Arbeitsbericht NAB 20-09

TBO Trüllikon-1-1: Data Report

Dossier II Core Photography

June 2021

National Cooperative
for the Disposal of
Radioactive Waste

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[1] Maya & Daniele
[2] Nagra

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Nagra Arbeitsberichte NAB ("Working Reports") present the results of work in progress that have not necessarily been subject to a comprehensive review. They are intended to provide rapid dissemination of current information.

This NAB aims at reporting drilling results at an early stage. Additional borehole-specific data will be published elsewhere.

In the event of inconsistencies between dossiers of this NAB, the dossier addressing the specific topic takes priority. In the event of discrepancies between Nagra reports, the chronologically later report is generally considered to be correct. Data sets and interpretations laid out in this NAB may be revised in subsequent reports. The reasoning leading to these revisions will be detailed there.

This Dossier was prepared by:
D. Kaehr (photography post-processing and core photograph composite design and compilation)
M. Gysi (project management, conceptualisation, QC and writing)

Editorial work: Geomecon and M. Unger

The Dossier has greatly benefitted from technical discussions with, and reviews by, external and internal experts. Their input and work are very much appreciated!

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Note: The appendix is only included it the digital version of this report and can be found under the paper clip symbol.

1 Introduction

1.1 Context

To provide input for site selection and the safety case for deep geological repositories for radioactive waste, Nagra has drilled a series of deep boreholes in Northern Switzerland. The aim of the drilling campaign is to characterise the deep underground of the three remaining siting regions located at the edge of the Northern Alpine Molasse Basin (Fig. 1-1).

In this report, we present the results from the Trüllikon-1-1 borehole.

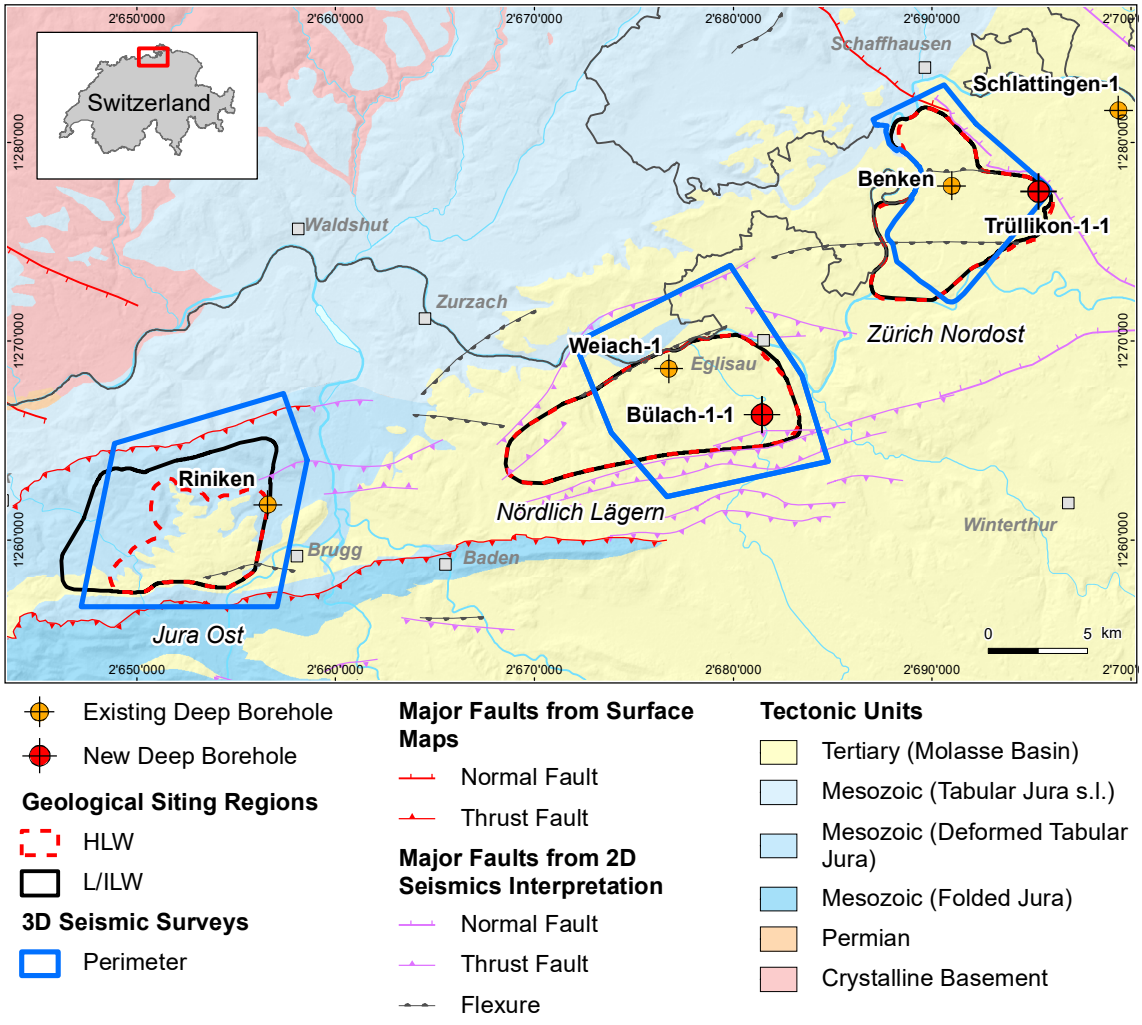


Fig. 1-1: Tectonic overview map with the three siting regions under investigation

1.2 Location and specifications of the borehole

The Trüllikon-1-1 (TRU1-1) exploratory borehole is the second borehole drilled within the framework of the TBO project. The drill site is located in the eastern part of the Zürich Nordost siting region (Fig. 1-2). The vertical borehole reached a final depth of 1'310 m (MD)[1]. The borehole specifications are provided in Tab. 1-1.

Tab. 1-1: General information about the TRU1-1 borehole

Siting region	Zürich Nordost
Municipality	Trüllikon (Canton Zürich / ZH), Switzerland
Drill site	Trüllikon-1 (TRU-1)
Borehole	Trüllikon-1-1 (TRU1-1)
Coordinates	LV95: 2'695'372.648 / 1'277'548.076
Elevation	Ground level = top of rig cellar: 475.07 m above sea level (asl)
Borehole depth	1'310.0 m measured depth (MD) below ground level (bgl)
Drilling period	15. August 2019 - 5. April 2020 (spud date to end of rig release)
Drilling company	PR Marriott Drilling Ltd.
Drilling rig	Rig-16 Drillmec HH102
Drilling fluid	Water-based mud with various amounts of different components such as[2] 46 – 712 m: Pure-Bore® 712 – 1161 m: Potassium silicate 1161 – 1310 m: Sodium chloride & polymers

The lithostratigraphic profile and the casing scheme are shown in Fig. 1-3. The comparison of the core versus log depth[3] of the main lithostratigraphic boundaries in the TRU1-1 borehole is shown in Tab. 1-2.

[1] Measured depth (MD) refers to the position along the borehole trajectory, starting at ground level, which for this borehole is the top of the rig cellar. For a perfectly vertical borehole, MD below ground level (bgl) and true vertical depth (TVD) are the same. In all Dossiers depth refers to MD unless stated otherwise.

[2] For detailed information see Dossier I.

[3] Core depth refers to the depth marked on the drill cores. Log depth results from the depth observed during geophysical wireline logging. Note that the petrophysical logs have not been shifted to core depth, hence log depth differs from core depth.

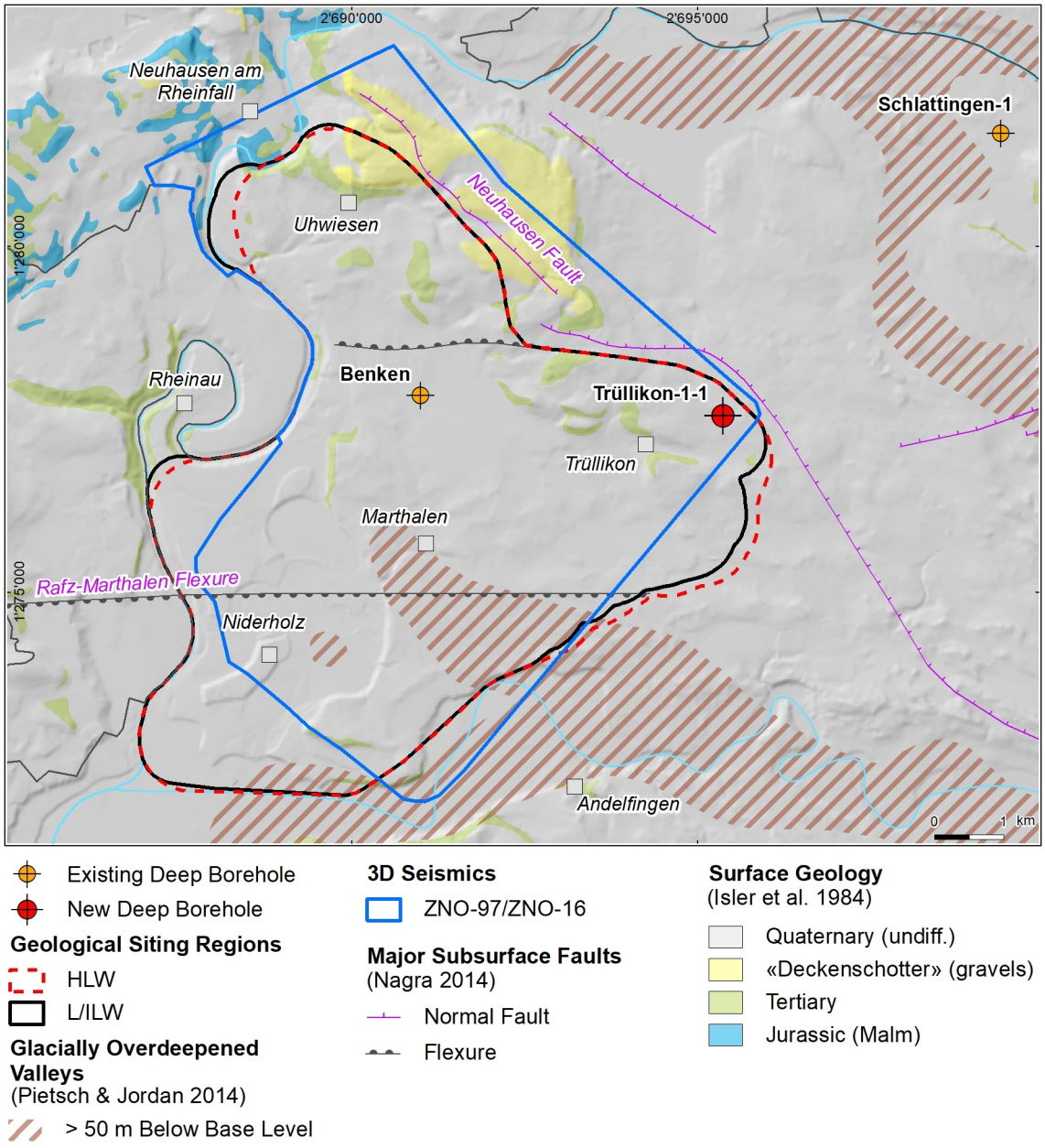


Fig. 1-2: Overview map of the investigation area in the Zürich Nordost siting region with the location of the TRU1-1 borehole in relation to the boreholes Benken and Schlattingen

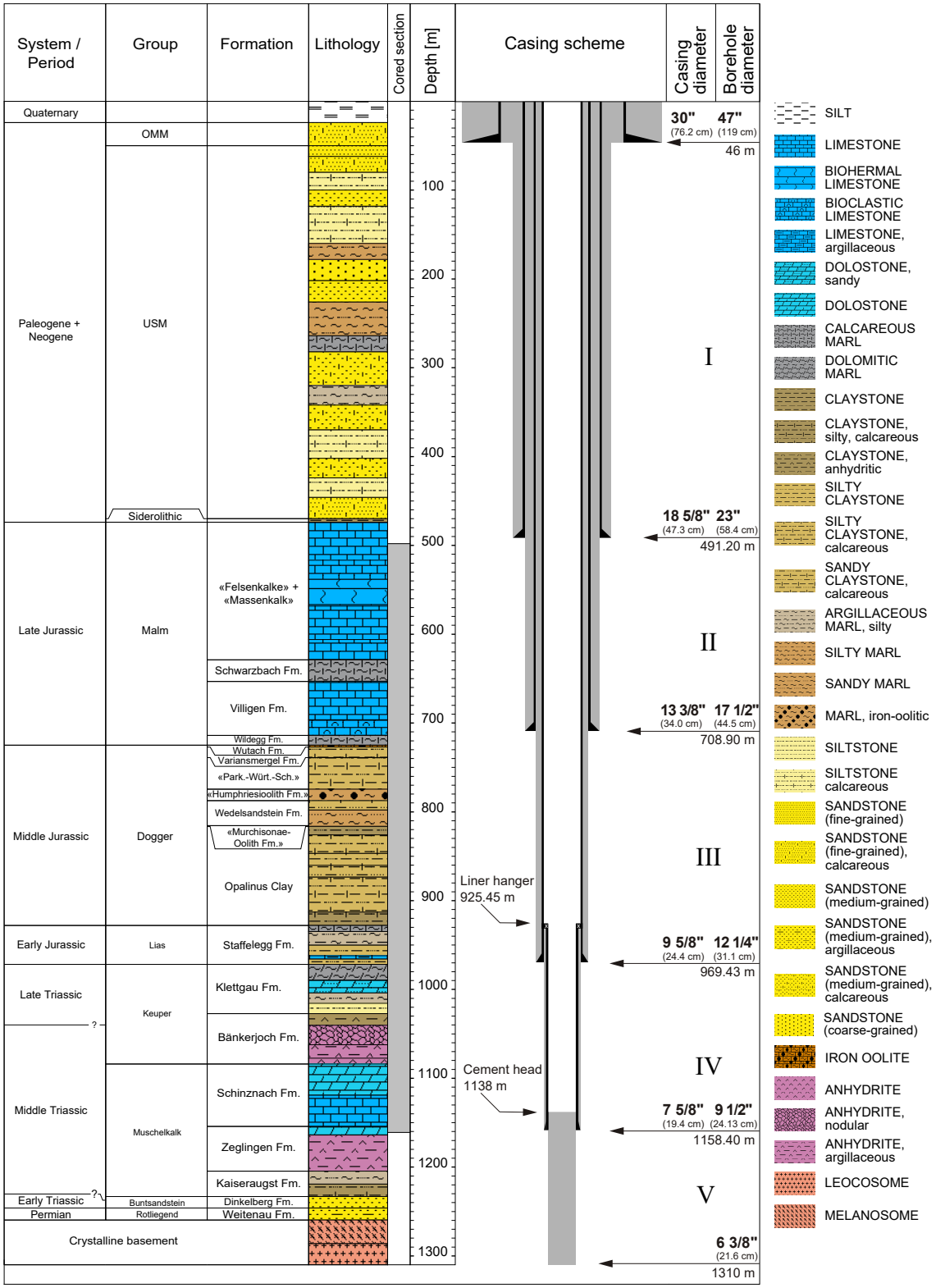


Fig. 1-3: Lithostratigraphic profile and casing scheme for the TRU1-1 borehole[4]

[4] For detailed information see Dossier I and III.

Tab. 1-2: Core and log depth for the main lithostratigraphic boundaries in the TRU1-1 borehole[5]

System / Period	Group	Formation	Core depth in m (MD)	Log depth in m (MD)	
Quaternary				**24.0**	—
Paleogene + Neogene	OMM			50.0	—
	USM			470.0	—
	Siderolithic			**474.0**	—
Jurassic	Malm	«Felsenkalke» + «Massenkalk»	628.87	628.75	—
		Schwarzbach Formation	653.29	653.15	—
		Villigen Formation	714.00	714.00	—
		Wildegg Formation	724.85	725.03	—
	Dogger	Wutach Formation	727.13	727.27	—
		Variansmergel Formation	738.97	739.06	—
		«Parkinsoni-Württembergica-Schichten»	774.55	774.66	—
		«Humphriesioolith Formation»	787.50	787.55	—
		Wedelsandstein Formation	815.51	815.50	—
		«Murchisonae-Oolith Formation»	816.42	816.43	—
		Opalinus Clay	927.91	927.87	—
	Lias	Staffelegg Formation	**971.68**	**971.55**	—
Triassic	Keuper	Klettgau Formation	1027.22	1027.44	—
		Bänkerjoch Formation	1084.01	1084.22	—
	Muschelkalk	Schinznach Formation	1154.25	1154.43	—
		Zeglingen Formation	1204.5		—
		Kaiseraugst Formation	1233.2		—
	Buntsandstein	Dinkelberg Formation	**1246.1**		—
Permian	Rotliegend	Weitenau Formation	**1259.7**		—
		Crystalline Basement	1310.0	final depth	

[5] For details regarding lithostratigraphic boundaries see Dossier III; for details about depth shifts (core goniometry) see Dossier V.

1.3 Documentation structure for the TRU1-1 borehole

NAB 20-09 documents the majority of the investigations carried out in the TRU1-1 borehole, including laboratory investigations on core material. The NAB comprises a series of stand-alone dossiers addressing individual topics and a final dossier with a summary composite plot (Tab.1-3).

This documentation aims at early publication of the data collected in the TRU1-1 borehole. It includes most of the data available approximately one year after completion of the borehole. Some analyses are still ongoing (e.g. diffusion experiments, analysis of veins, hydrochemical interpretation of water samples) and results will be published in separate reports.

The current borehole report will provide an important basis for the integration of datasets from different boreholes. The integration and interpretation of the results in the wider geological context will be documented later in separate geoscientific reports.

Tab. 1-3: List of dossiers included in NAB 20-09

Black marks the dossier at hand.

Dossier	Title	Authors
I	TBO Trüllikon-1-1: Drilling	M. Ammen & P.-J. Palten
II	**TBO Trüllikon-1-1: Core Photography**	**D. Kaehr & M. Gysi**
III	TBO Trüllikon-1-1: Lithostratigraphy	M. Schwarz, P. Jordan, P. Schürch, H. Naef, T. Ibele, R. Felber & M. Gysi
IV	TBO Trüllikon-1-1: Microfacies, Bio- and Chemostratigraphic Analysis	S. Wohlwend, H.R. Bläsi, S. Feist-Burkhardt, B. Hostettler, U. Menkveld-Gfeller, V. Dietze & G. Deplazes
V	TBO Trüllikon-1-1: Structural Geology	A. Ebert , S. Cioldi, L. Gregorczyk, S. Rust, D. Böhni & M. Gysi
VI	TBO Trüllikon-1-1: Wireline Logging and Microhydraulic Fracturing	J. Gonus, E. Bailey, J. Desroches & R. Garrard
VII	TBO Trüllikon-1-1: Hydraulic Packer Testing	R. Schwarz, L. Schlickenrieder, H.R. Müller, S. Köhler, A. Pechstein & T. Vogt
VIII	TBO Trüllikon 1-1: Rock Properties, Porewater Characterisation and Natural Tracer Profiles	L. Aschwanden, L. Camesi, T. Gimmi, A. Jenni, M. Kiczka, U. Mäder, M. Mazurek, D. Rufer, H.N. Waber, P. Wersin, C. Zwahlen & D. Traber
IX	TBO Trüllikon-1-1: Rock-mechanical and Geomechanical Laboratory Testing	E. Crisci, L. Laloui & S. Giger
X	TBO Trüllikon-1-1: Petrophysical Log Analysis	S. Marnat & J.K. Becker
	TBO Trüllikon-1-1: Summary Plot	Nagra

1.4 Scope and objectives of this dossier

The dossier at hand (Dossier II) documents core photography. The objectives are the following:

- summary of core handling, core photography and core resination for this drilling campaign
- visual documentation of the cuttings samples and cores of TRU1-1 from 3 m to 1'310.0 m MD core depth
- visual documentation of the resinated core slabs of TRU1-1 from 721.50 m to 1'029.07 m MD core depth

2 Executed working procedures

2.1 On-site core handling

The cores were drilled with a 6 m long inner core barrel containing an inner plastic tube. To avoid core jamming and to obtain a better core quality the length of a core run was 3 m, only. After cutting the core, the drilling crew pulled the inner core barrel up with a winch (wireline coring) and placed it on the pipe rack (Fig. 2-1). The core catcher was detached and the inner plastic tube was removed and laid down on trestles. The section containing the core was separated from the empty plastic tube by cutting the tube to a length of approximately 3.5 m. The core was then carried to the core processing area (Fig. 2-2) and pushed out of the tube using an appropriate rod. If the core was jammed inside the tube, the plastic liner was cut laterally using an electric cutting machine.



Fig. 2-1: The inner core barrel is placed on the pipe rack

Showcase picture of rig 16 (Marriott); workflow comparable at the Daldrup rig (picture credits: © Maya & Daniele)



Fig. 2-2: The 3 m core in the plastic liner is carried to the core processing area

Showcase picture of rig 16 (Marriott); workflow comparable at the Daldrup rig (picture credits: © Maya & Daniele)

Once laid out, the core was washed with water to remove the drilling fluid (Figs. 2-3 and 2-4). Afterwards, the top of the newly cut core was aligned with the bottom of the previous core section. If the two core pieces did not fit properly, they were marked with a red cross and a new set of orientation lines was started. If a fit was established, the orientation lines were correctly copied onto the newly cored section. These orientation lines consist of two parallel lines drawn along the core axis with additional arrows indicating the downhole direction. The line on the right-hand side when looking towards the core top is red (Figs. 2-5 and 2-6). The colour of the line on the left-hand side can be white, yellow or black depending on the colour of the cored rock. The core depth was marked on the core with a line perpendicular to the core axis and corresponding depth labels at 0.5 m intervals.

To facilitate proper core handling, transportation and further analyses, the core sections were cut into pieces approximately one metre long using a diamond-impregnated rock saw before being stored in one metre core boxes.



Fig. 2-3: A core covered in drilling fluid on the core processing table

Picture credits: © Maya & Daniele



Fig. 2-4: A core is washed with water on the core processing table to remove the drilling fluid

Picture credits: © Maya & Daniele



Fig. 2-5: A core is marked with orientation lines

Picture credits: © Maya & Daniele

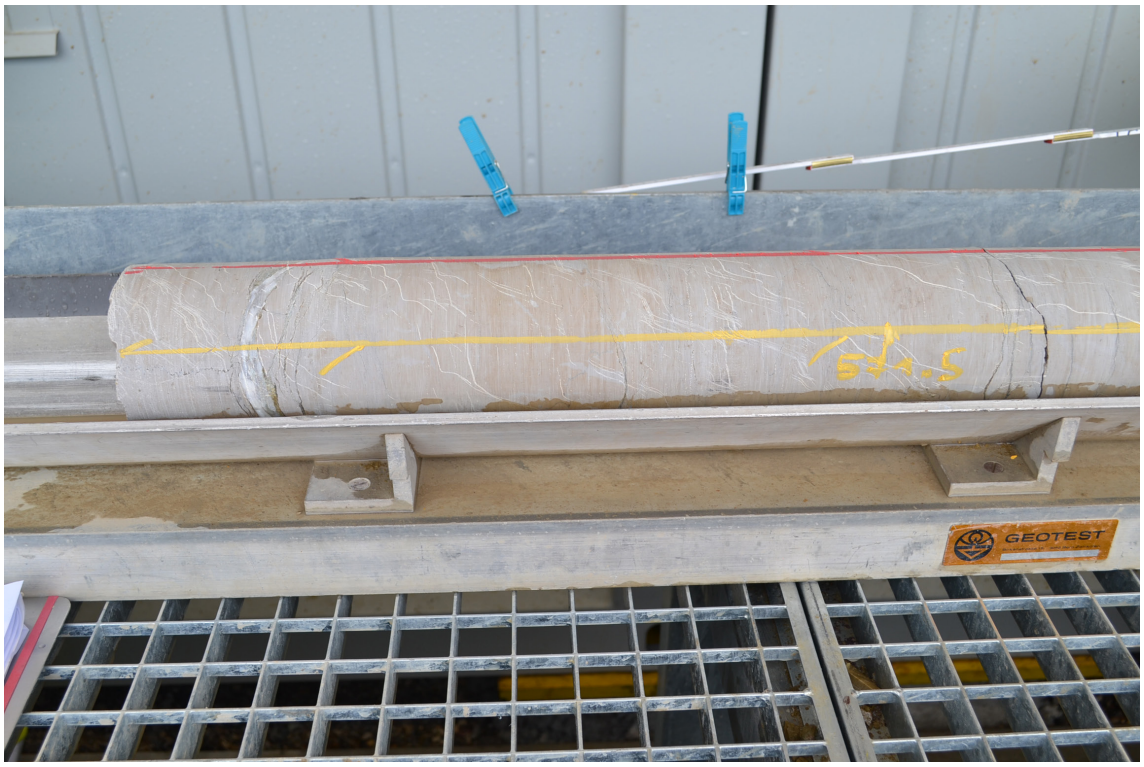


Fig. 2-6: Cleaned, measured and marked core

2.2 Core photography

All core pieces were photographed (planar pictures) using a modified version of the DMT CoreScan^3 system (Fig. 2-7) specifically designed to take high-resolution core photographs (10 px/mm). If the core geometry and condition allowed it, 360° photographs of the core surface were also taken (not documented in this dossier). For both planar and 360° photographs, the core was placed on two rubber rollers and a digital line scan camera recorded the picture via an inclined mirror in the top section of the CoreScan^3 system. During 360° photography, the core was rotated around its longitudinal axis and the picture was taken at the upper section of the core. In addition, all 360° photographs were digitally rotated to set the red orientation line to 0°. Both planar and 360° photographs were saved on the CoreScan^3 computer, which automatically synchronised the data with the Nagra network-attached storage (NAS) located at the core storage facility in Würenlingen.

2.2.1 Specifications

Camera:

- manufacturer: avaluar GmbH
- camera model: CCD-Colour camera CSc3b1.26
- resolution y: 6'400 (10 px/mm)
- resolution x: 10'680 (10 px/mm)
- spectral response: 400 nm to 700 nm
- sharpening: 0
- gamma: 1.4
- lens maker: Schneider Kreuznach
- lens model: APO COMPONON f4.0/60mm
- aperture: f/8
- focal length: 35 mm
- exposure time: program very dark (custom calibrated for Nagra's LED panels)

LED panels:

- 4x Aladdin BI-FLEX 4 (200 W Bi-Colour Panel): two at the back and two at the front of the CoreScan^3 system, protected in aluminium boxes with a diffusor plate as front cover
- 2x Aladdin BI-FLEX 2 (70 W Bi-Colour Panel): one on the left-hand side and one on the right-hand side of the CoreScan^3 system, protected in an aluminium box with a diffusor plate as front cover
- all six panels are calibrated to 5'000 K with a Sekonic C-800 SpectroMaster

Reference cards:

- X-Rite ColorChecker White Balance: used for camera calibration (shading)
- X-Rite ColorChecker Classic Mini colour chart: colour reference on every core photo
- BST14 greyscale chart: greyscale reference on every core photo
- Datacolor SpyderCHECKR 48 colour chart: colour reference chart for reference photographs

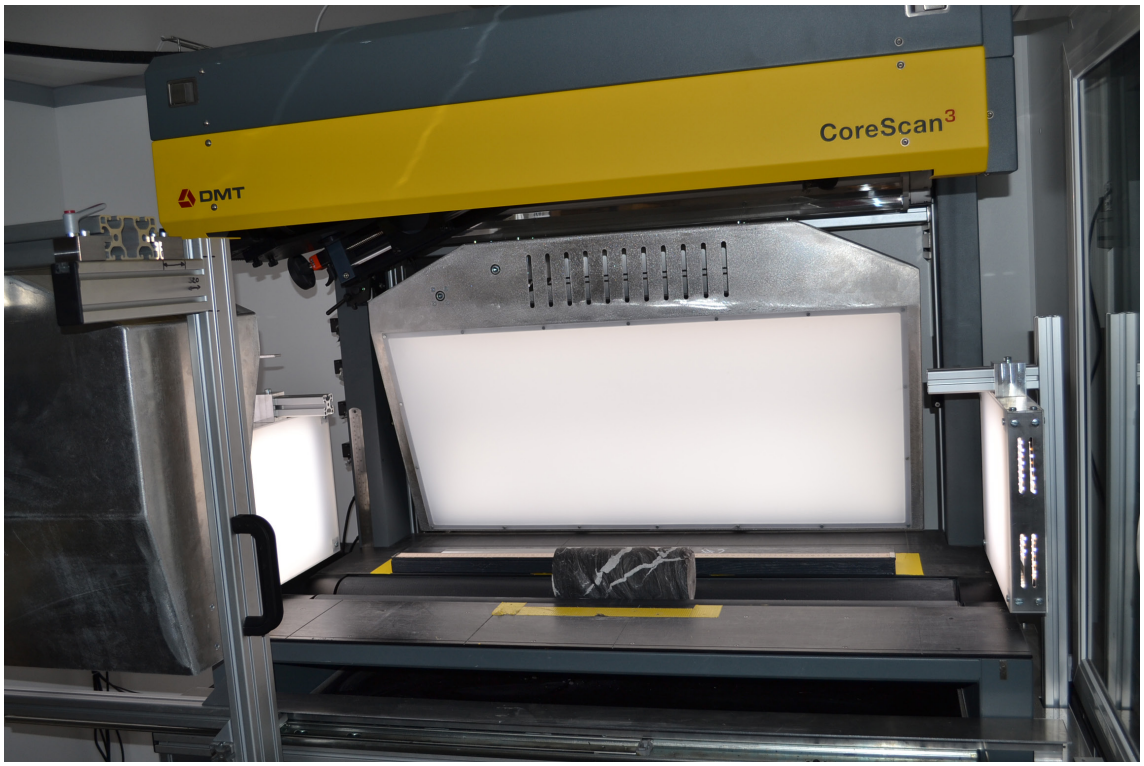


Fig. 2-7: Modified DMT CoreScan^3 system at the drill site

2.2.2 Colour drift monitoring

During coring operations, a reference photograph of the Datacolor SpyderCHECKR 48 colour chart was taken with the CoreScan^3 system at least twice per 24 h (Fig. 2-8). These reference photographs enabled to monitor the proper functioning of the CoreScan^3 system during operations. Issues regarding colour correctness and contrast could be detected early and necessary adjustments to the CoreScan^3 system or environment conditions (especially room temperature) could be made. The reference photographs could further be used to create an ICC profile (International Color Consortium): a data set characterising the colour input / output for the most accurate colour matching.

Each core photograph taken included a metre scale, a BST14 greyscale chart and an X-Rite ColorChecker Classic Mini colour chart (Fig. 2-9). The metre scale is essential to have a depth indicator on the core photograph, whereas the colour and greyscale charts allow manual colour management during post-processing of the core photograph if required.



Fig. 2-8: Reference photograph setup of the CoreScan[3] system with a Datacolor Spyder-CHECKR 48 colour chart, a metre scale, a BST14 greyscale chart and an X-Rite ColorChecker Classic Mini colour chart

Picture credits: © Maya & Daniele



Fig. 2-9: CoreScan³ system setup during core photography with a metre scale, a BST14 grey-scale chart and an X-Rite ColorChecker Classic Mini colour chart

Picture credits: © Maya & Daniele

2.3 Post-processing of core photographs

All core photographs taken on the drill site were post-processed by a professional photographer. The colour management of the post-processing workflow provided colour-matched, high-resolution core photograph reproductions with enhanced quality and fidelity. The following post-processing steps were applied to a batch of core photographs with comparable camera settings and environmental conditions:

1. noise reduction of the reference photographs of the Datacolor SpyderCHECKR 48 colour chart, shot with the CoreScan³ system
2. ICC profiling of the noise-reduced reference photographs, shot with the CoreScan³ system
3. evaluation of the ICC profiles and selection of the best ICC profile for the post-processing of the core photographs
4. ICC profile application to the core photographs in batch mode
5. correction of contrast and brightness of the core photographs in batch mode
6. conversion of the photographs to eciRGB_v2 standard colour space in batch mode
7. noise reduction and pre-sharpening of every single core photograph
8. correction of colour, exposure and contrast of the core photographs in batch mode

9. comparison between the best ICC profile of the Datacolor SpyderCHECKR 48 colour chart reference photograph, shot with the CoreScan^3 system and the ICC profile of the Datacolor SpyderCHECKR 48 colour chart reference photograph, shot with a Canon 5DmkIV camera
10. visual adjustment of the best ICC profile of the Datacolor SpyderCHECKR 48 colour chart reference photograph, shot with the CoreScan^3 system to the ICC profile of the Datacolor SpyderCHECKR 48 colour reference photograph, shot with a Canon 5DmkIV camera
11. application of the colour adjustement defined in the previous step to the core photographs in batch mode
12. if required, manual colour neutralisation of every single core photograph based on the BST14 greyscale chart and the X-Rite ColorChecker Classic Mini colour chart
13. cropping of the core photographs to the core outlines
14. export of the core photographs as .jpg and .tiff in pre-defined resolutions and corresponding sharpening parameters

2.4 Core slab resination

Core slab resination is carried out to protect a designated section of the core from further deterioration and to present a clean core face for inspection, photography and archiving. To create the resinated slab, the following steps were applied:

1. full core stabilisation with an aluminium foil taped to the plastic core protection tube
2. cutting of high-quality core slabs with an automated slabbing system (dry cut for clay-rich sediments), leaving ⅓ and ⅔ of the core section (Fig. 2-10)
3. placing the ⅔ core section flat side down in the metal tray
4. placing the strati-slab flat side up in the metal tray; a strati-slab is a 22 mm thick piece of a core sample which was cut parallel to the core axis
5. labelling the metal tray with the borehole name, section number, box number, top and bottom depth and measuring scale
6. core resination with a transparent epoxy resin-hardener mixture by pouring the epoxy resin-hardener mixture around the core in the metal tray (resin thickness approximately 10 mm)
7. hardening of the resin for at least 12 h
8. cutting of high-quality core slabs with an automated slabbing system (dry cut for clay-rich sediments) parallel to the resin tray leaving a ½ core-section and a 18 mm thick "biscuit cut" core slab (Fig. 2-10).
   Slabing the strati-slabs was challenging due to their reduced thickness and their shape. A diminished slab quality is therefore possible along strati-slab sections (Fig. 2-11)
9. a four stage core surface preparation sequence was applied for core slab finishing:
   - sanding using 80-grit sandpaper
   - sanding using 240-grit sandpaper
   - buffing of the surface using nylon polishing pads
   - buffing of the surface using lint-free cloths

The main aim of the TRU1-1 borehole was the detailed characterisation of the host rock and of the adjacent confining units. This interval from the Wutach Formation to the Klettgau Formation is dominated by sandy / silty claystone, claystone, argillaceous marl and dolomitic marl, which are prone to core deterioration (see Appendix A for lithostratigraphic profile or Dossier III for more details about the lithostratigraphy). To enable proper long-term archiving of these delicate lithologies, resinated core slabs from 721.00 m to 1'029.07 m MD core depth (Base Wildegg Formation to Top Bänkerjoch Formation) were prepared.

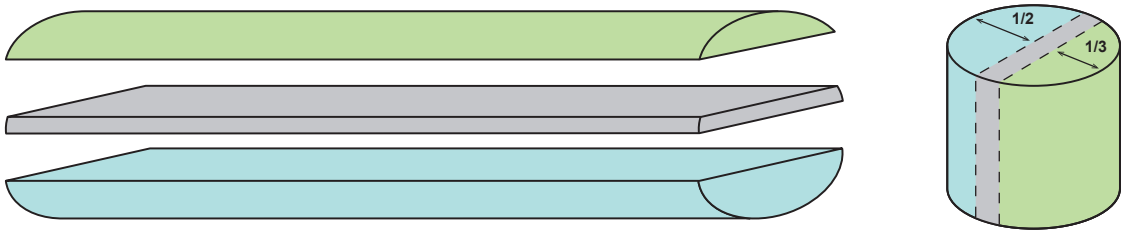


Fig. 2-10: Schematic illustration of the different core sections after cutting high-quality core slabs with an automated slabbing system

Green: ⅓ core section; grey: 18 mm "biscuit cut" slab; turqois: ½ core-section



Fig. 2-11: Resinated core slab in the metal tray

Left: 95 mm wide "biscuit cut" slab; center: strati slab; right: empty due to complete core sample without strati-slab

2.5 Signatures

The following signatures were used in the composite displays of the complete cores and resinated core slabs:

- white hachures: missing core due to formation integrity test (FIT) pilot hole or drilling-related technical issues (Fig. 2-12)
- box with white letters: missing photo
- white shading with black label: missing core sample due to complete core sample without strati-slab, labelled with sample name (Fig. 2-12)

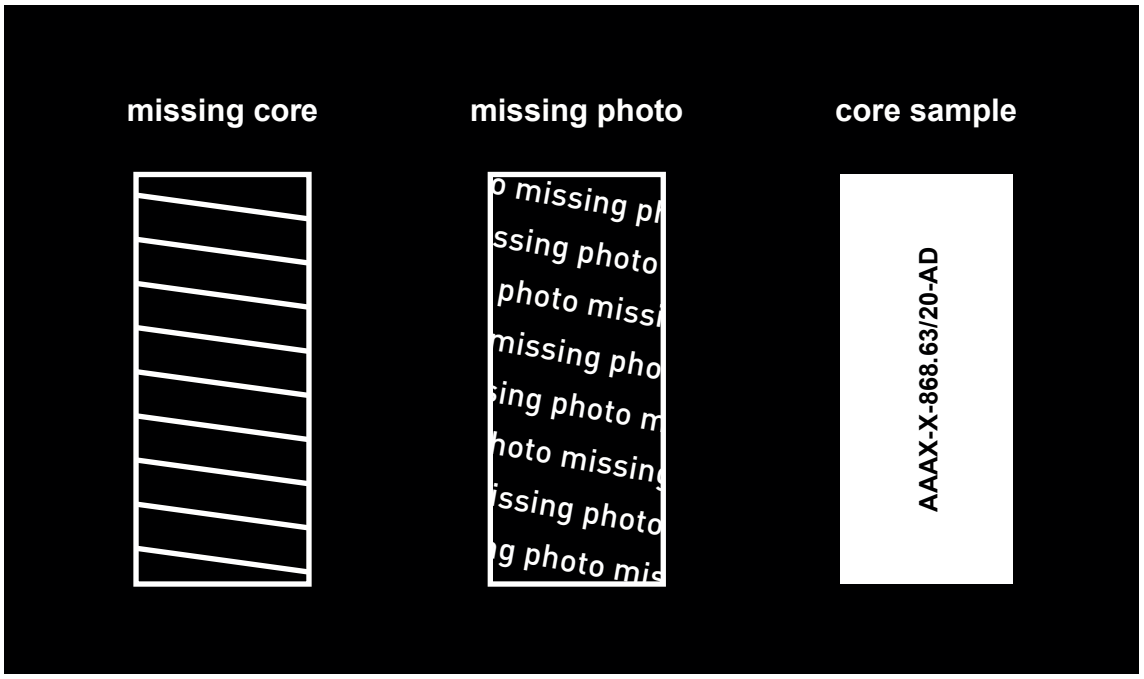


Fig. 2-12: Signatures used in the composite displays of the complete cores and resinated core slabs

Left: missing core due to FIT pilot hole or drilling related technical issues; middle: missing photo; right: missing core sample due to complete core sample without strati slab labelled with sample name

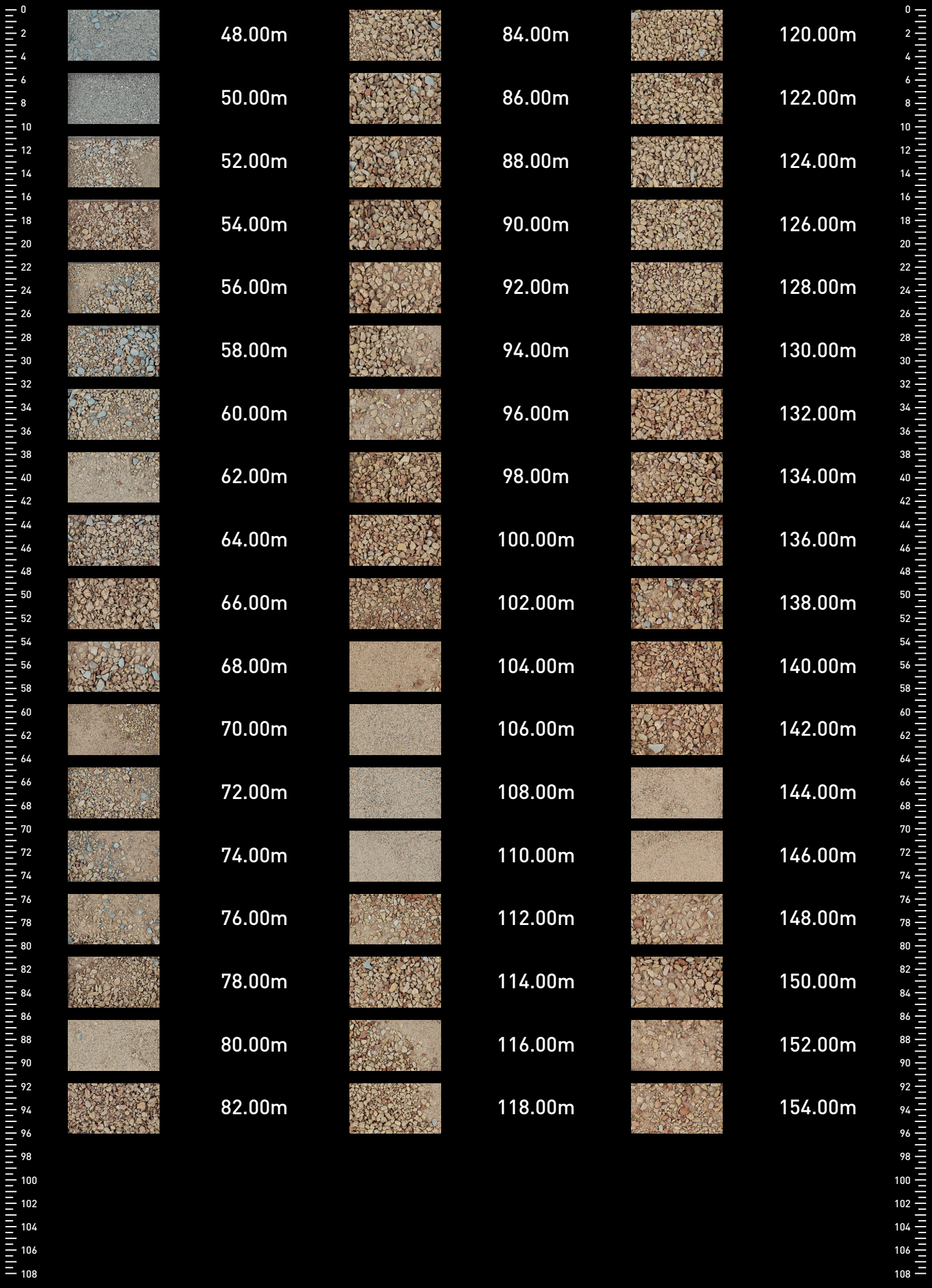
3 Trüllikon-1-1 core- and cuttings composites

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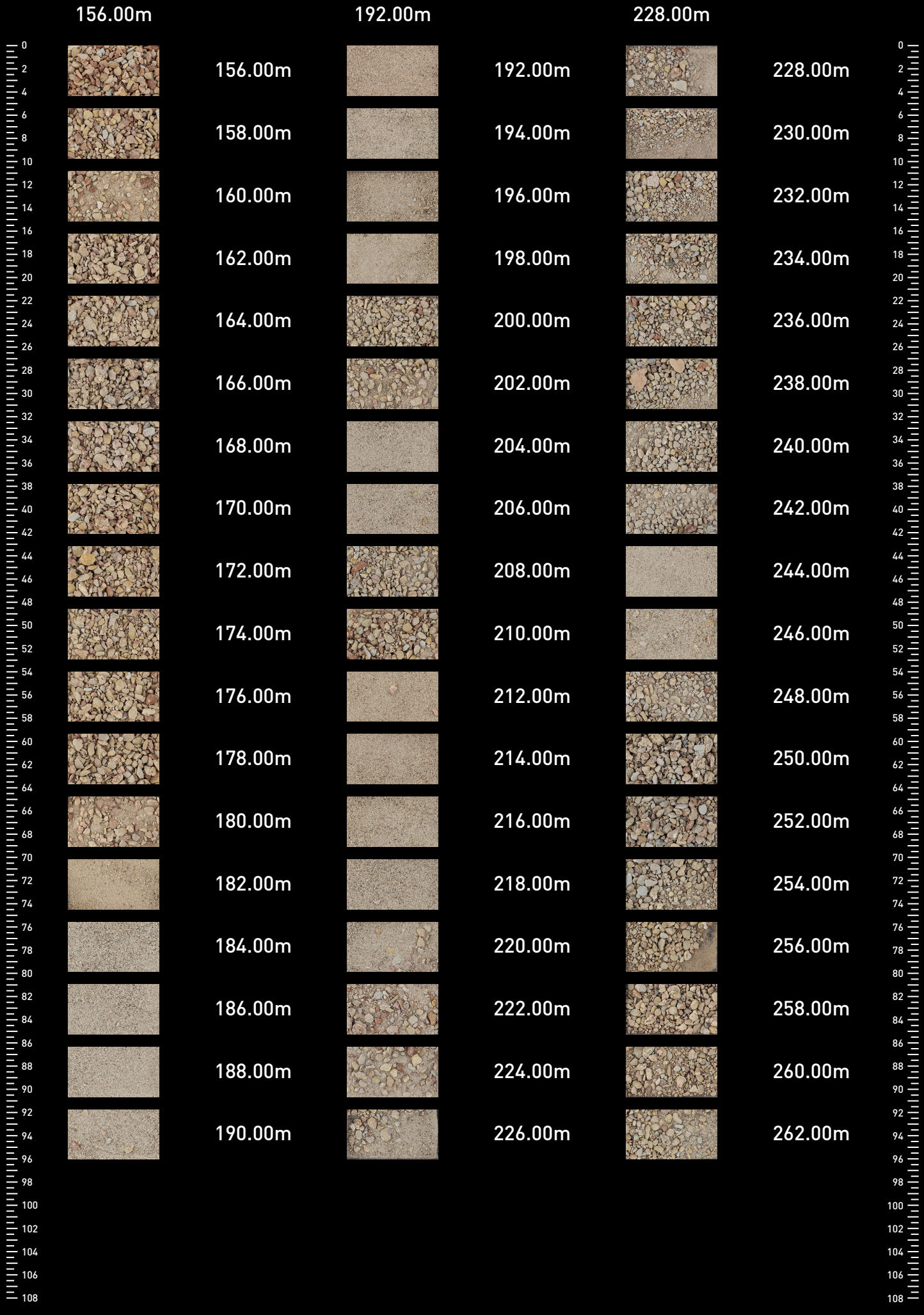


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48.00m 84.00m 120.00m



82.00m 118.00m 154.00m


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160.00m
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190.00m
226.00m
262.00m

264.00m 300.00m 336.00m



298.00m 334.00m 370.00m

372.00m 408.00m 444.00m



406.00m 442.00m 478.00m

480.00m



480.00m

482.00m

484.00m

486.00m

488.00m

490.00m

492.00m

493.00m

493.00m

498.00m 498.98m 499.62m 500.22m 500.90m 501.61m



498.98m 499.62m 500.22m 500.90m 501.61m 502.62m

502.62m 503.03m 504.00m 505.00m 505.99m 506.89m



503.03m 503.99m 505.00m 505.99m 506.89m 507.90m

507.90m 508.28m 508.97m 509.92m 510.73m 511.56m



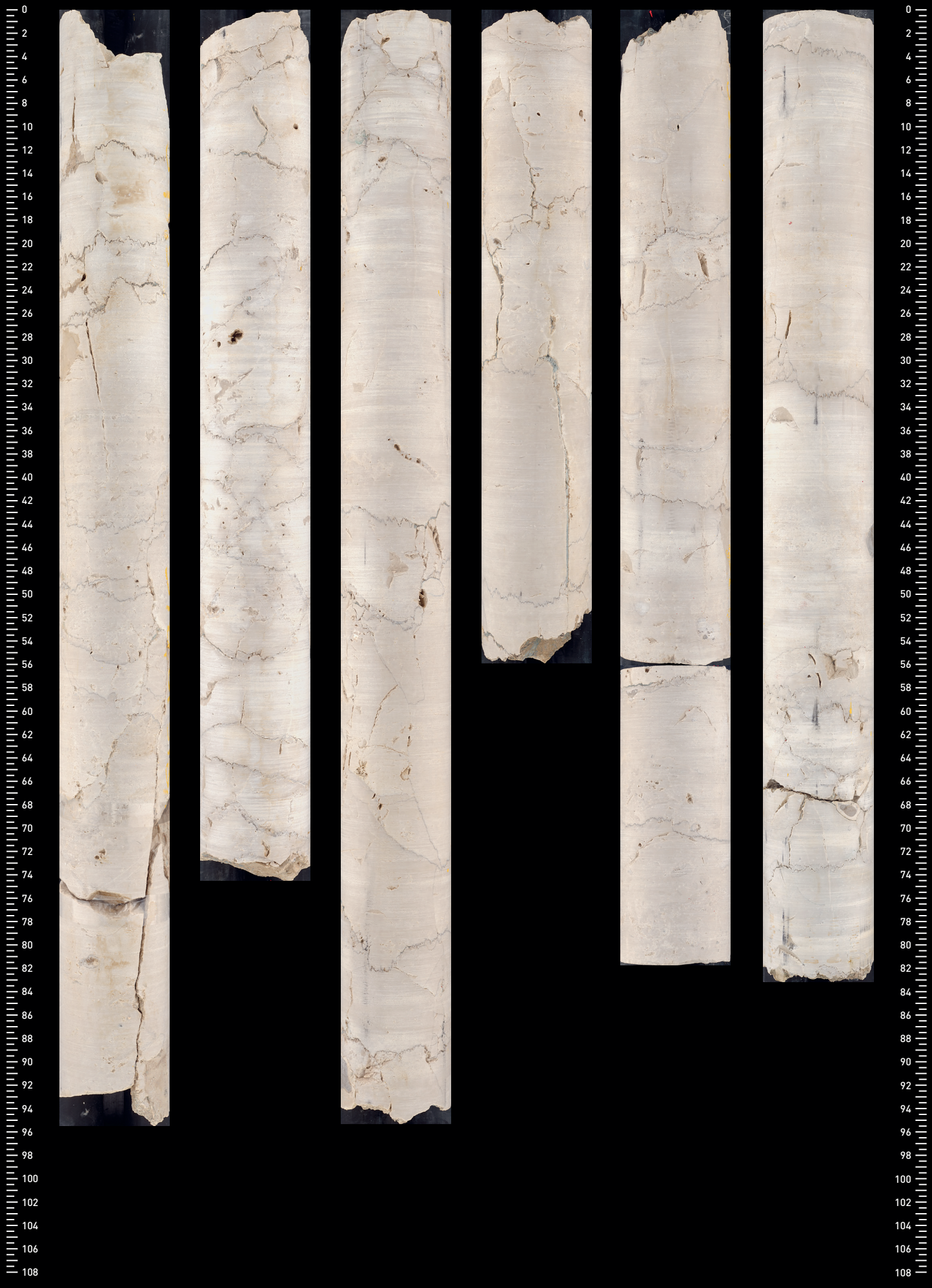
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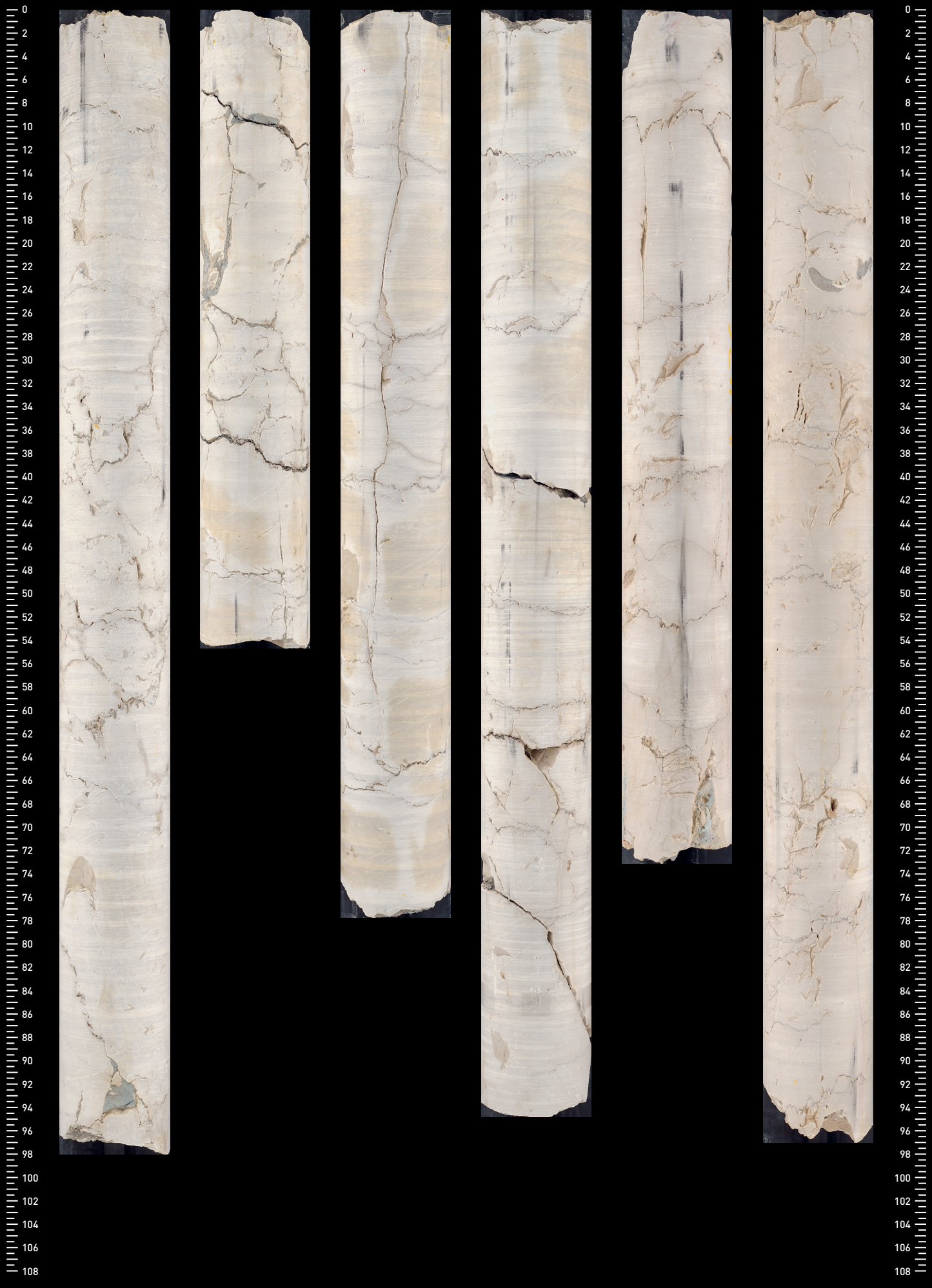
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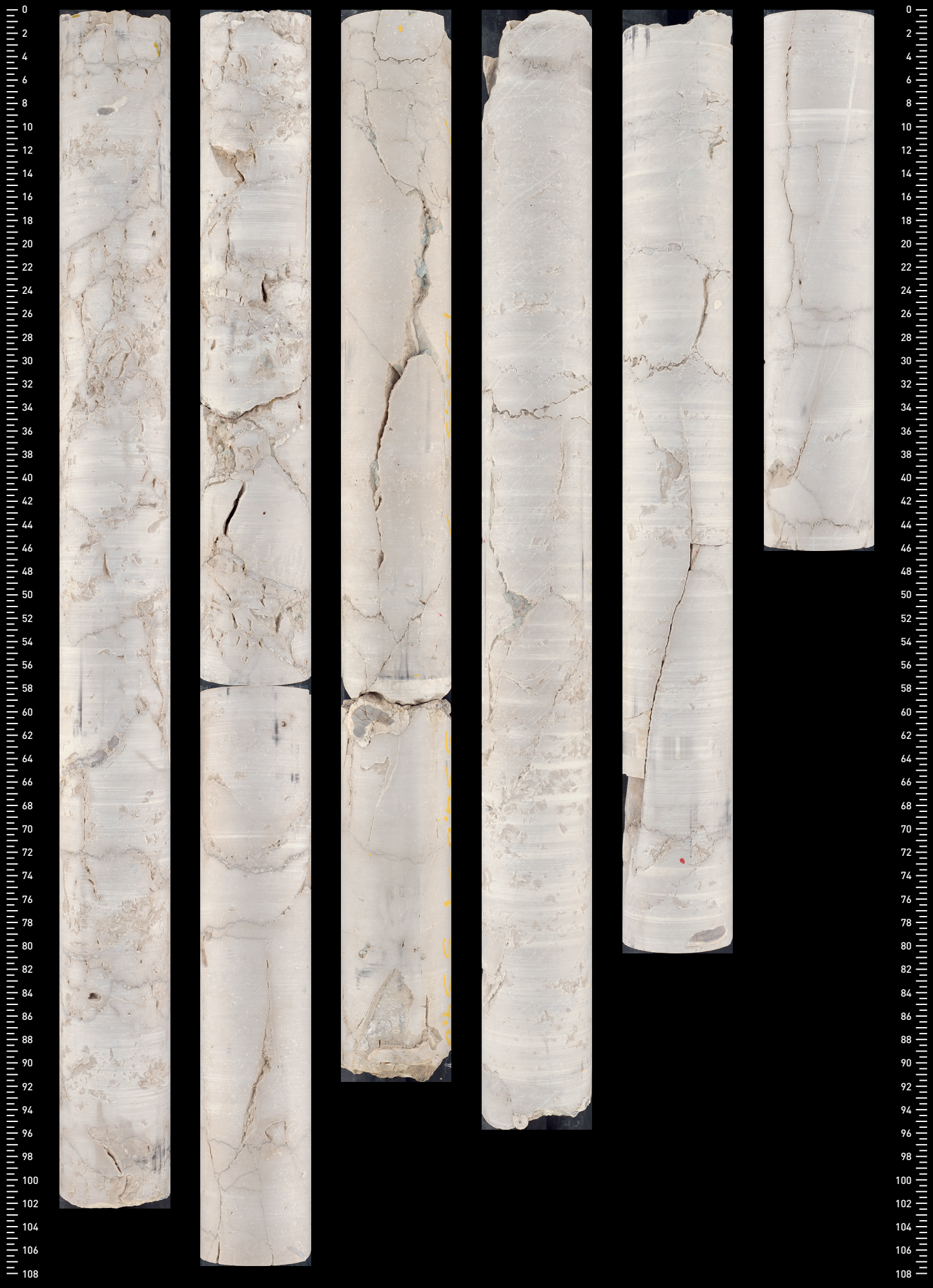
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531.21m 532.20m 533.25m 534.14m 535.04m 535.82m



