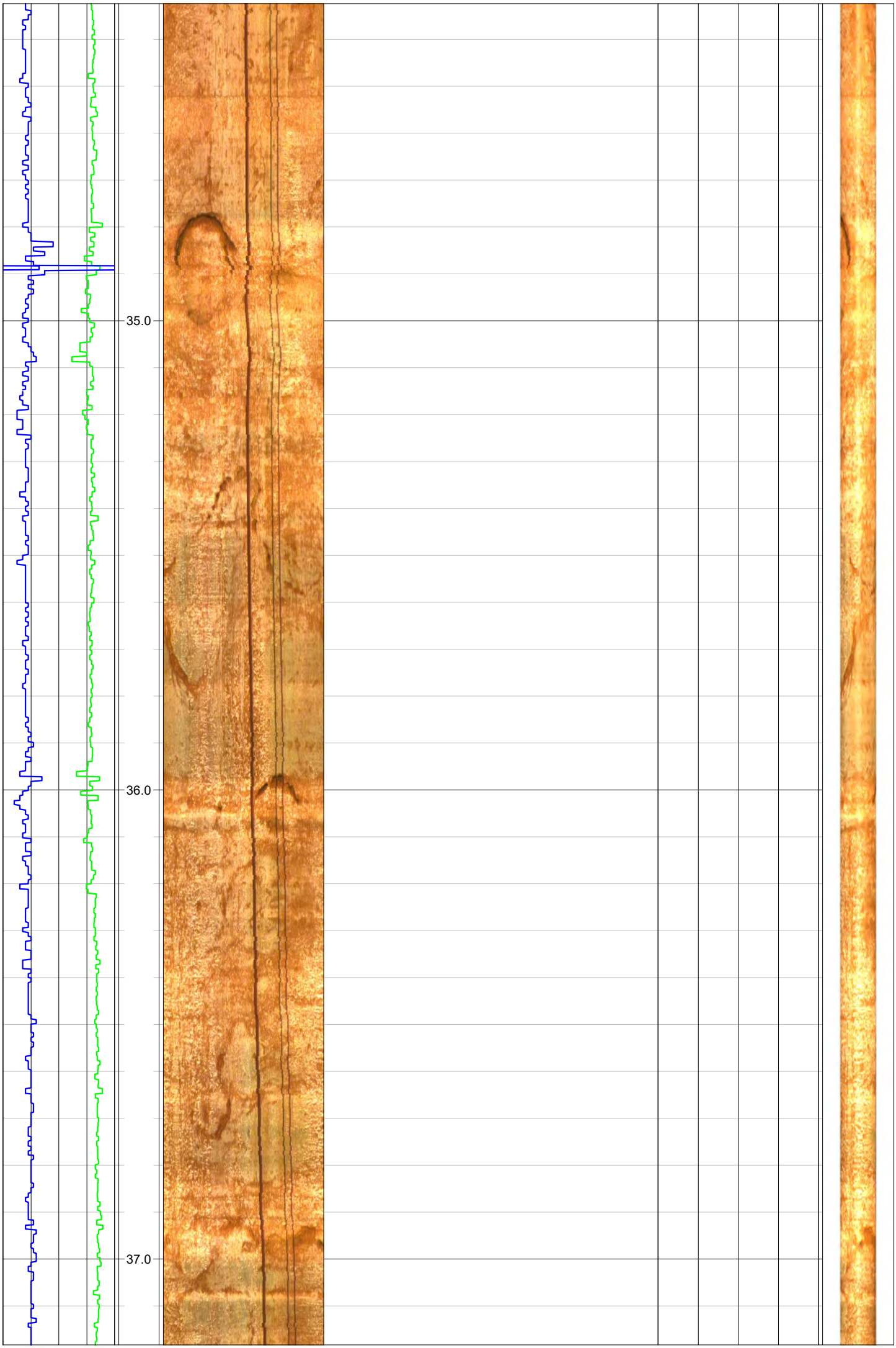
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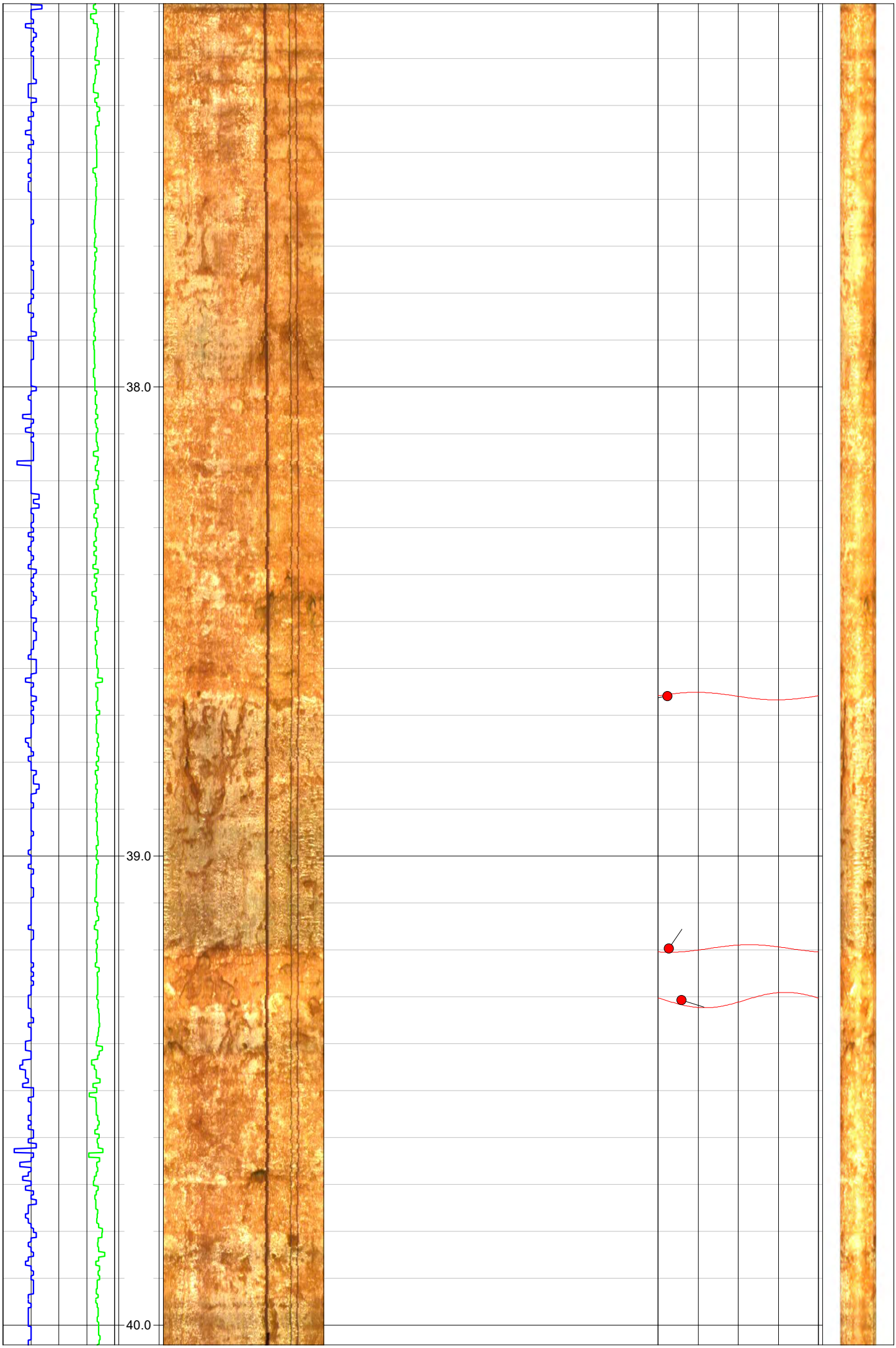
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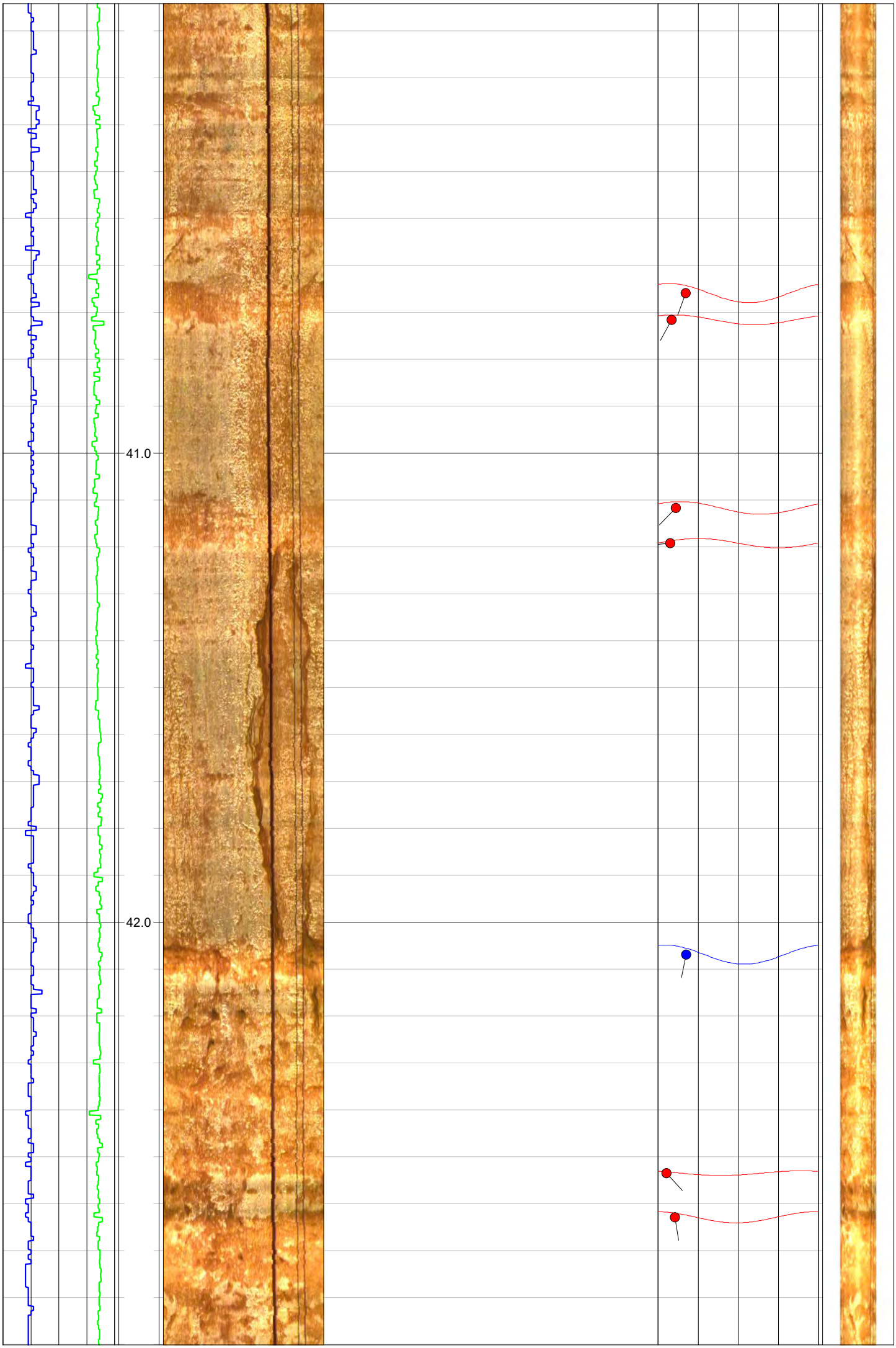
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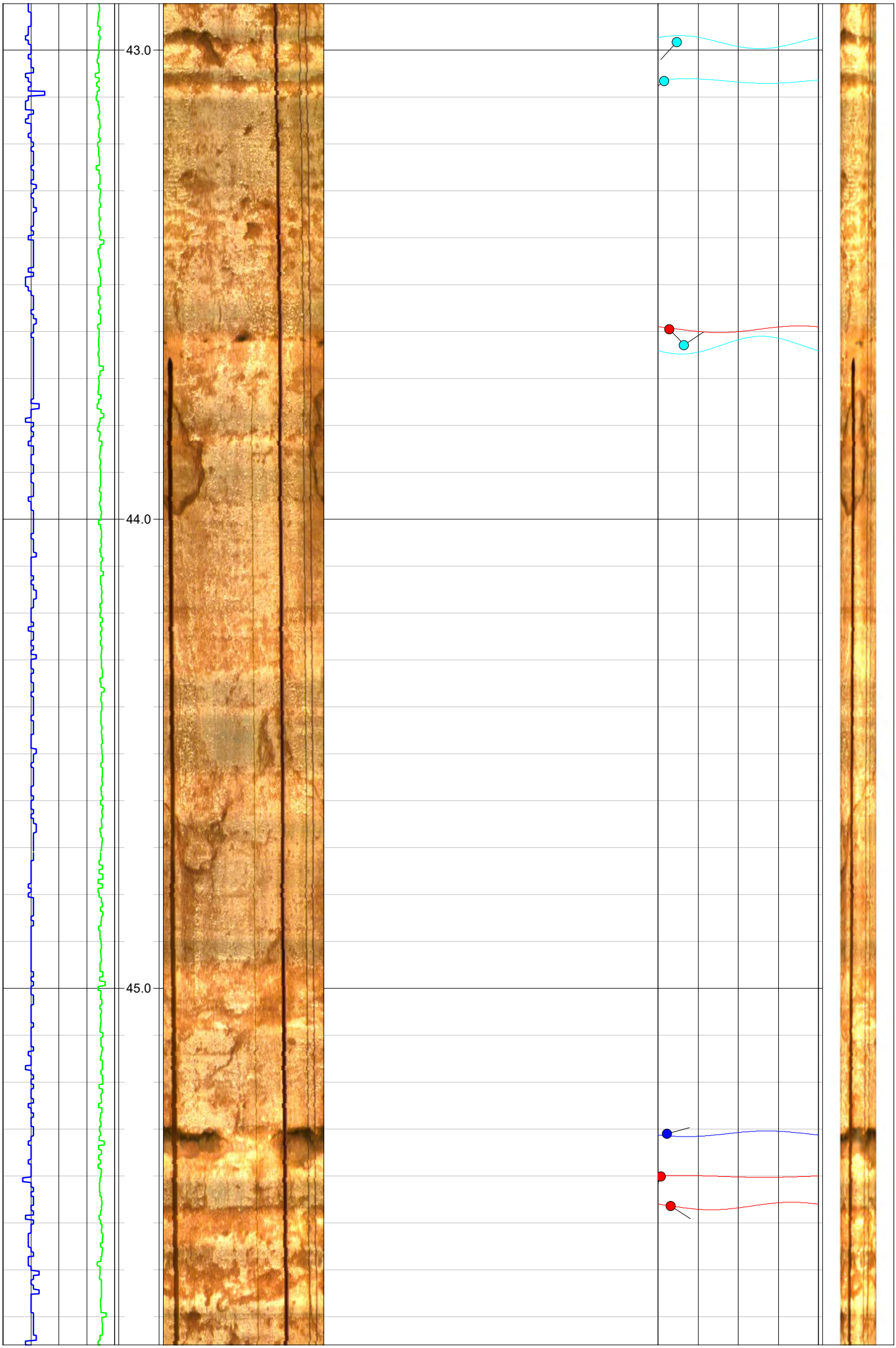
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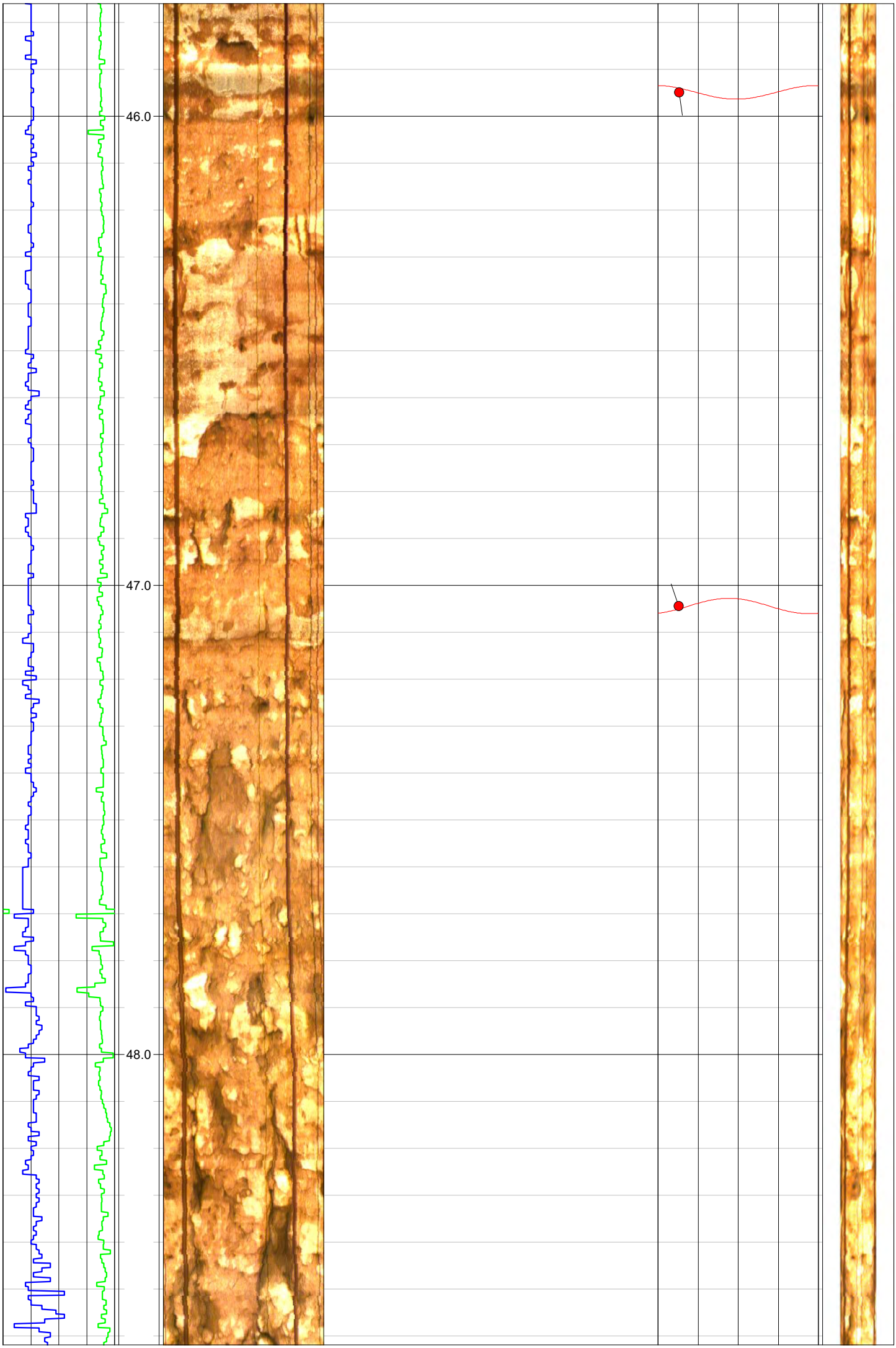
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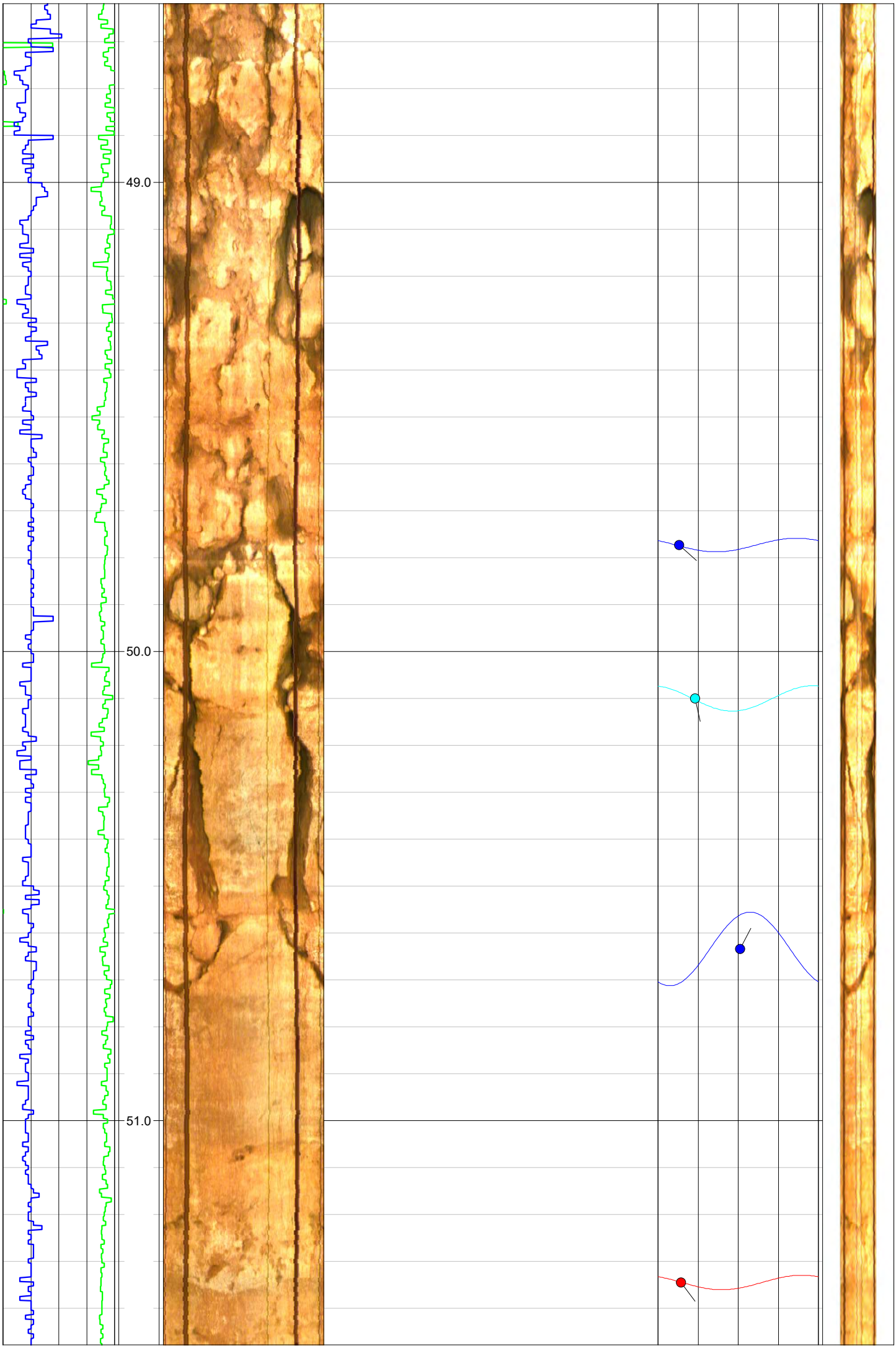
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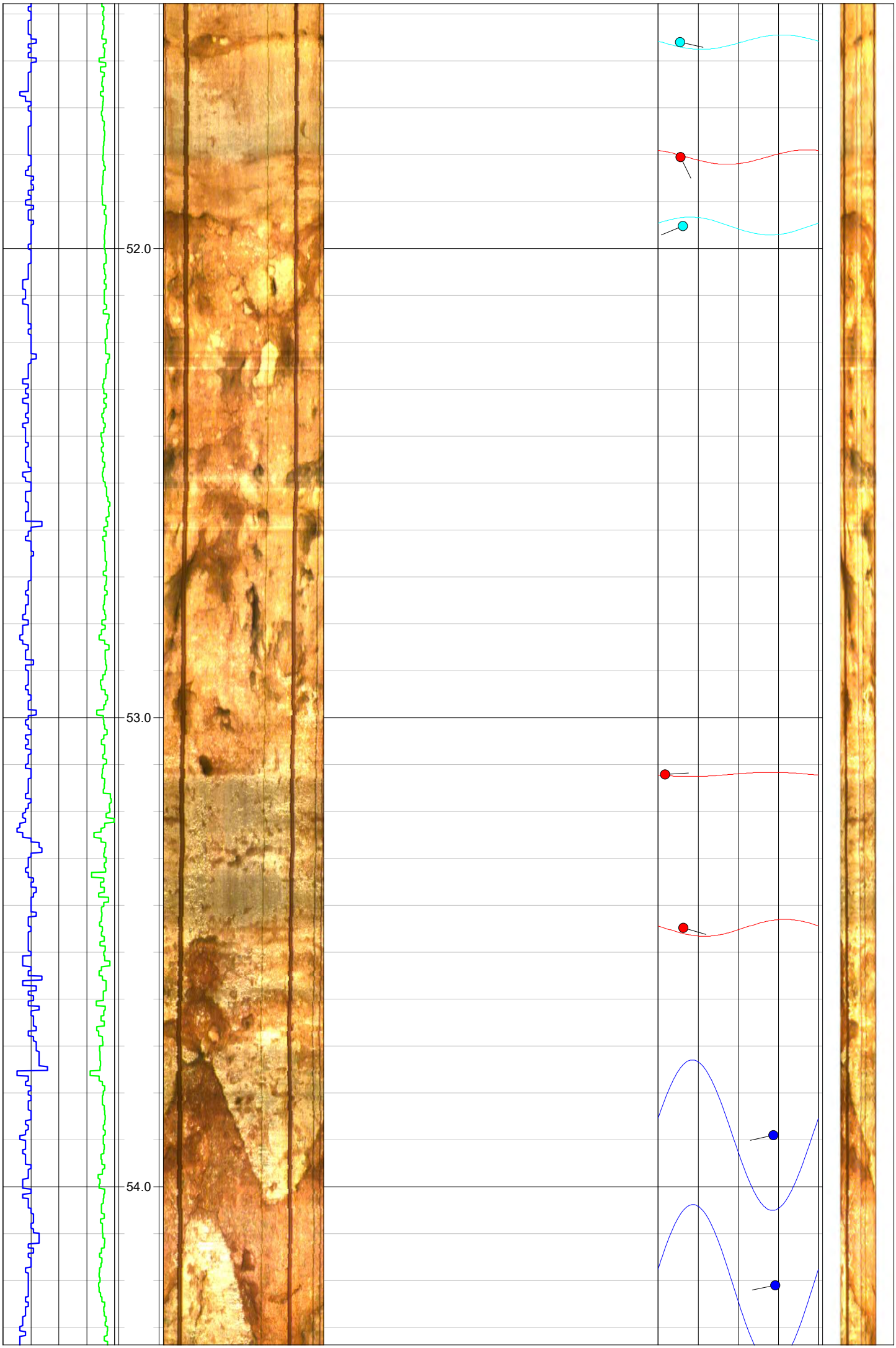
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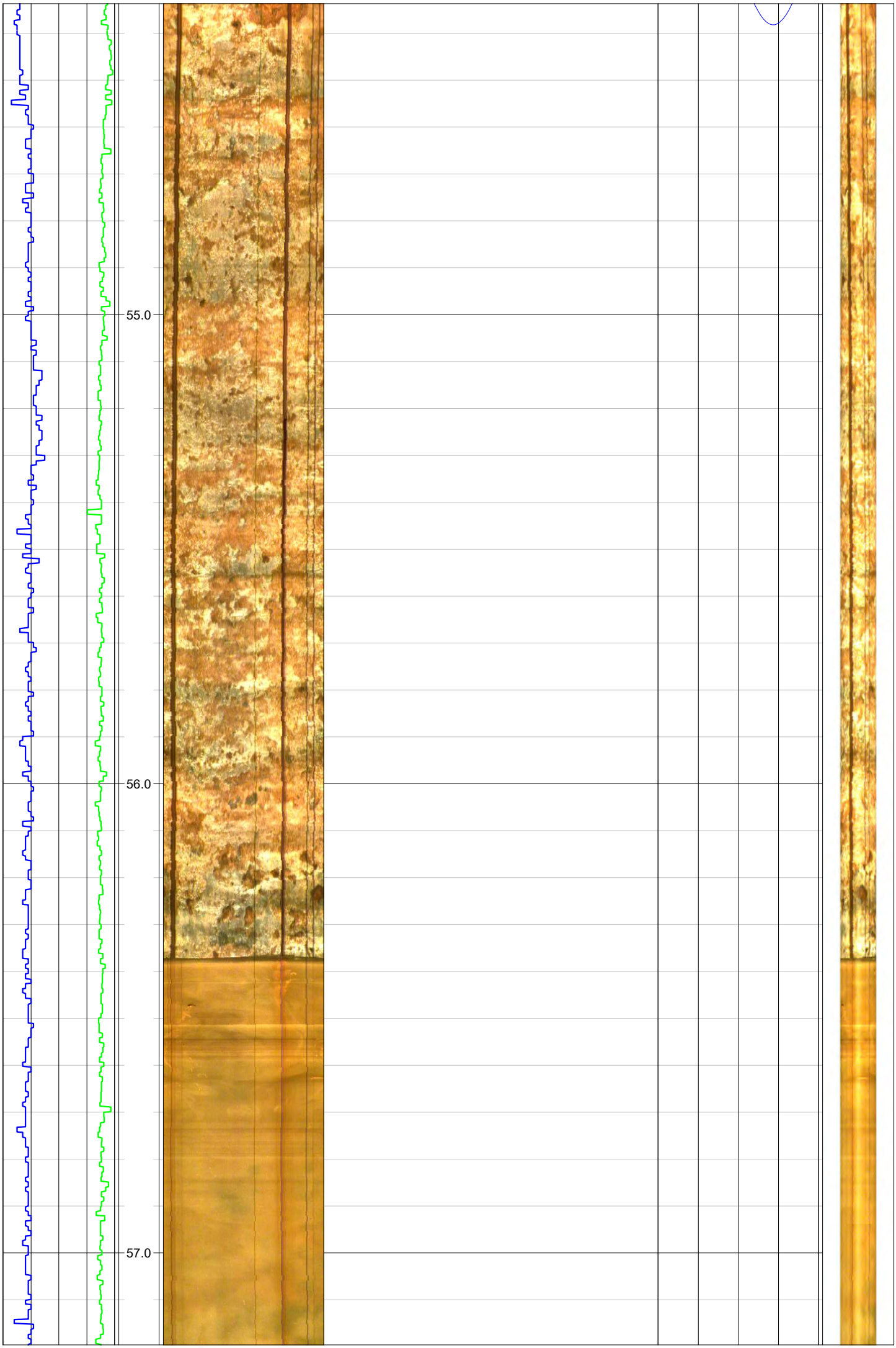
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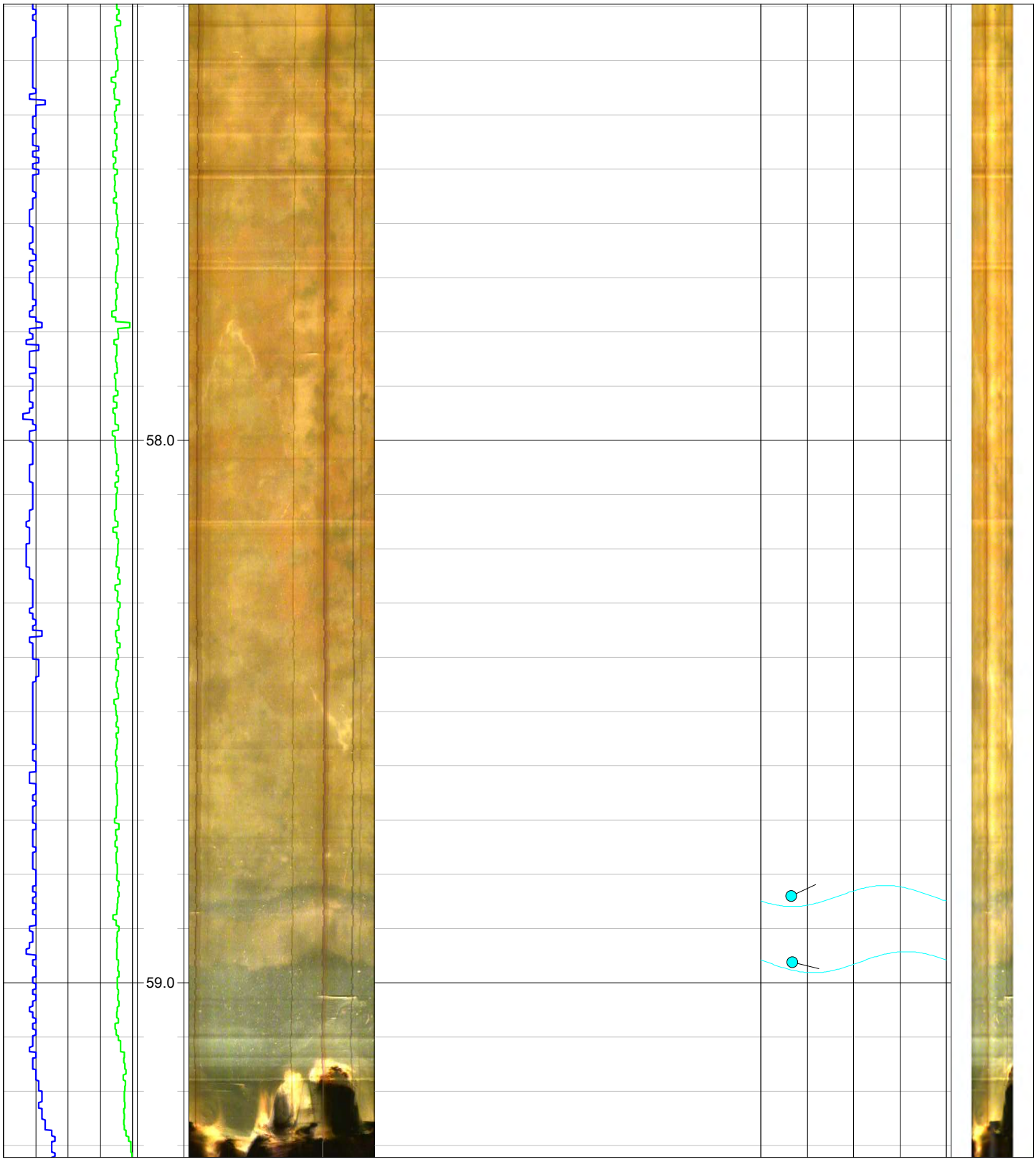

58.0
59.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH304**

Log Type: ***Composite***

Location: **A417, Birdlip** Area: **Crickely Hill** Grid Ref: **393329.2E 216103.9N** Elevation: **233.25m**

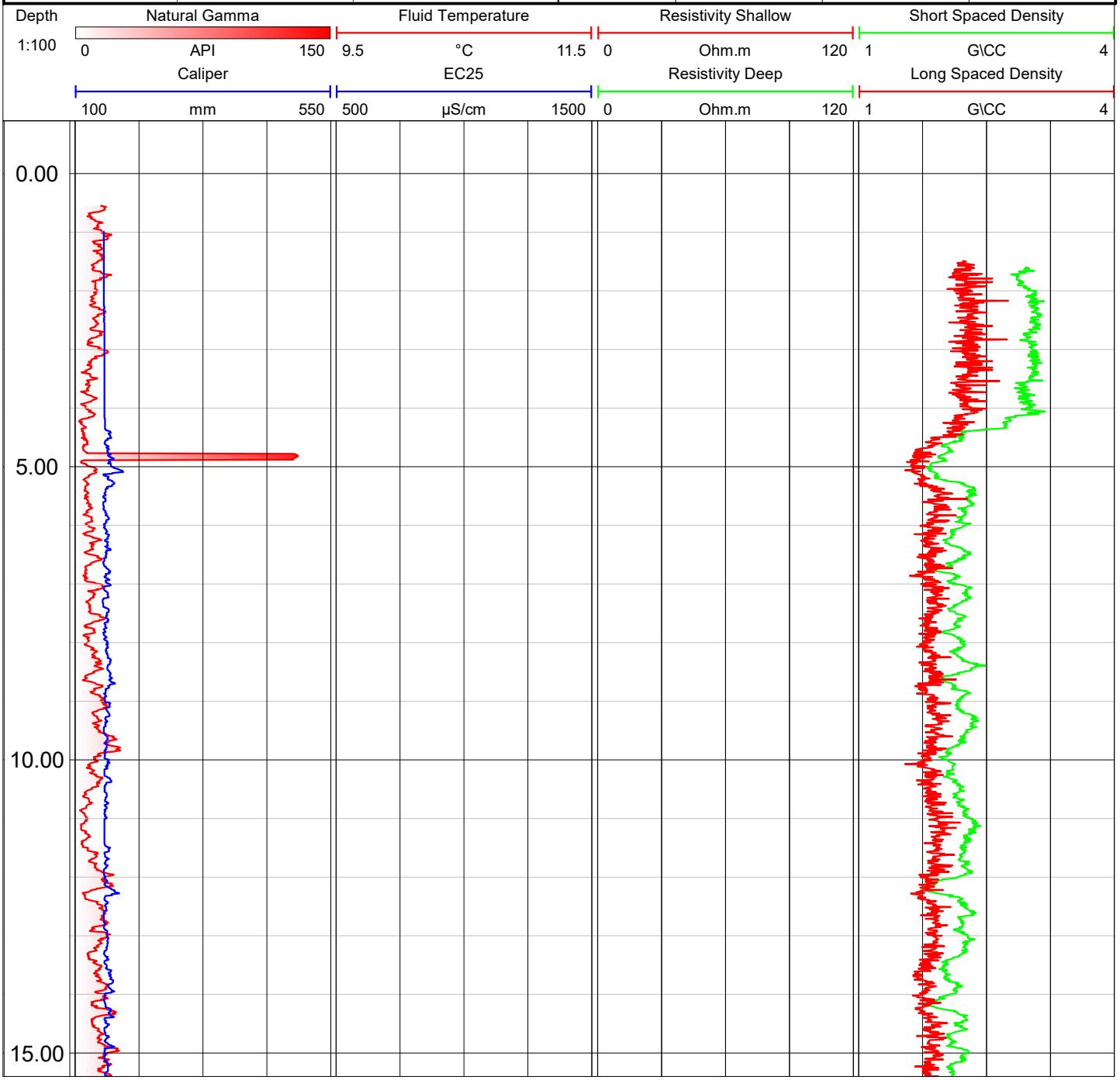
Drilled Depth: (m)	**60.0**	Date:	**18.03.2020**
Logged Depth: (m)	**55.8**	Recorded By:	**Dave Hingley / Charlie Clinton**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0 - 55.8**		
Fluid Level: (m)	**24.8**		

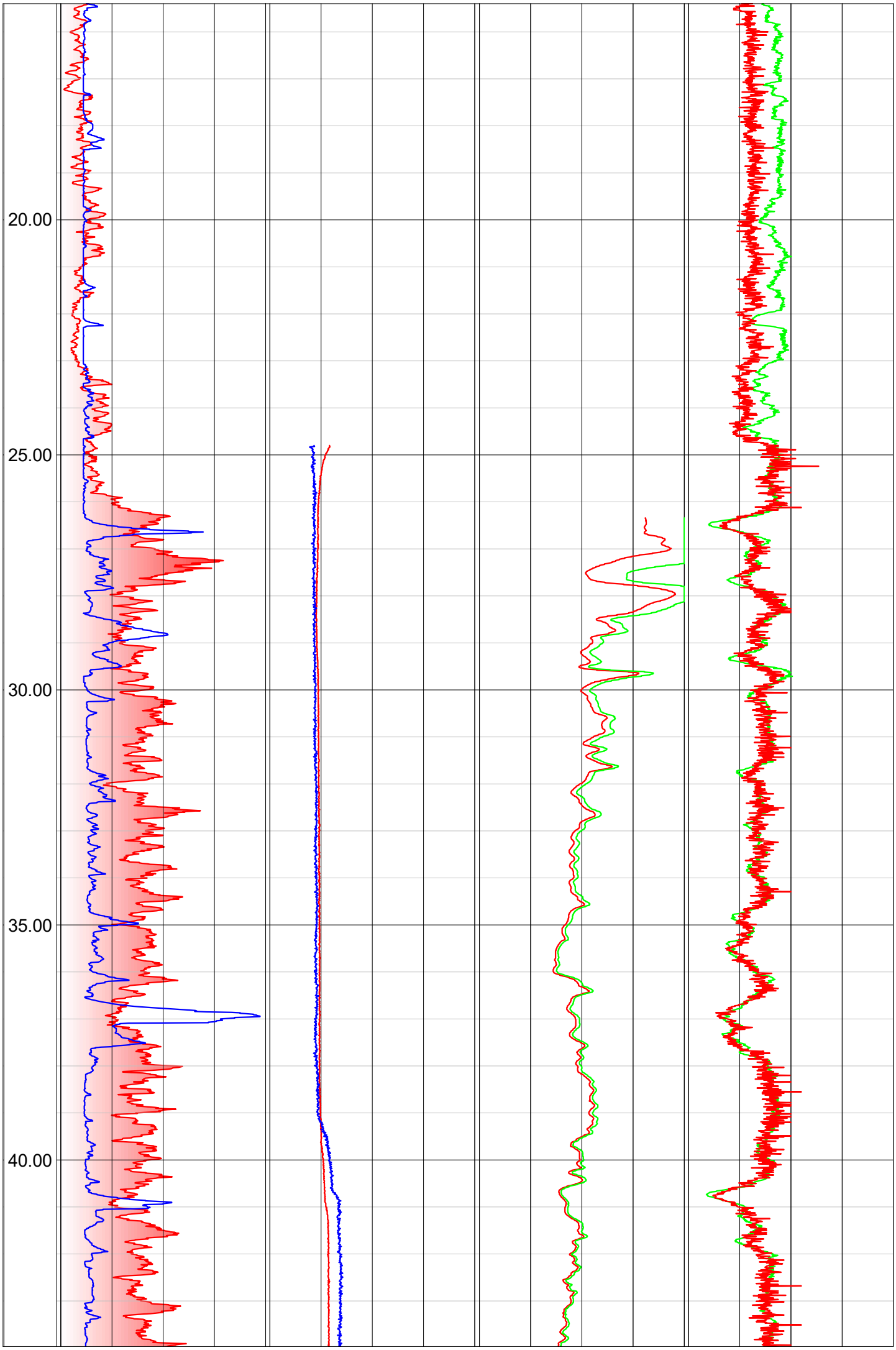
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**148**	**-0.3**	**4.3**

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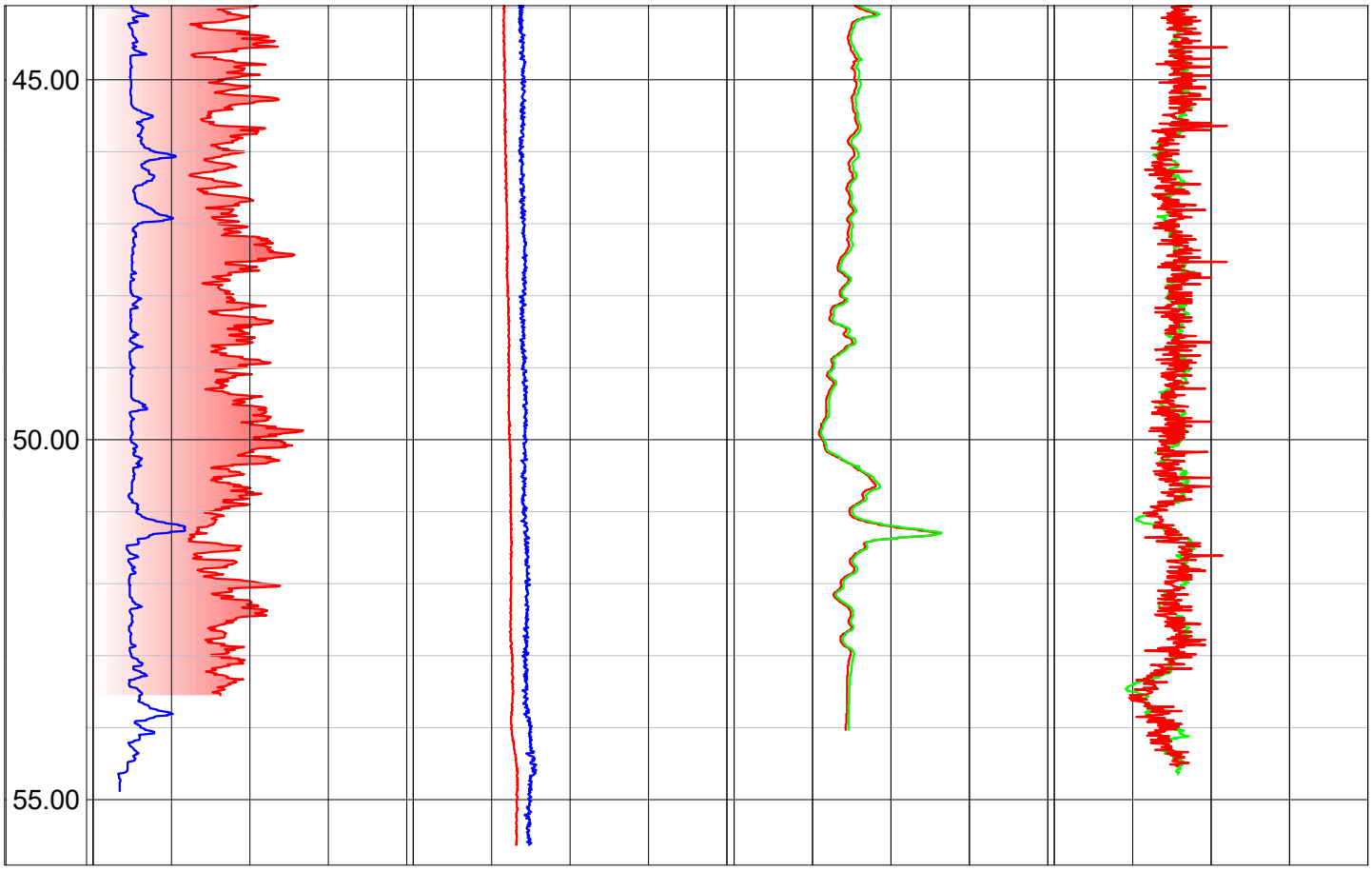
45.00
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55.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH304**

Log Type: ***Image***

Location: **A417, Birdlip** Area: **Crickely Hill** Grid Ref: **393329.2E 216103.9N** Elevation: **233.25m**

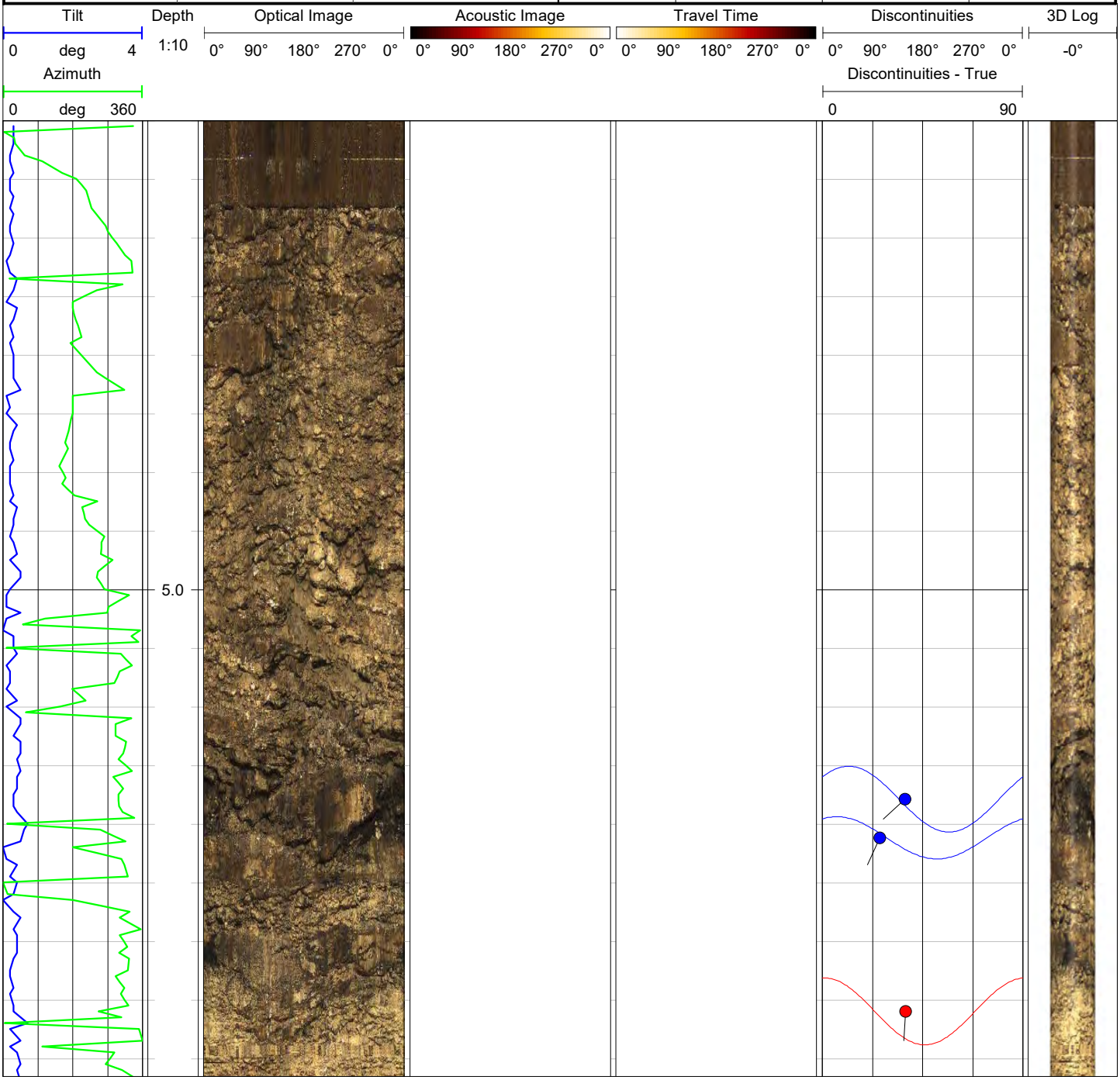
Drilled Depth: (m)	**60.0**	Date:	**18.03.2020**
Logged Depth: (m)	**56.0**	Recorded By:	**Dave Hingley / Charlie Clinton**
Logging Datum:	**Ground Level**	Remarks:	Optical image stopped logging at 27.3m due to poor water clarity
Logged Interval: (m)	**4.3 - 56.0**		
Fluid Level: (m)	**24.8**		

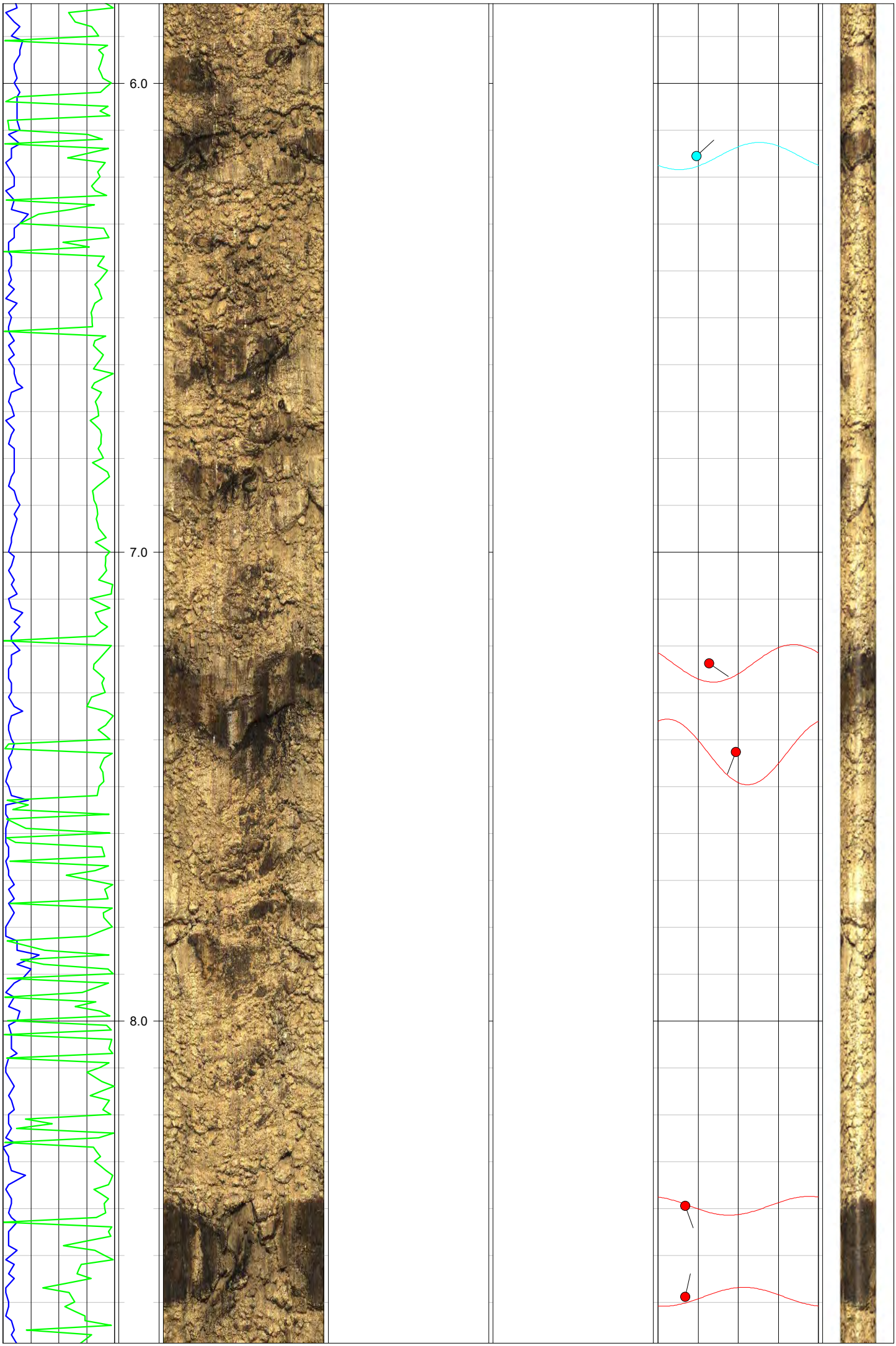
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**148**	**-0.3**	**4.3**

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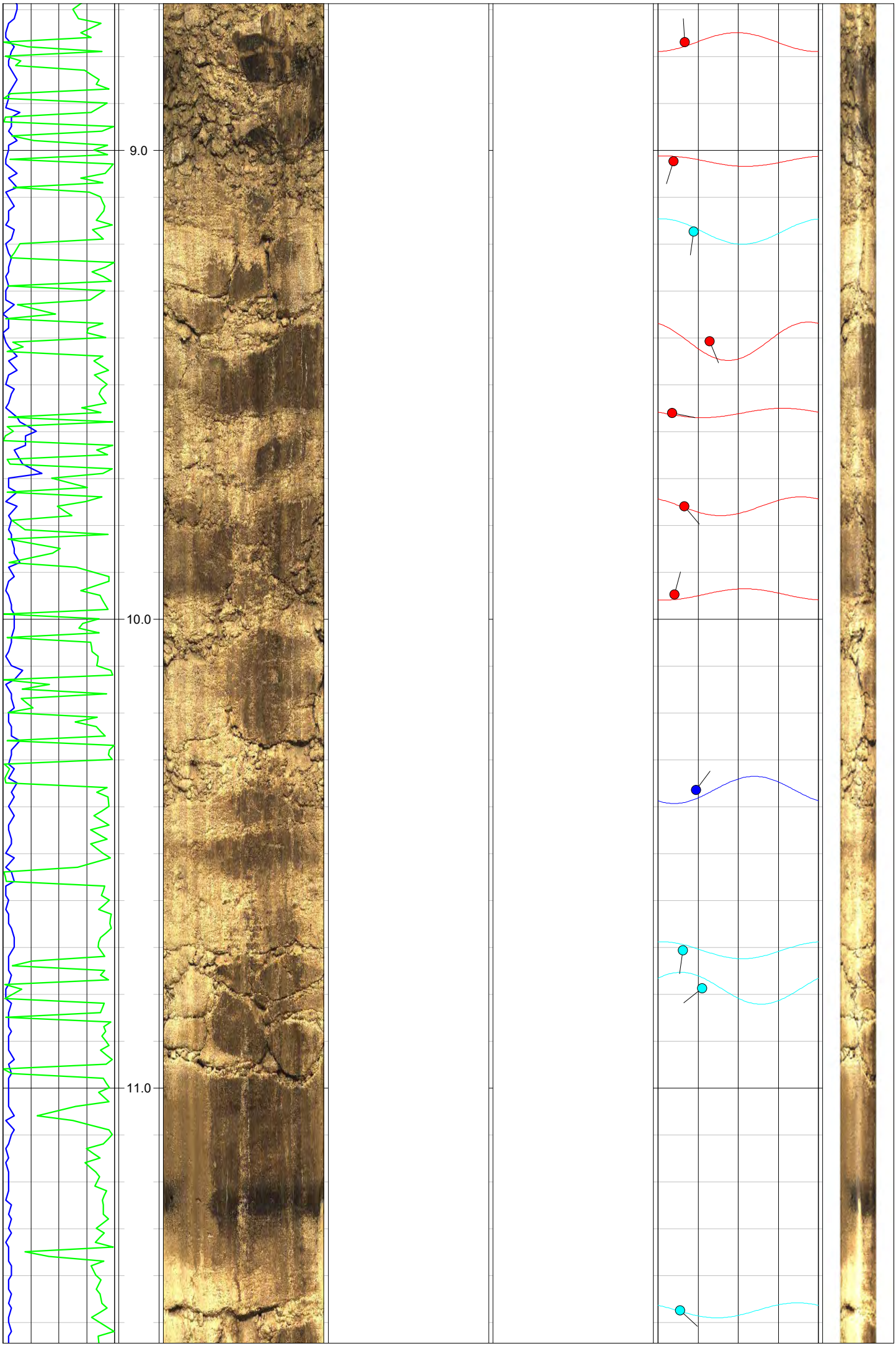
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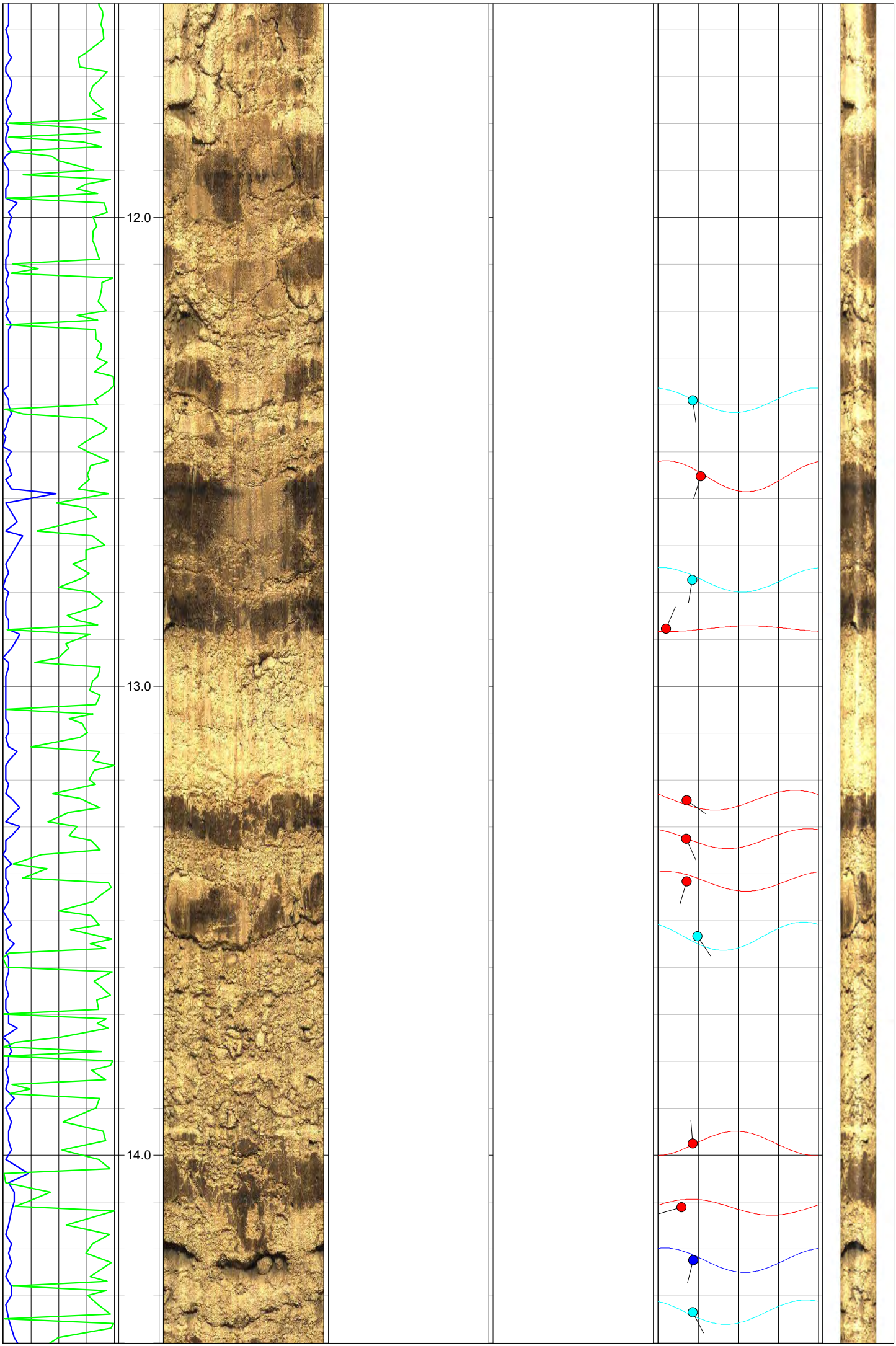
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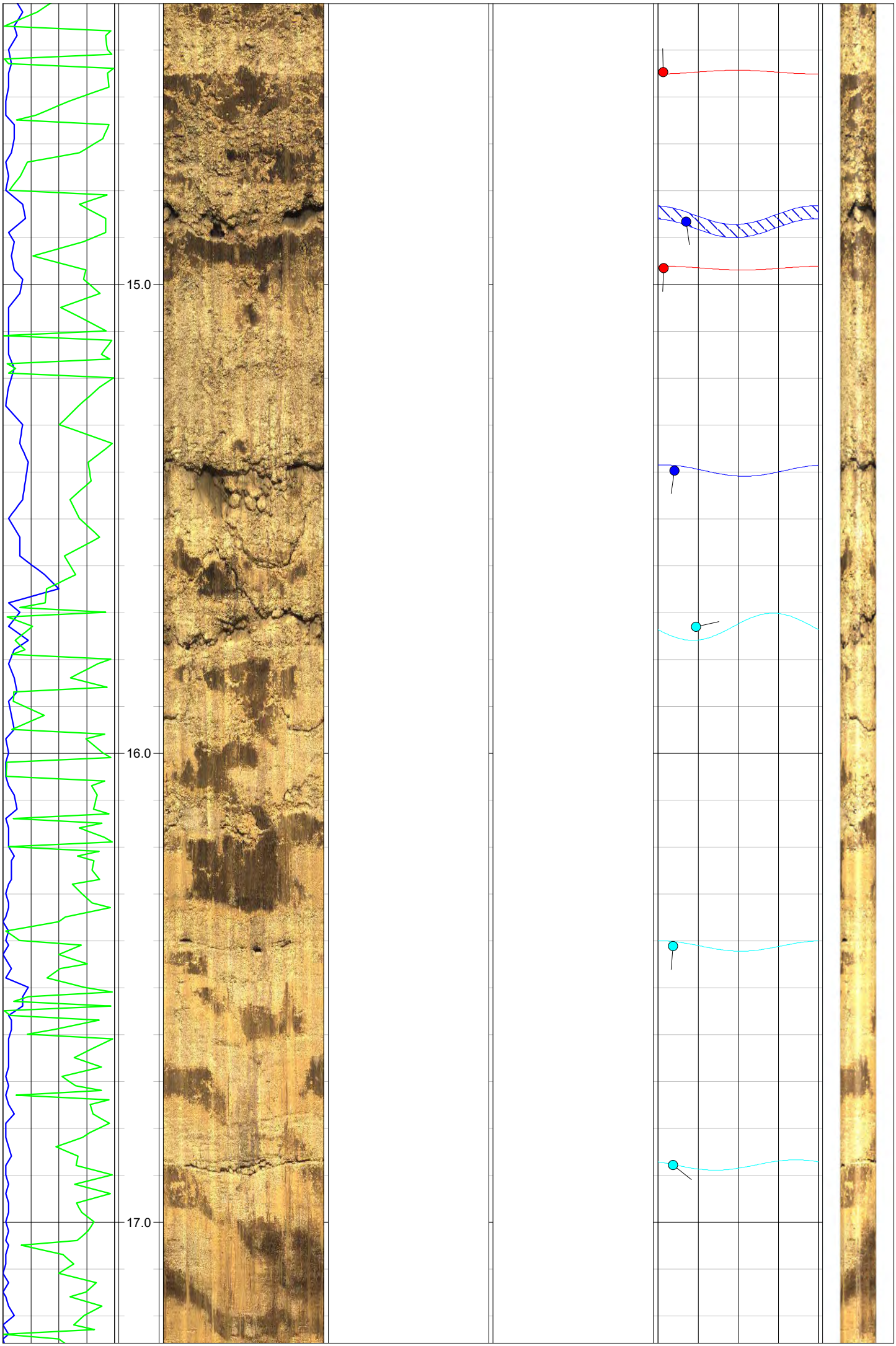
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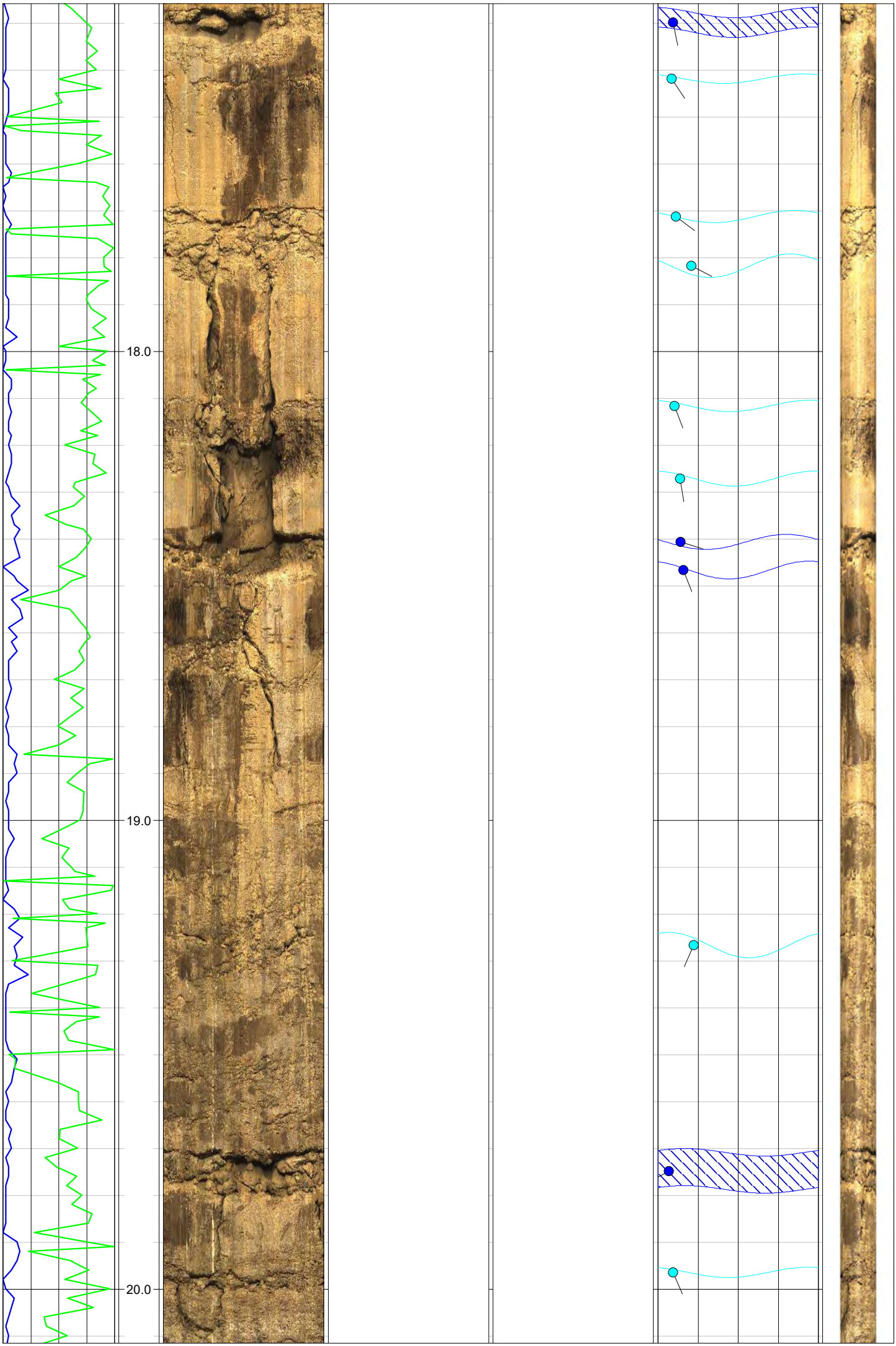
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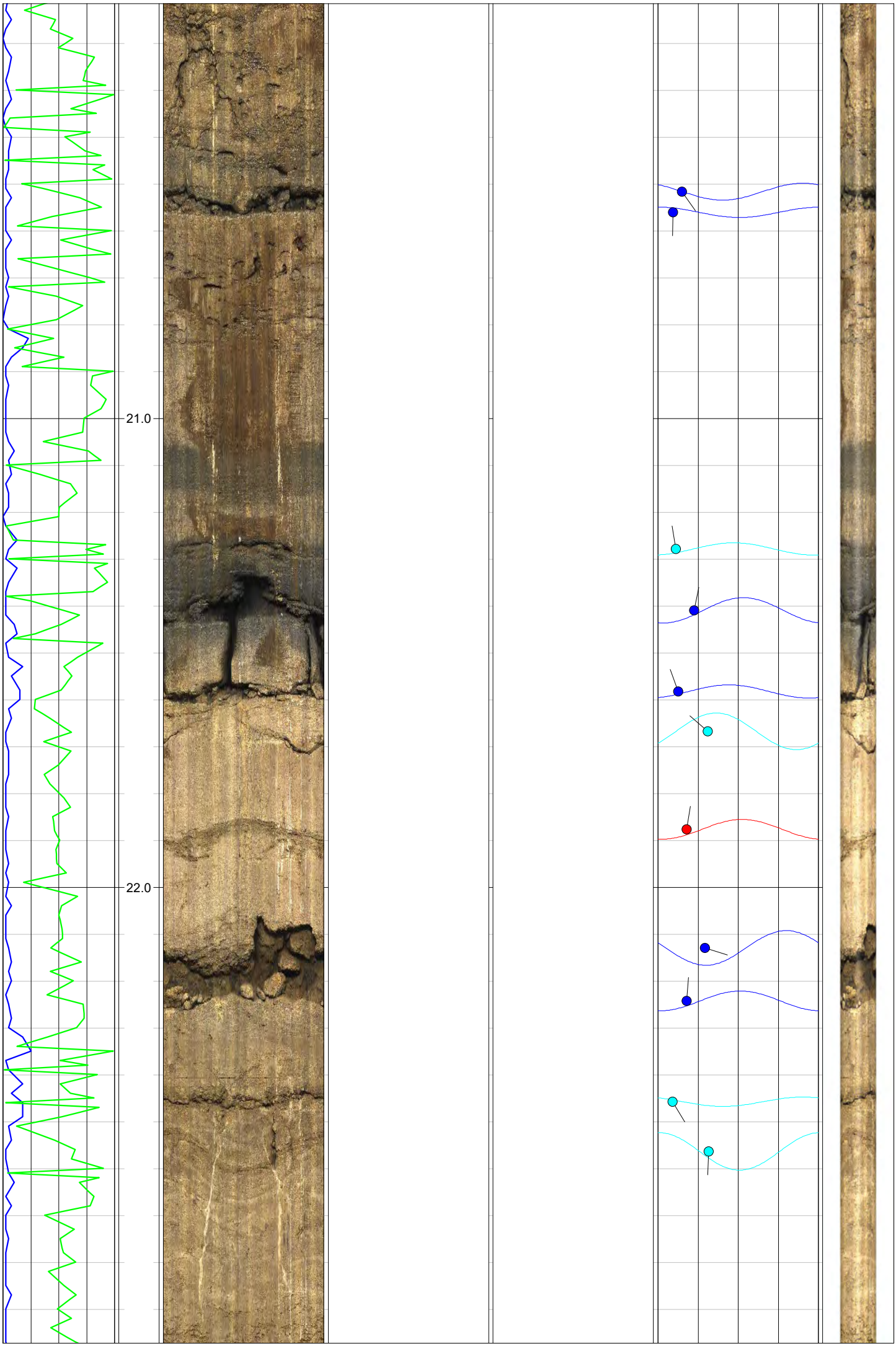
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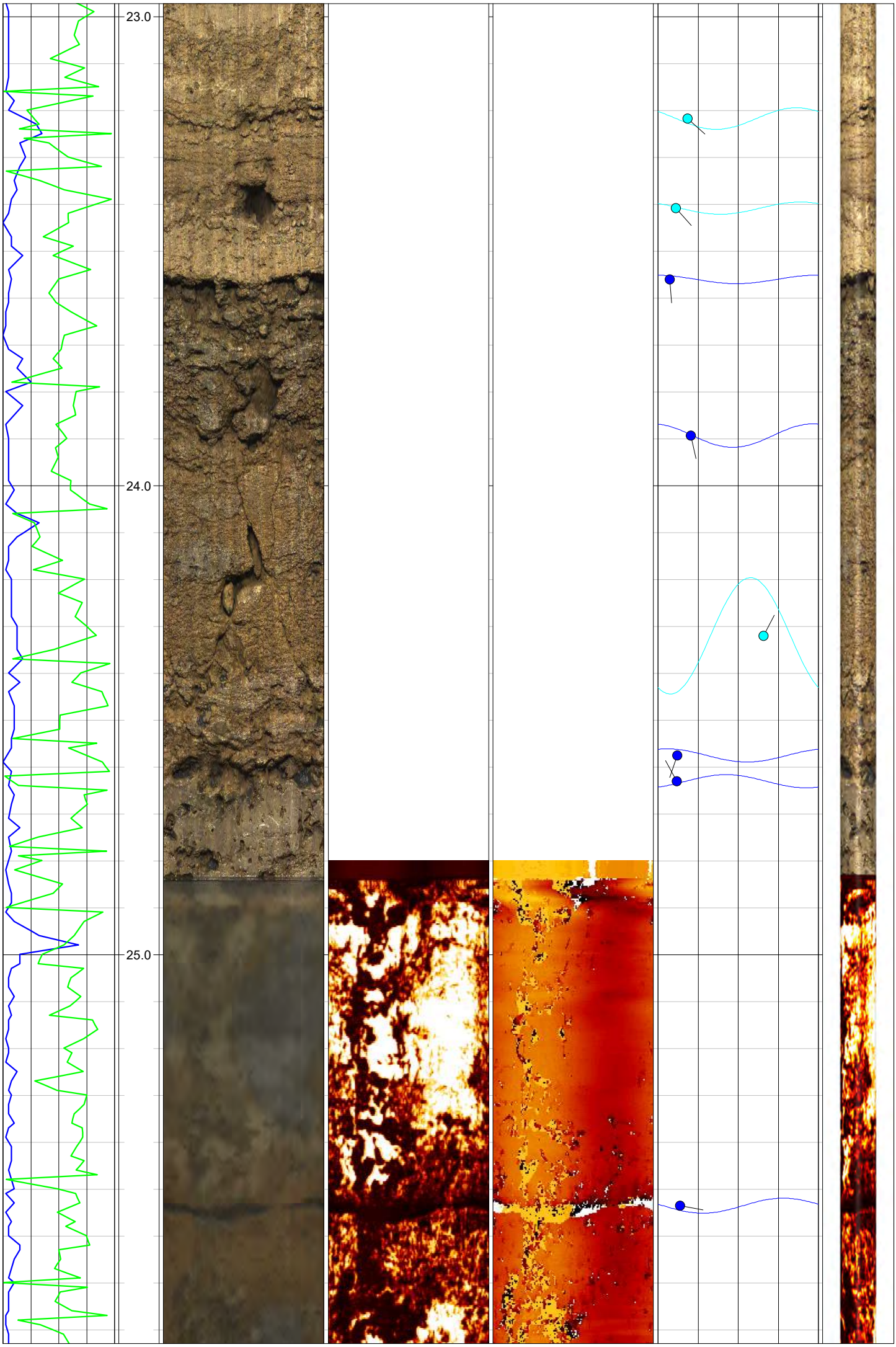
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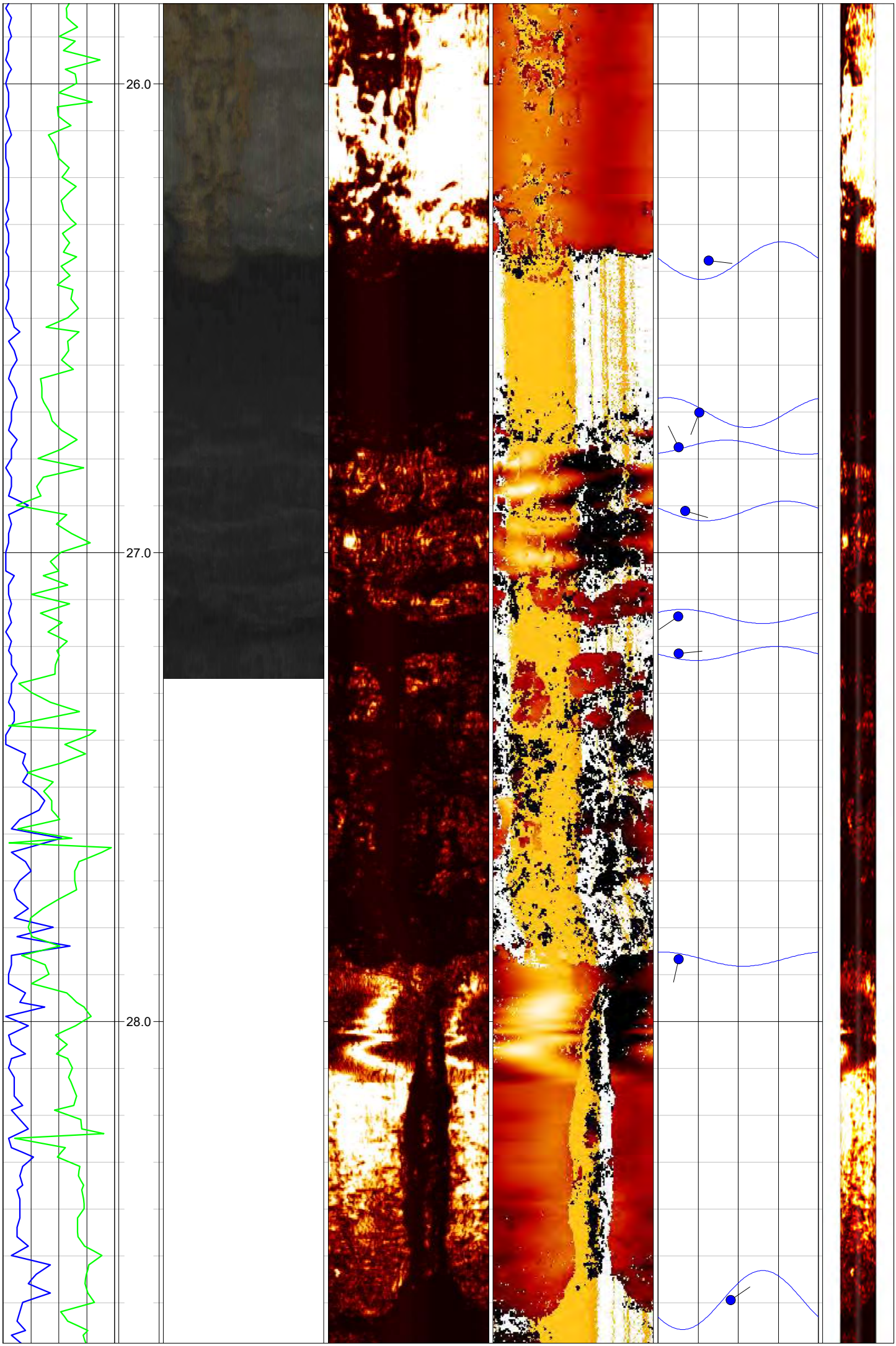
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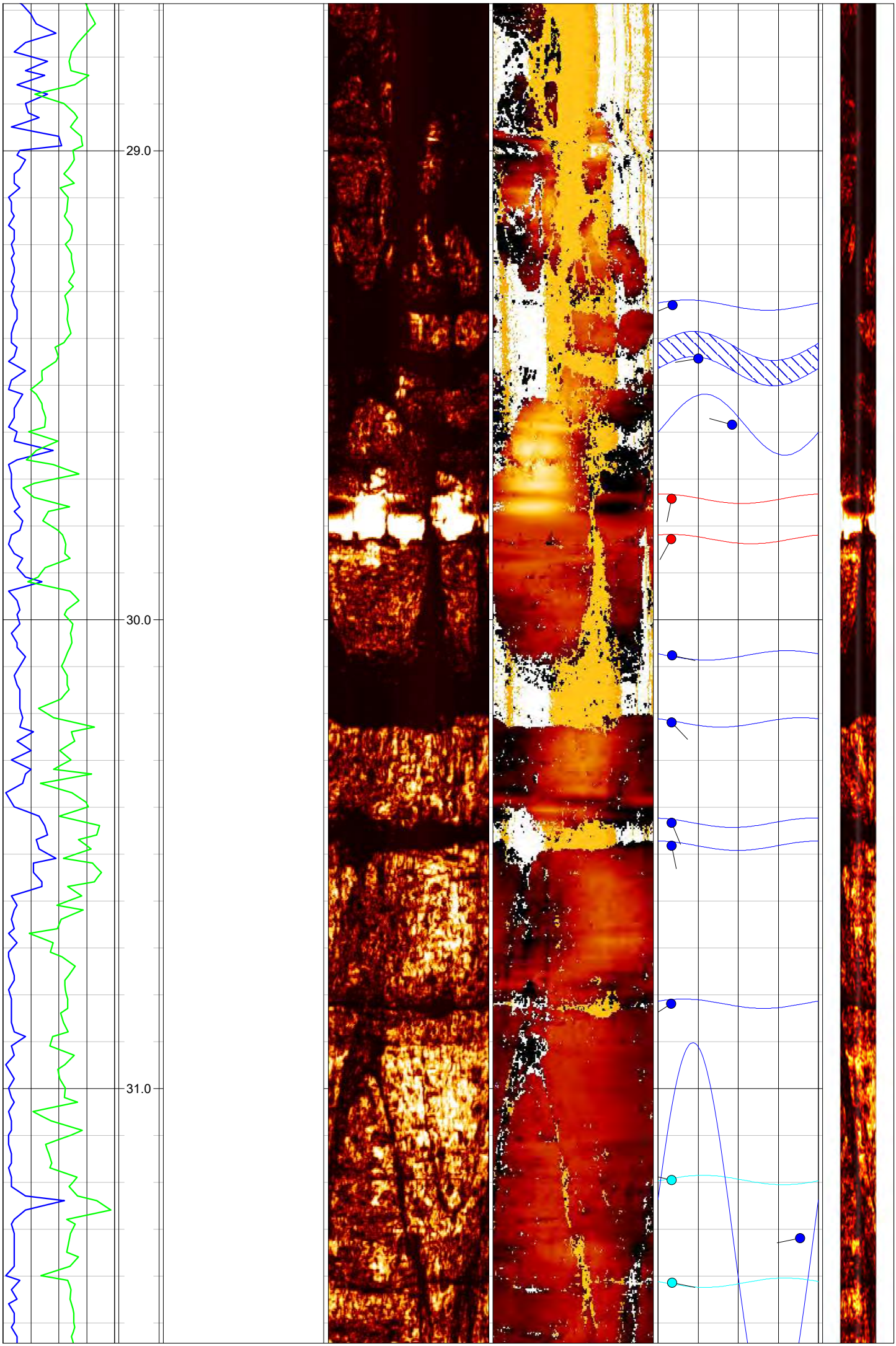
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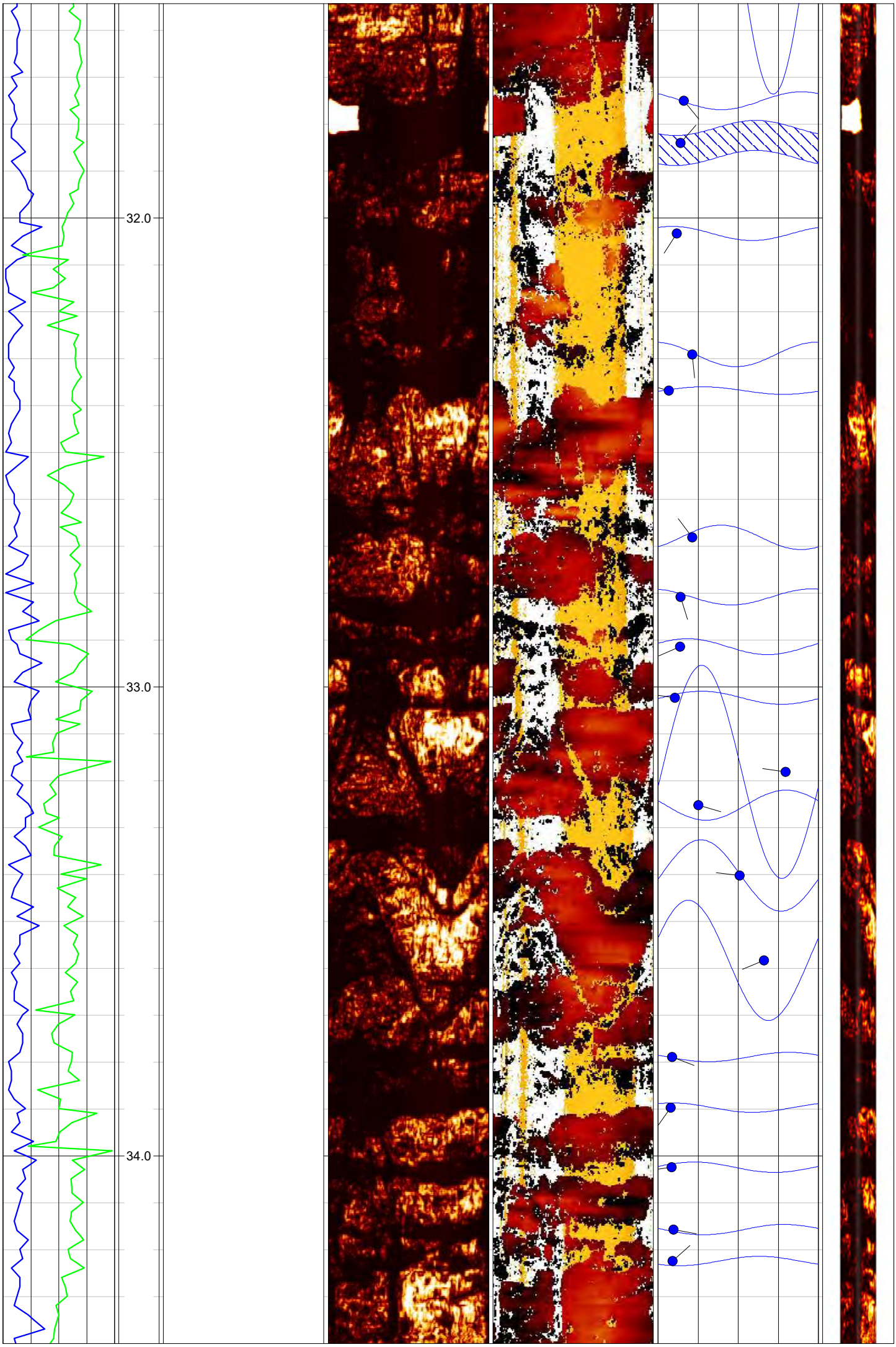
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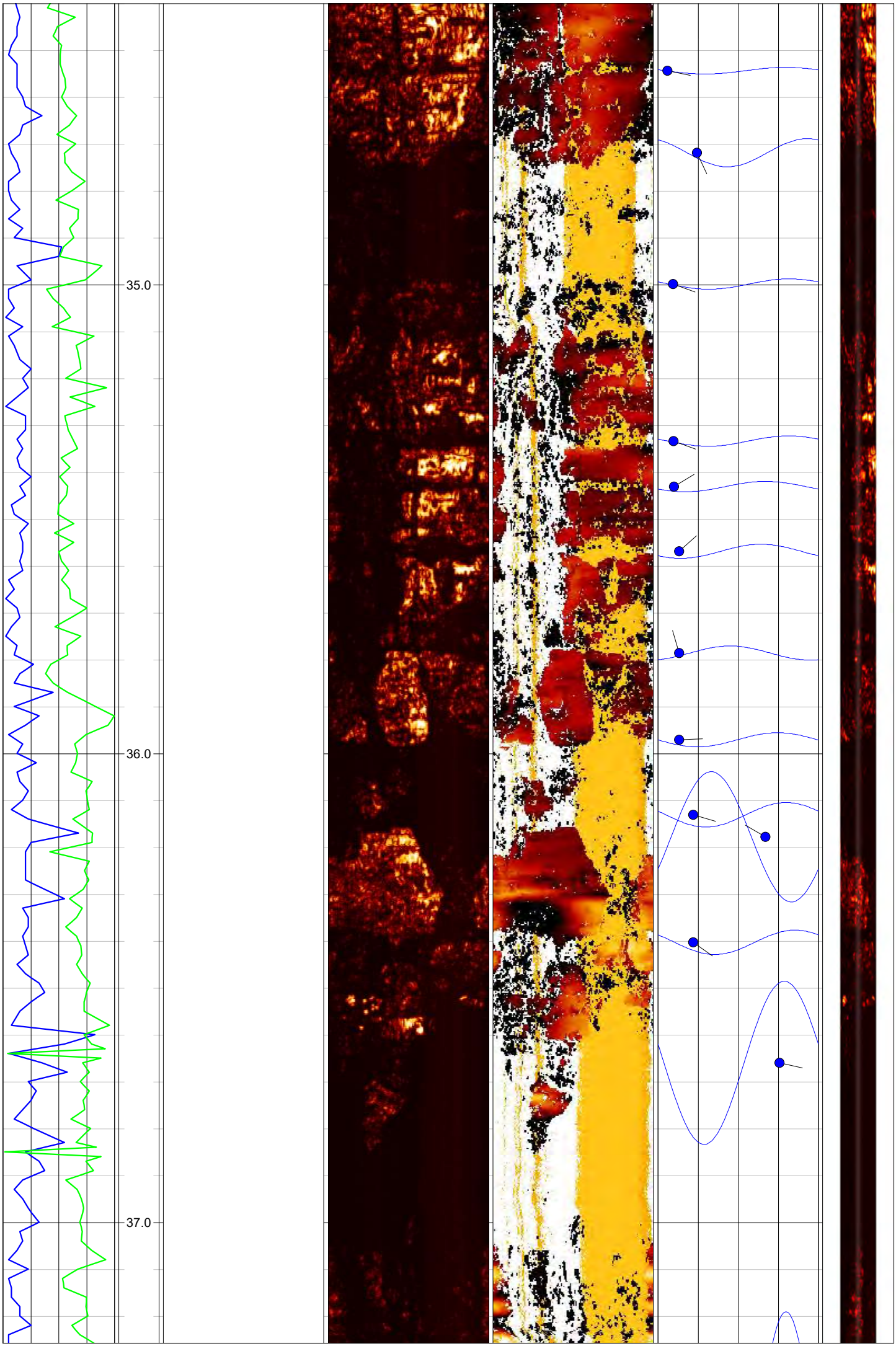
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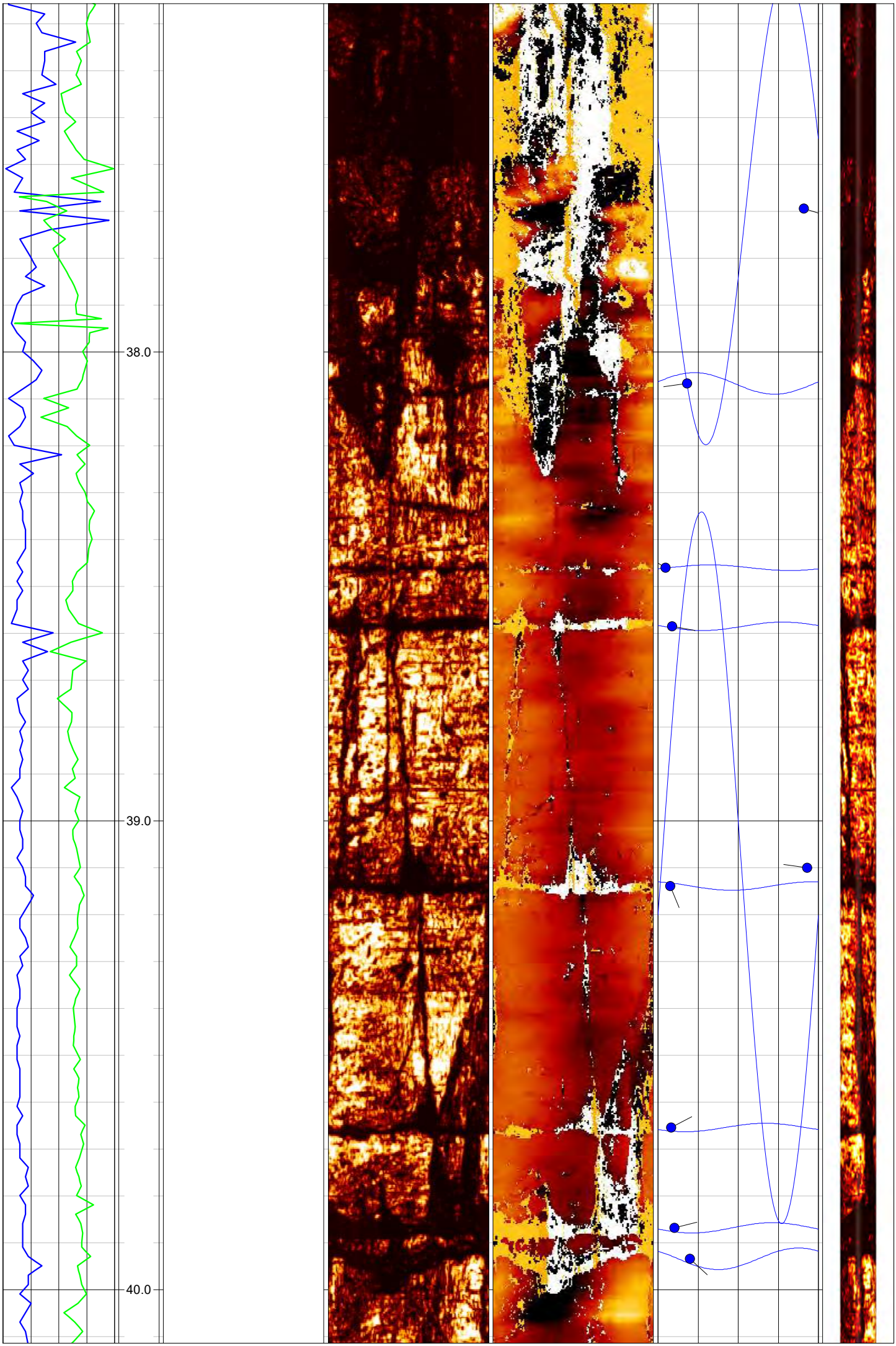
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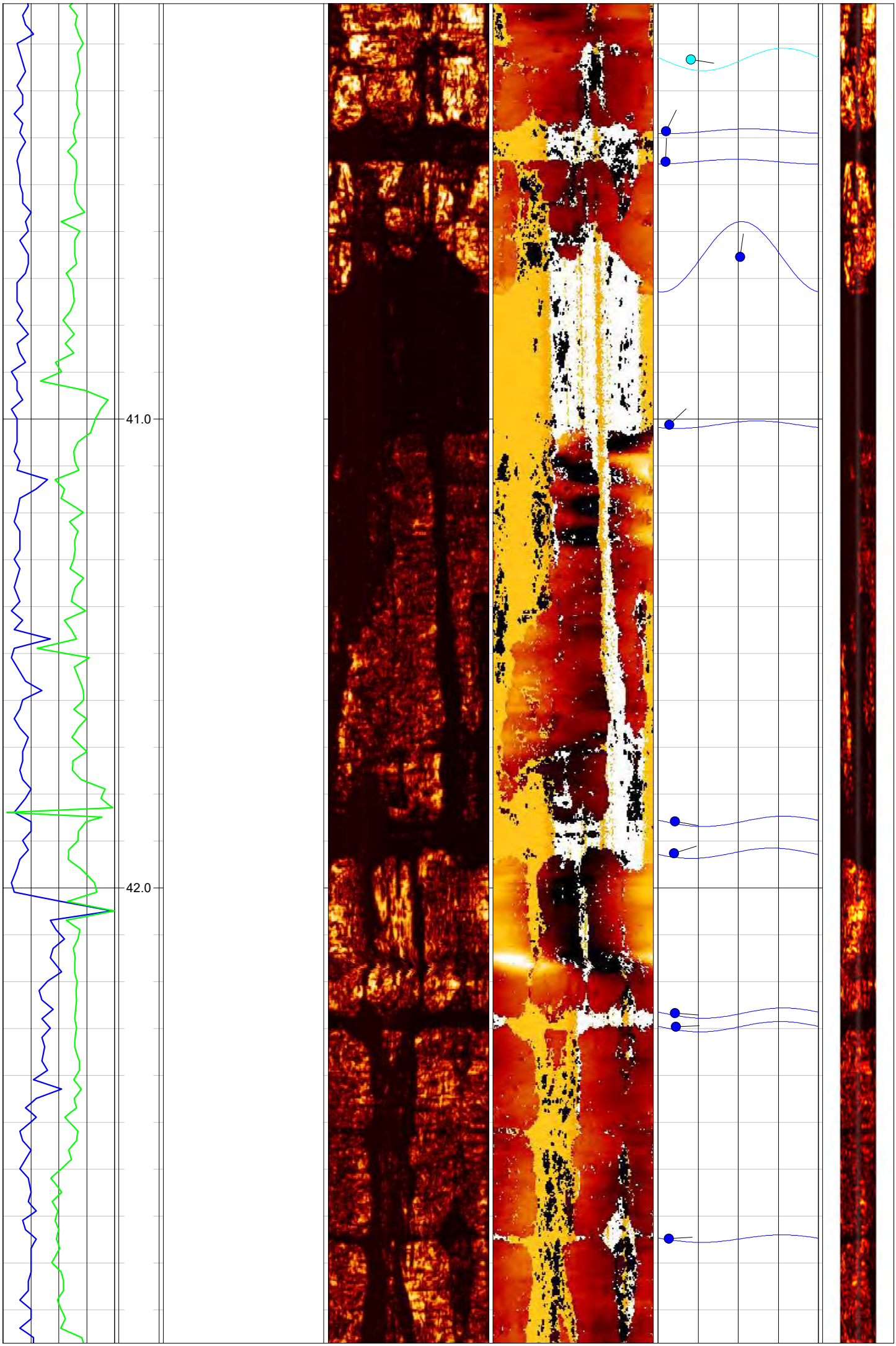
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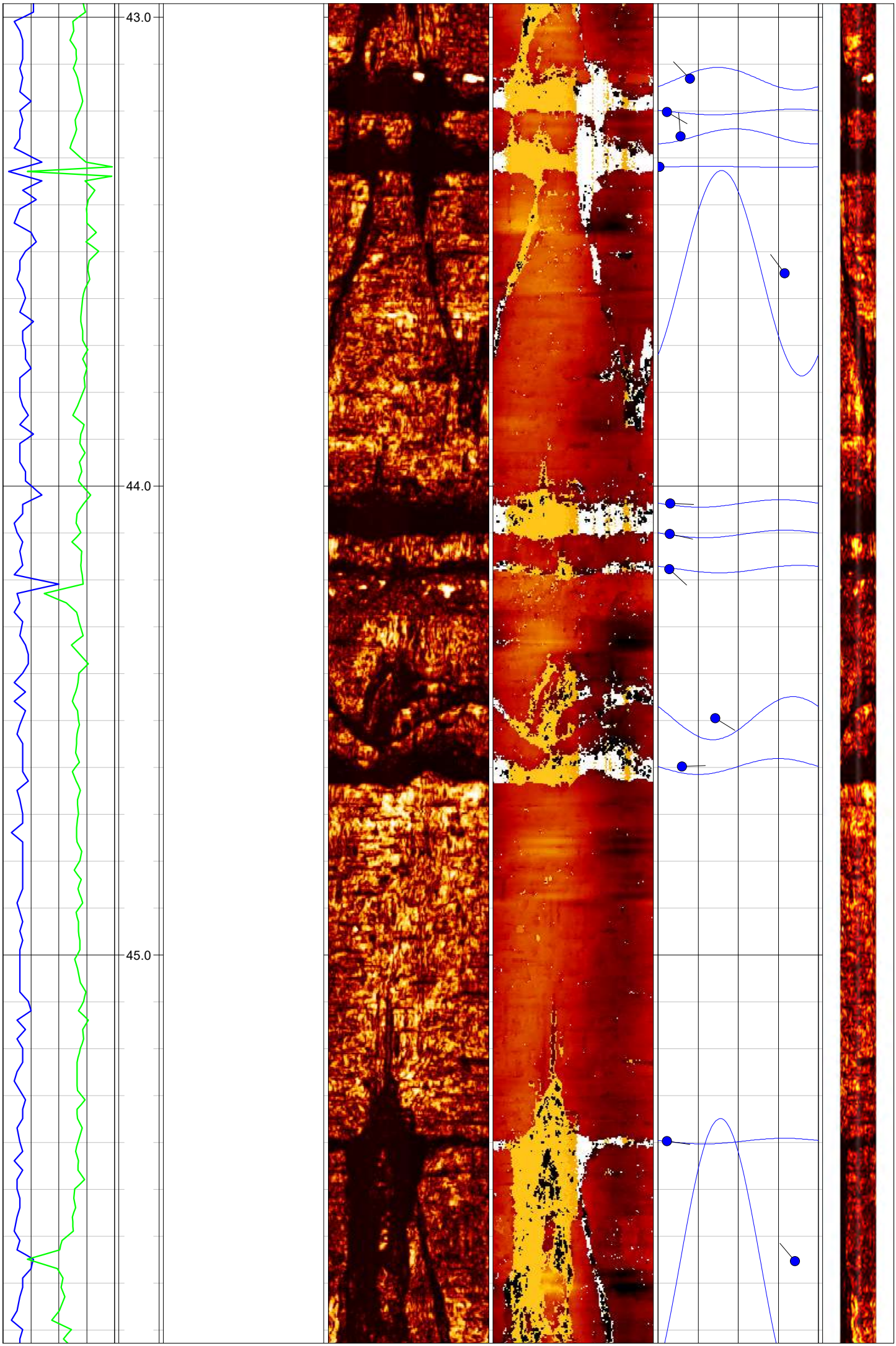
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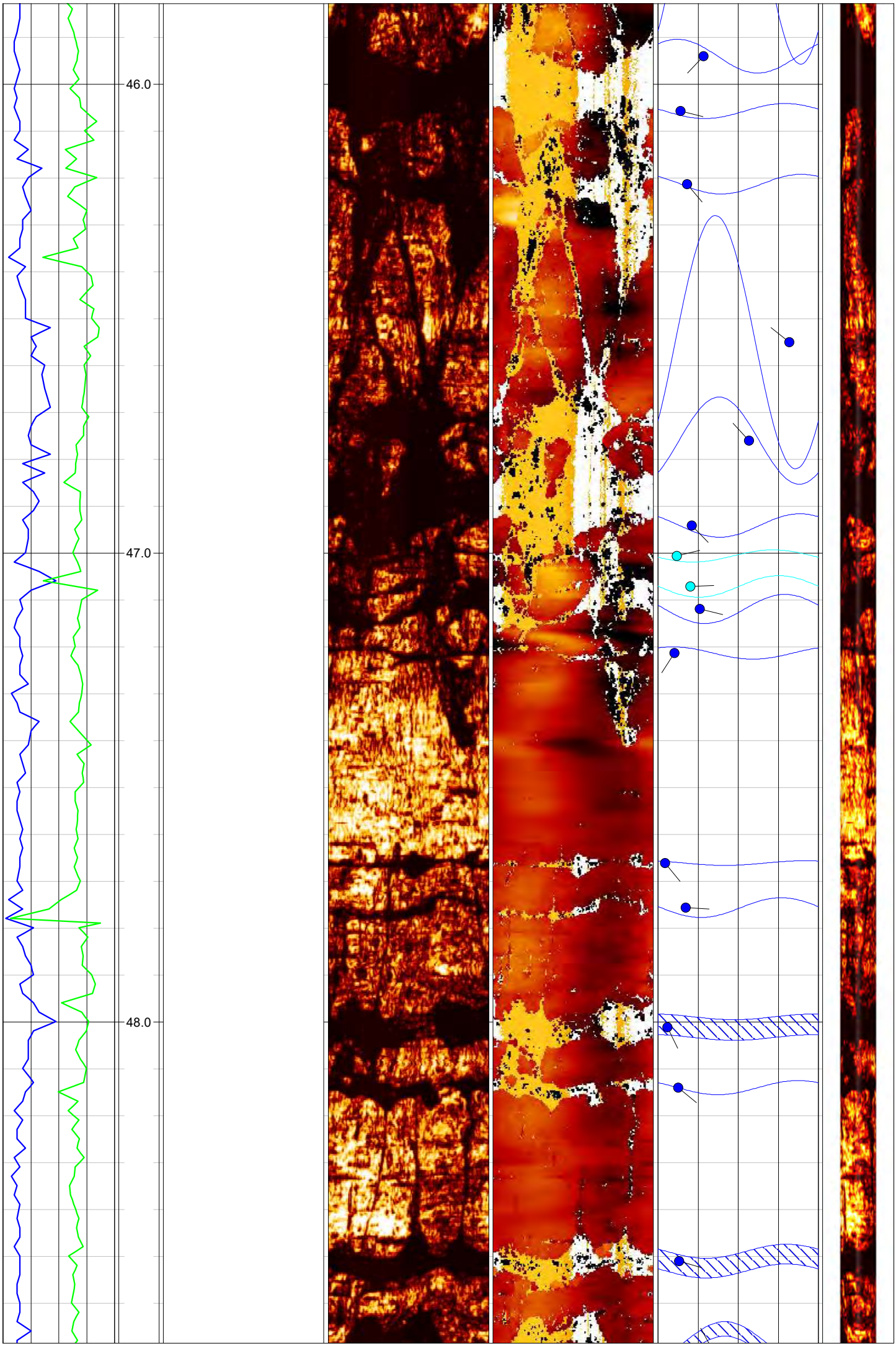
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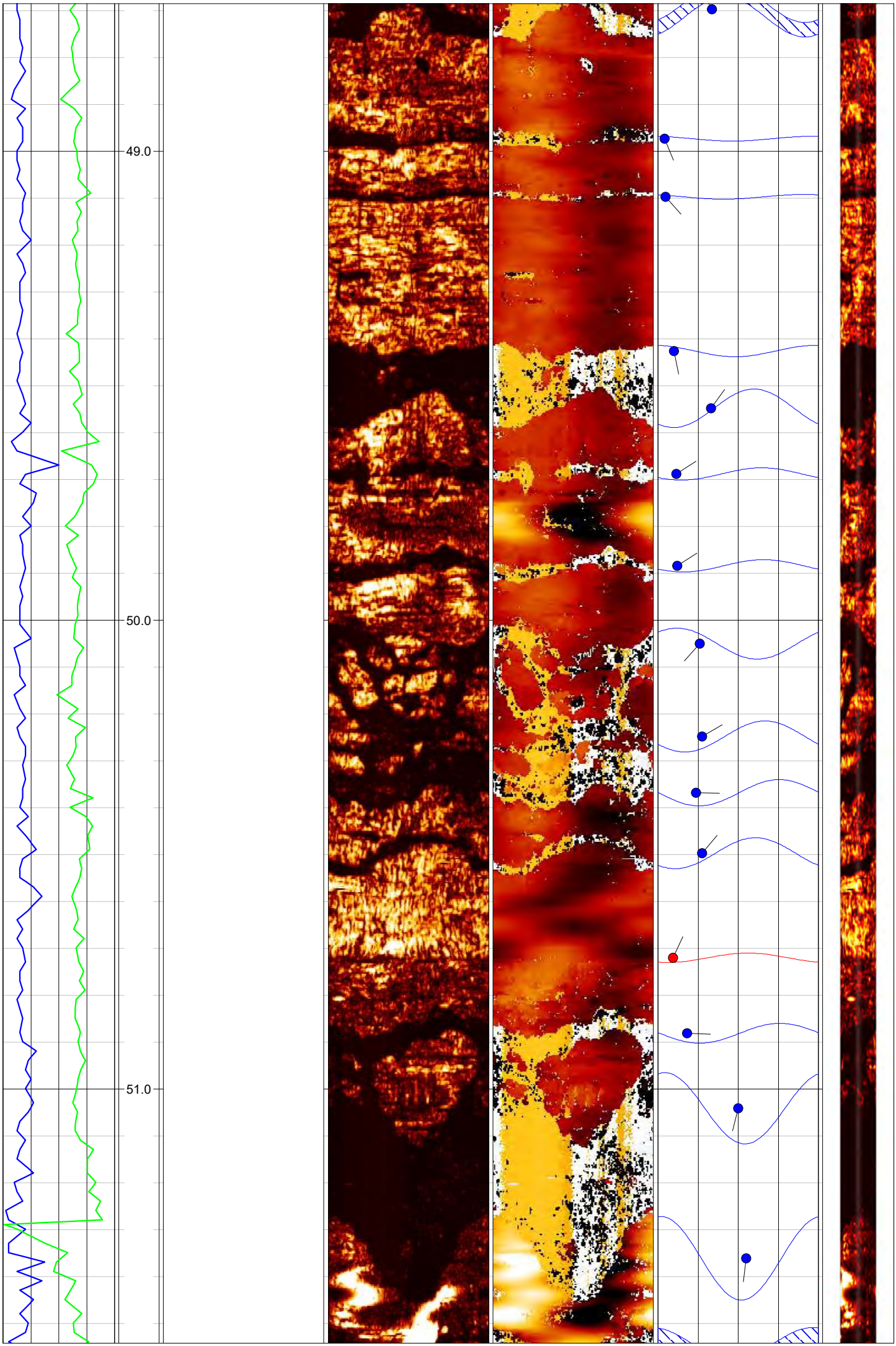
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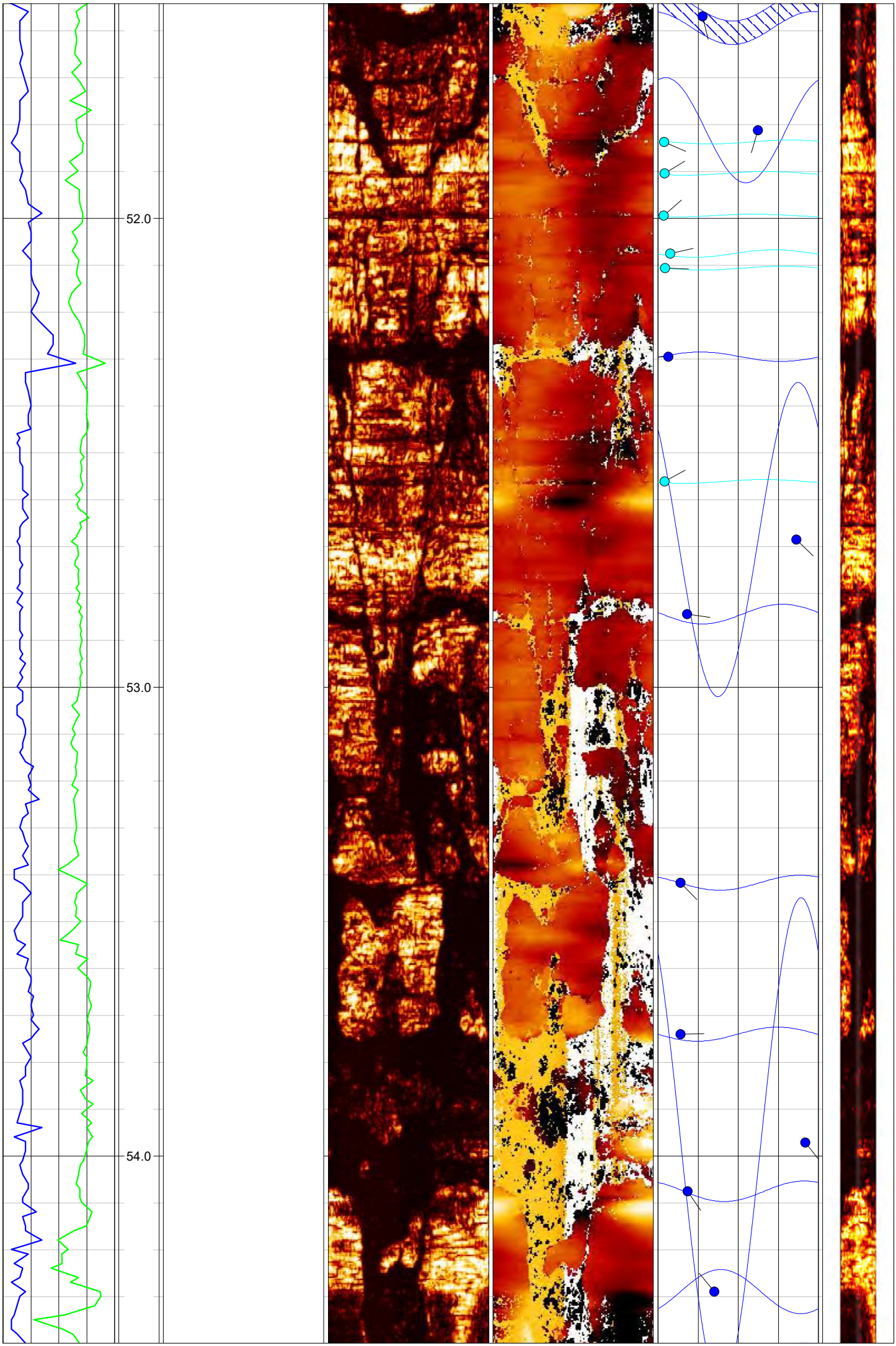
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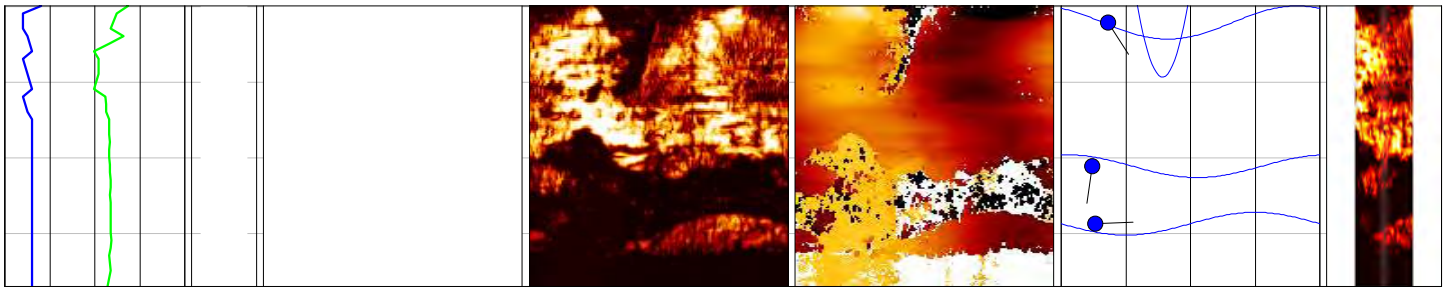


EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH400**

Log Type: ***Composite***

Location: **A417, Birdlip** Area: **Gloucestershire** Grid Ref: **394666.1E 213848.1N** Elevation: **267.95m**

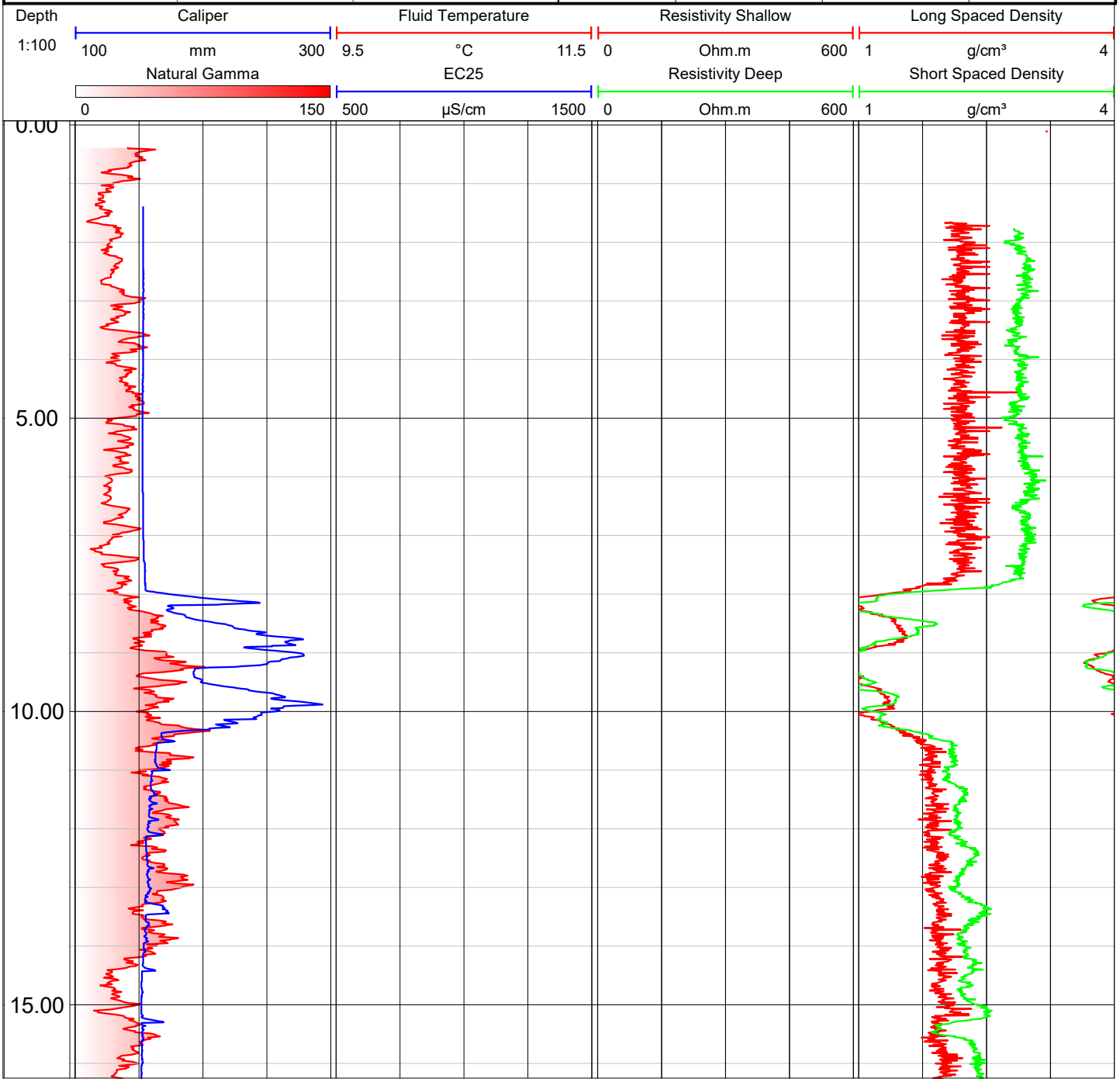
Drilled Depth: (m)	**90.0**	Date:	**14.10.2019**
Logged Depth: (m)	**86.5**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole fluid cloudy. High volume of sediment in suspention meant no fluid flow log possible.
Logged Interval: (m)	**1.0 - 86.5**		
Fluid Level: (m)	**70.8**		

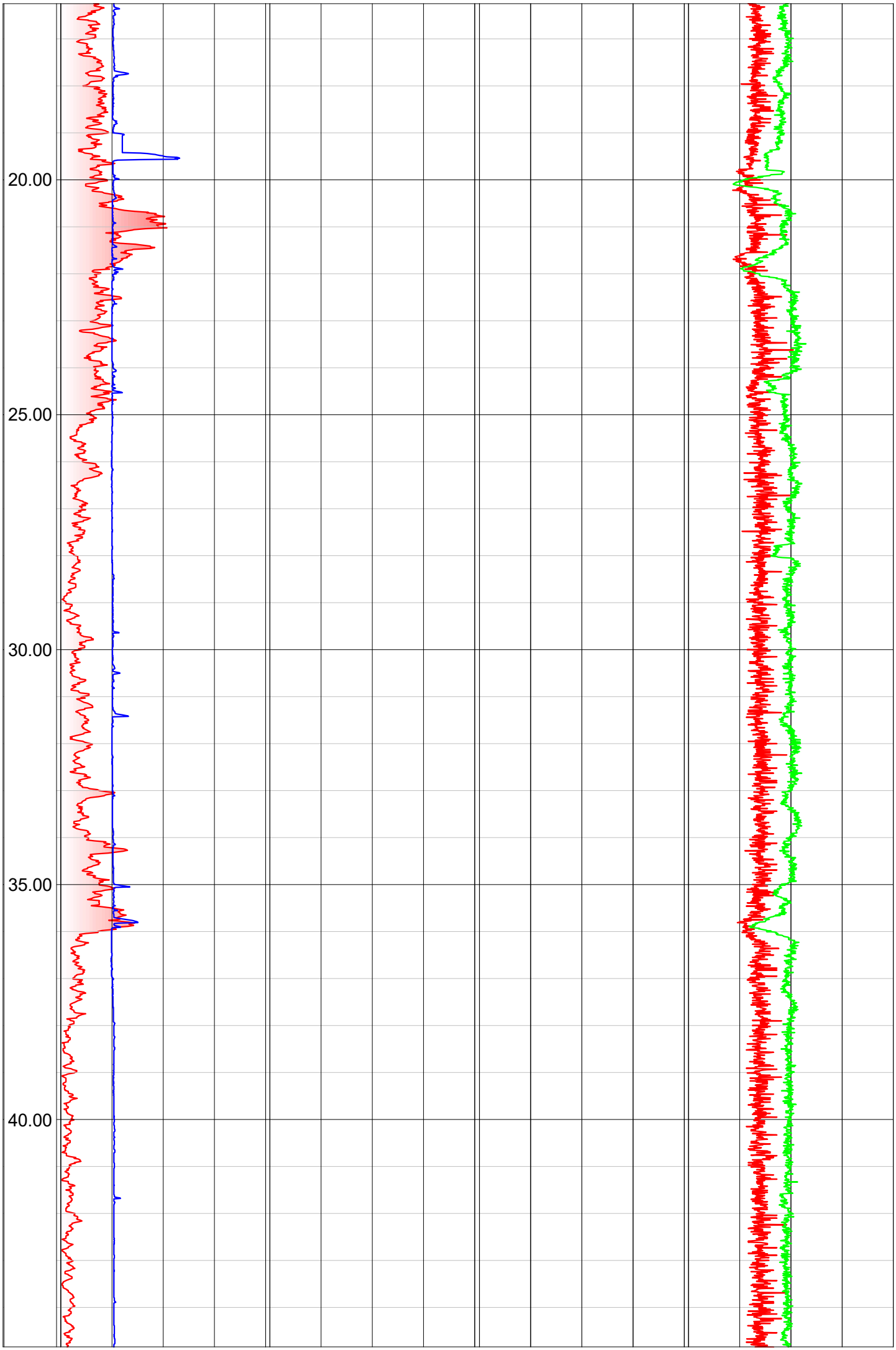
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**8.1**	**90.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**8.1**

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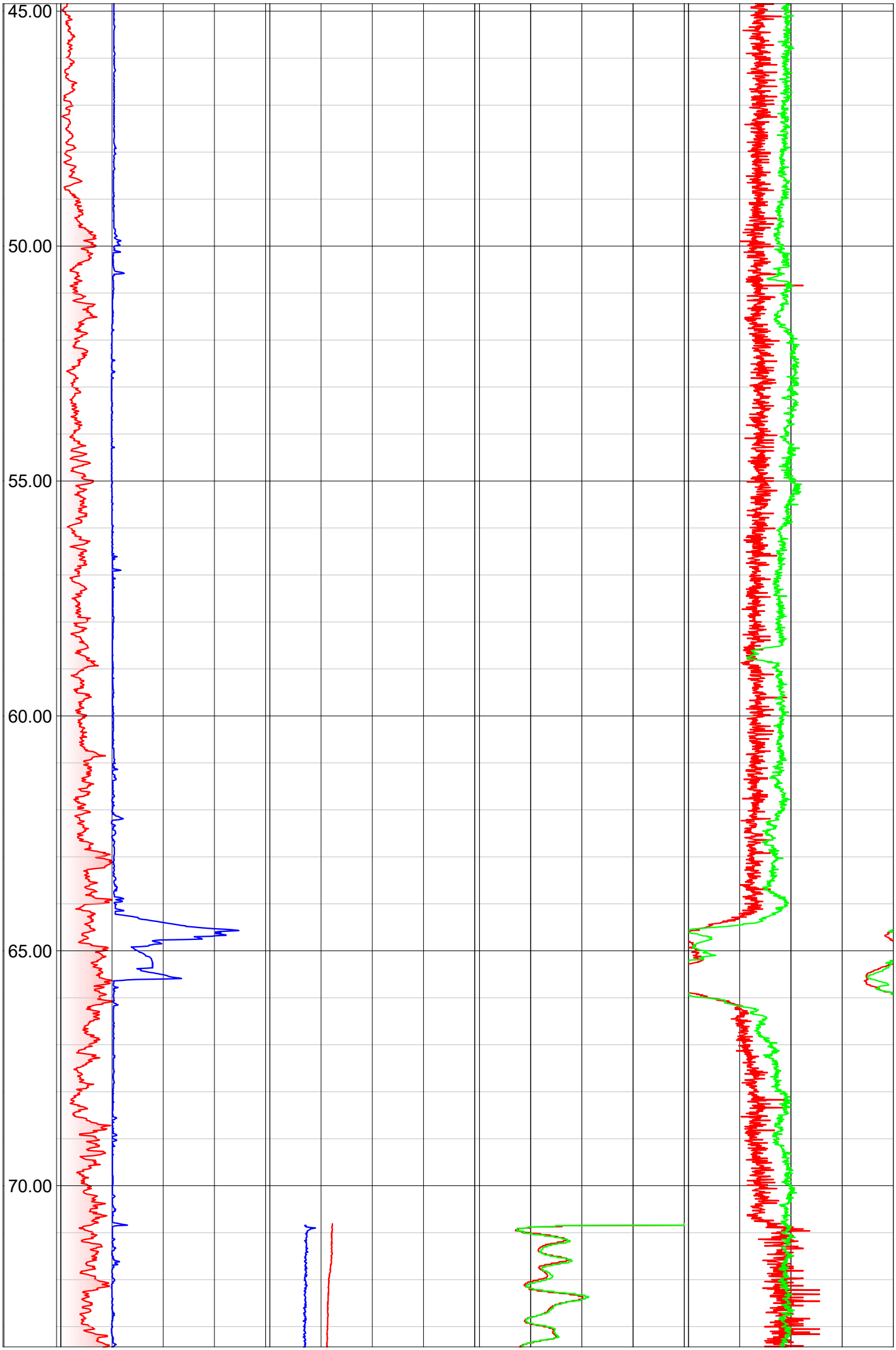
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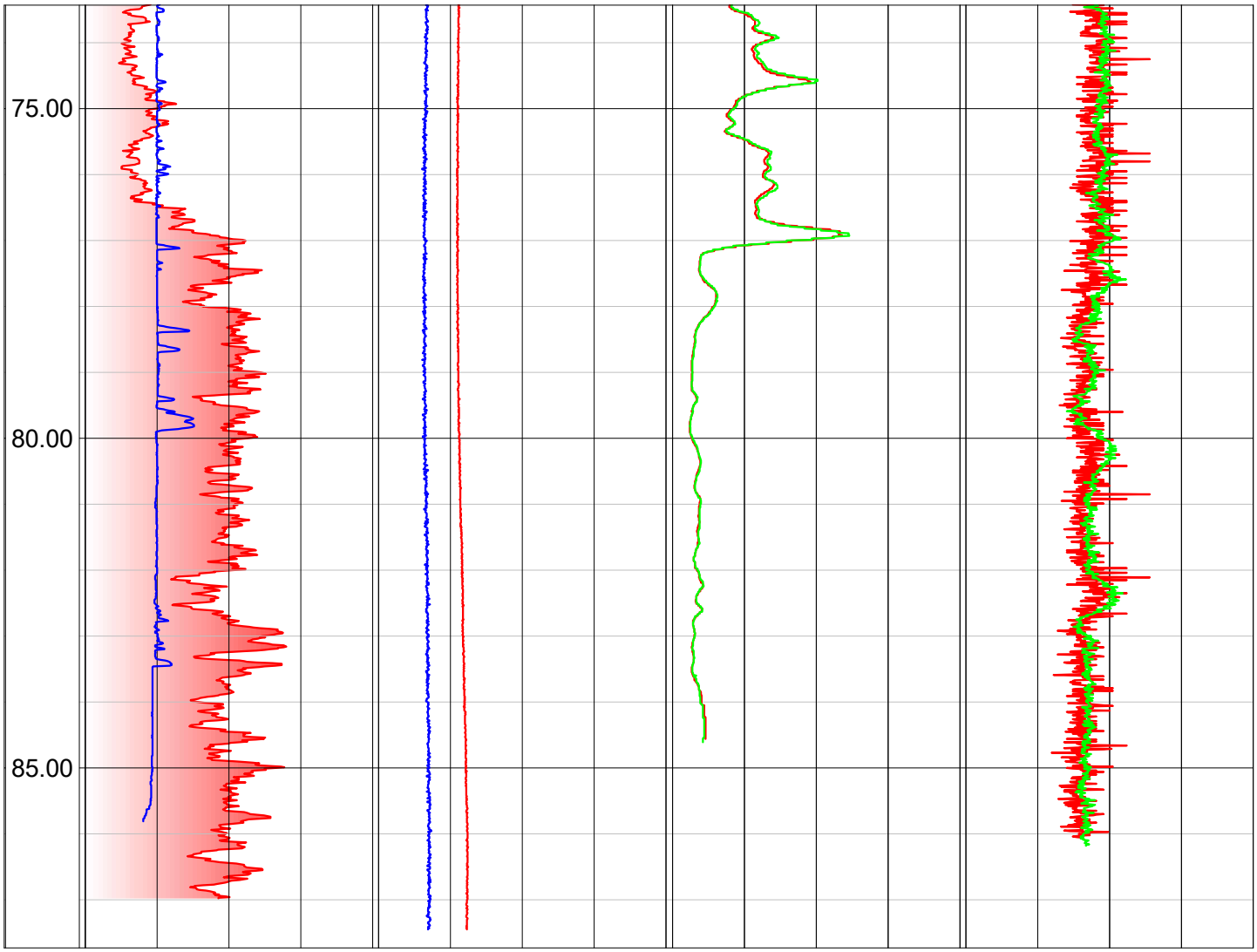
55.00
60.00
65.00
70.00


75.00
80.00
85.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH400**

Log Type: ***Image***

Location: **A417, Birdlip** Area: **Gloucestershire** Grid Ref: **394666.1E 213848.1N** Elevation: **267.95m**

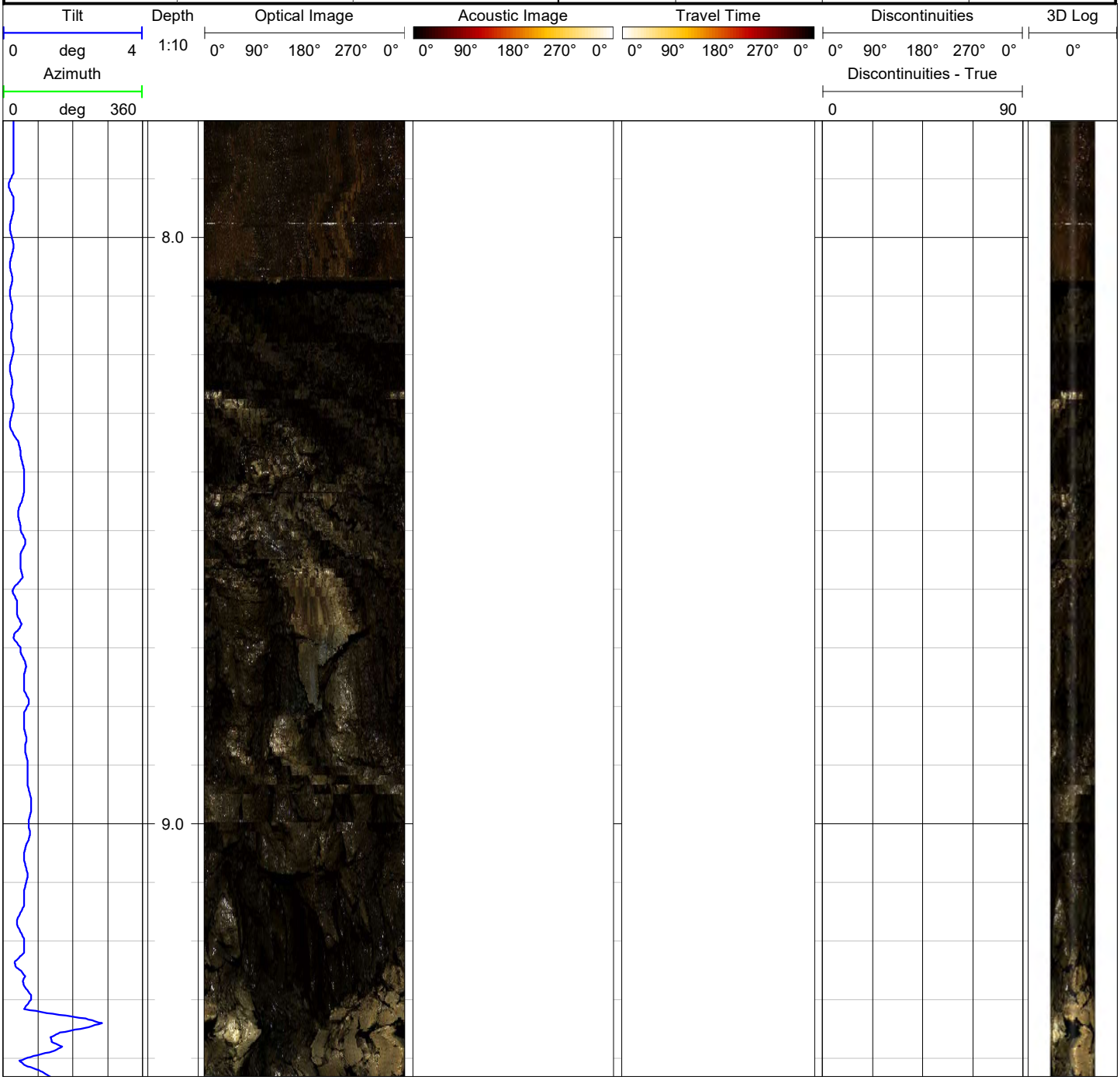
Drilled Depth: (m)	**90.0**	Date:	**14.10.2019**
Logged Depth: (m)	**86.5**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	Borehole fluid cloudy.
Logged Interval: (m)	**8.1 - 86.5**		
Fluid Level: (m)	**70.8**		

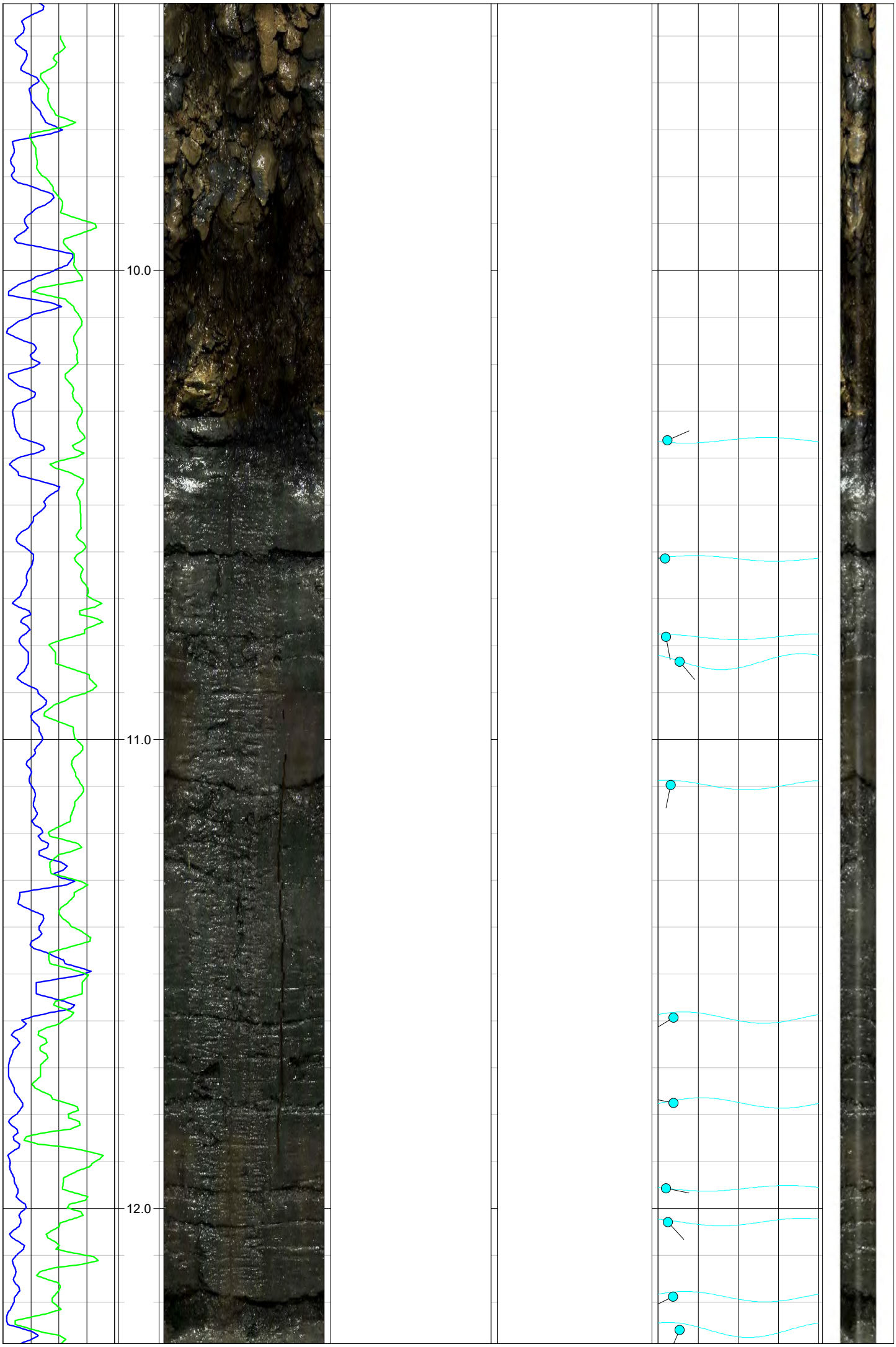
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
150	**8.1**	**90.0**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Plain Steel	**150**	**0.0**	**8.1**