532.20m 533.25m 534.14m 535.04m 535.82m 536.27m

536.27m 537.17m 538.09m 539.08m 540.11m 541.09m



537.17m 538.09m 539.08m 540.11m 541.09m 542.00m

542.00m 542.92m 543.97m 544.79m 545.27m 546.21m



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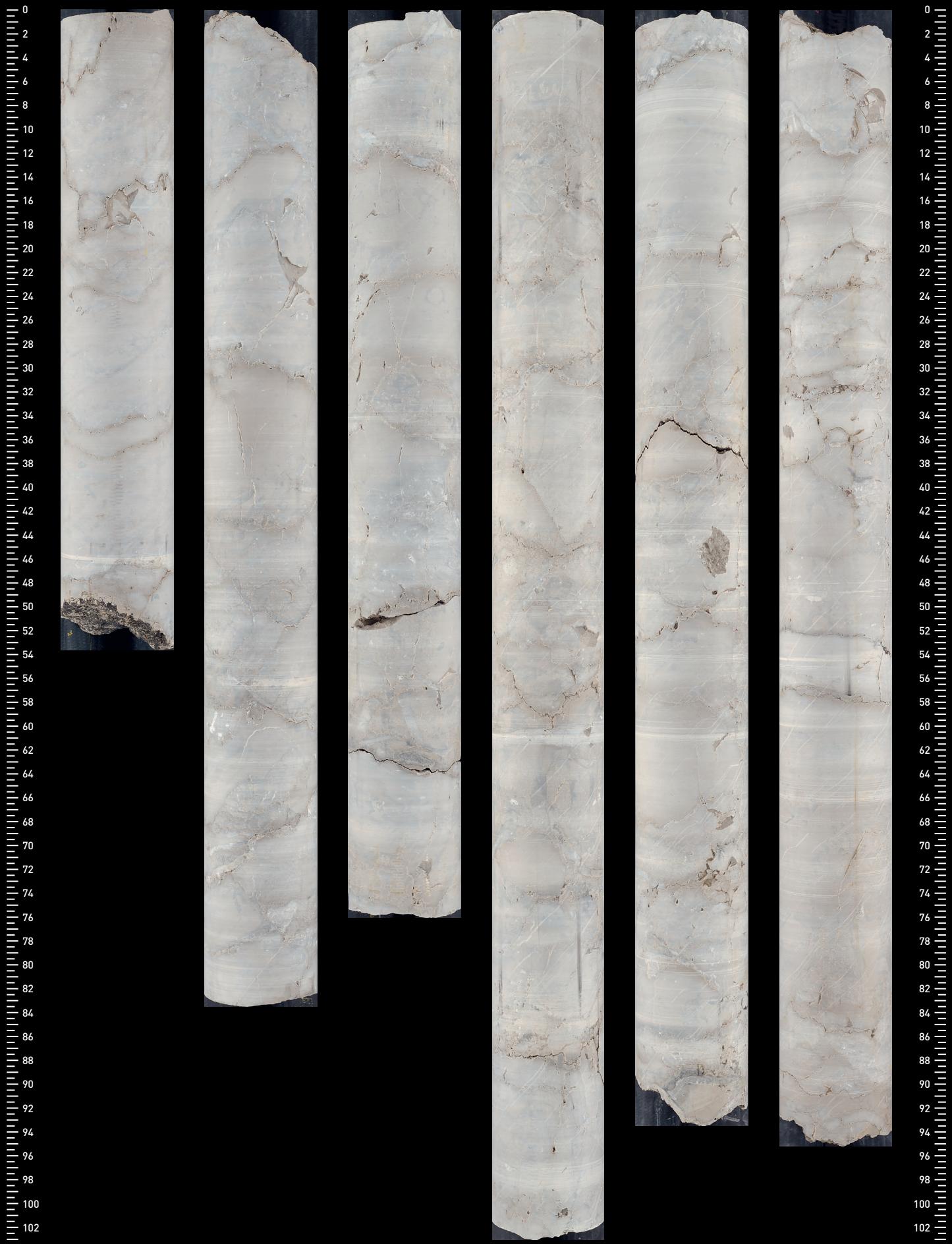
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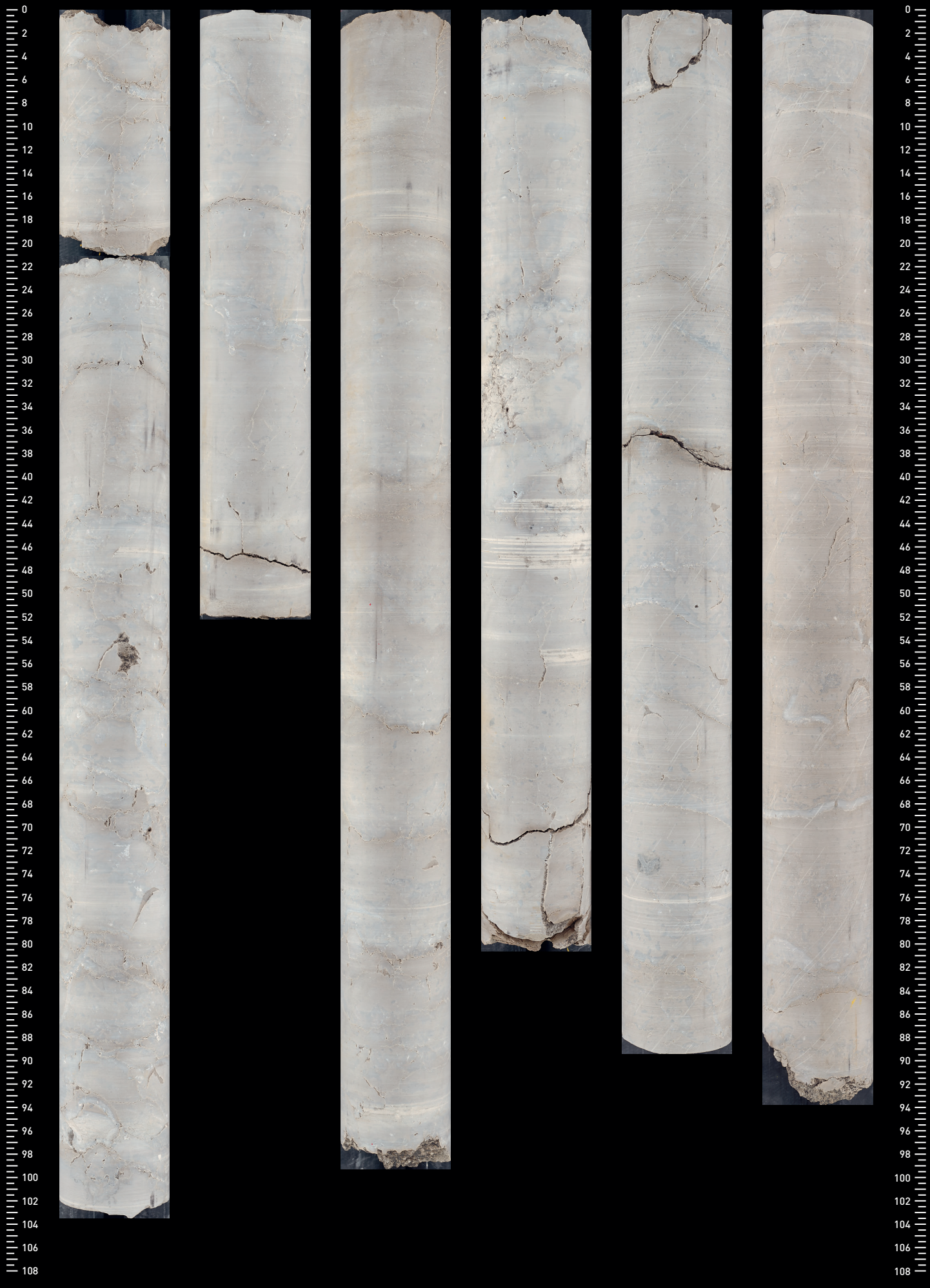


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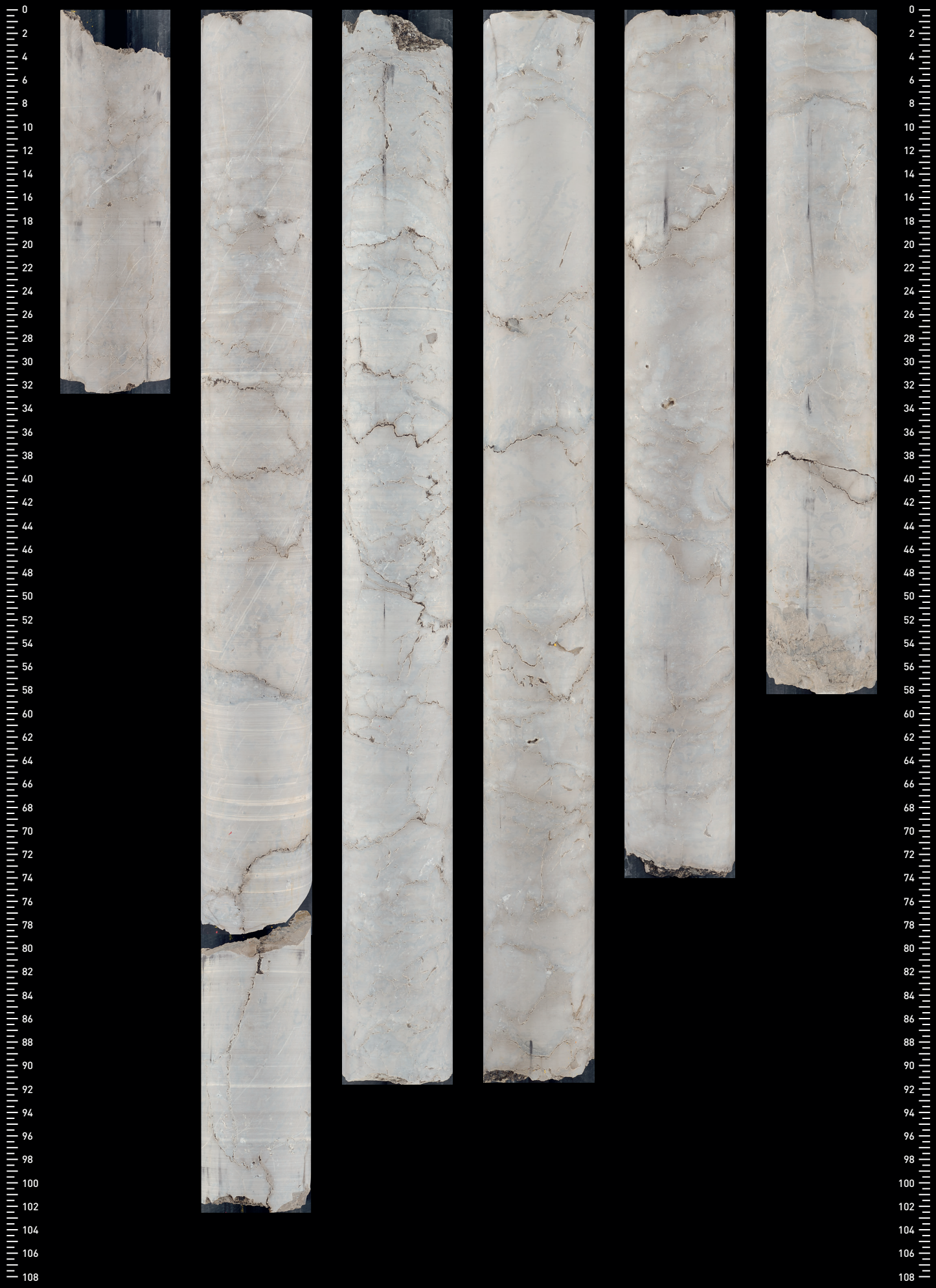
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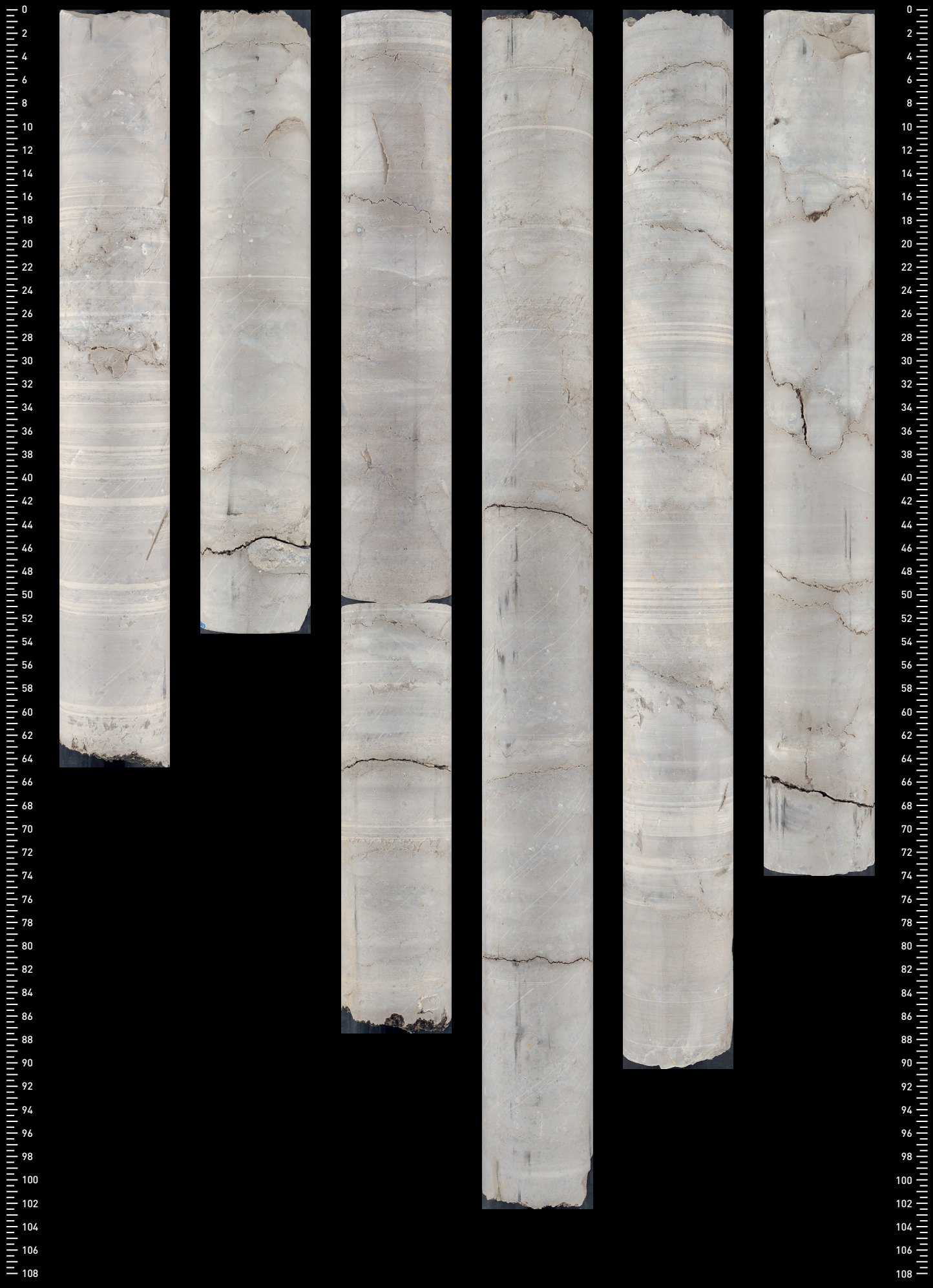

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571.10m
572.00m

572.00m 572.29m 573.27m 574.17m 575.04m 575.78m



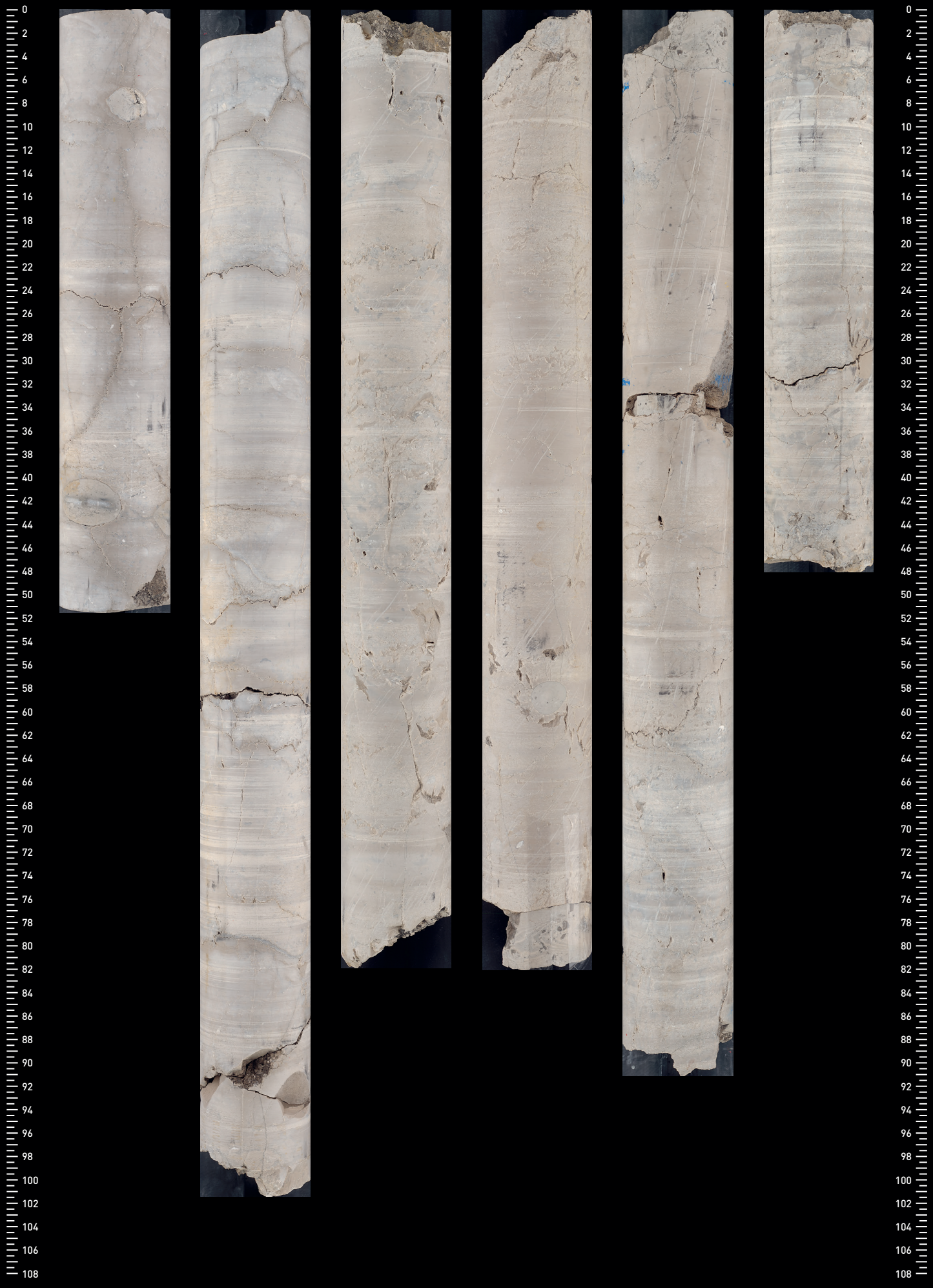
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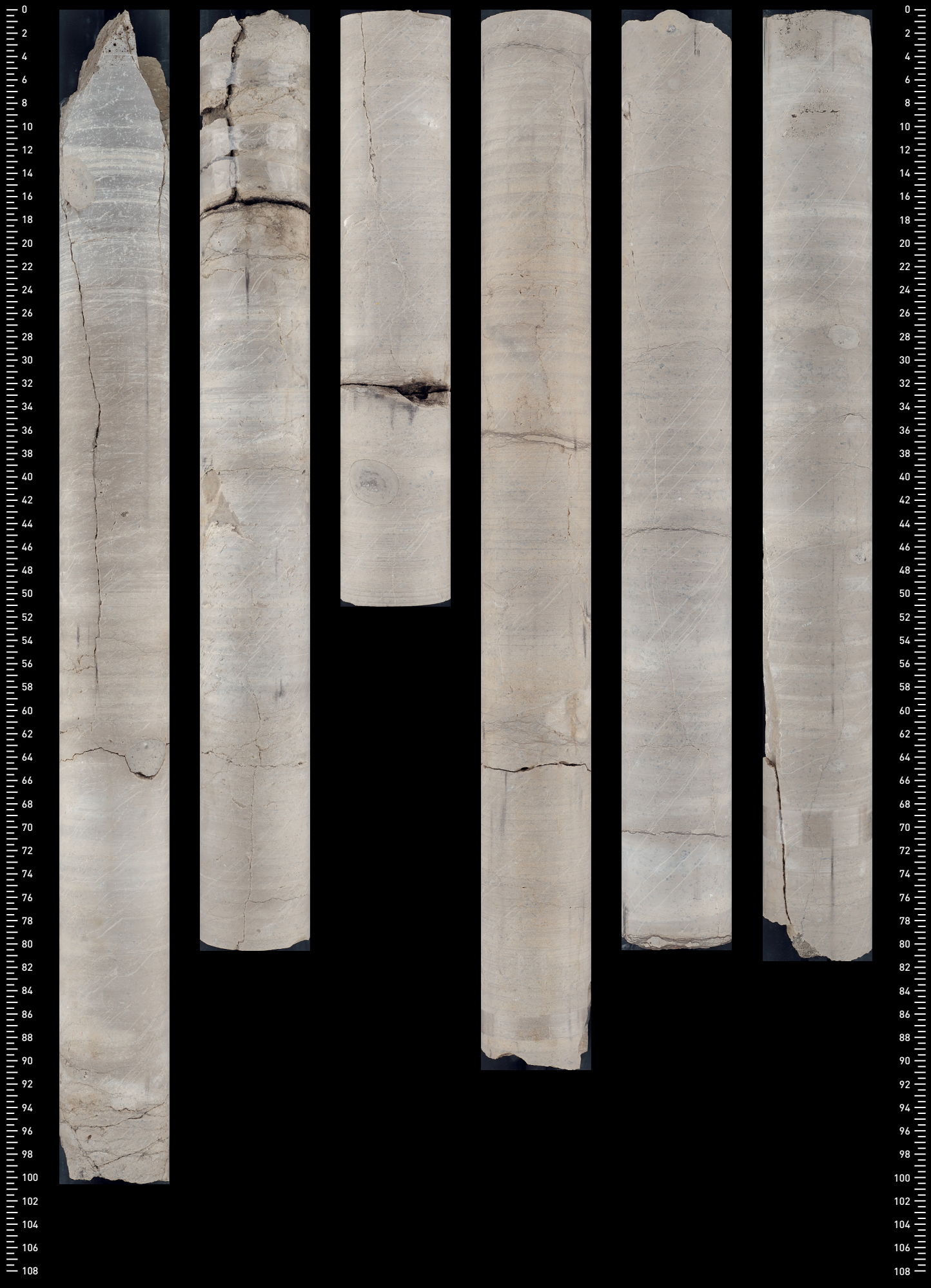


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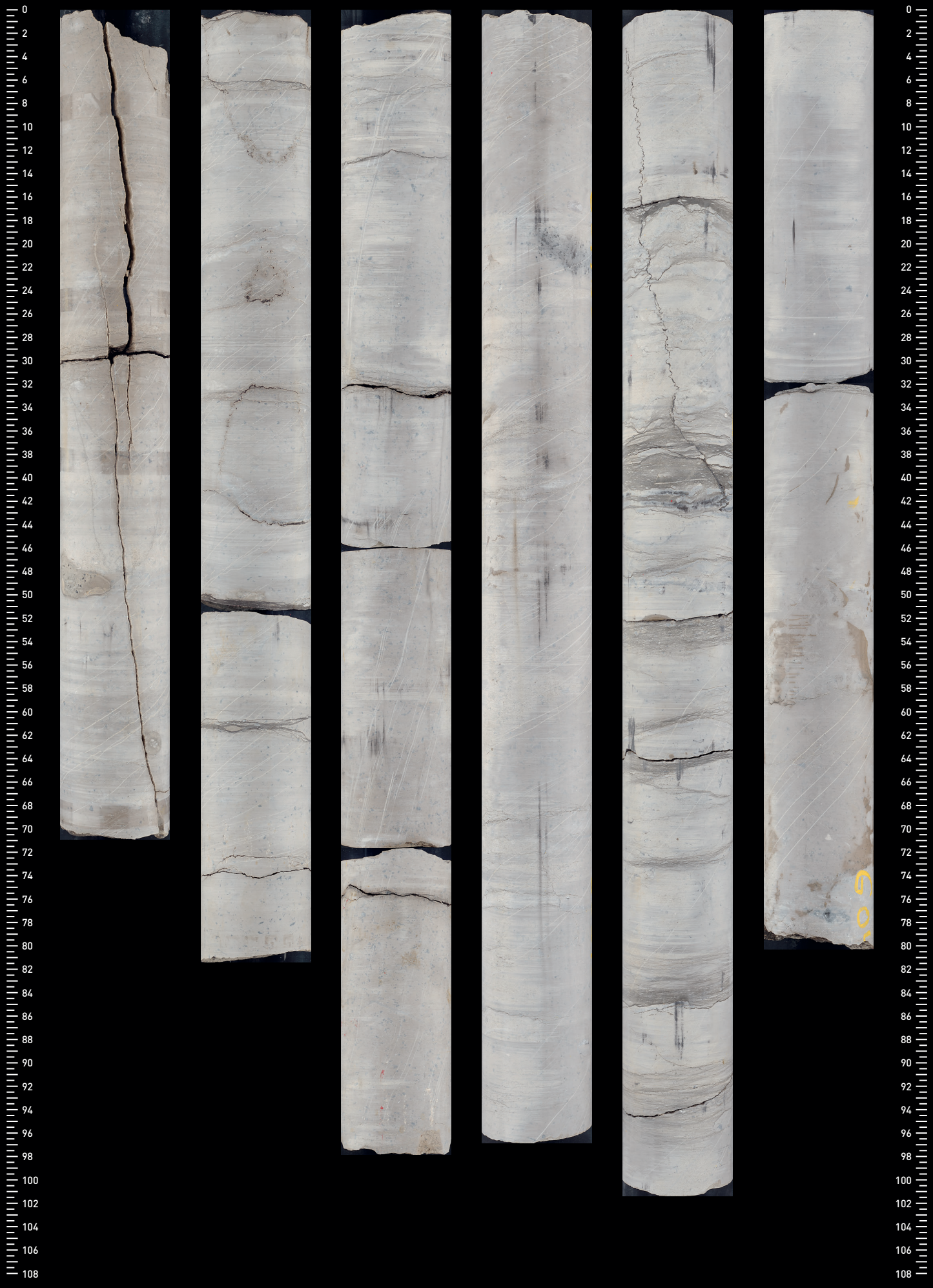
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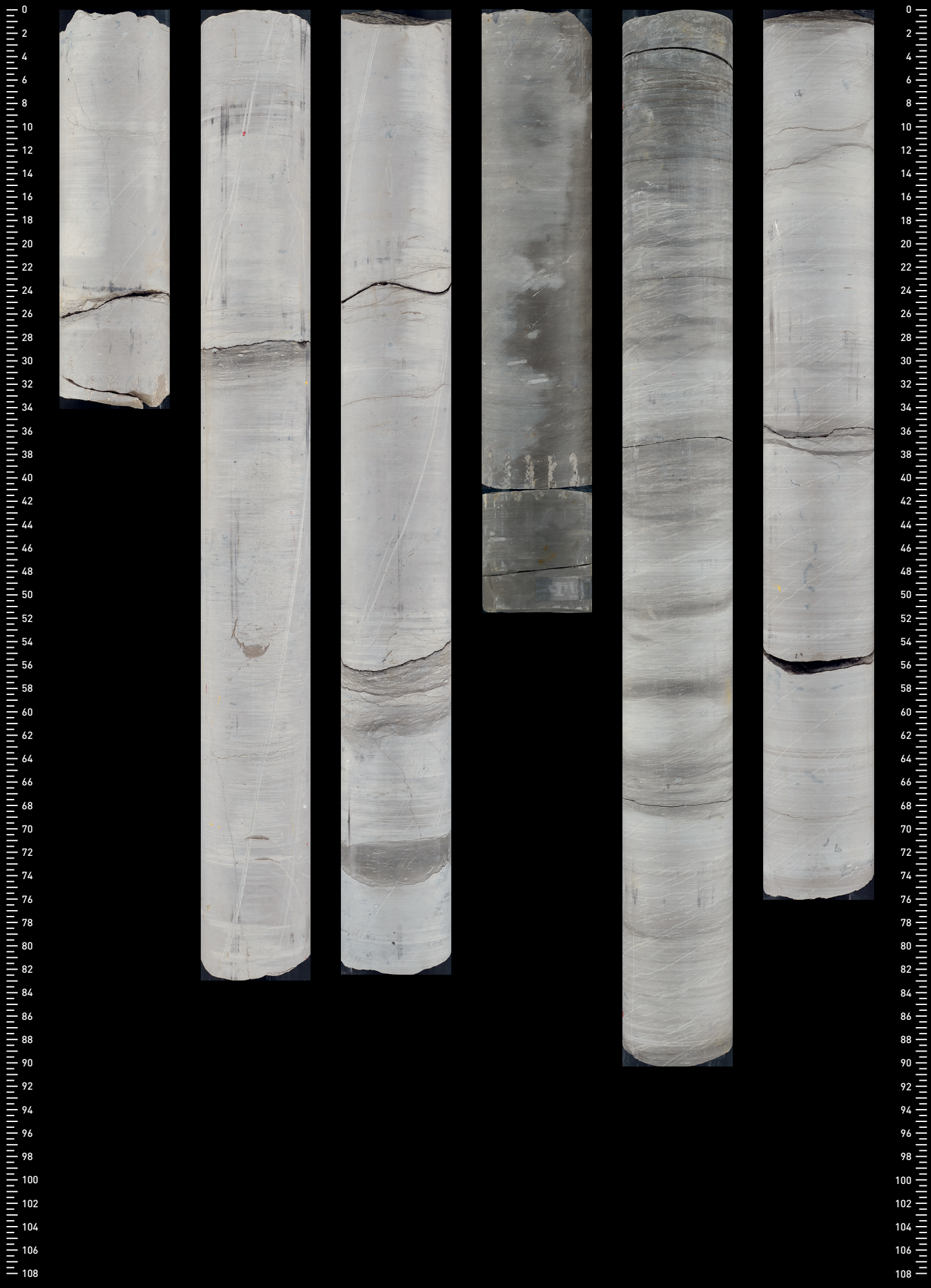

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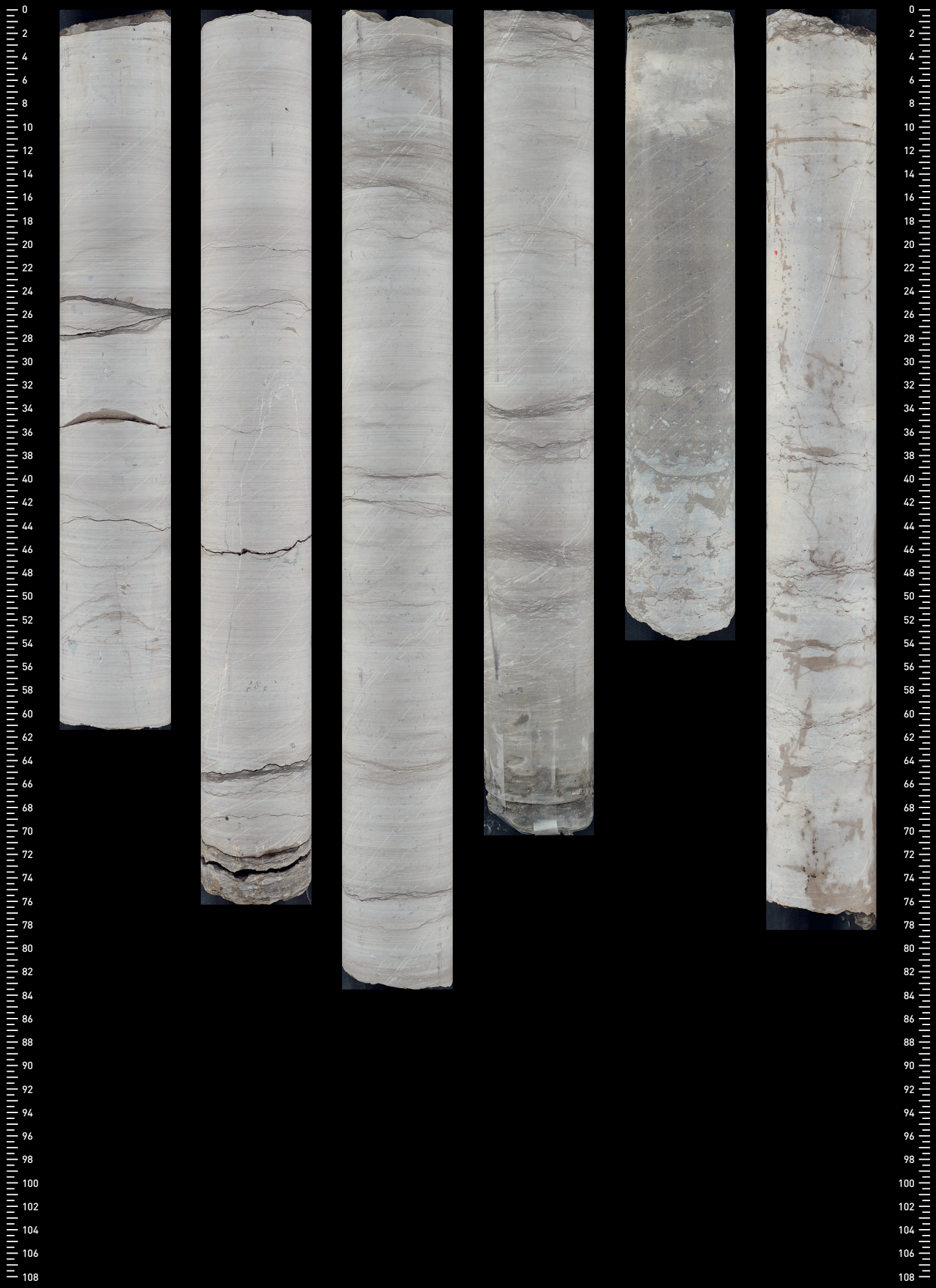
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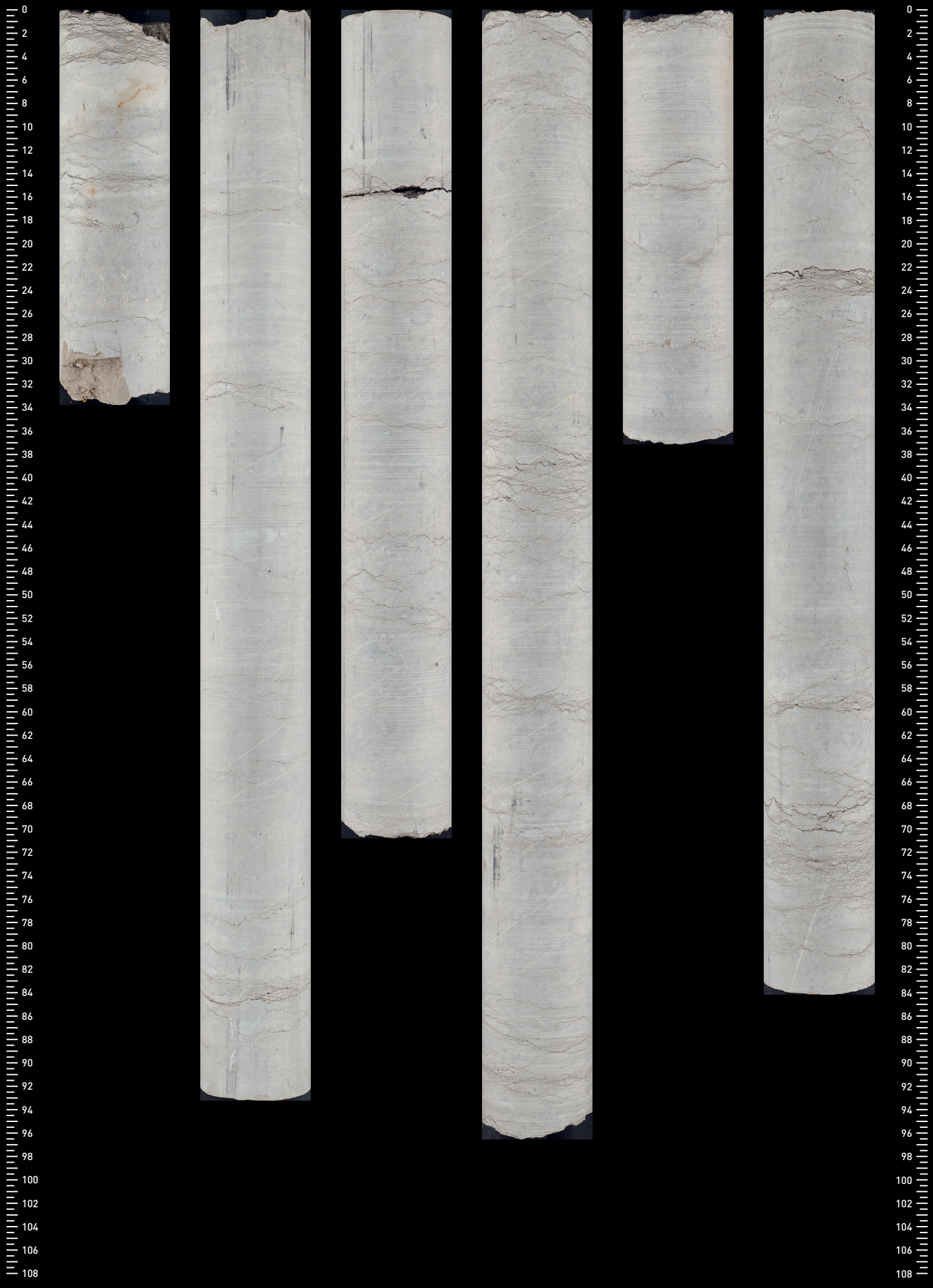
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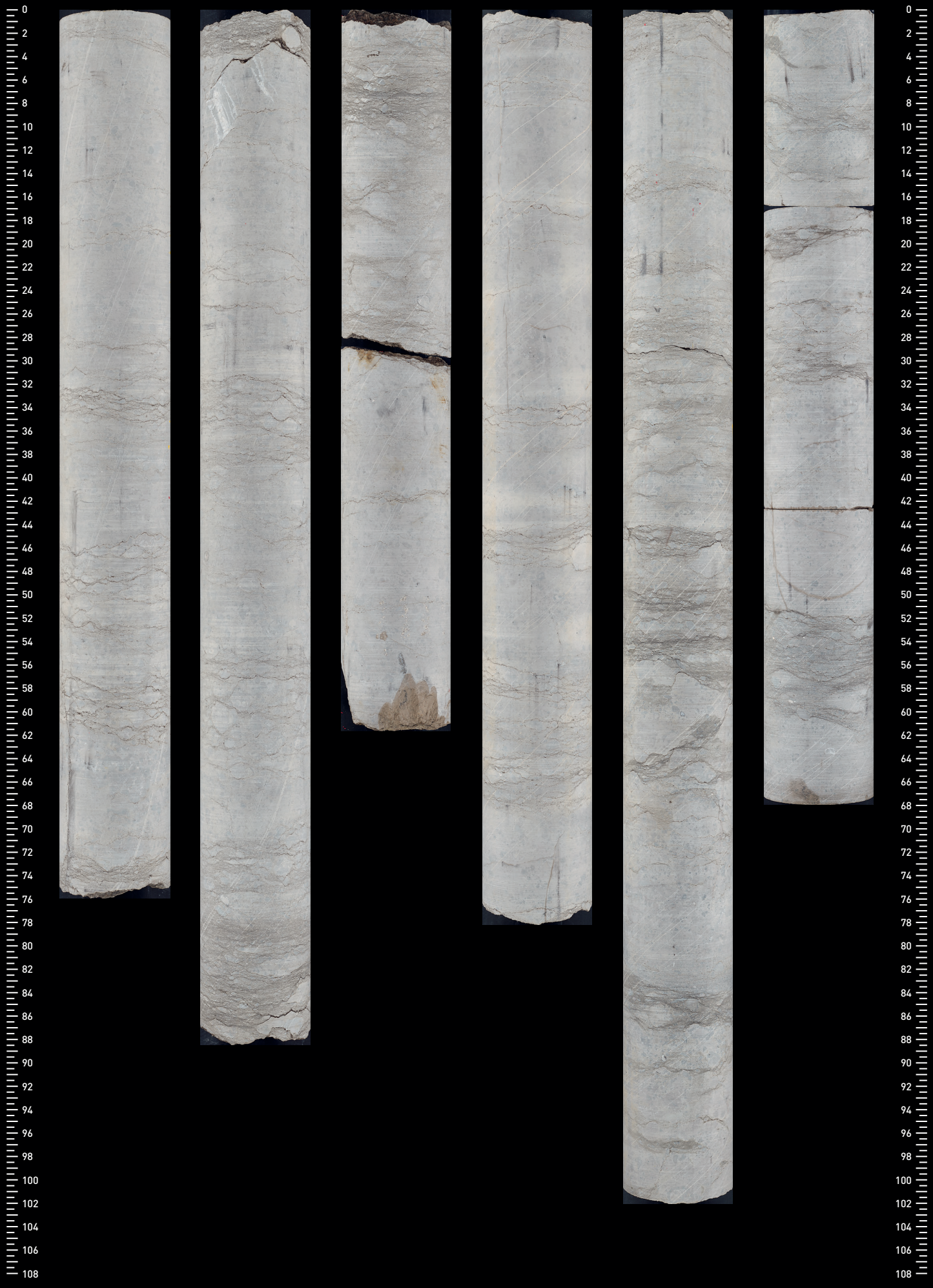
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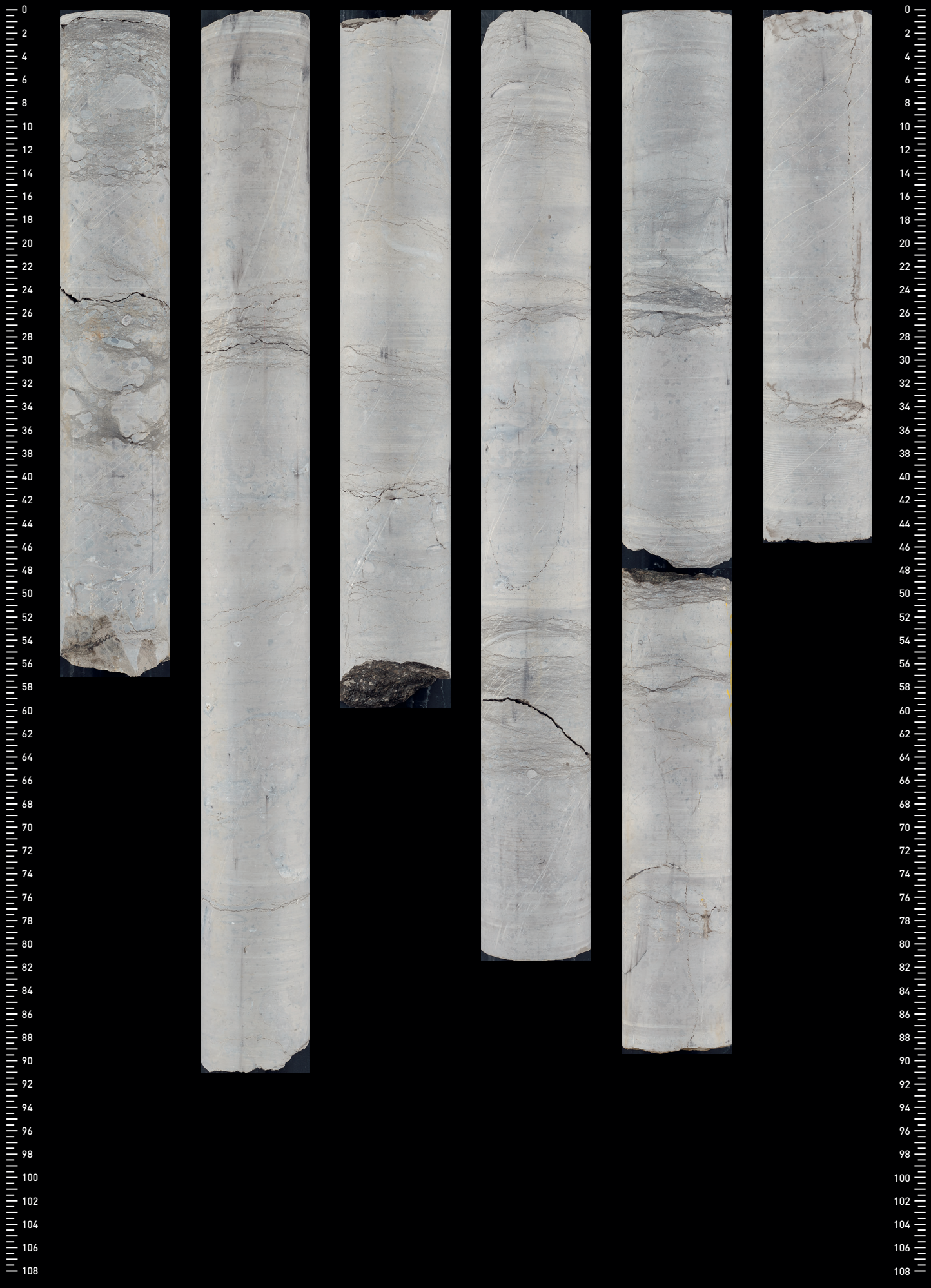
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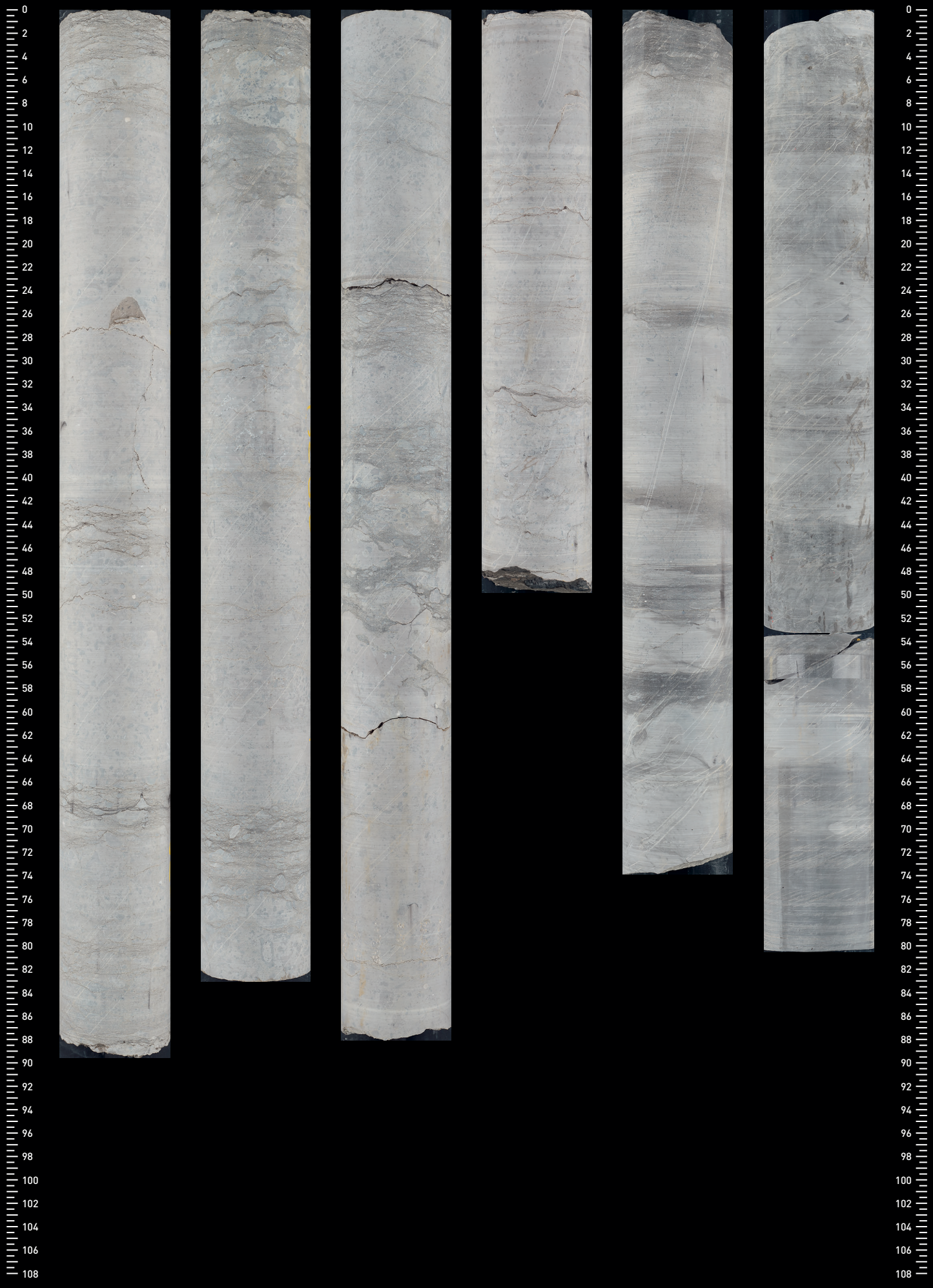
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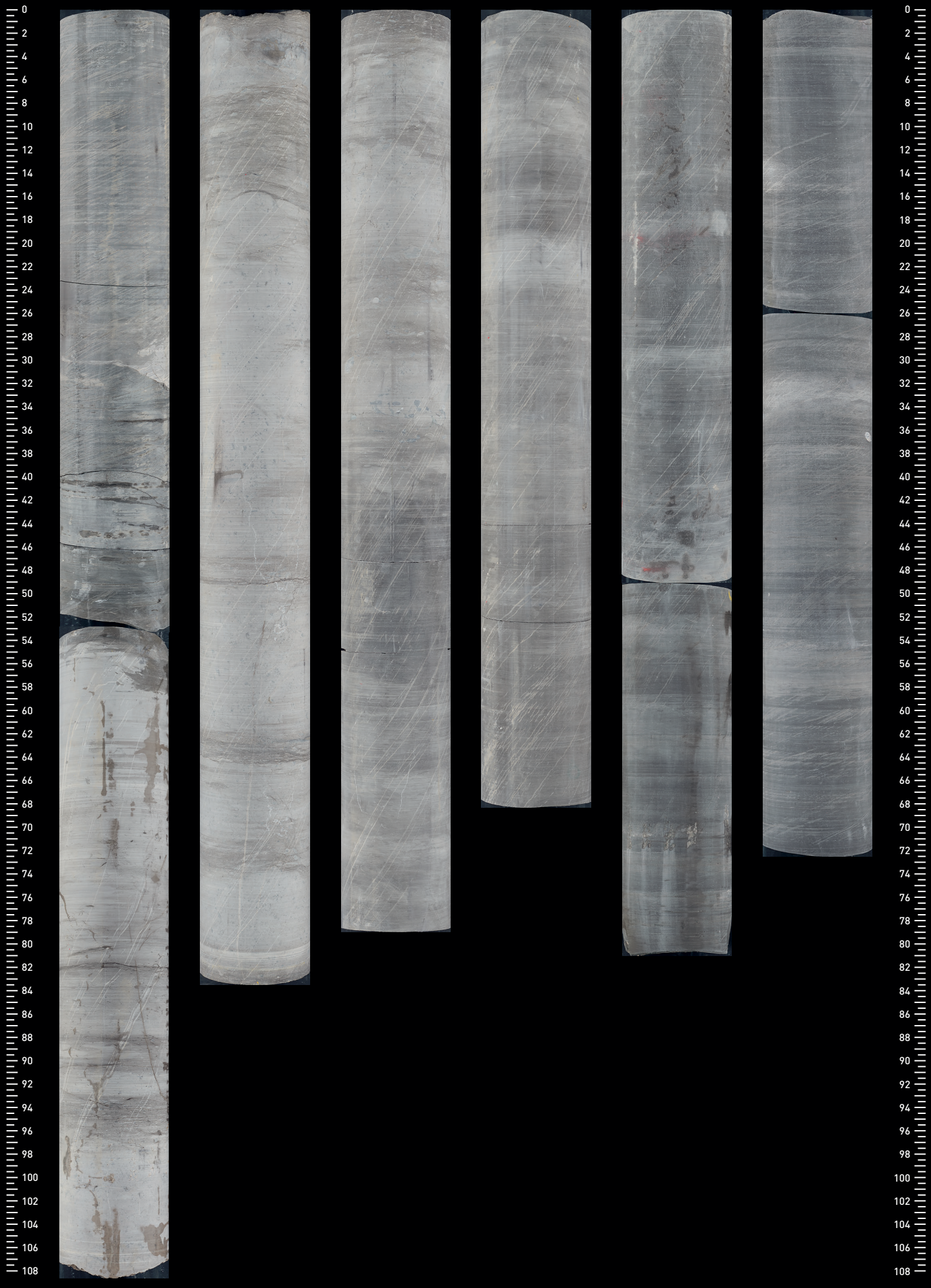
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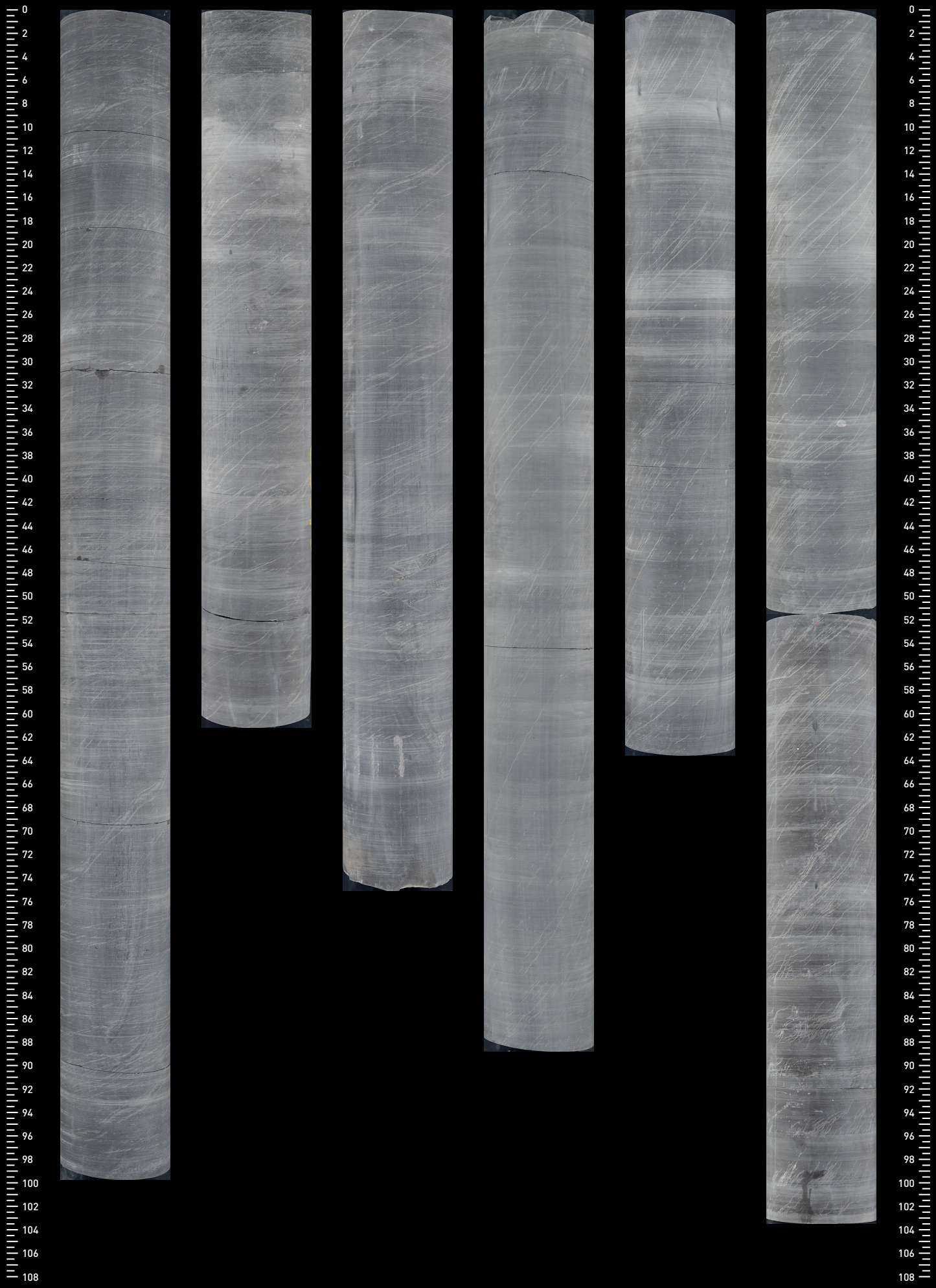
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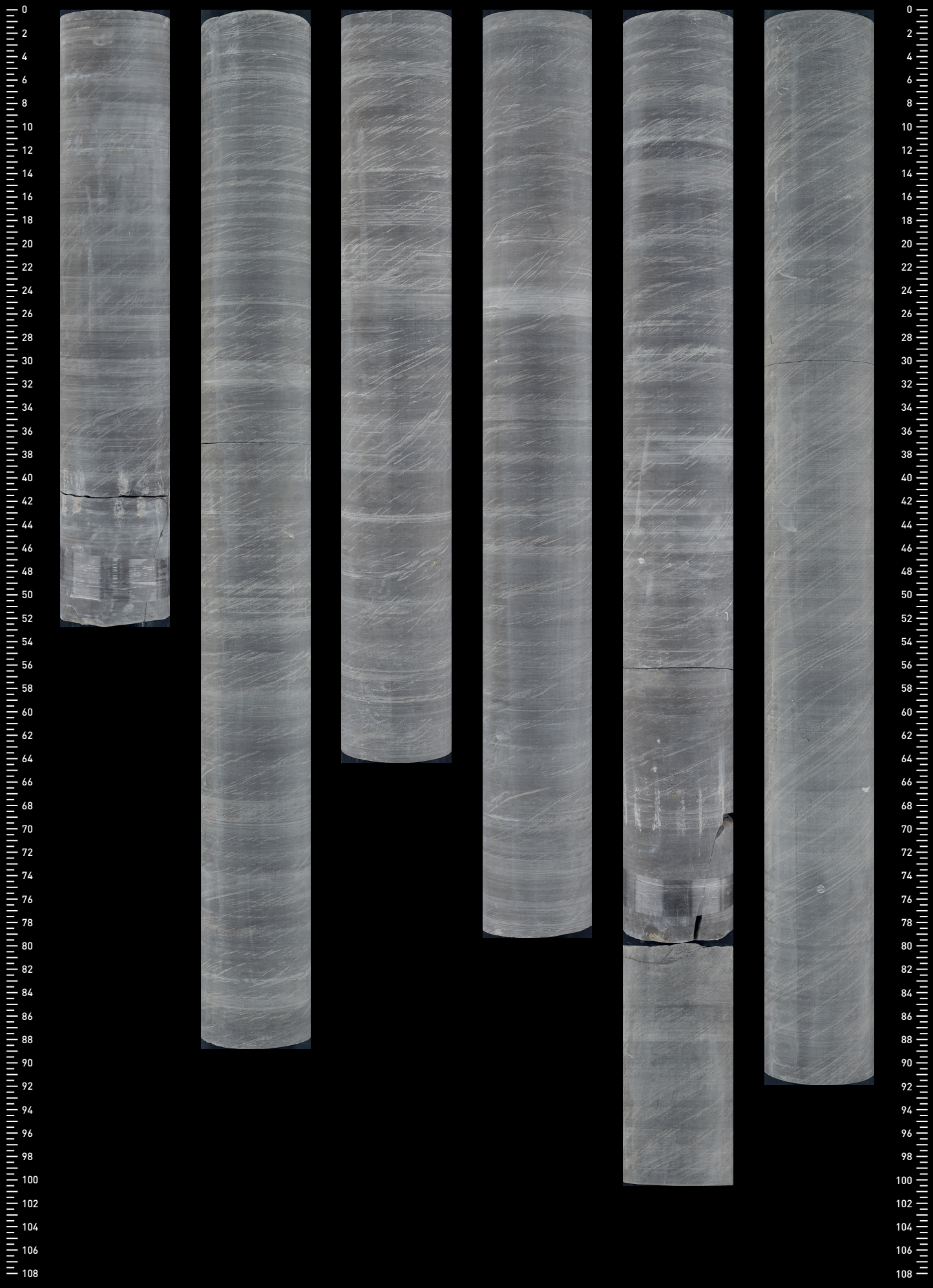
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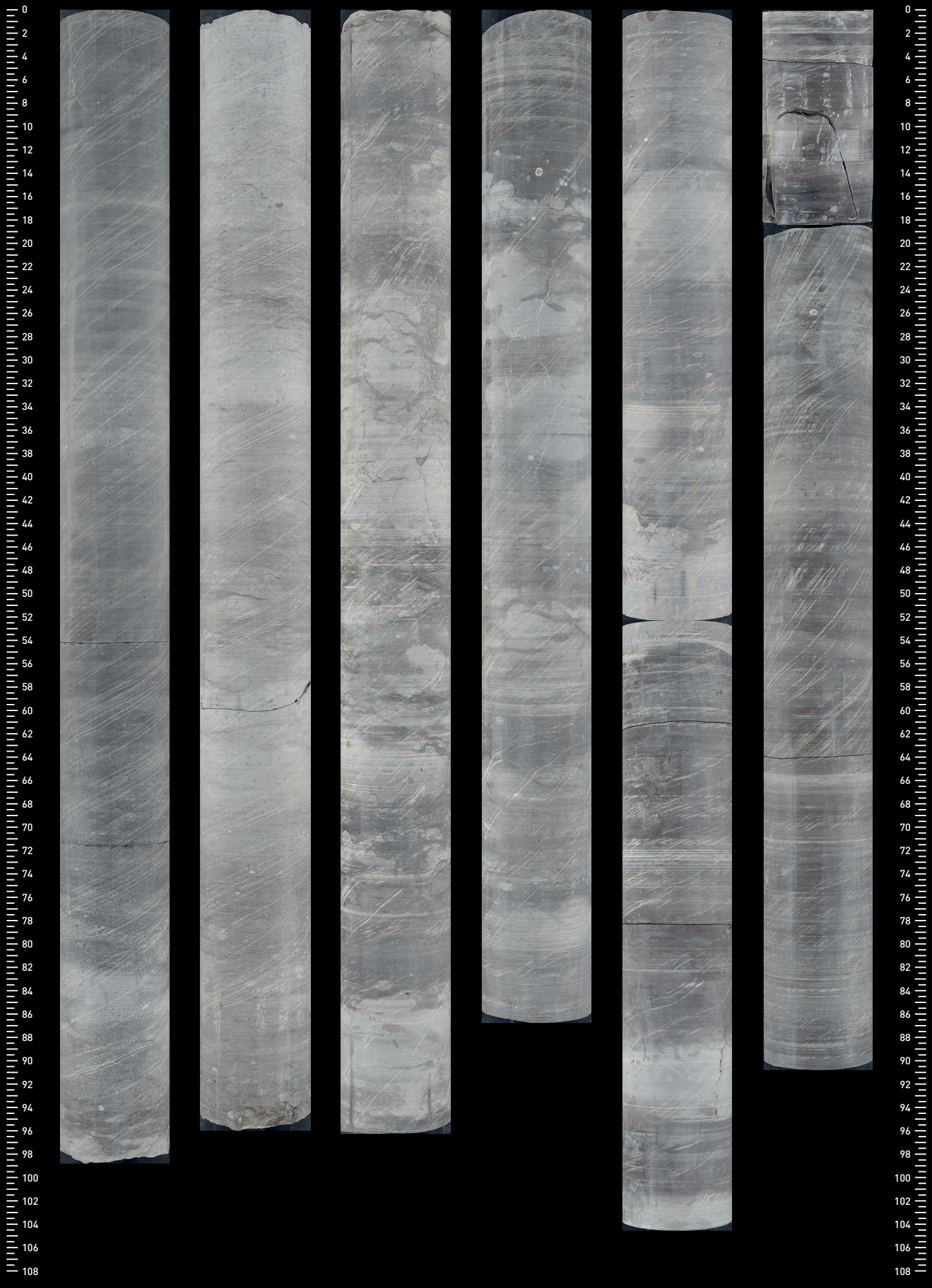
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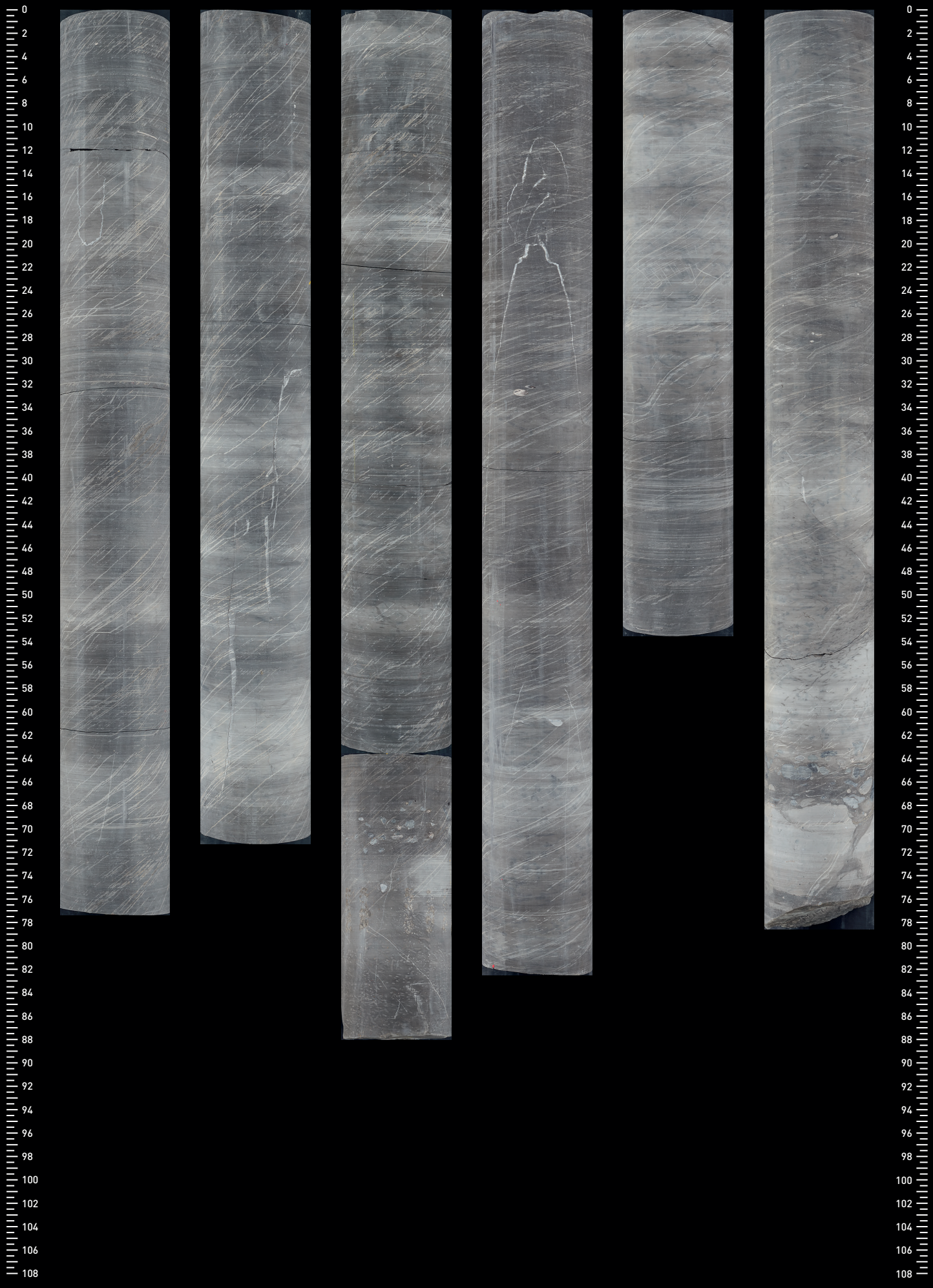
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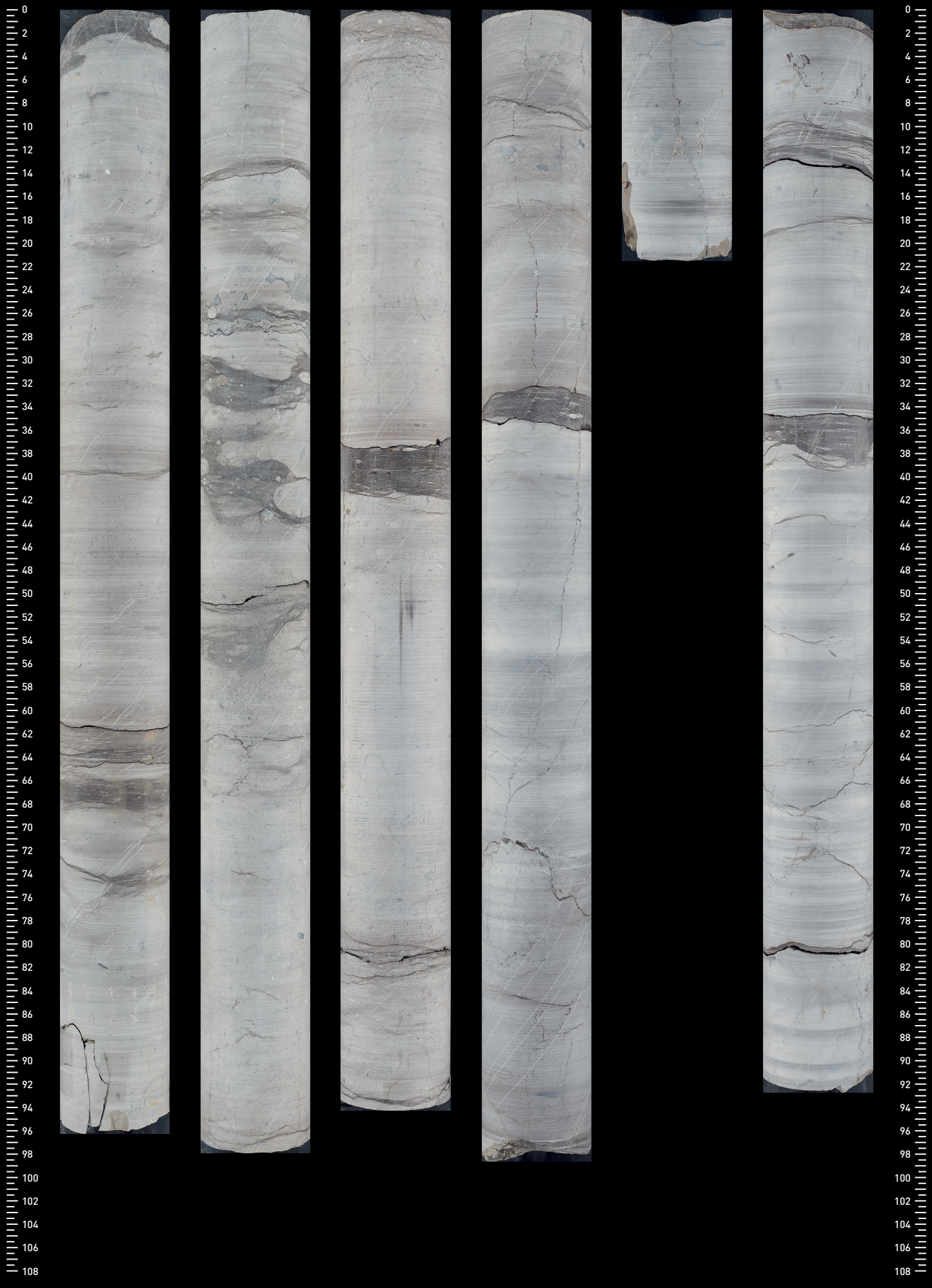
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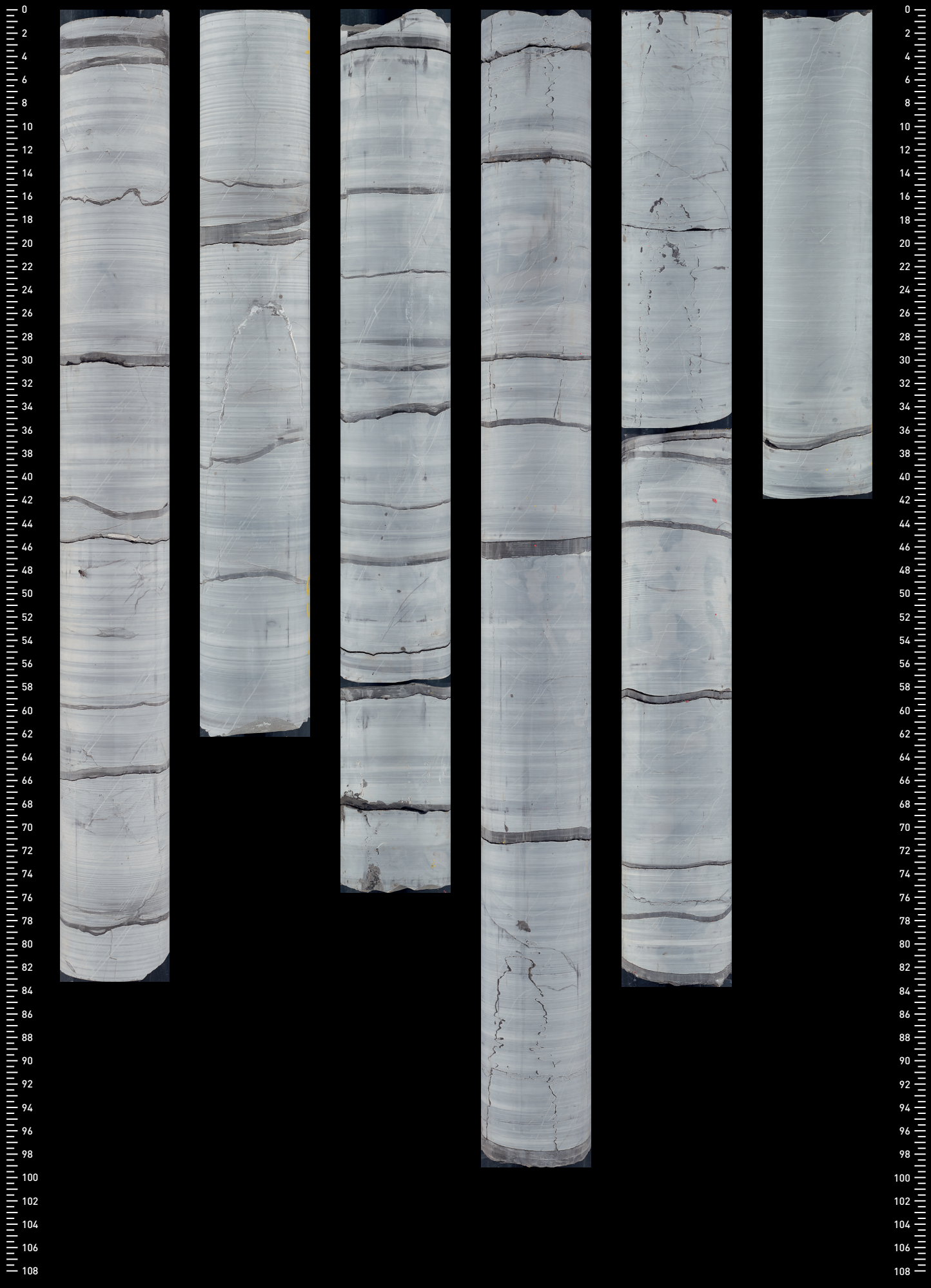


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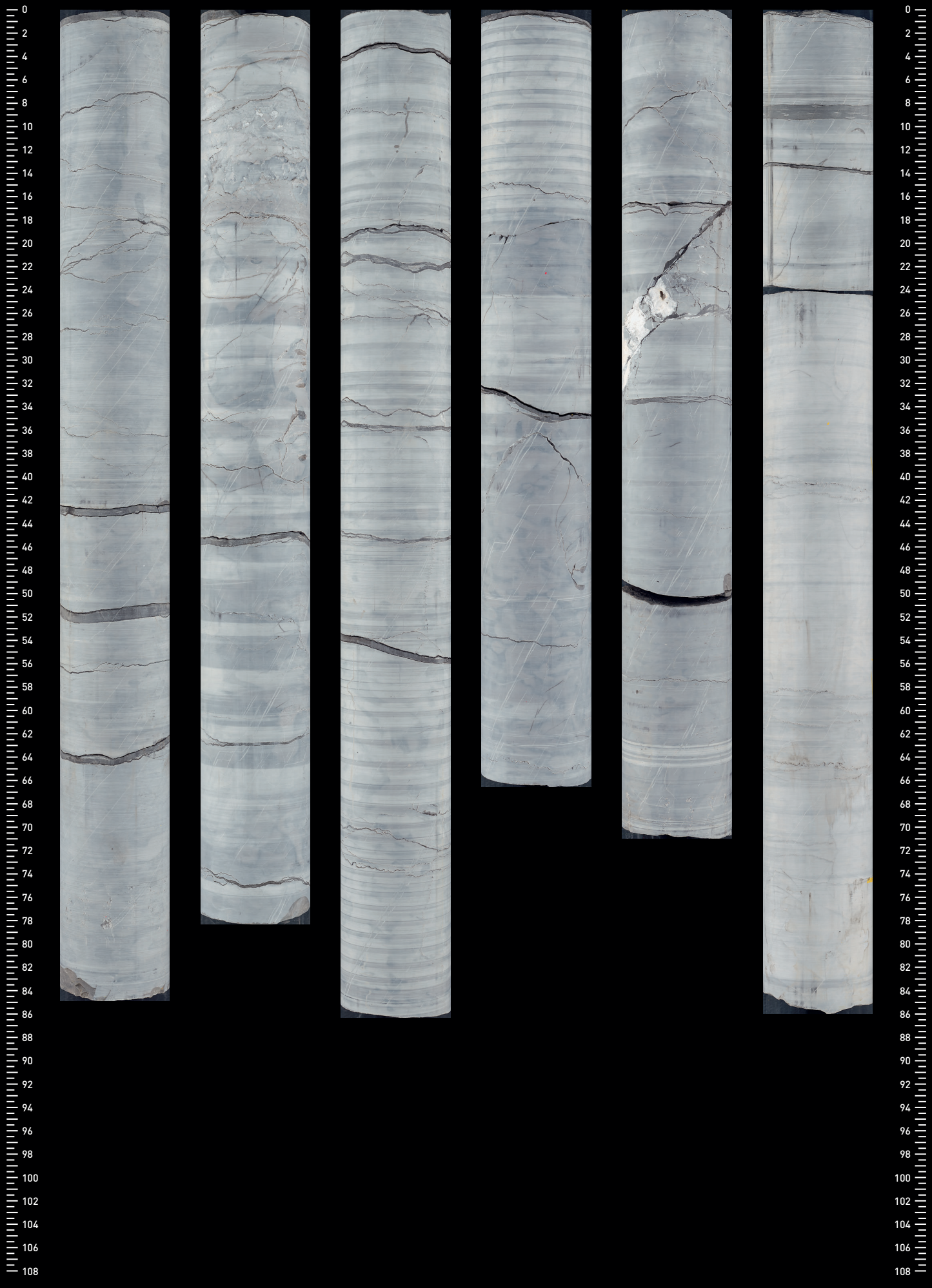
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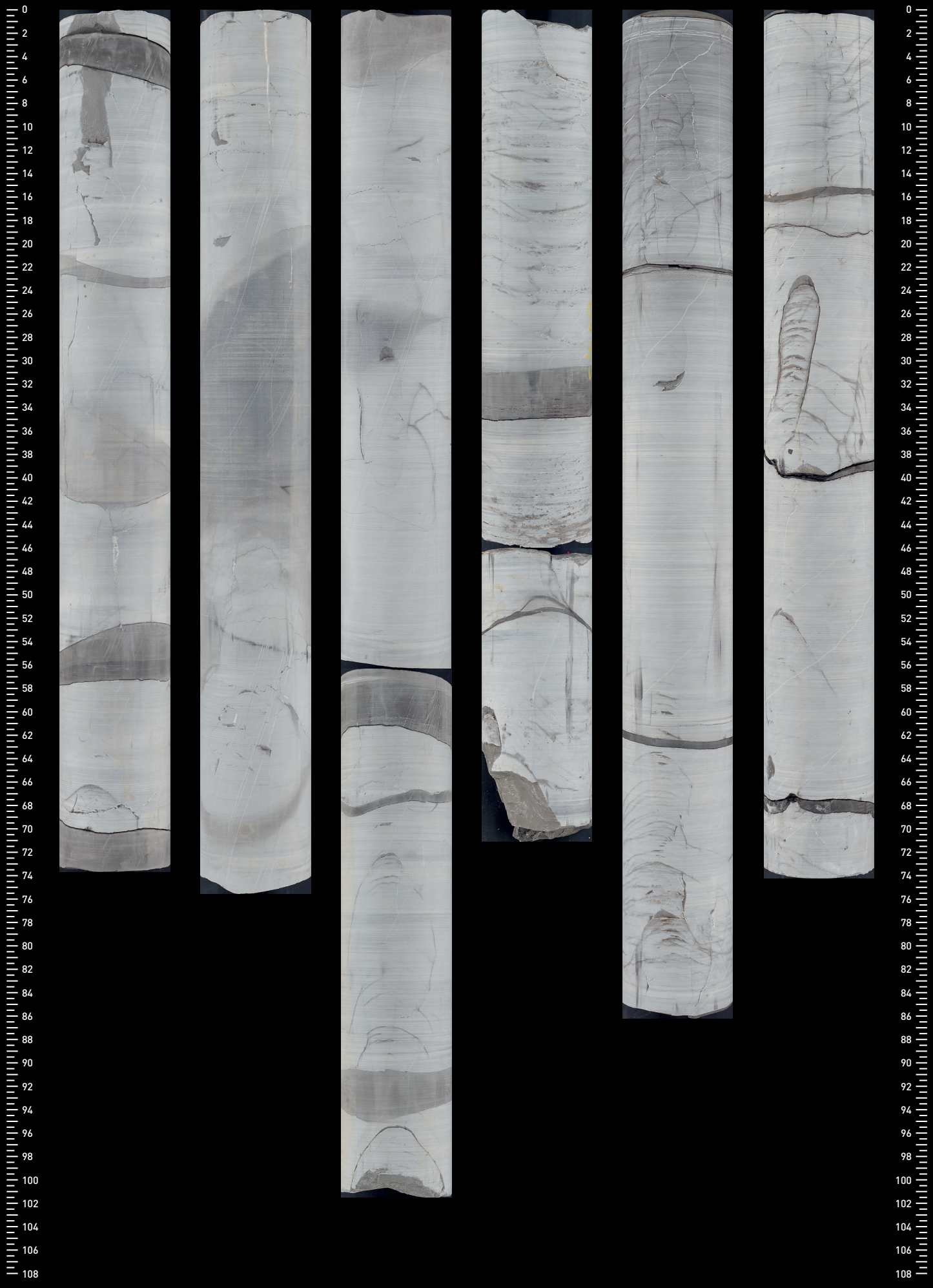
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681.79m 682.52m 683.25m 684.23m 685.03m 685.86m