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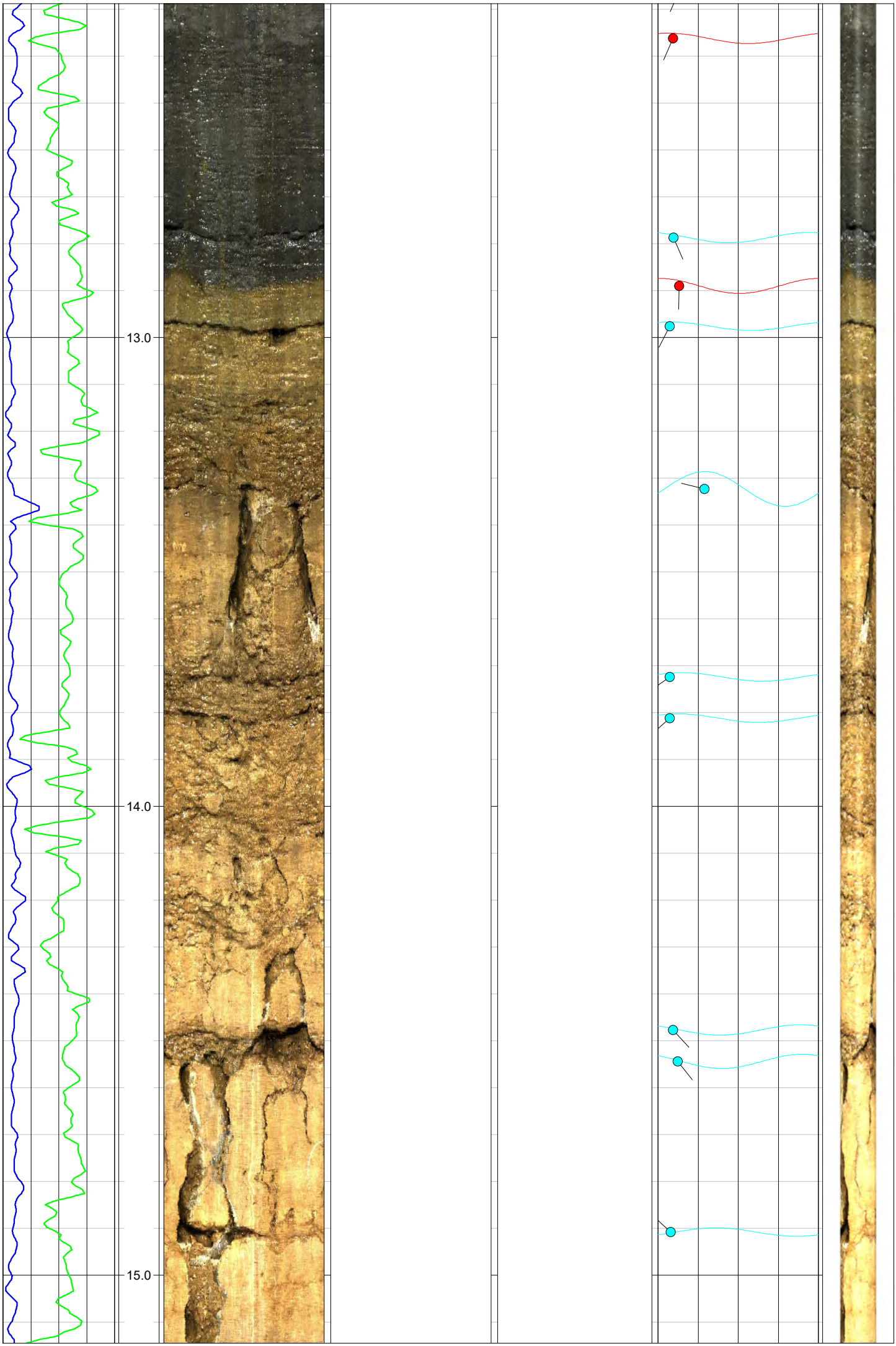
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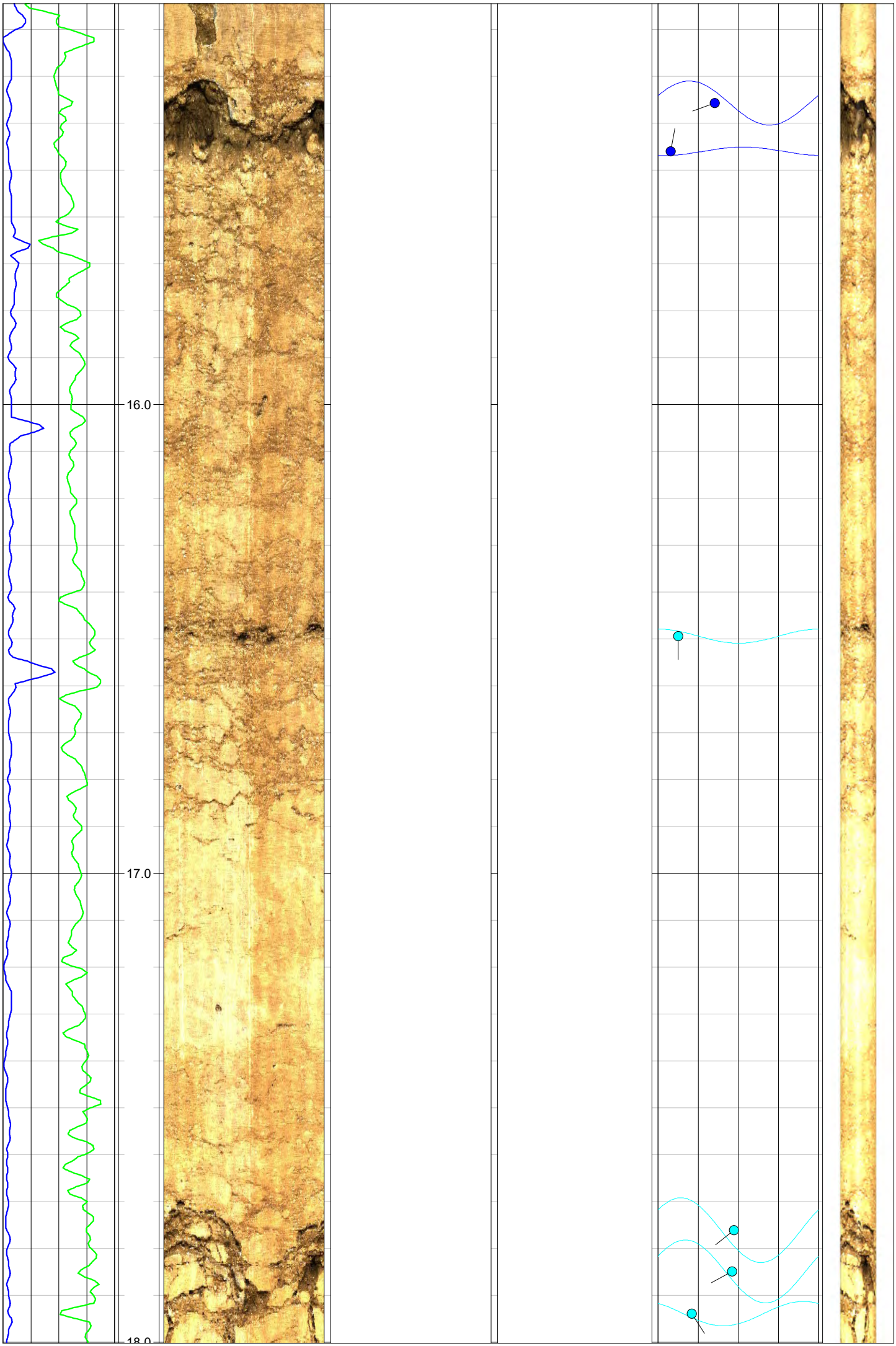
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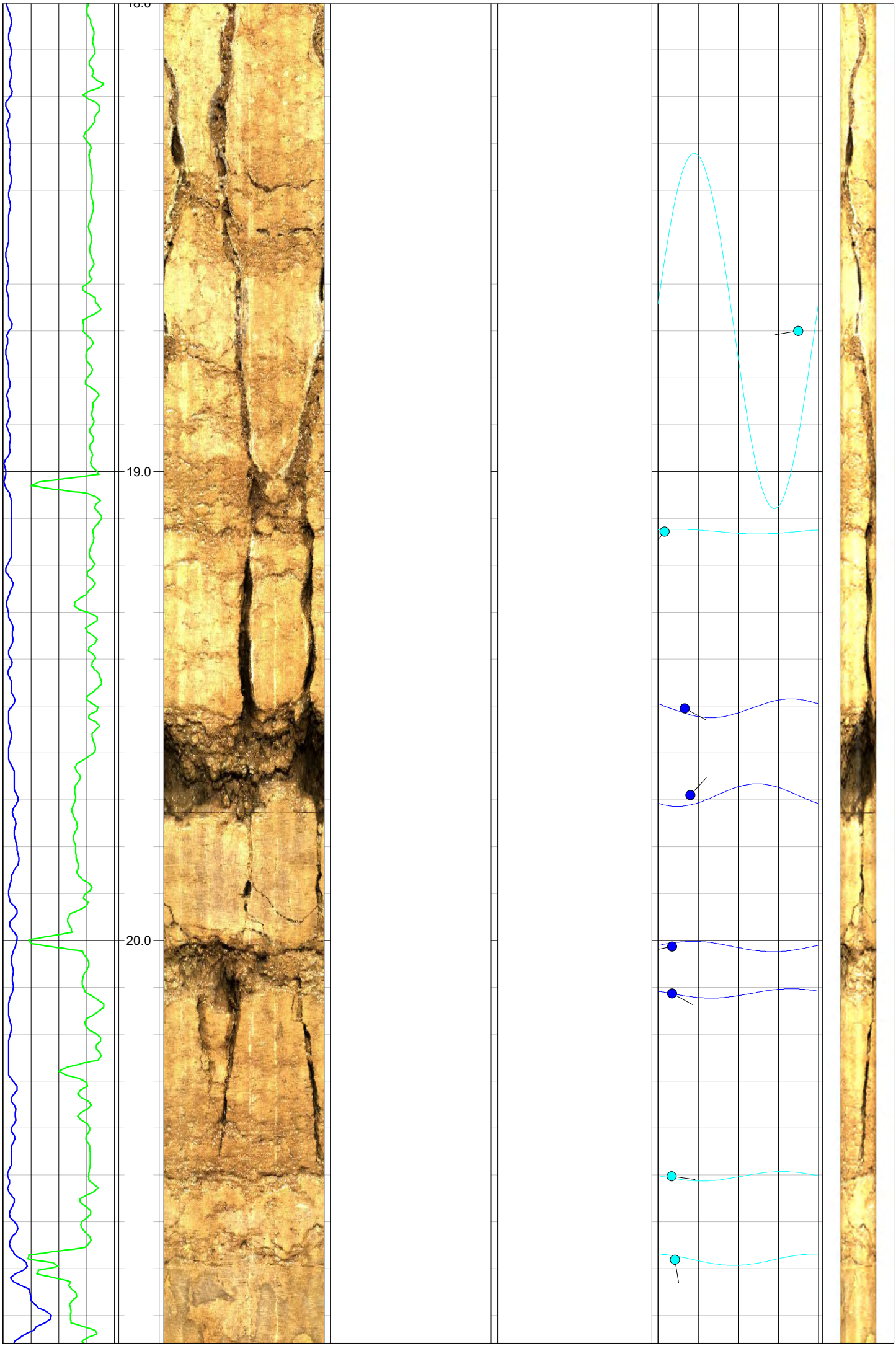
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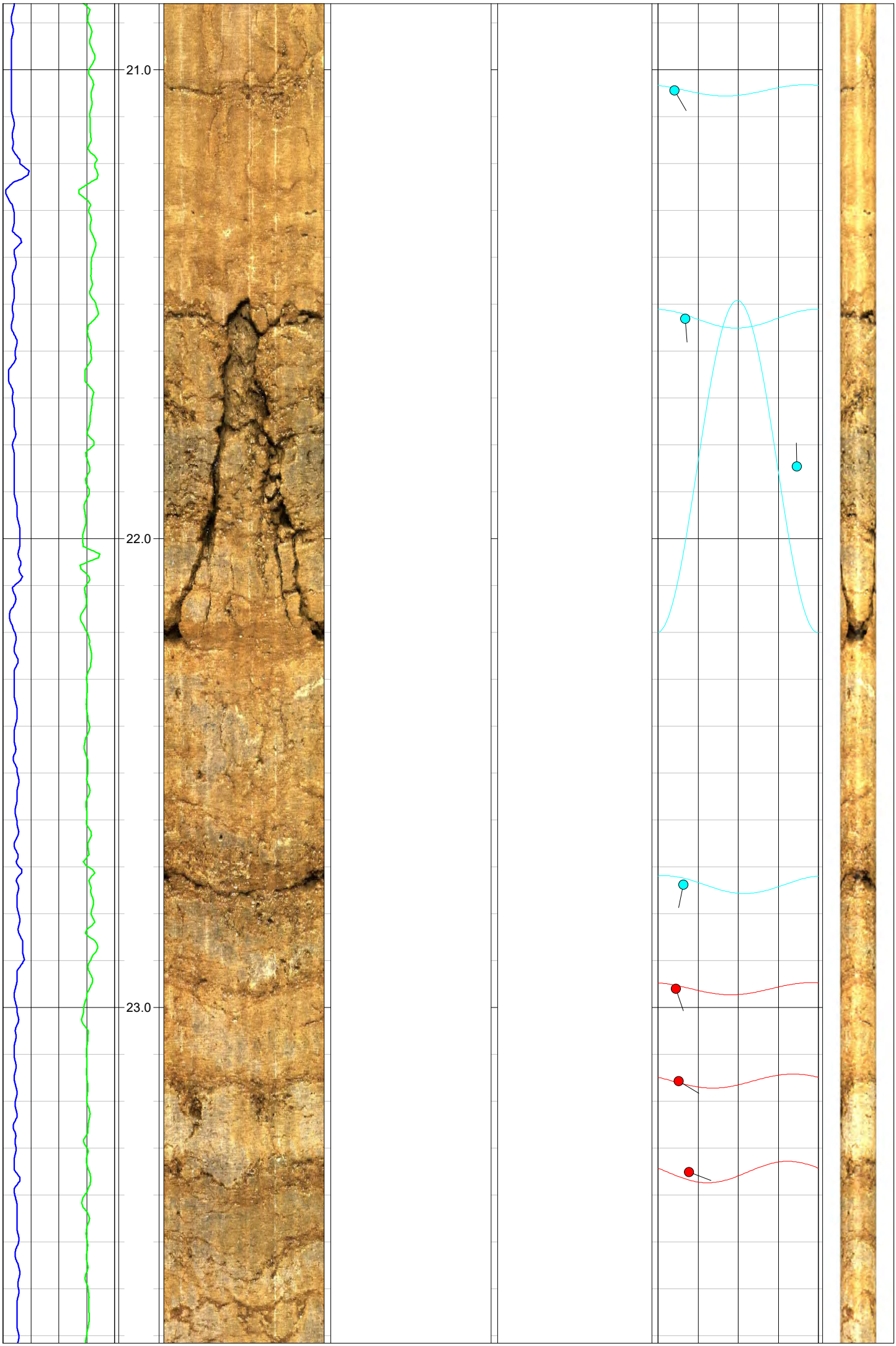
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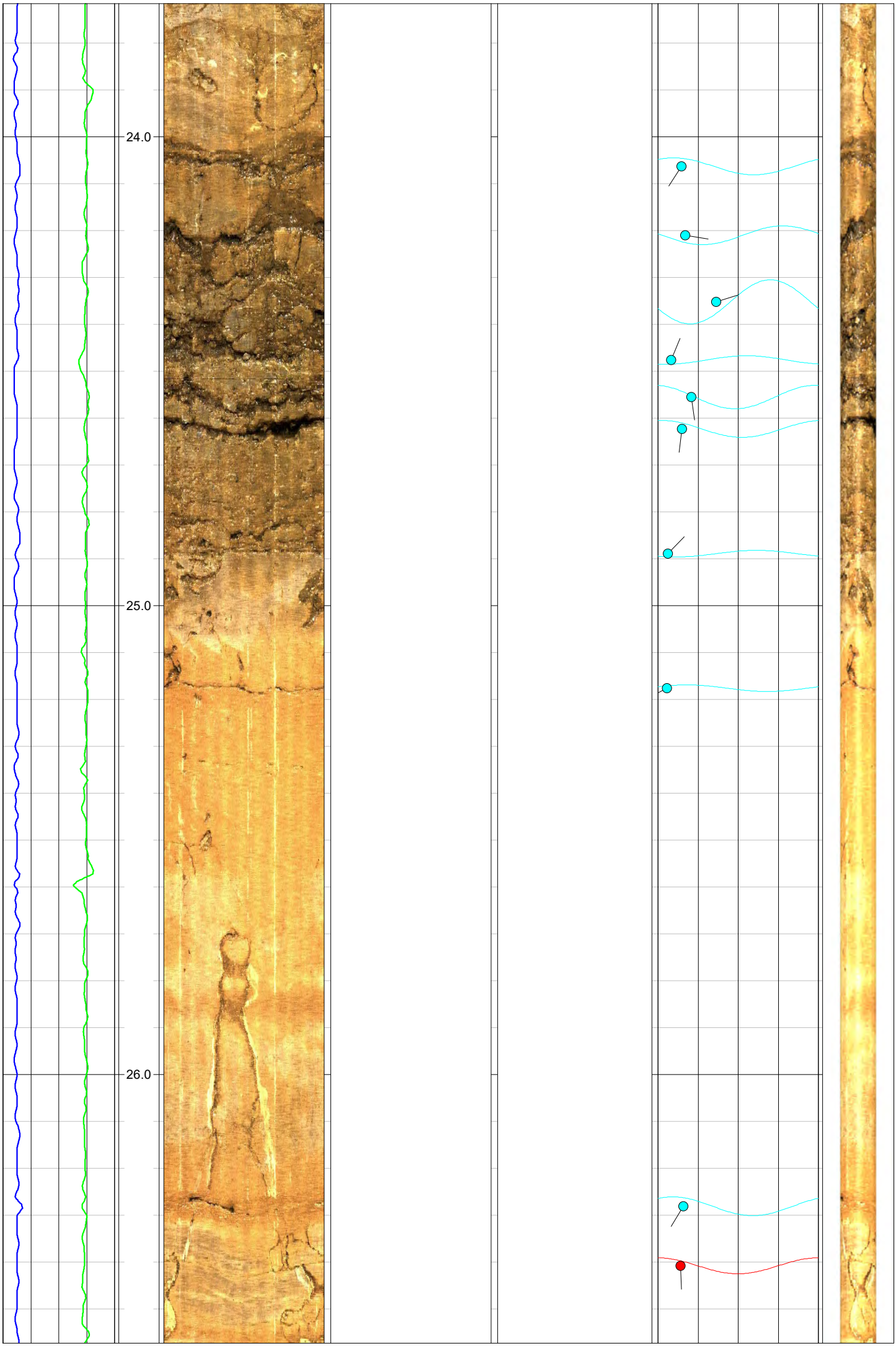
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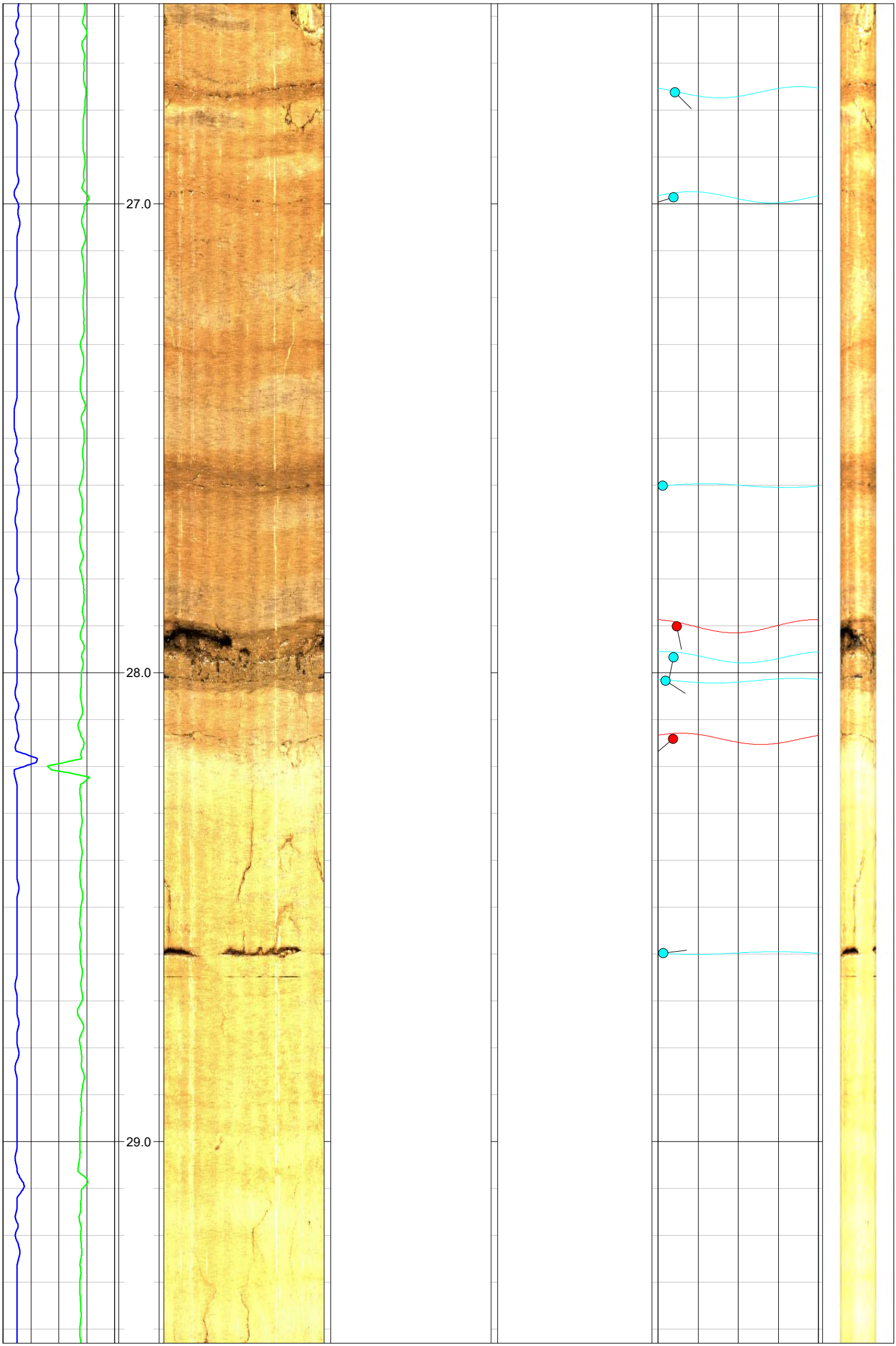
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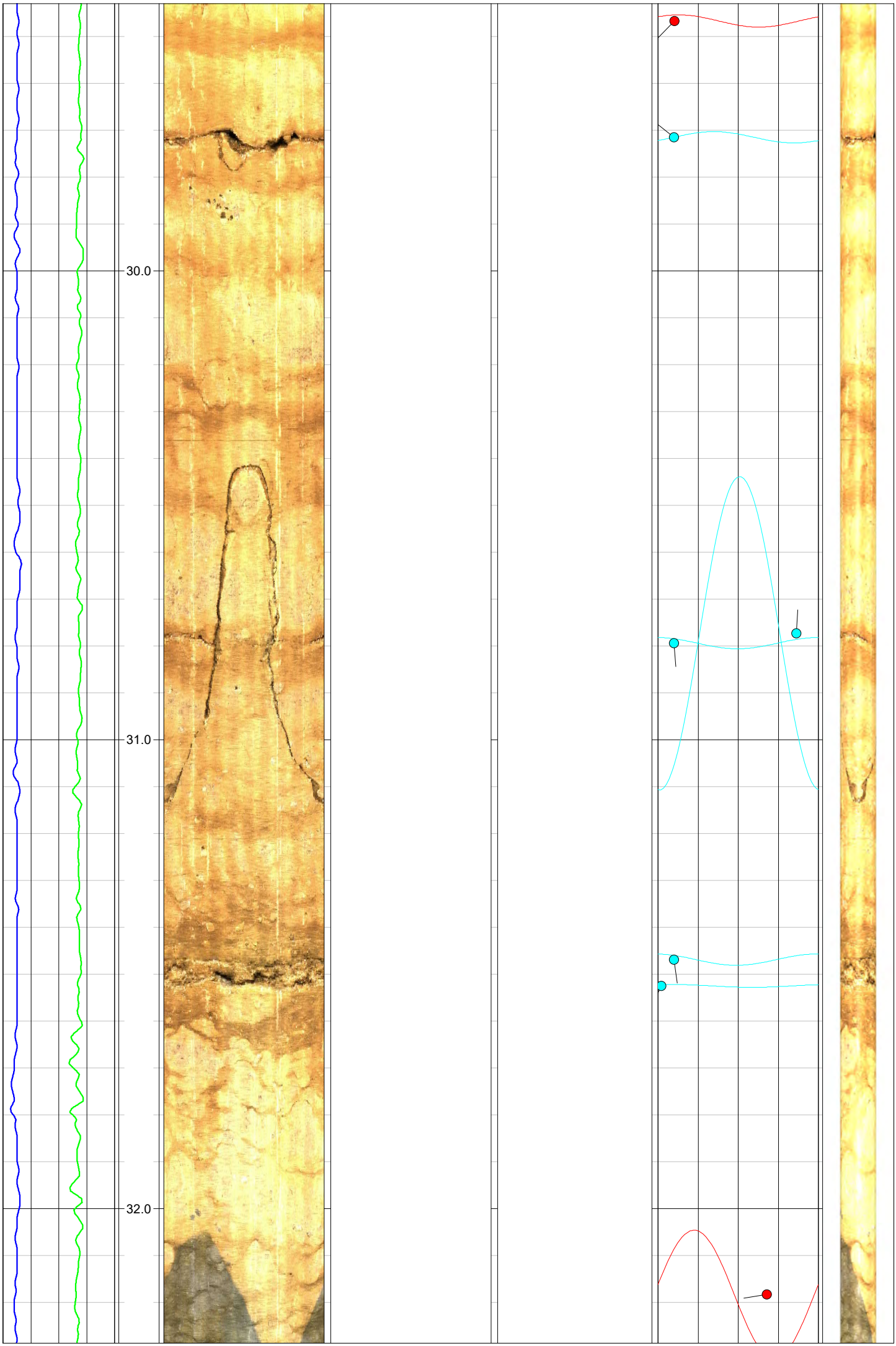
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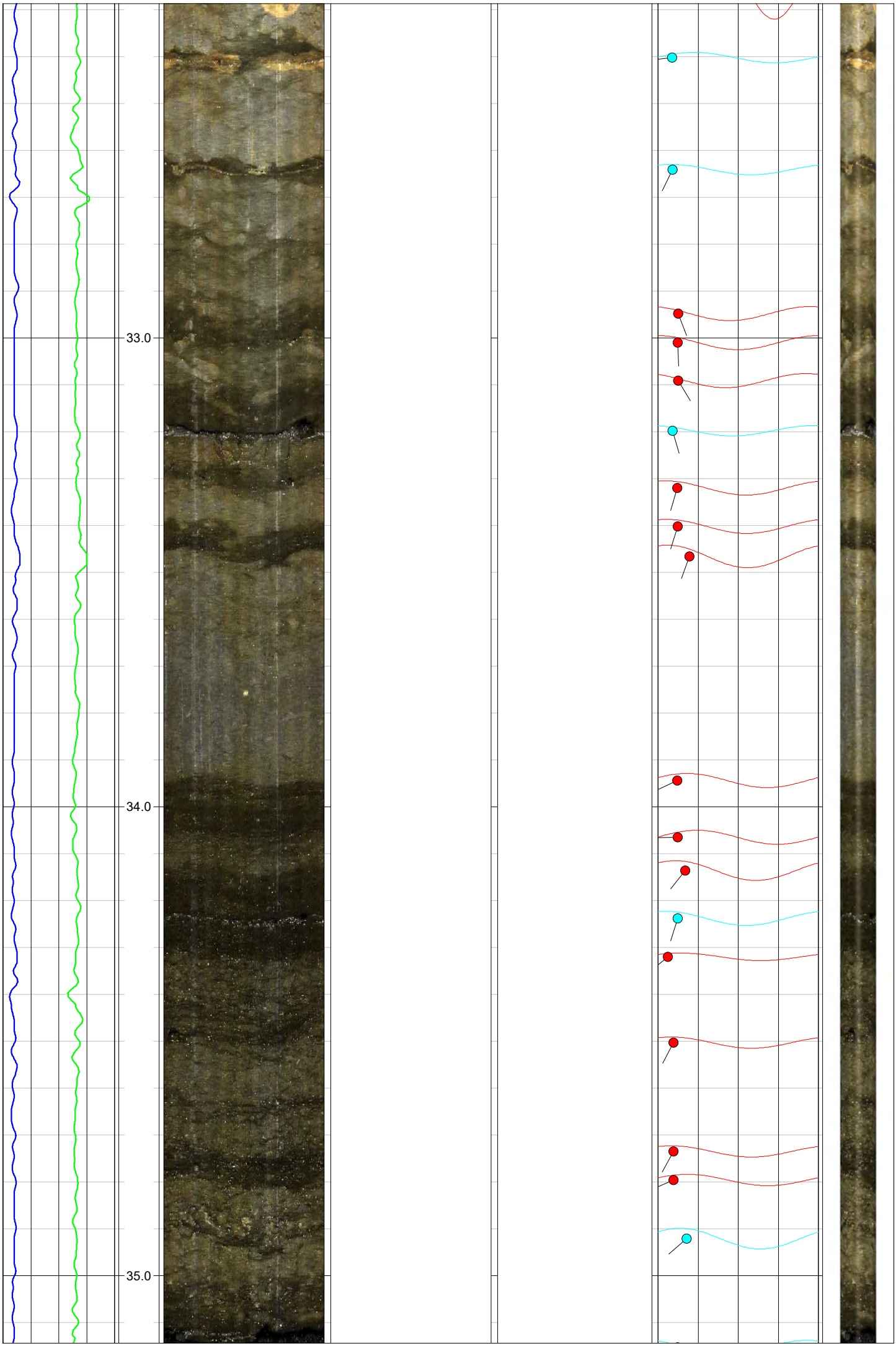
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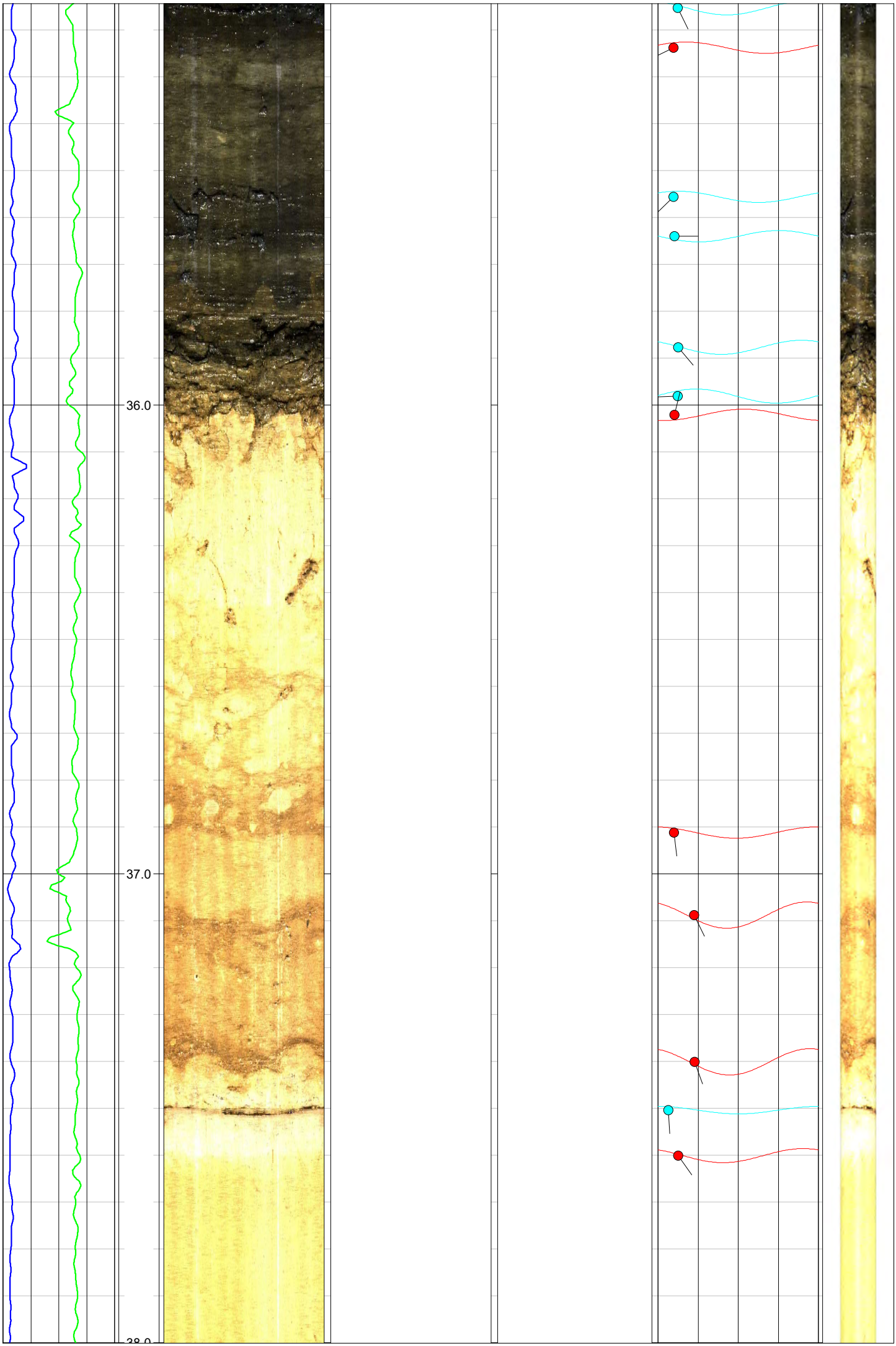
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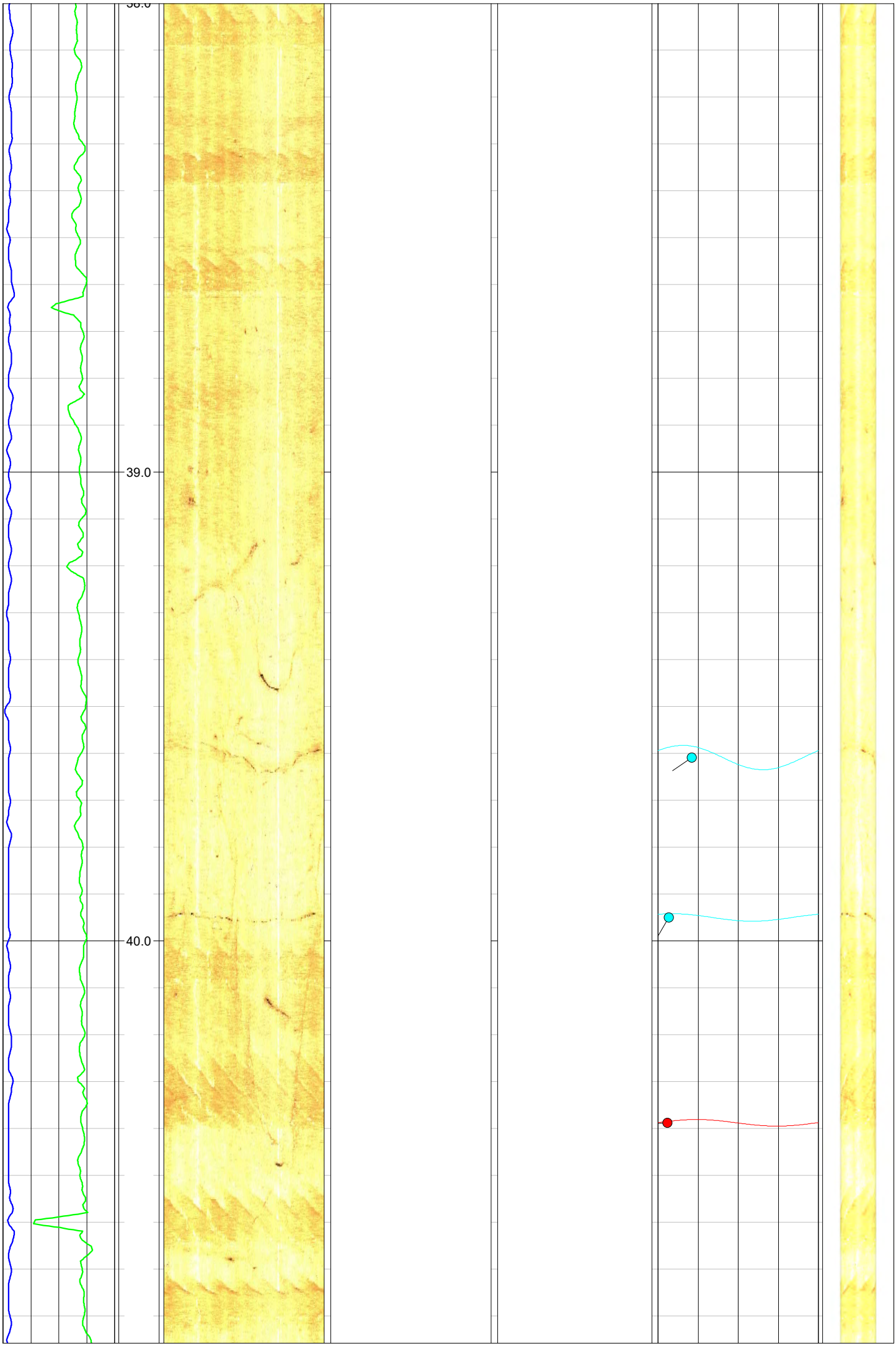
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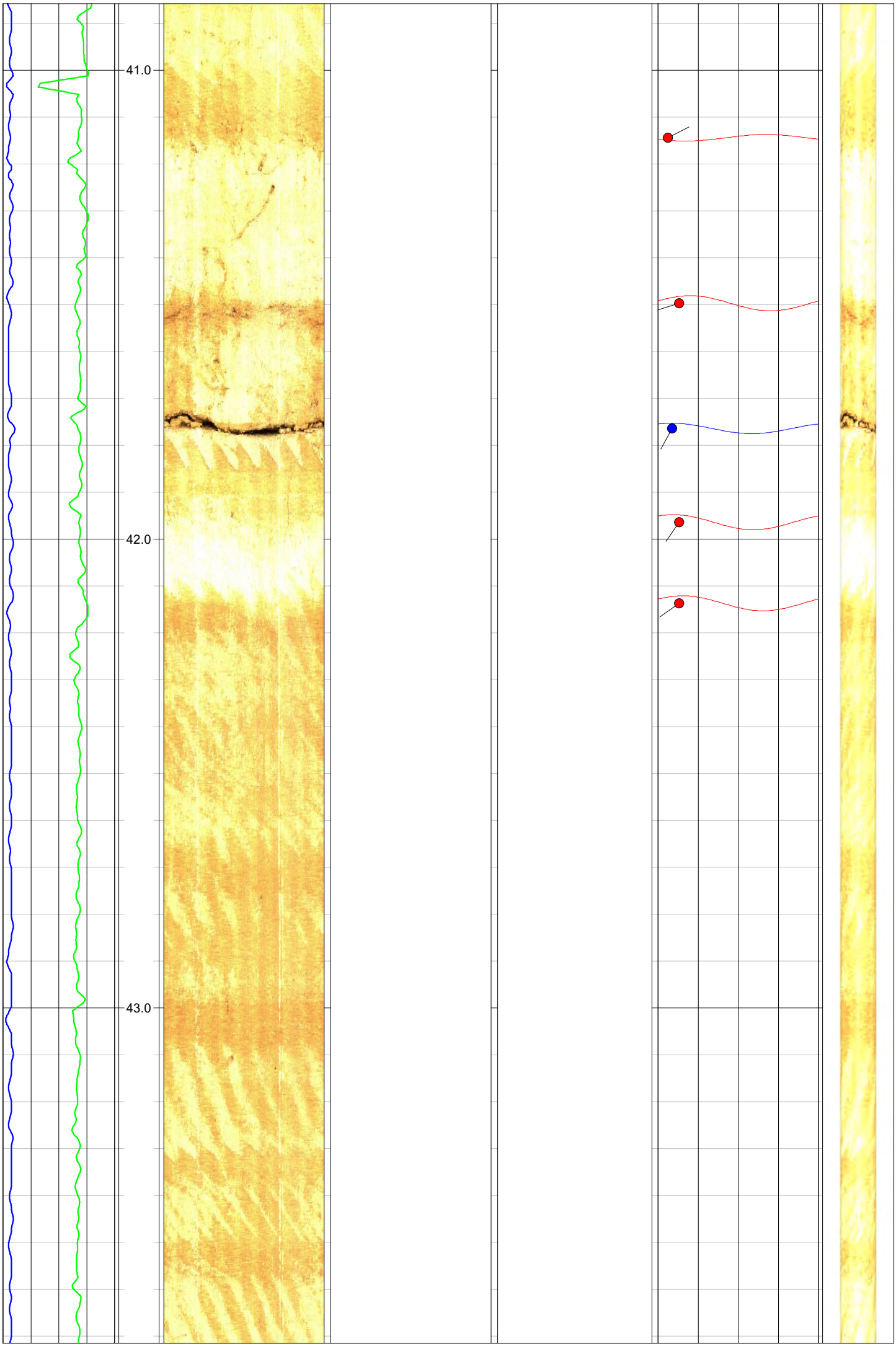
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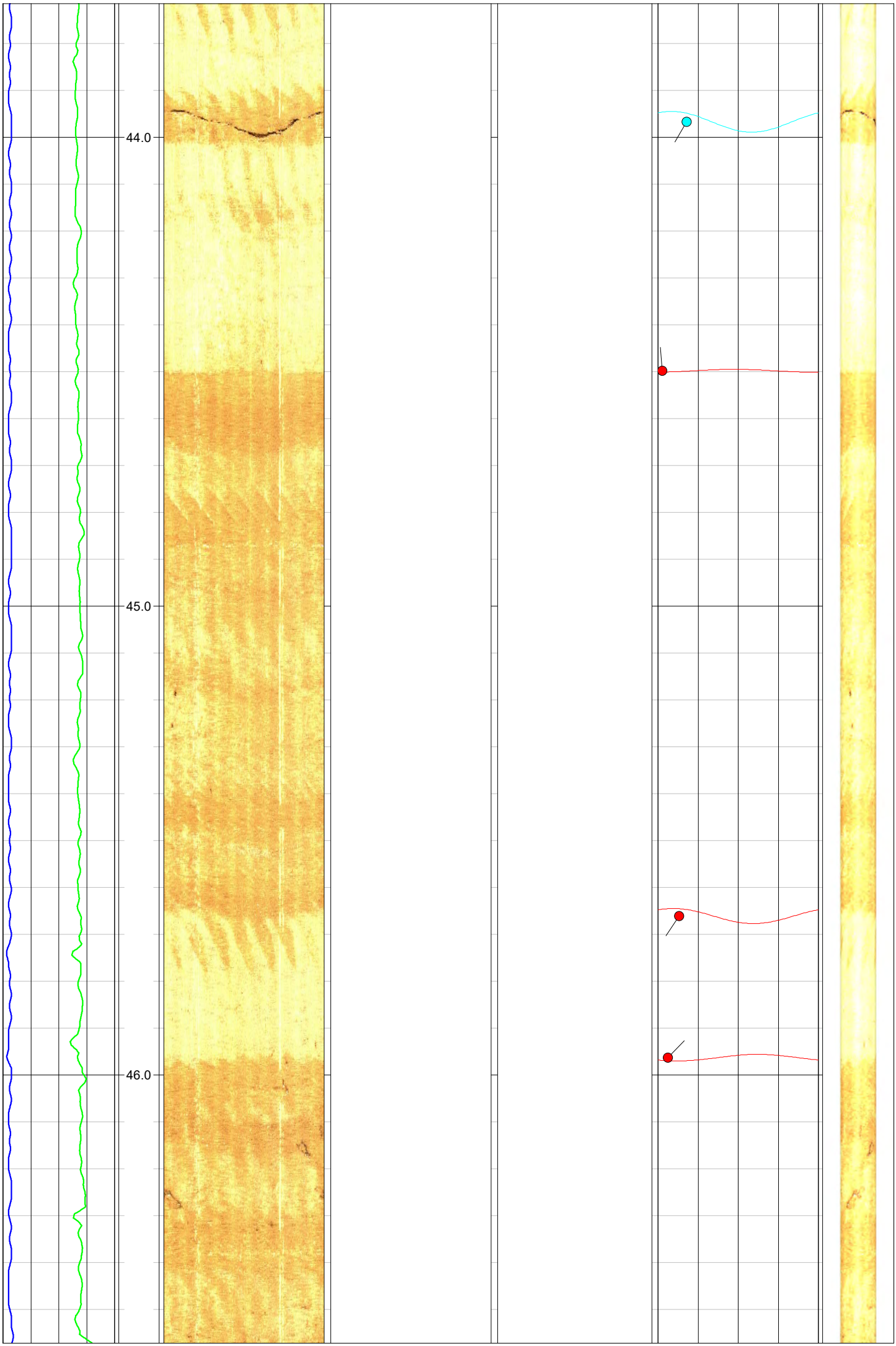
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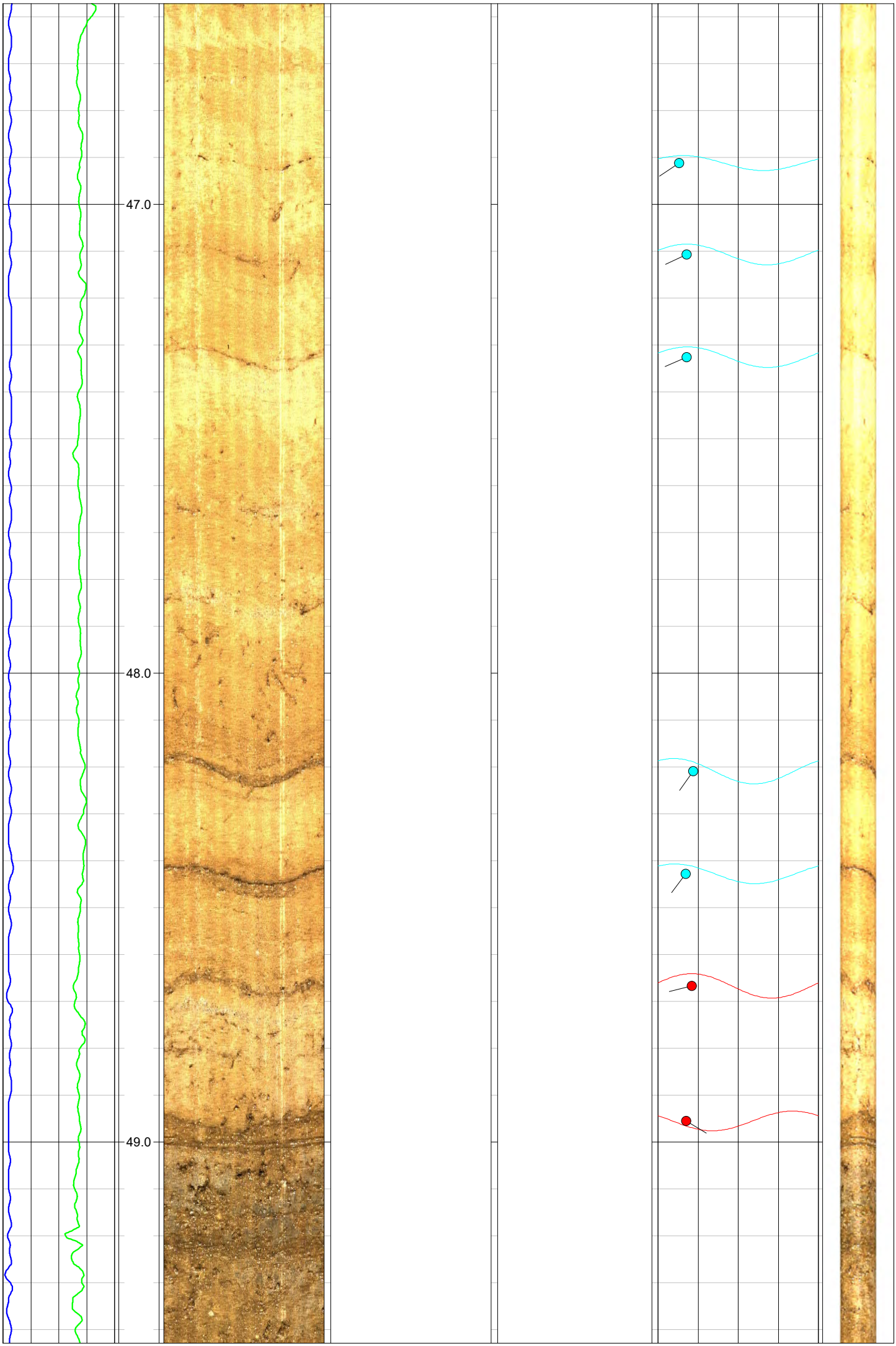
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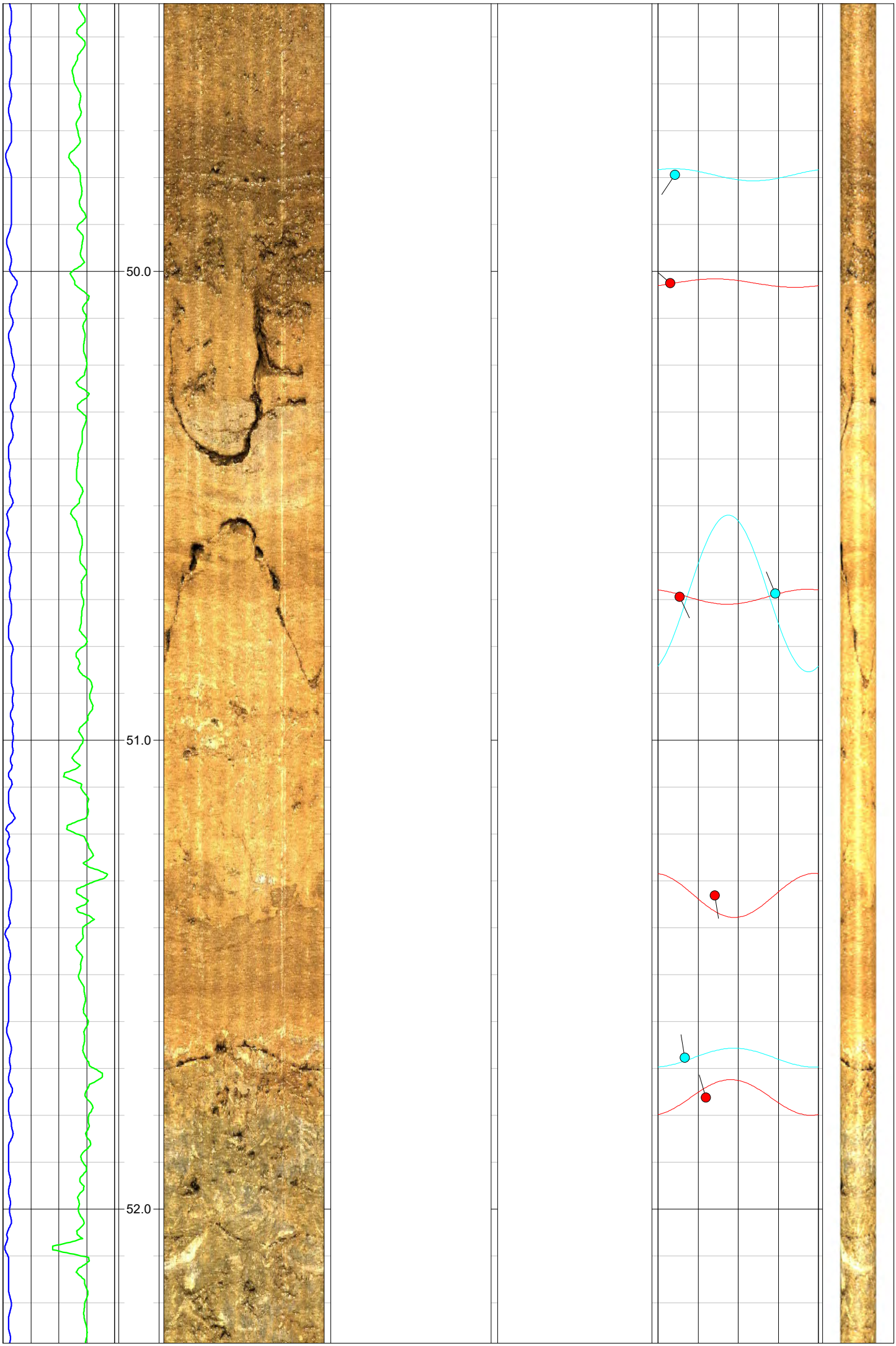
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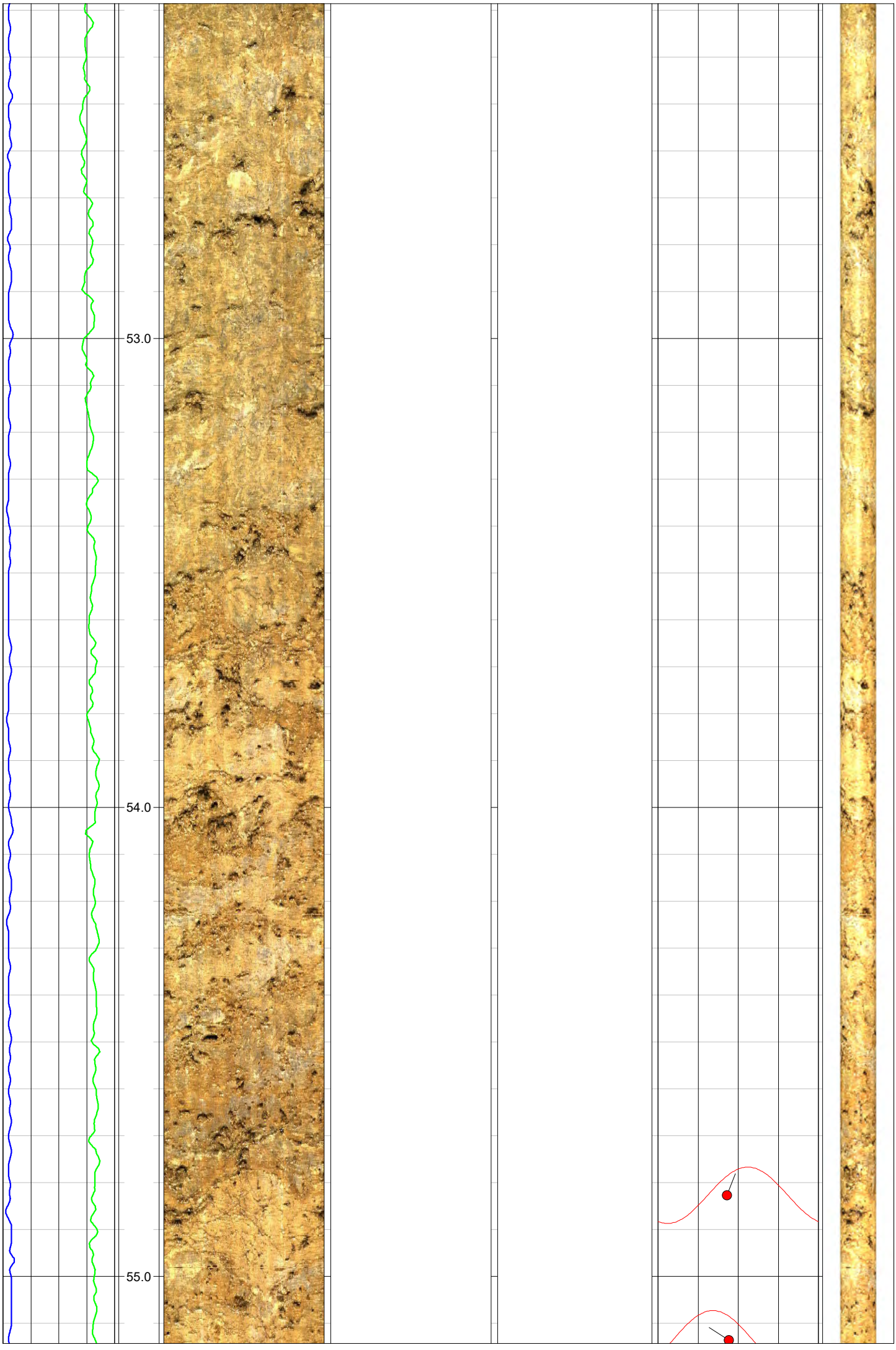
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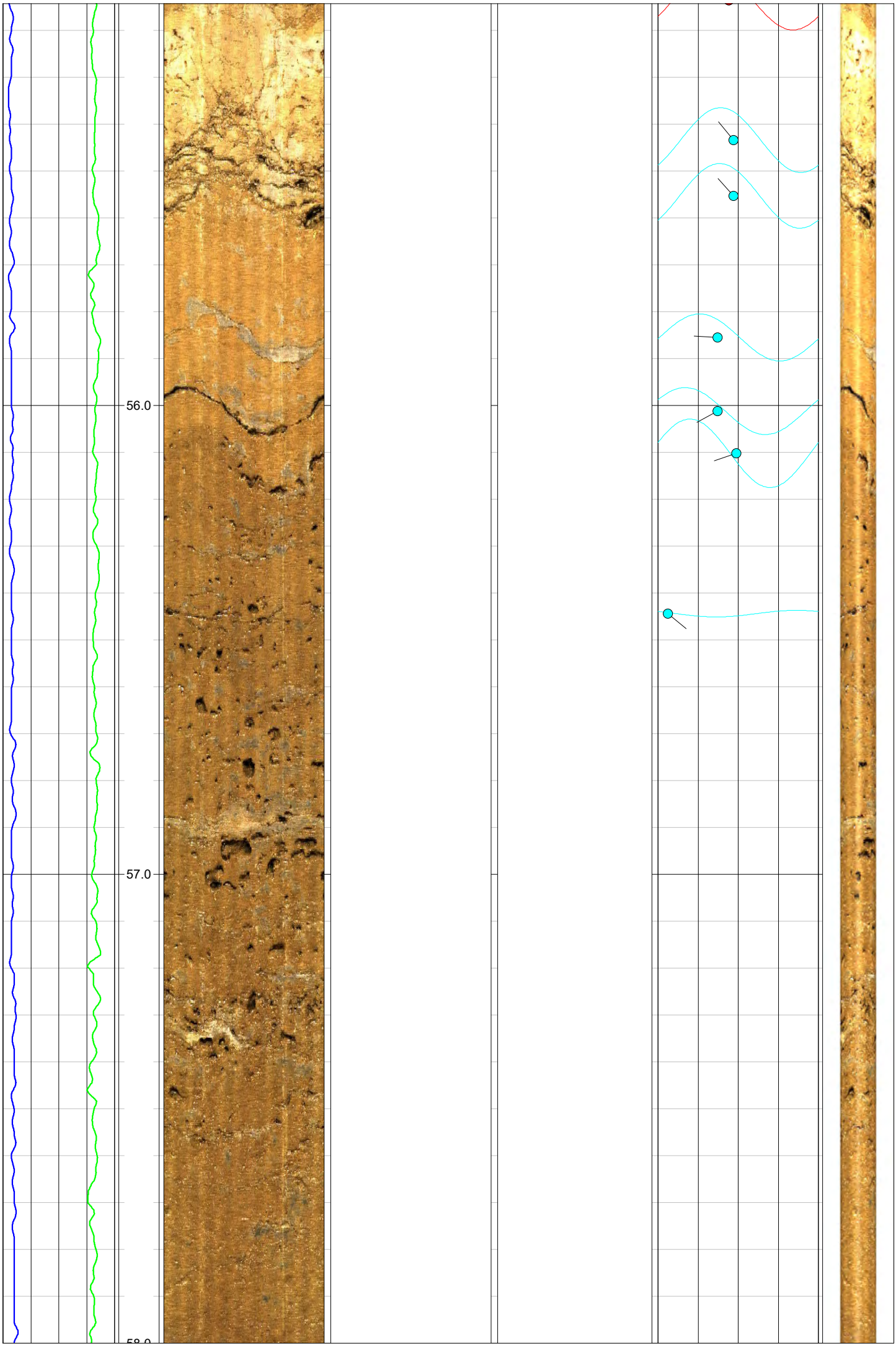
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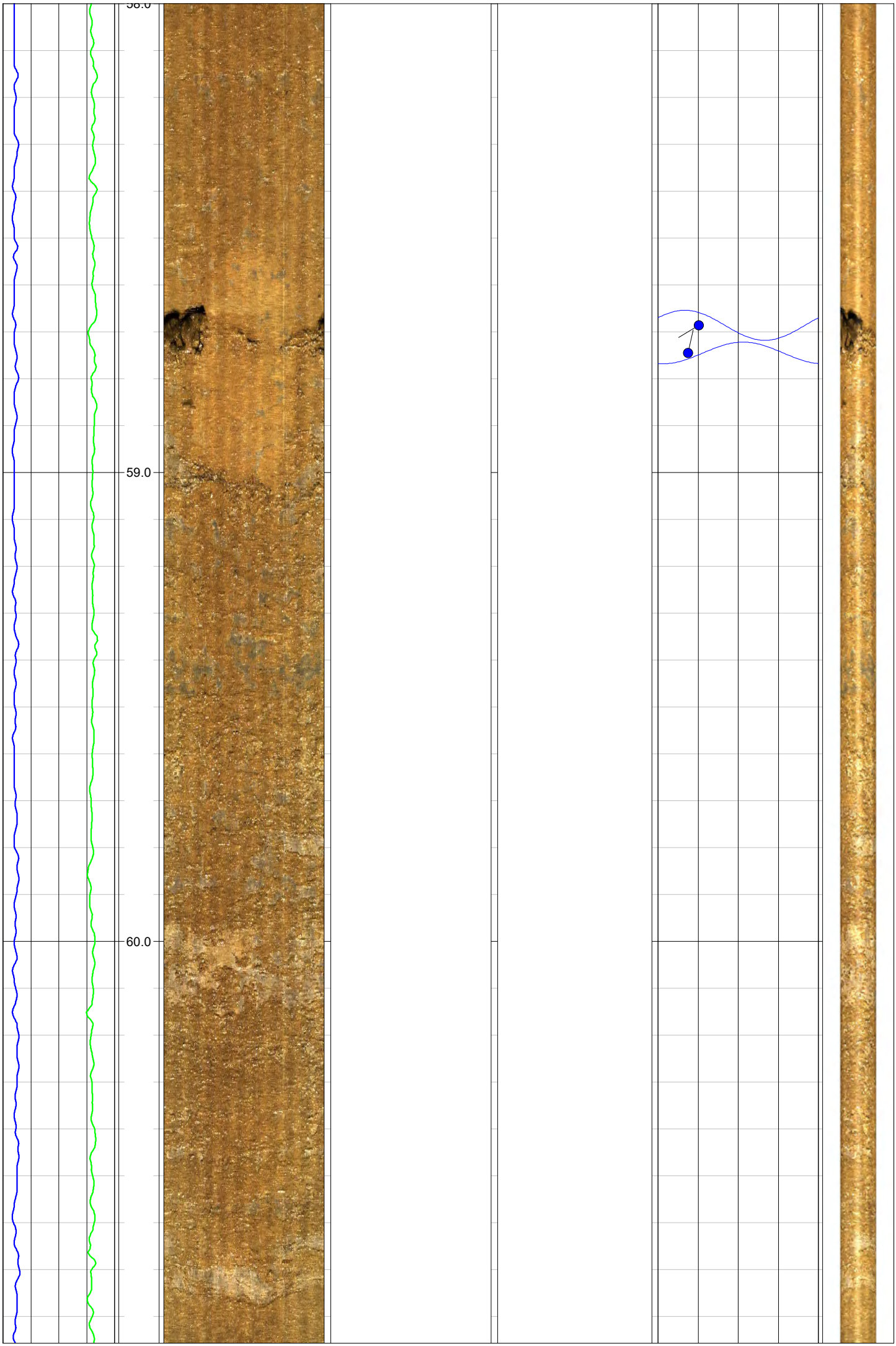
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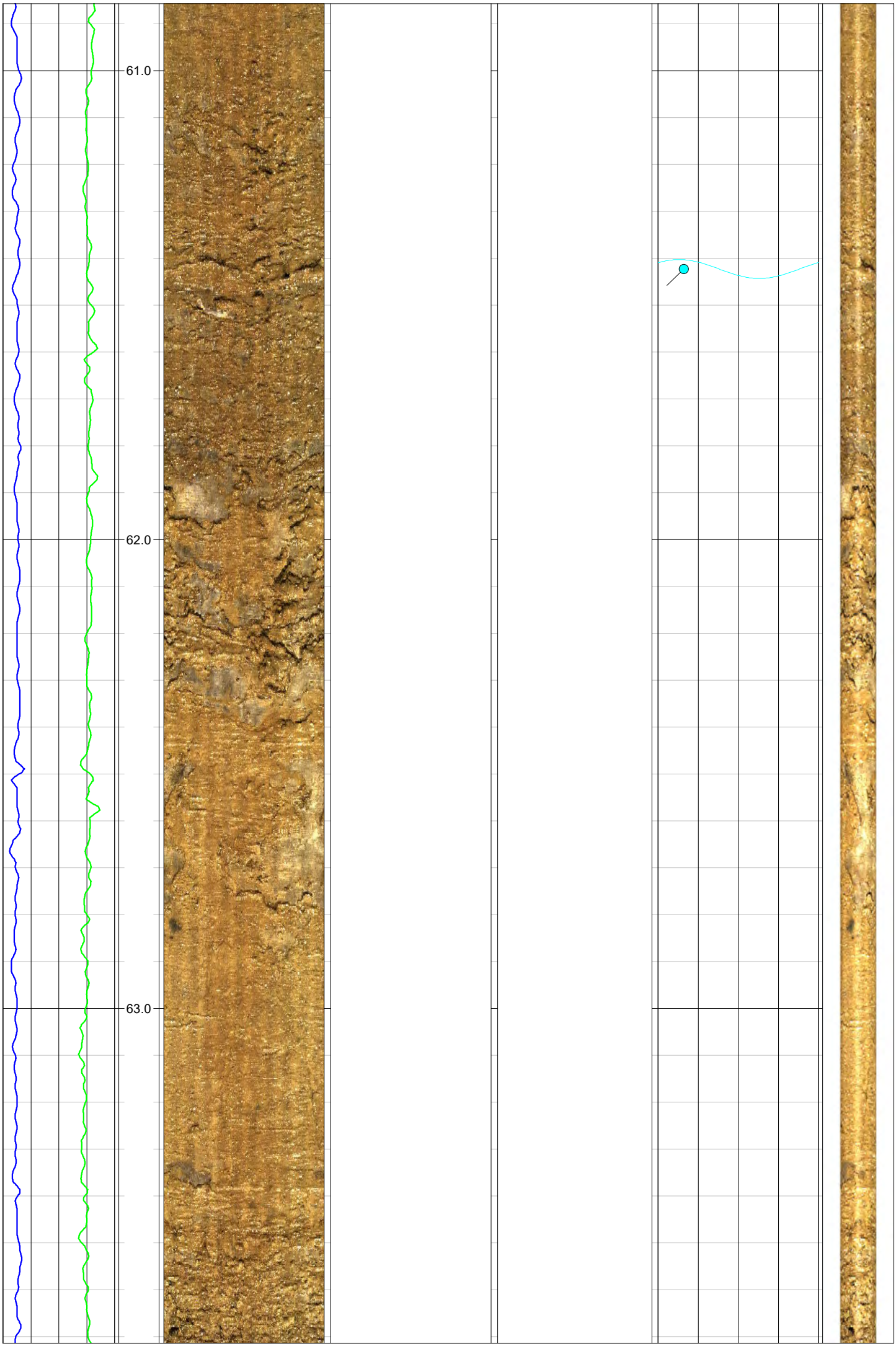
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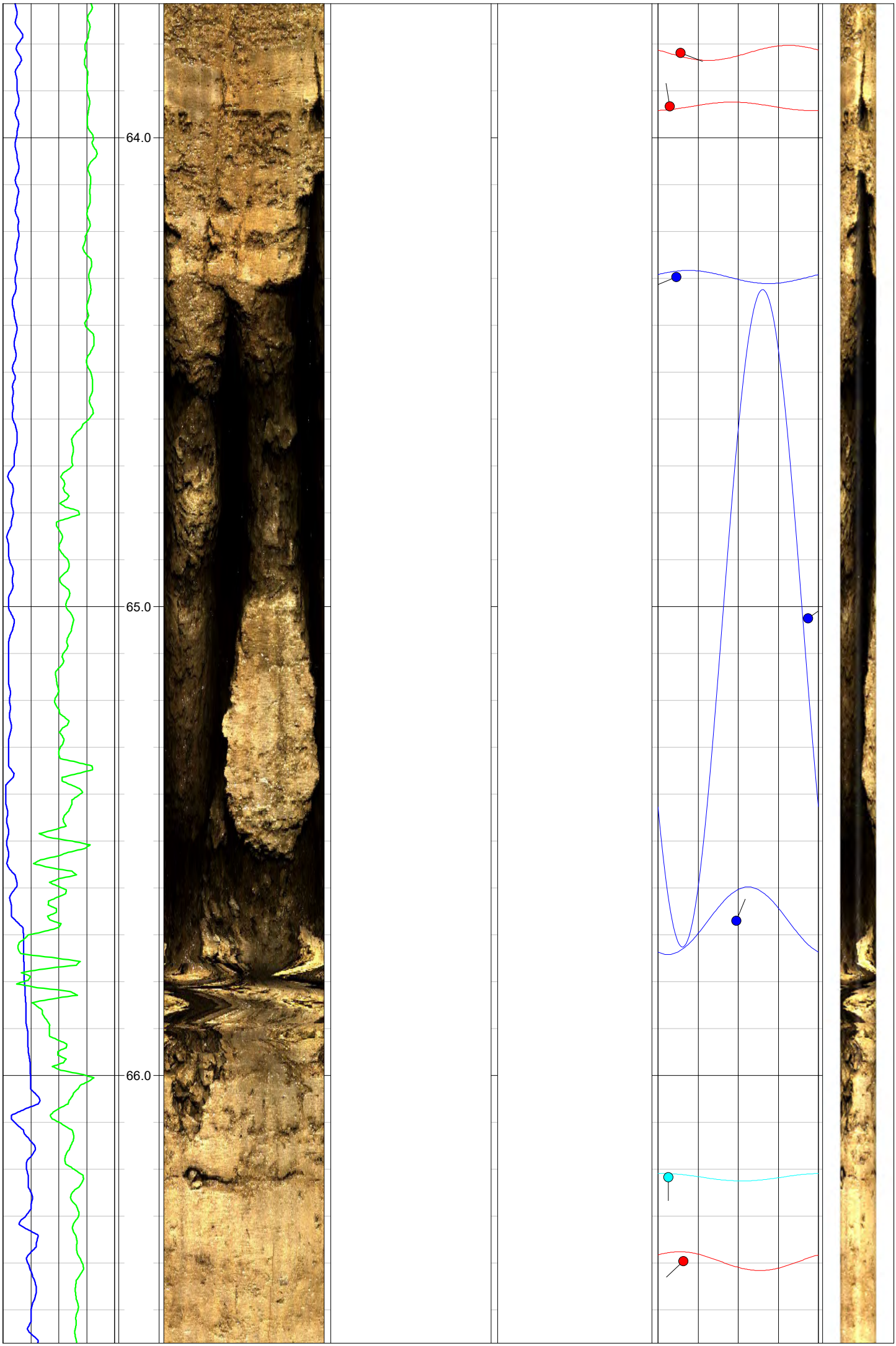
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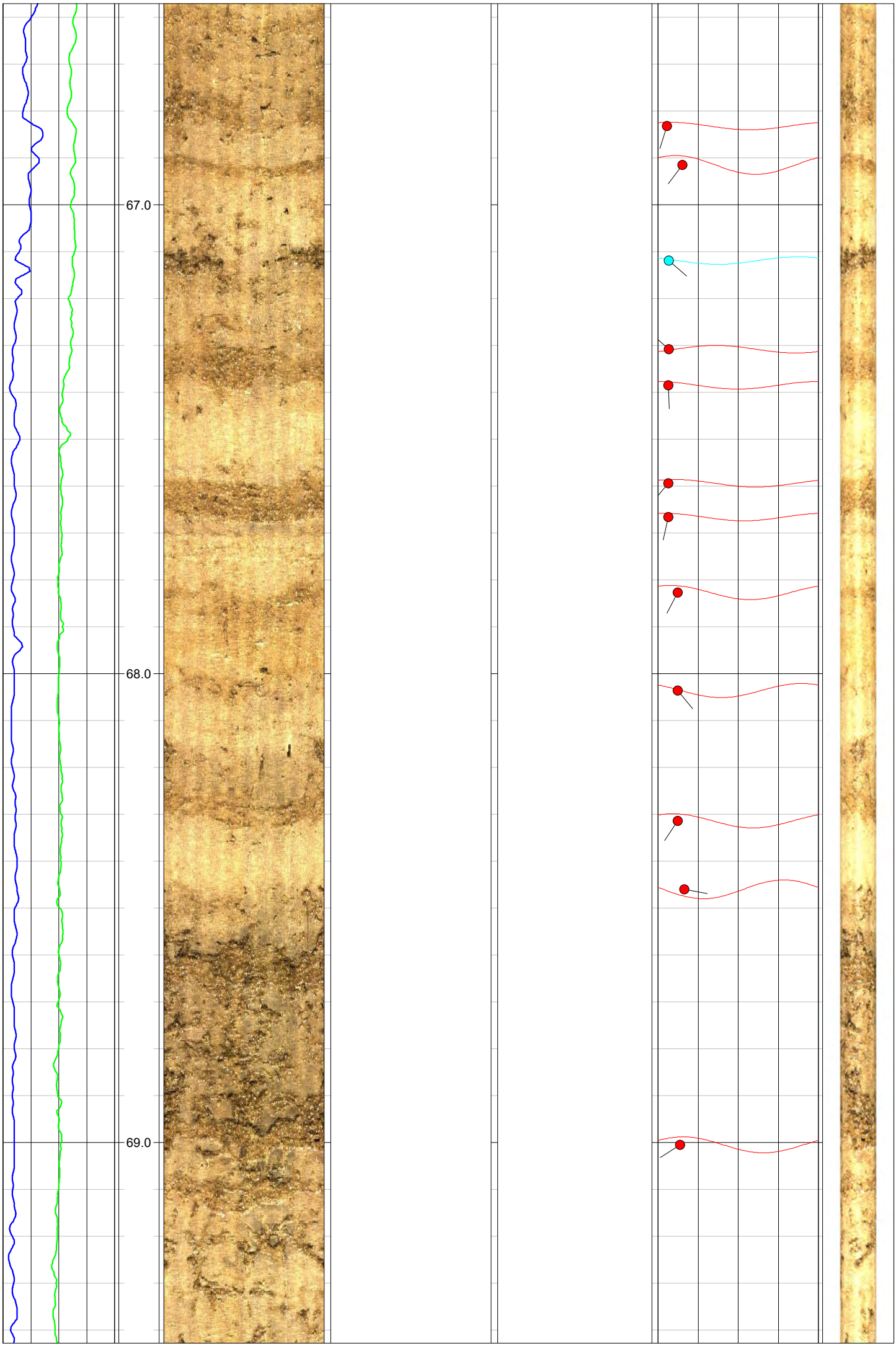
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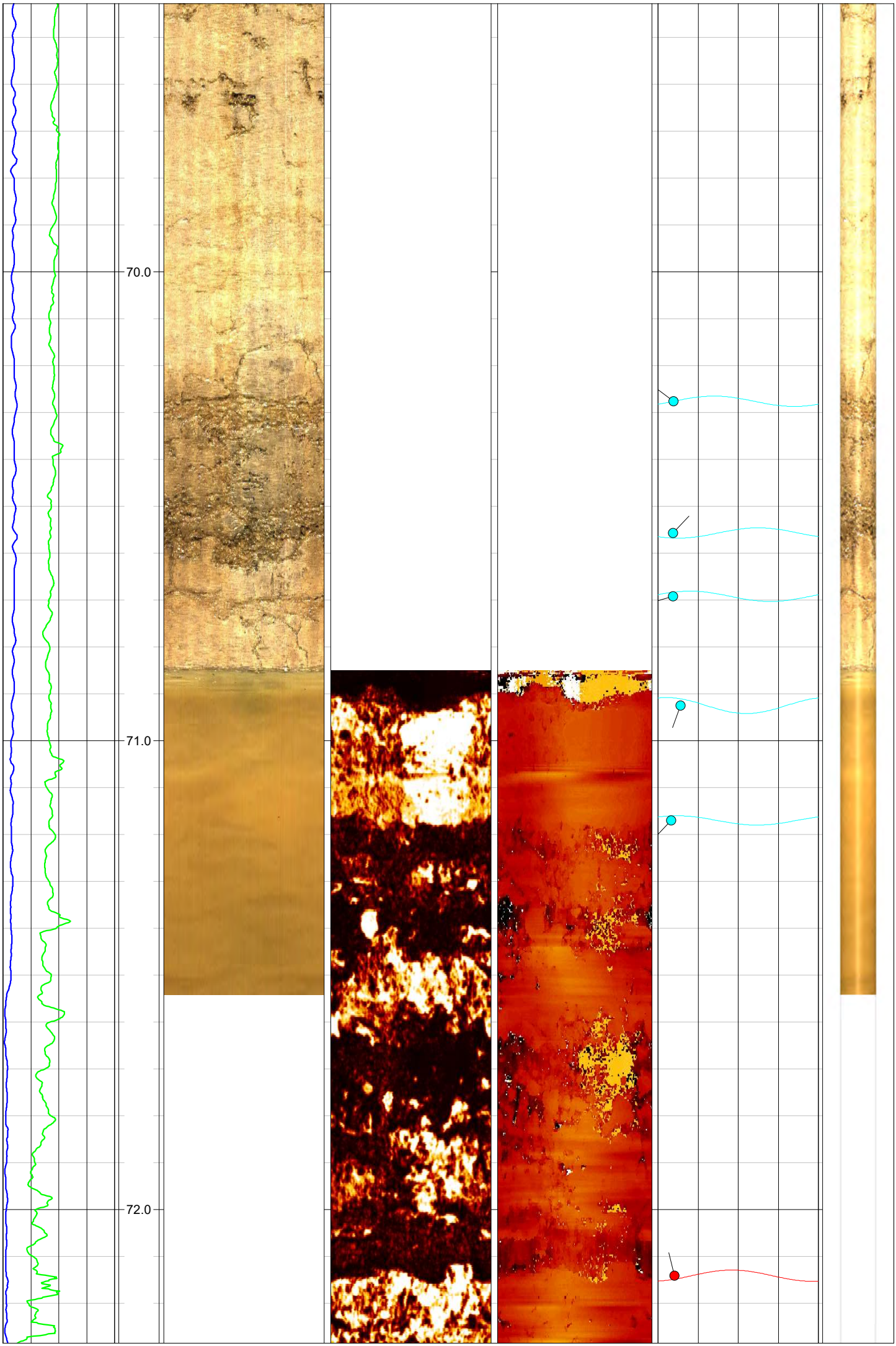
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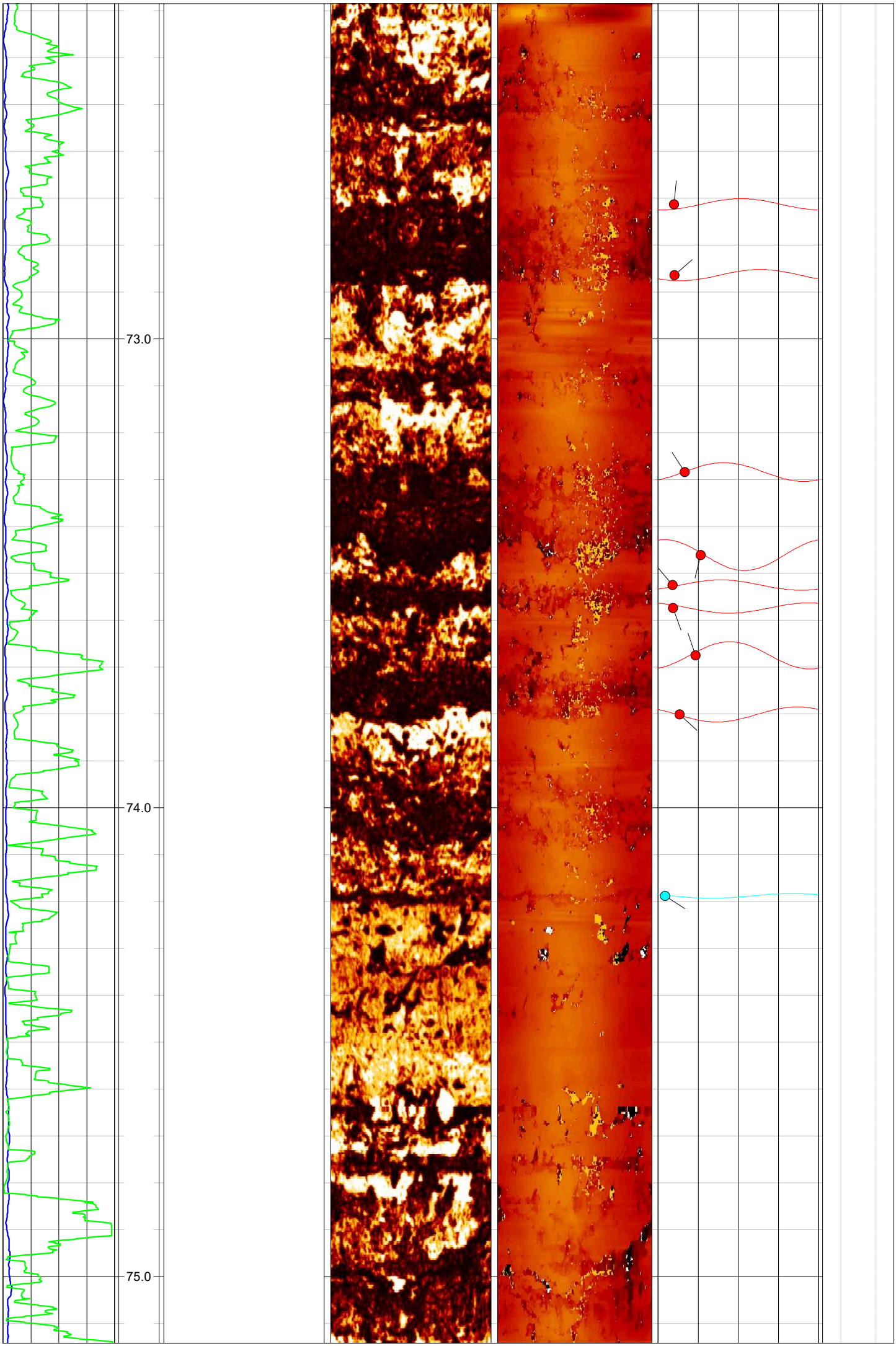
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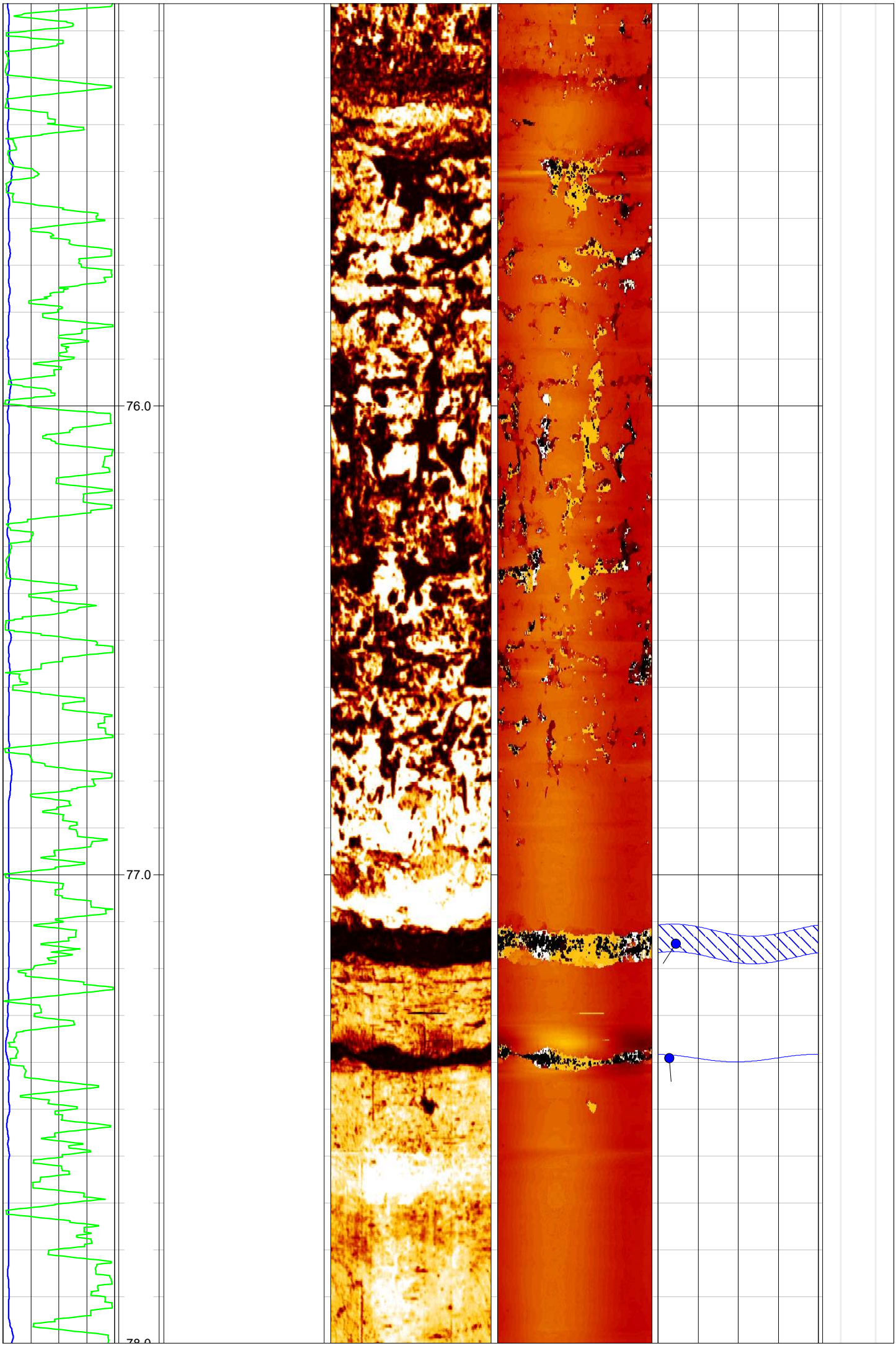
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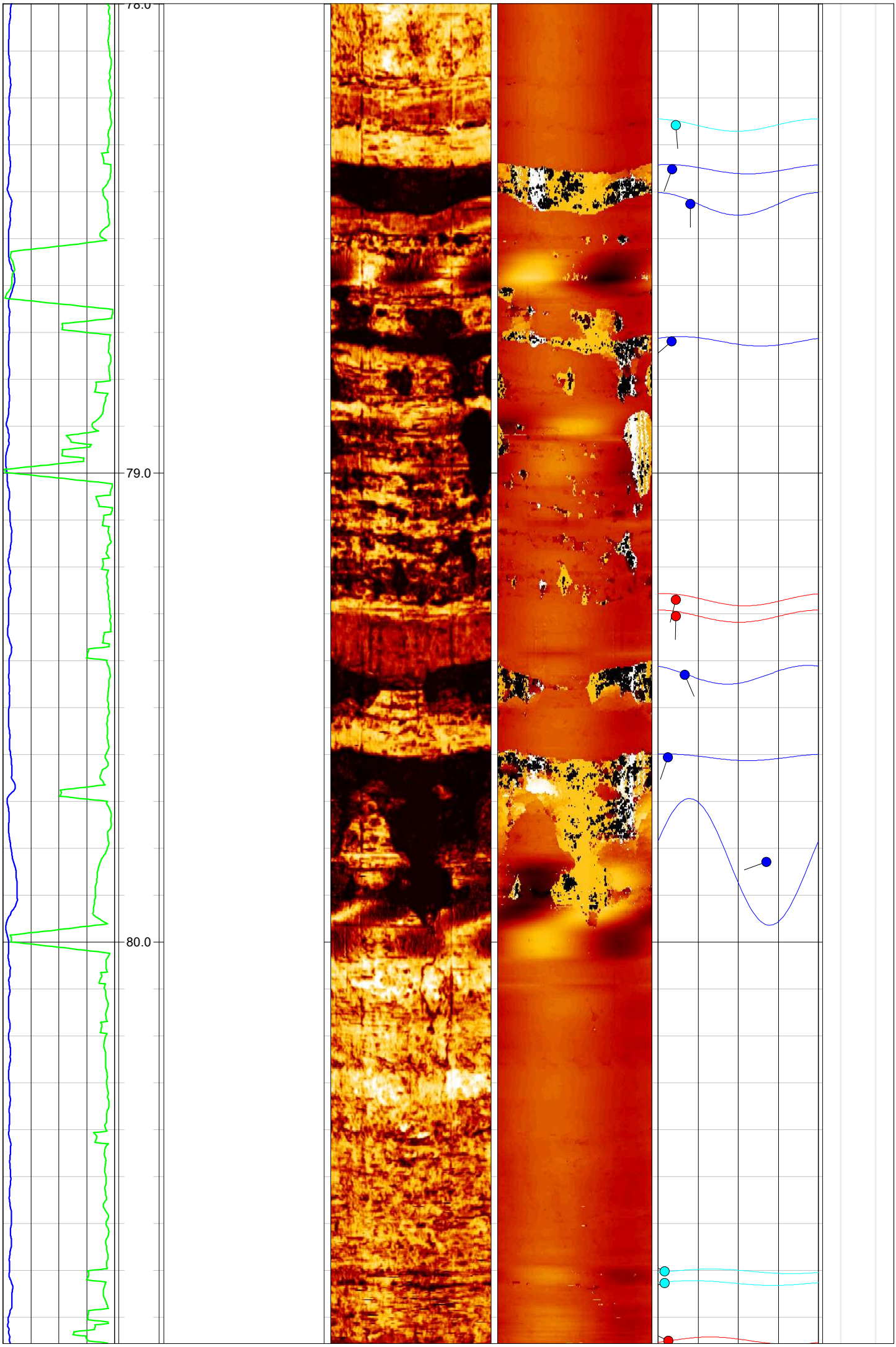
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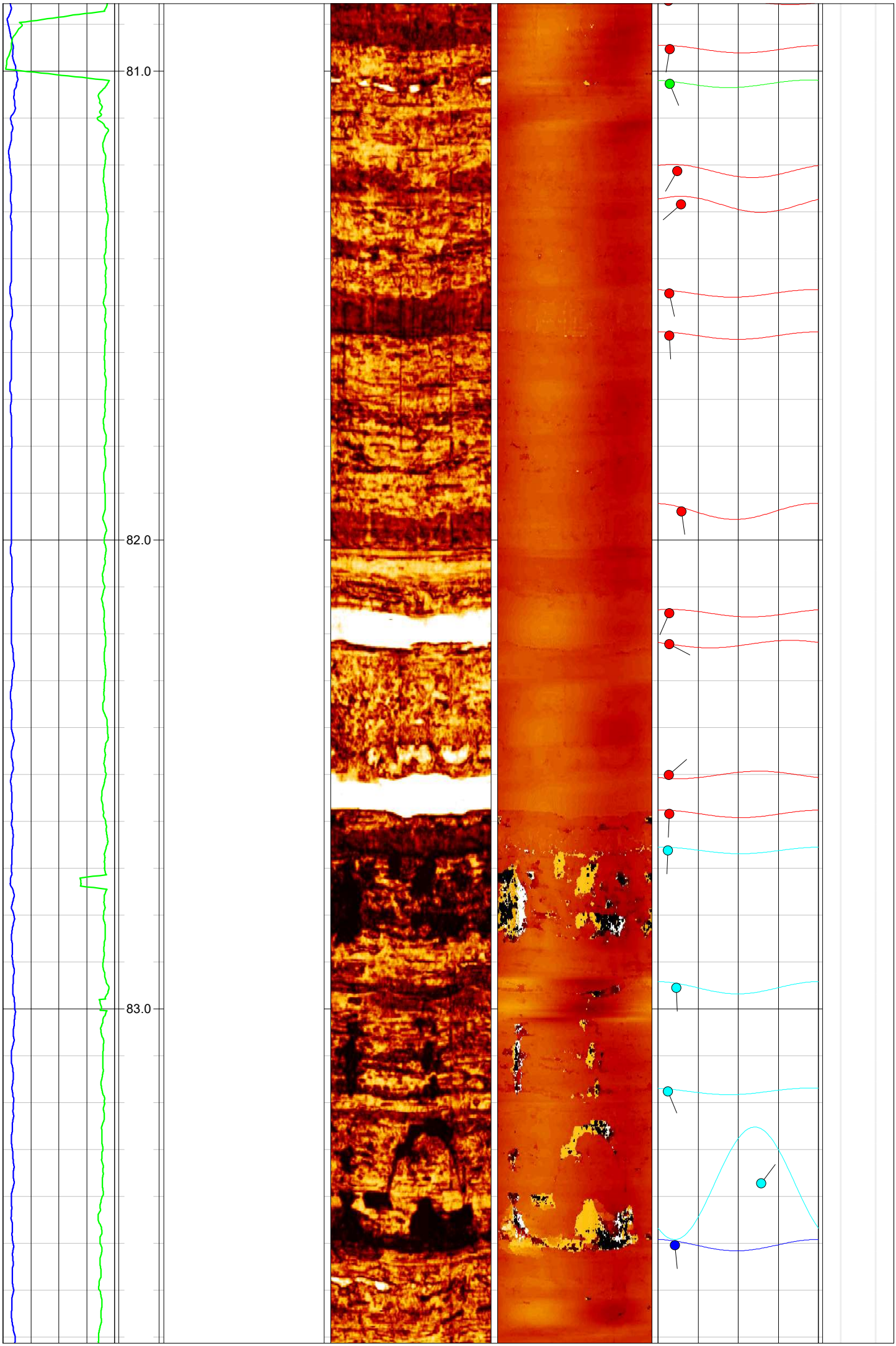
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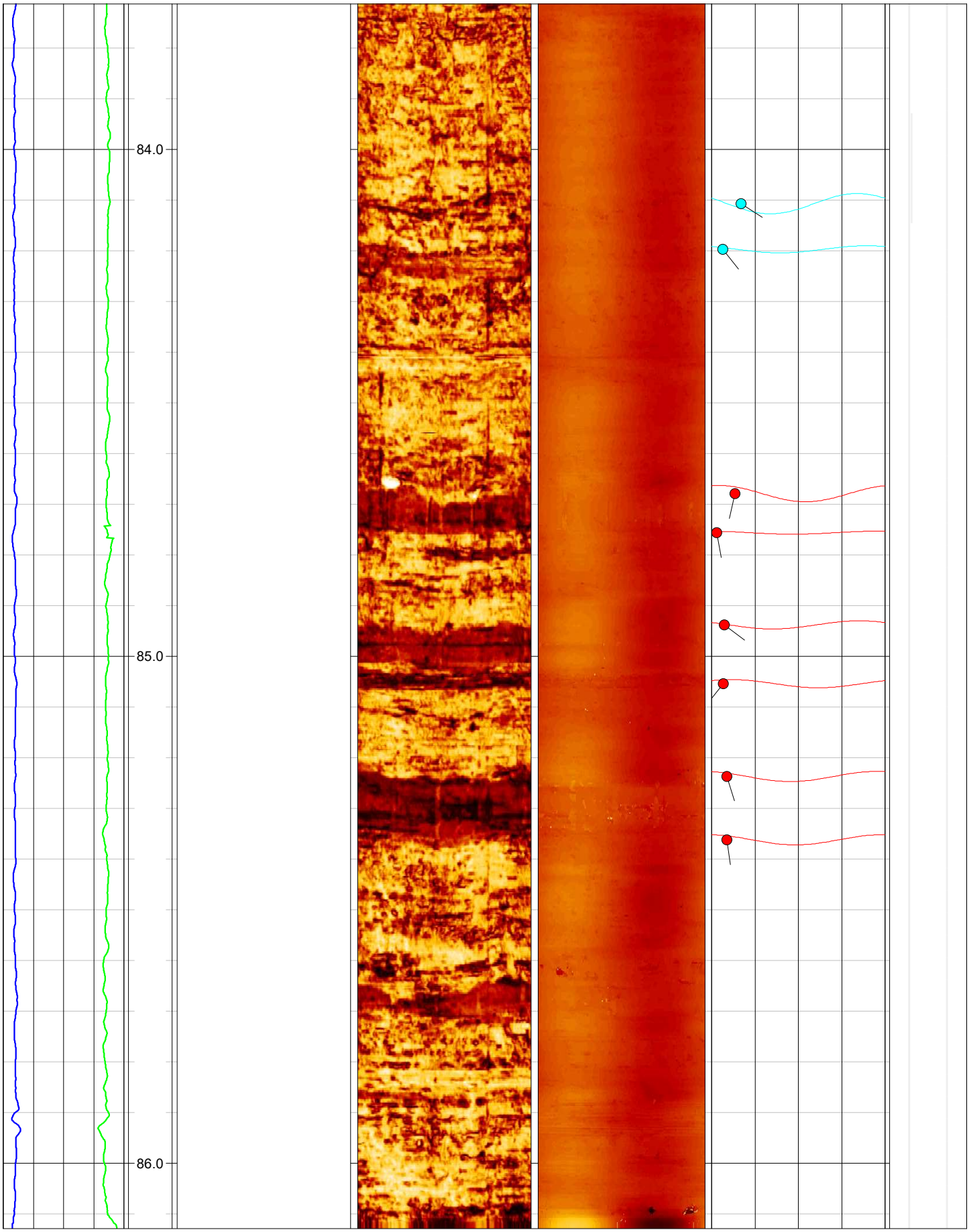
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86.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH412**