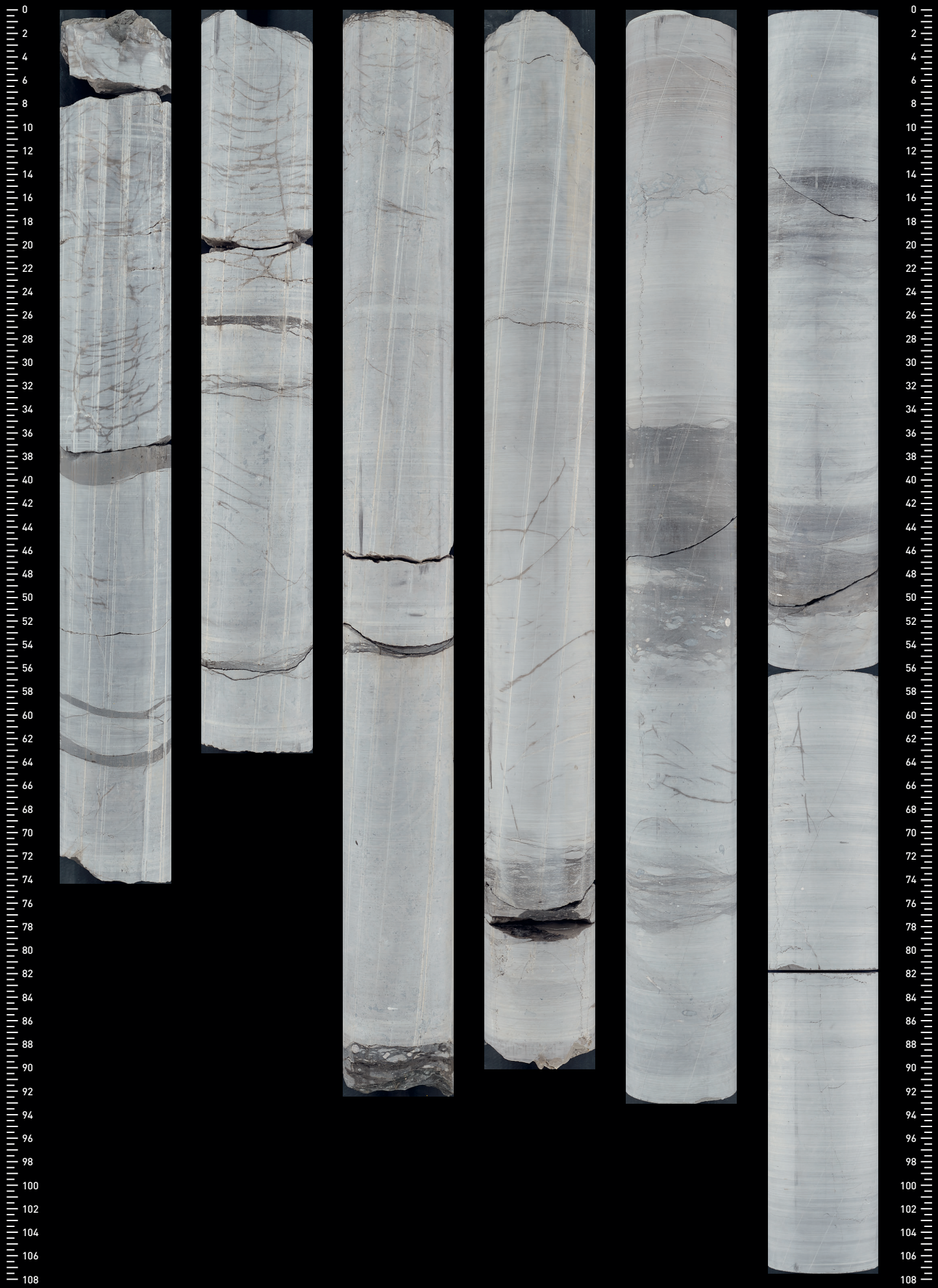
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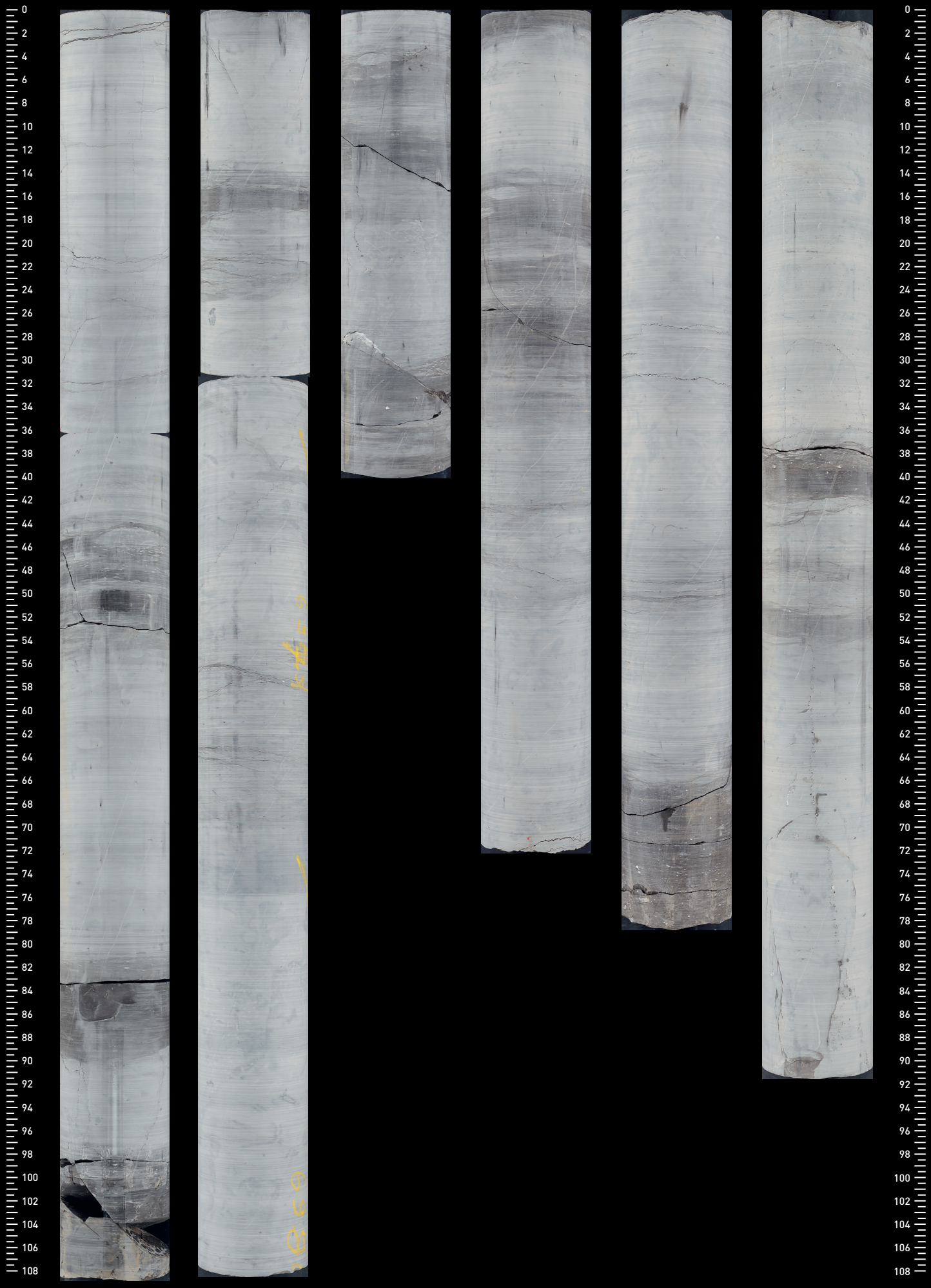
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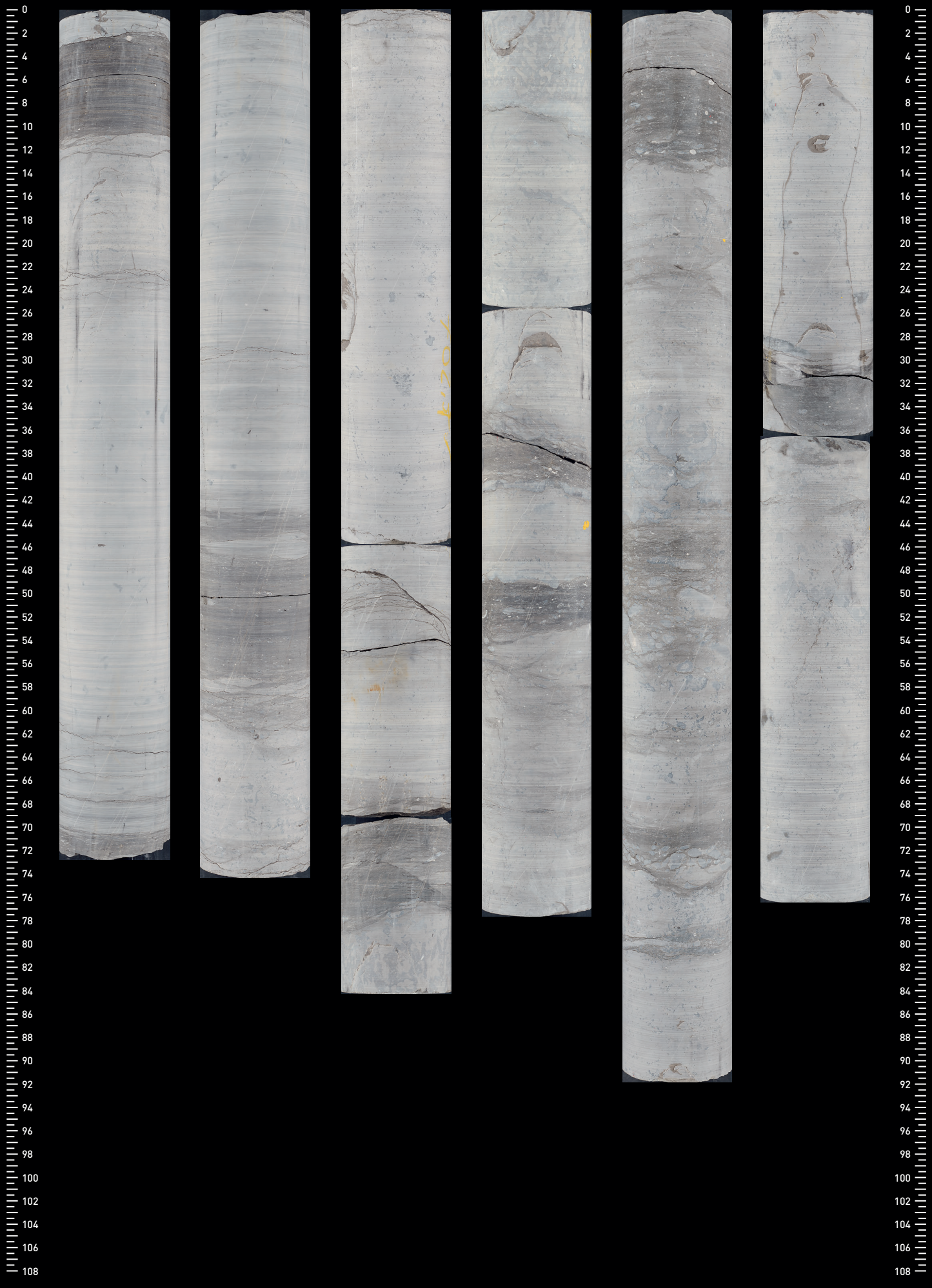
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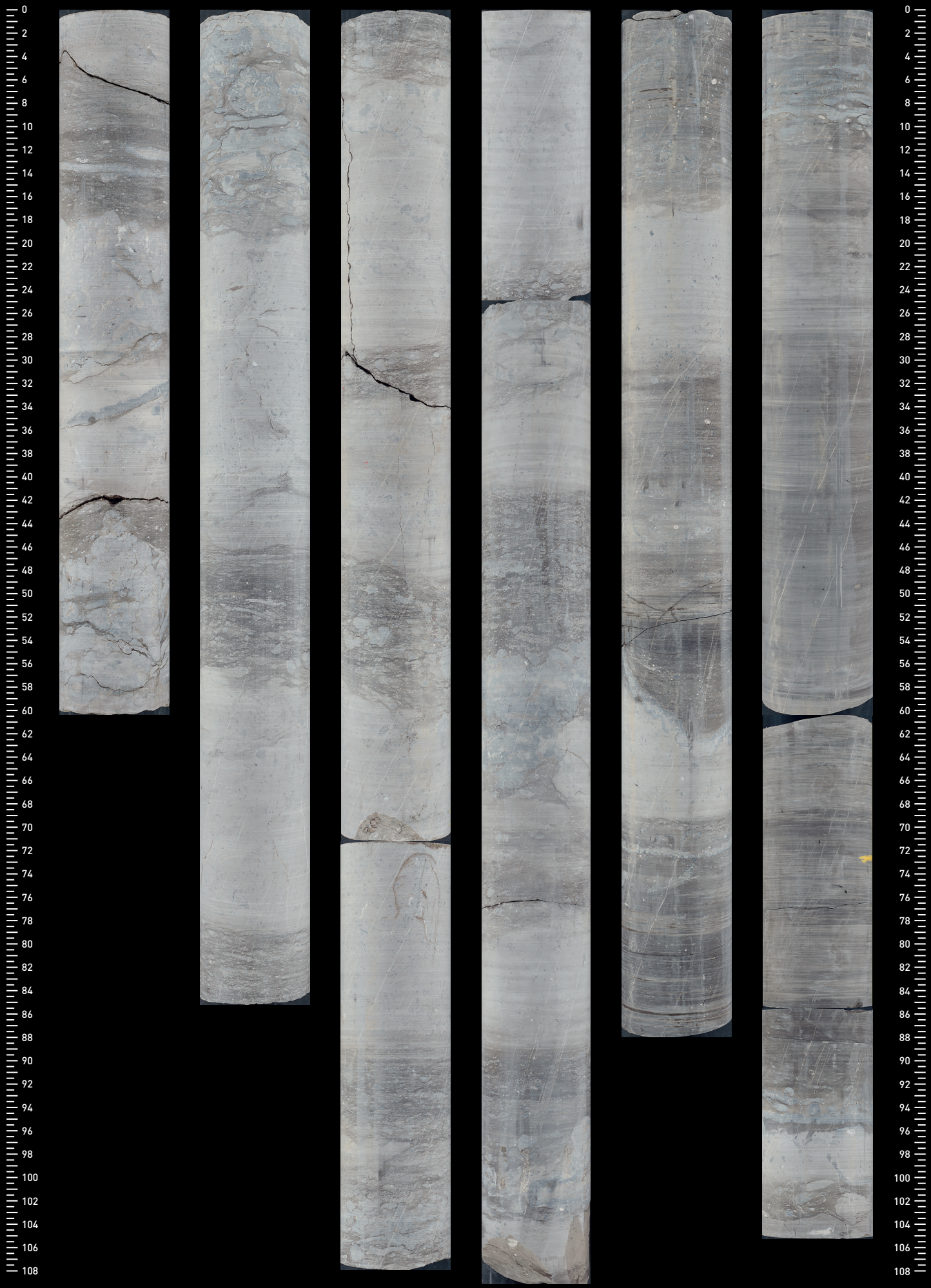
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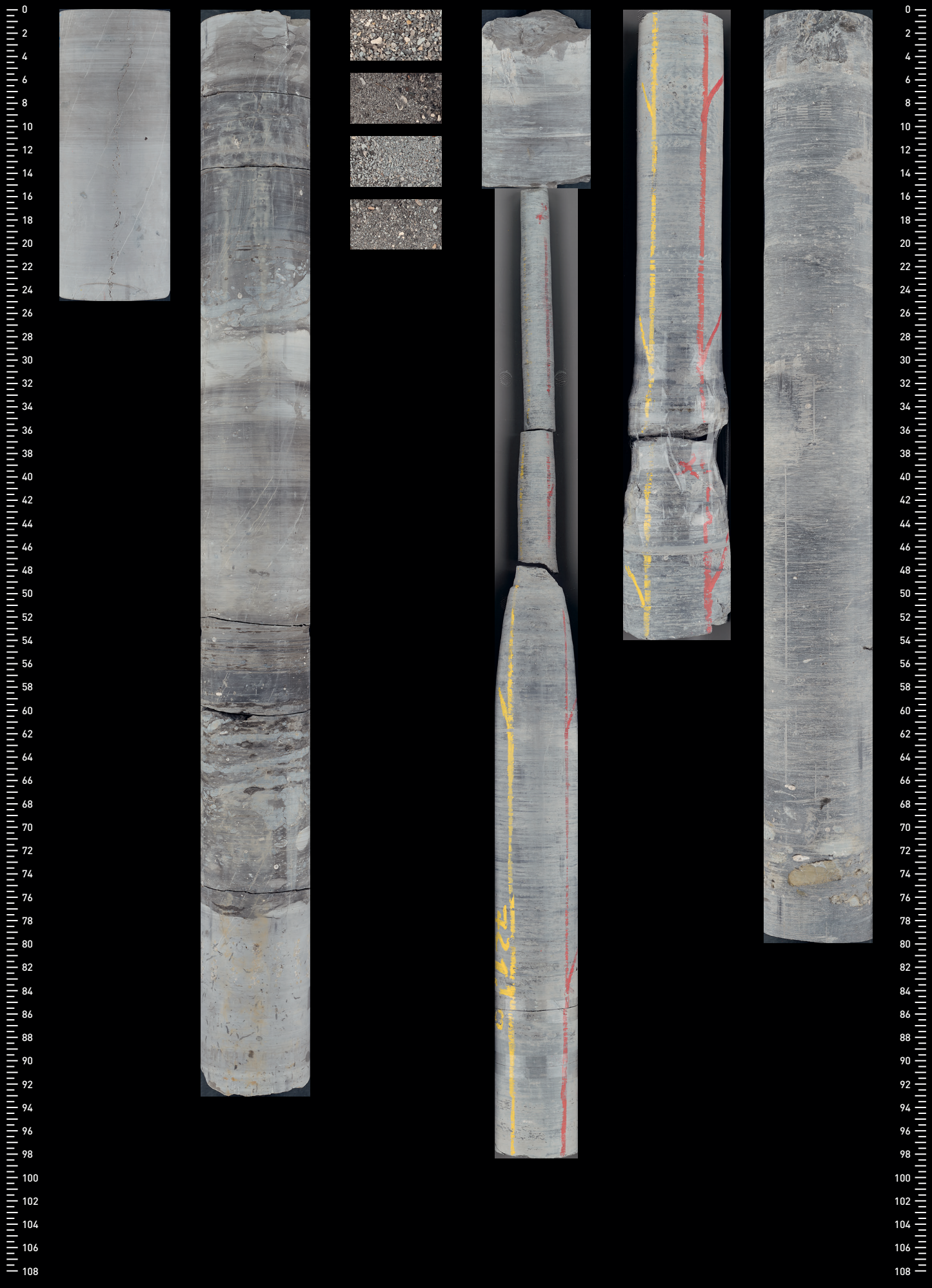
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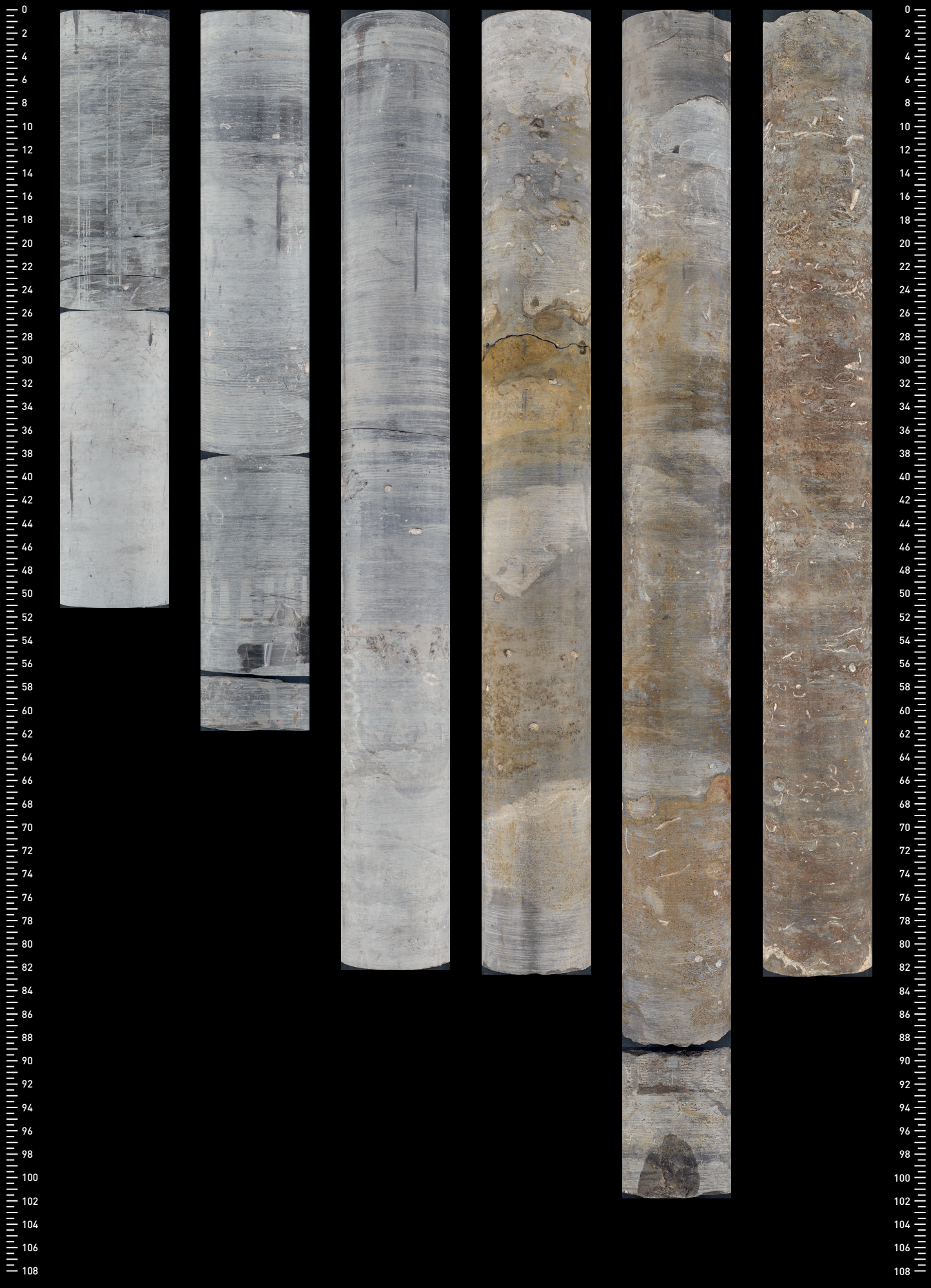
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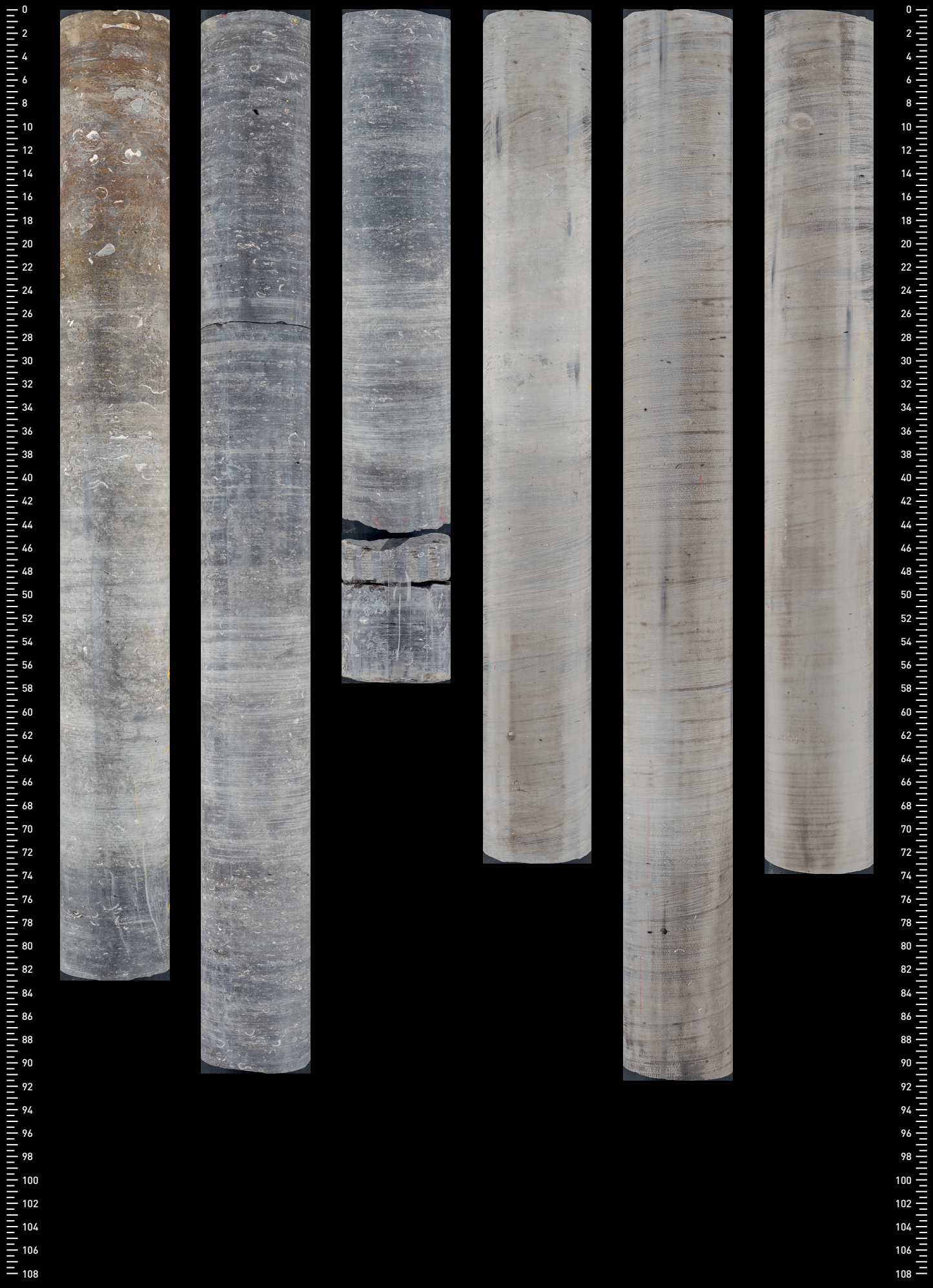
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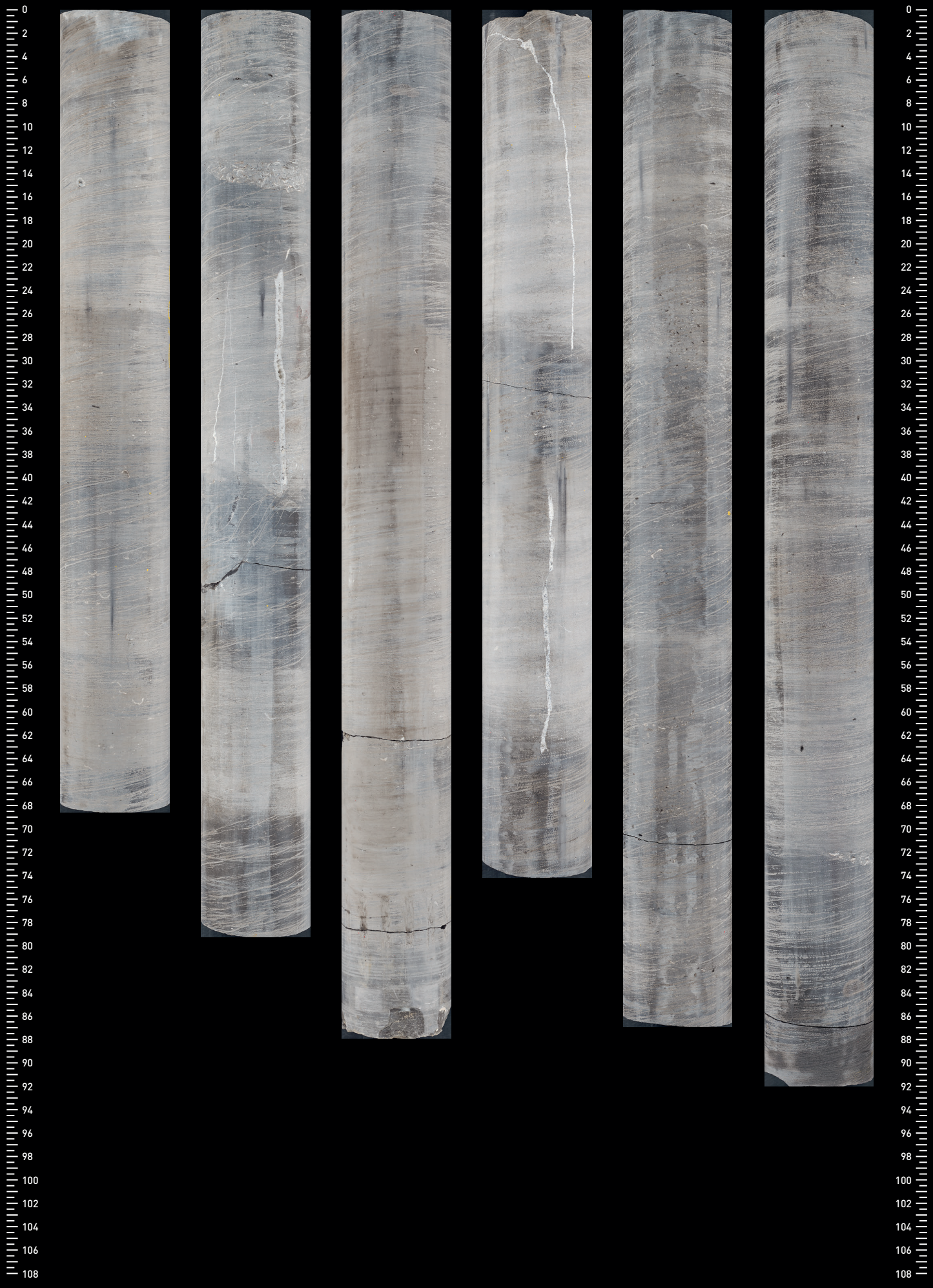
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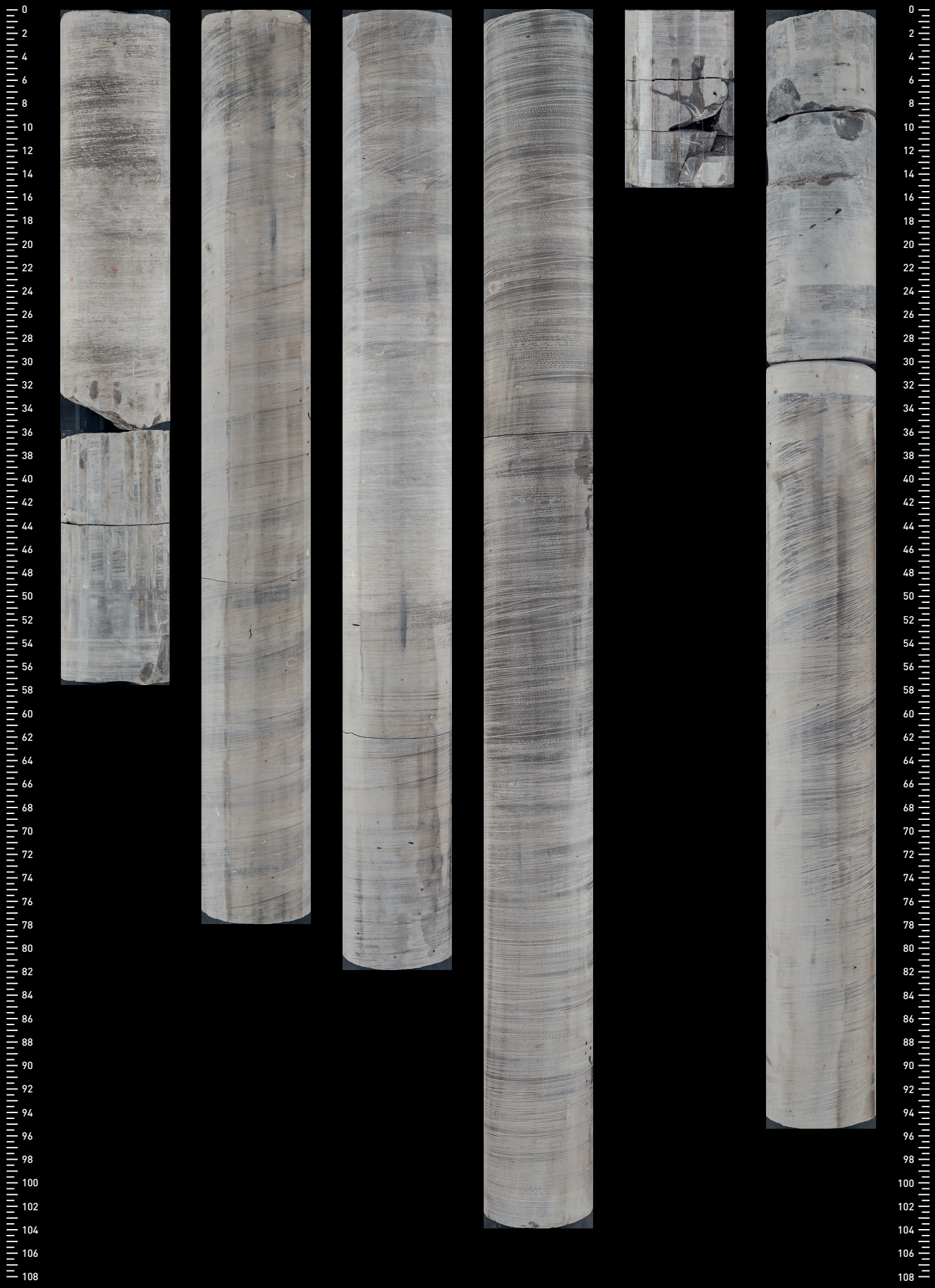
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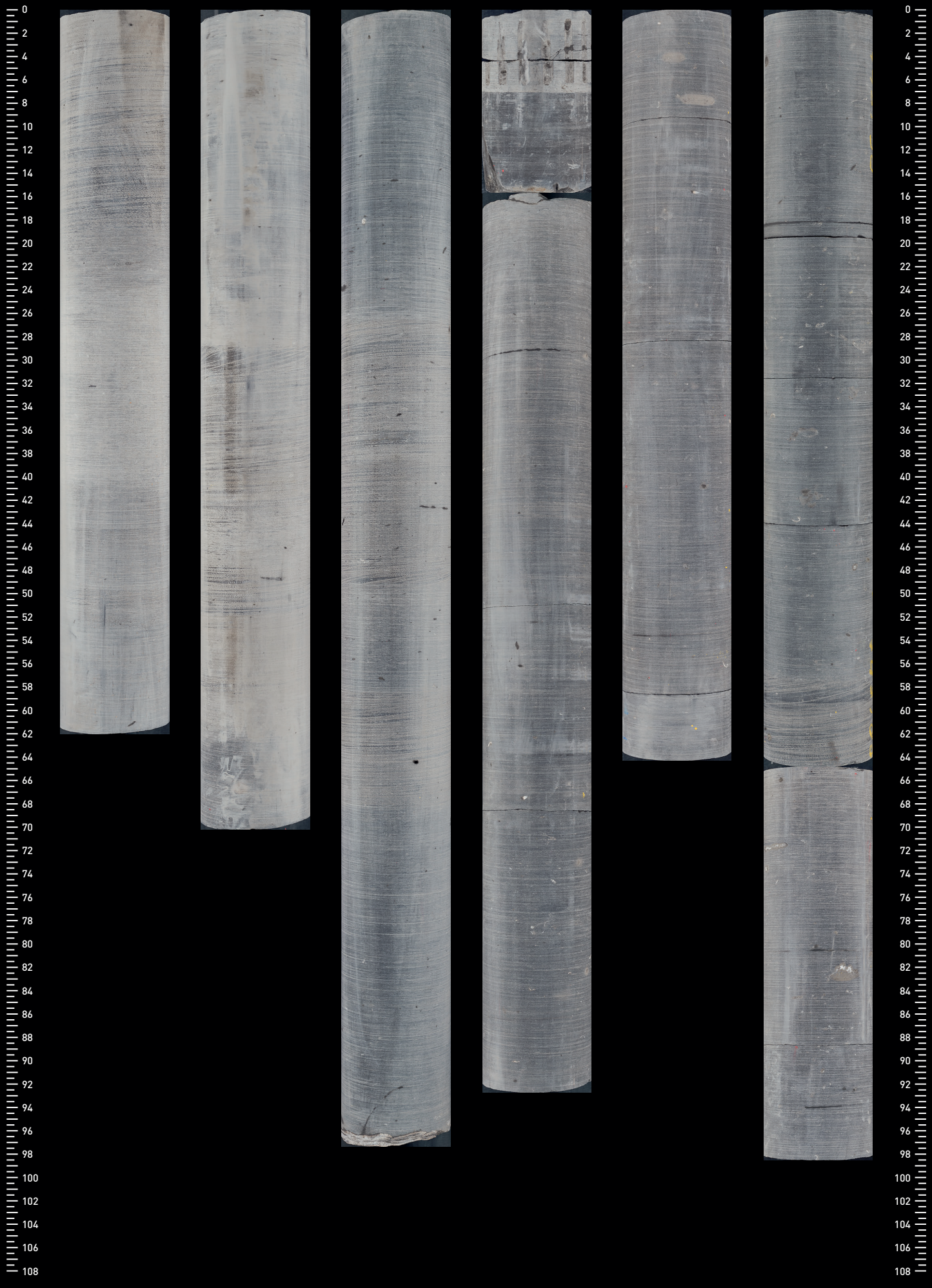
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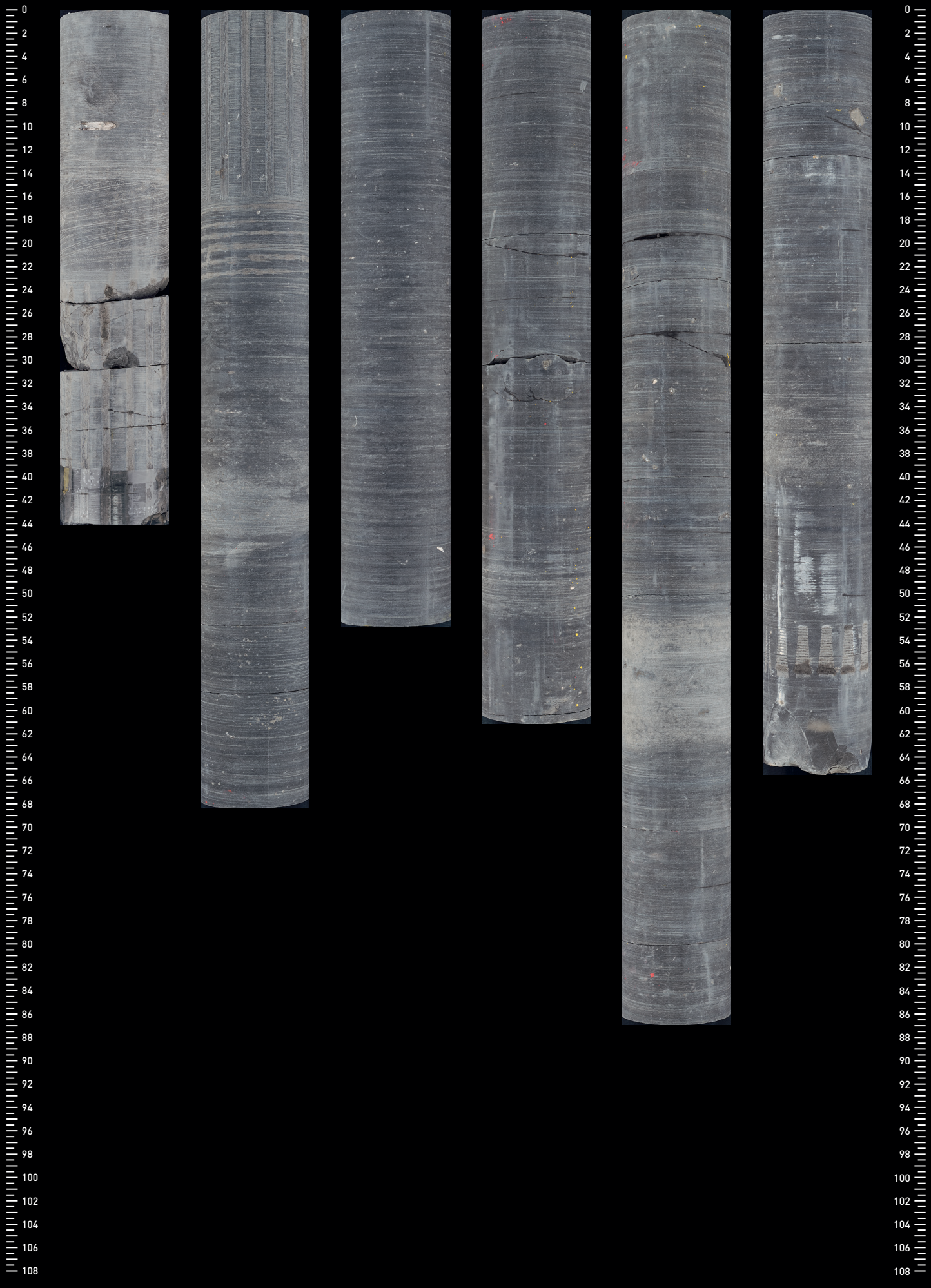
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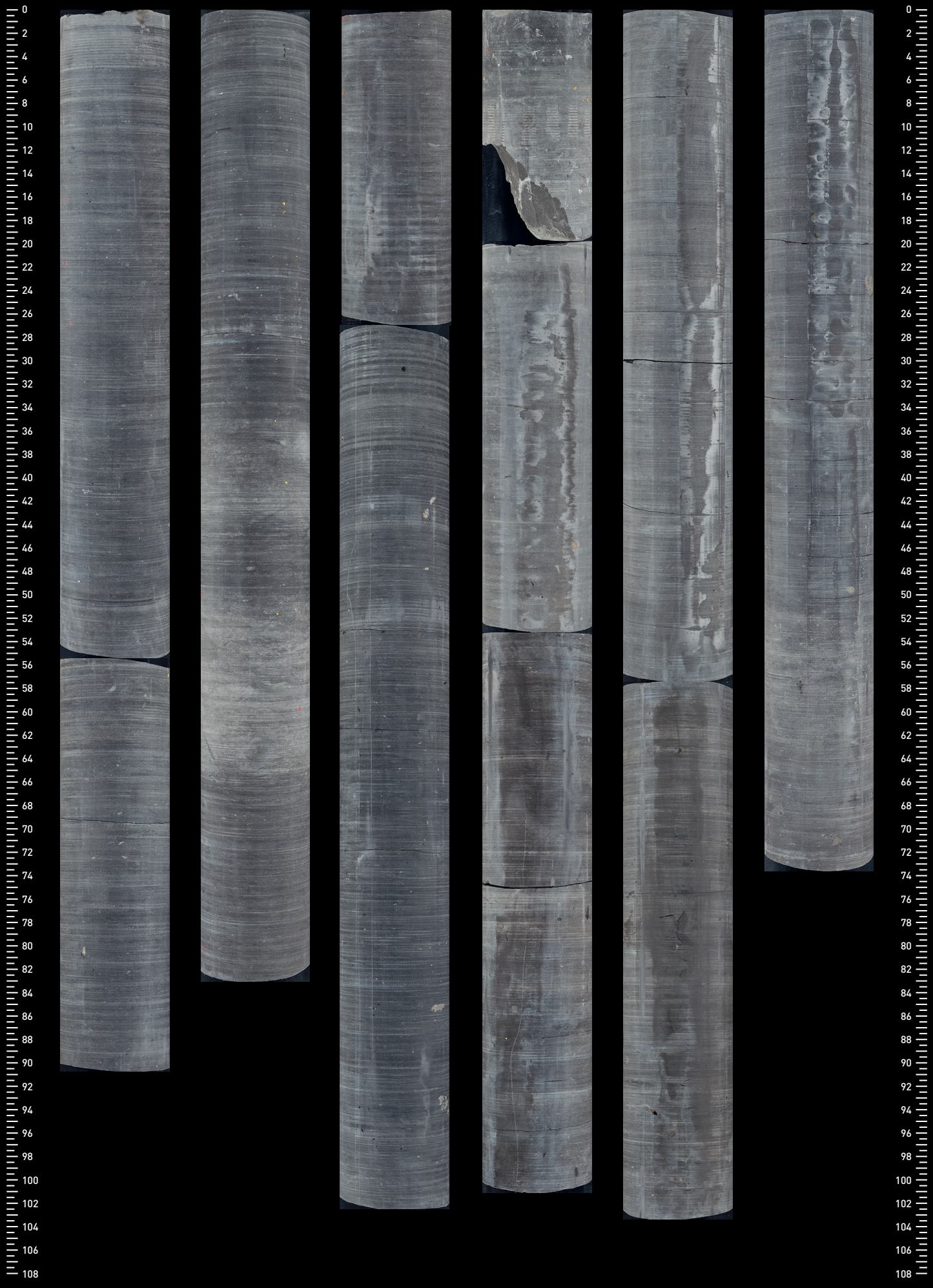
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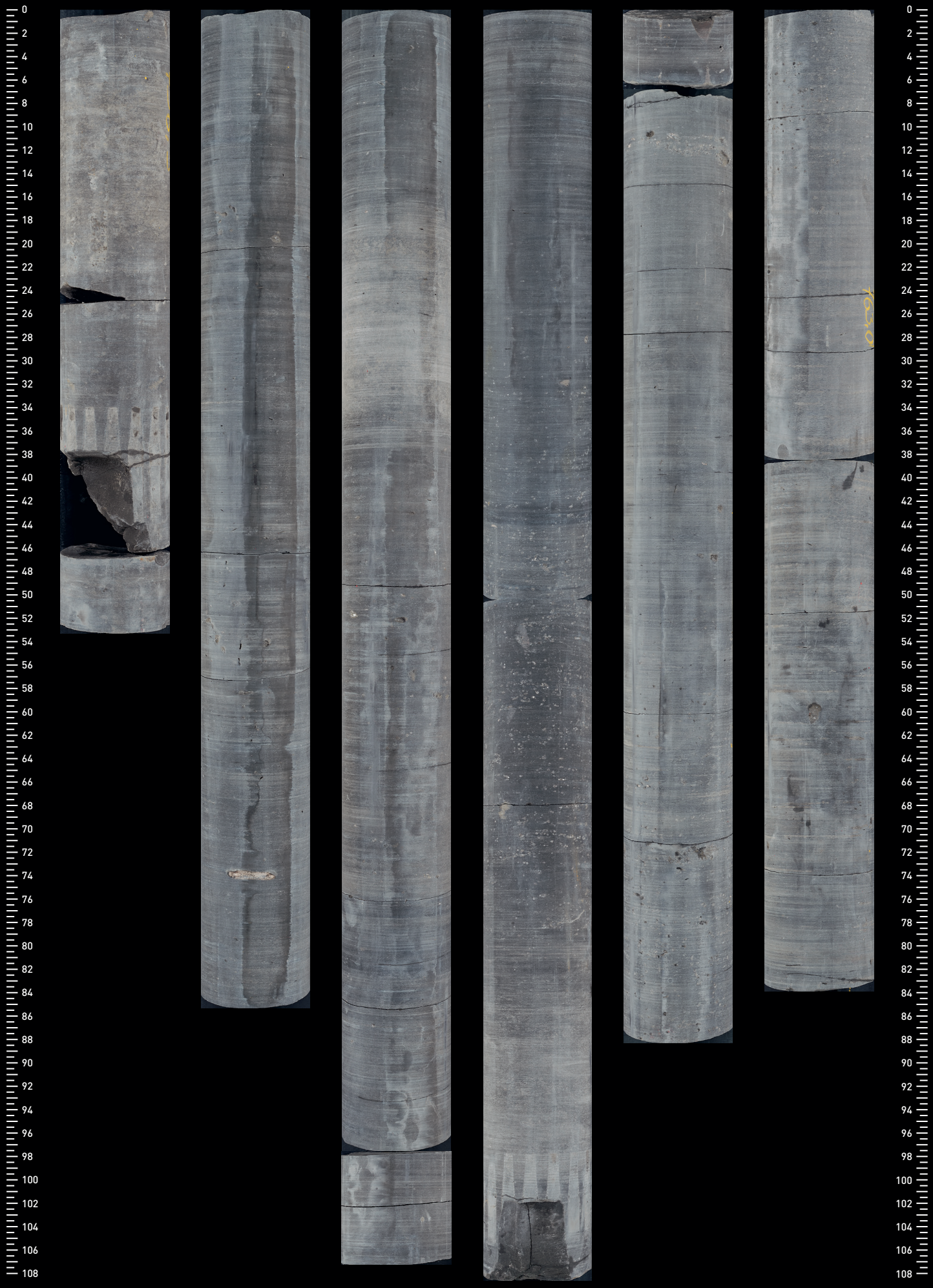
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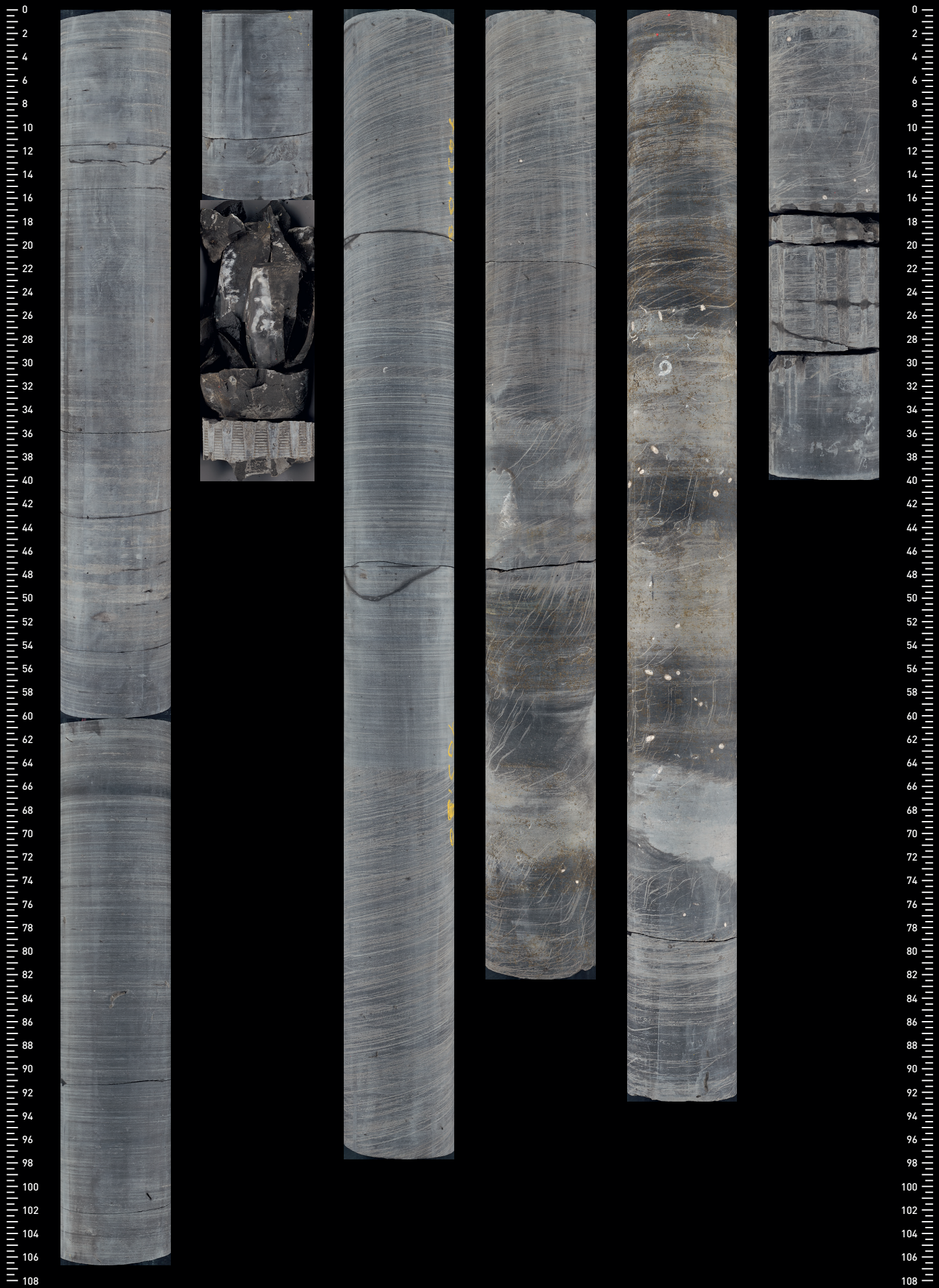
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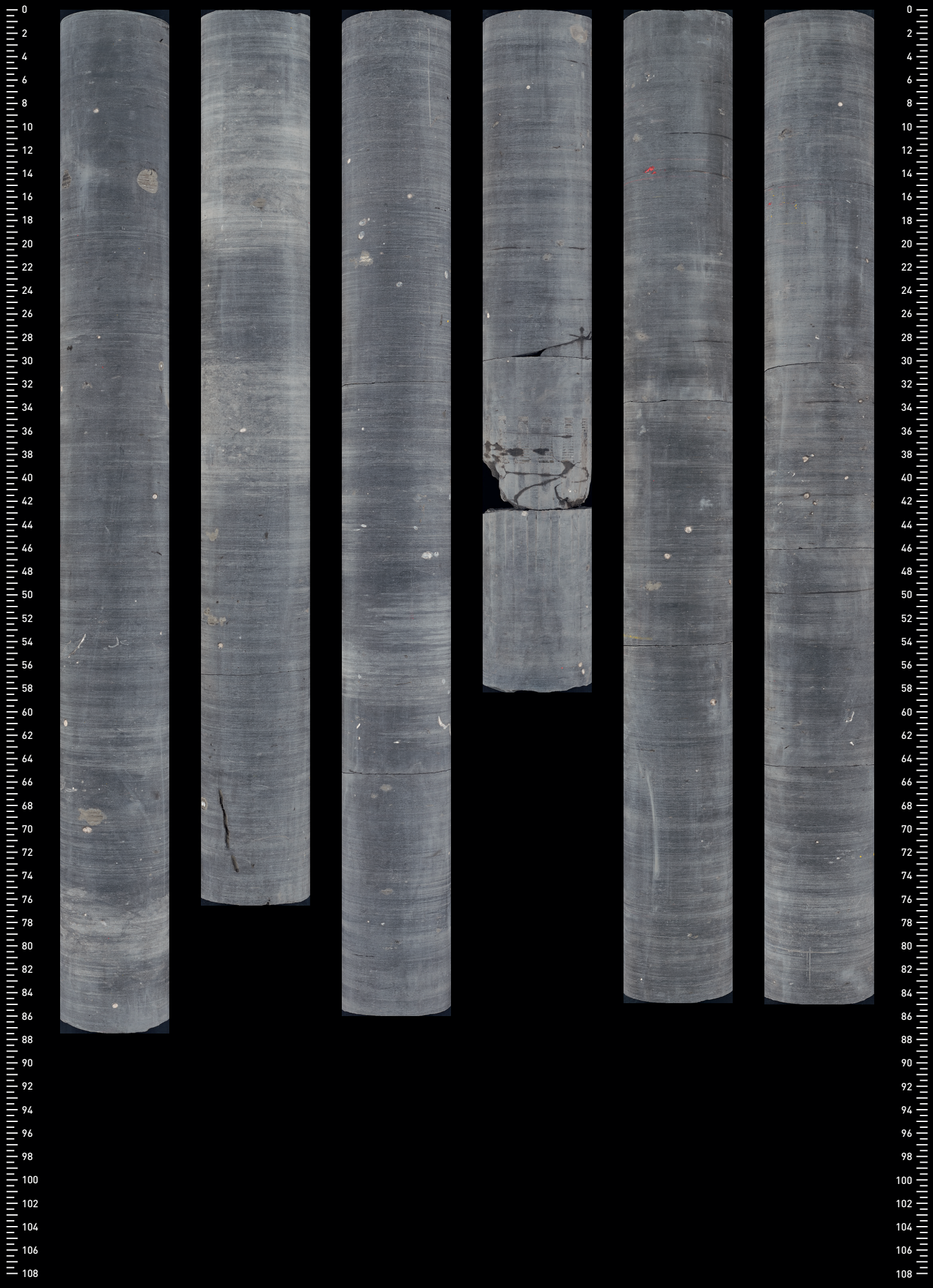
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764.56m 764.88m 765.83m 766.67m 767.59m 767.92m

767.92m 768.76m 769.51m 770.35m 770.92m 771.75m



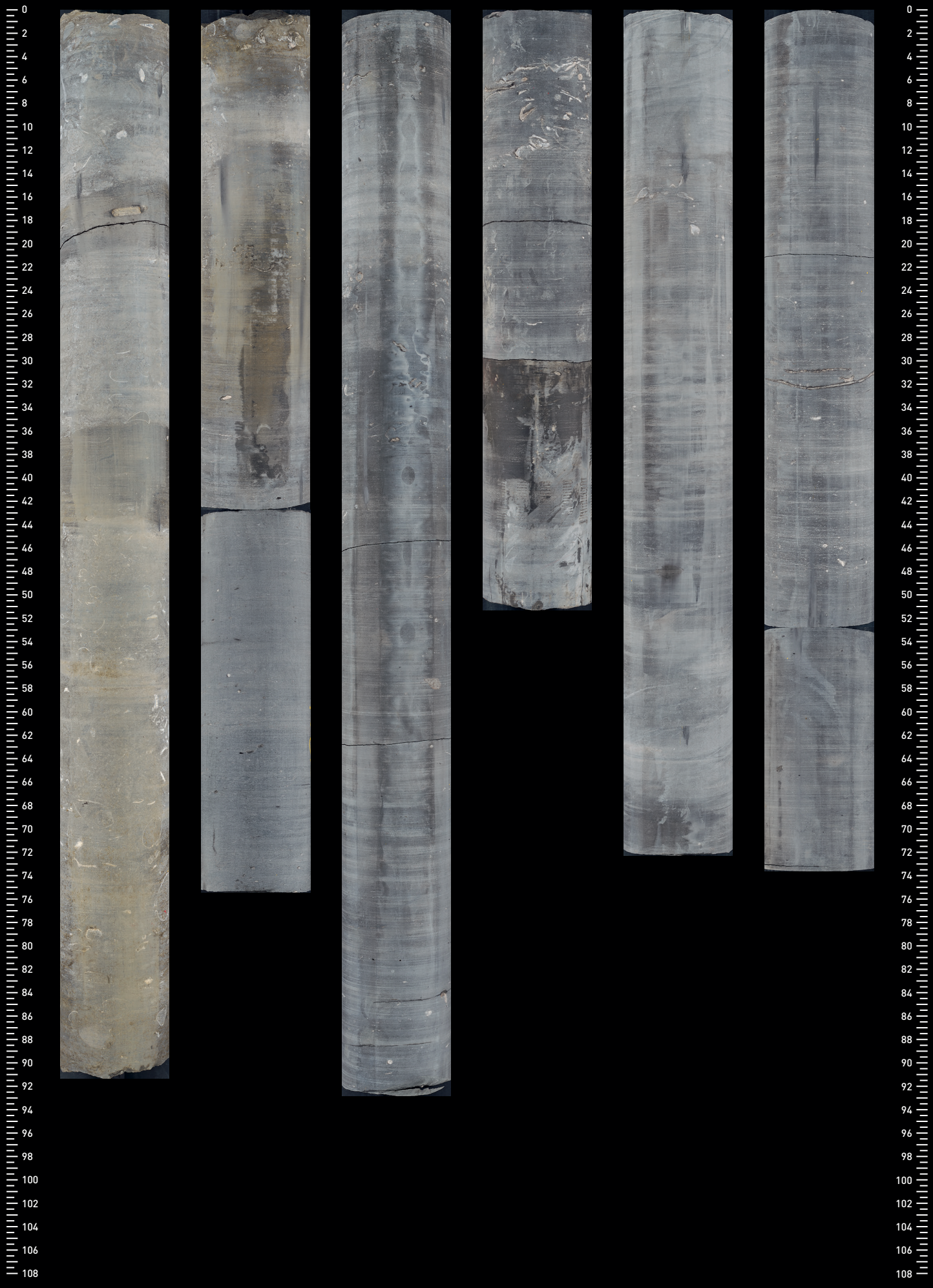
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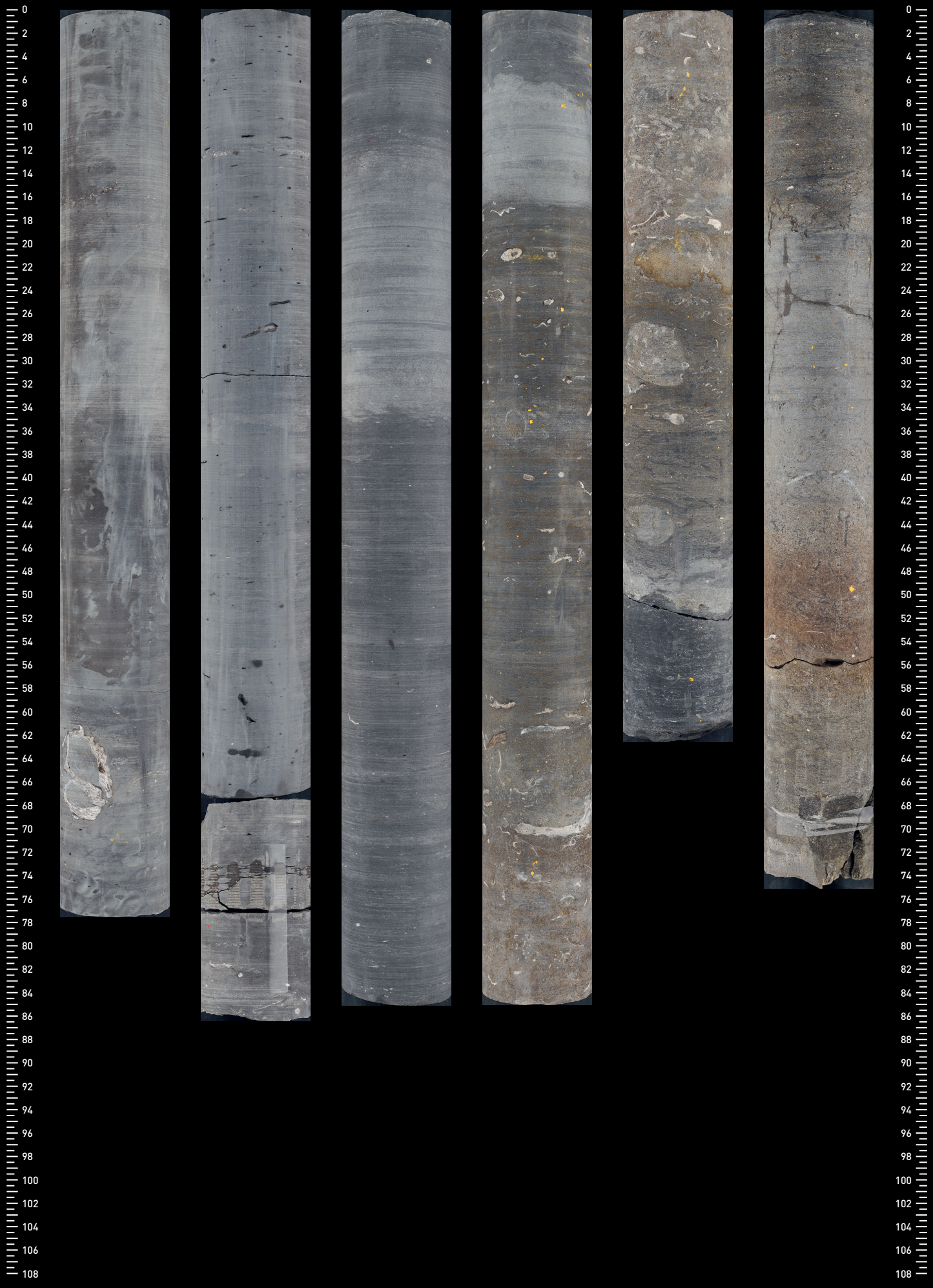
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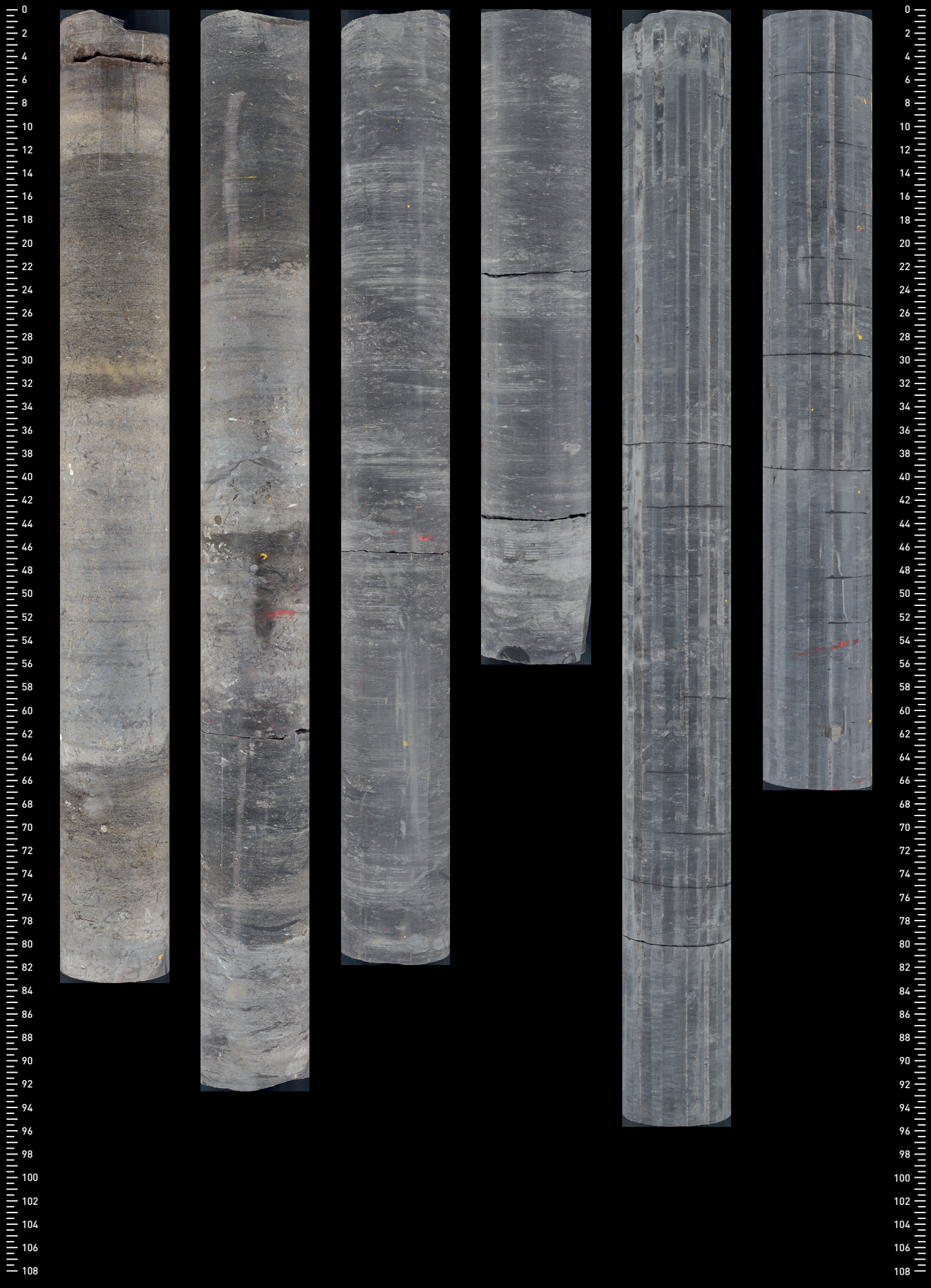
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781.35m 782.10m 782.94m 783.76m 784.60m 785.20m



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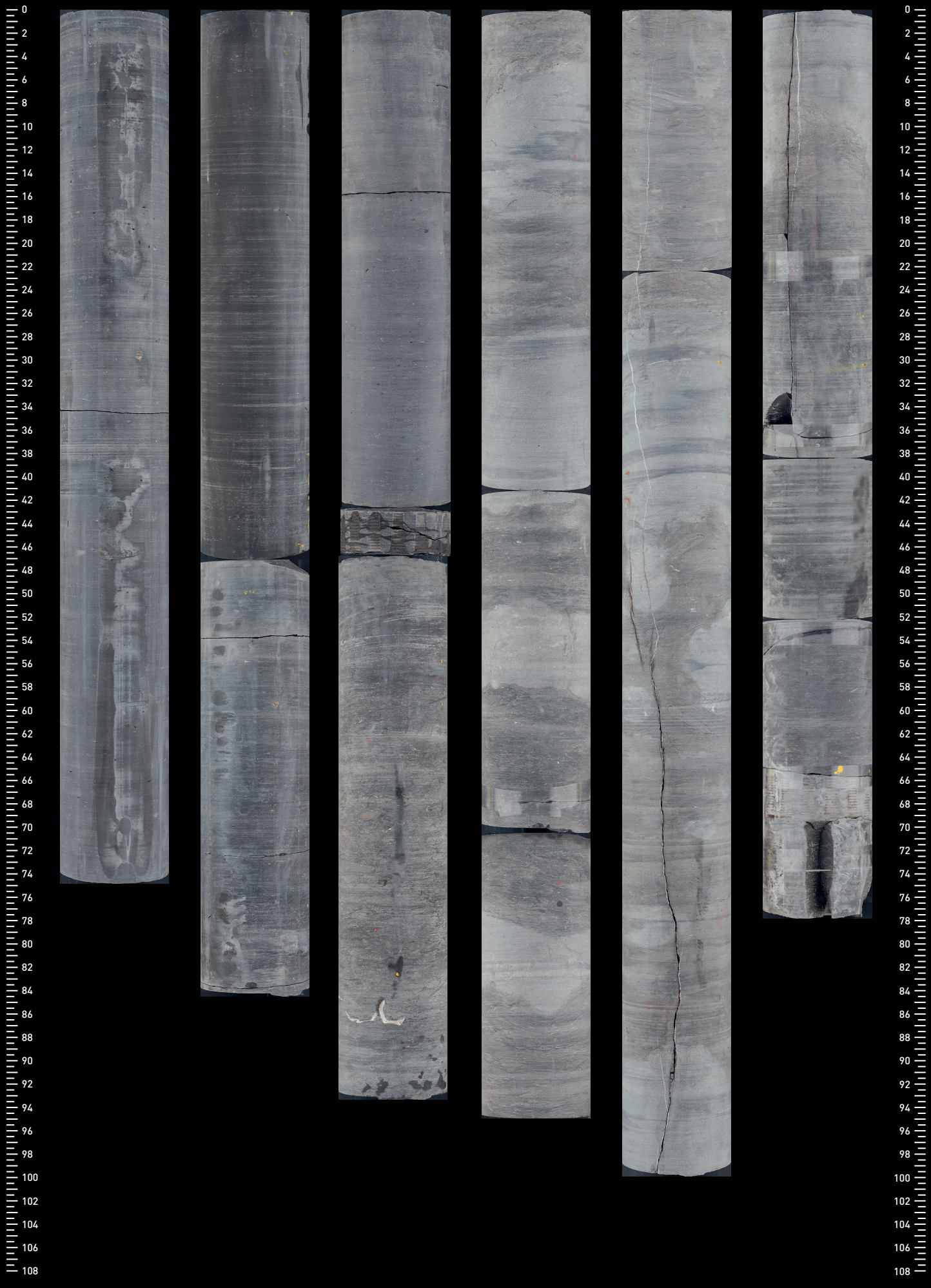
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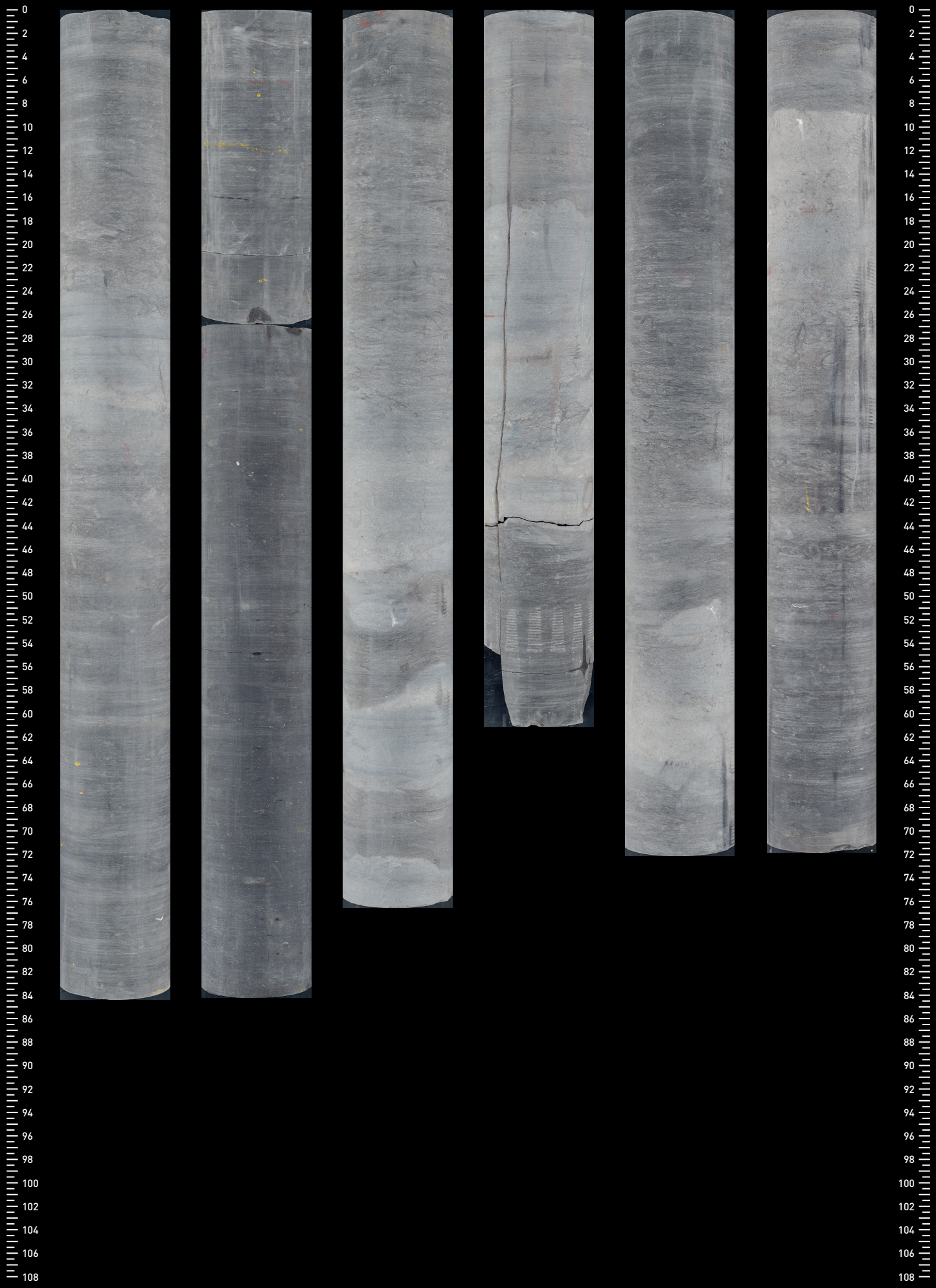
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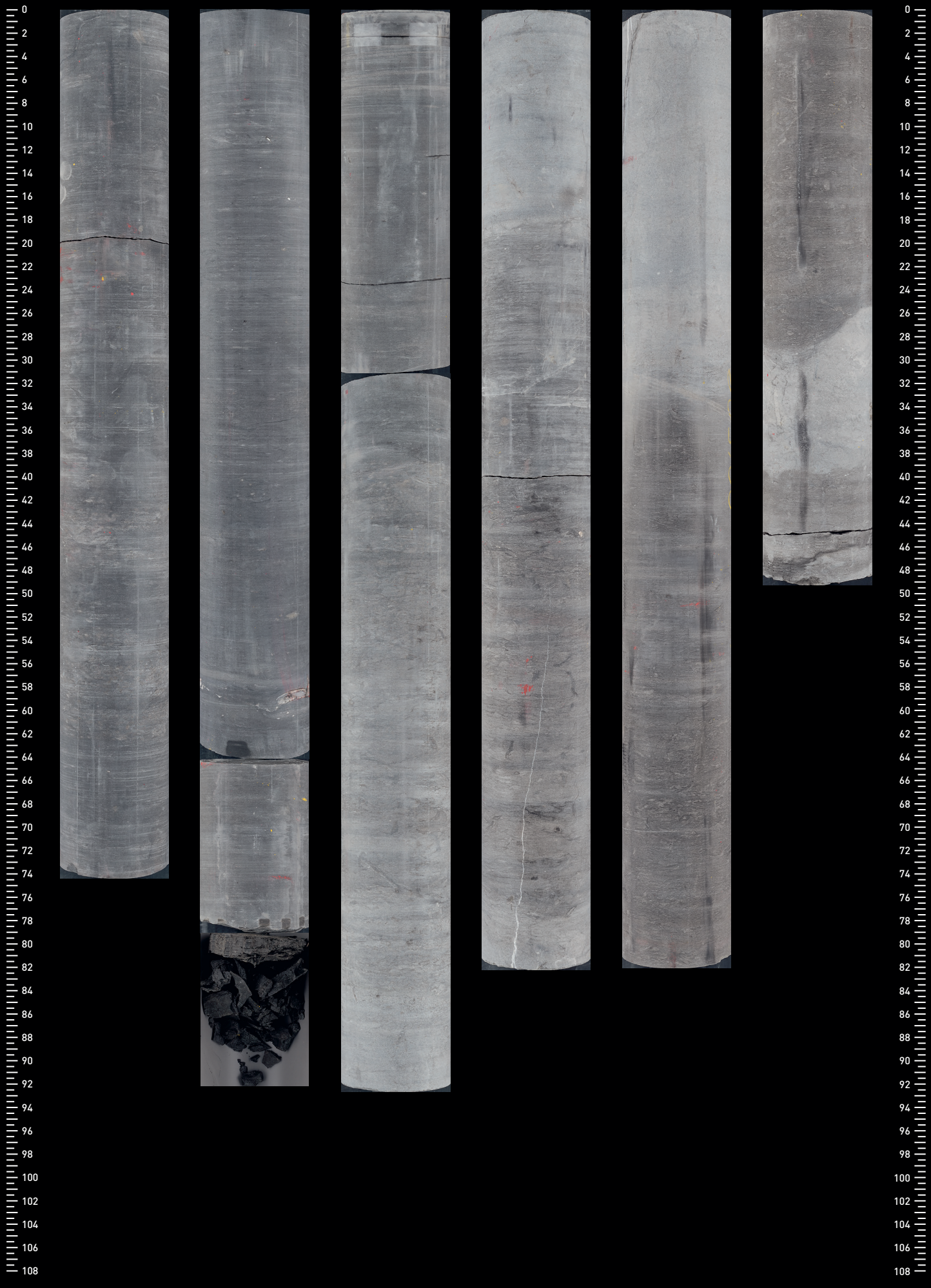
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801.03m 801.86m 802.67m 803.42m 804.02m 804.73m