Log Type: ***Composite***

Location: **A417** Area: **Birdlip** Grid Ref: **394240.9E 215146.1N** Elevation: **250.30m**

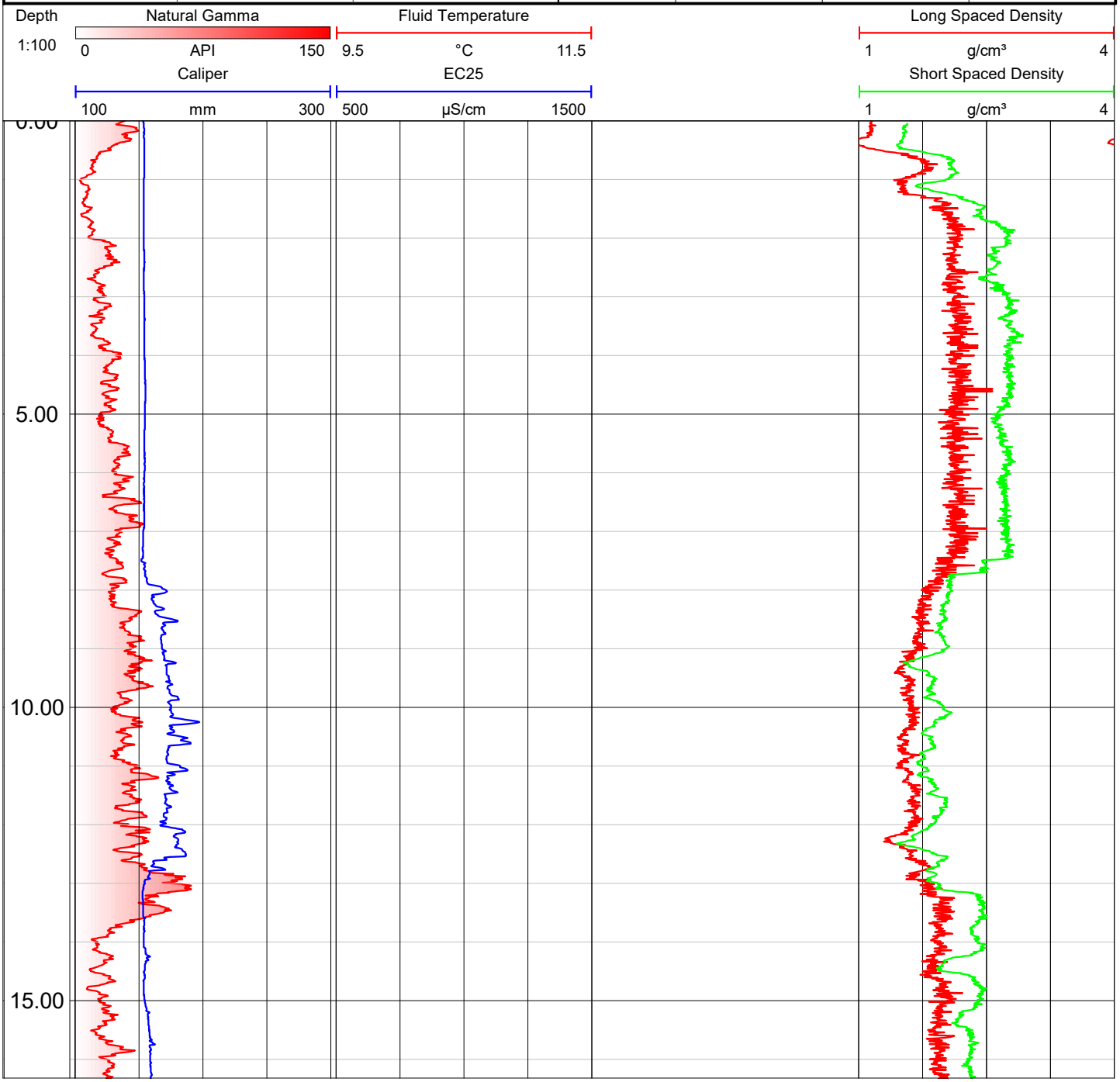
Drilled Depth: (m)	**30.2**	Date:	**28th October 2019**
Logged Depth: (m)	**30.1**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Cascading water into borehole. Water level too low to run resistivity and flow logs.
Logged Interval: (m)	**0.0 - 30.1**		
Fluid Level: (m)	**28.8**		

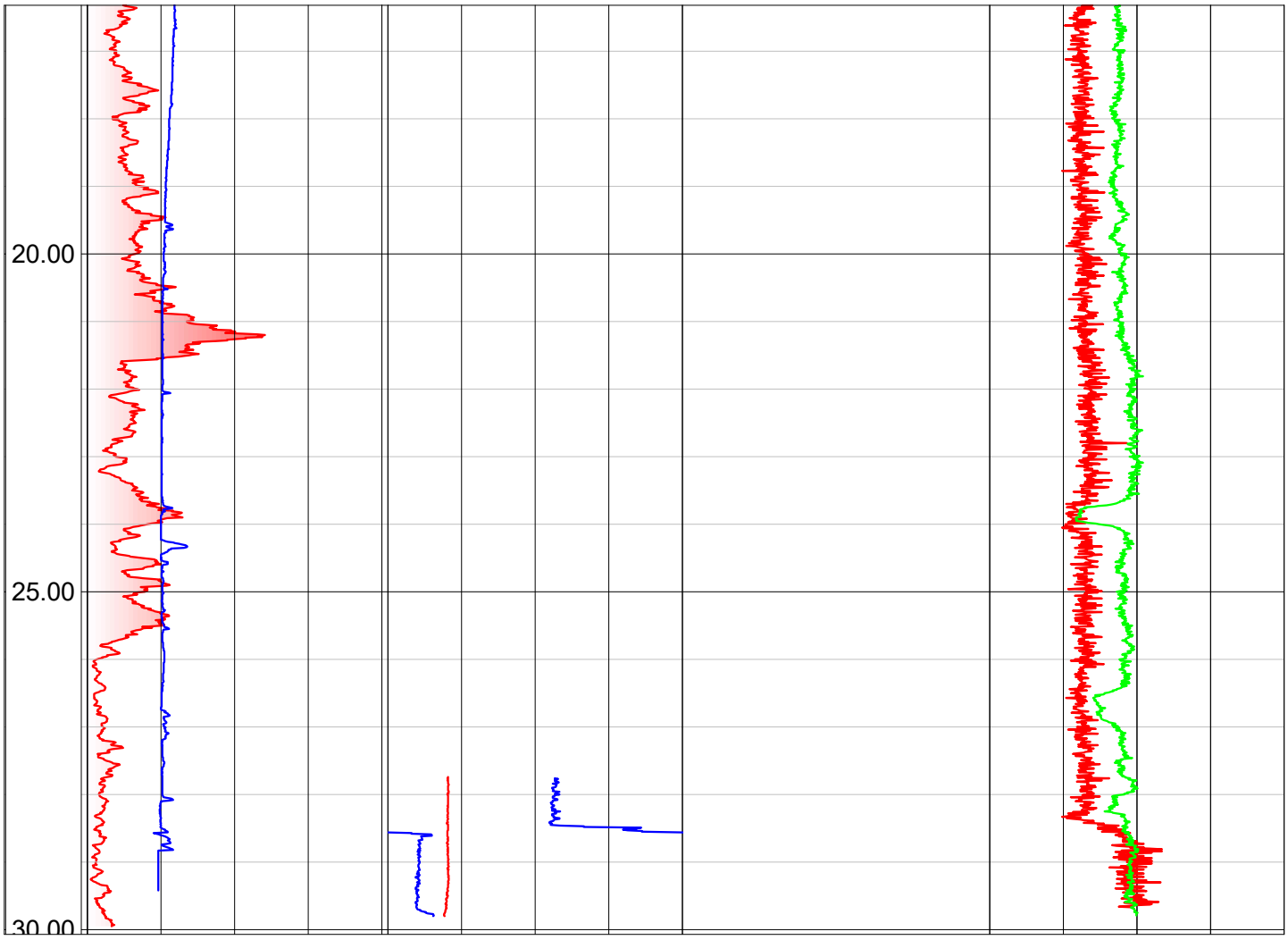
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**155**	**-1.0**	**7.7**




20.00
25.00
30.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **DSRCOH0412**

Log Type: ***Image***

Location: **A417** Area: **Birdlip** Grid Ref: **394240.9E 215146.1N** Elevation: **250.30m**

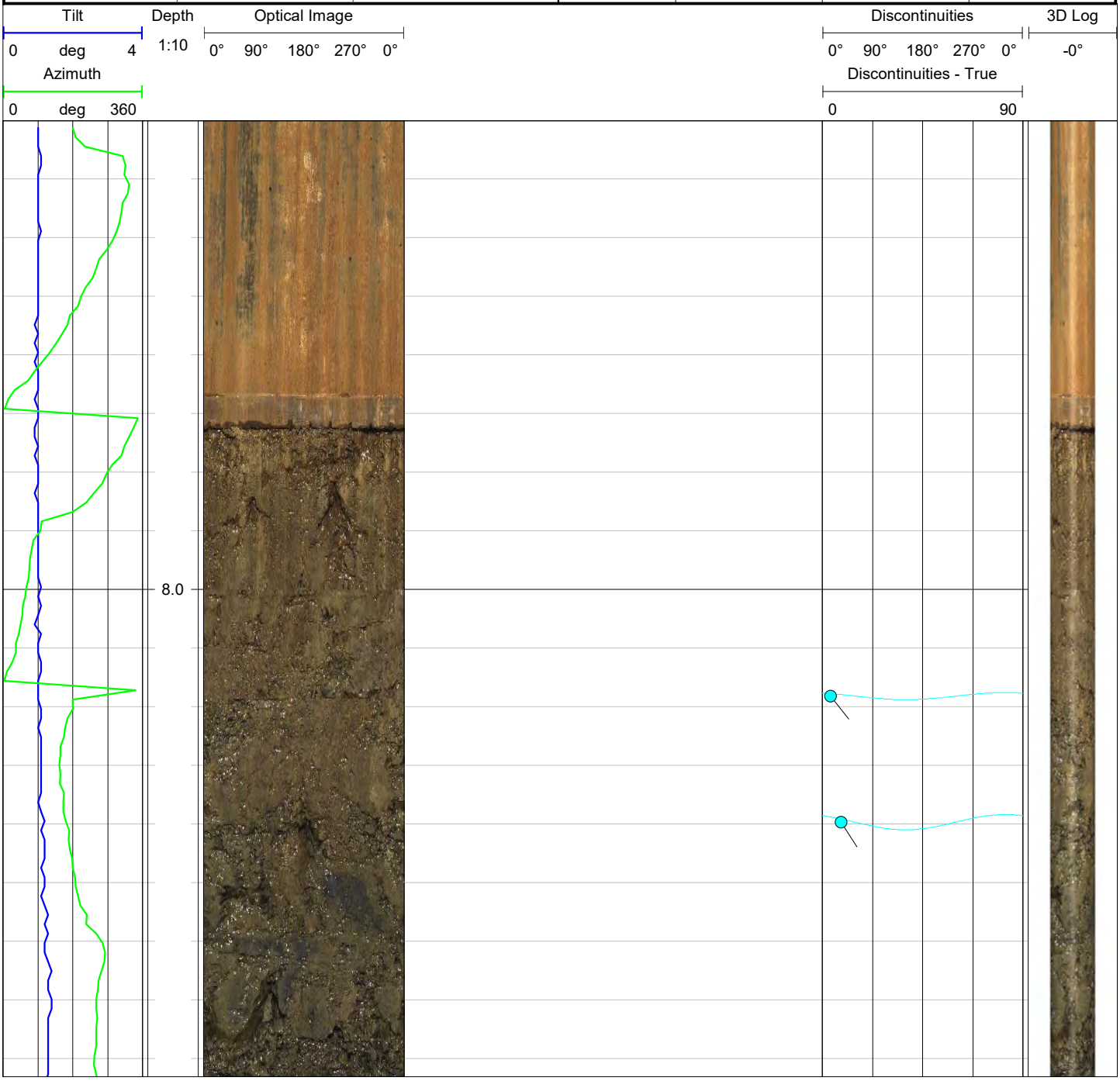
Drilled Depth: (m)	**30.2**	Date:	**28th October 2019**
Logged Depth: (m)	**30.1**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Cascading water into borehole.
Logged Interval: (m)	**7.7 - 30.1**		
Fluid Level: (m)	**28.8**		

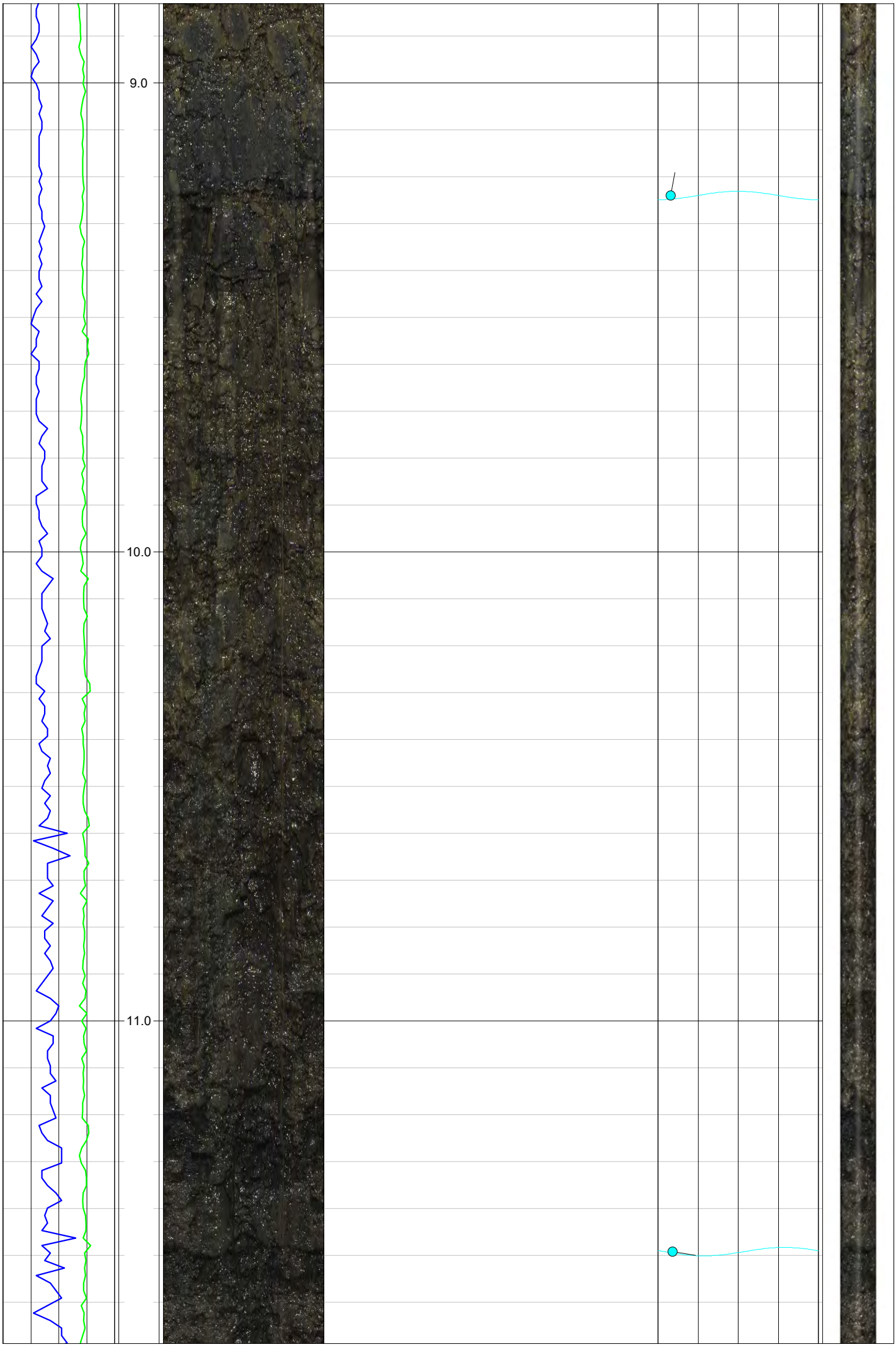
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**155**	**-1.0**	**7.7**

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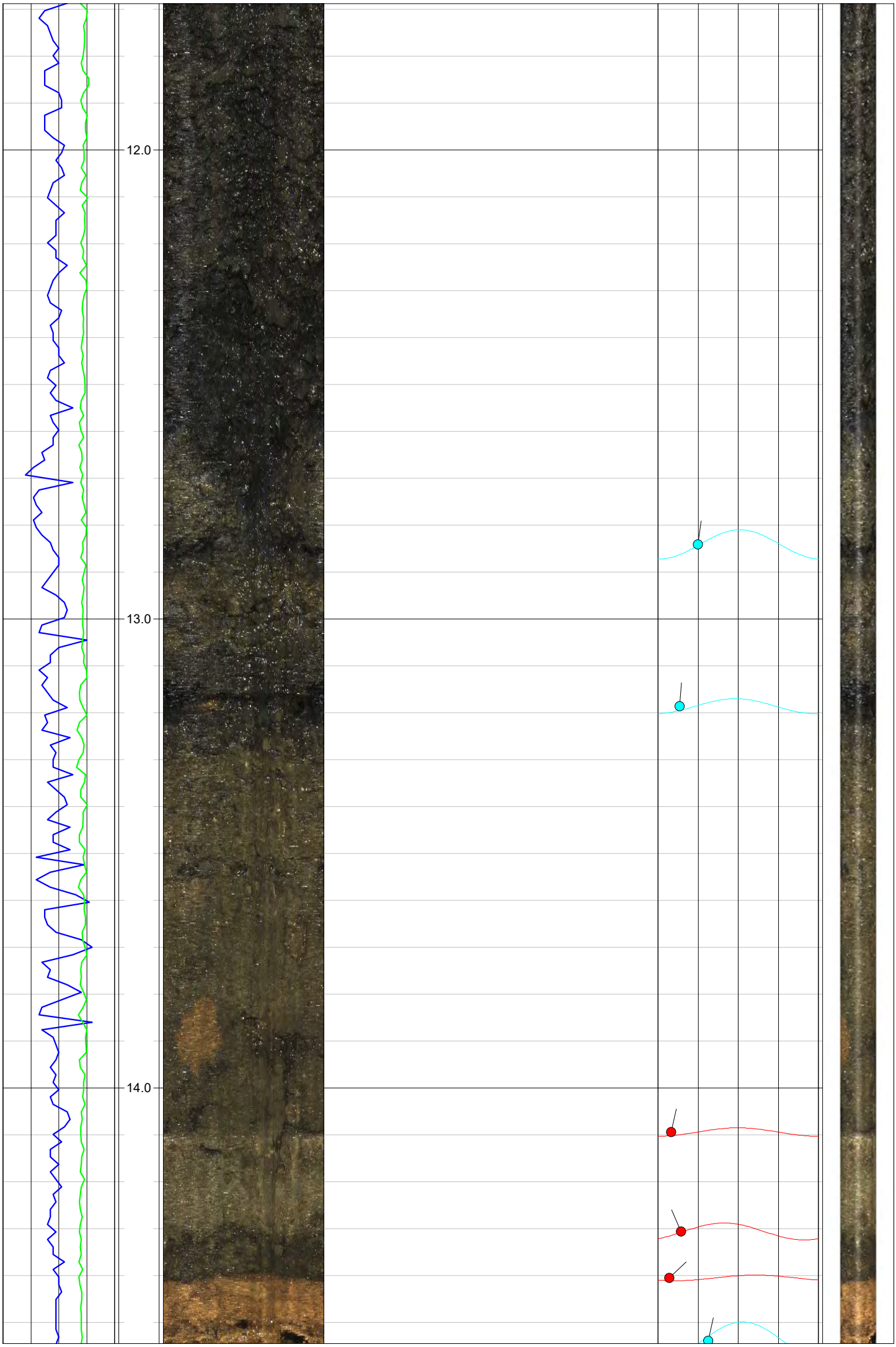
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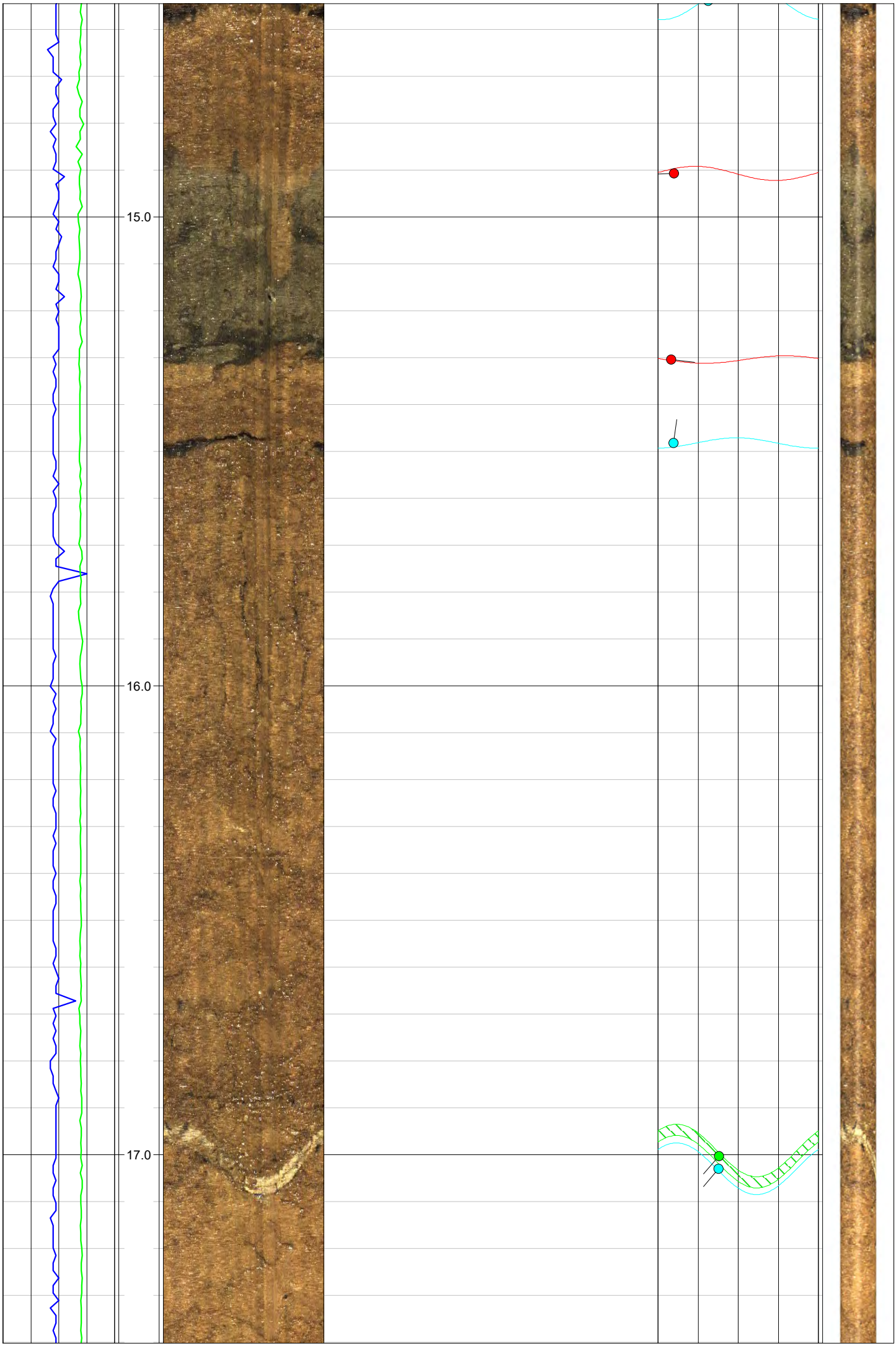
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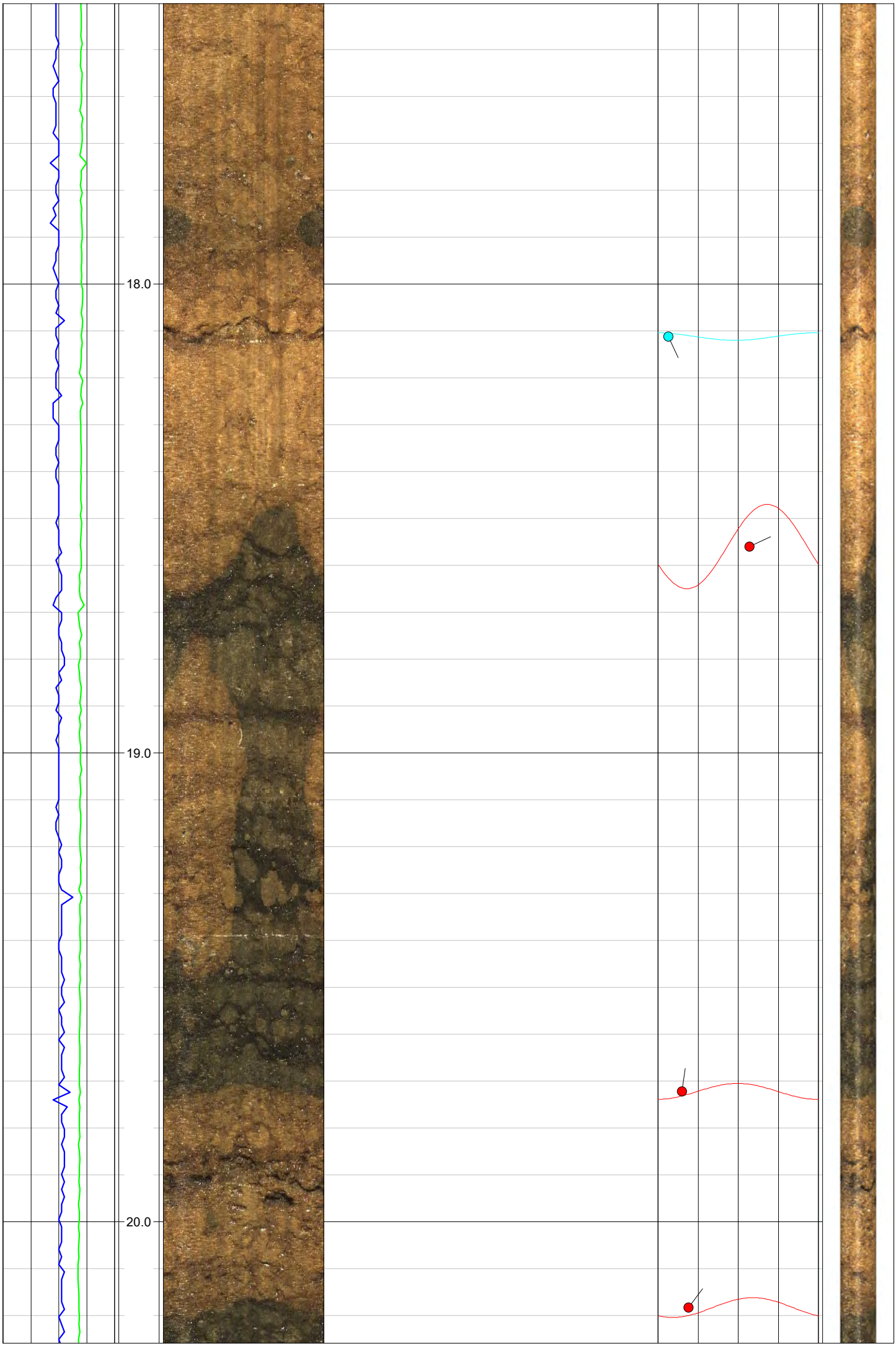
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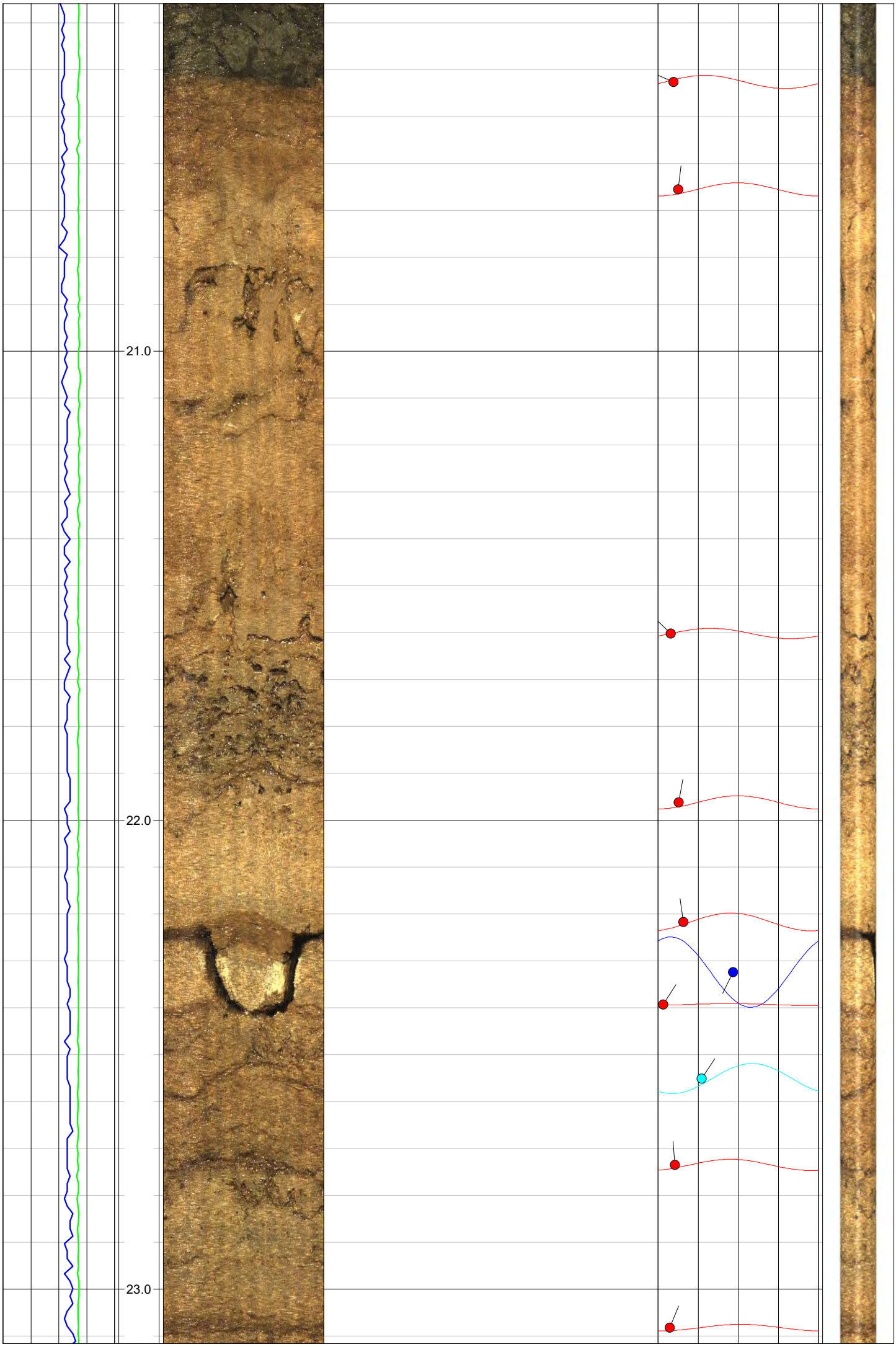
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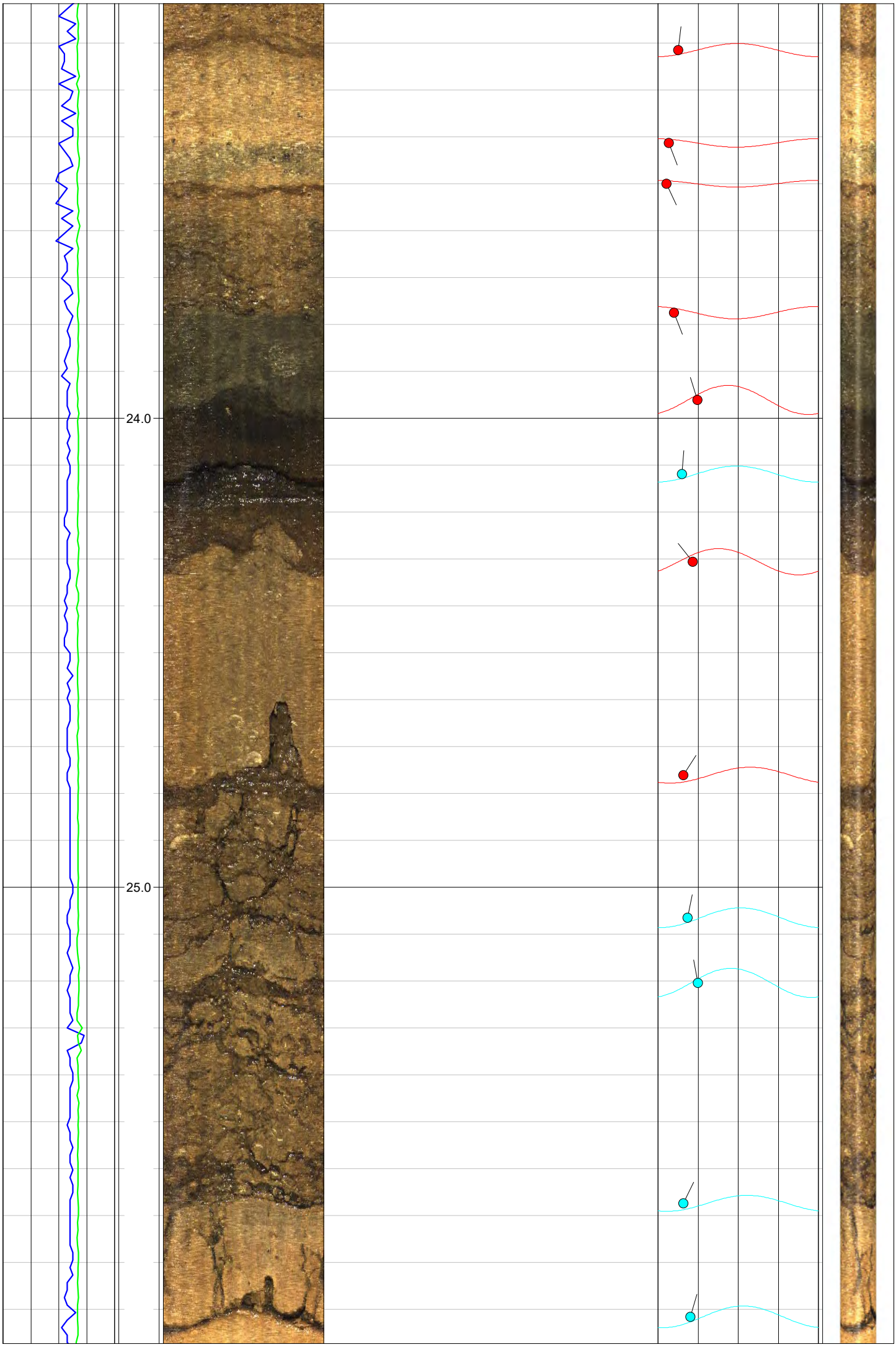
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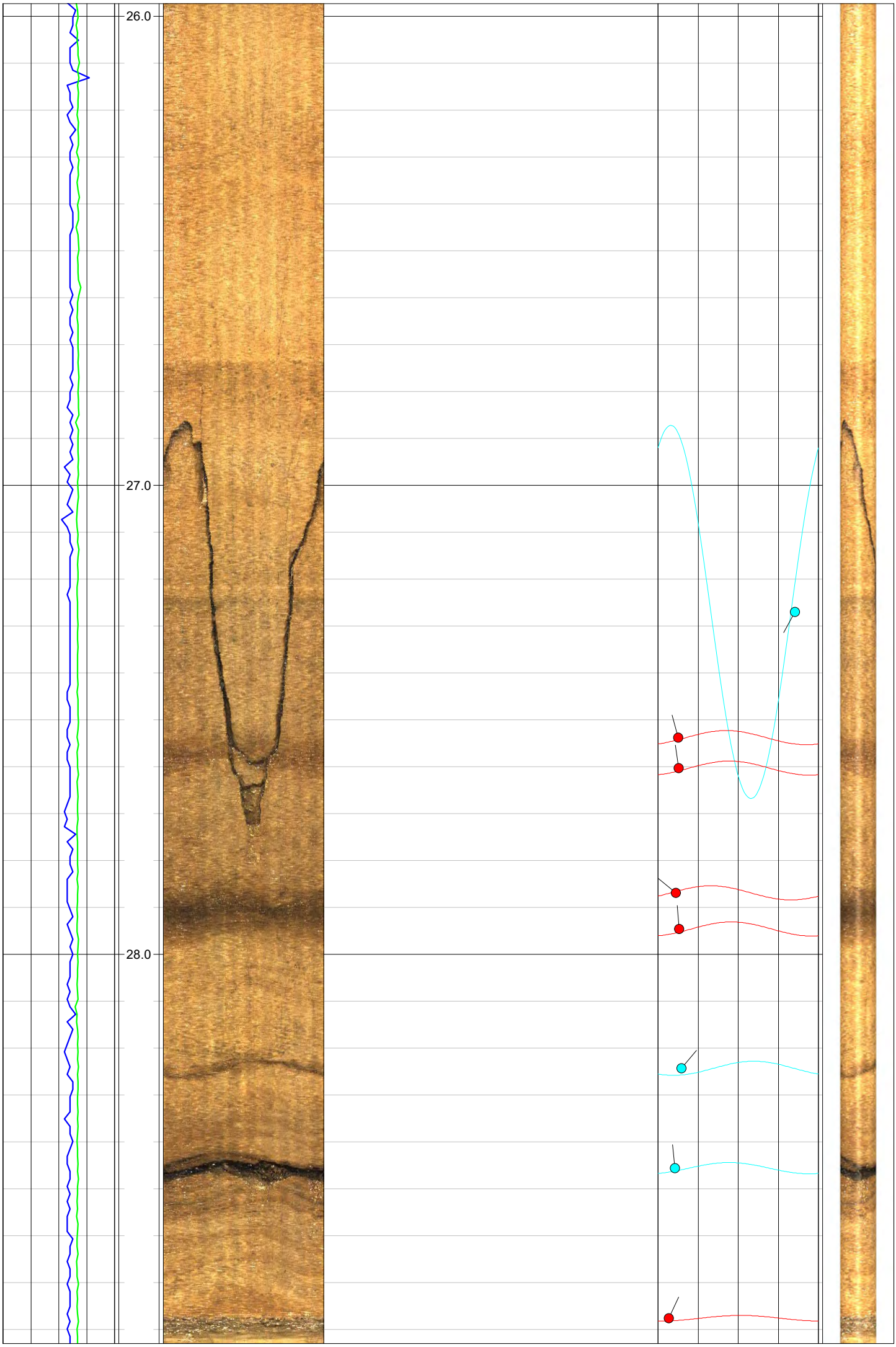
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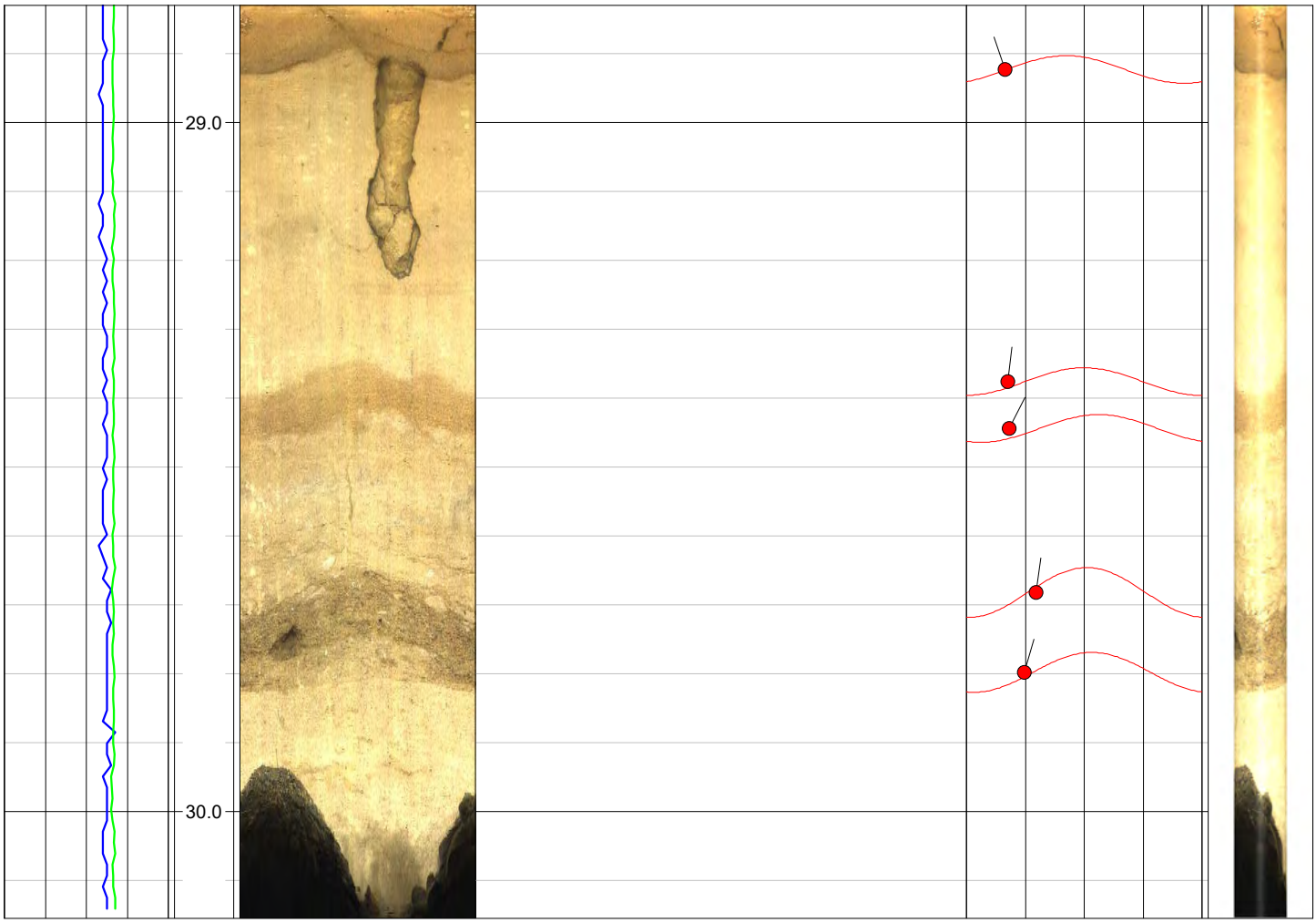
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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **OH411**

Log Type: ***Composite***

Location: **A417** Area: **Gloucestershire** Grid Ref: Elevation:

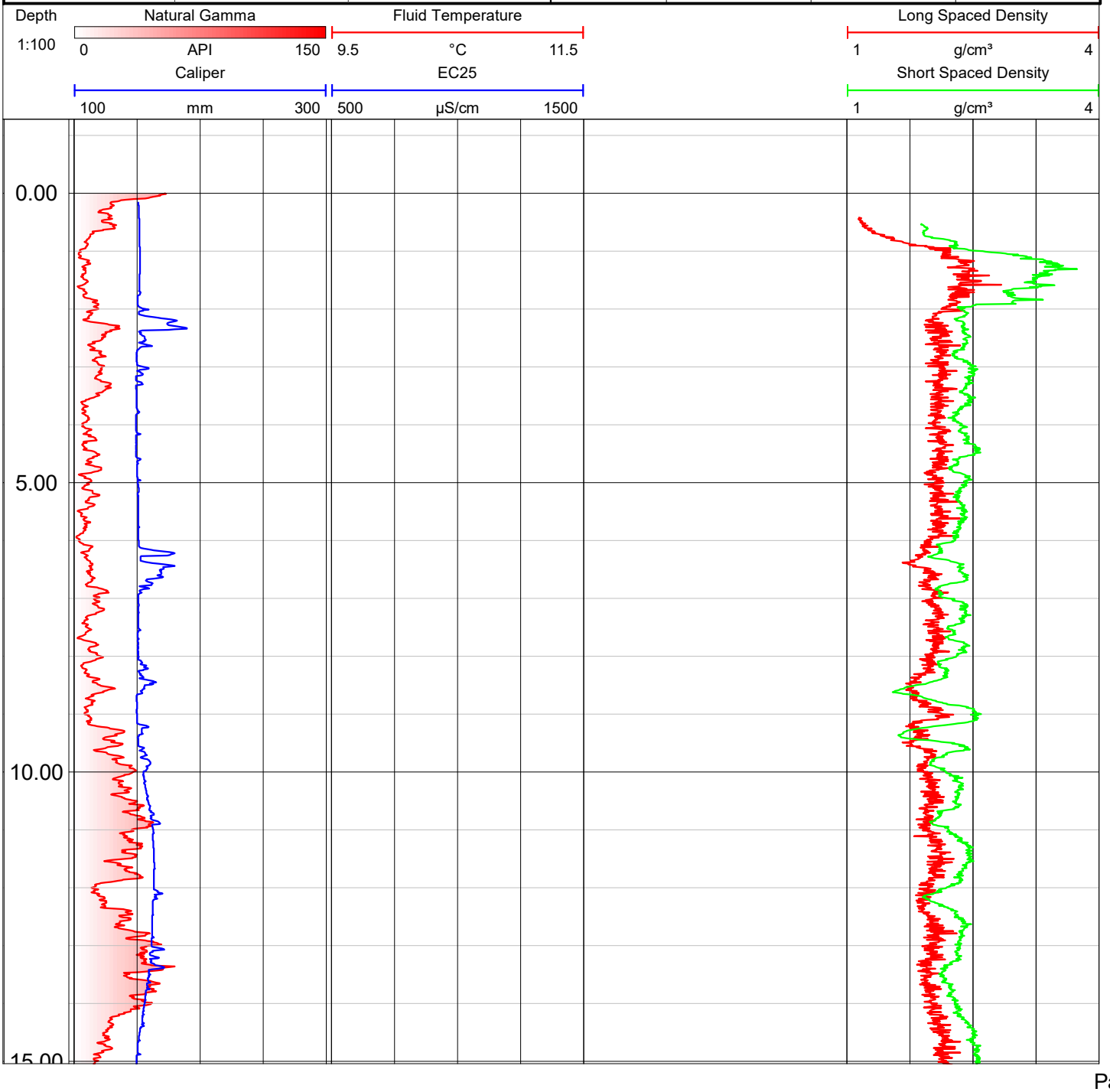
Drilled Depth: (m)	**100.0**	Date:	**09.06.2020**
Logged Depth: (m)	**86.2**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Obstruction at 86.2m blocking tool access
Logged Interval: (m)	**0.0 - 86.2**		
Fluid Level: (m)	**81.2**		

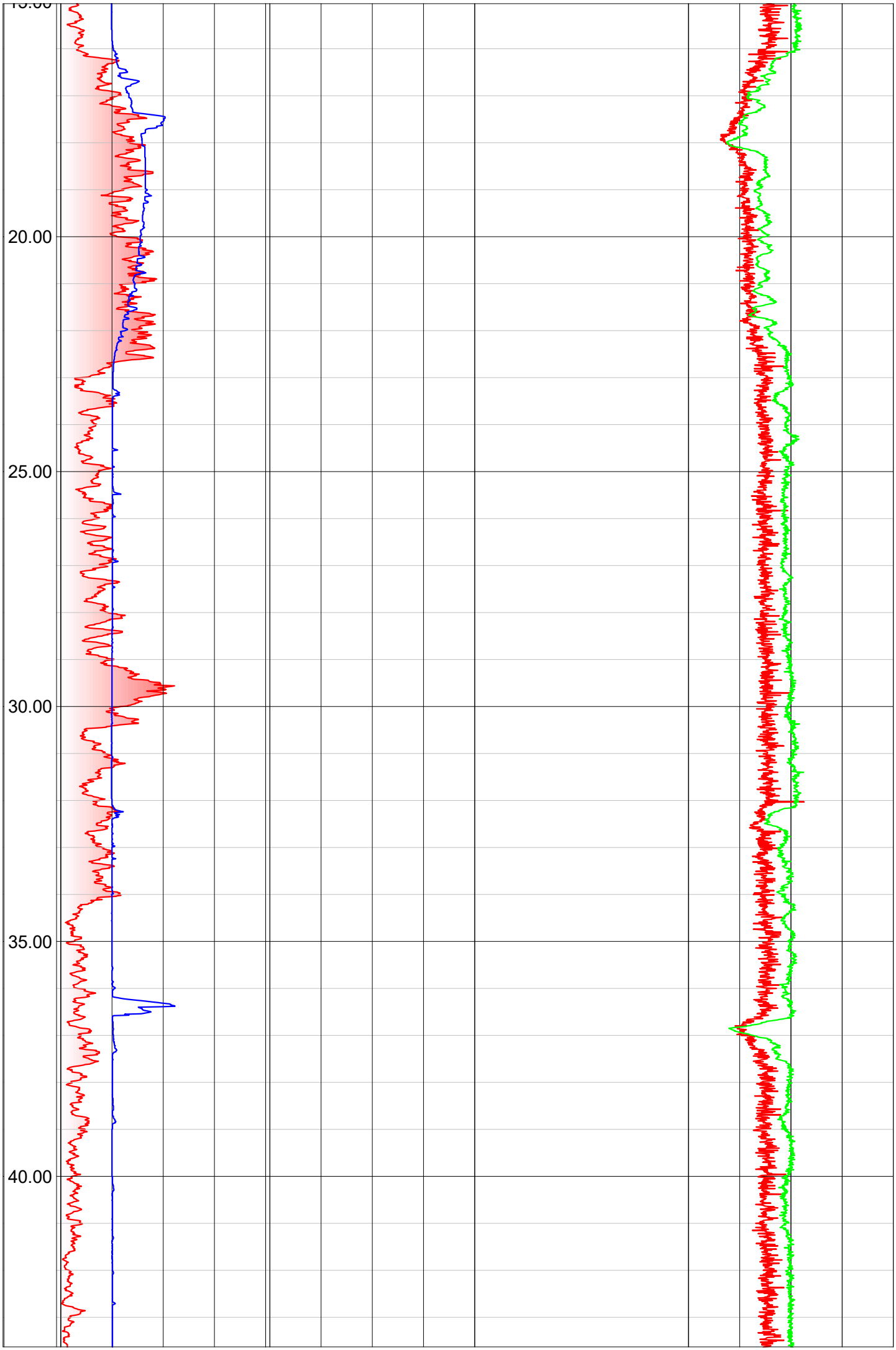
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**146**	**-0.2**	**1.8**

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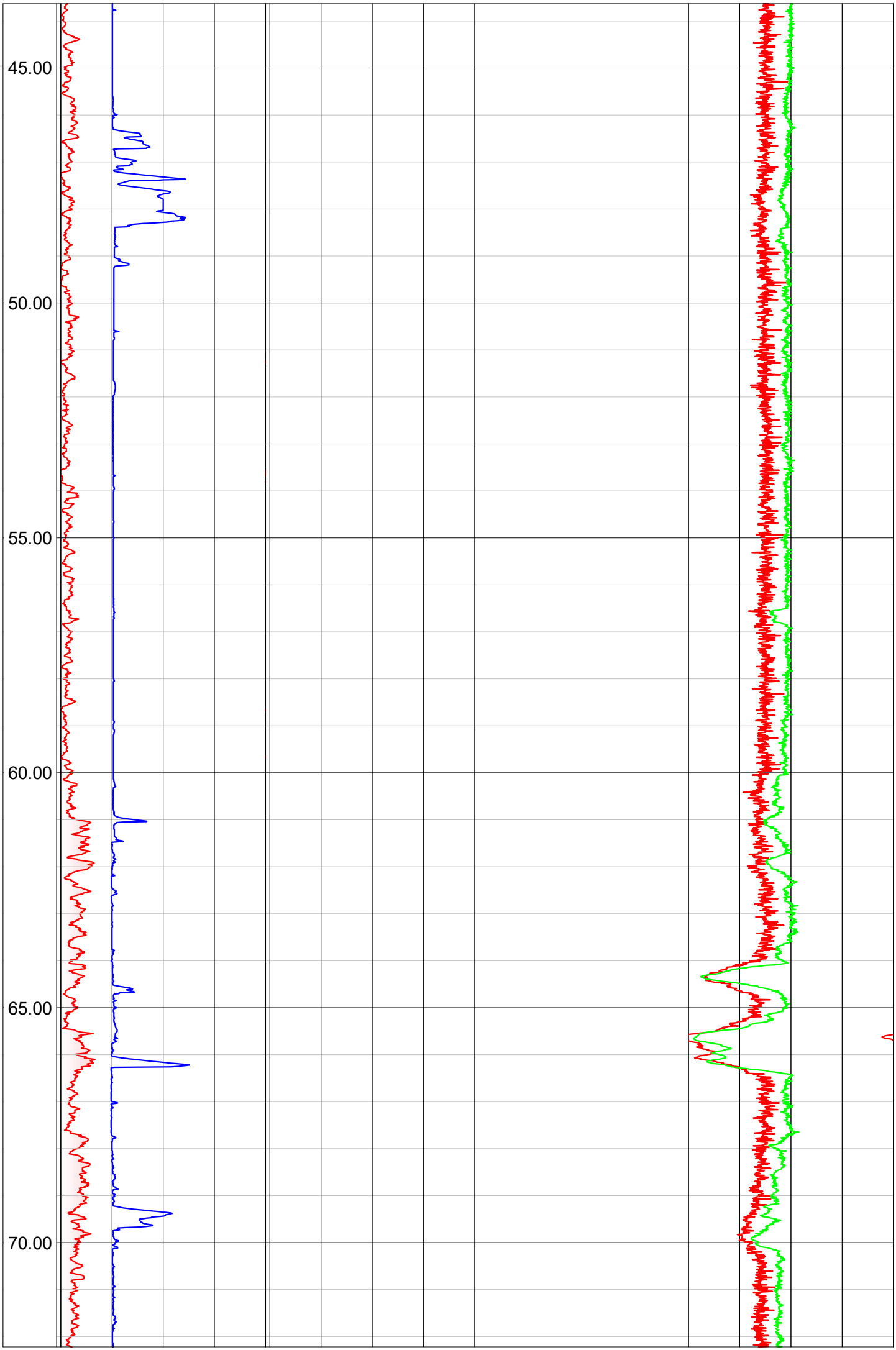
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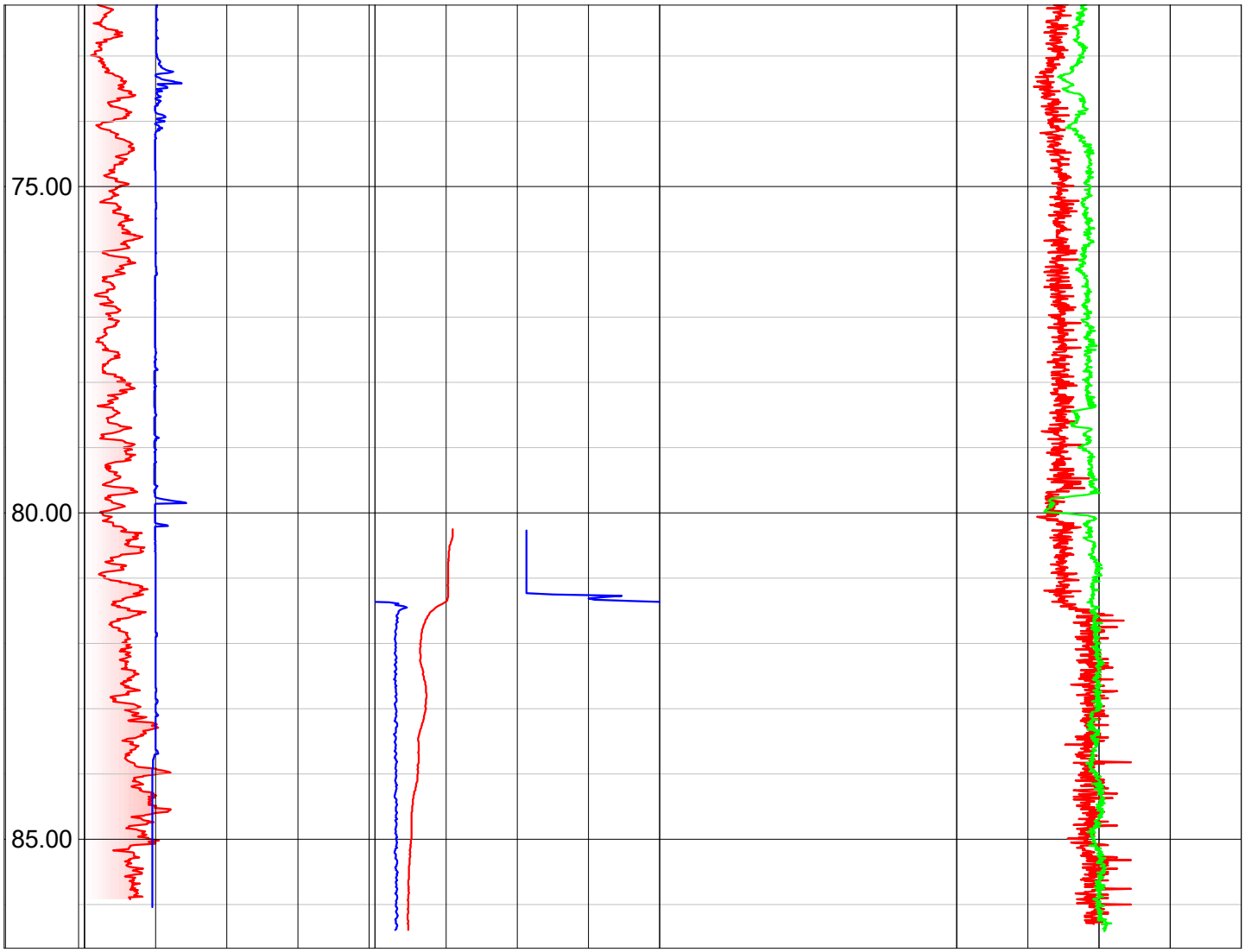
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85.00

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **OH411**

Log Type: ***Image***

Location: **A417** Area: **Gloucestershire** Grid Ref: Elevation:

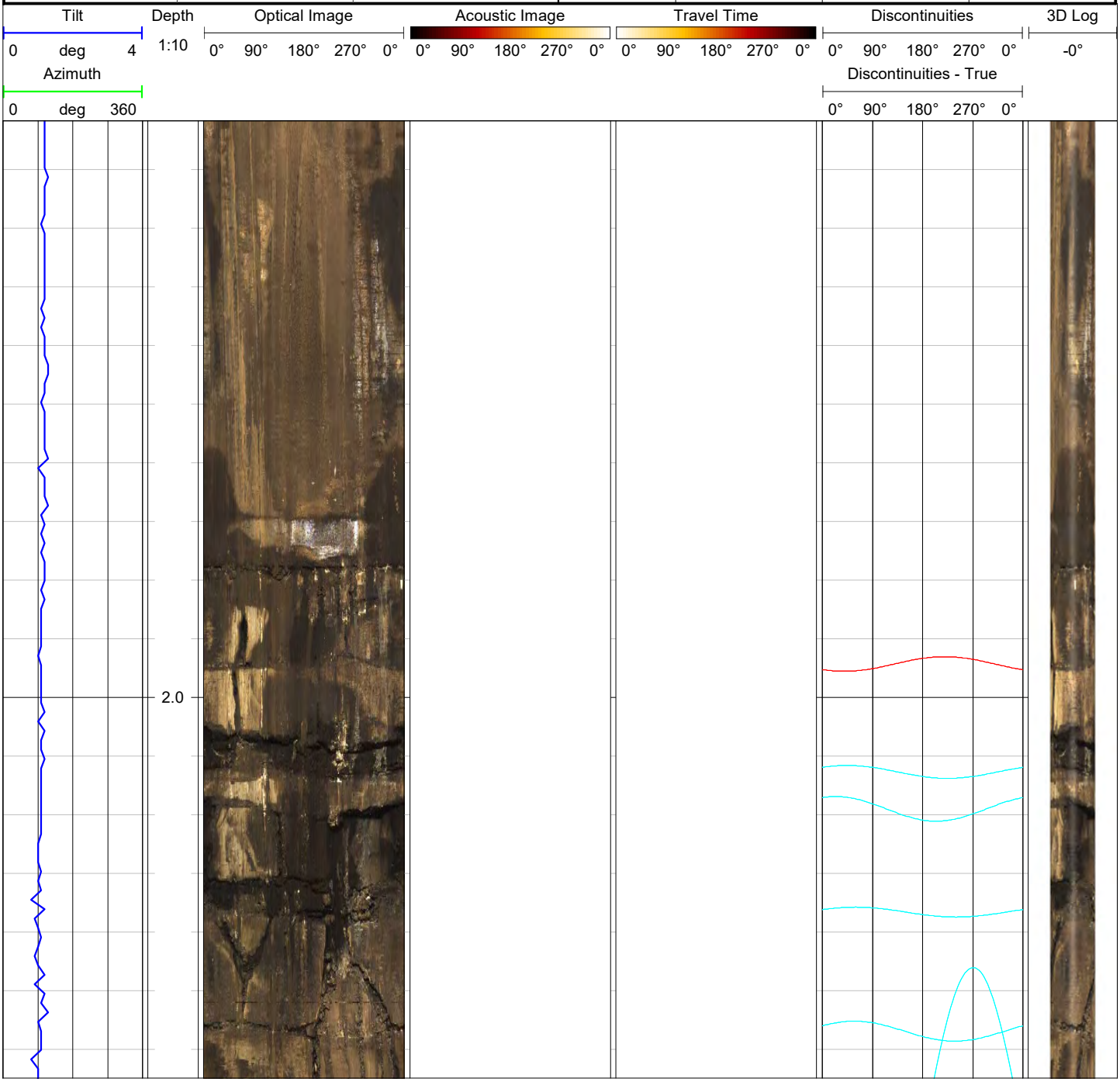
Drilled Depth: (m)	**100.0**	Date:	**09.06.2020**
Logged Depth: (m)	**86.2**	Recorded By:	**Dave Hingley**
Logging Datum:	**Ground Level**	Remarks:	Obstruction at 86.2m blocking tool access.
Logged Interval: (m)	**1.8 - 86.2**		
Fluid Level: (m)	**81.2**		

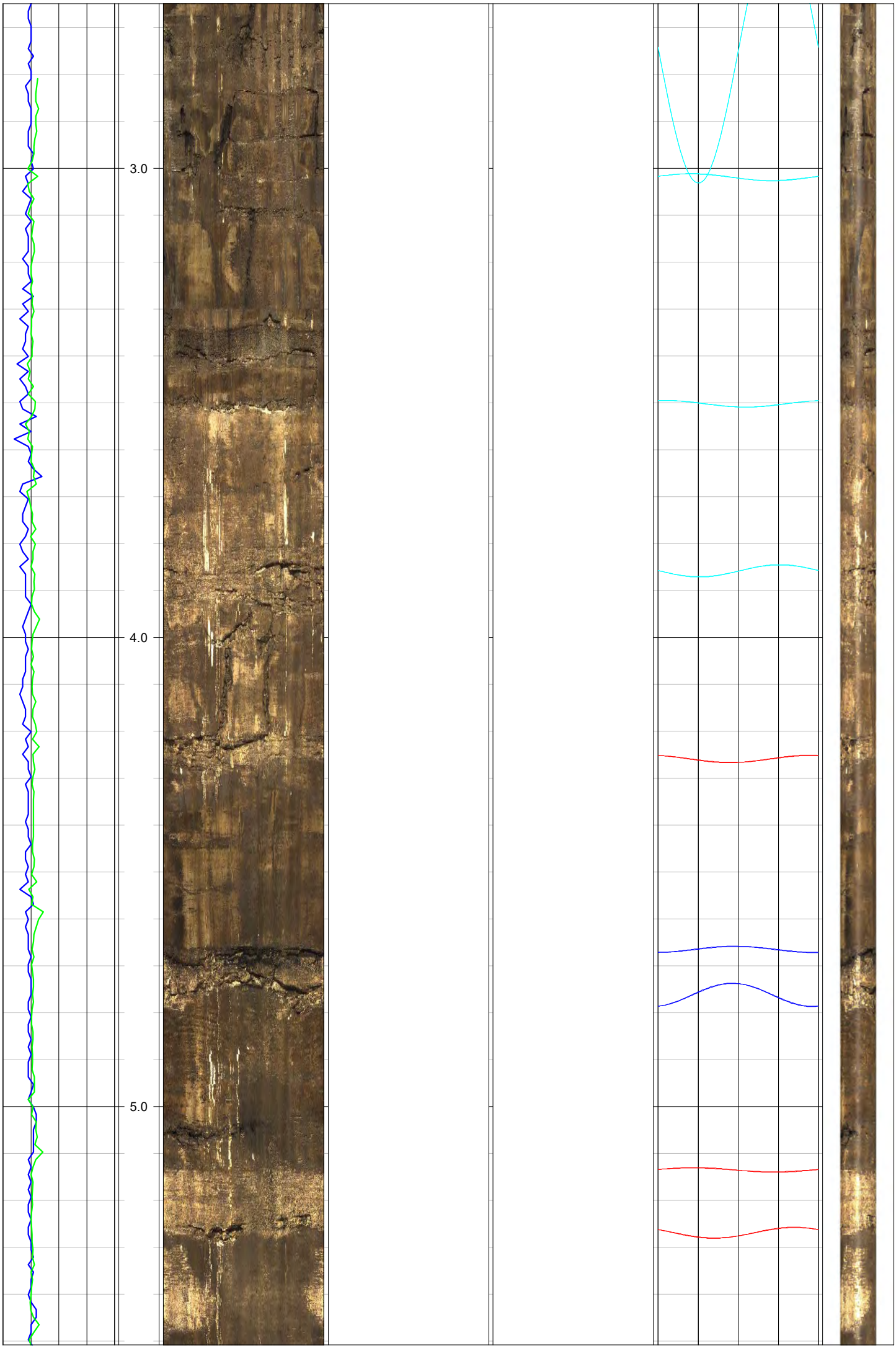
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
steel	**146**	**-0.2**	**1.8**