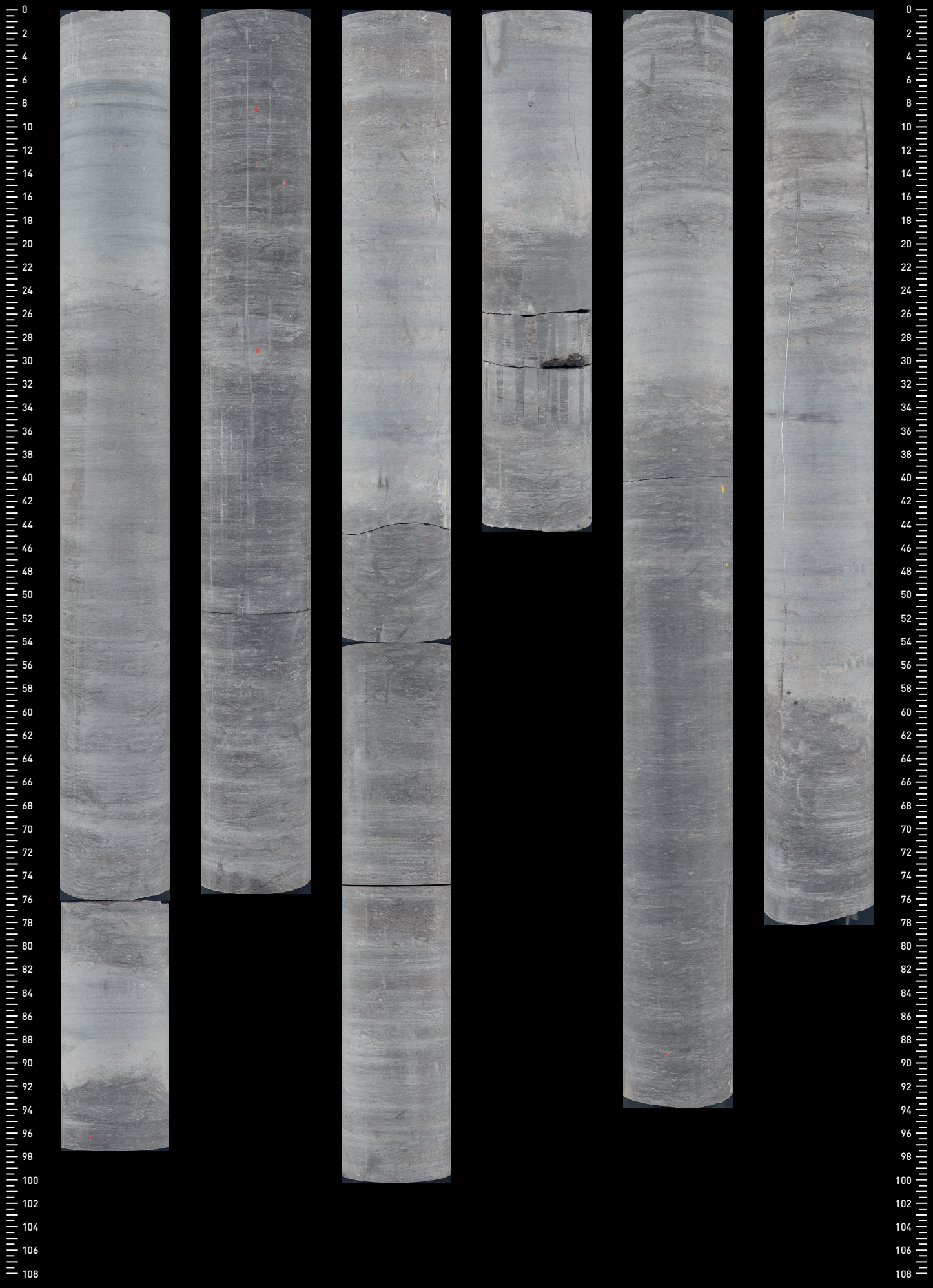
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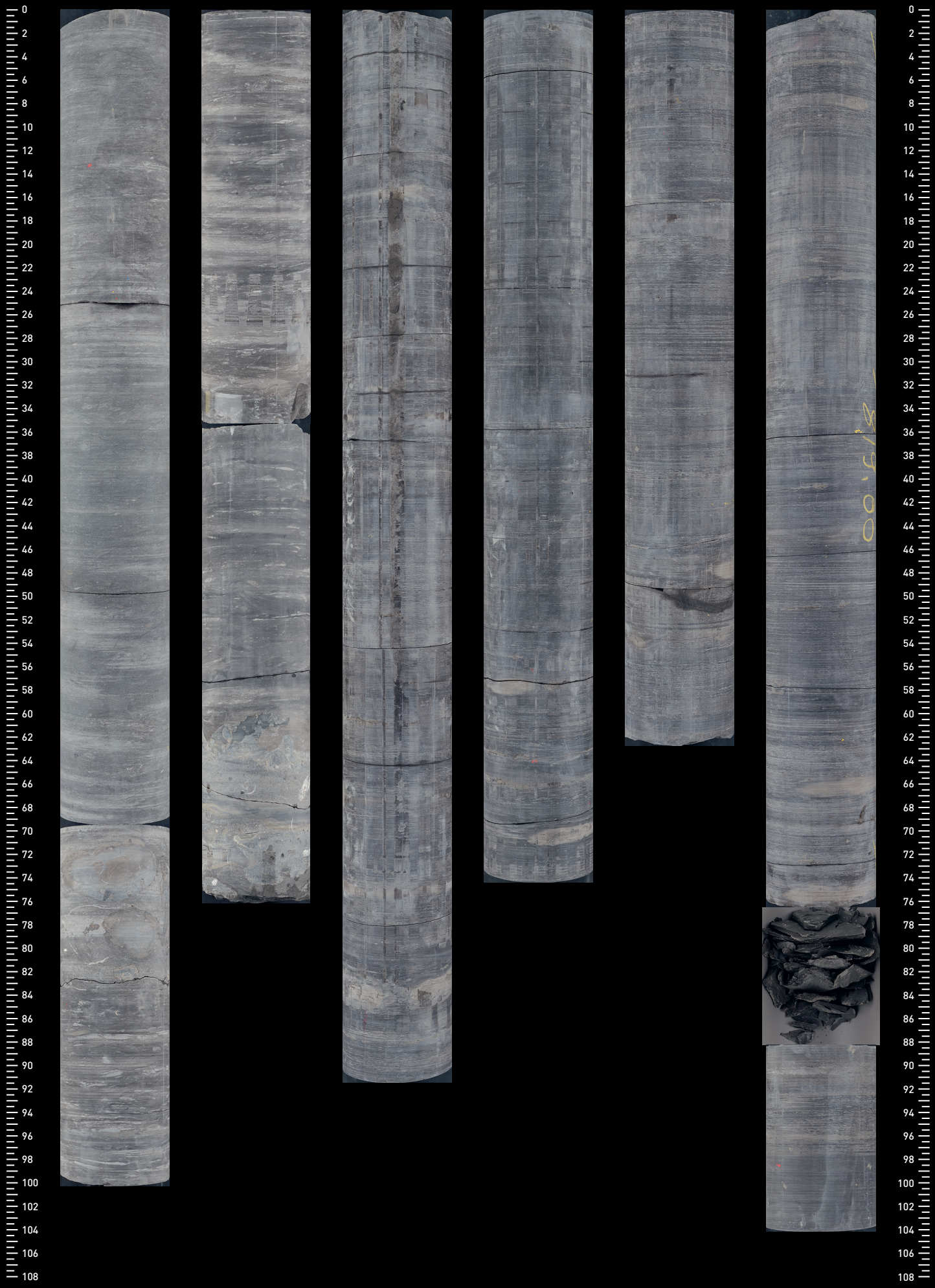
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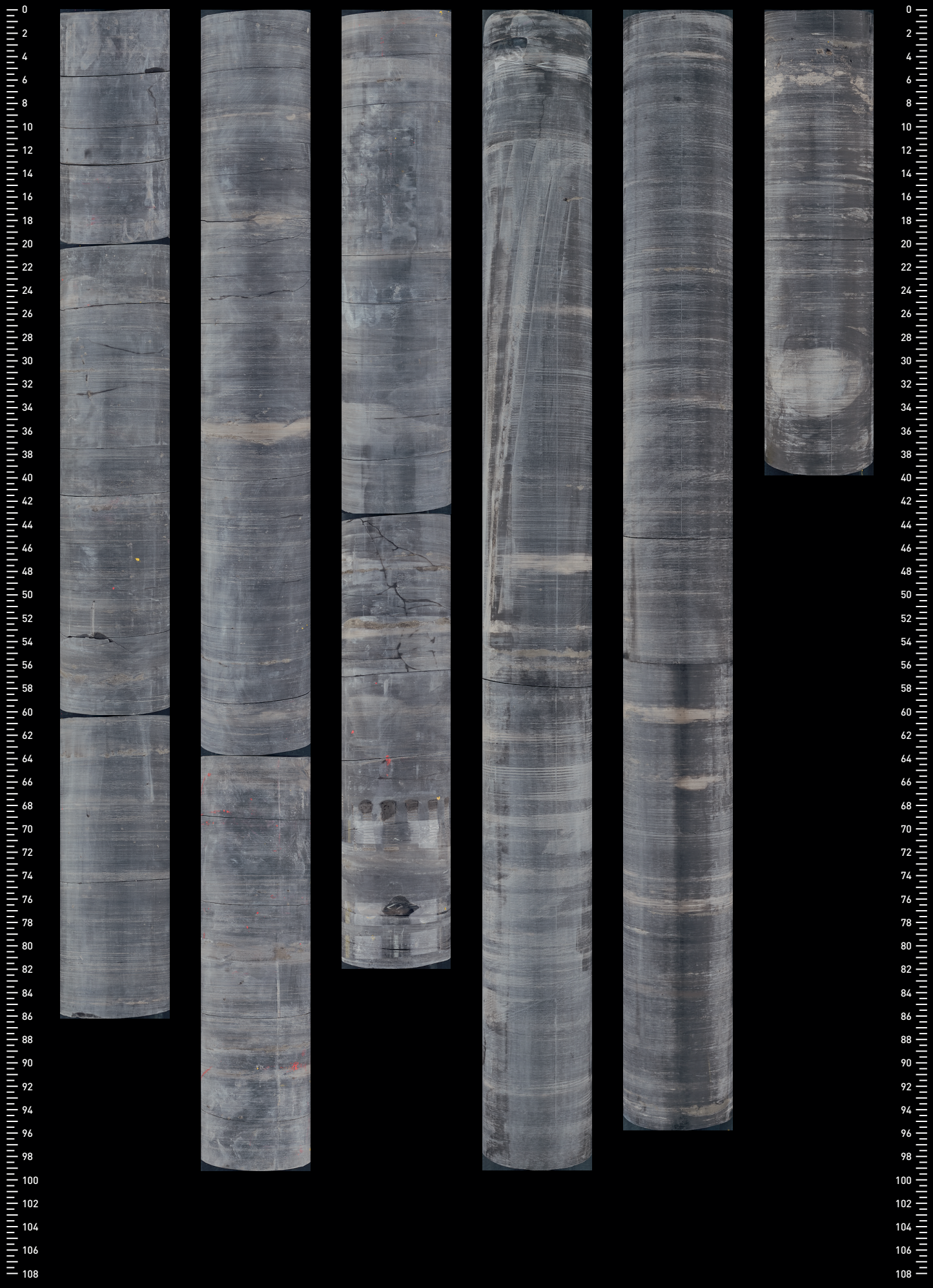
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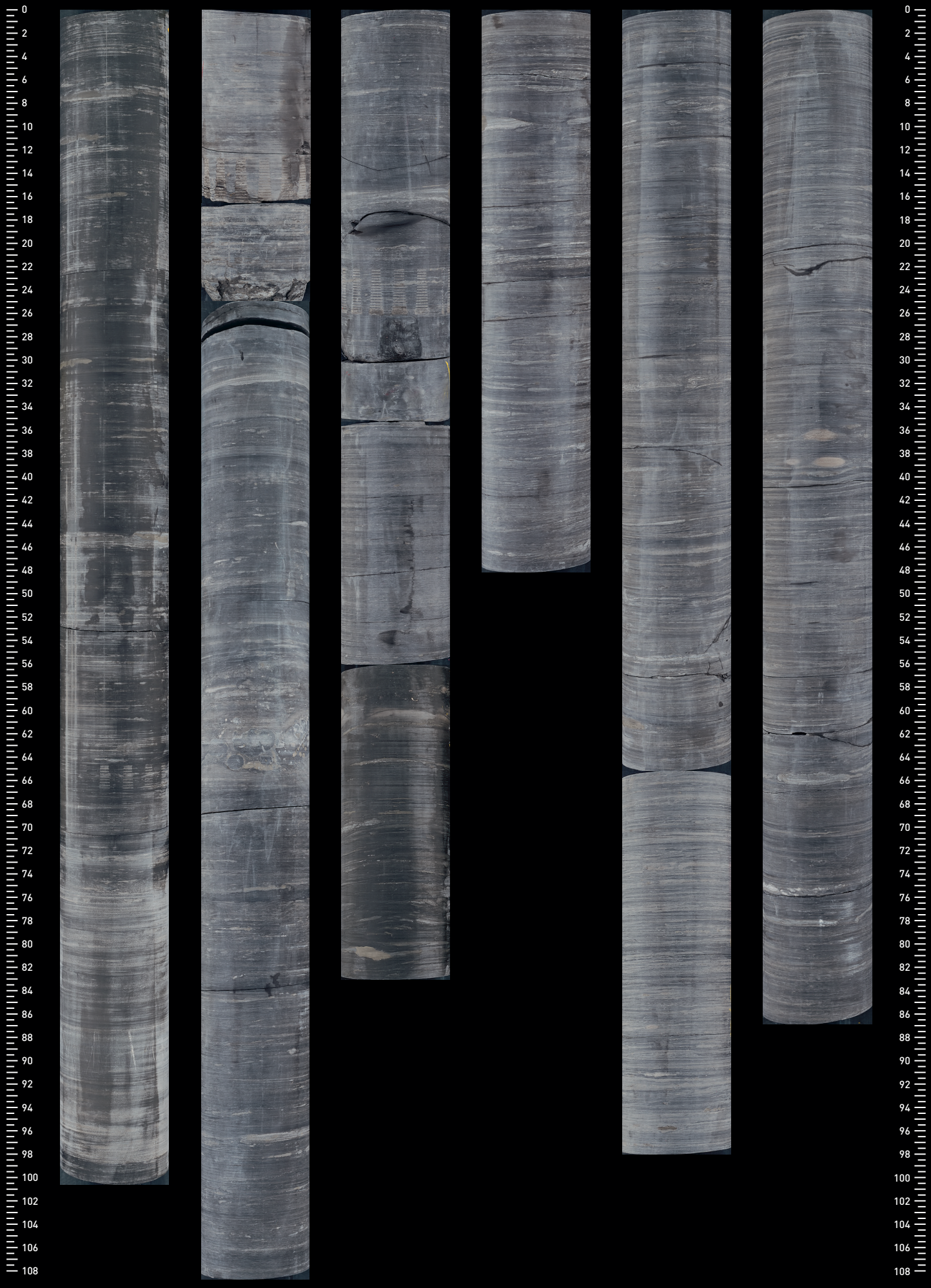
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819.56m 820.40m 821.36m 822.15m 823.11m 824.04m



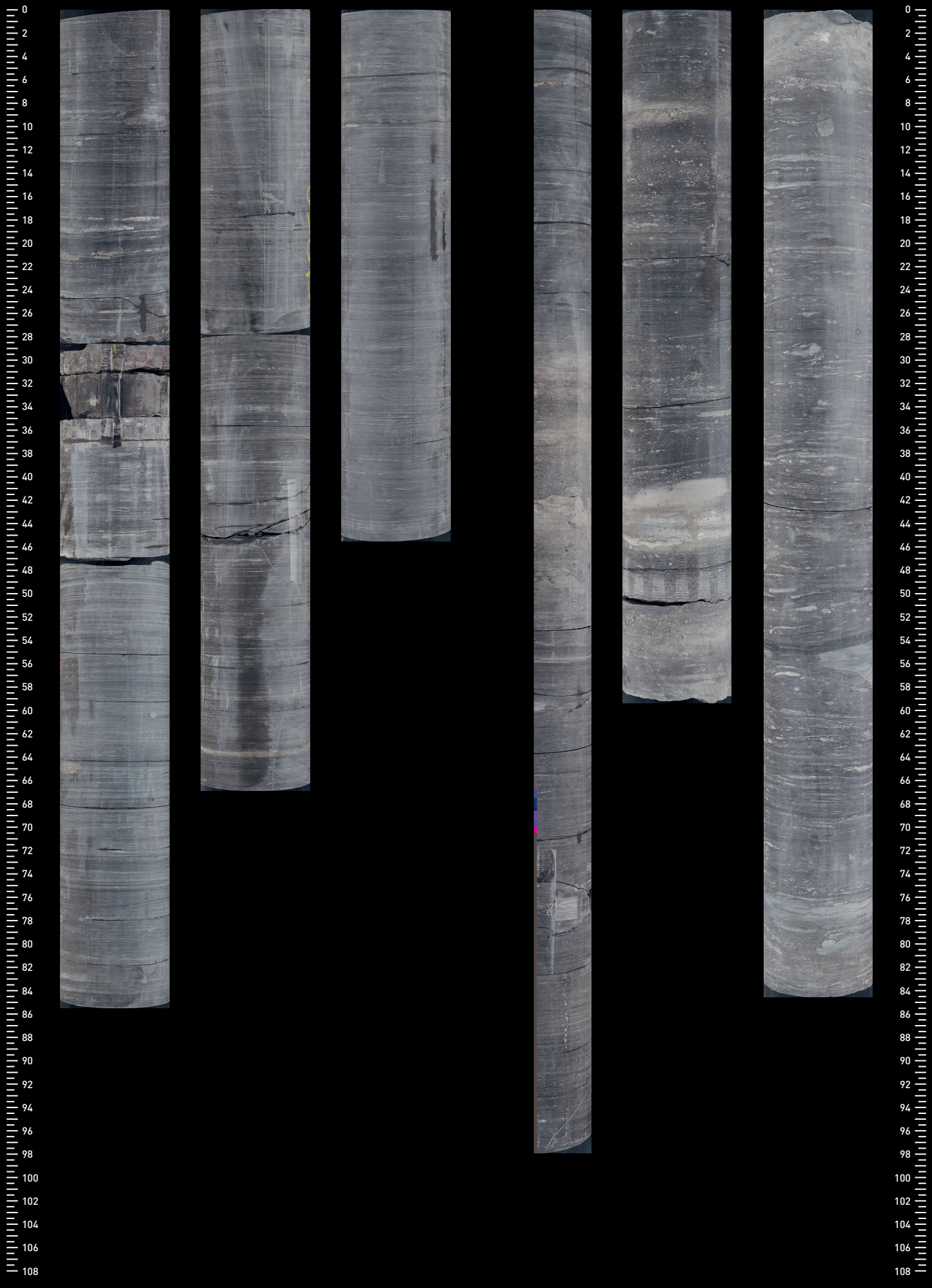
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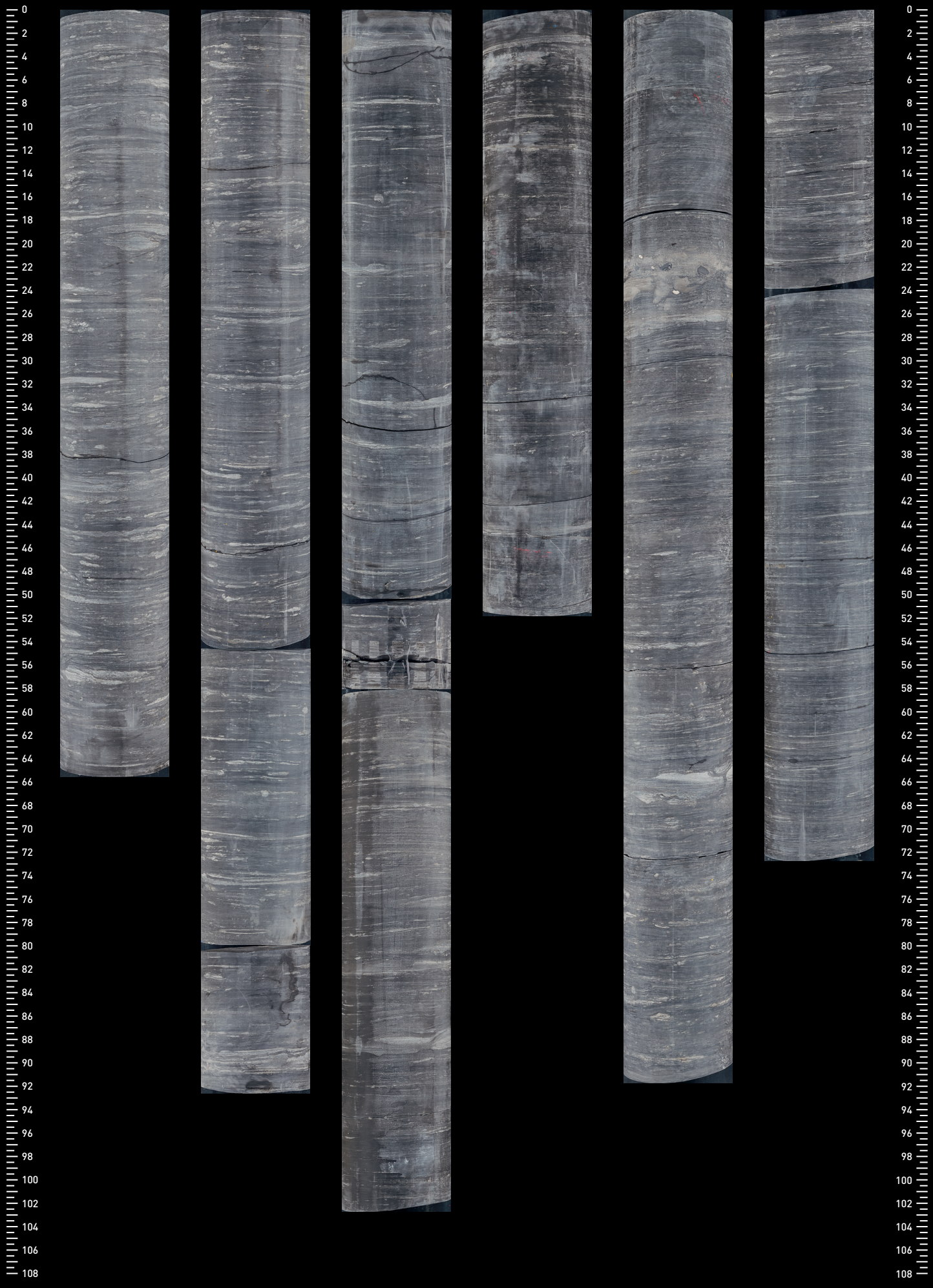
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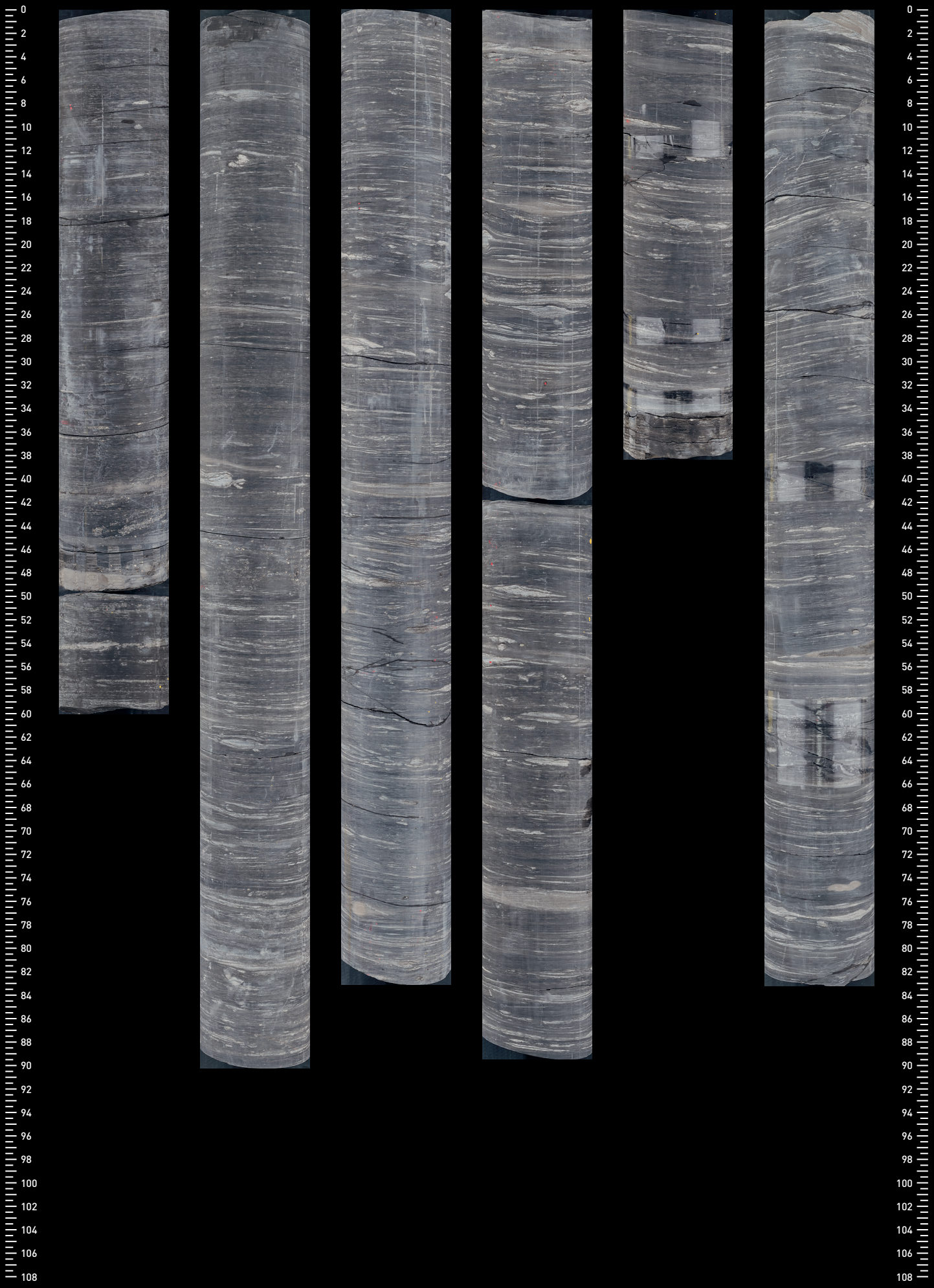


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NAB 20-09

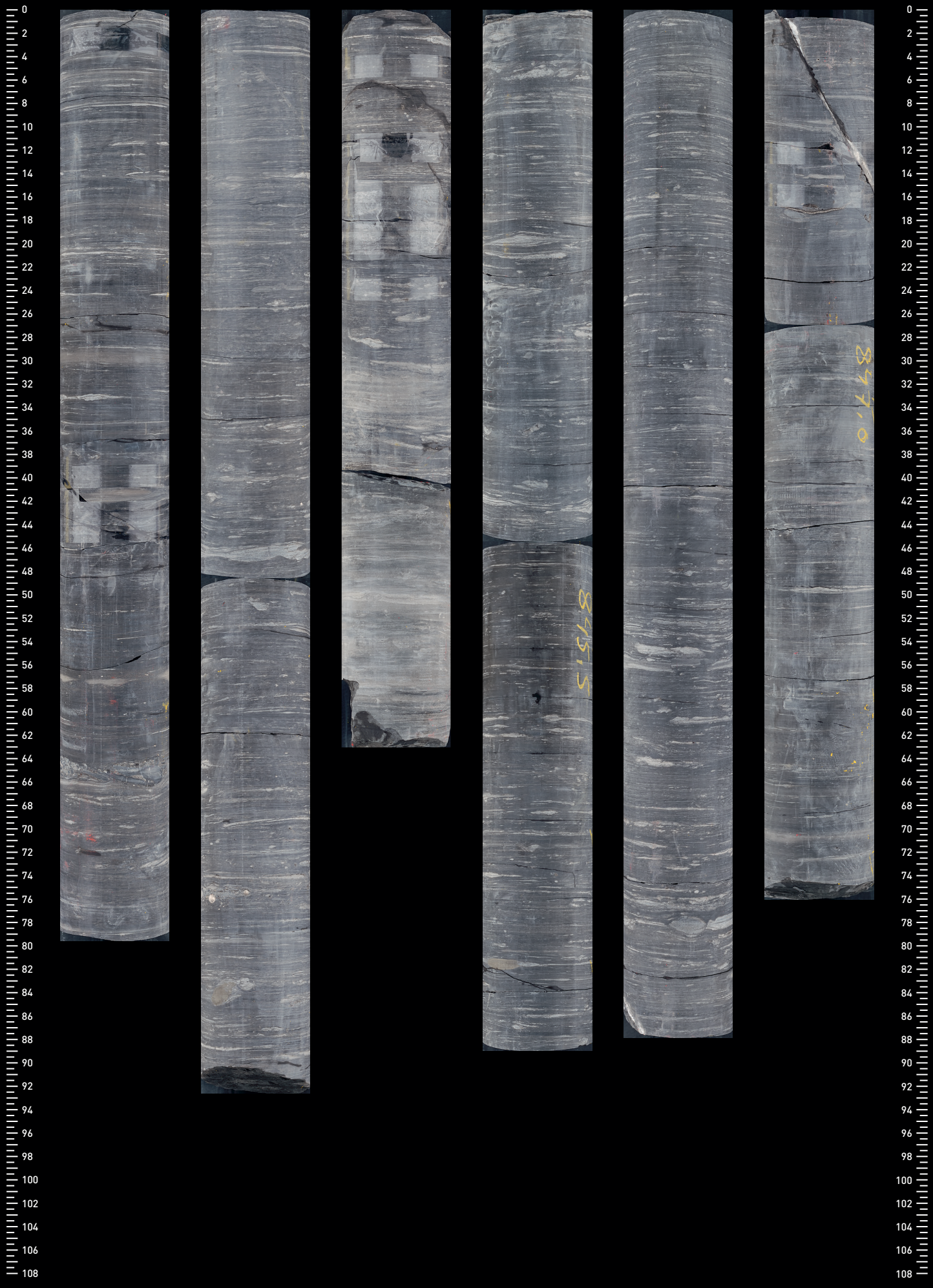
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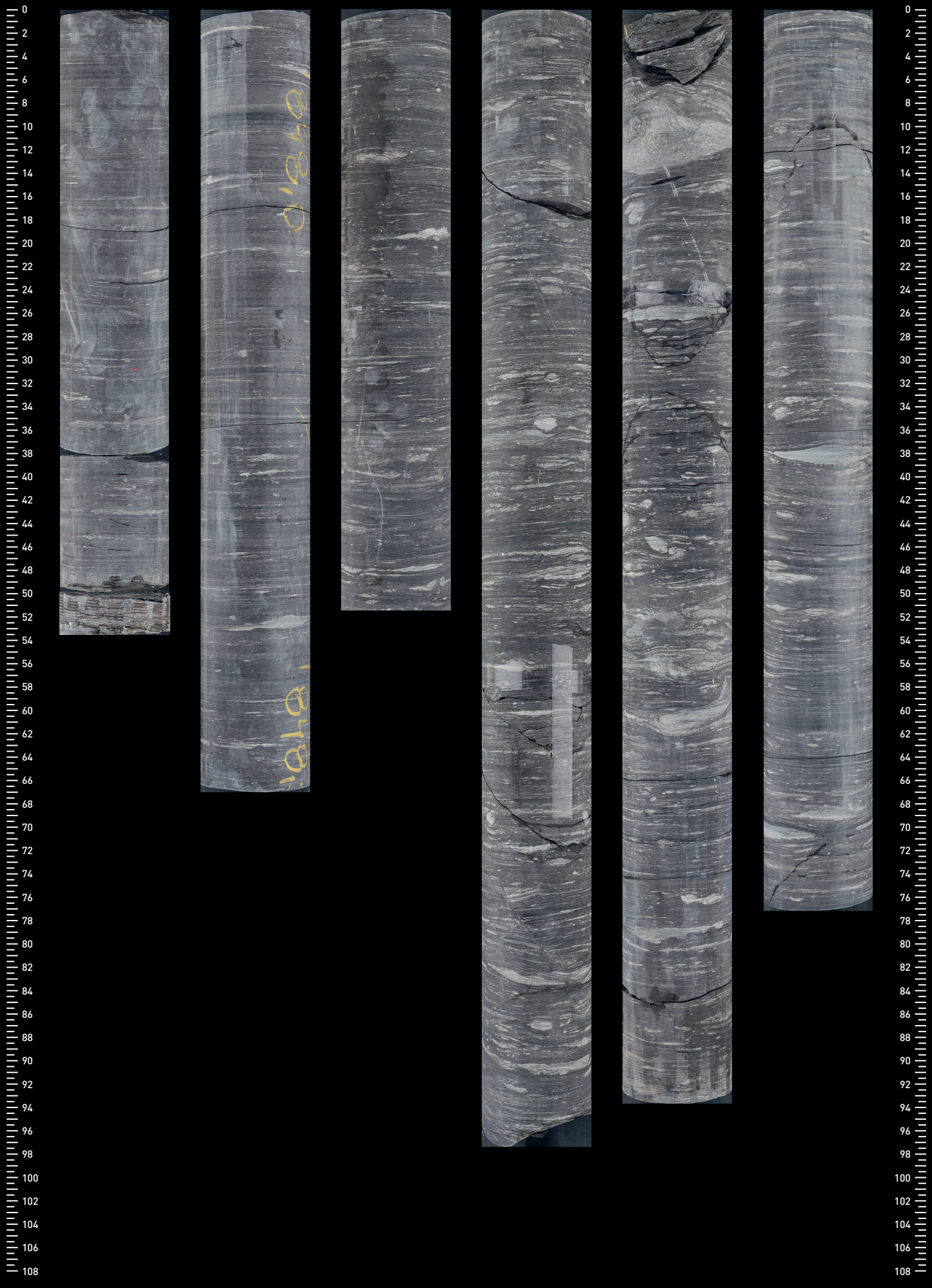
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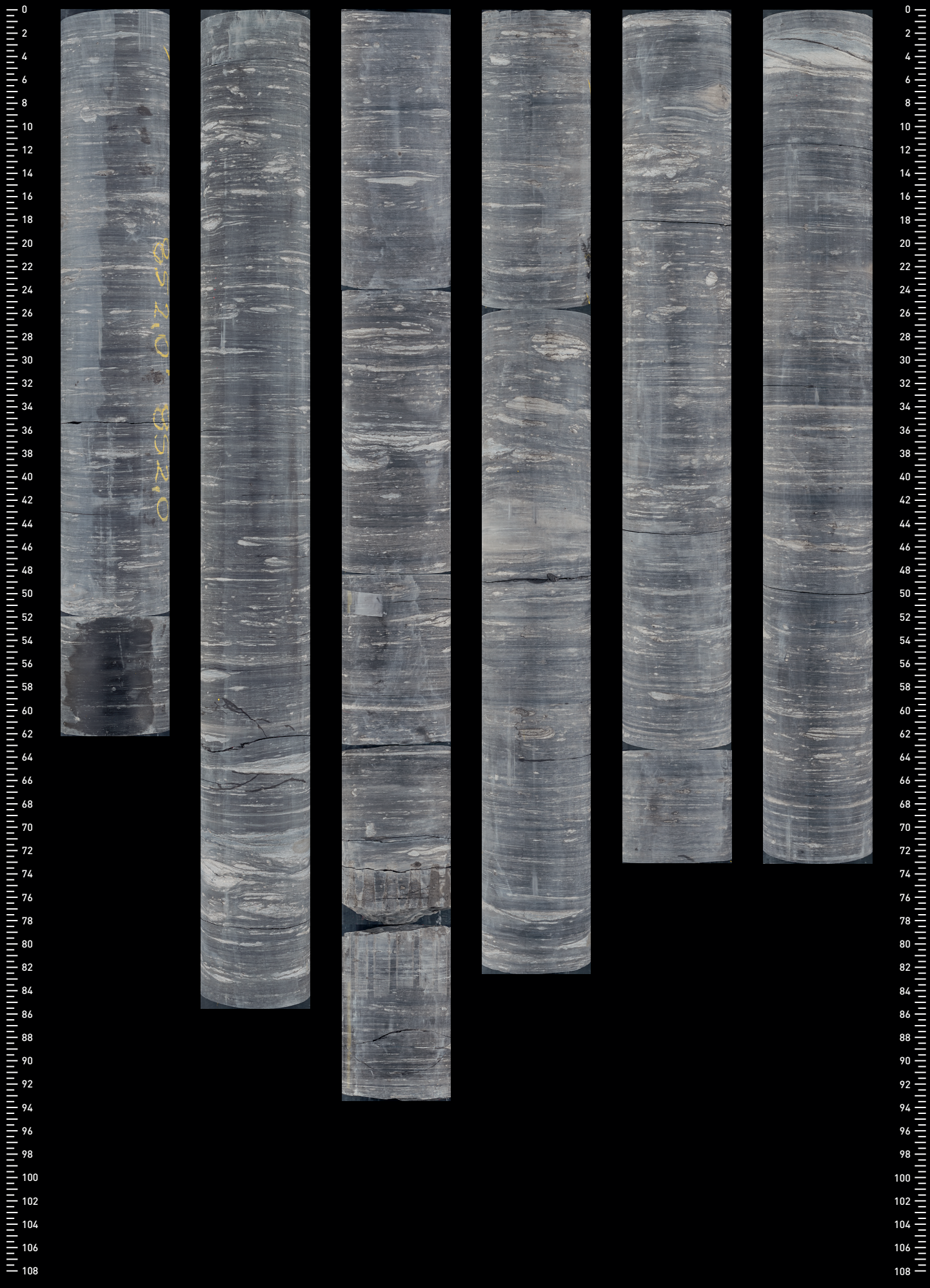


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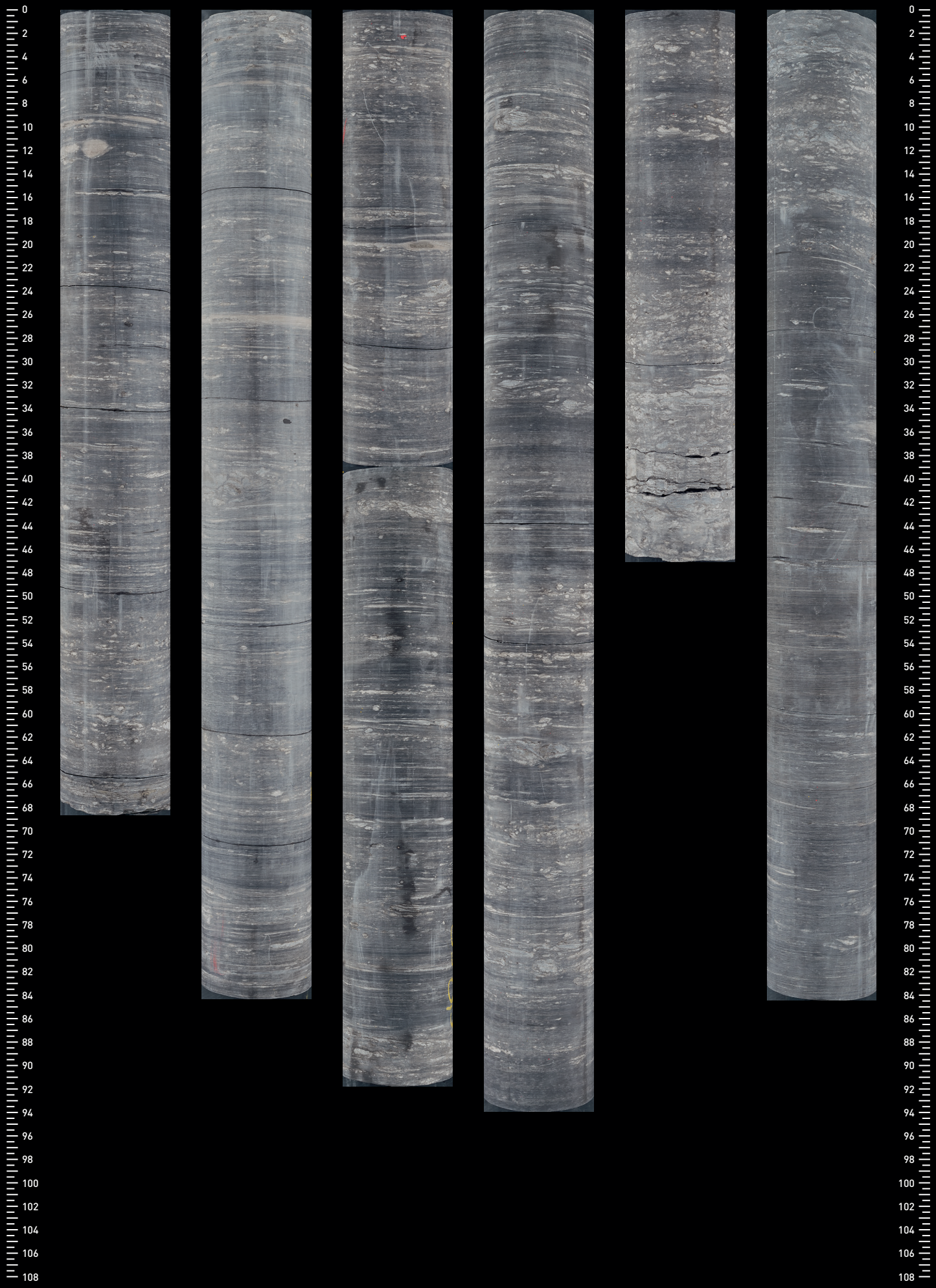
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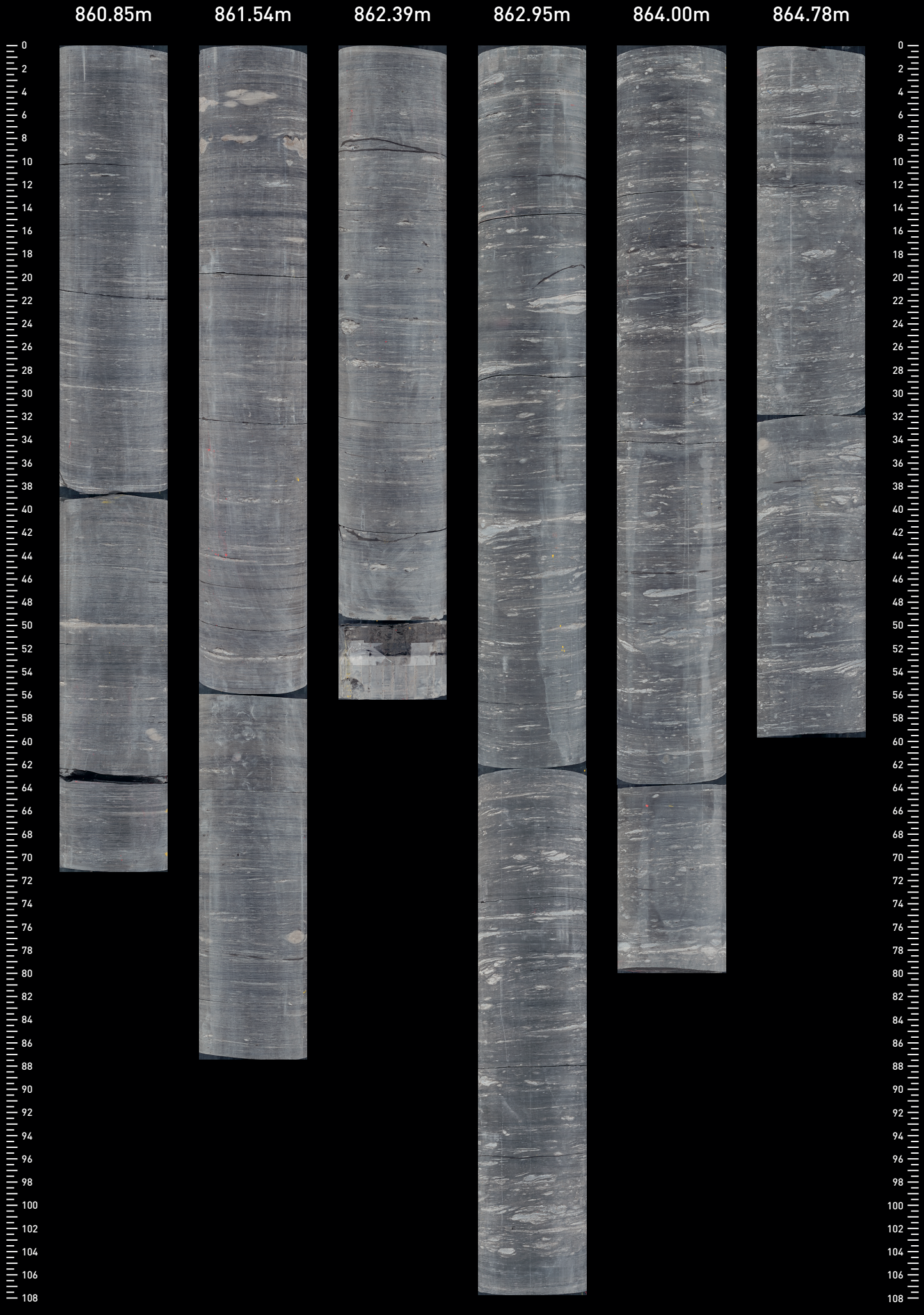
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851.70m
852.30m
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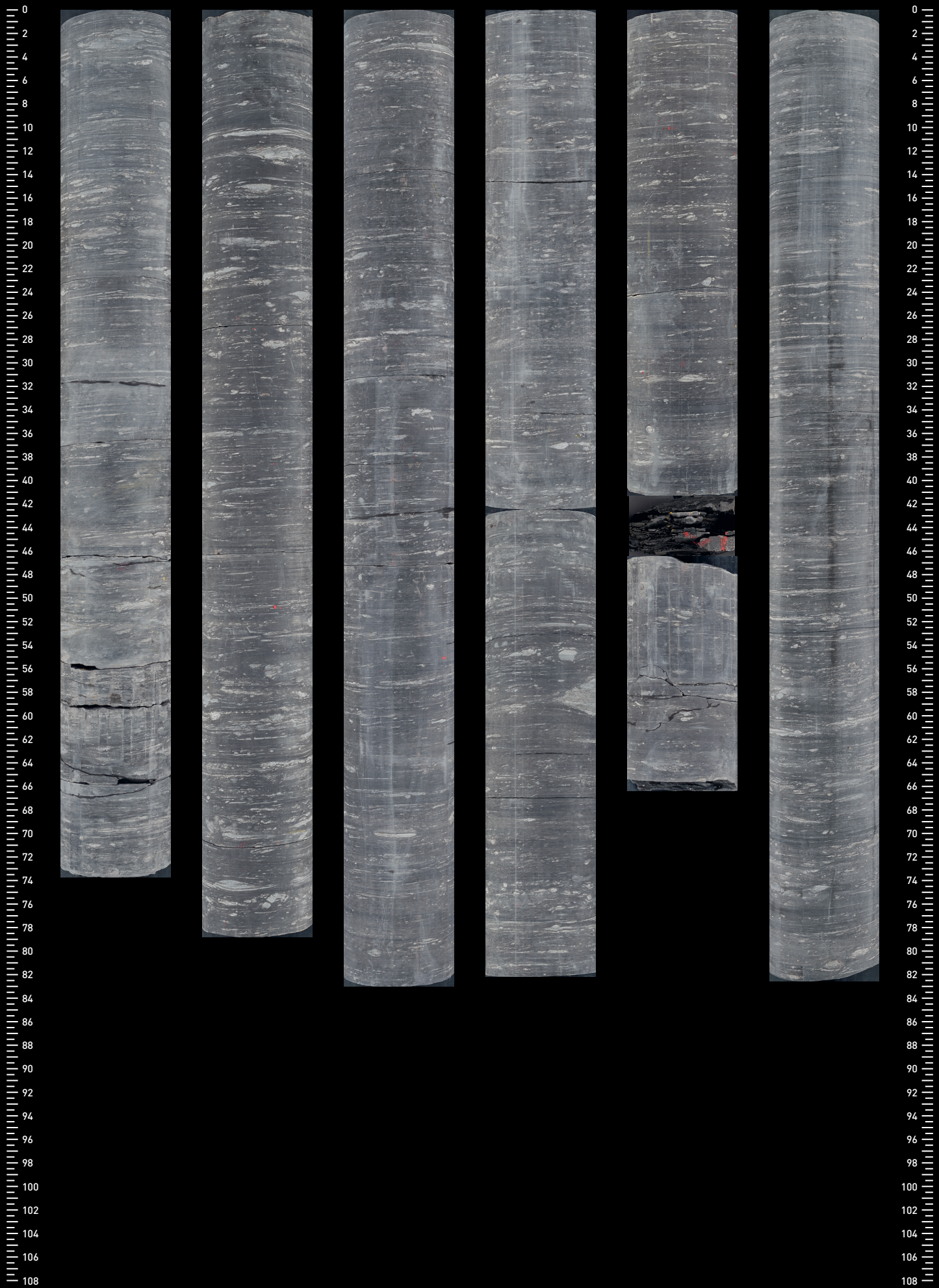
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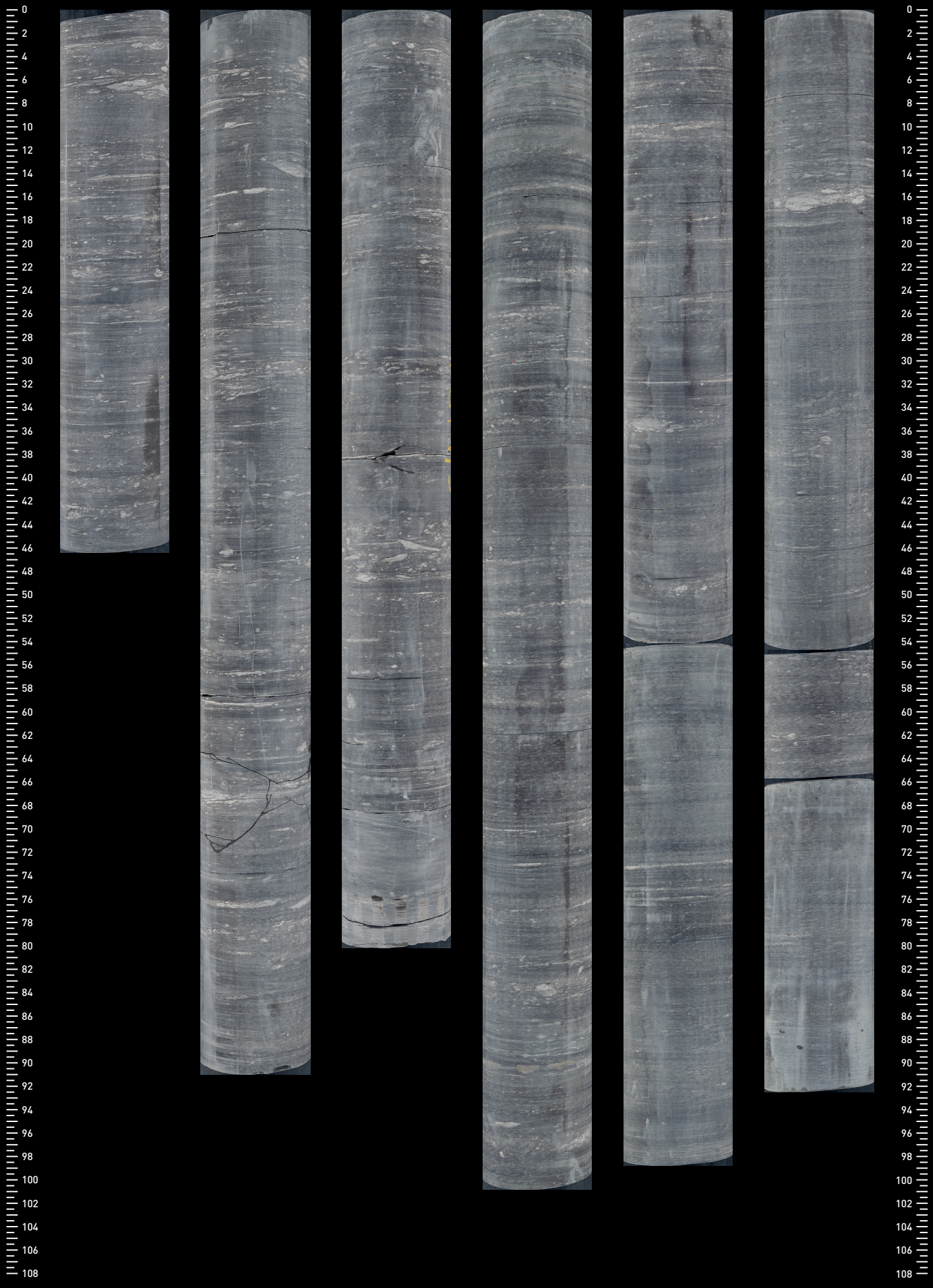