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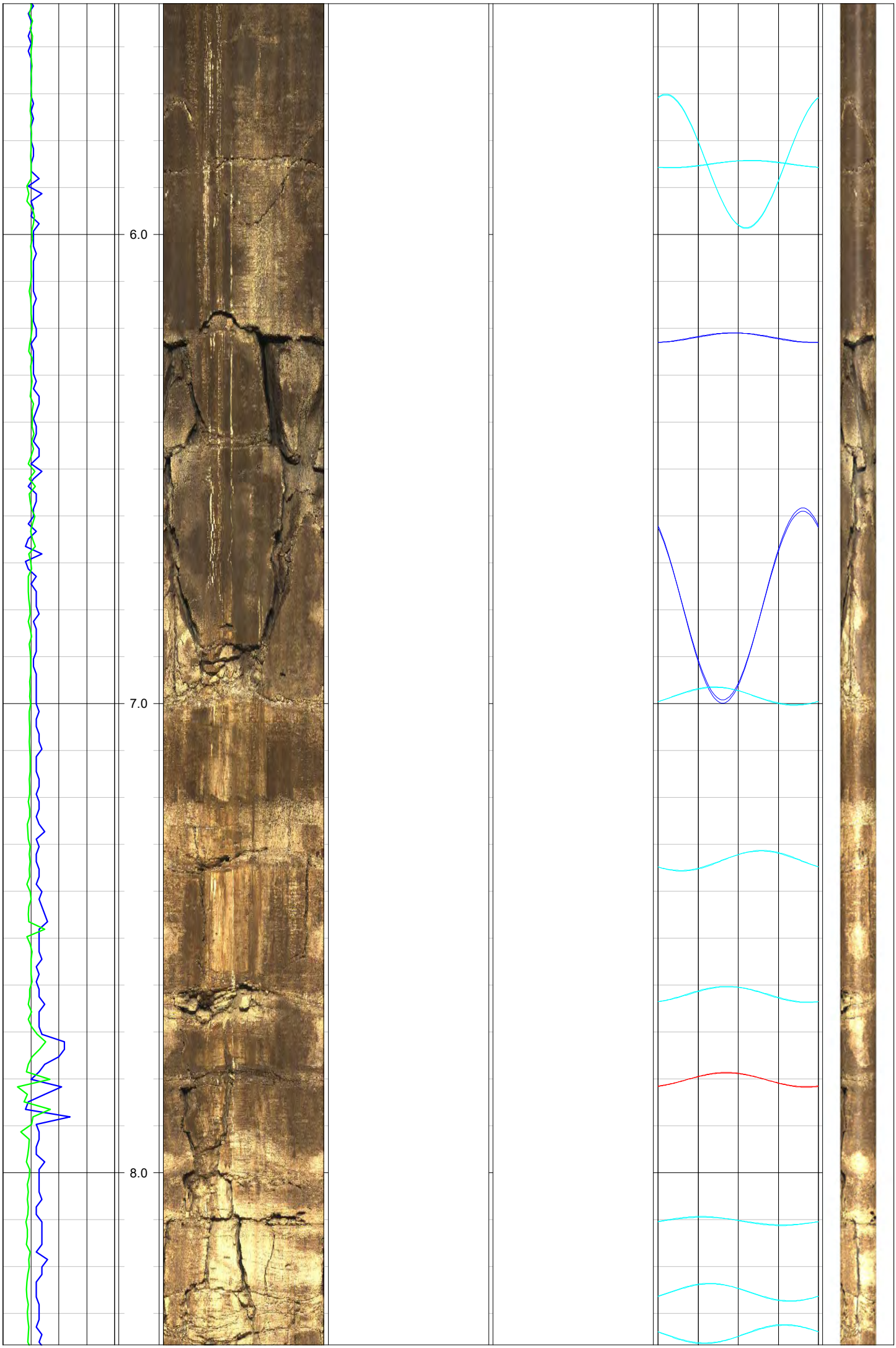
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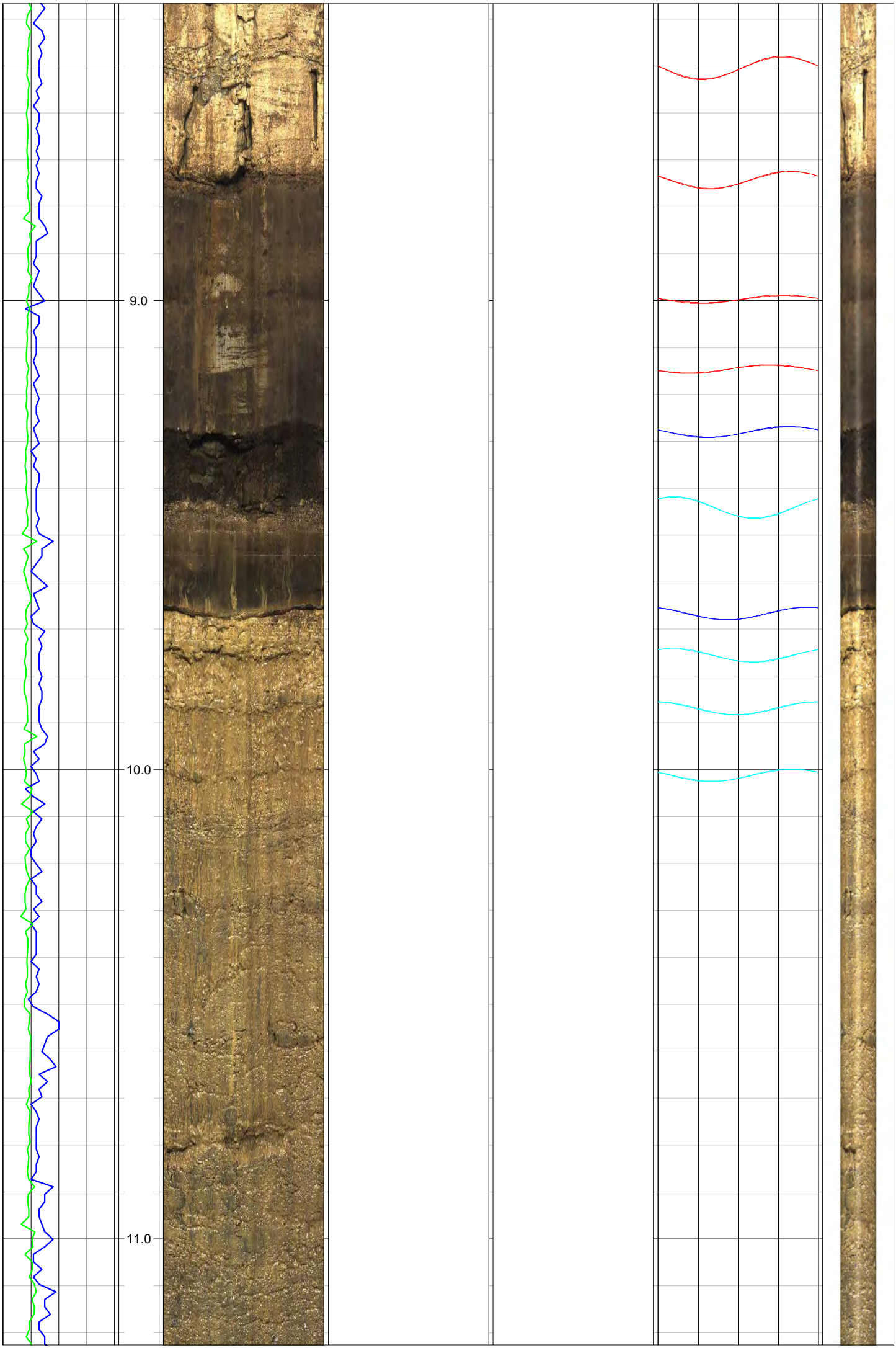
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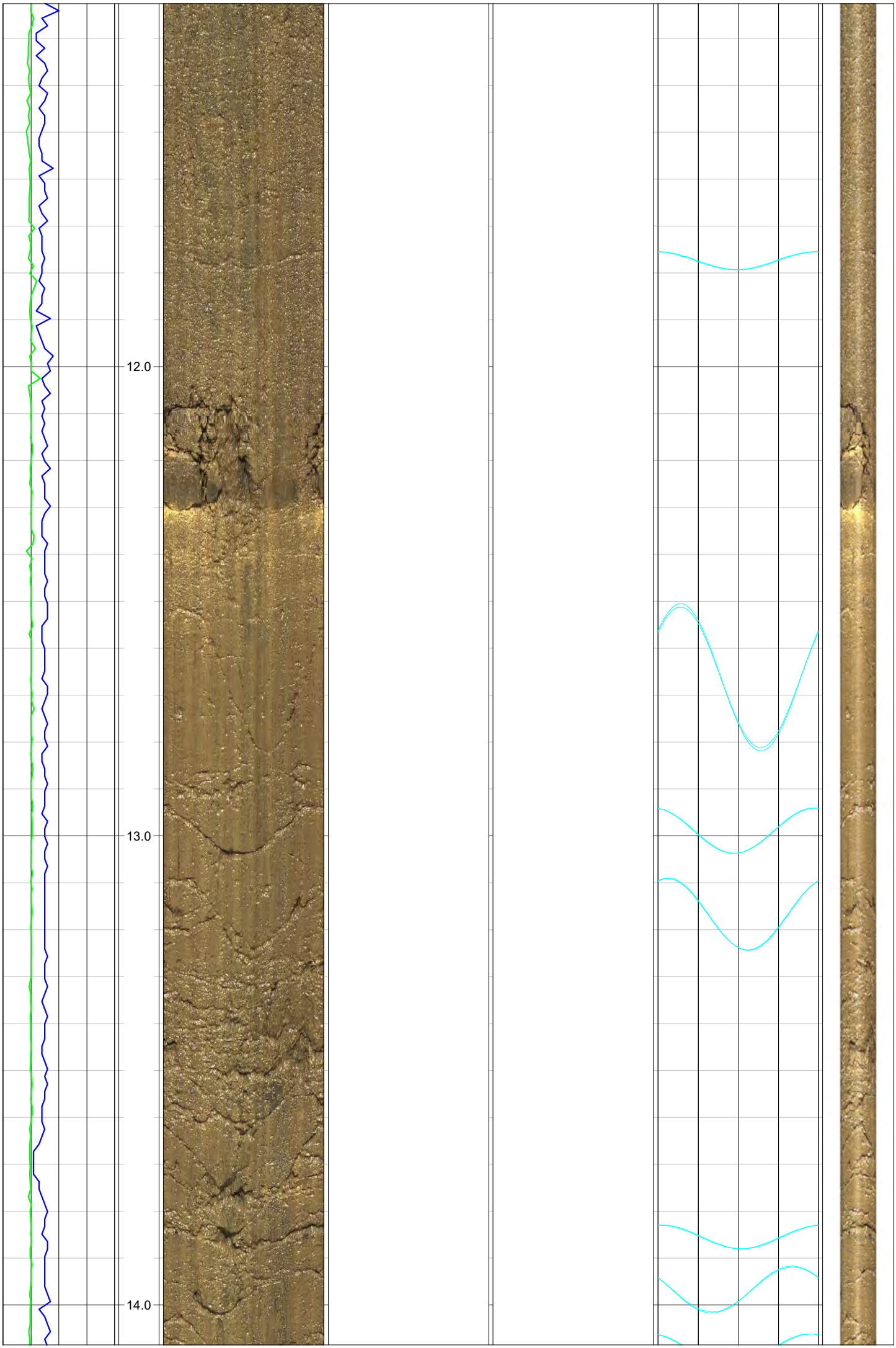
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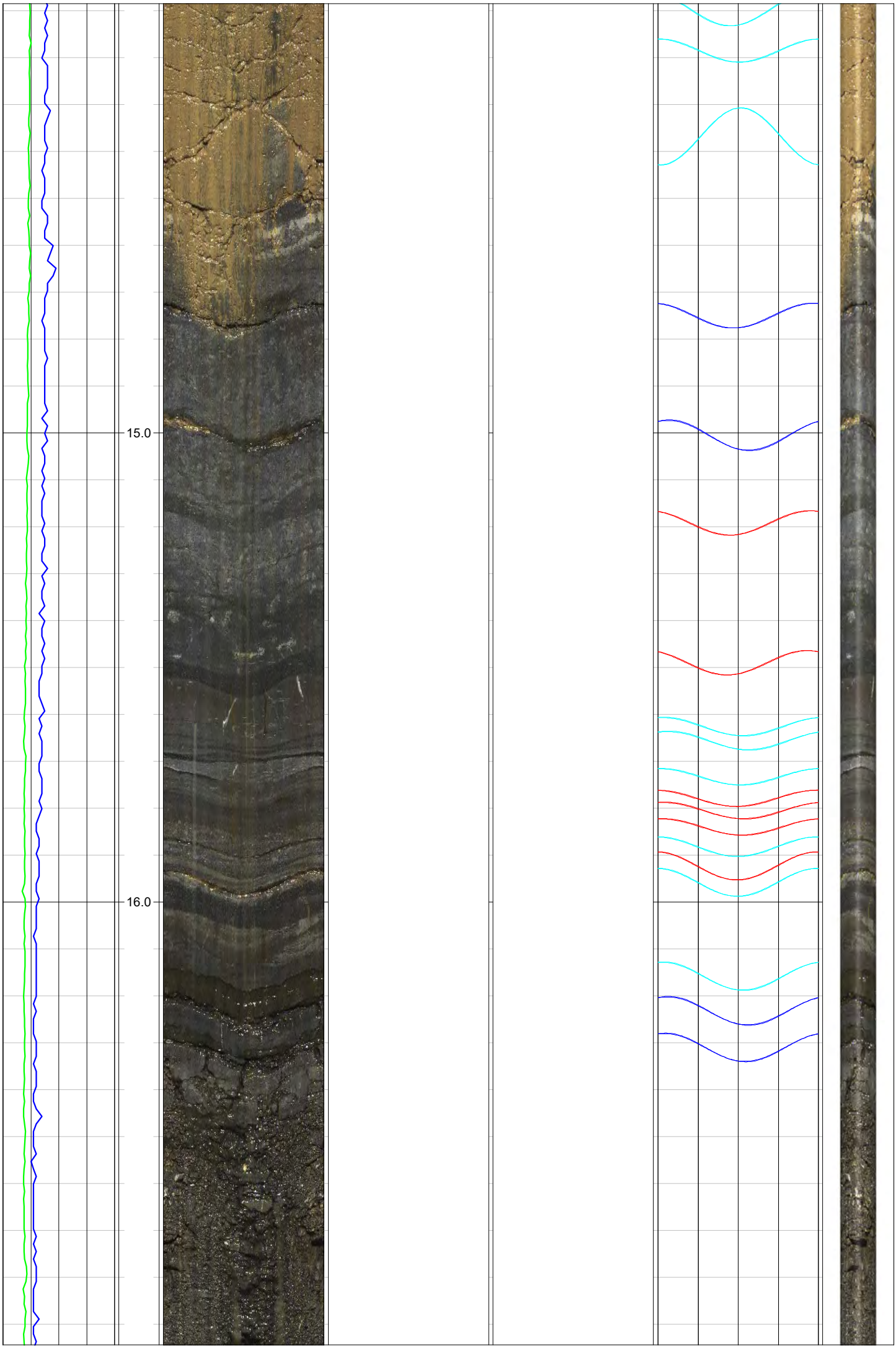
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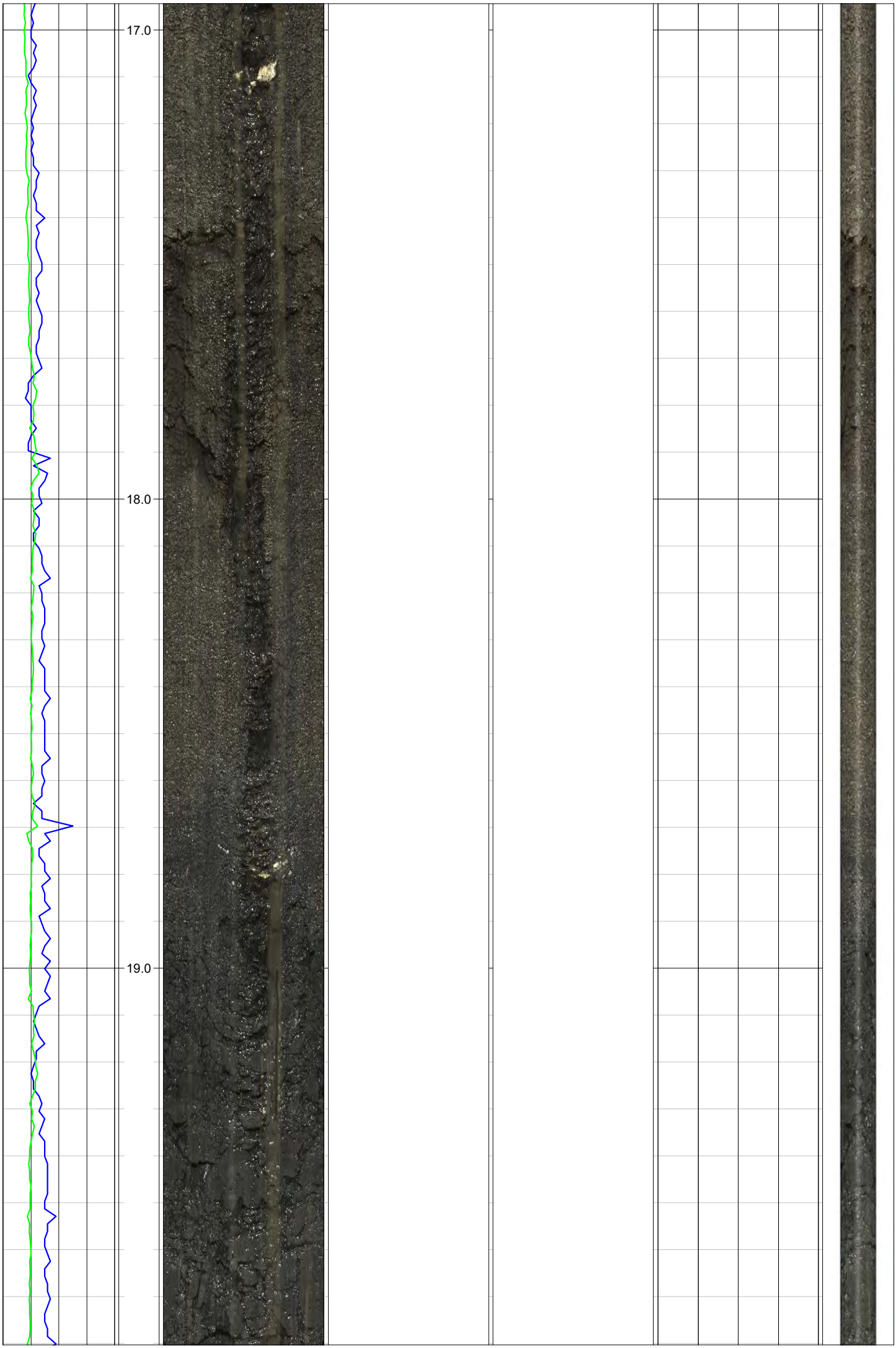
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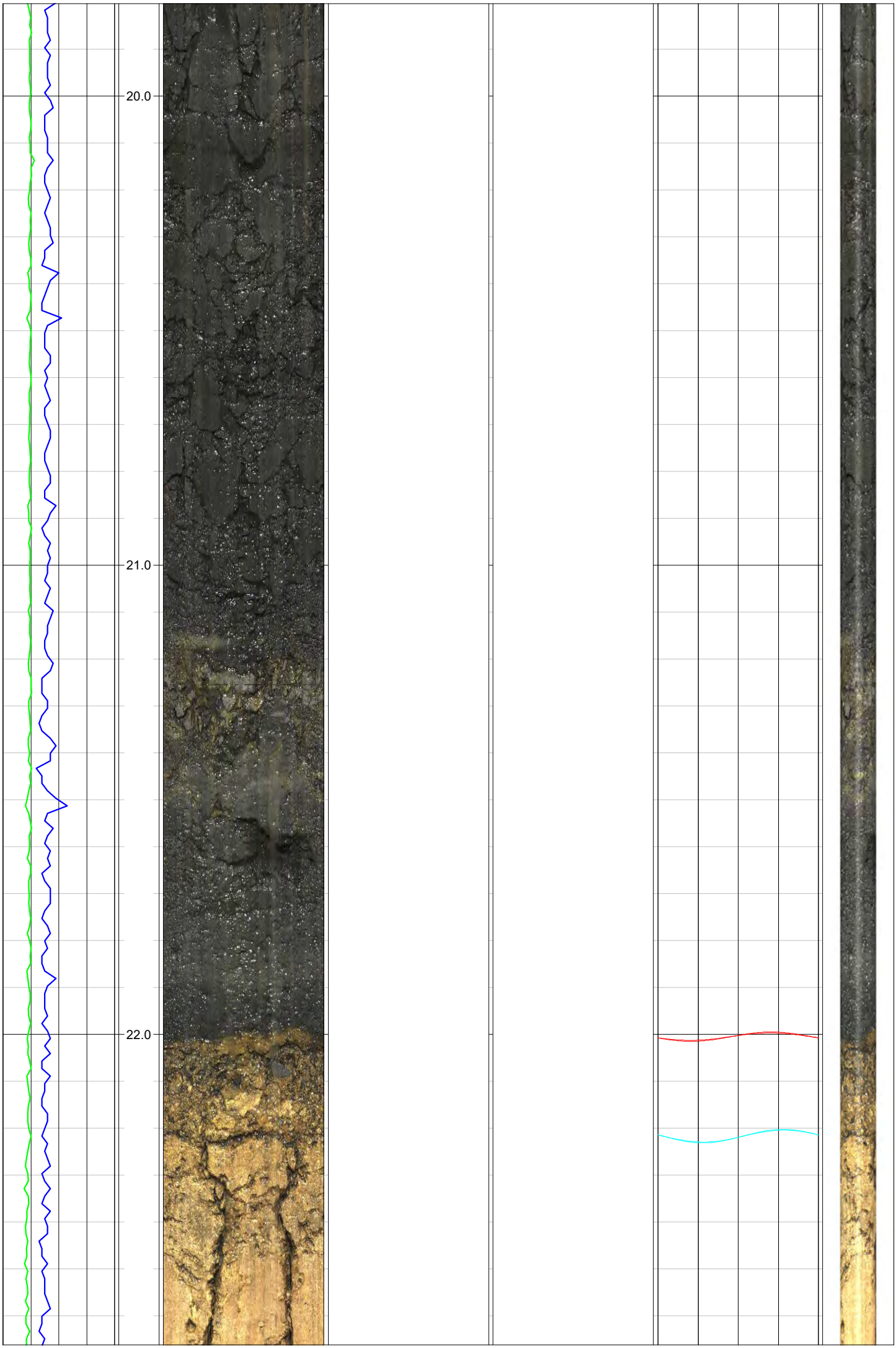
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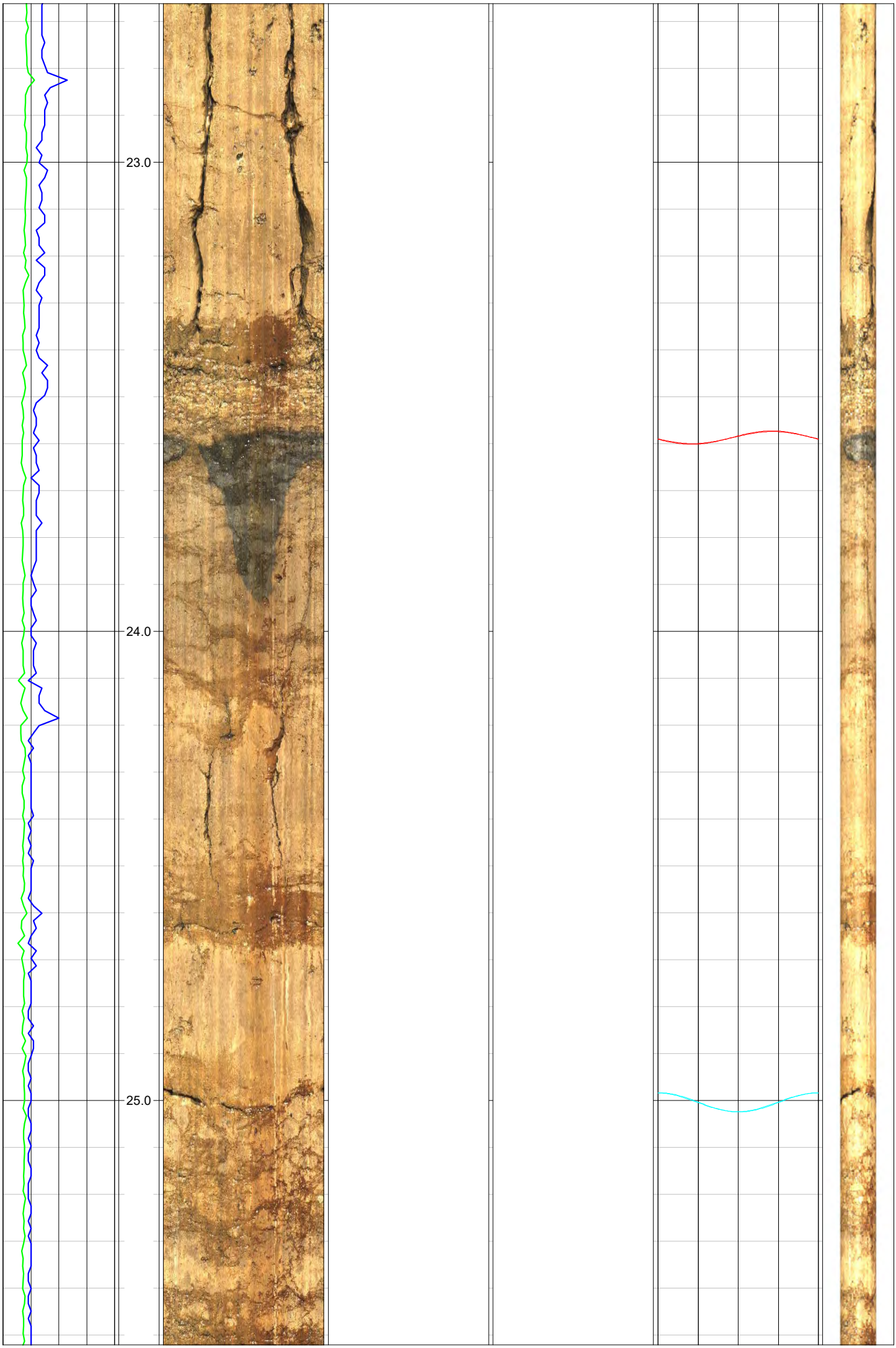
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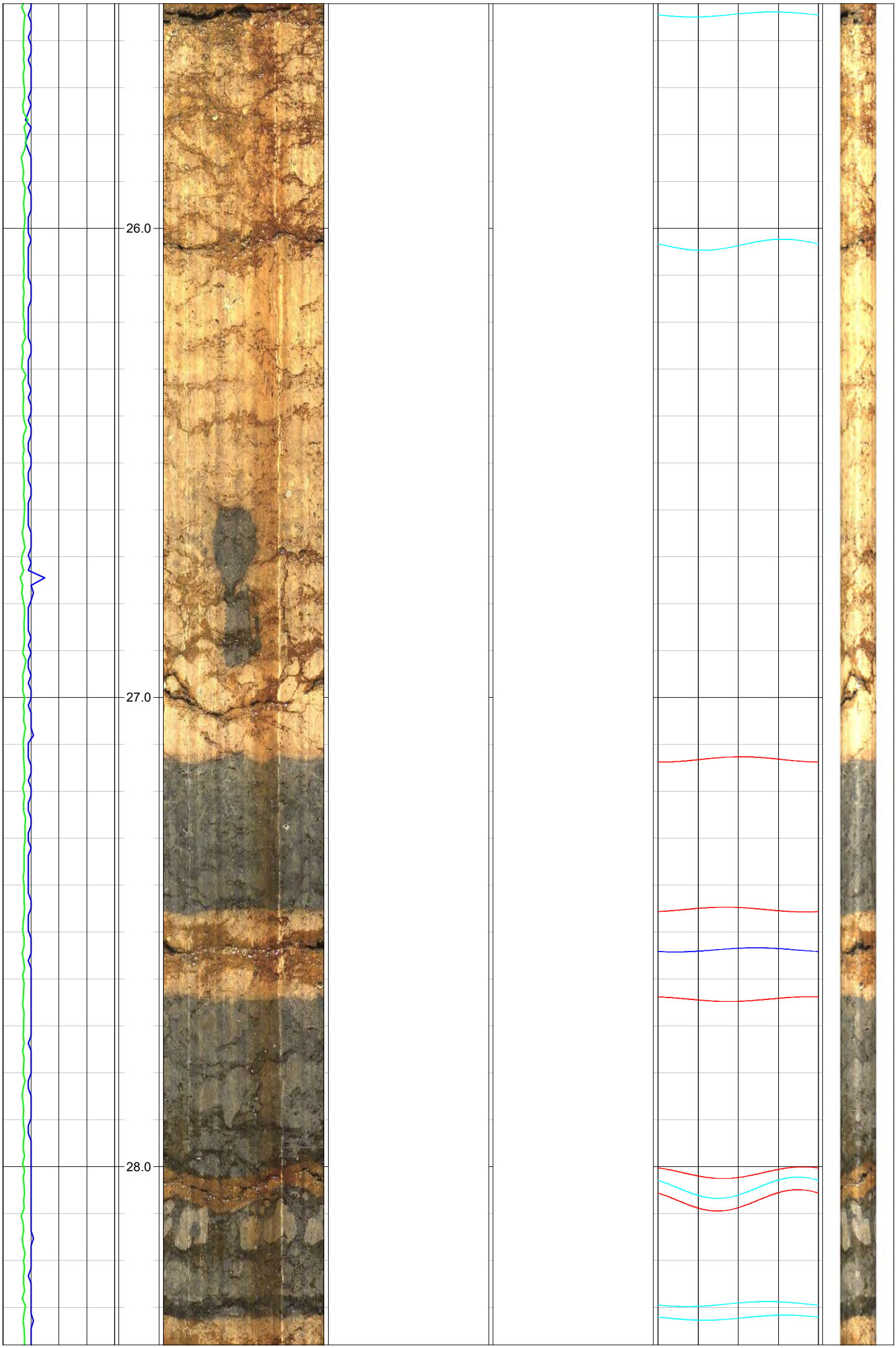
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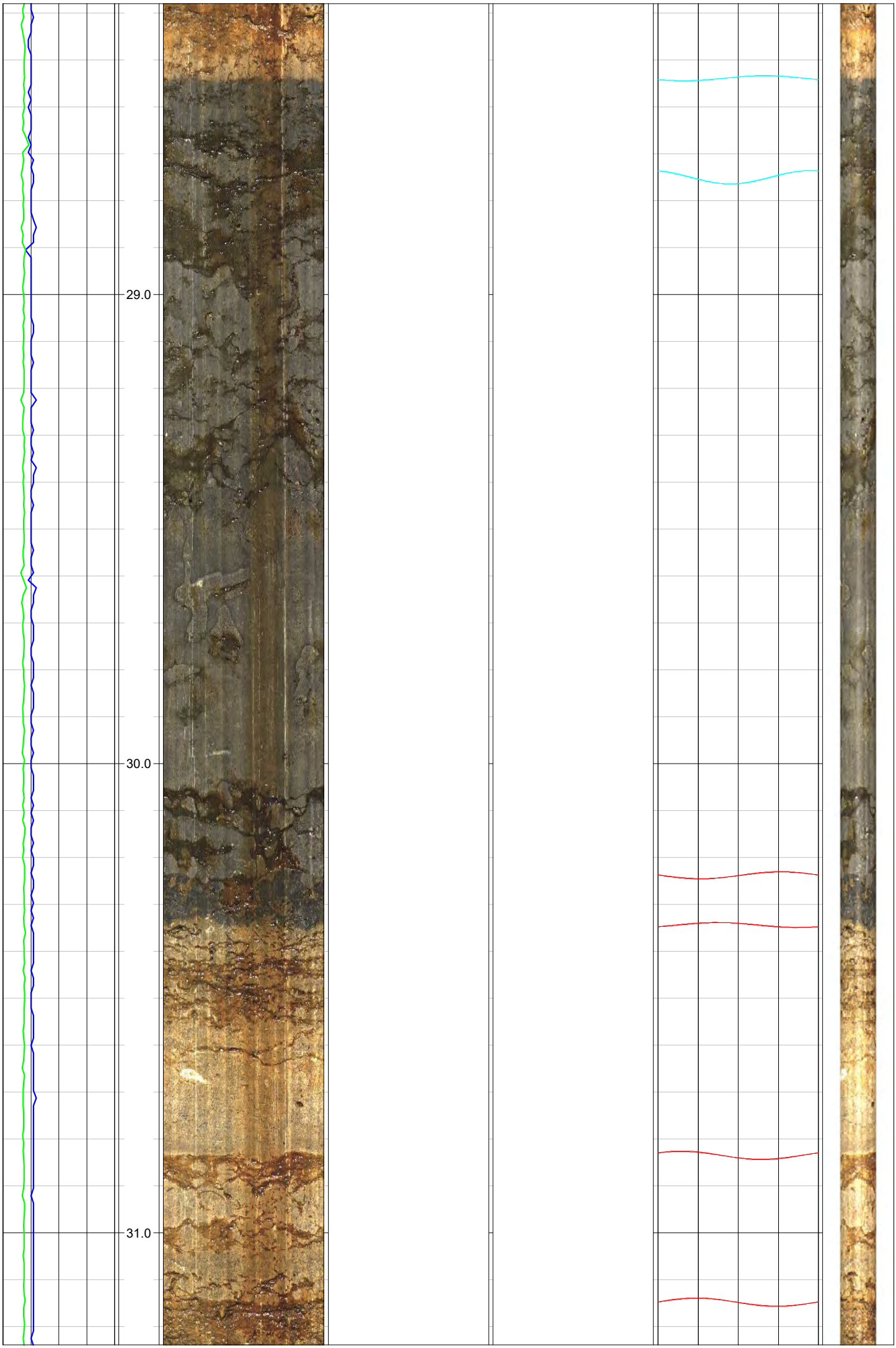
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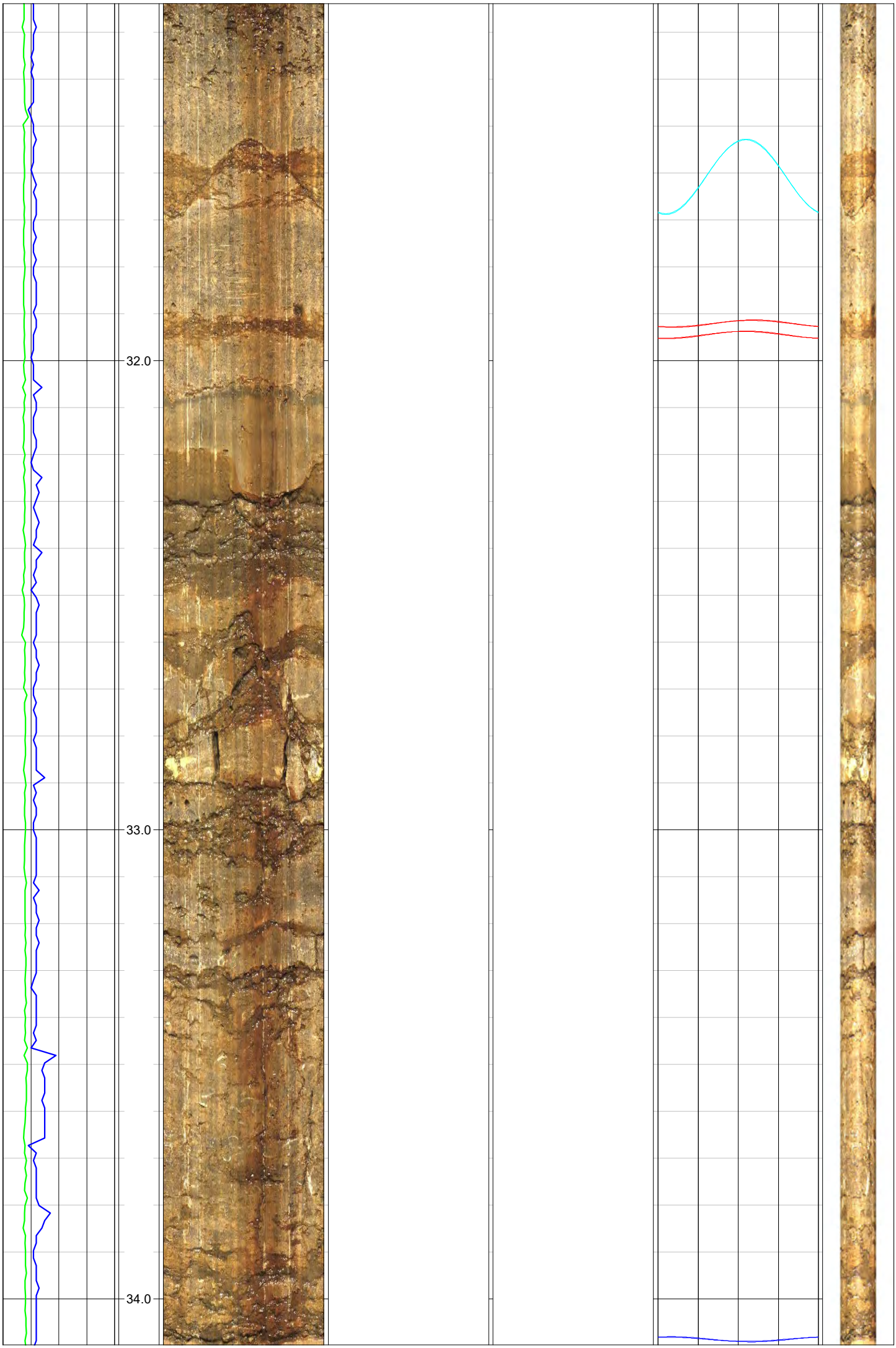
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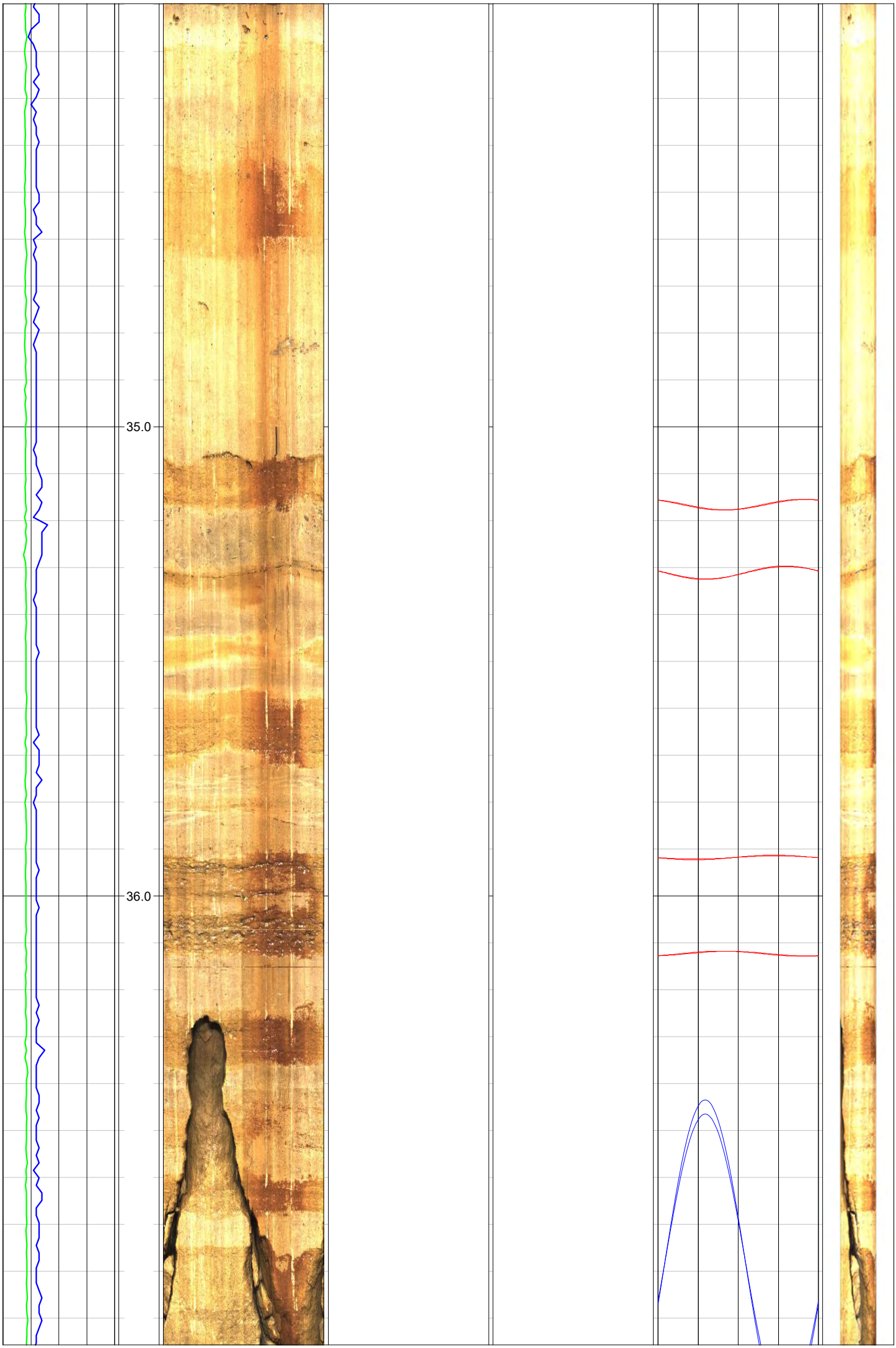
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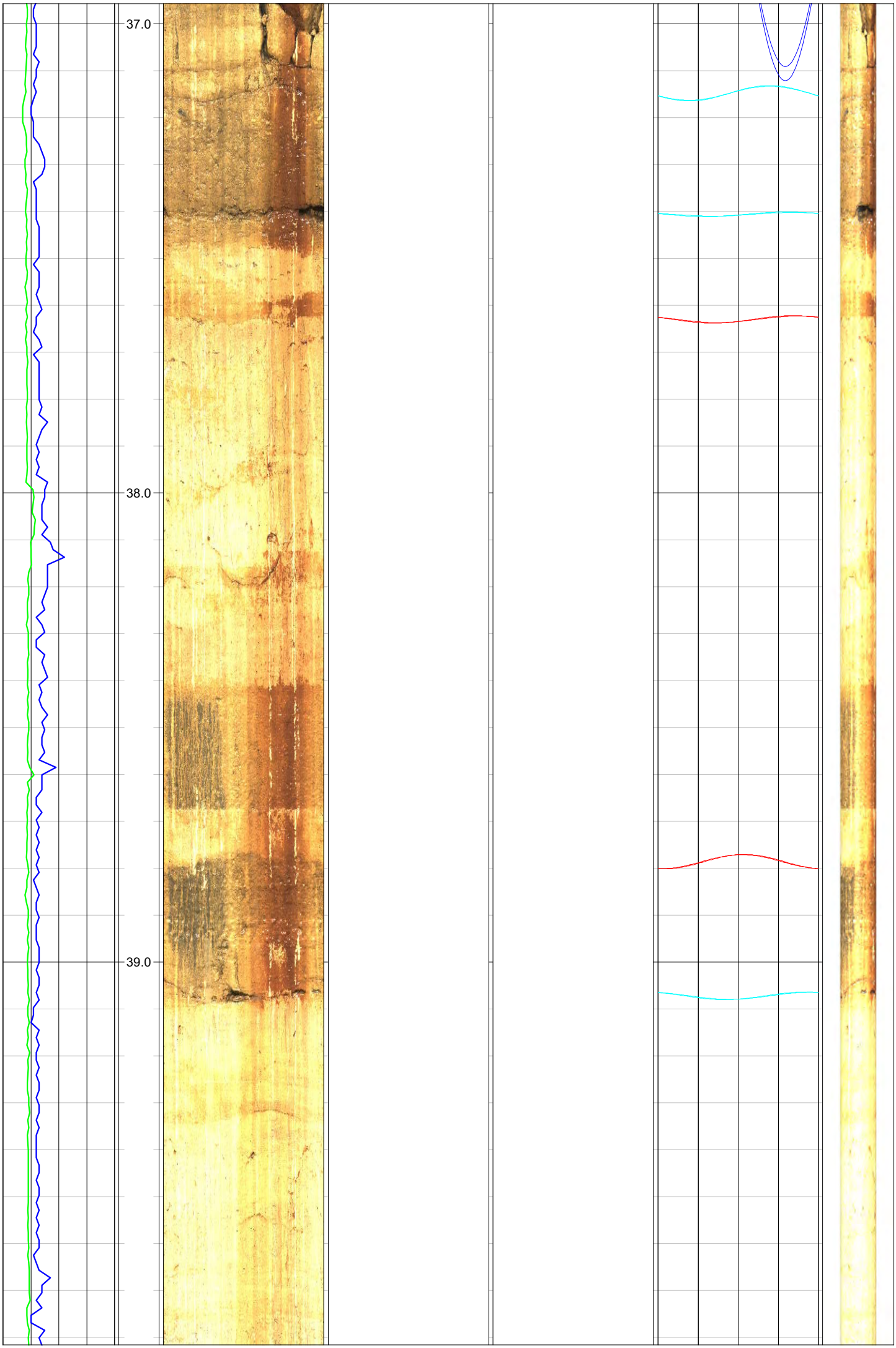
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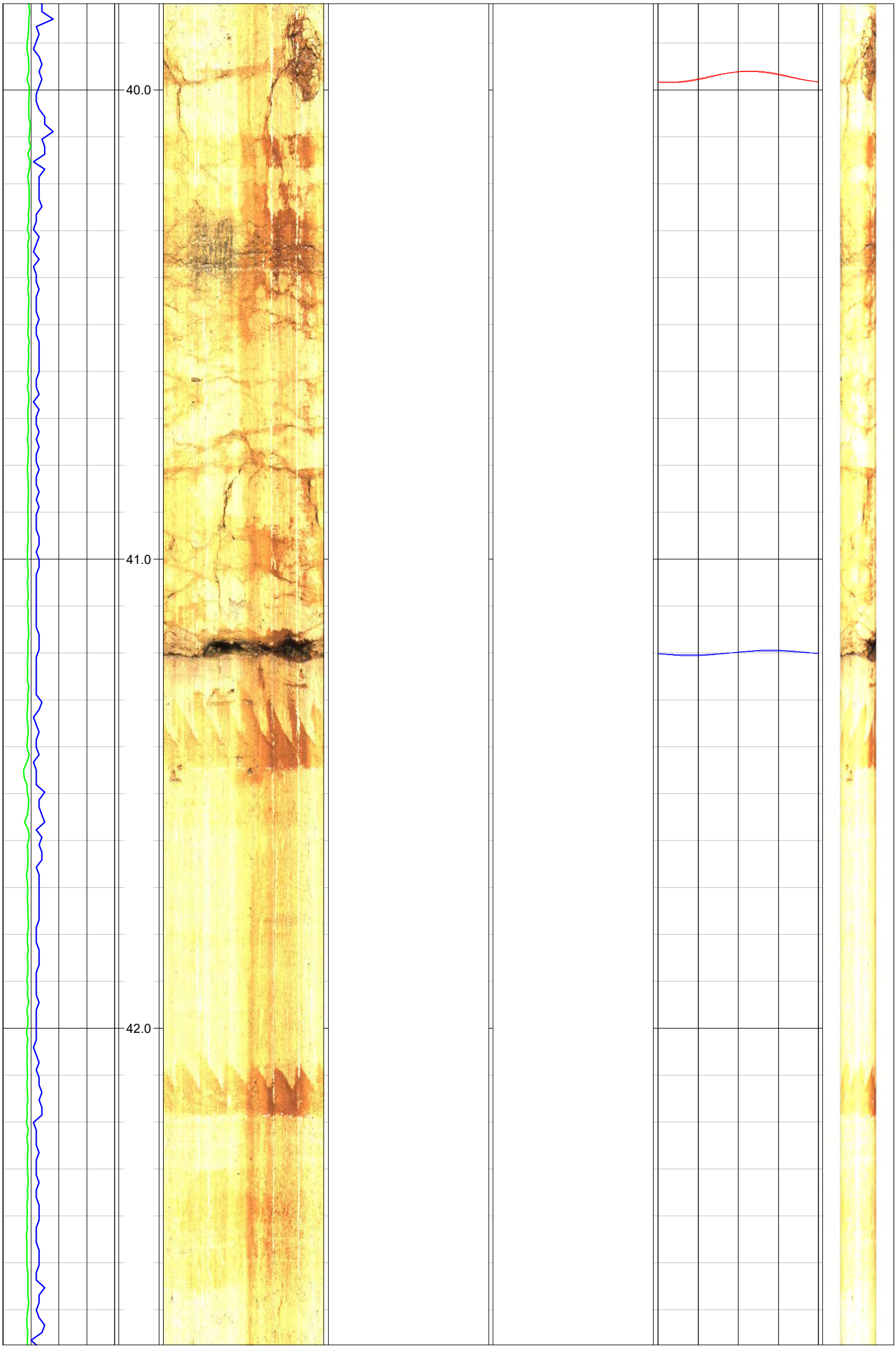
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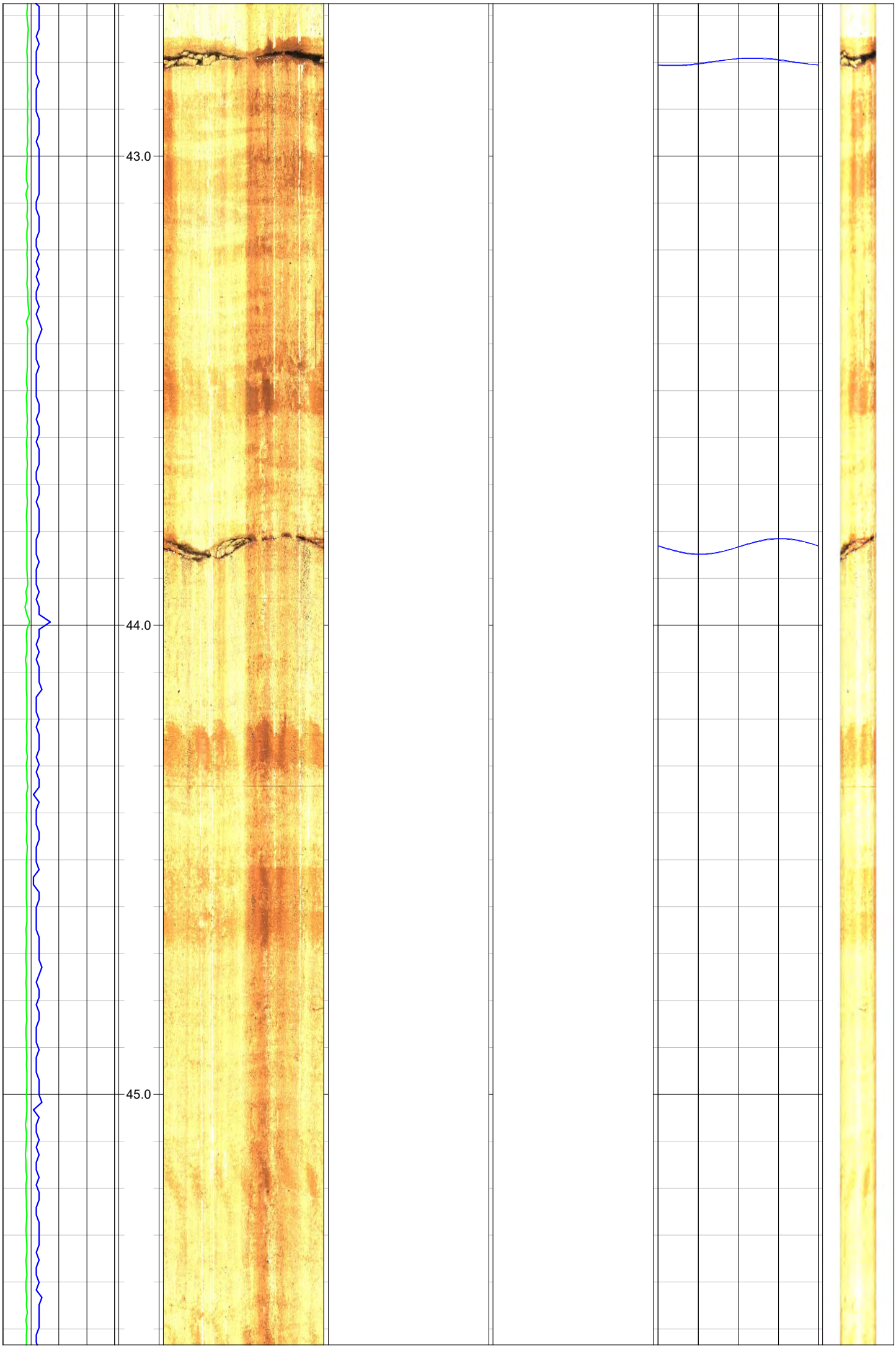
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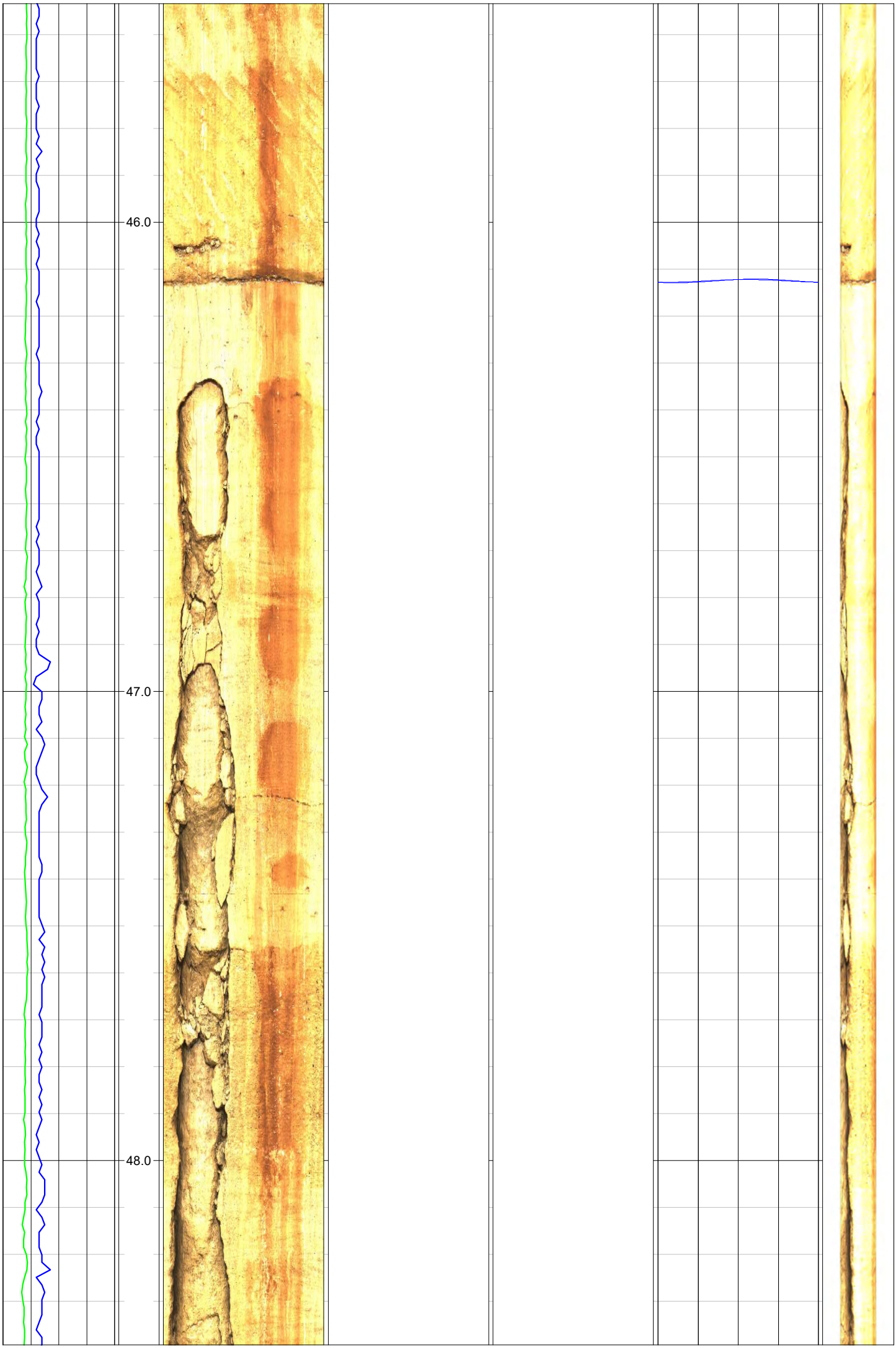
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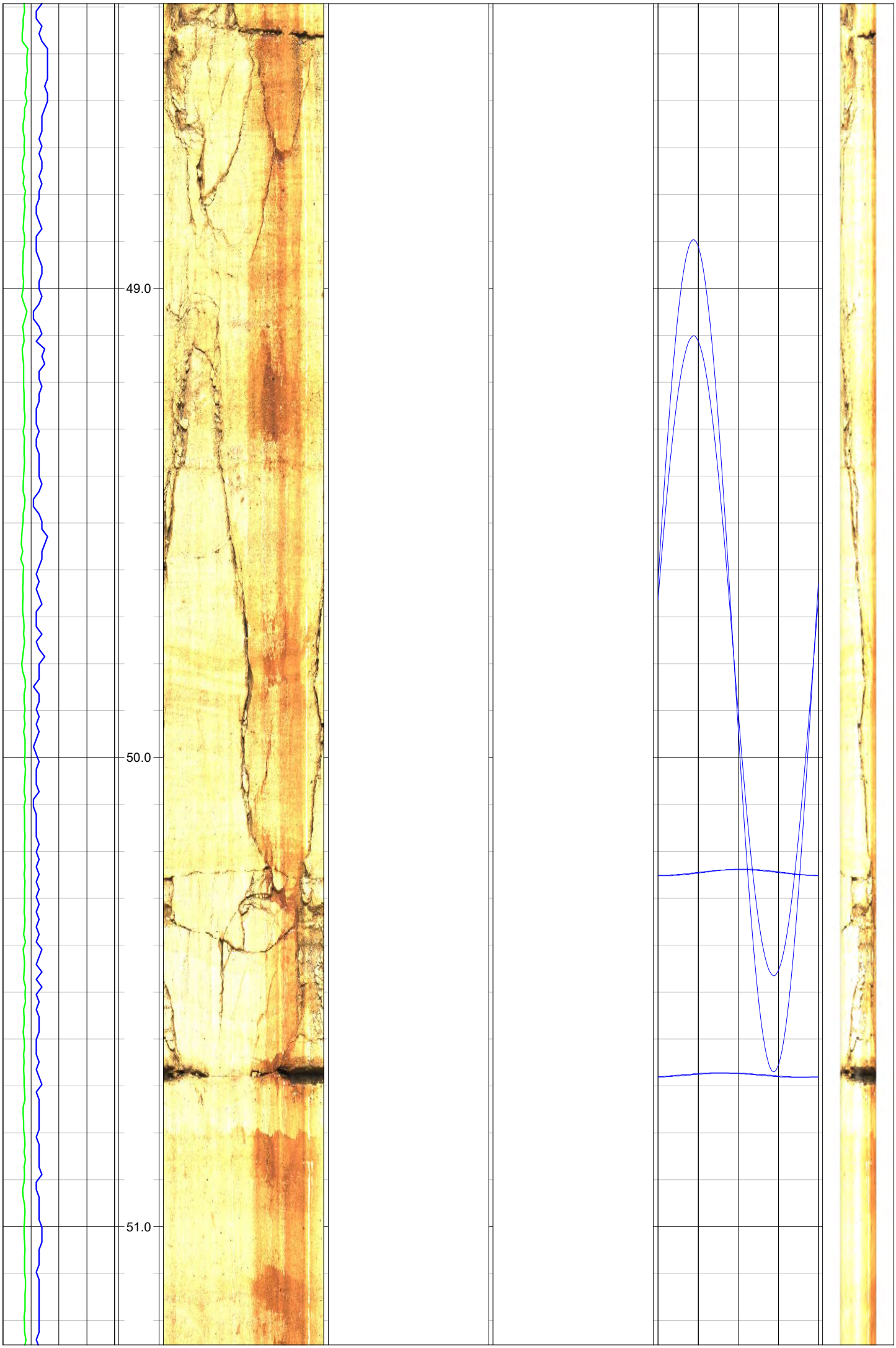
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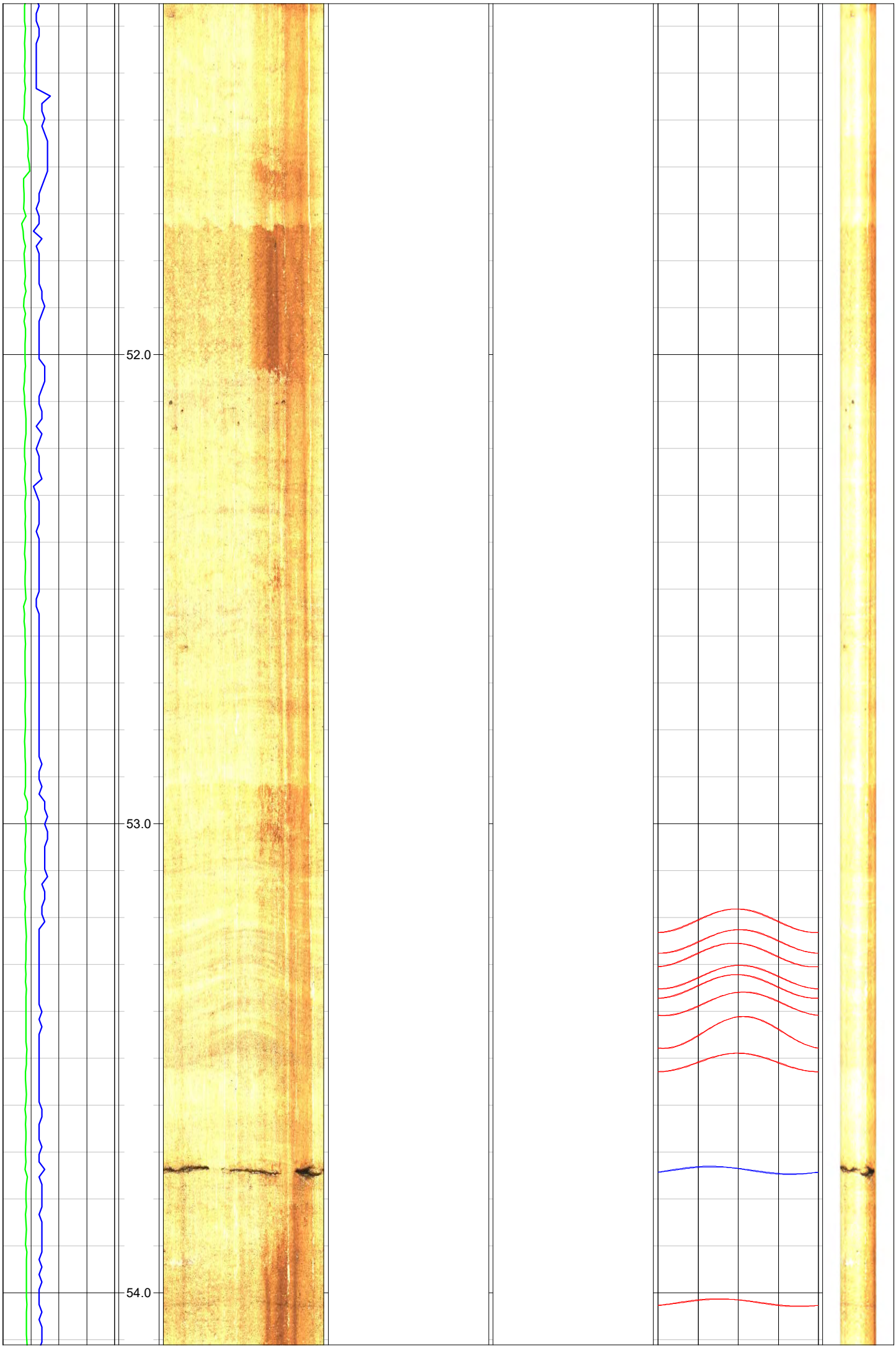
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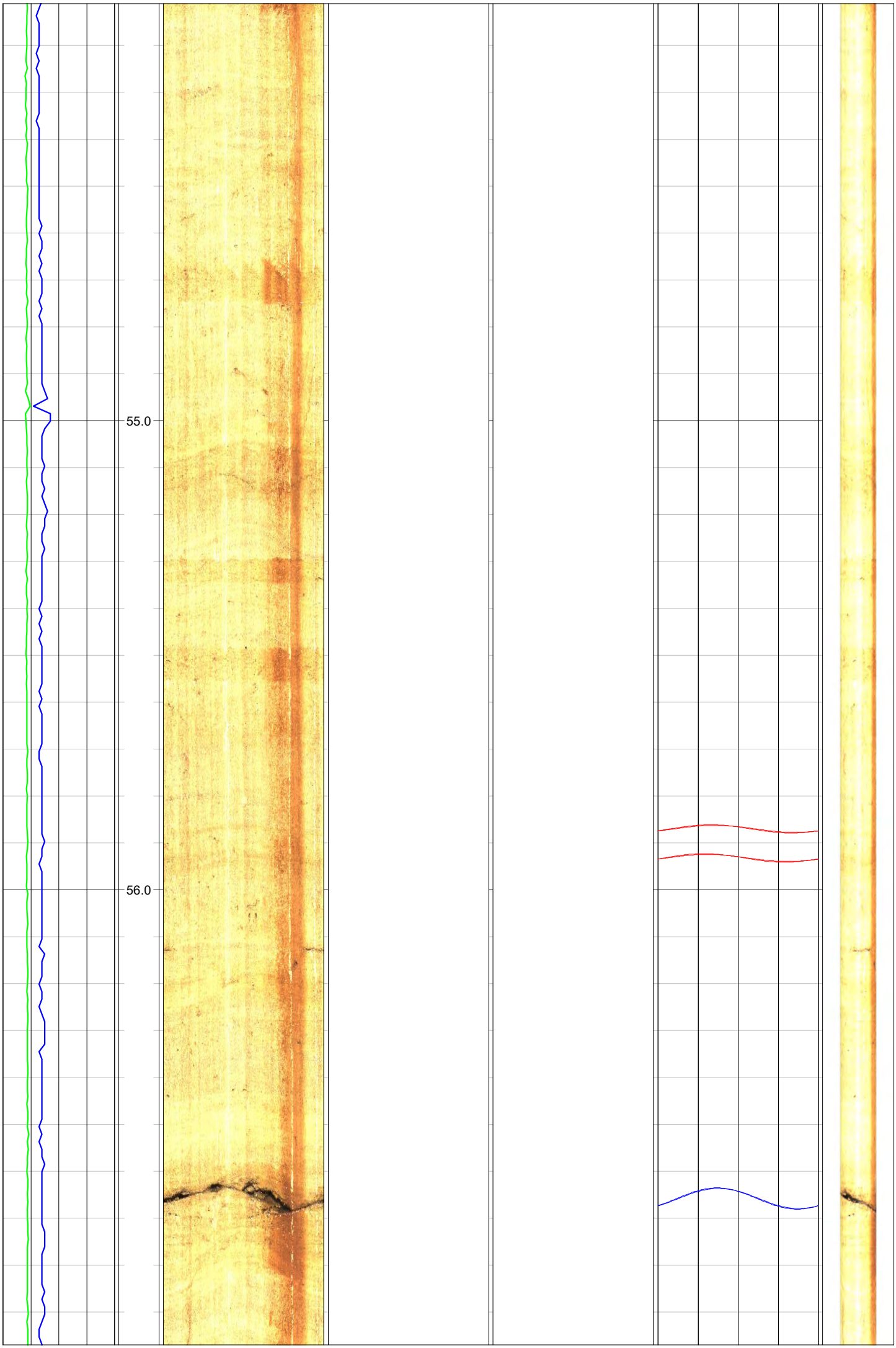
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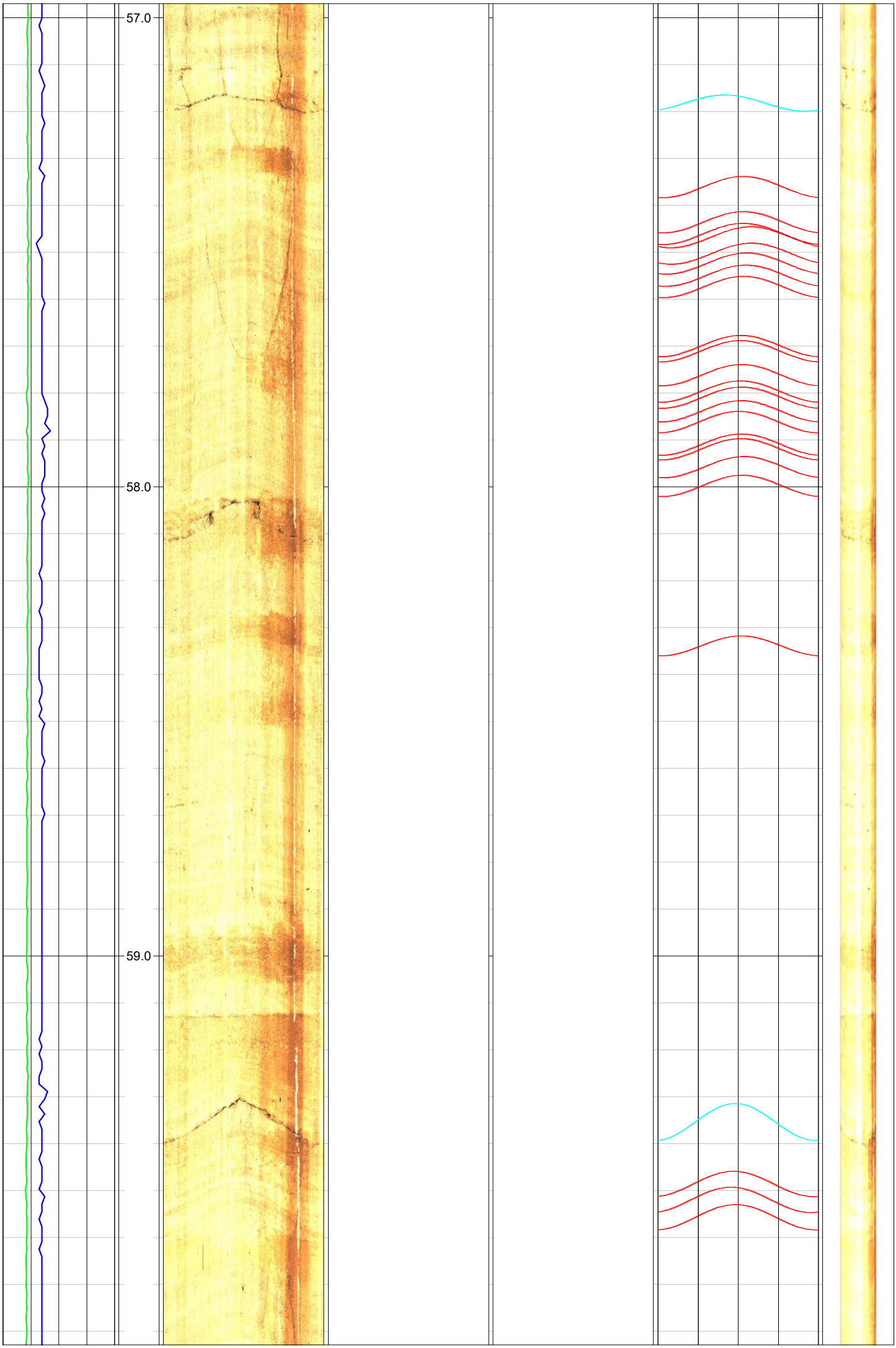
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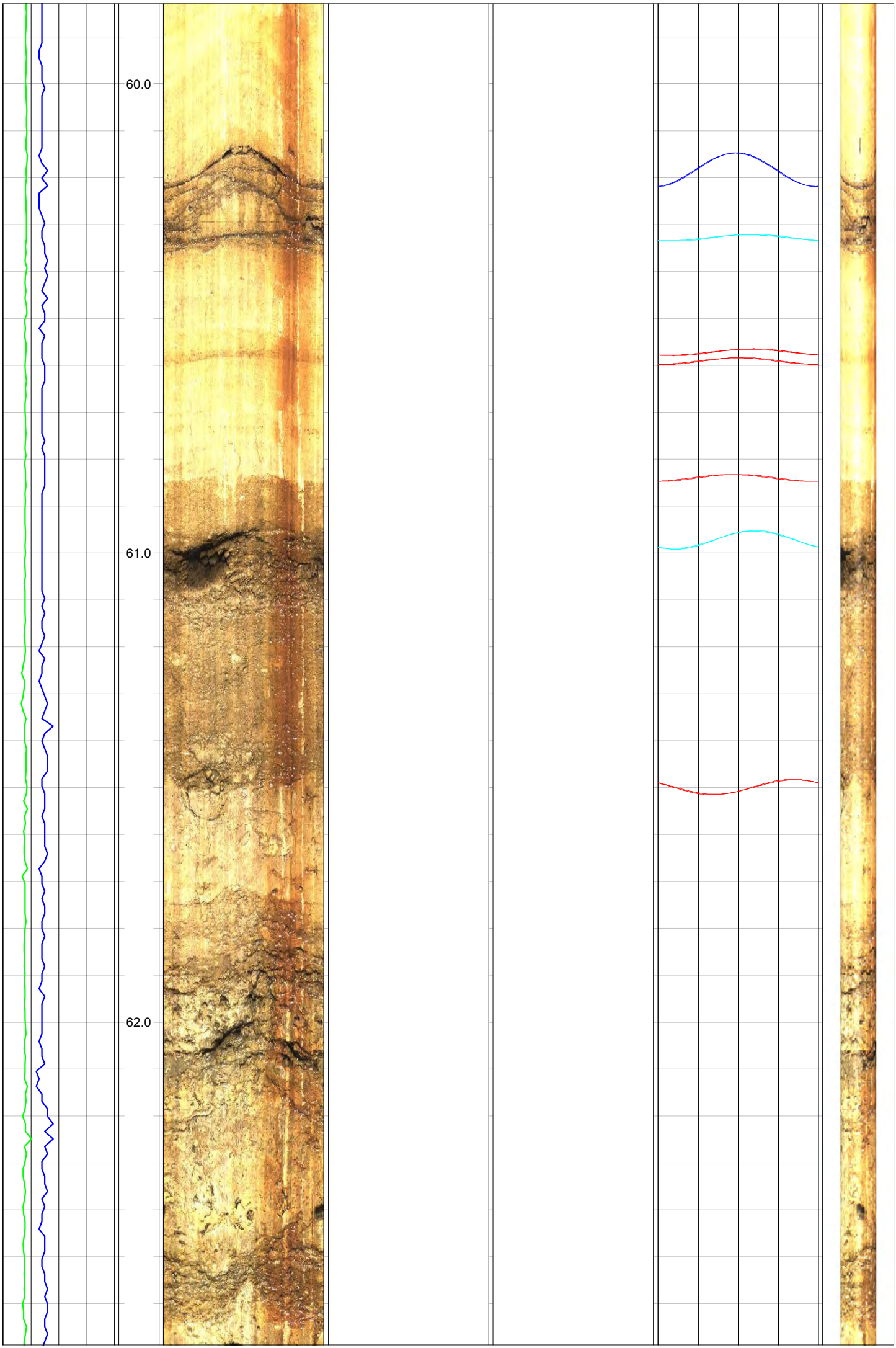
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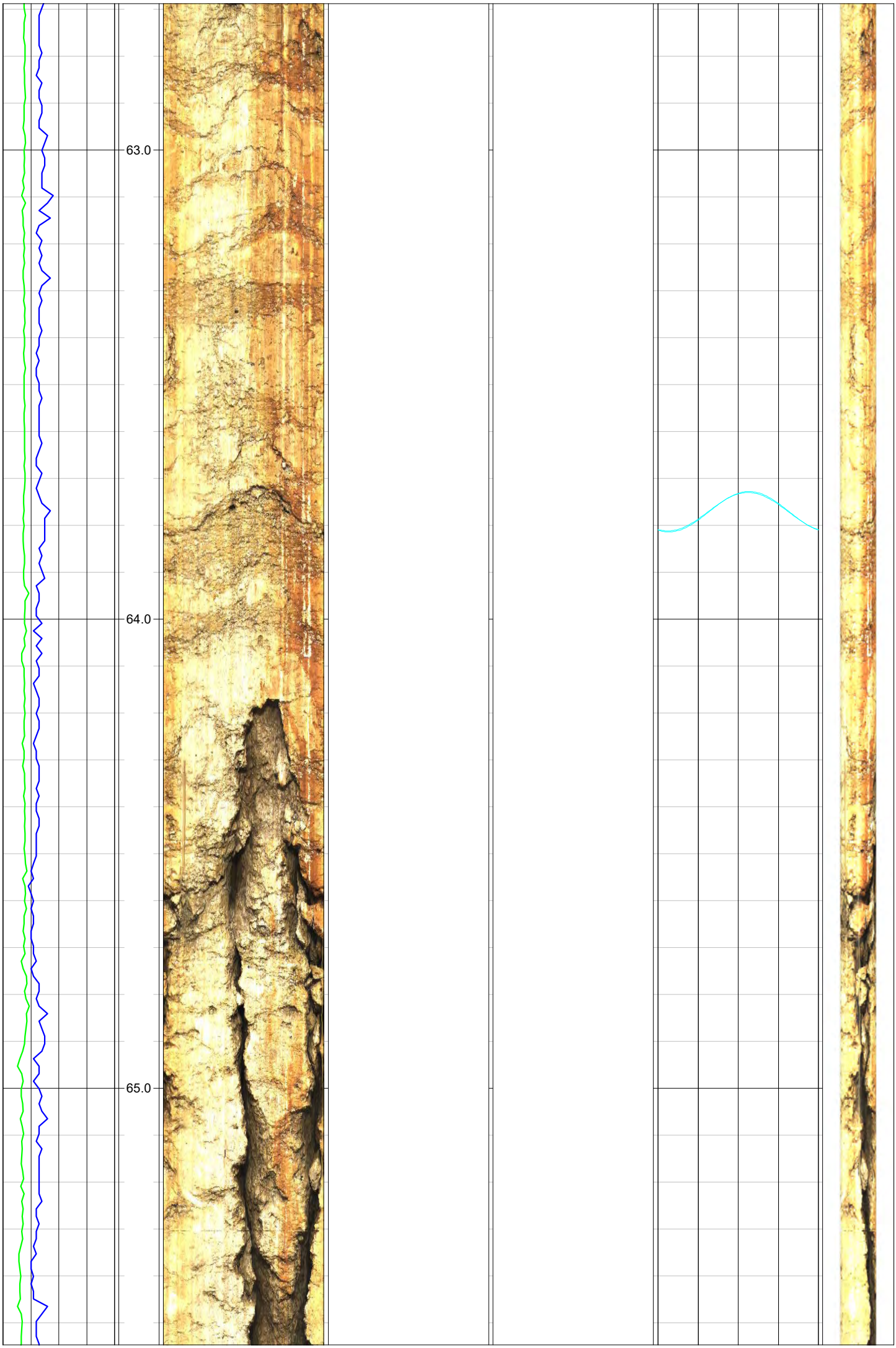
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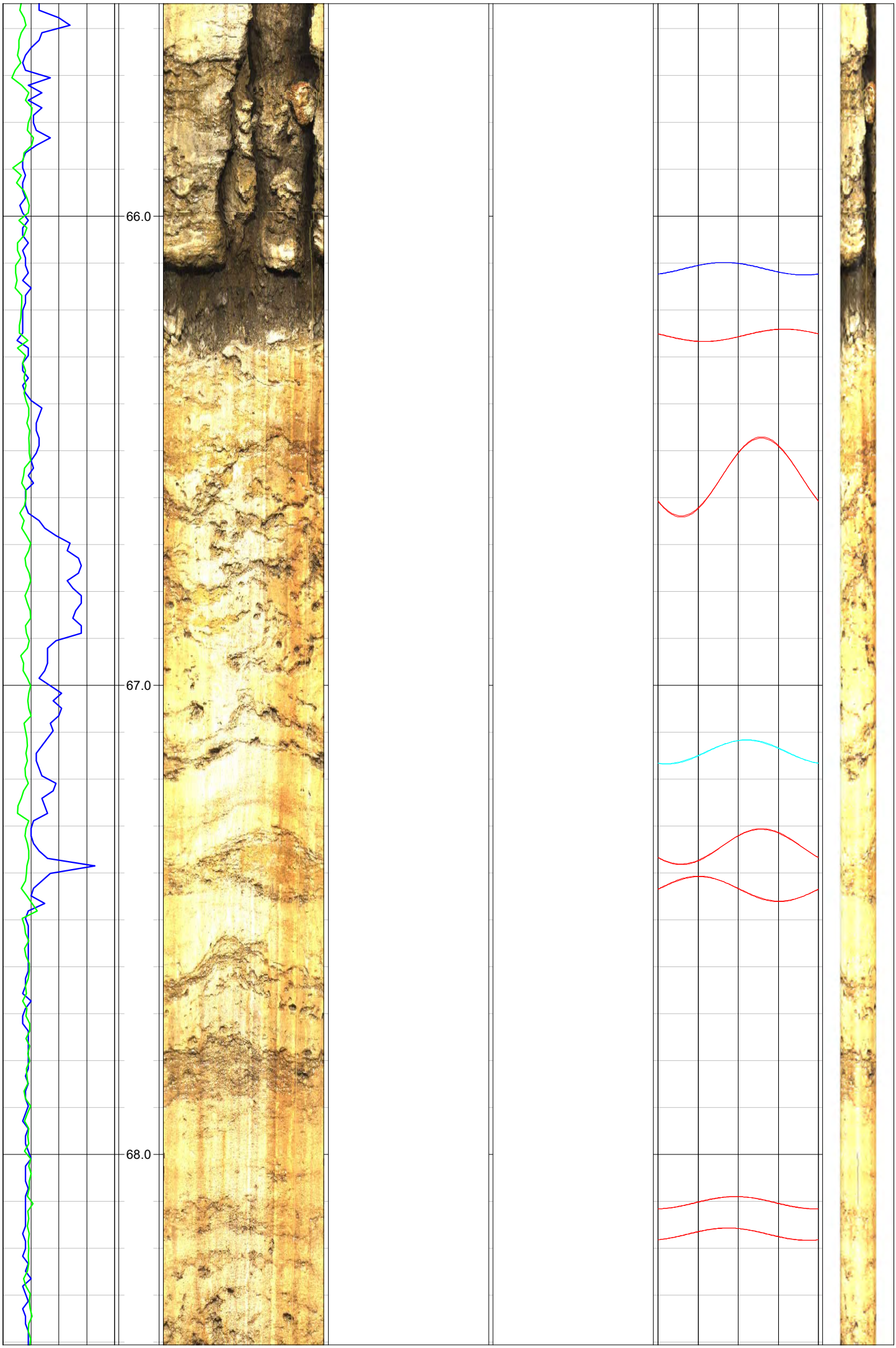
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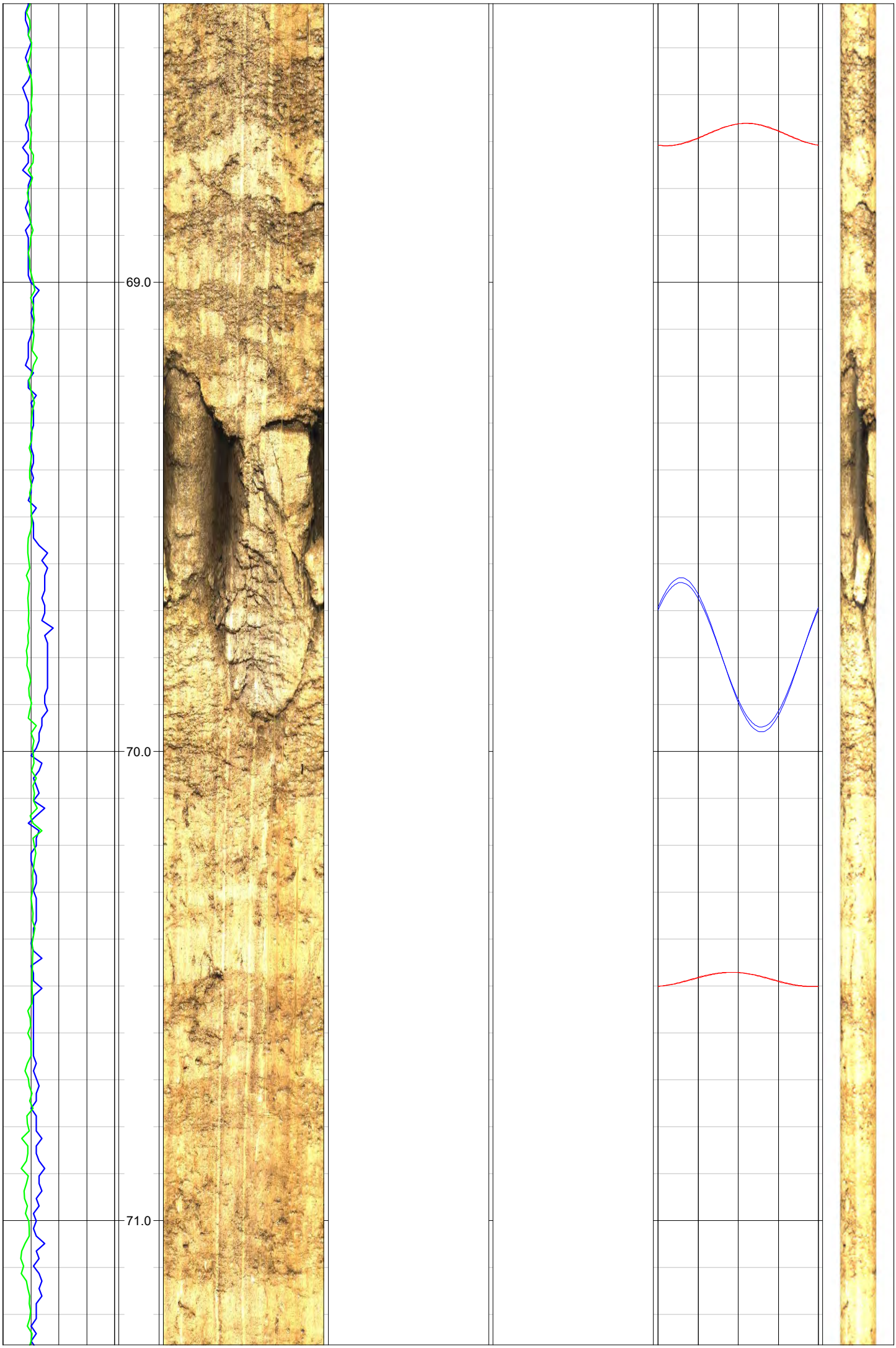
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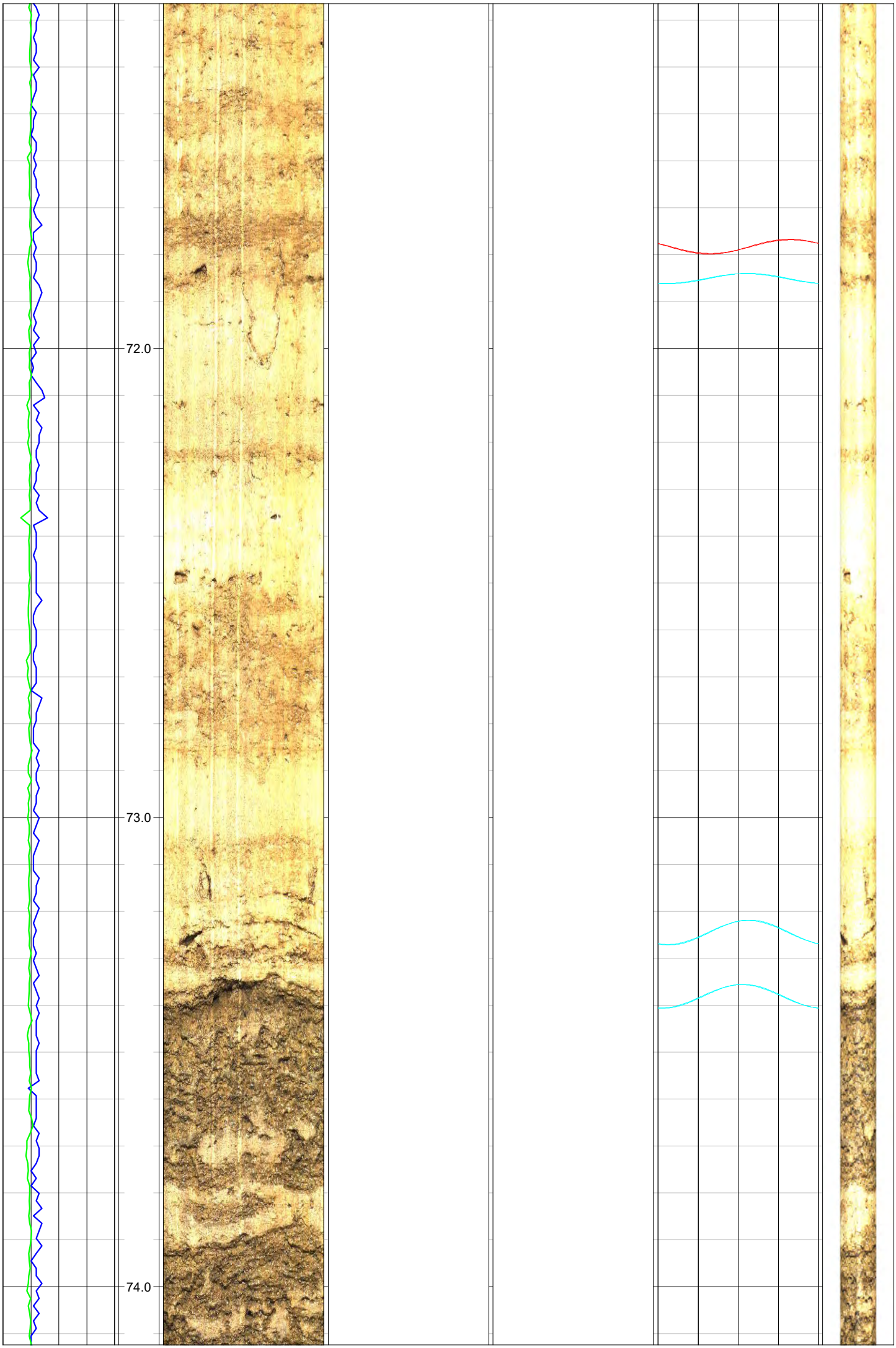
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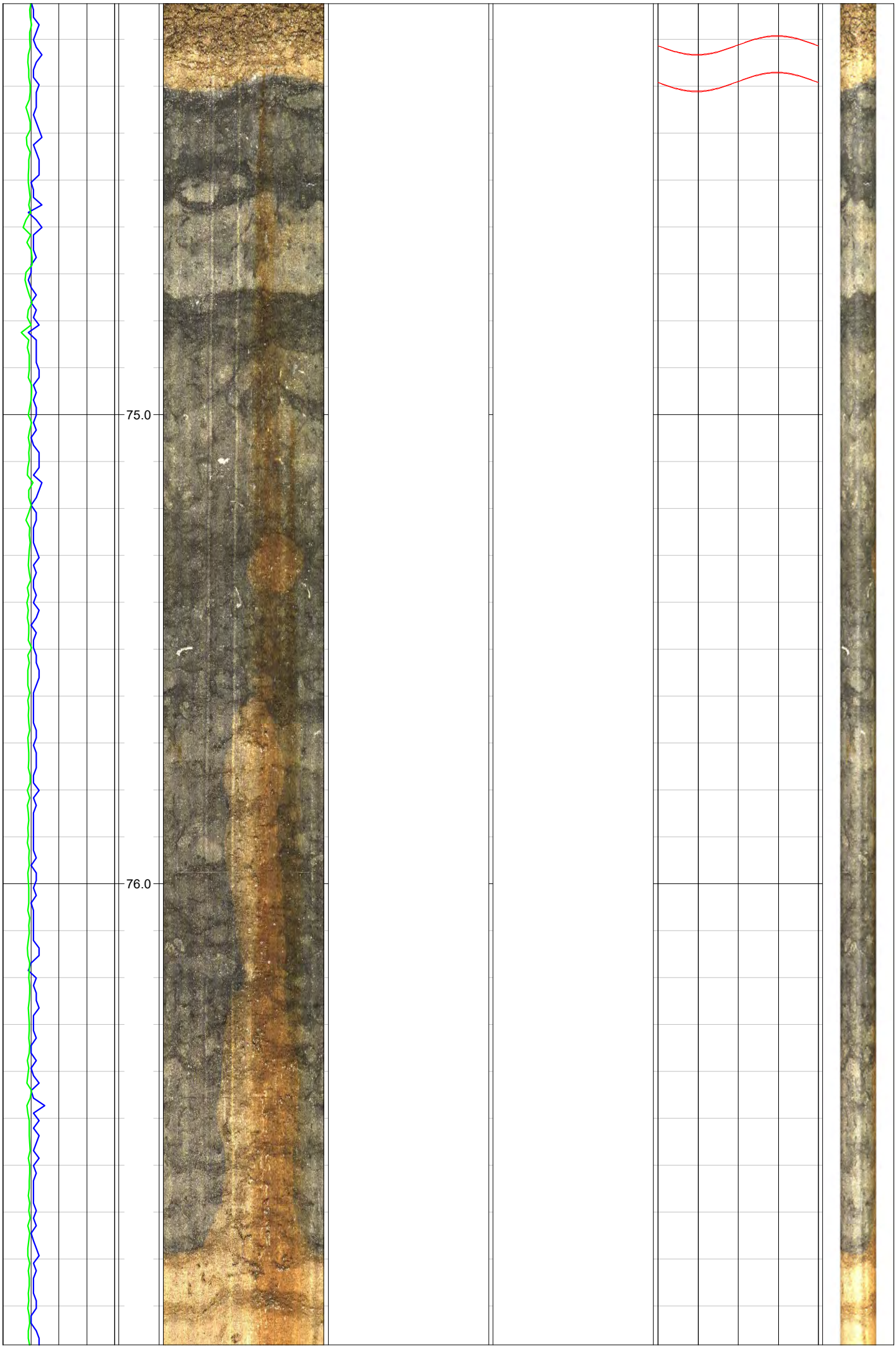
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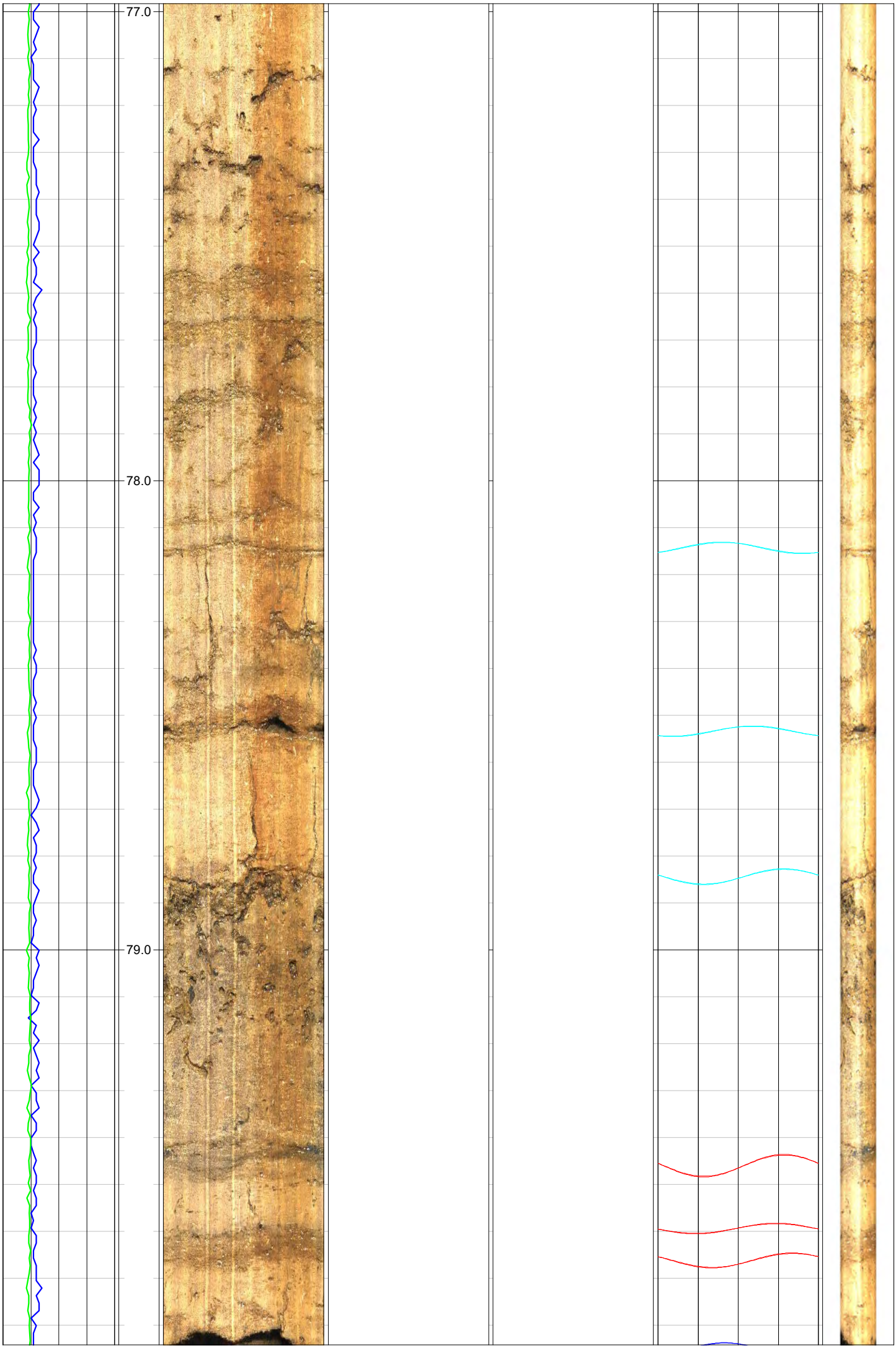
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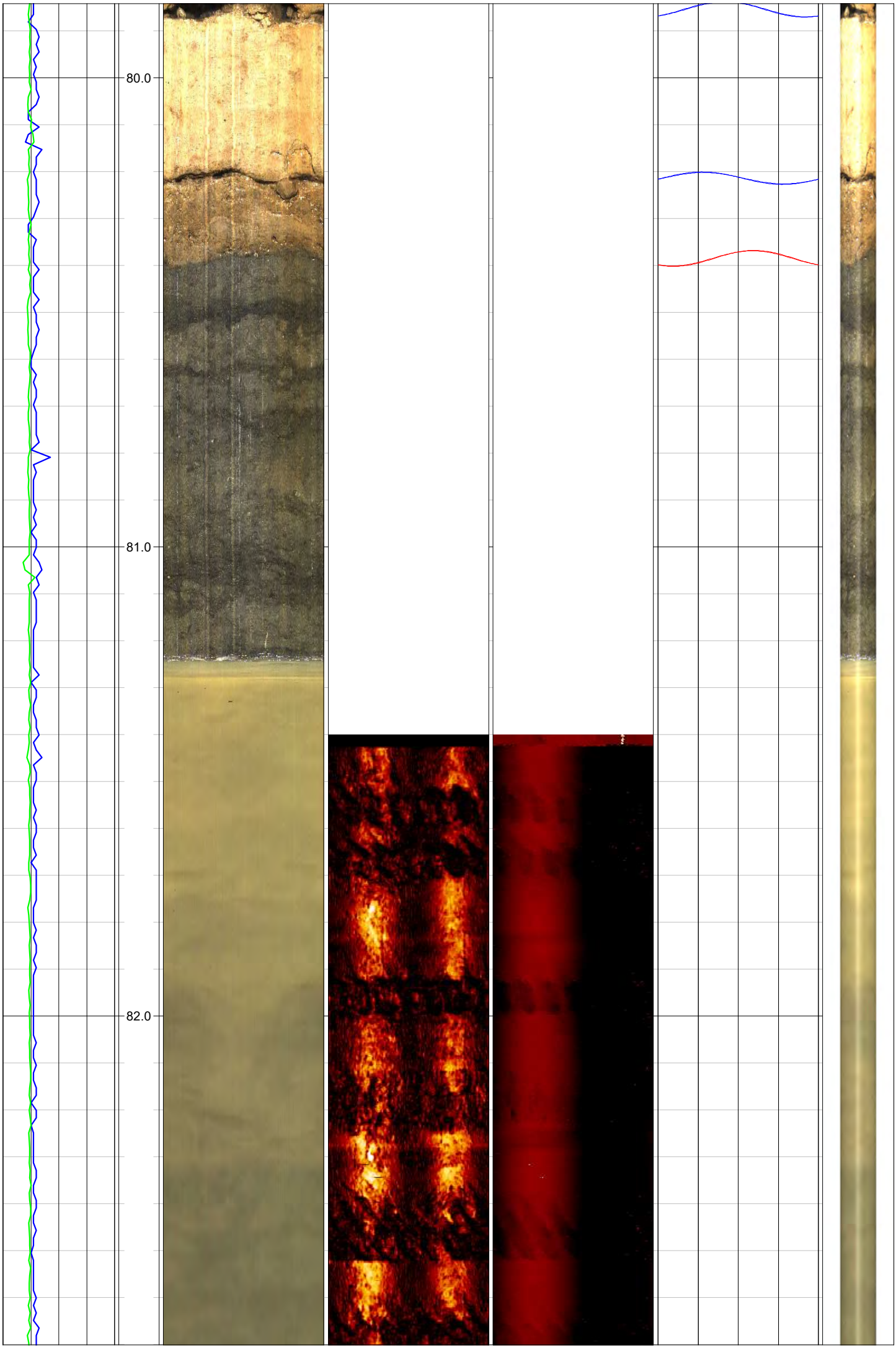
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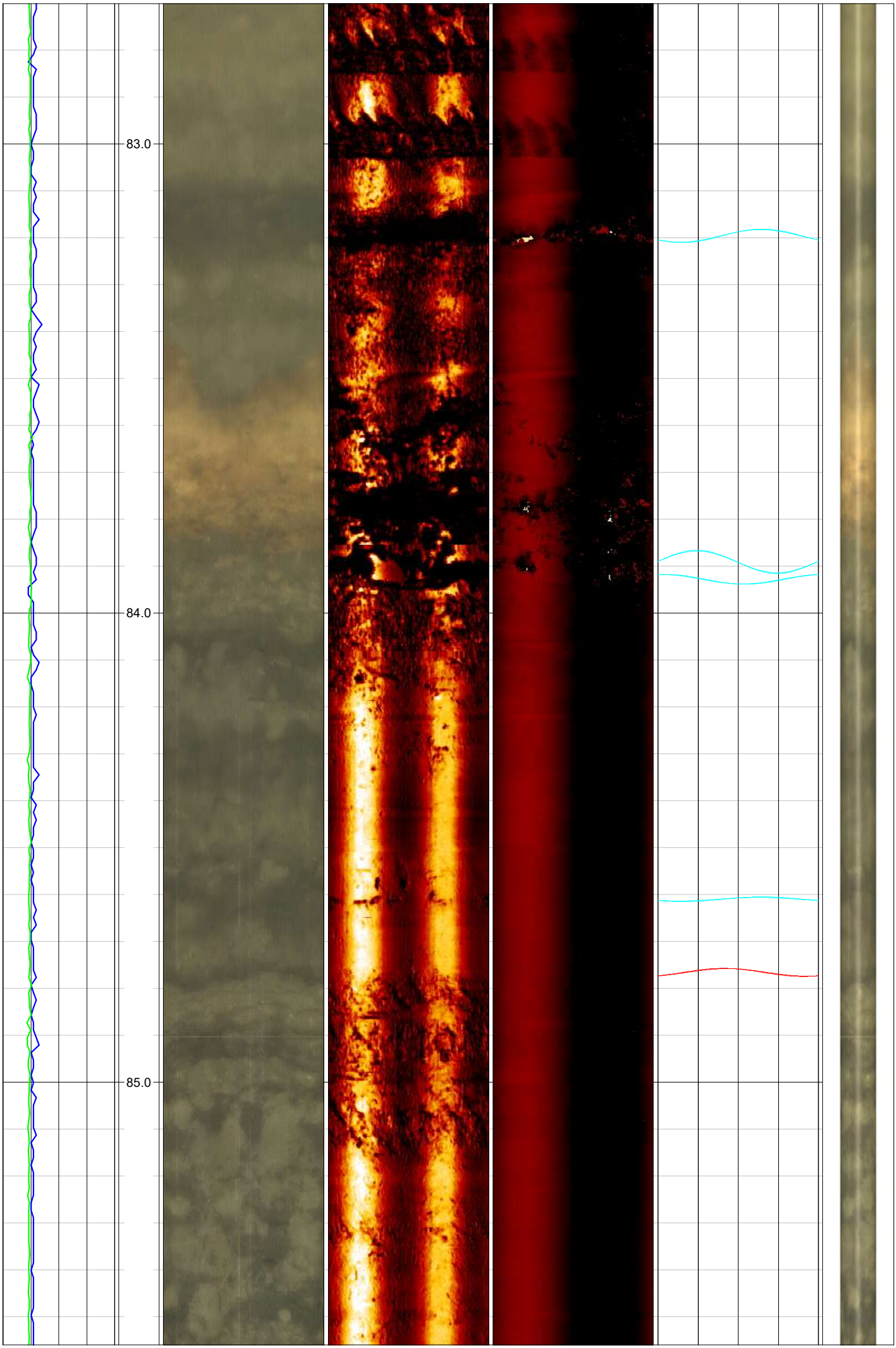
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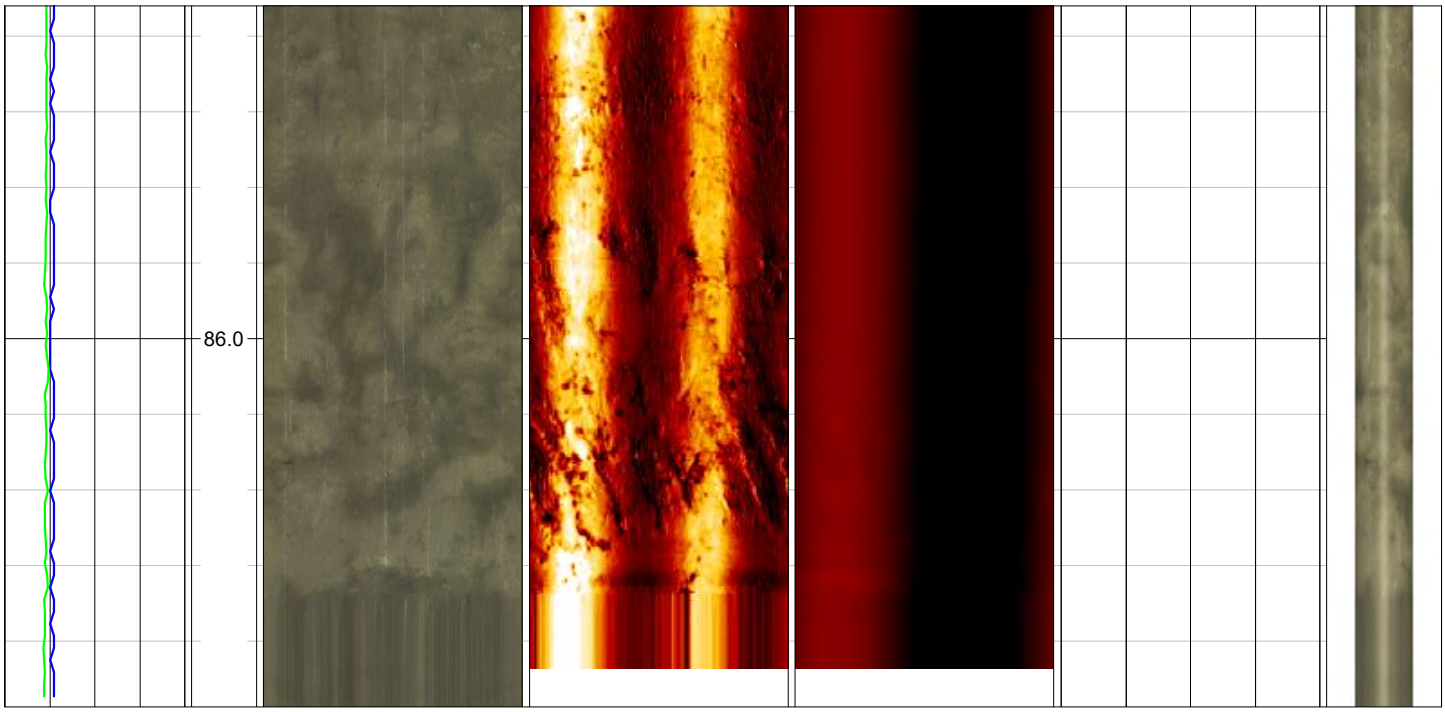
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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Geotechnical Engineering**