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861.54m
862.39m
862.95m
864.00m
864.78m
861.54m
862.39m
862.95m
864.00m
864.78m
865.36m

865.36m 866.07m 866.84m 867.65m 868.45m 869.08m



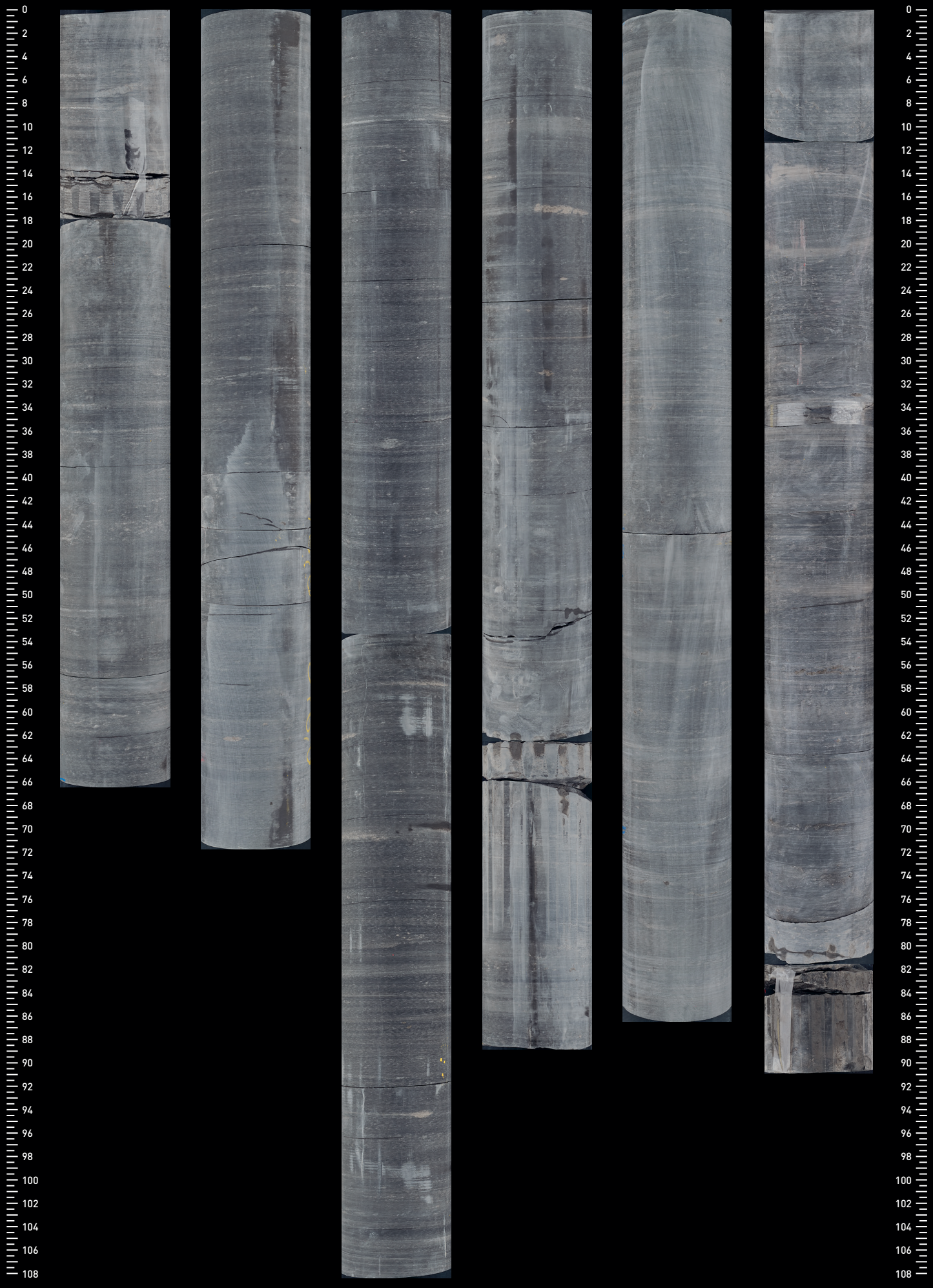
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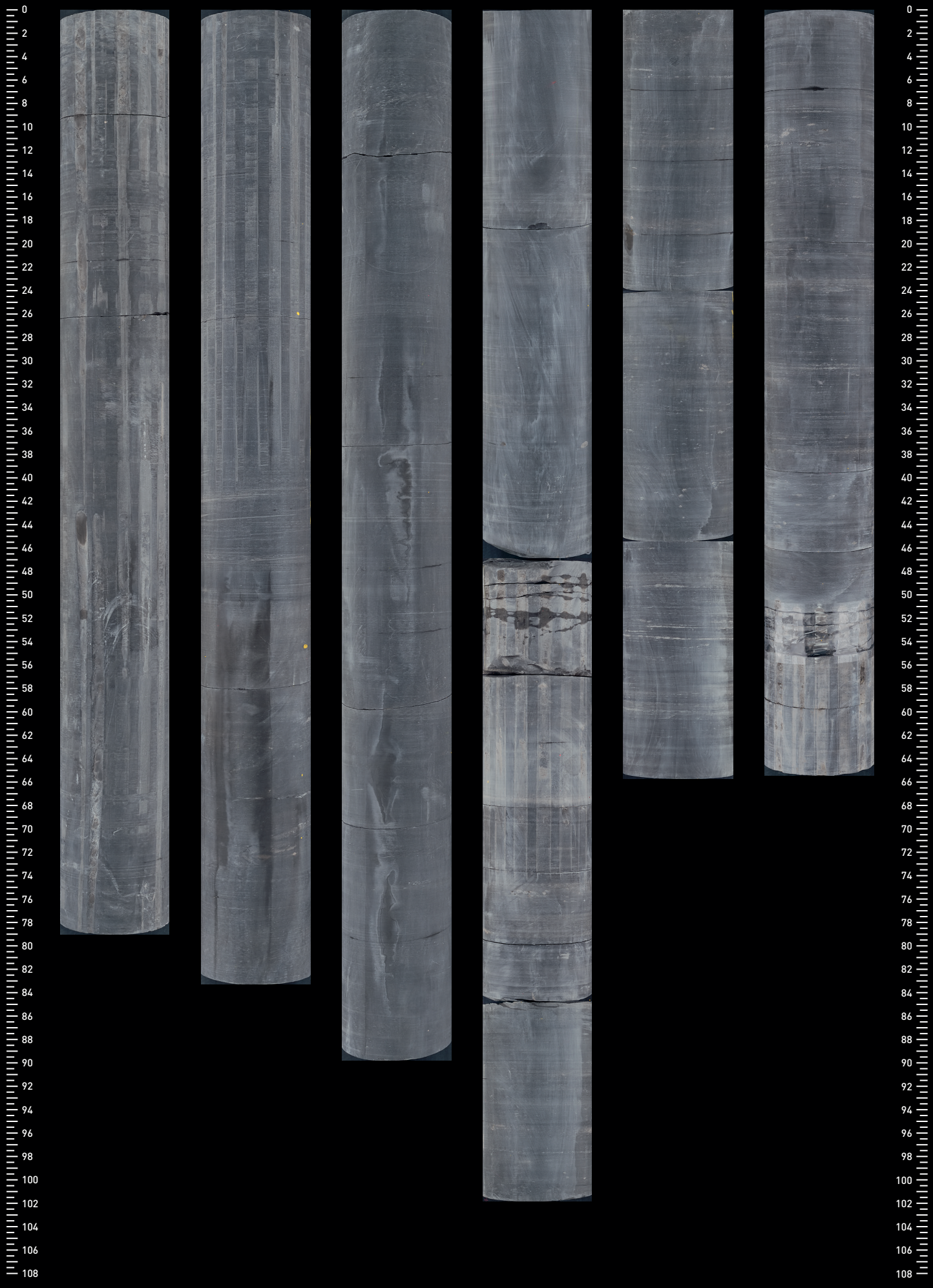
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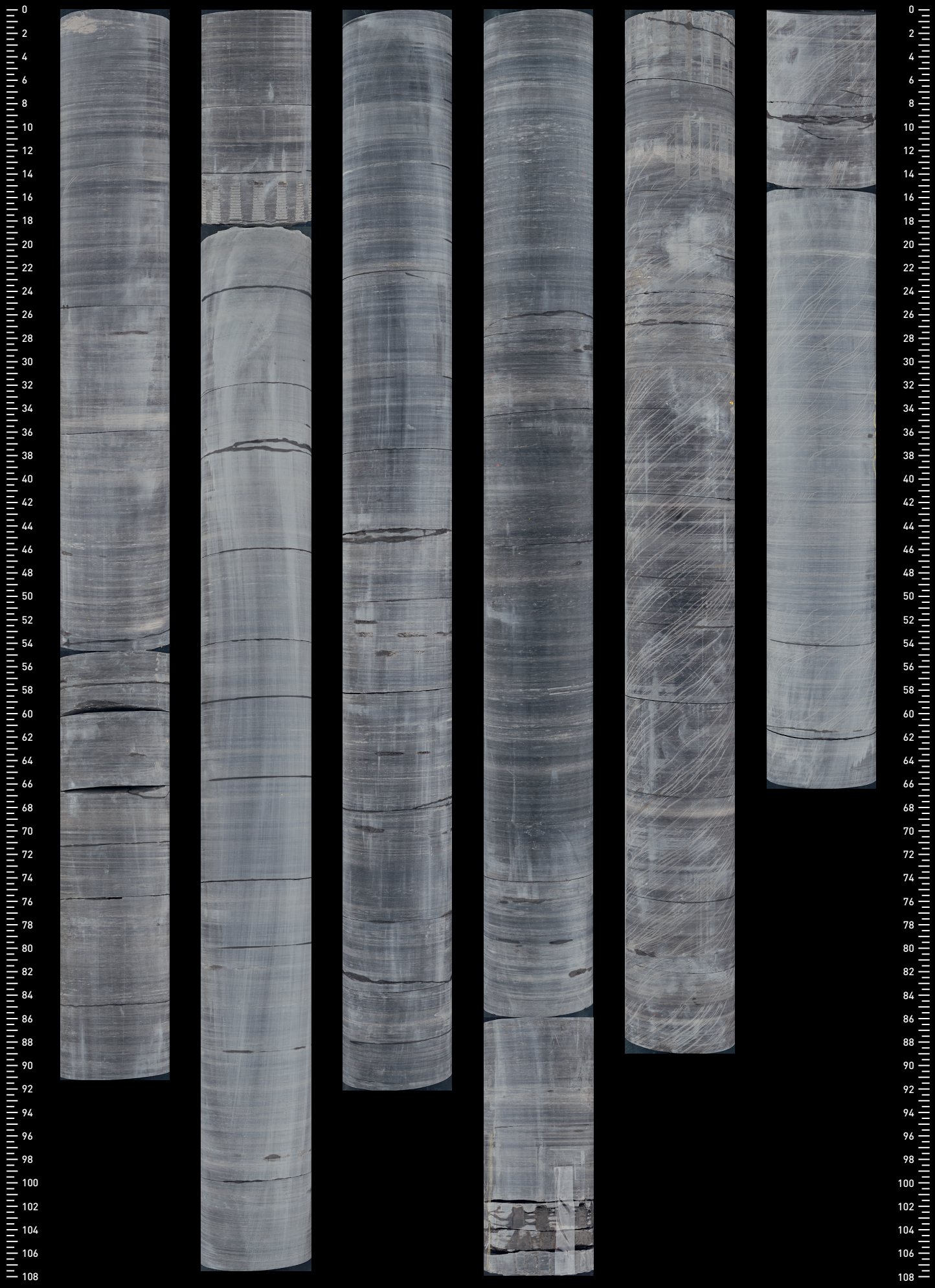
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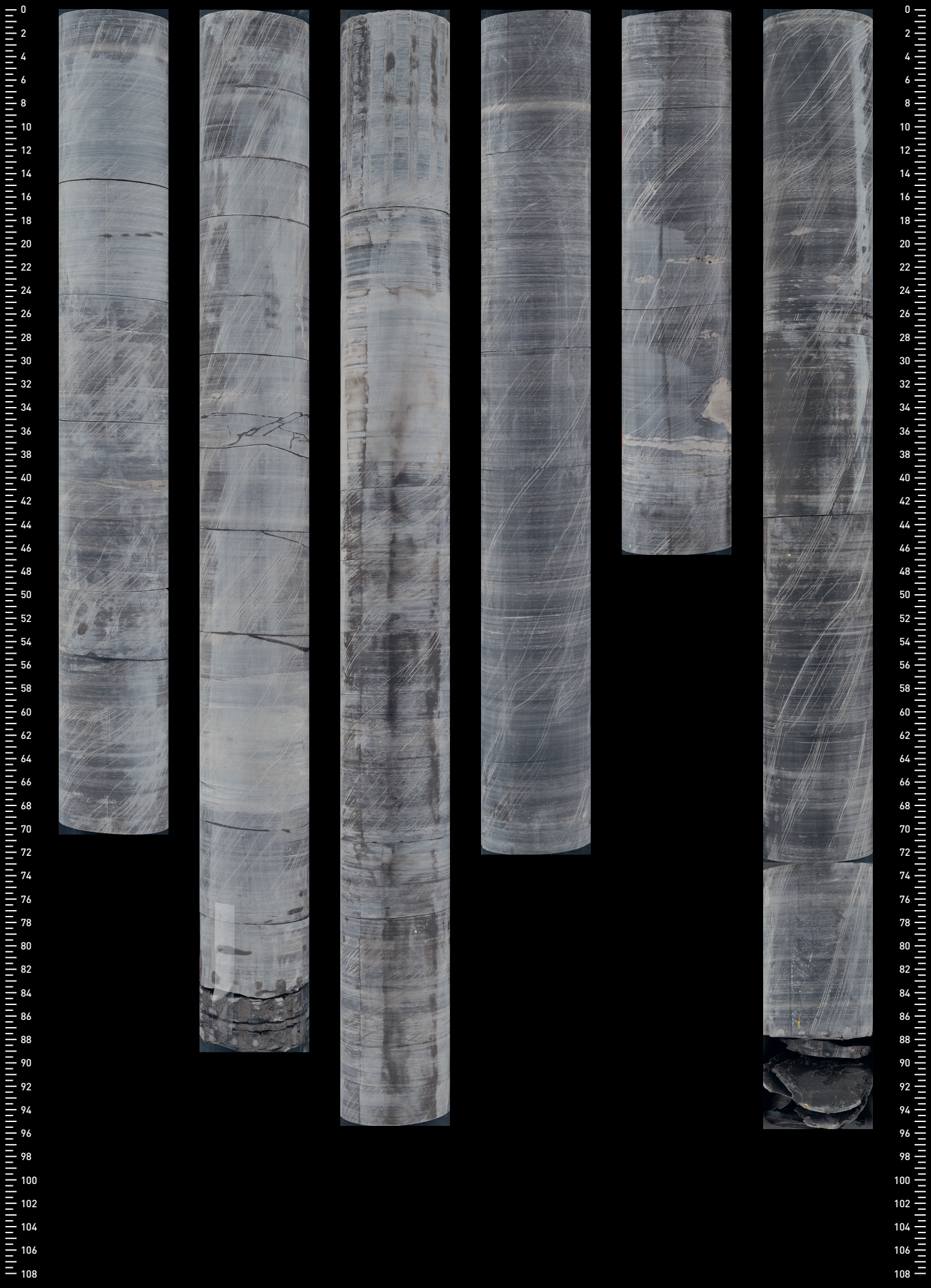
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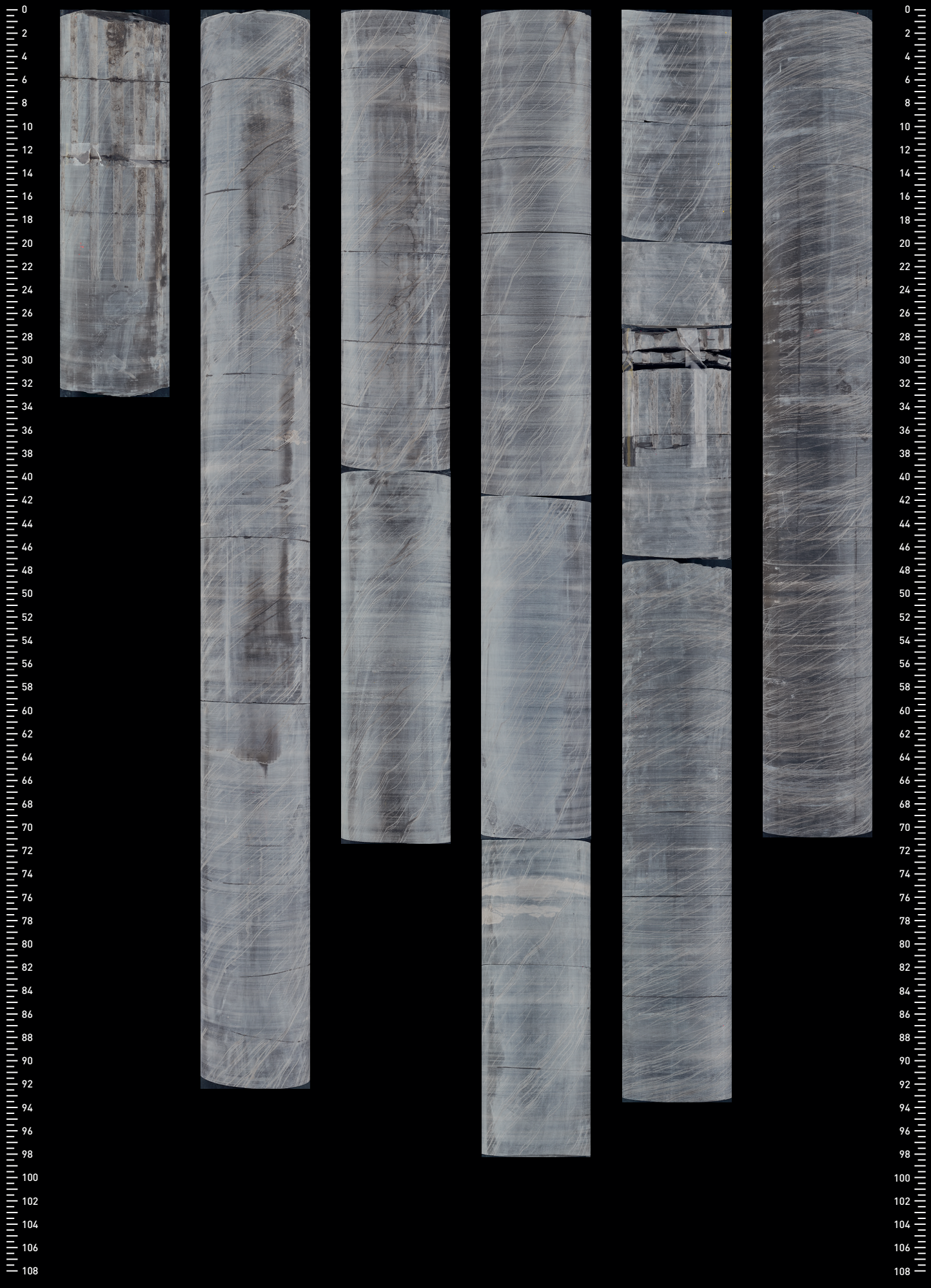
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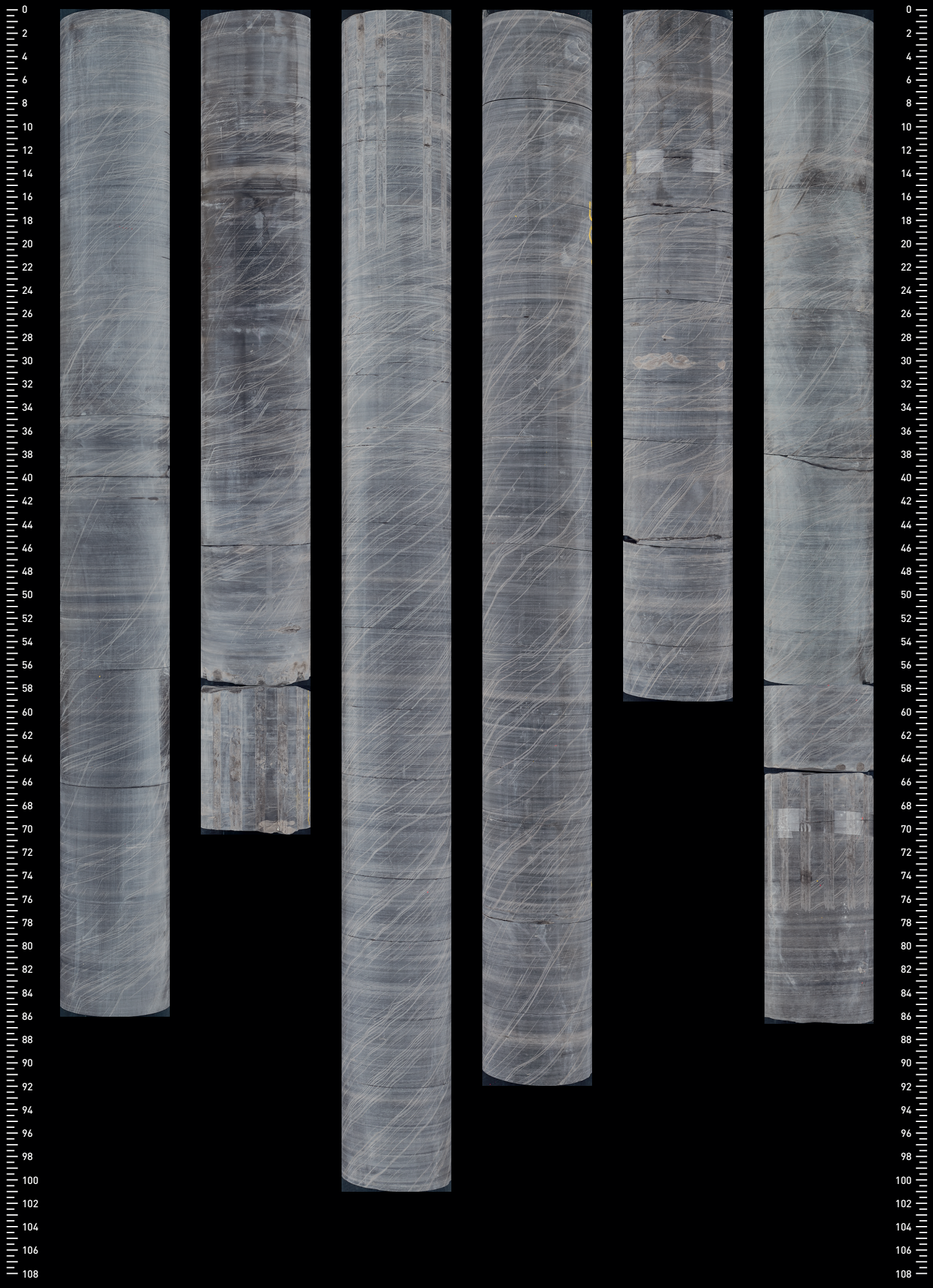
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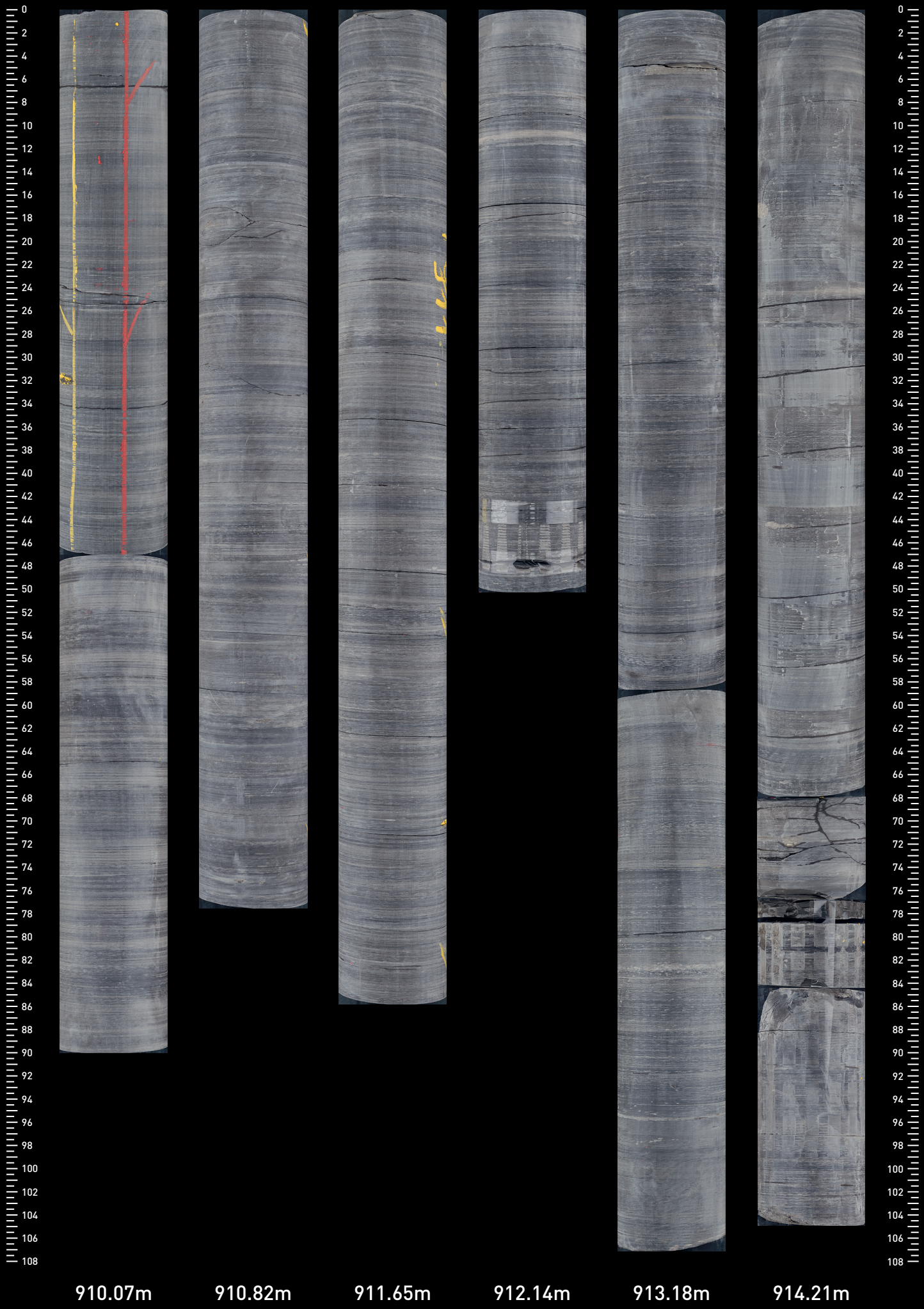


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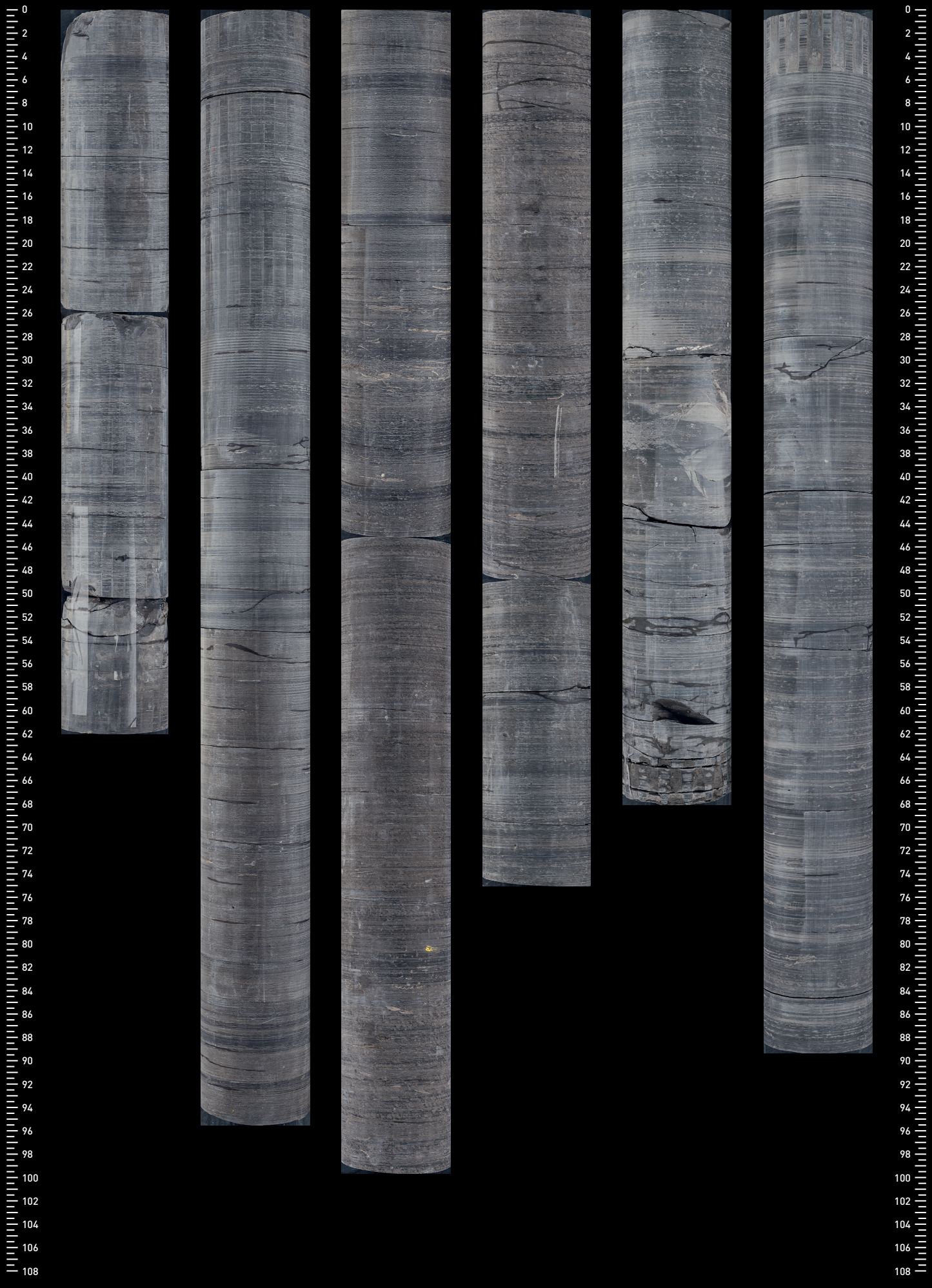
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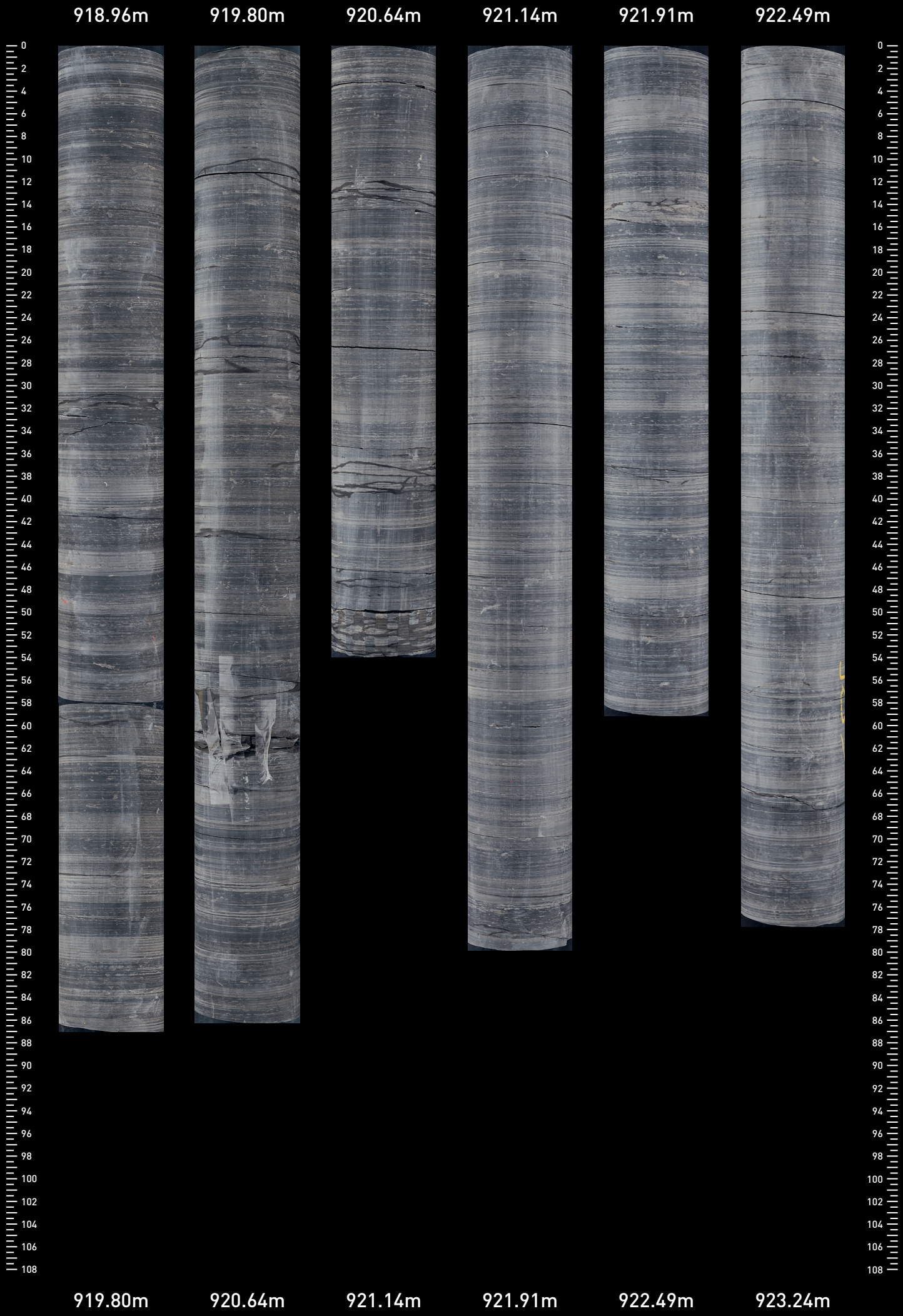
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909.19m
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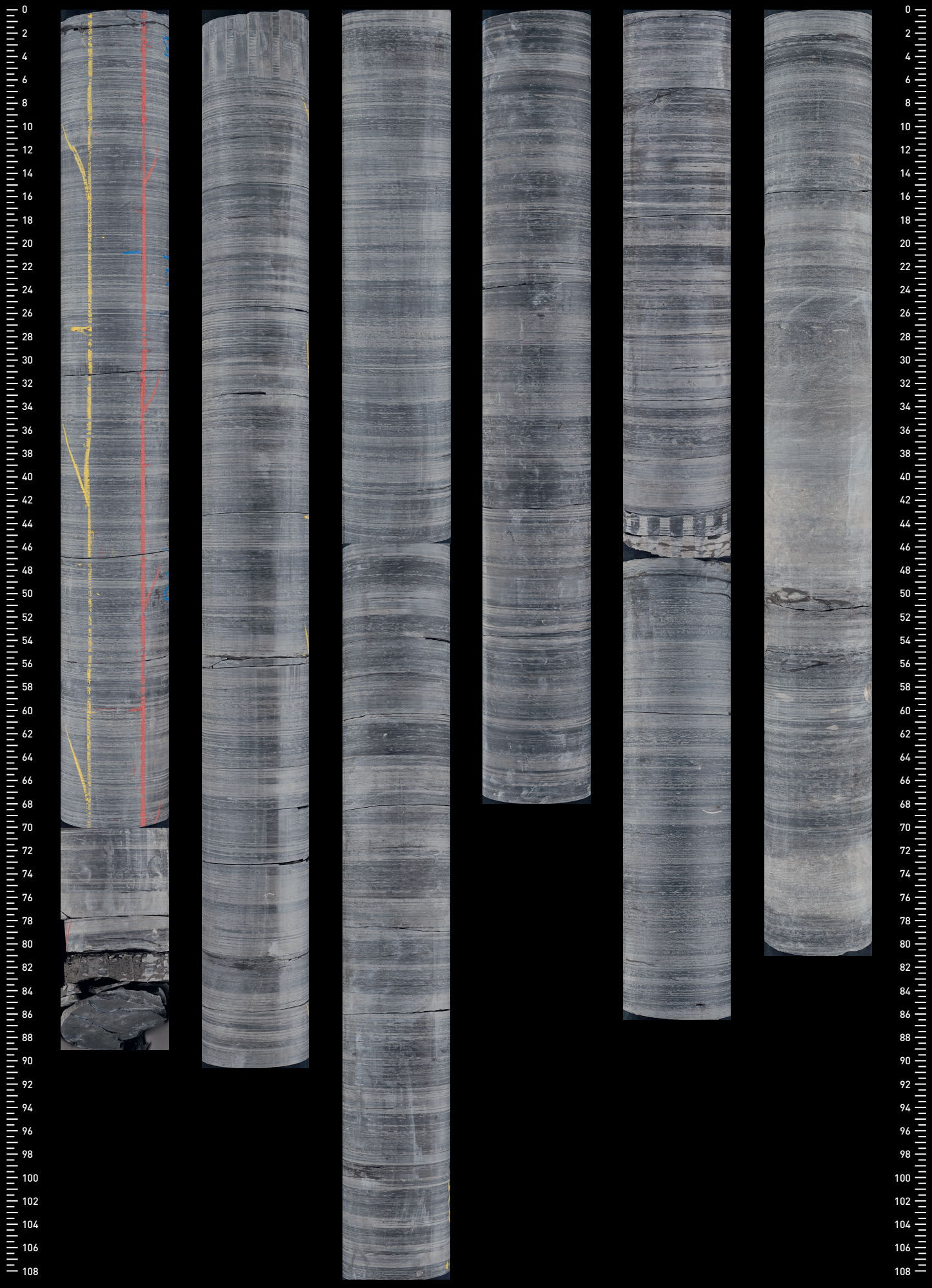
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914.82m 915.72m 916.71m 917.44m 918.09m 918.96m


918.96m
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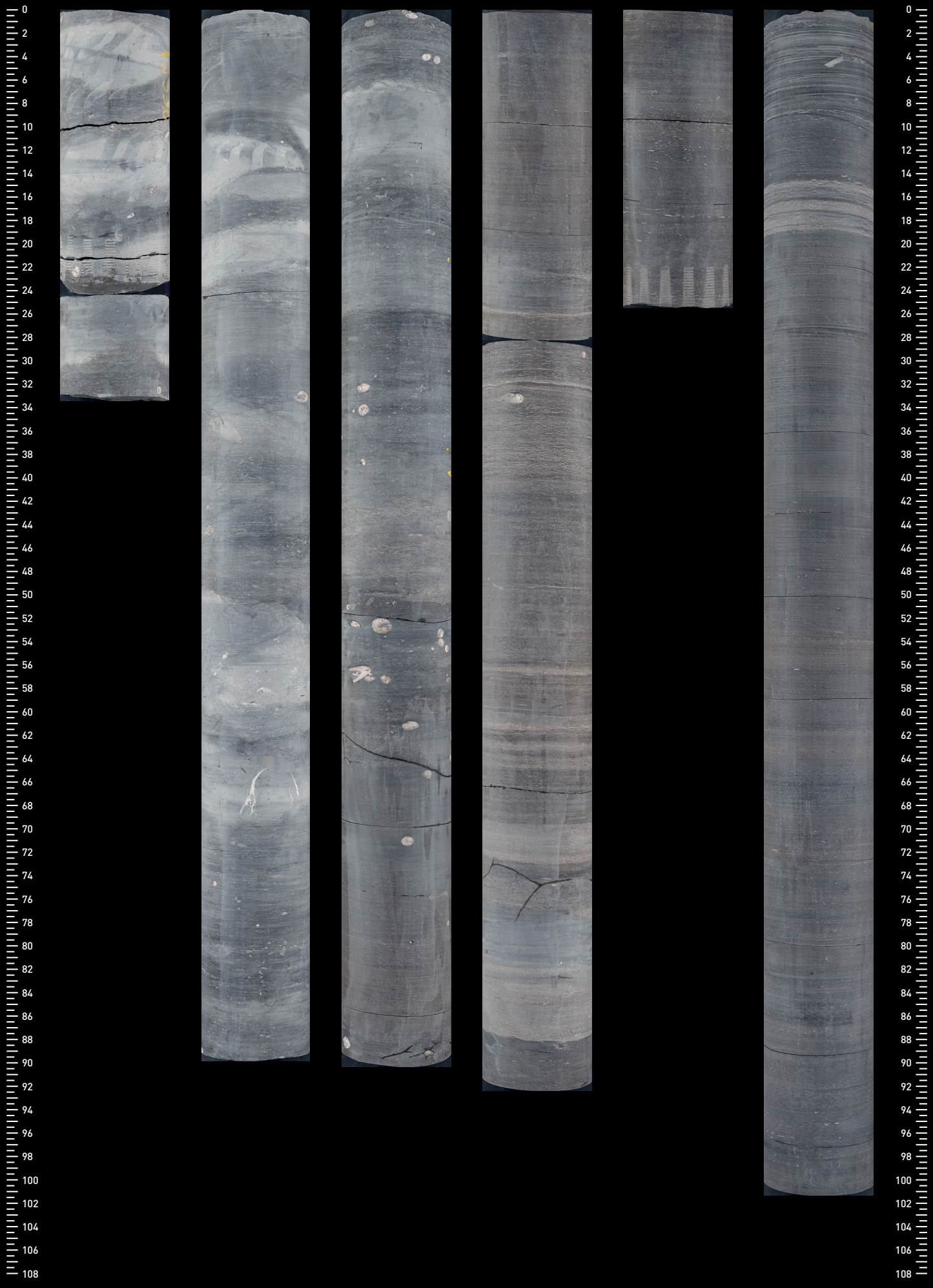
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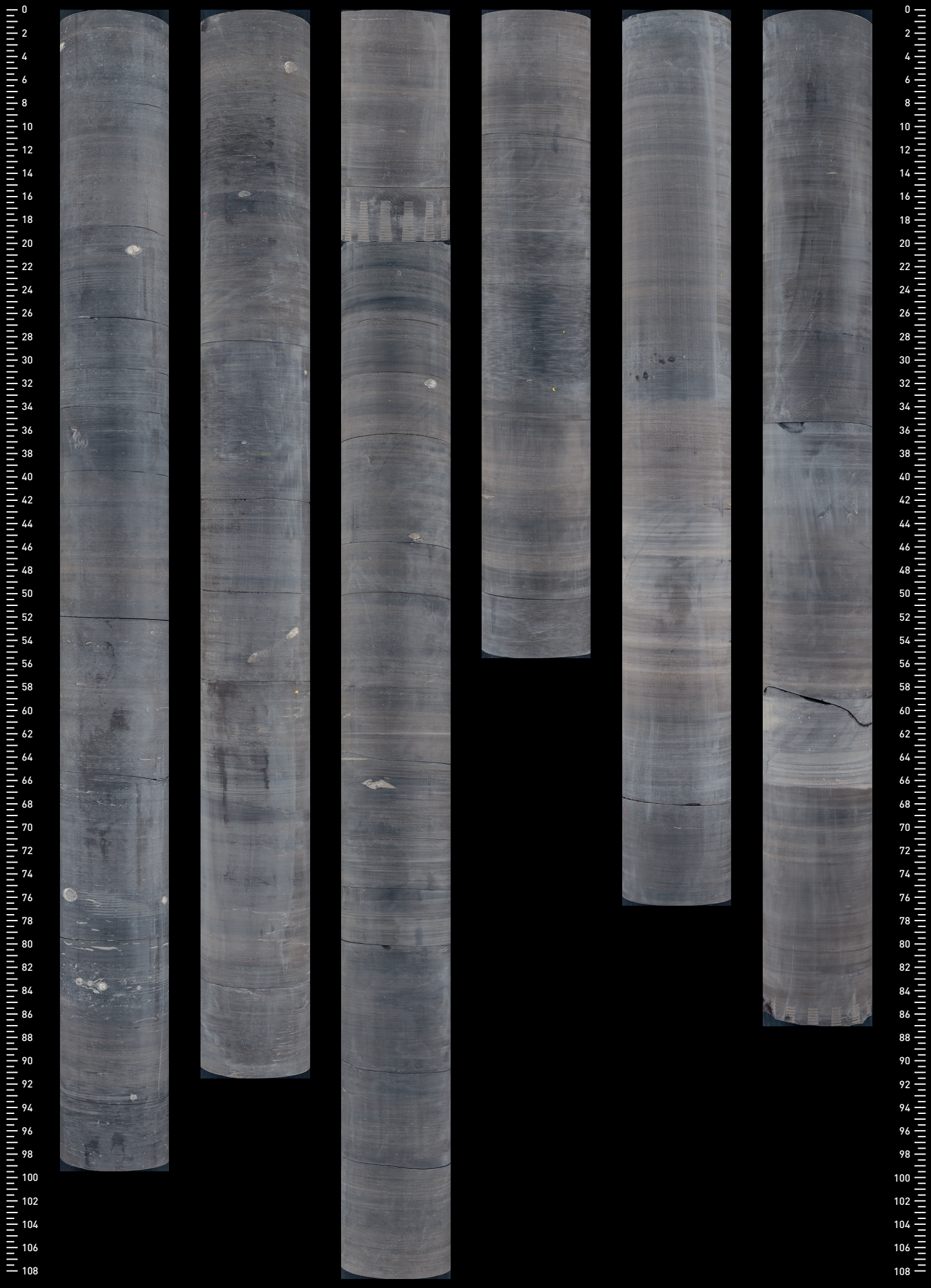
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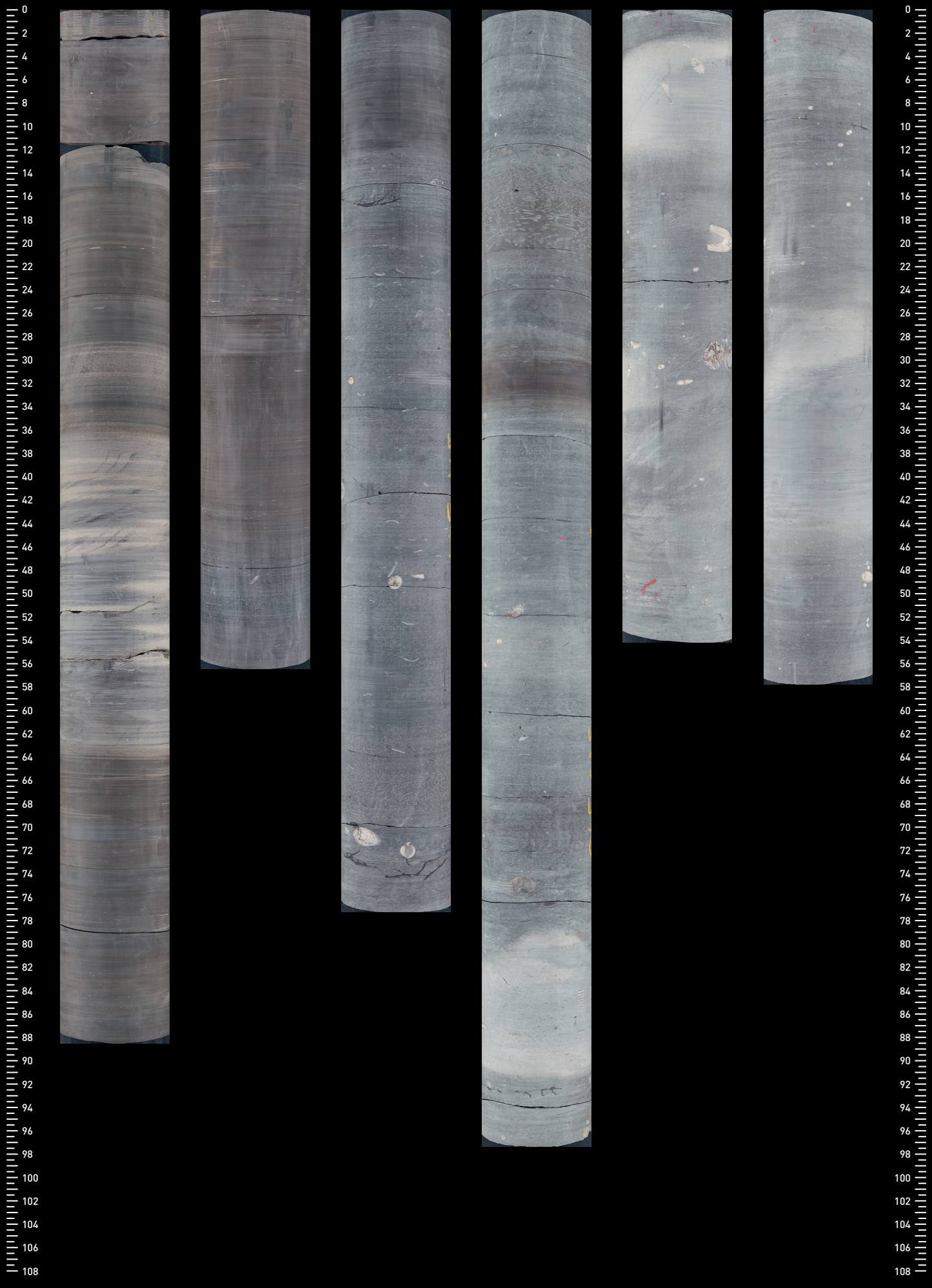
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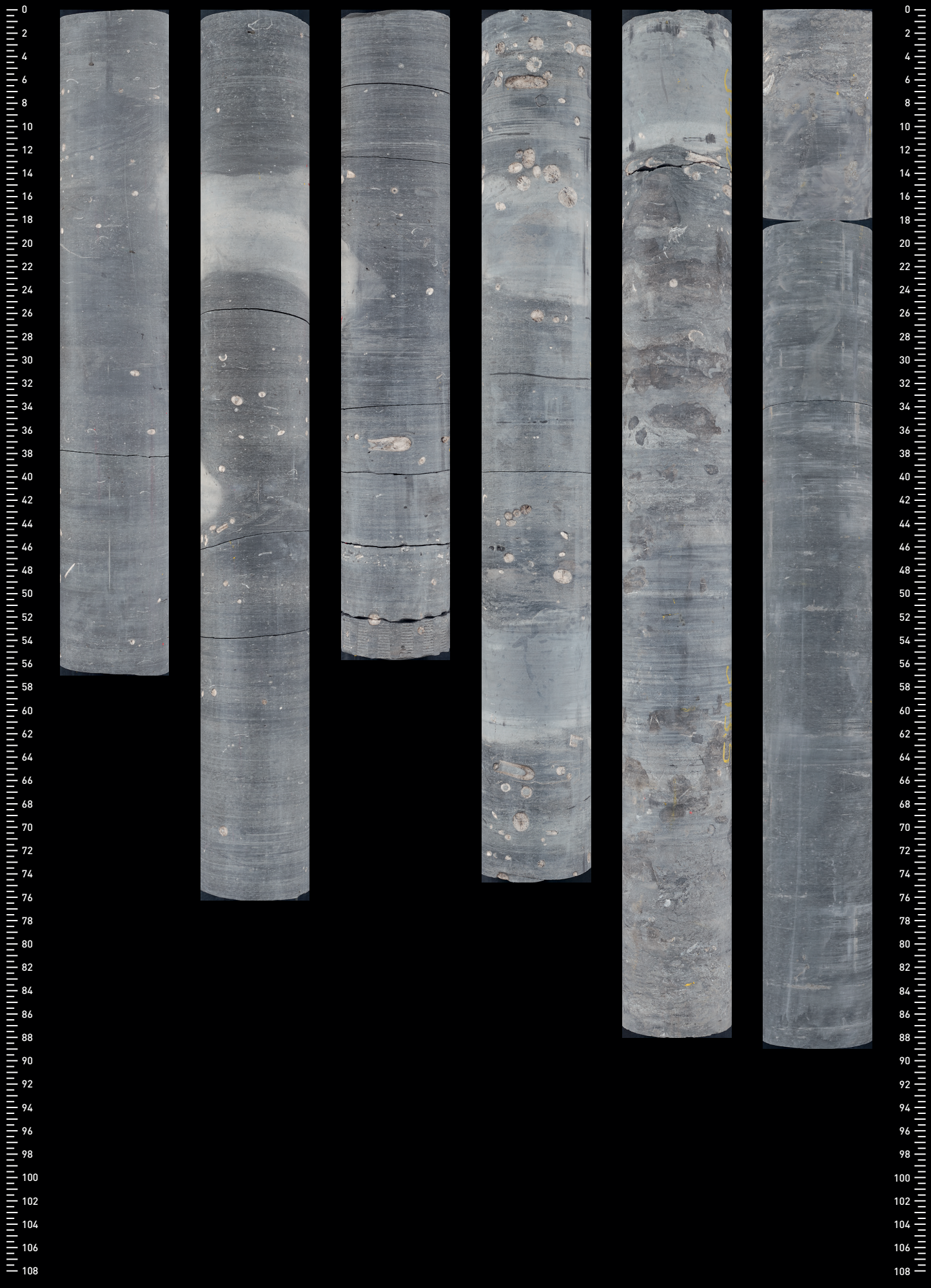
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942.20m 943.06m 943.61m 944.36m 945.31m 945.84m



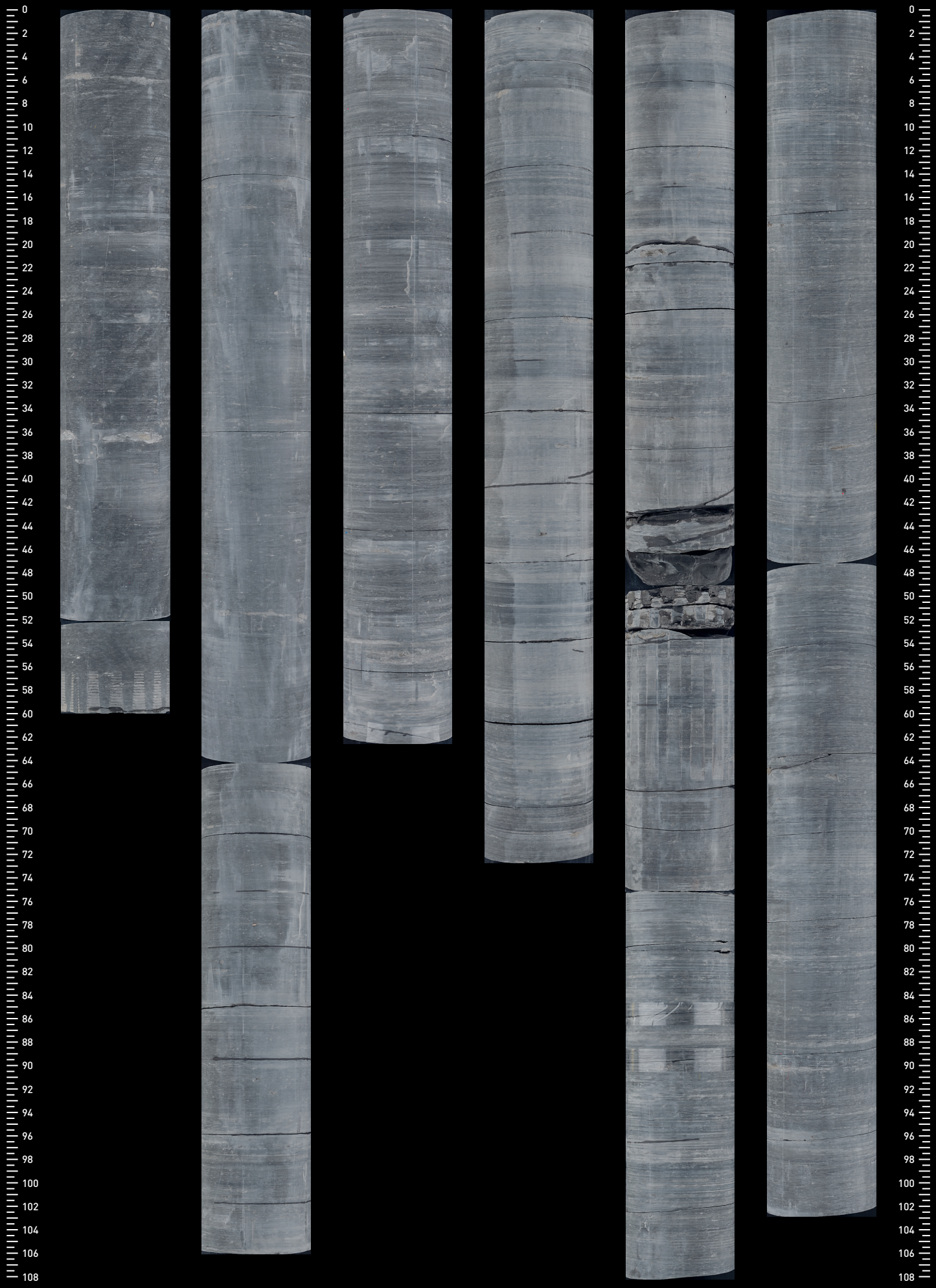
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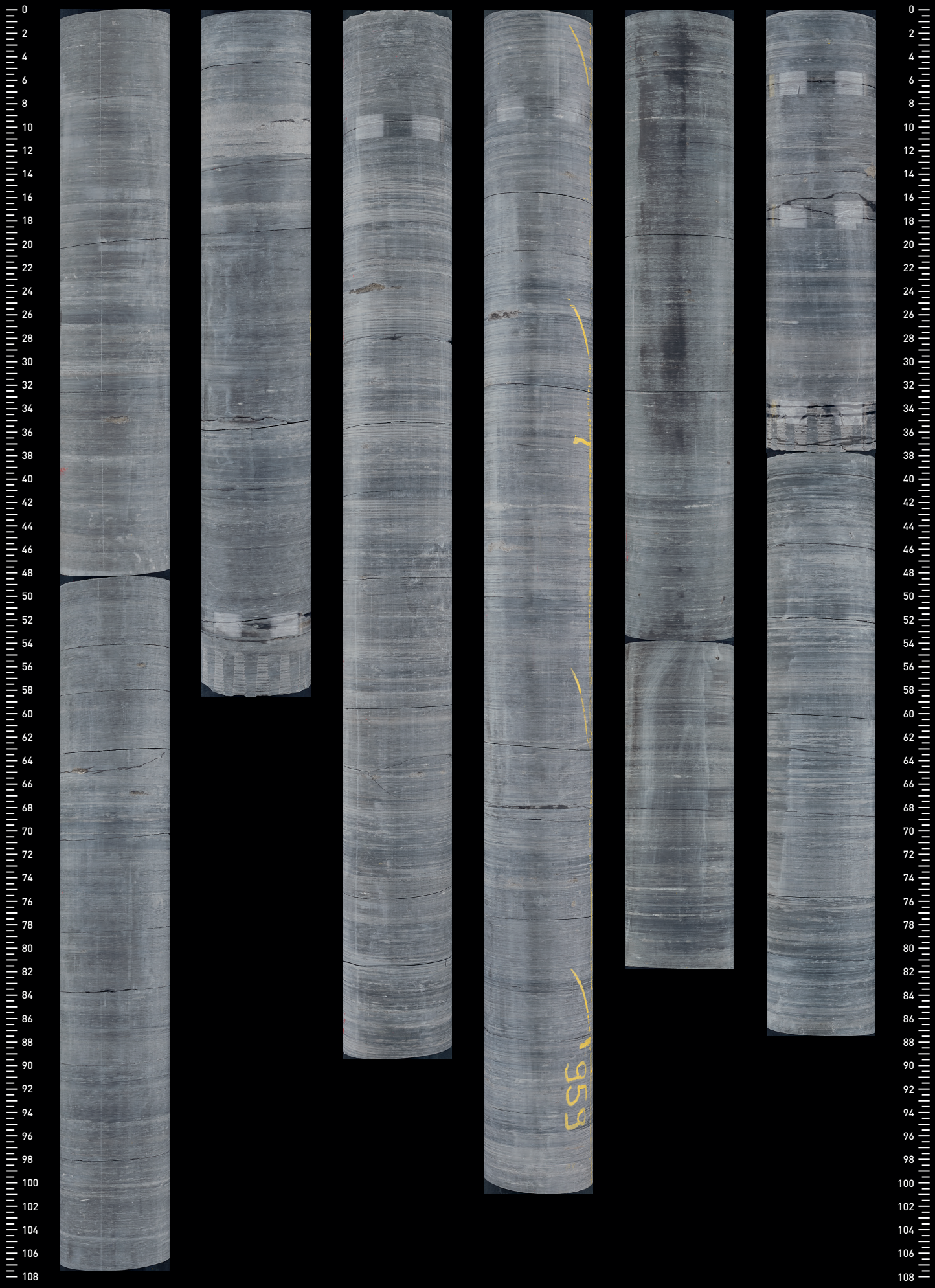
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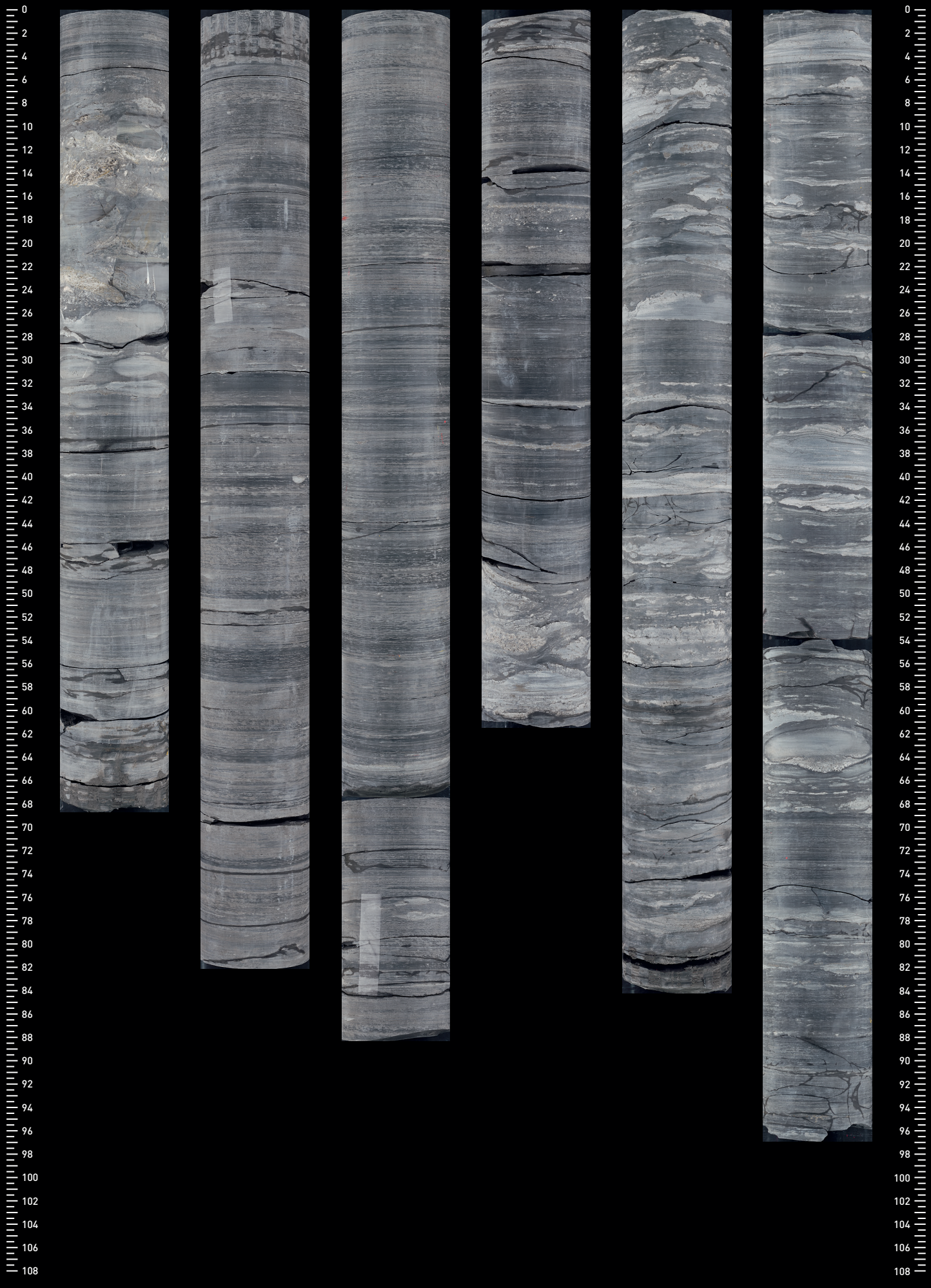
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961.81m 962.76m 963.38m 964.36m 964.96m 965.60m

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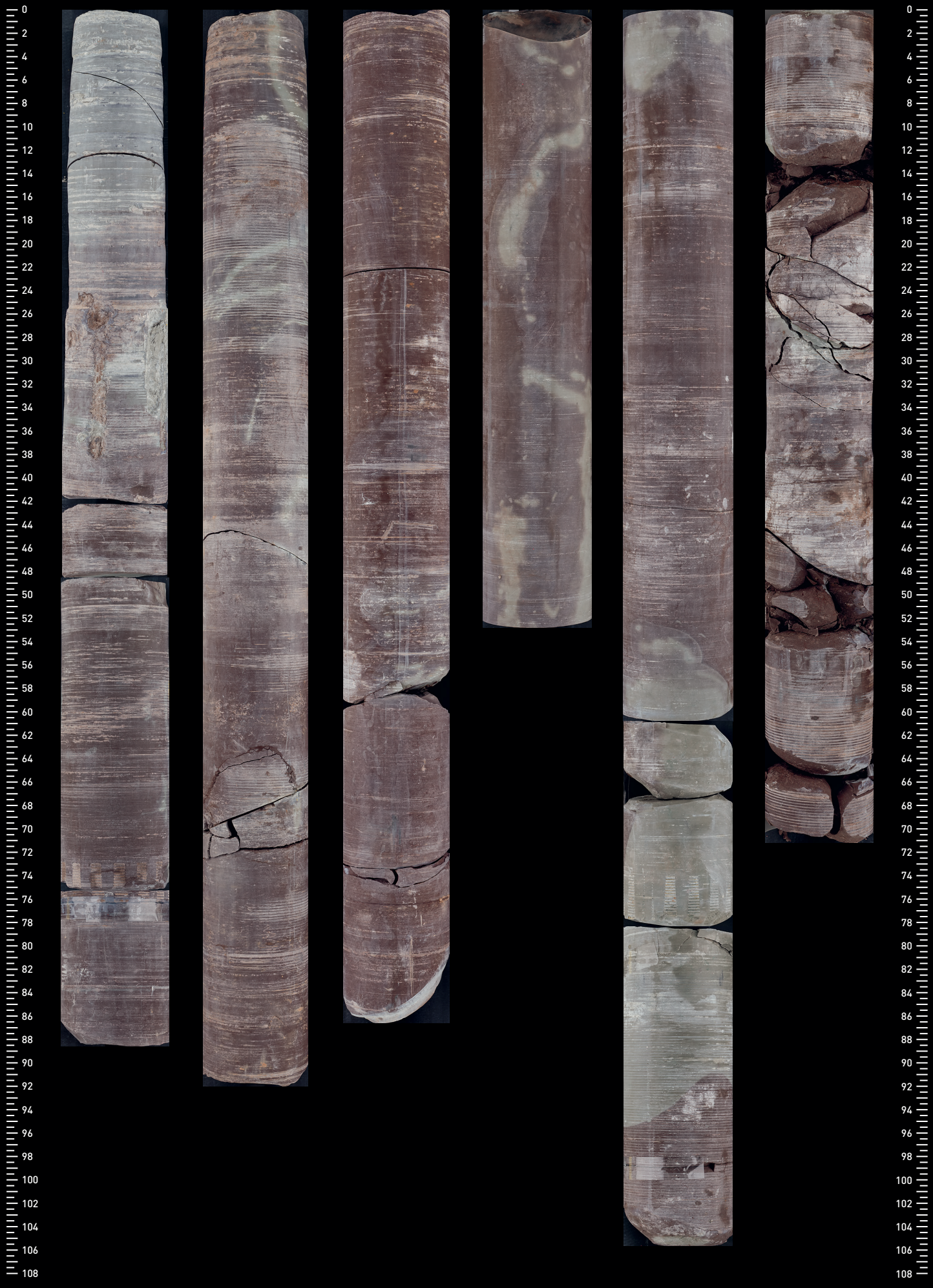
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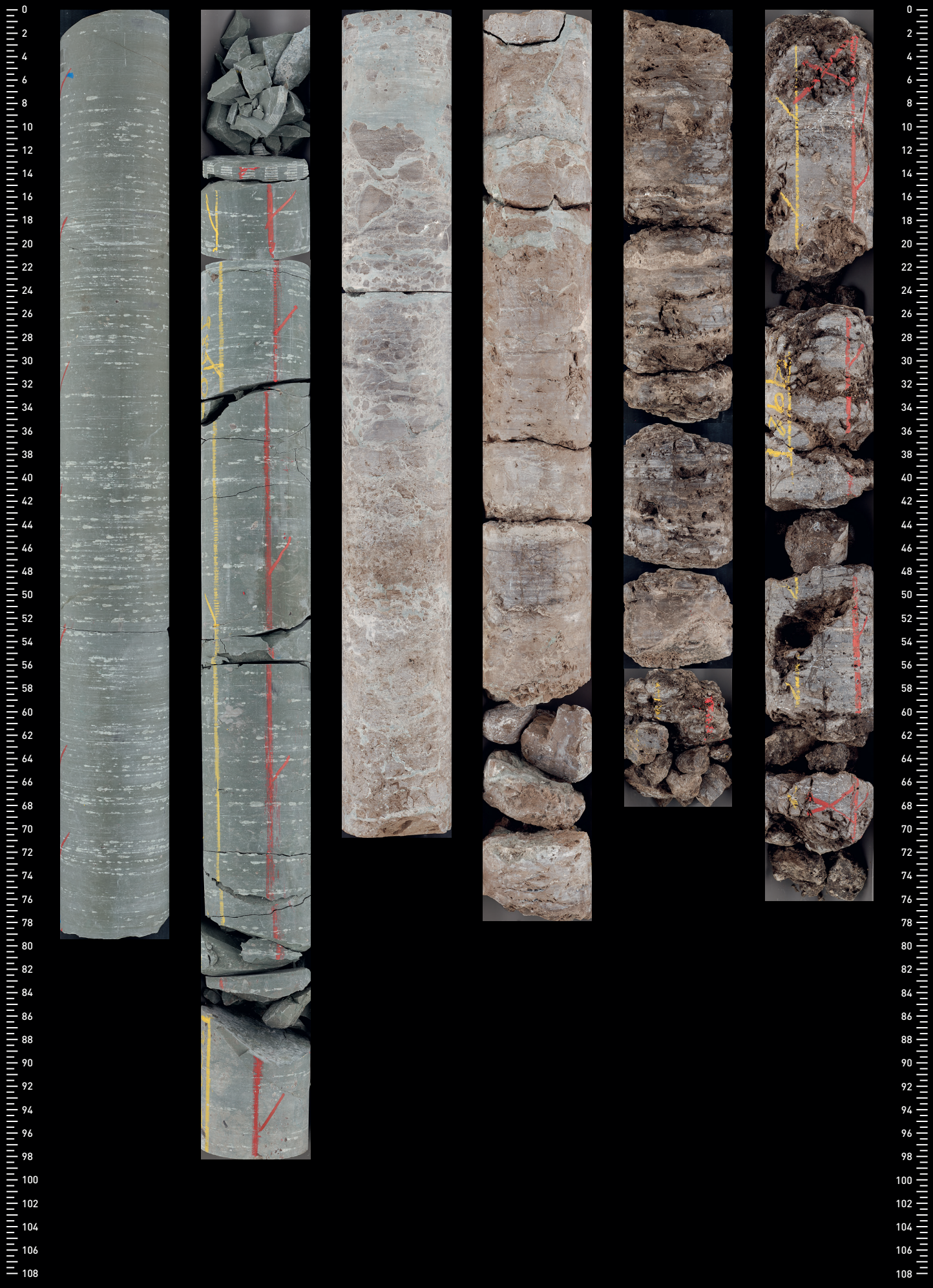
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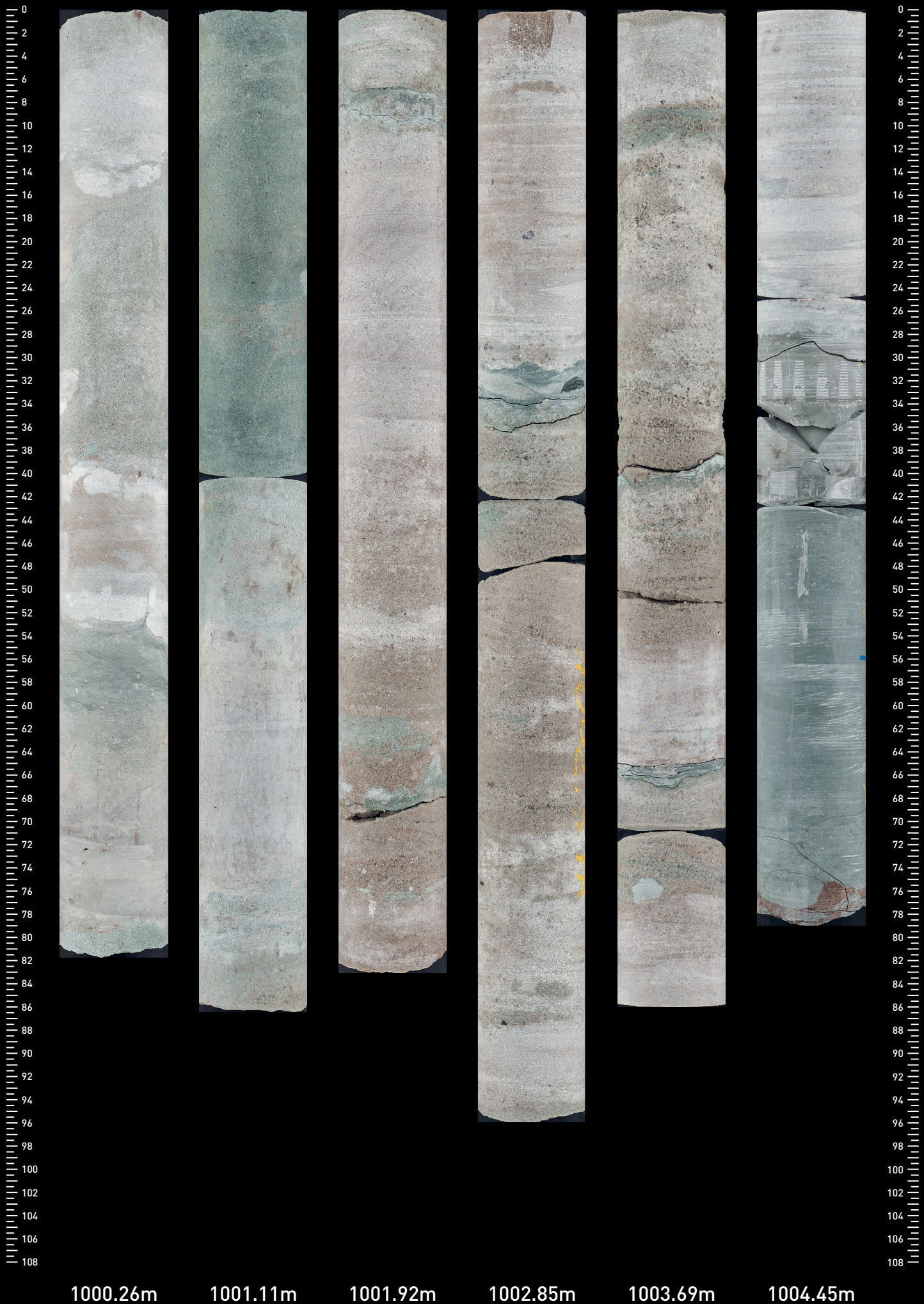


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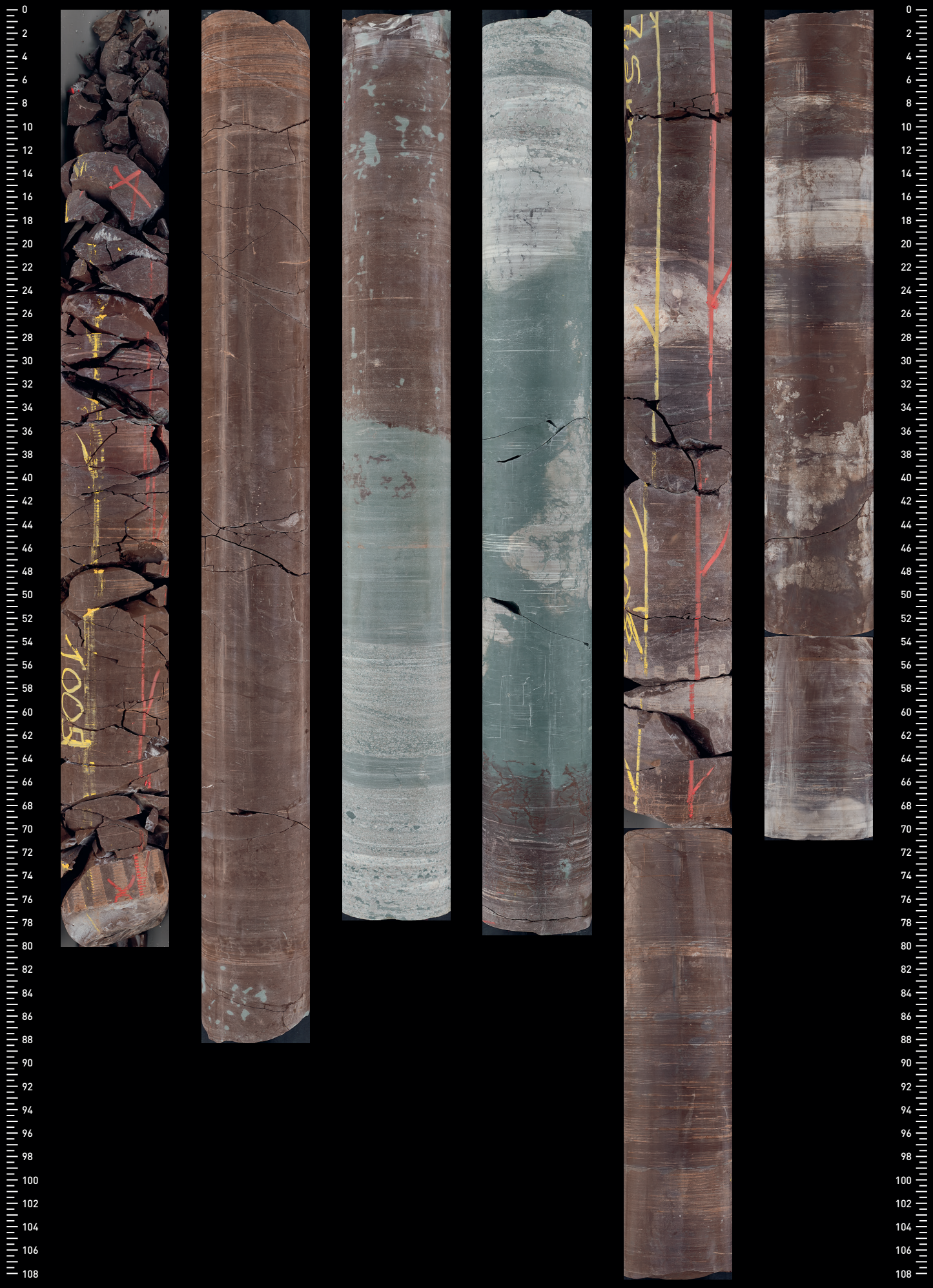
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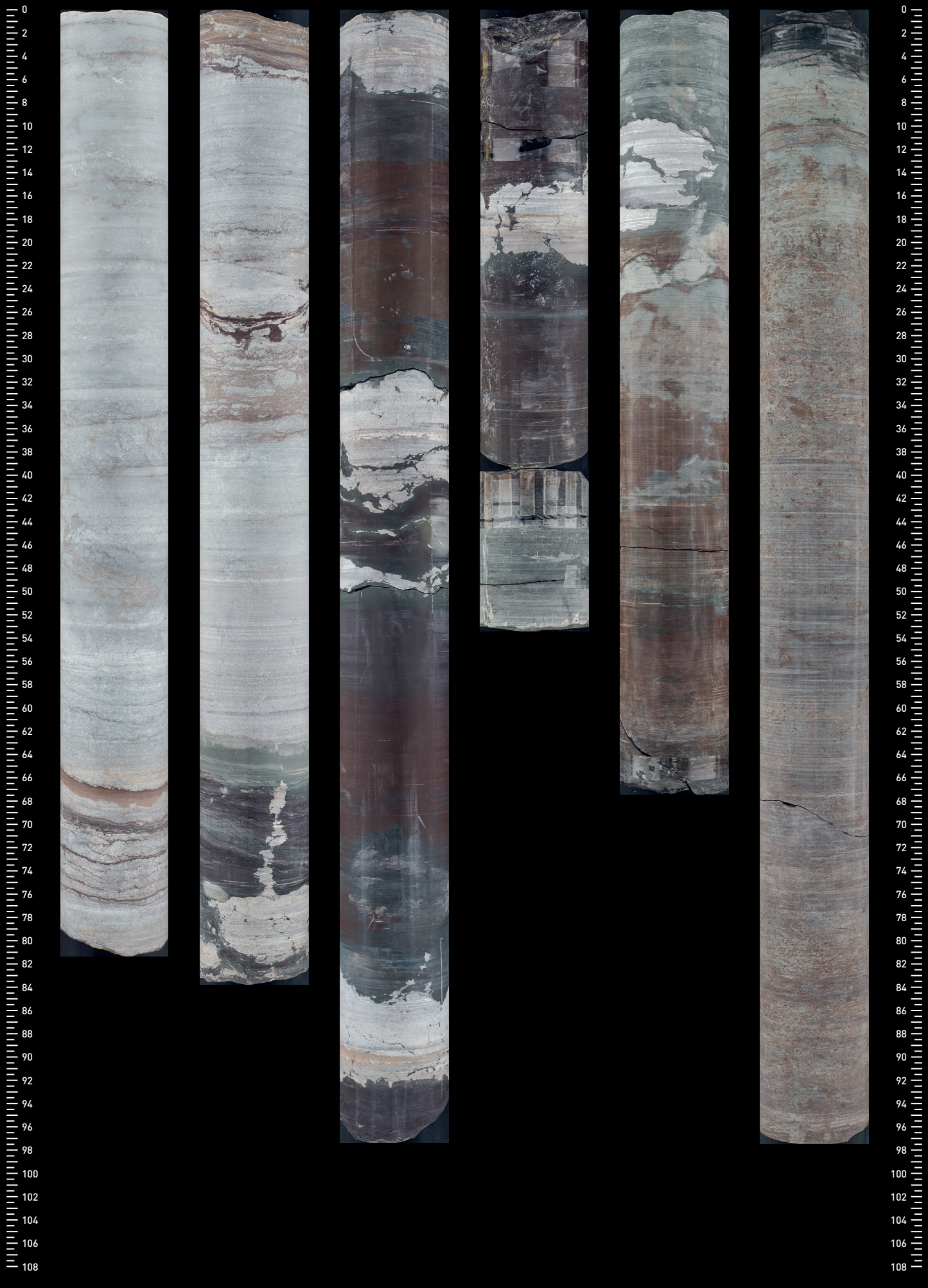
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1014.10m

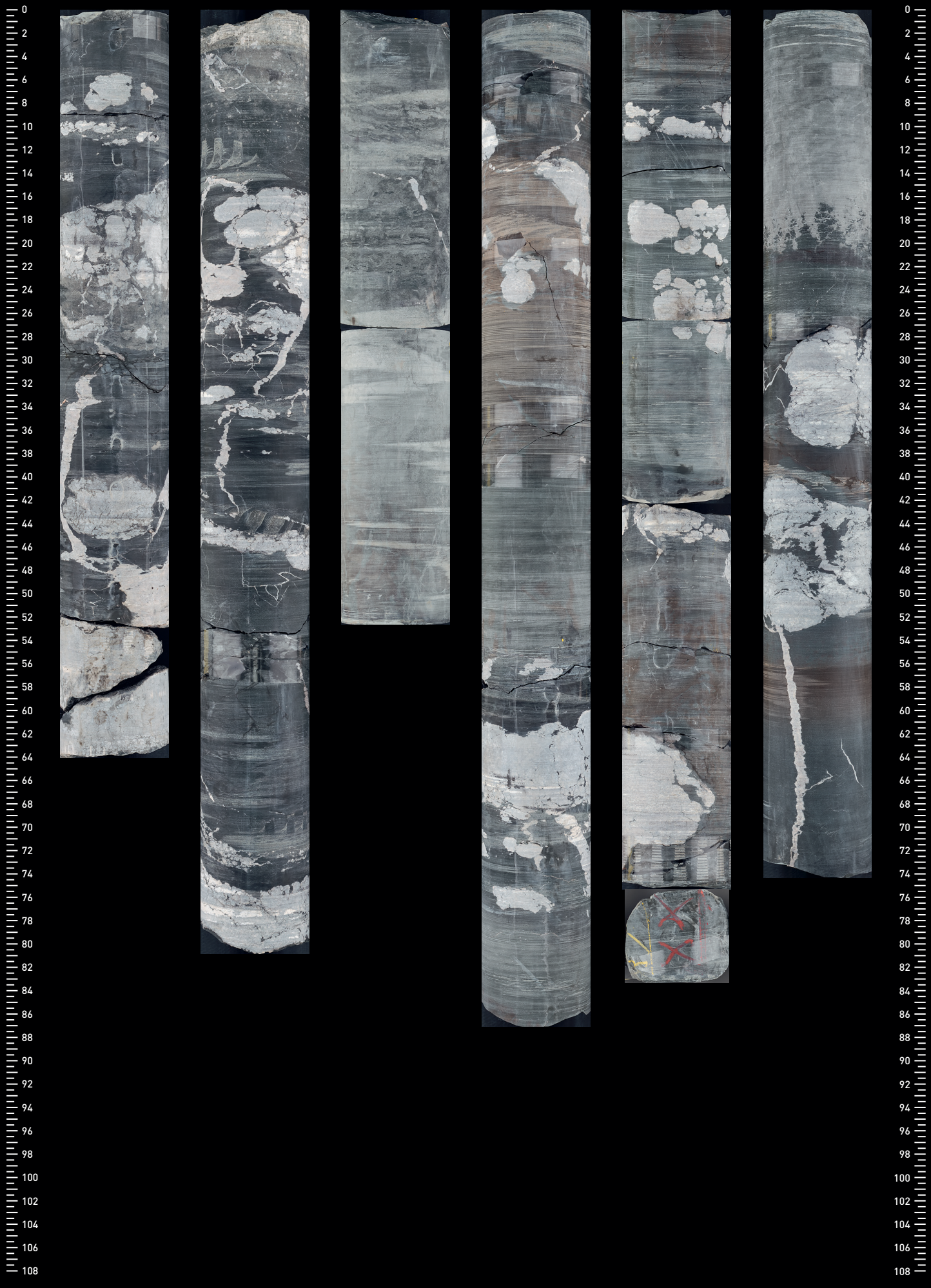
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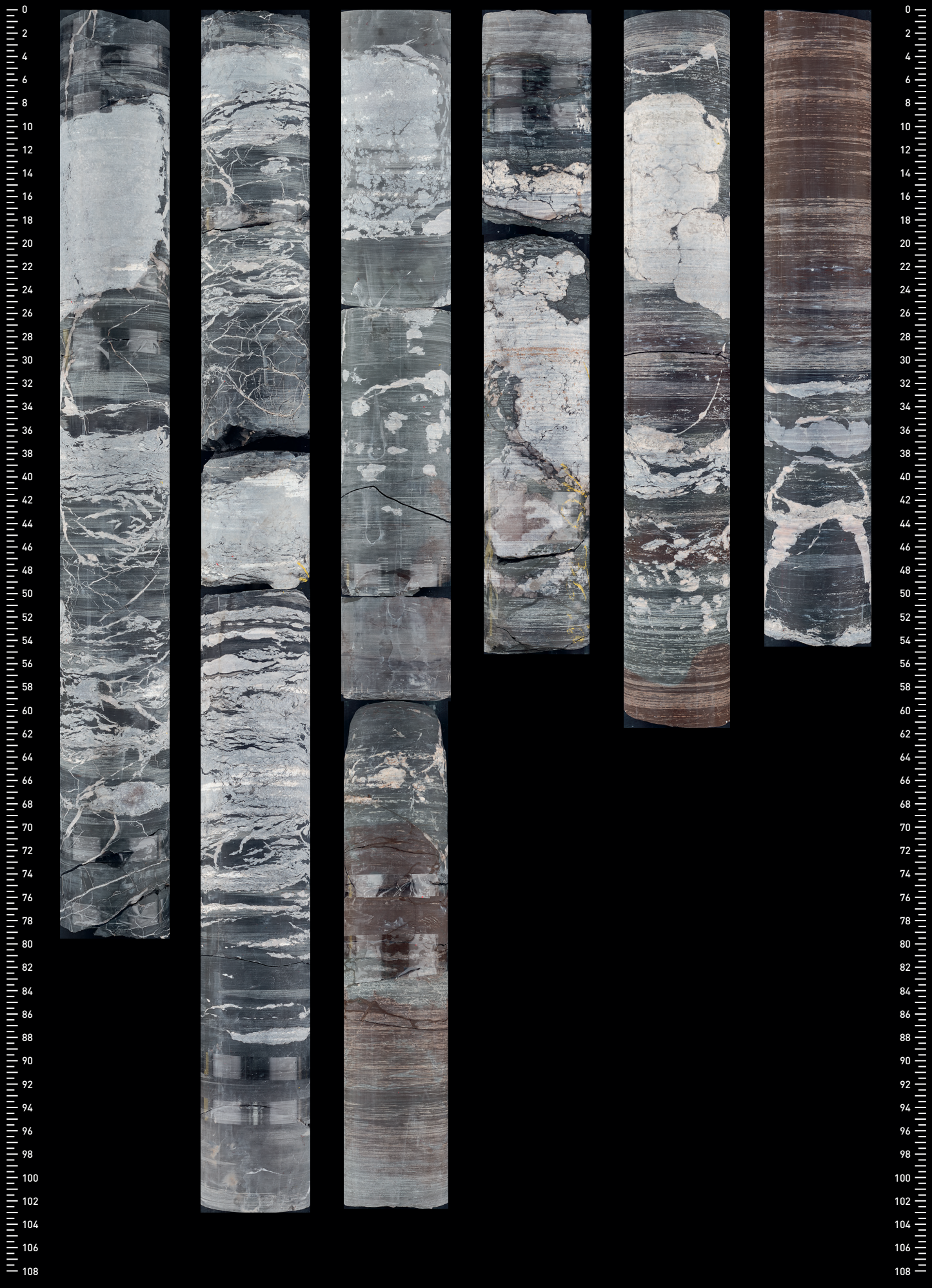
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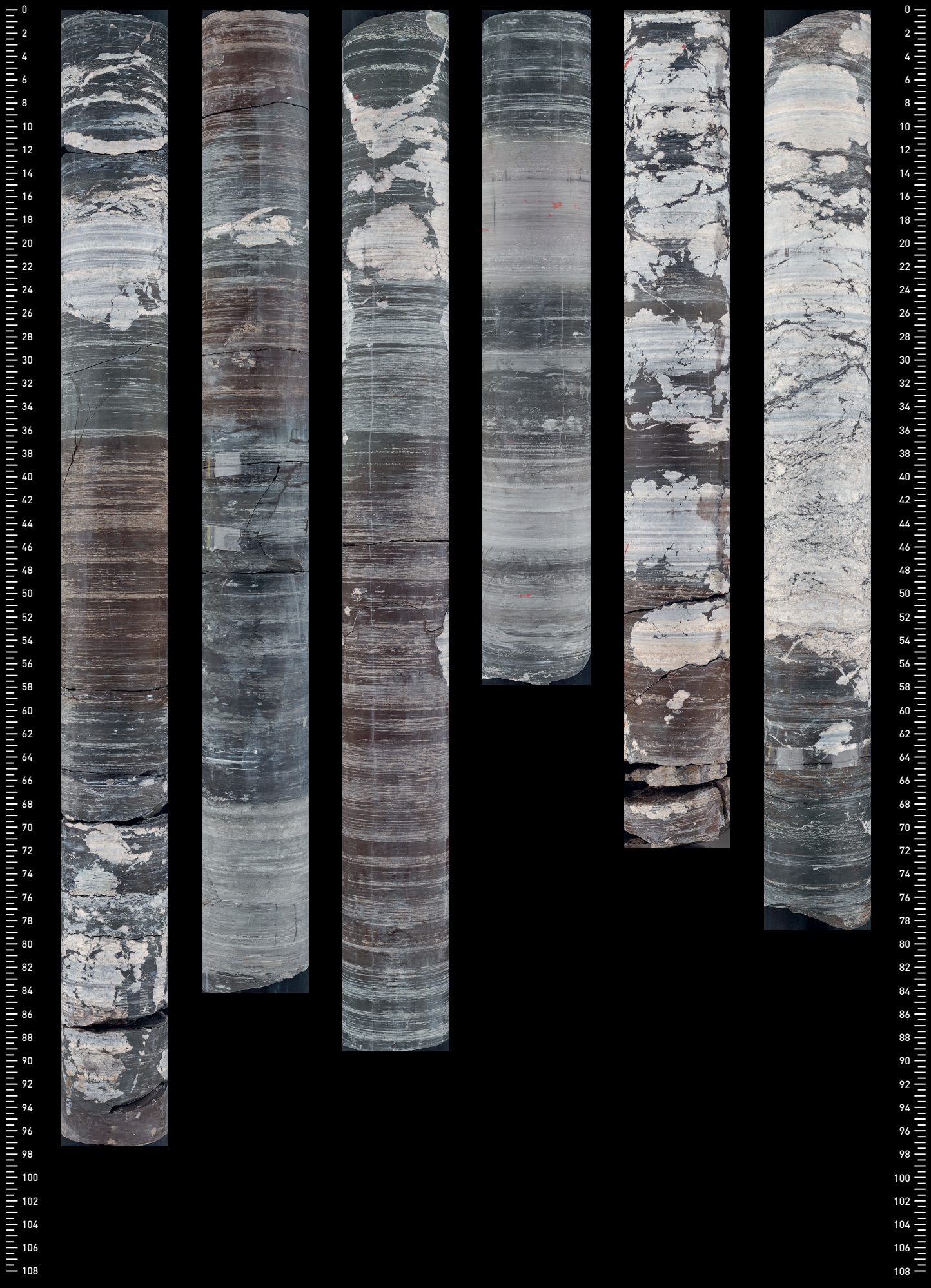

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1027.60m
1028.45m


1028.45m
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1029.85m
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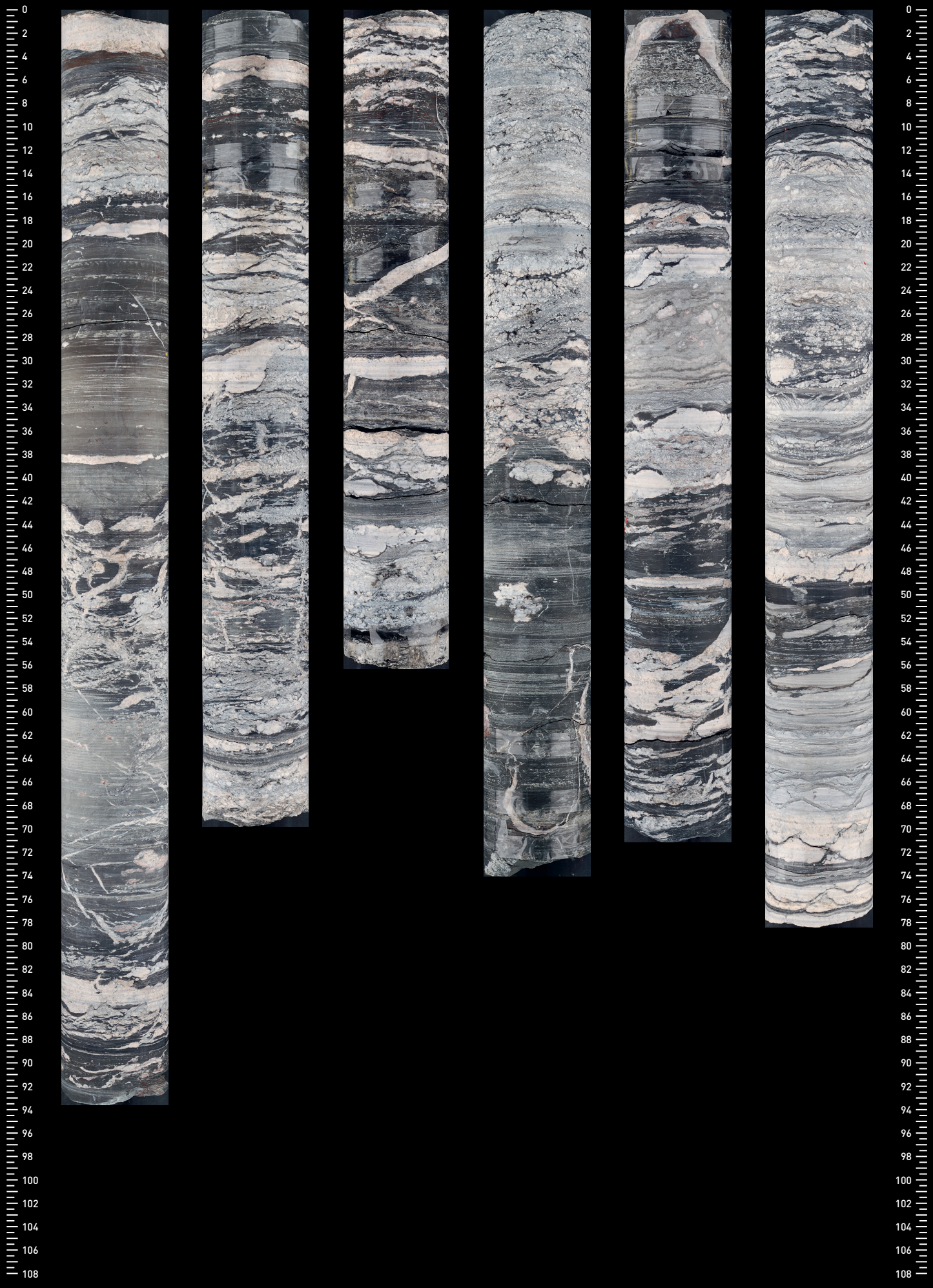
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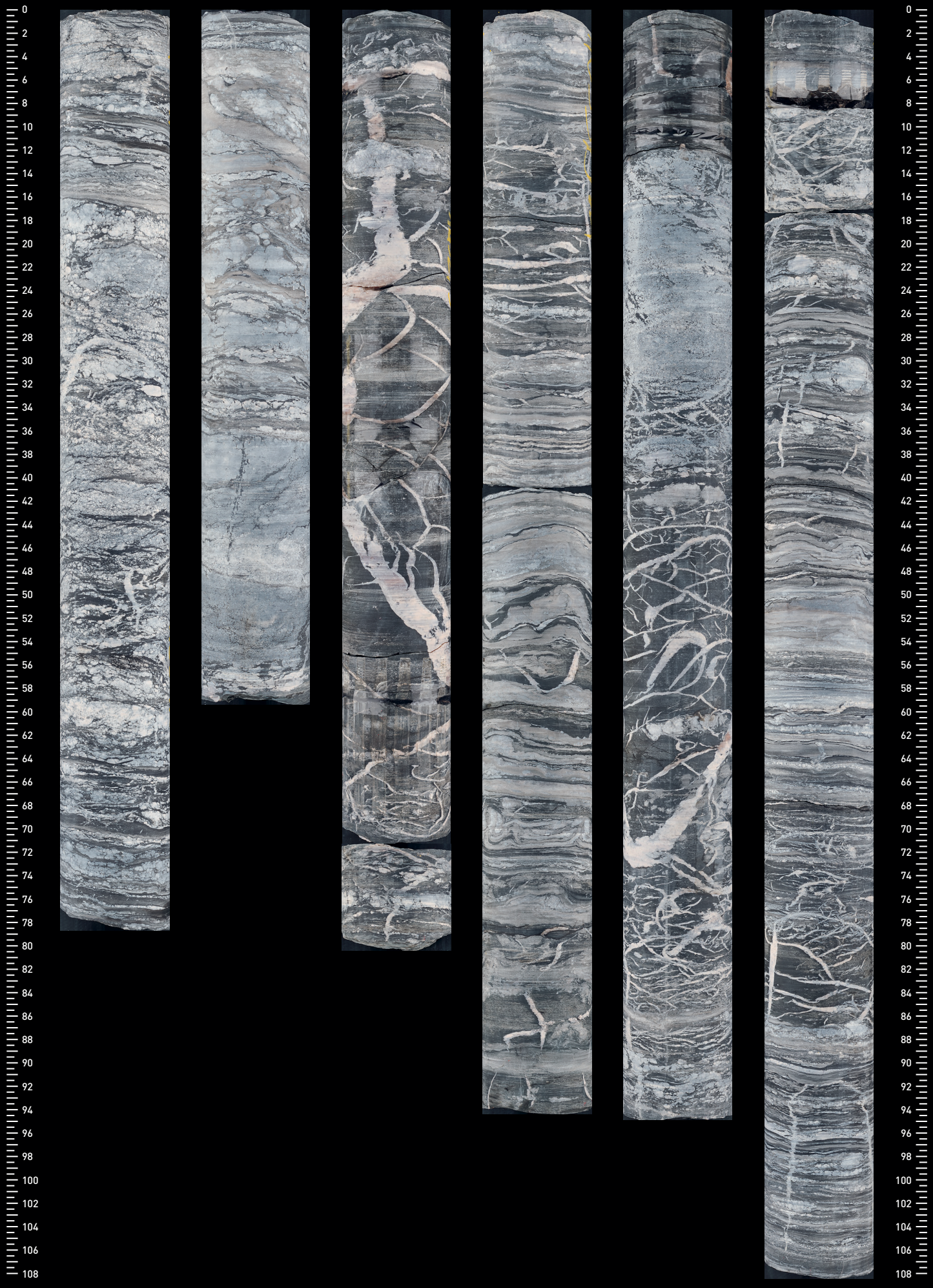
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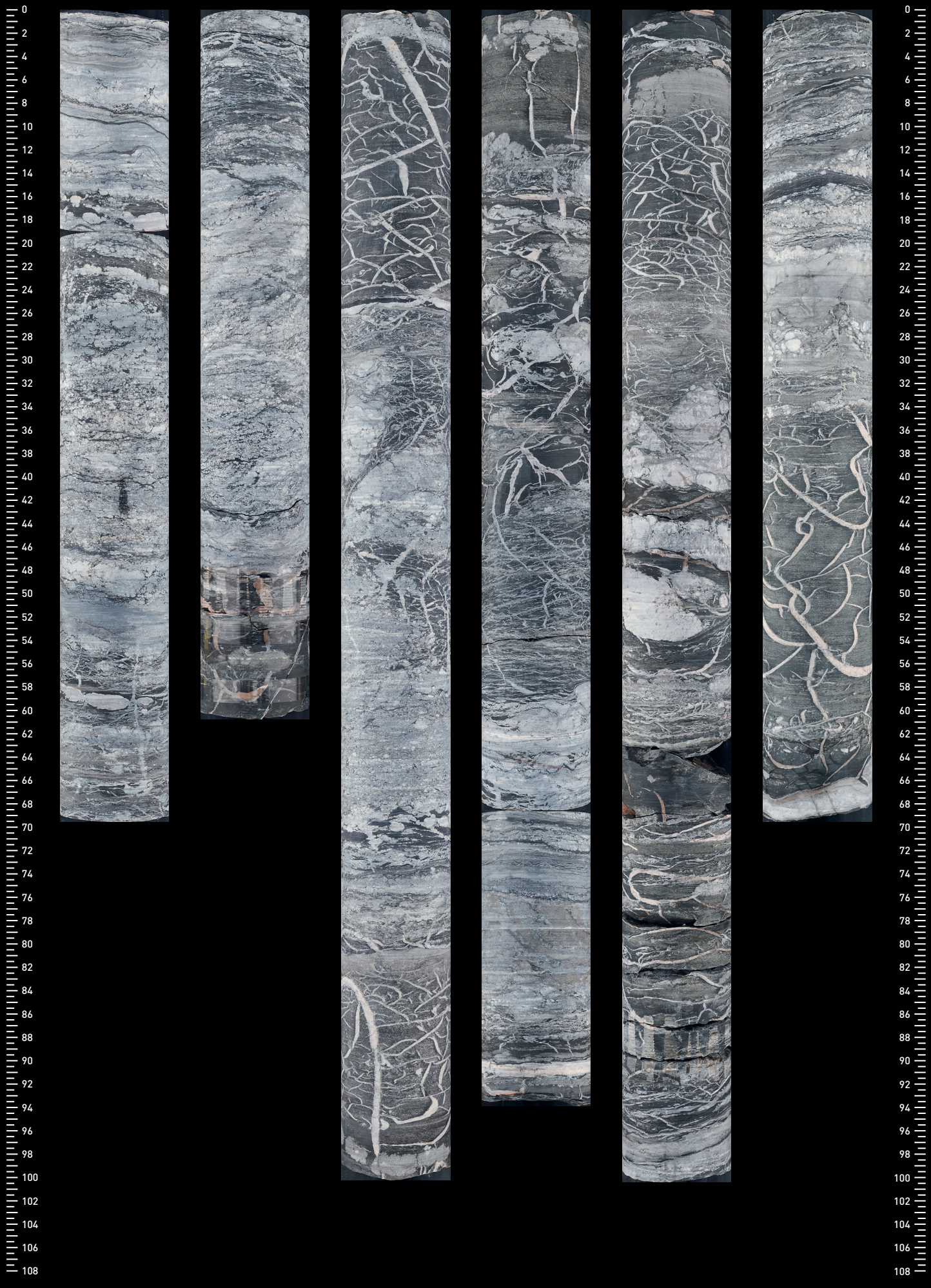
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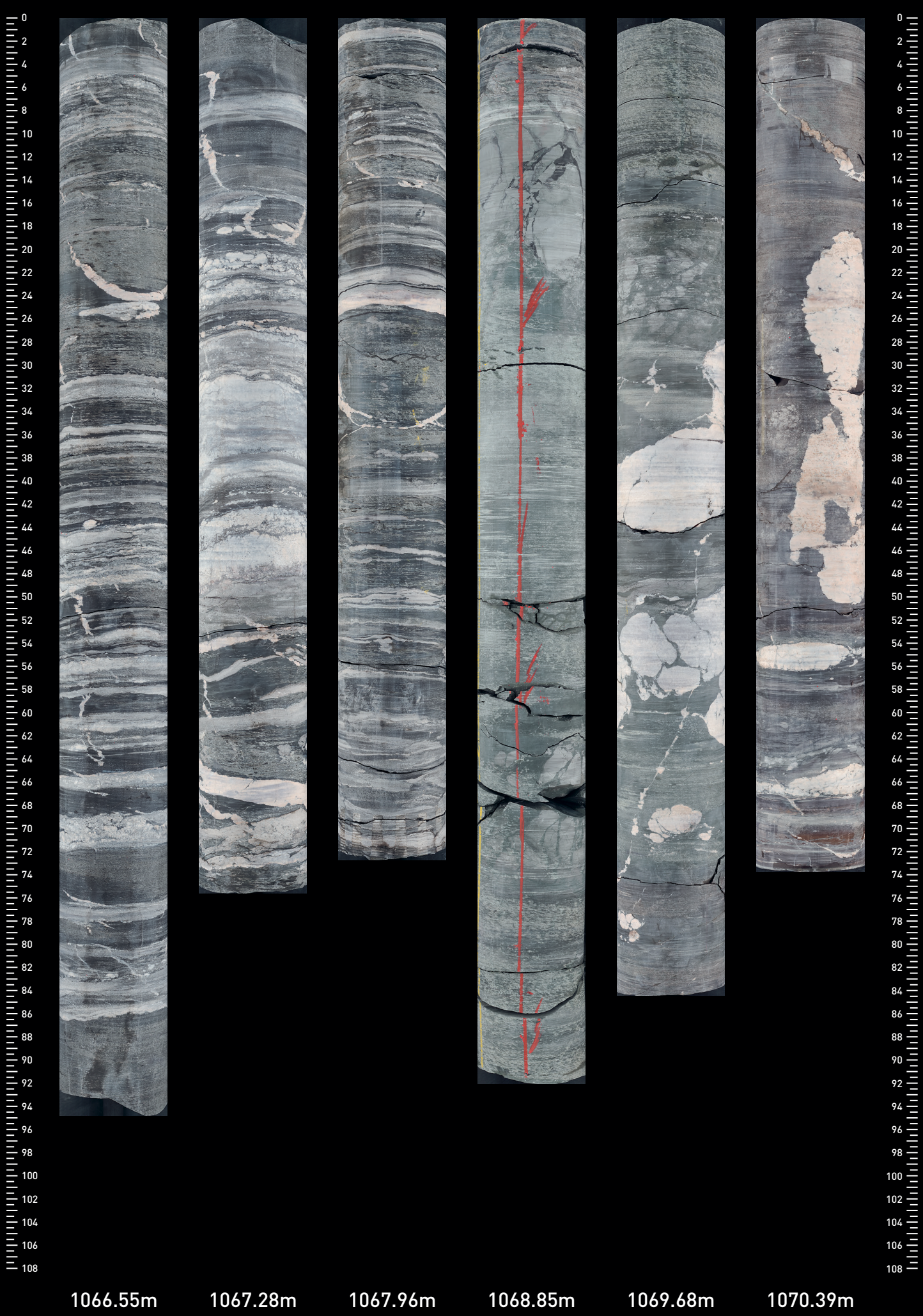
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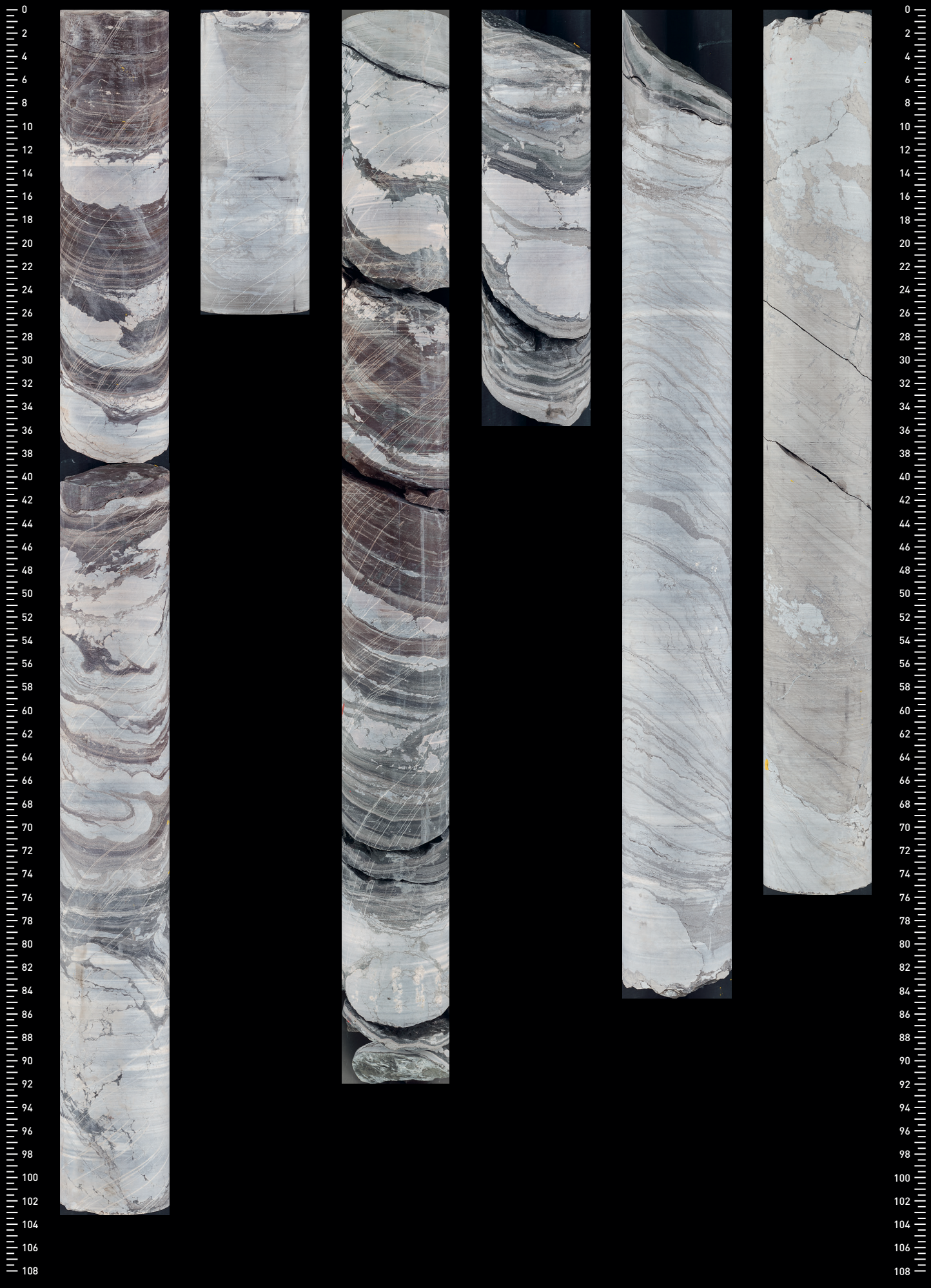
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1078.81m