Borehole: **OH413**

Log Type: ***Composite***

Location: **A417 Birdlip** Area: **Gloucestershire** Grid Ref: **394312.1E 214960.1N** Elevation: **270.65m**

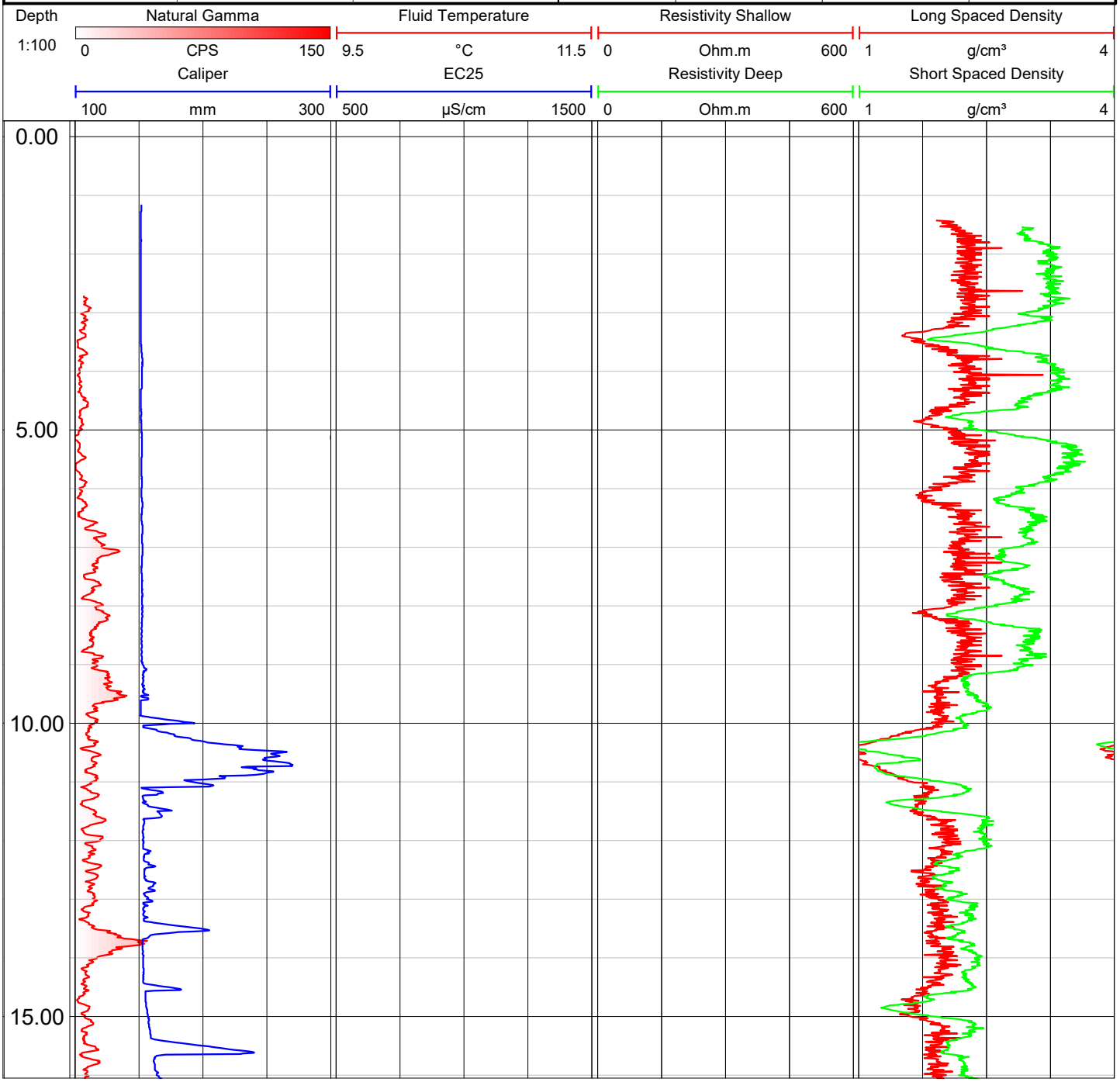
Drilled Depth: (m)	**104.0**	Date:	**26.09.19**
Logged Depth: (m)	**101.0**	Recorded By:	**M. Kynaston**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**8.0 - 101.0**		
Fluid Level: (m)	**79.4**		

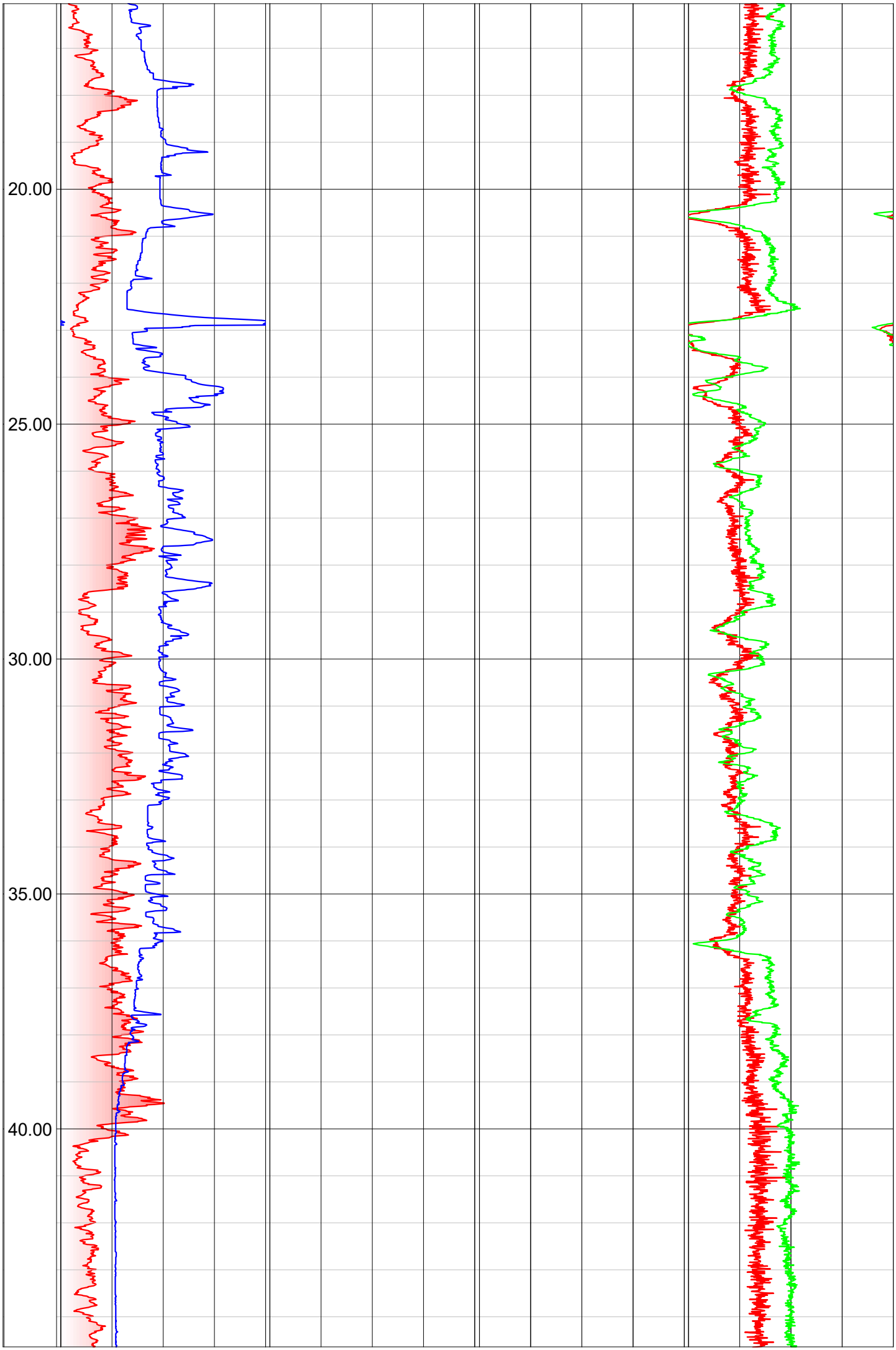
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**150**	**0.0**	**9.0**

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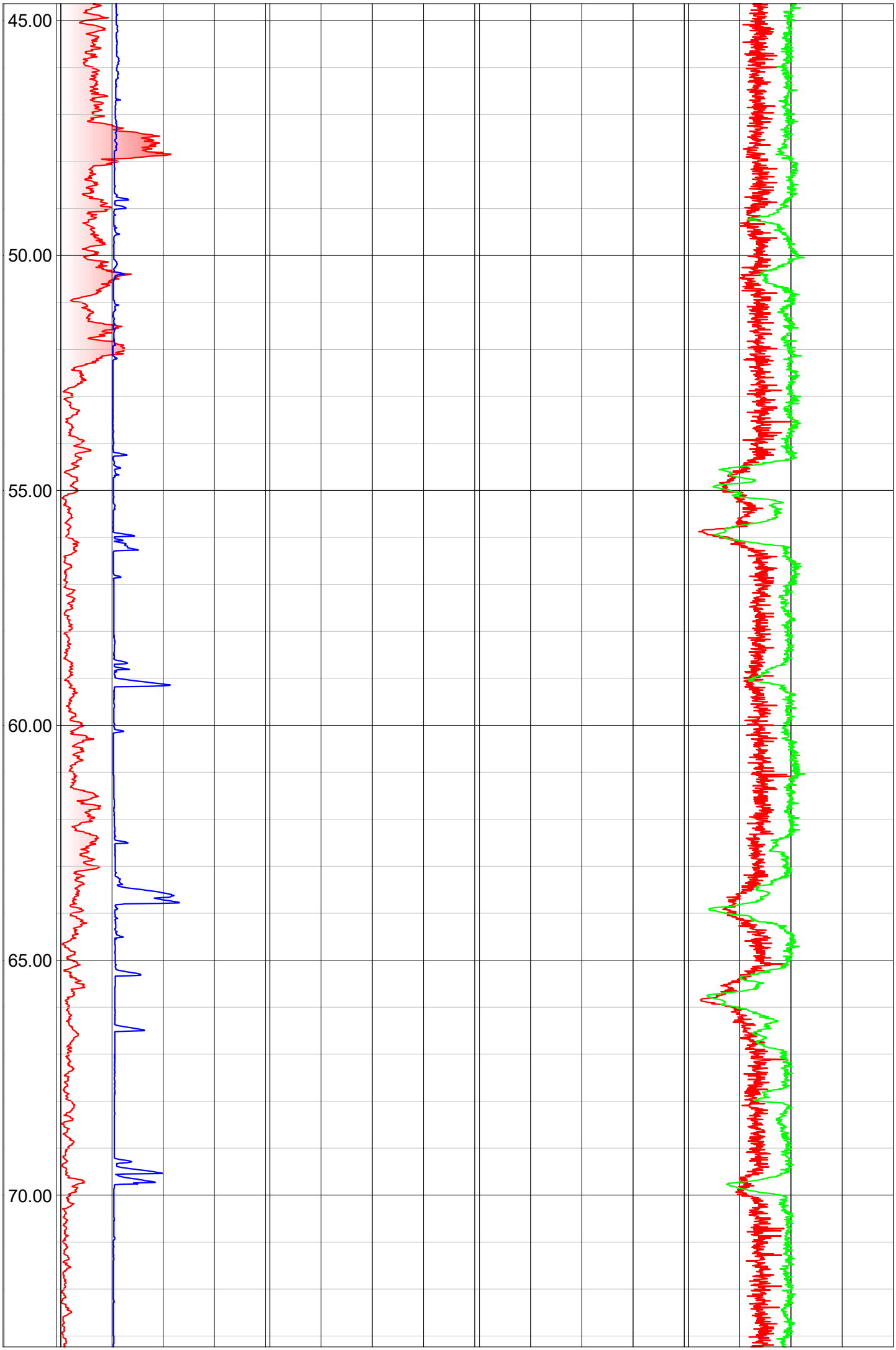
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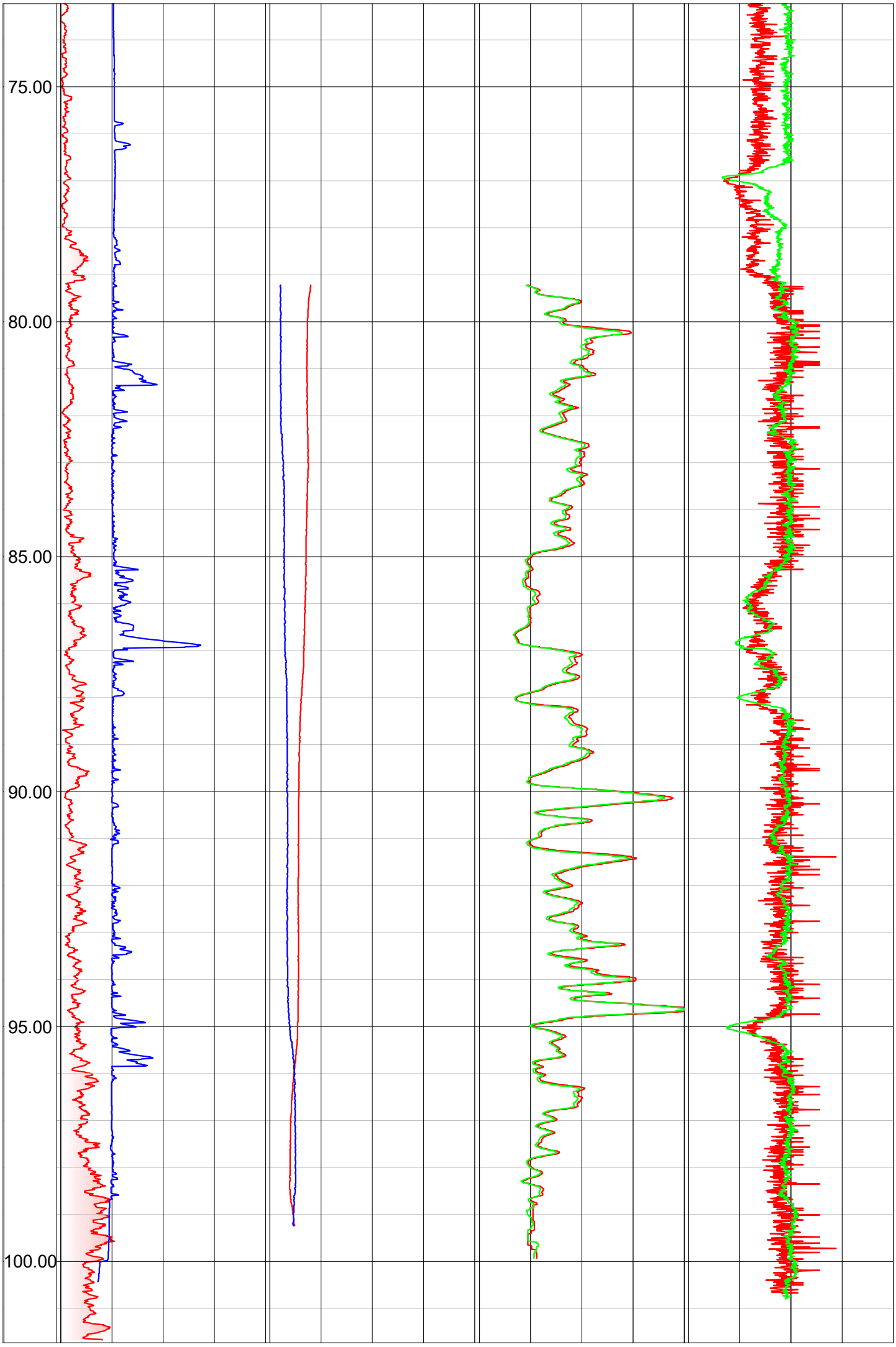
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