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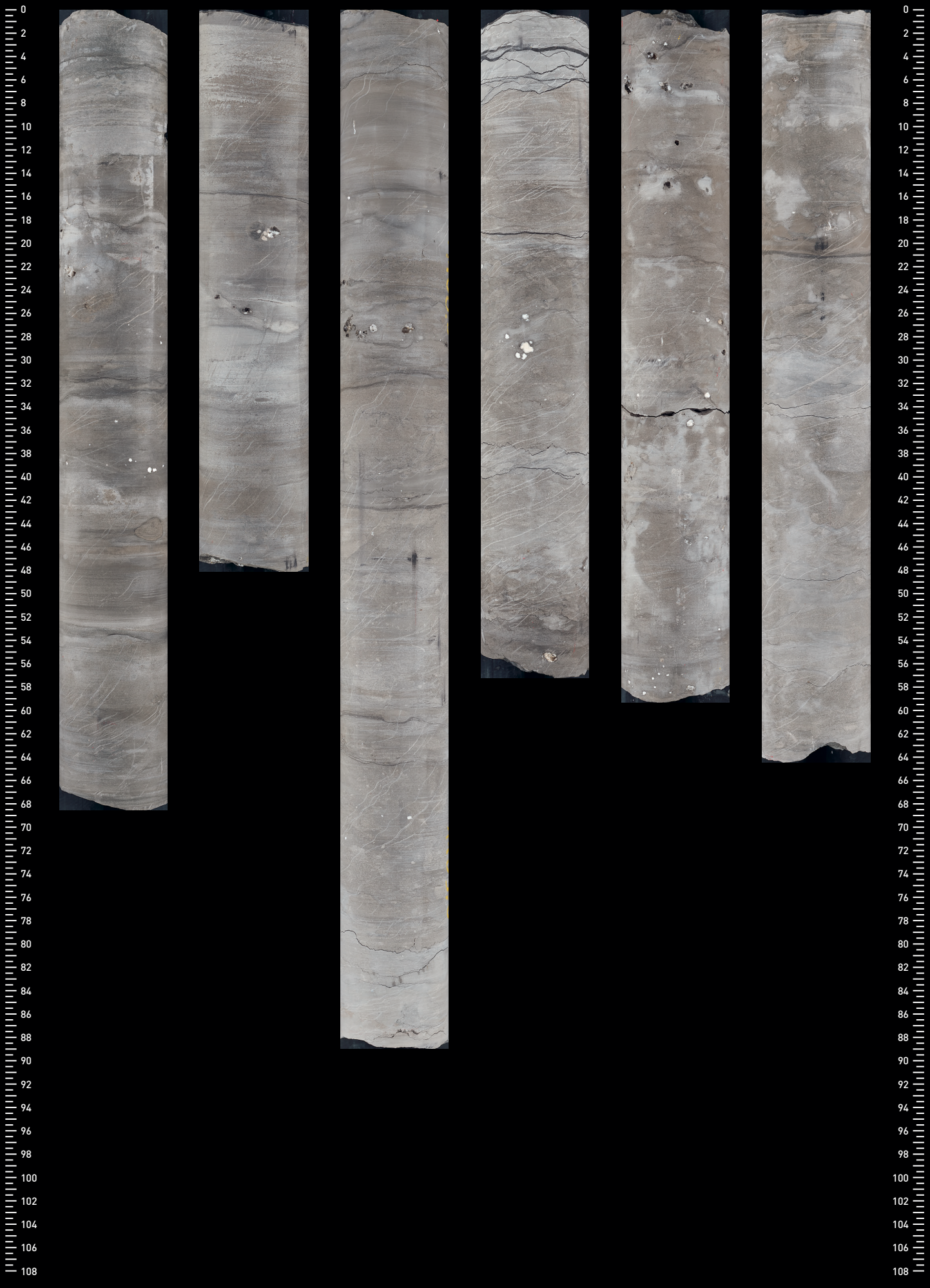
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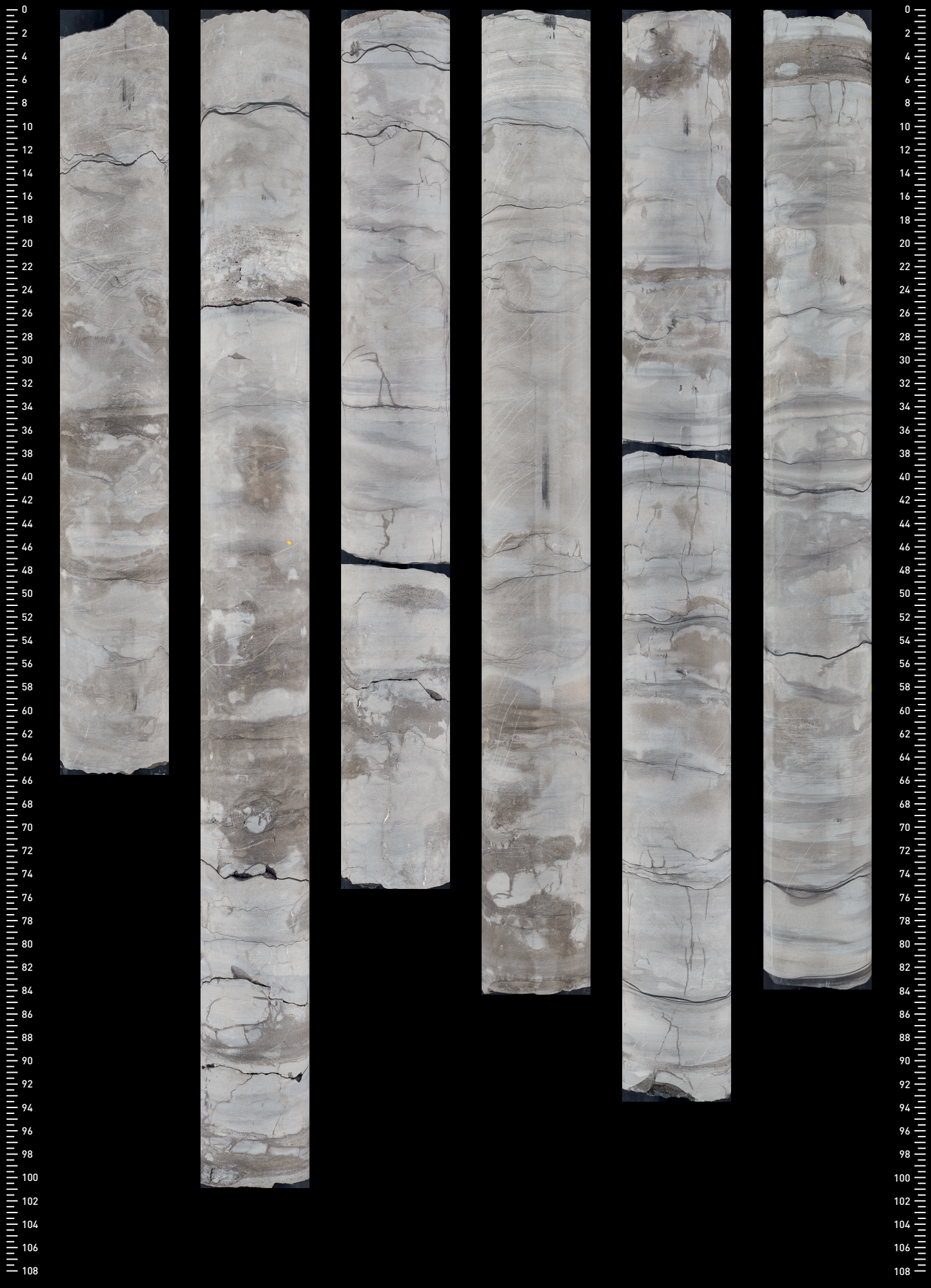
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1107.17m 1107.82m 1108.29m 1109.14m 1109.69m 1110.25m



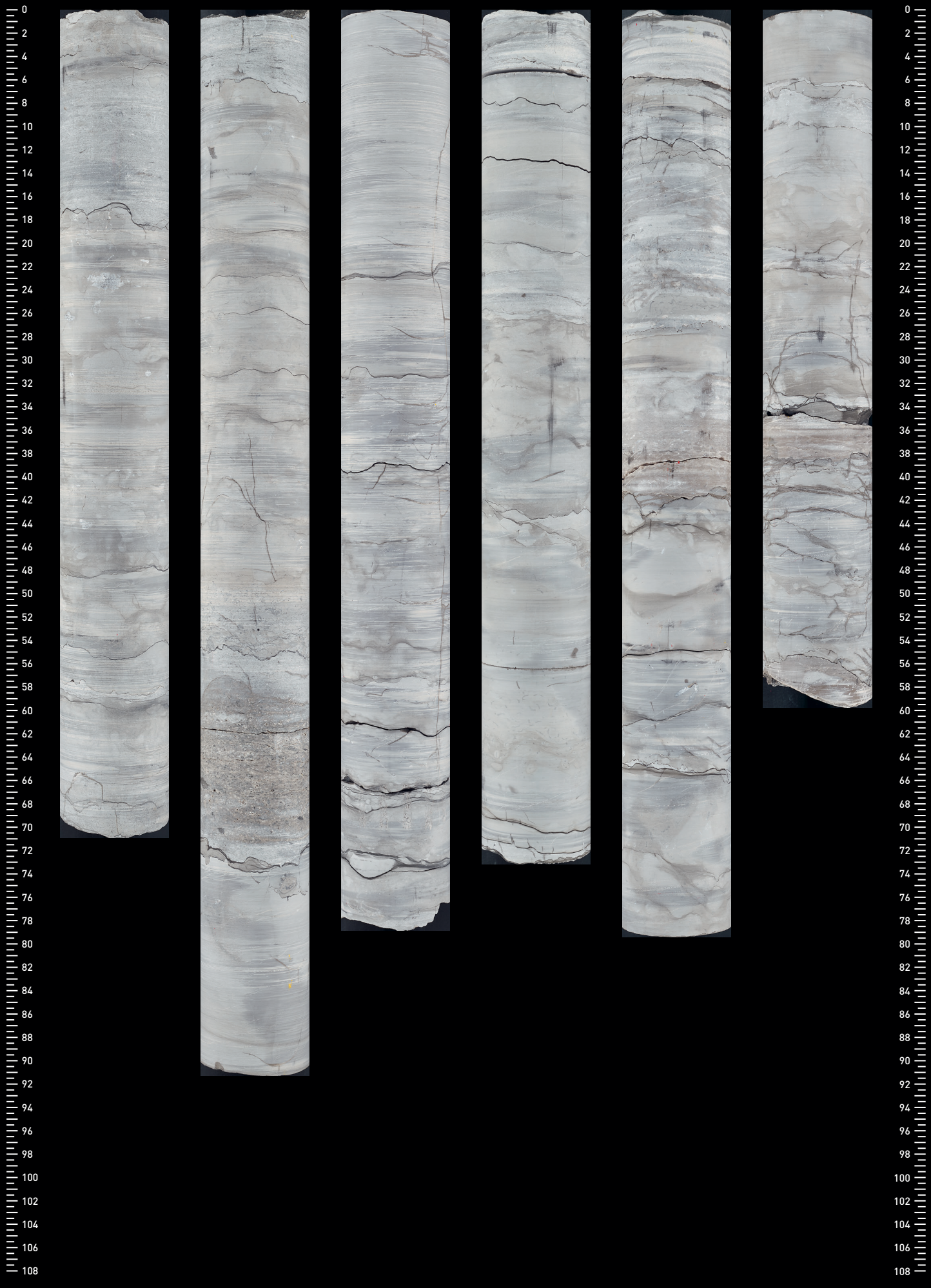
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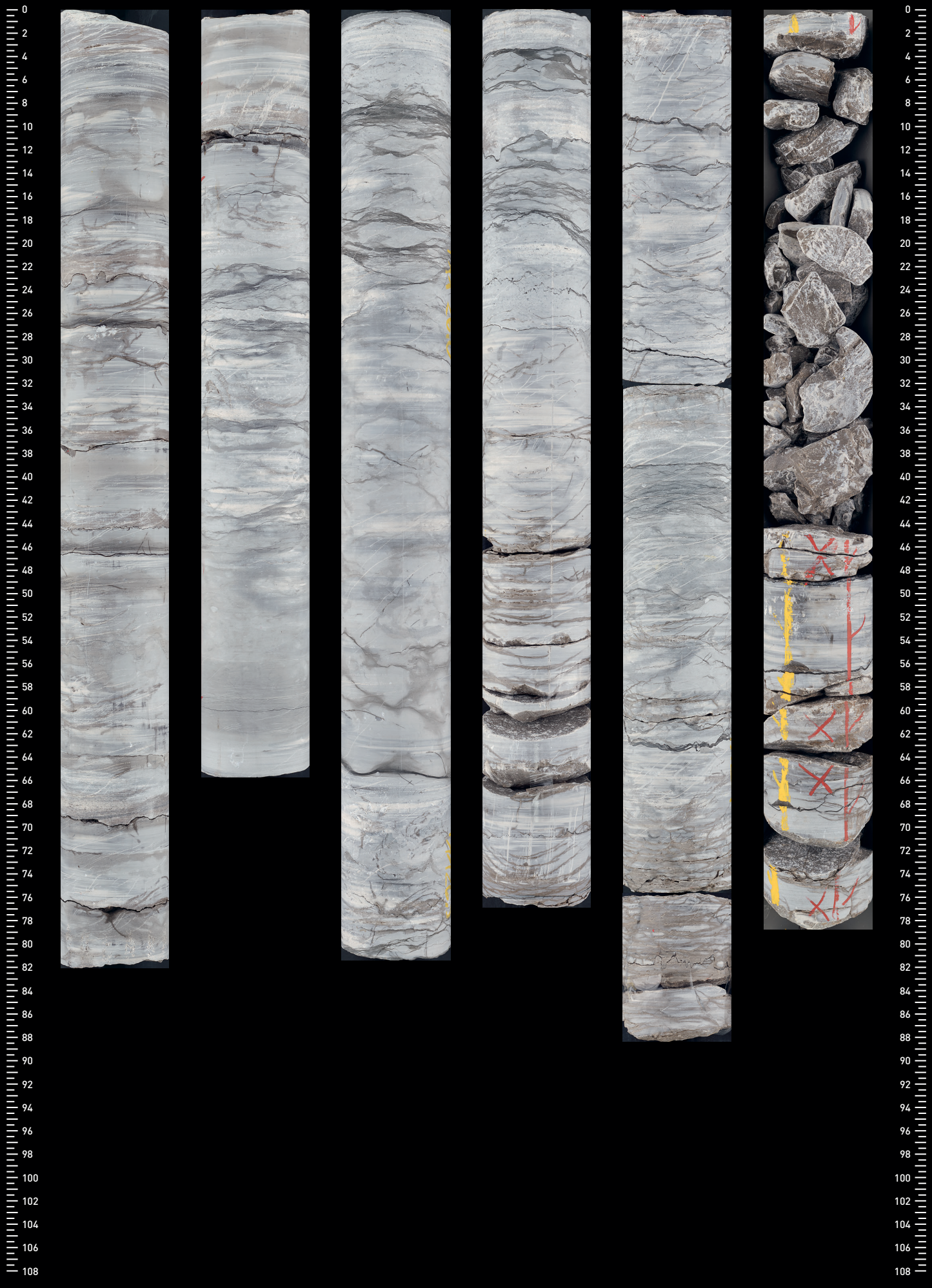
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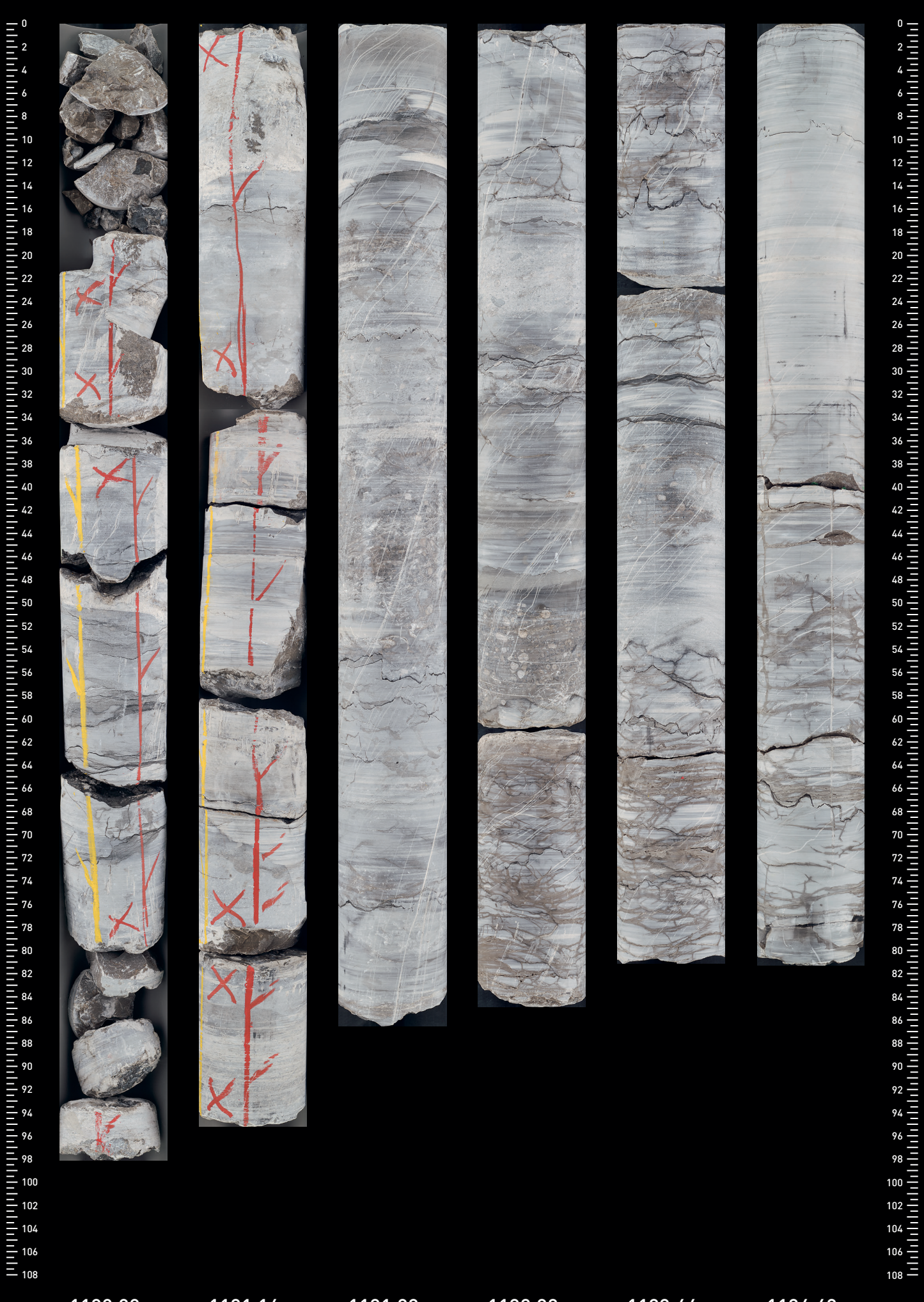
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1124.37m 1125.18m 1125.82m 1126.60m 1127.37m 1128.23m



1125.18m 1125.82m 1126.60m 1127.37m 1128.23m 1129.00m


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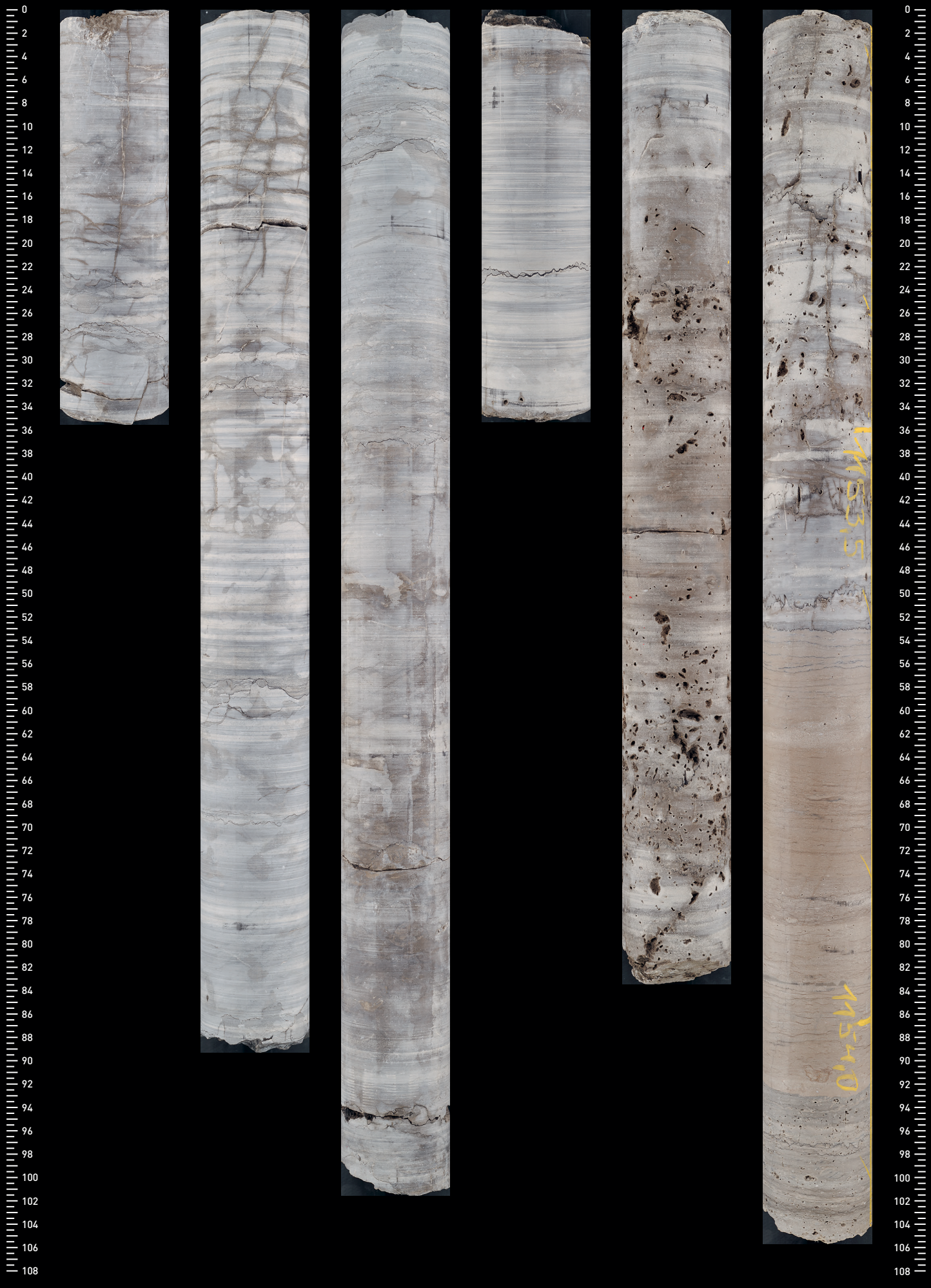
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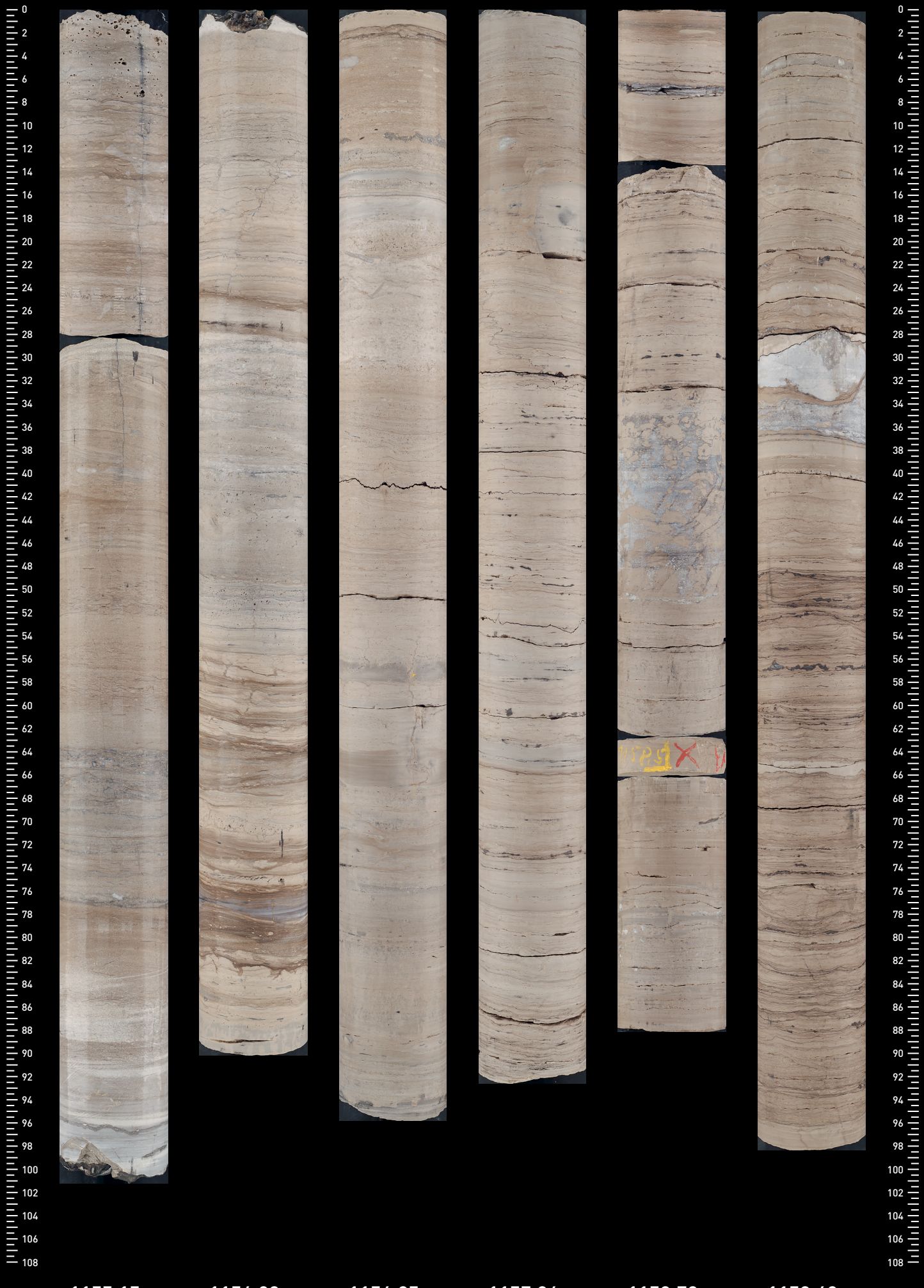


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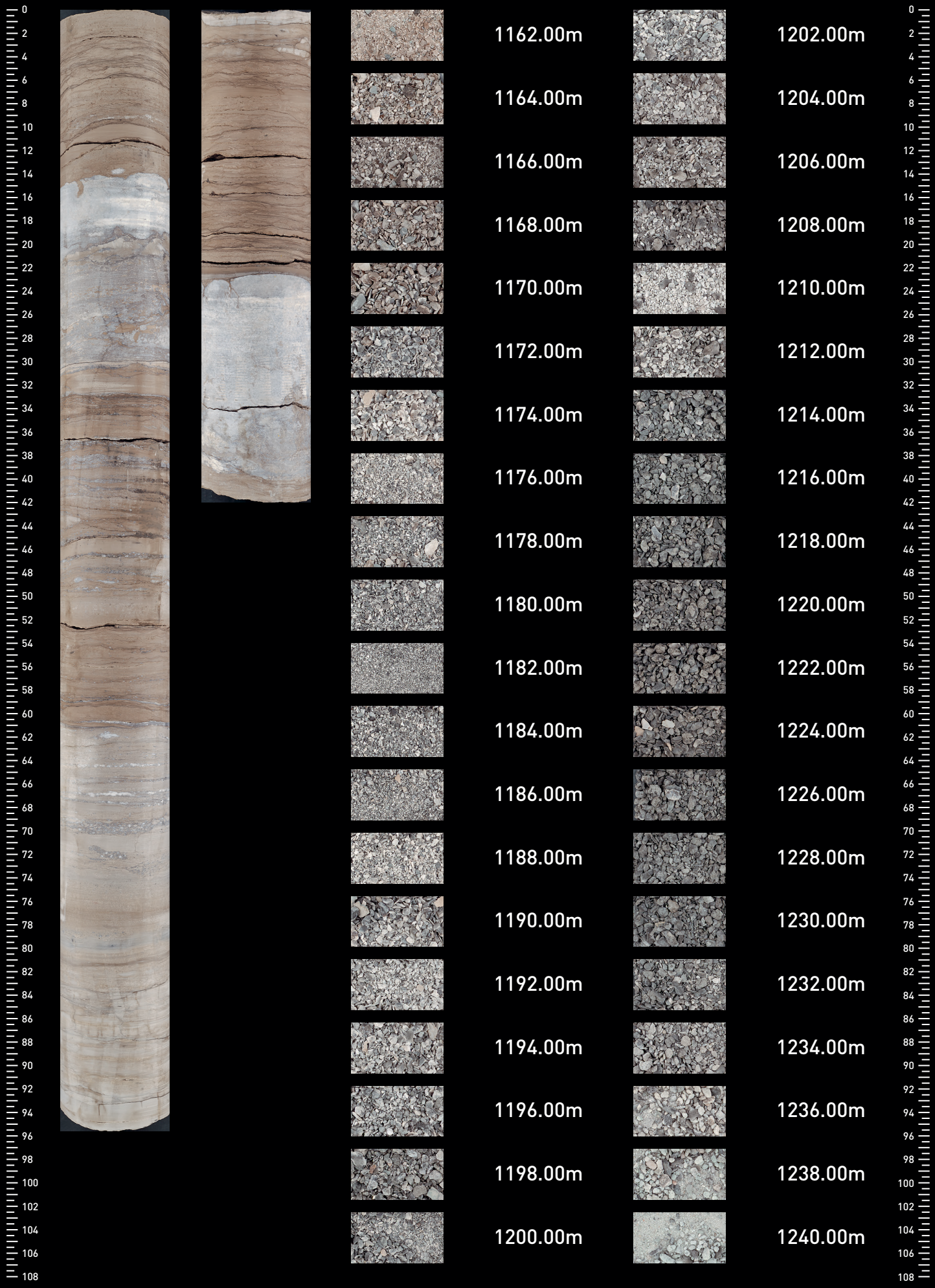

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1160.61m 1161.03m 1200.00m 1240.00m

1242.00m 1282.00m



1280.00m 1310.00m

4 Trüllikon-1-1 resinated corelab composites

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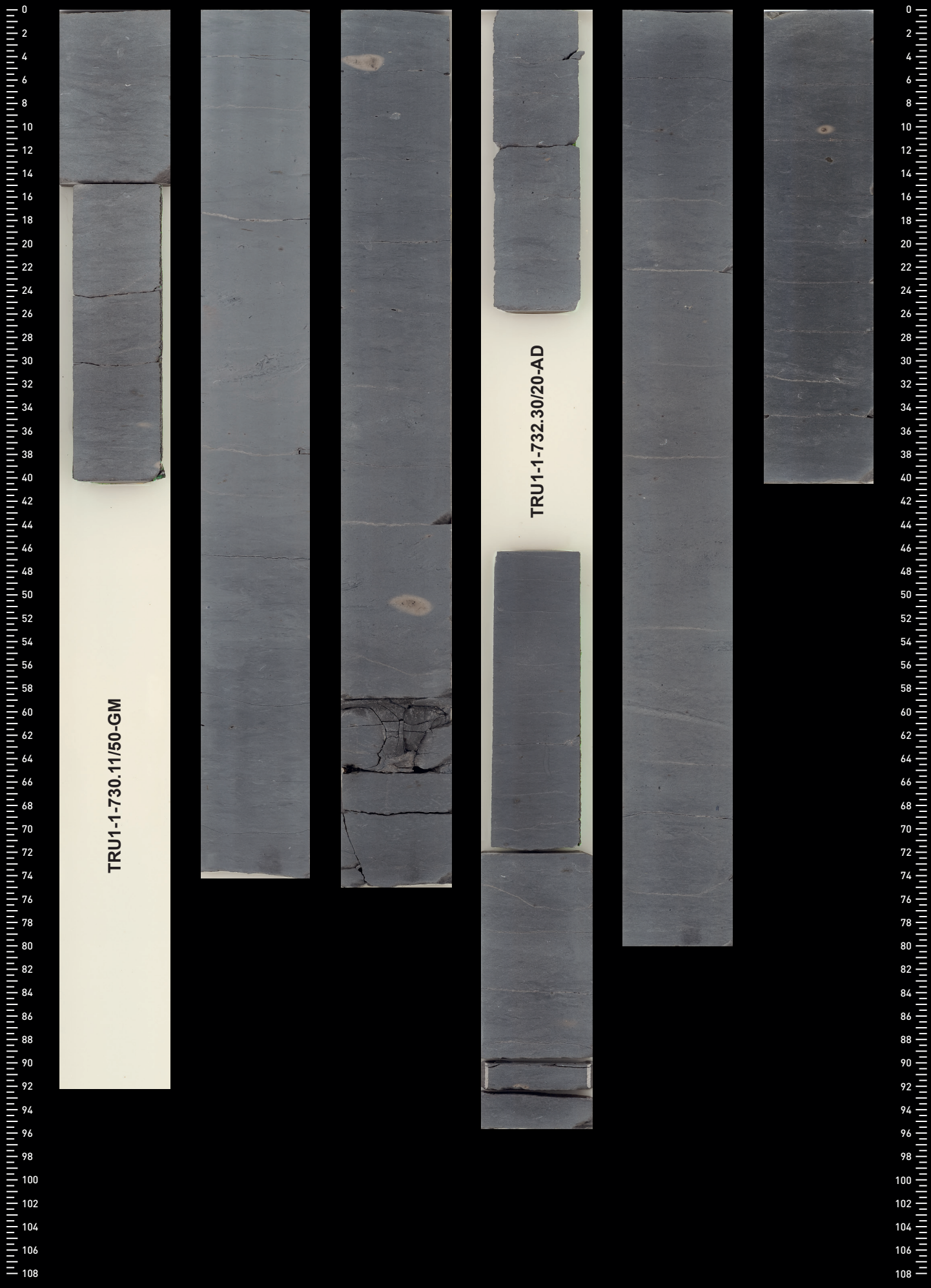
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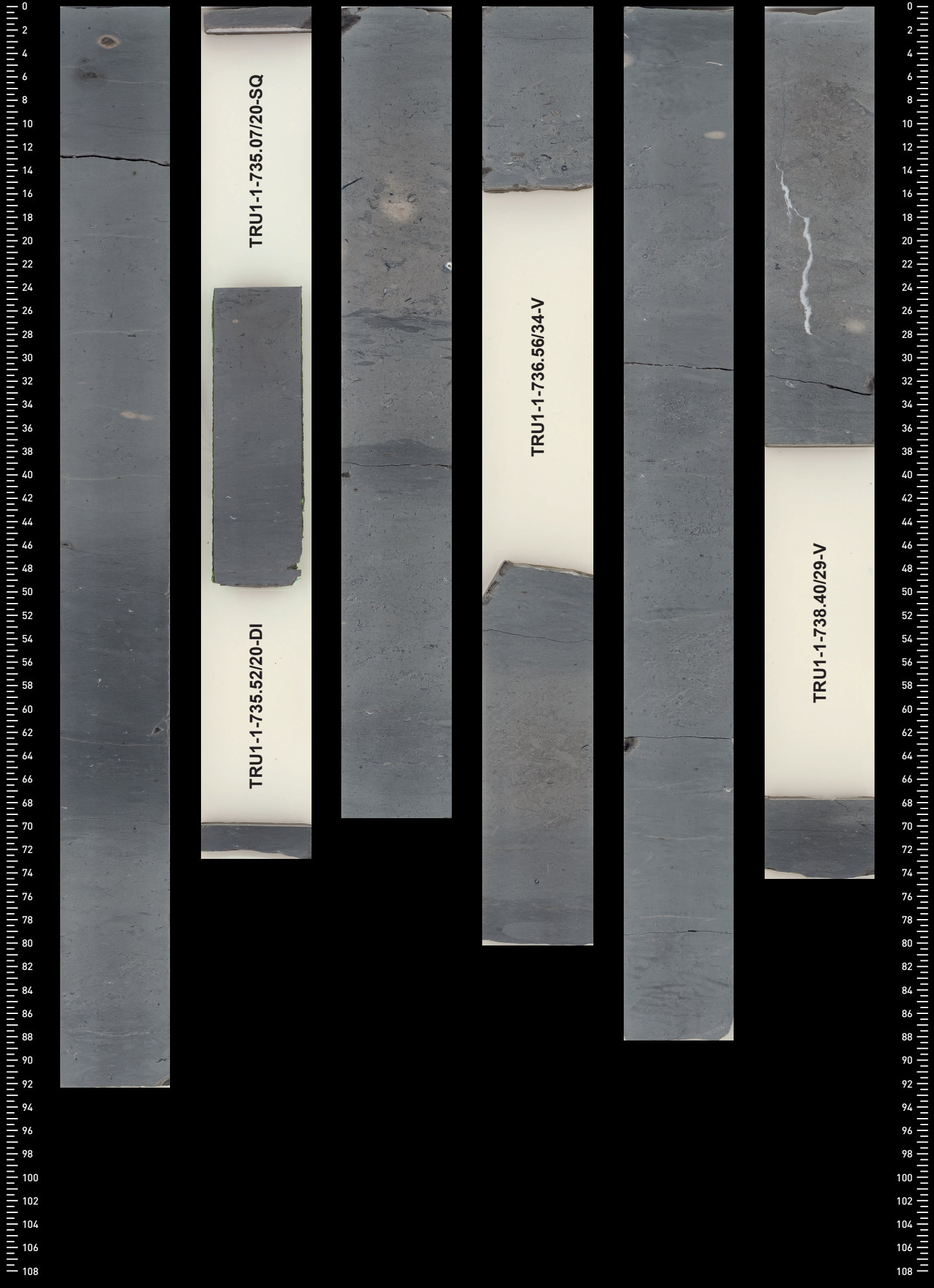
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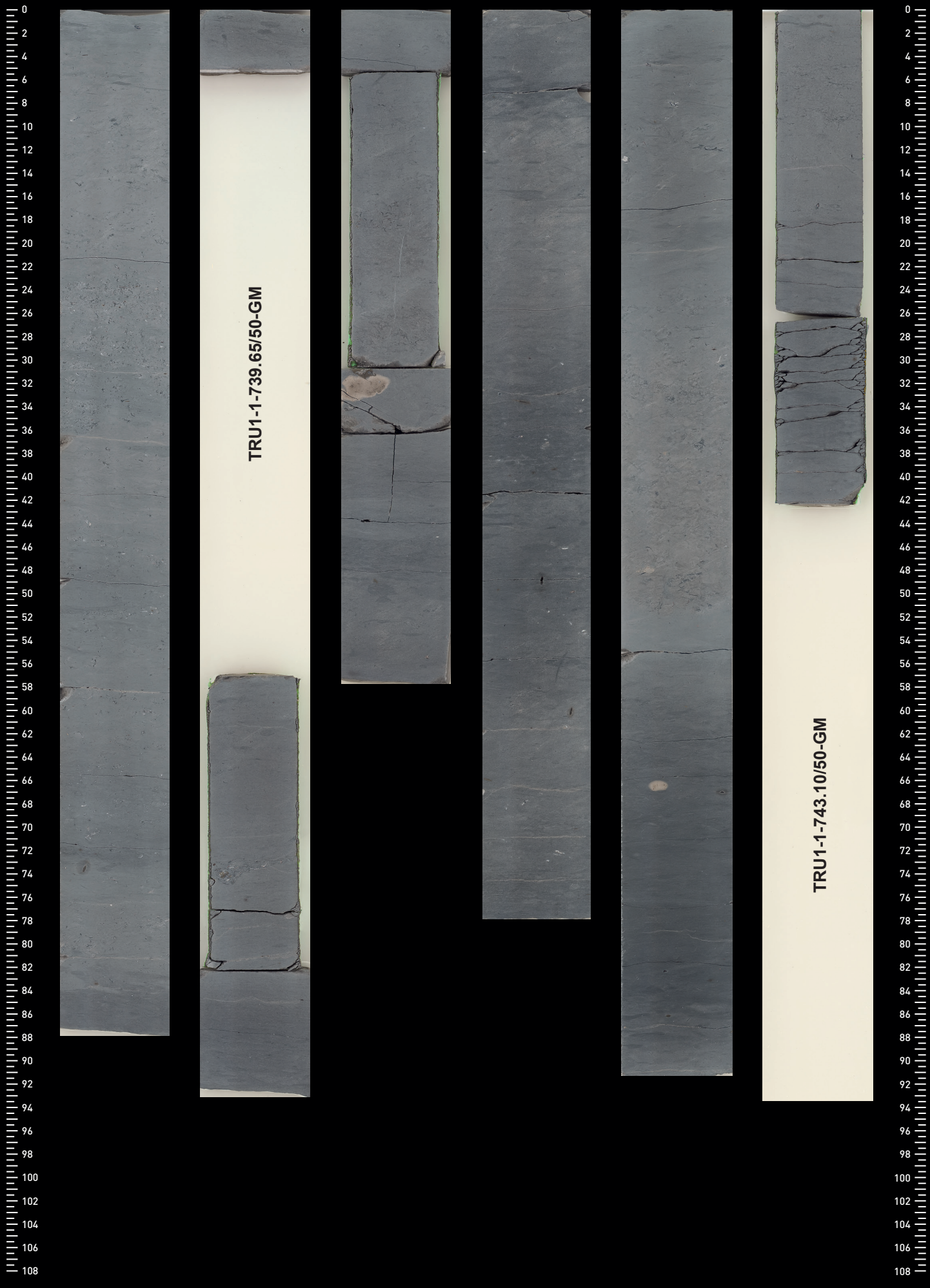


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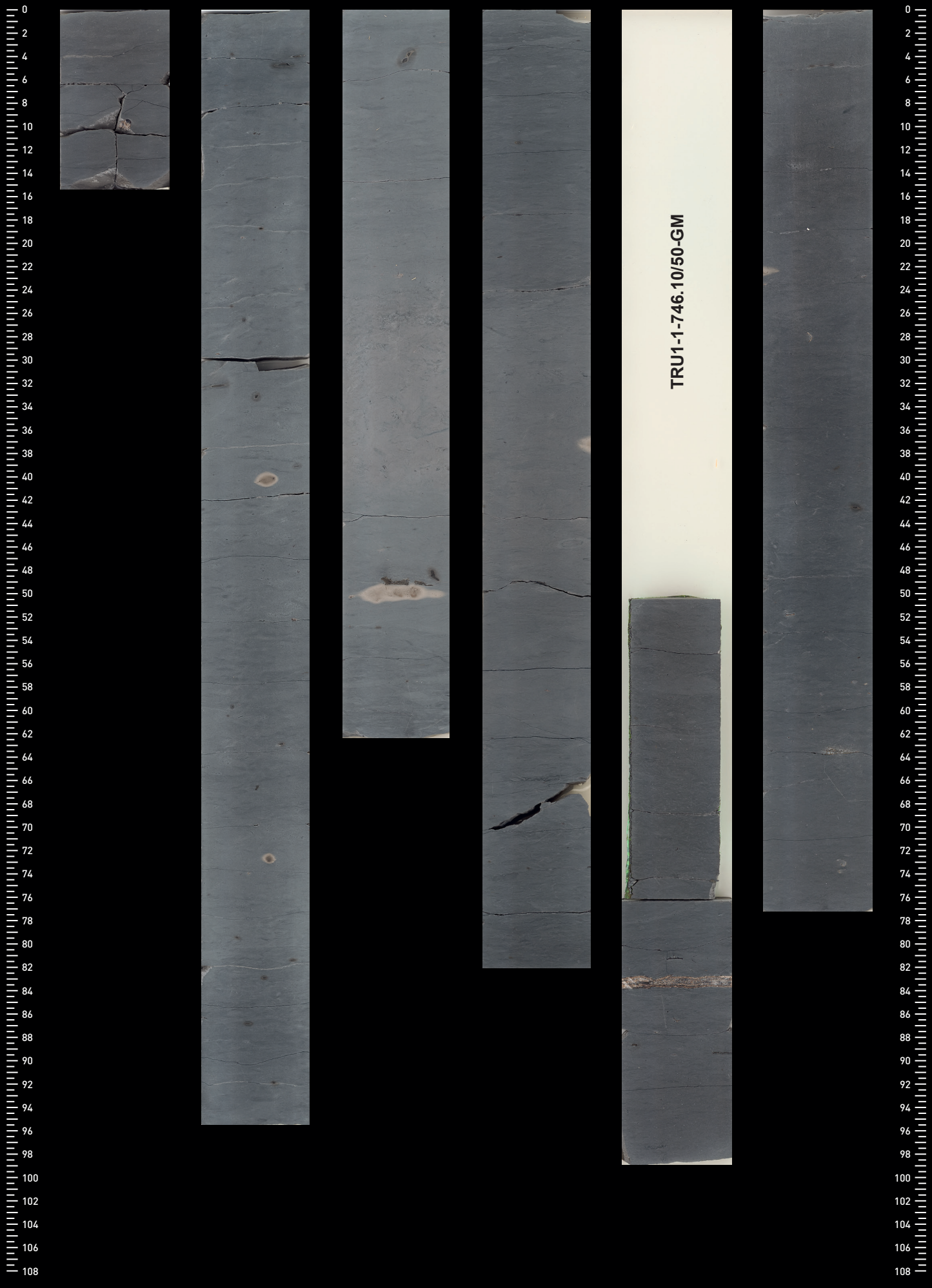
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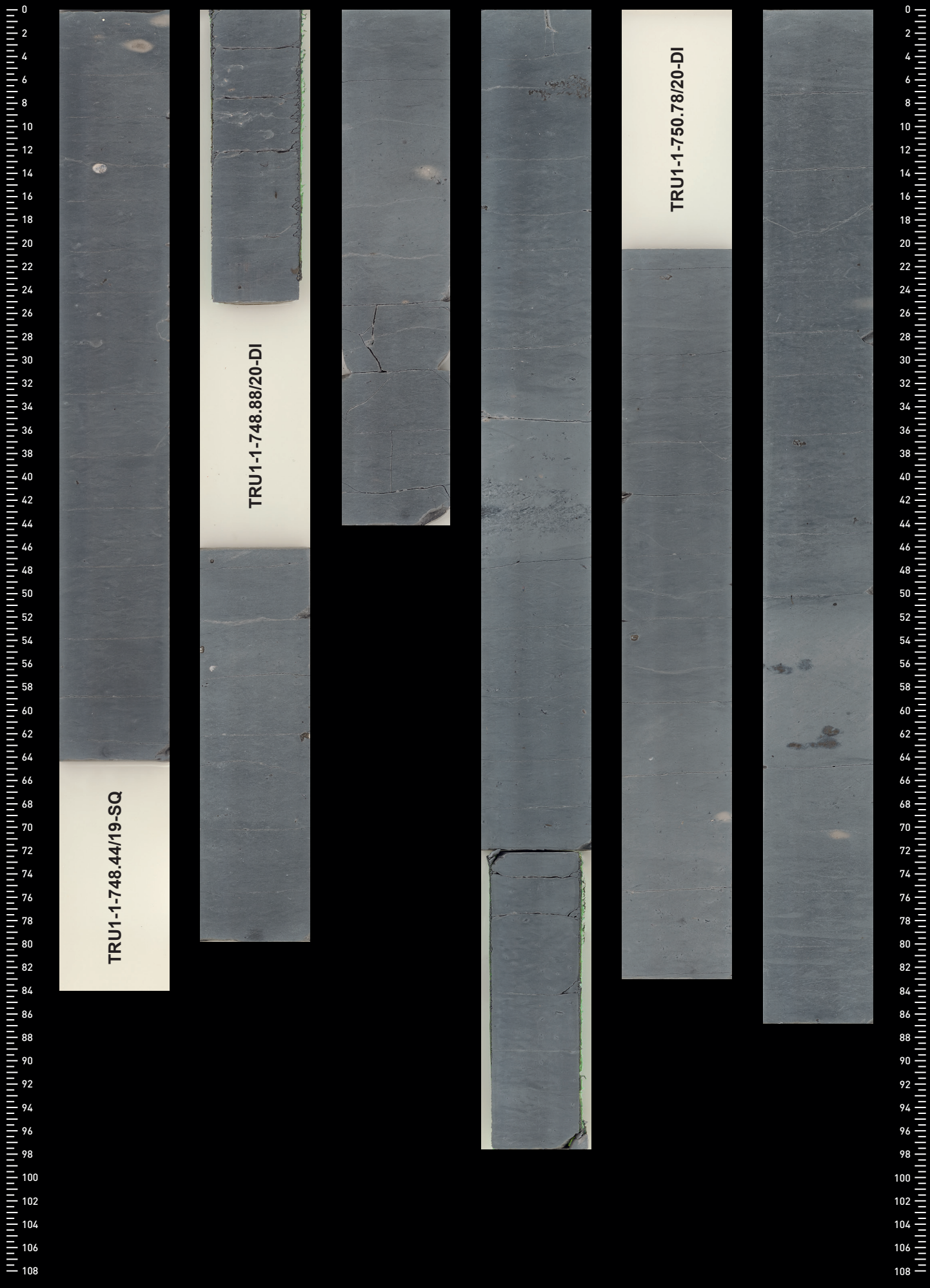
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742.69m
TRU1-1-739.65/50-GM
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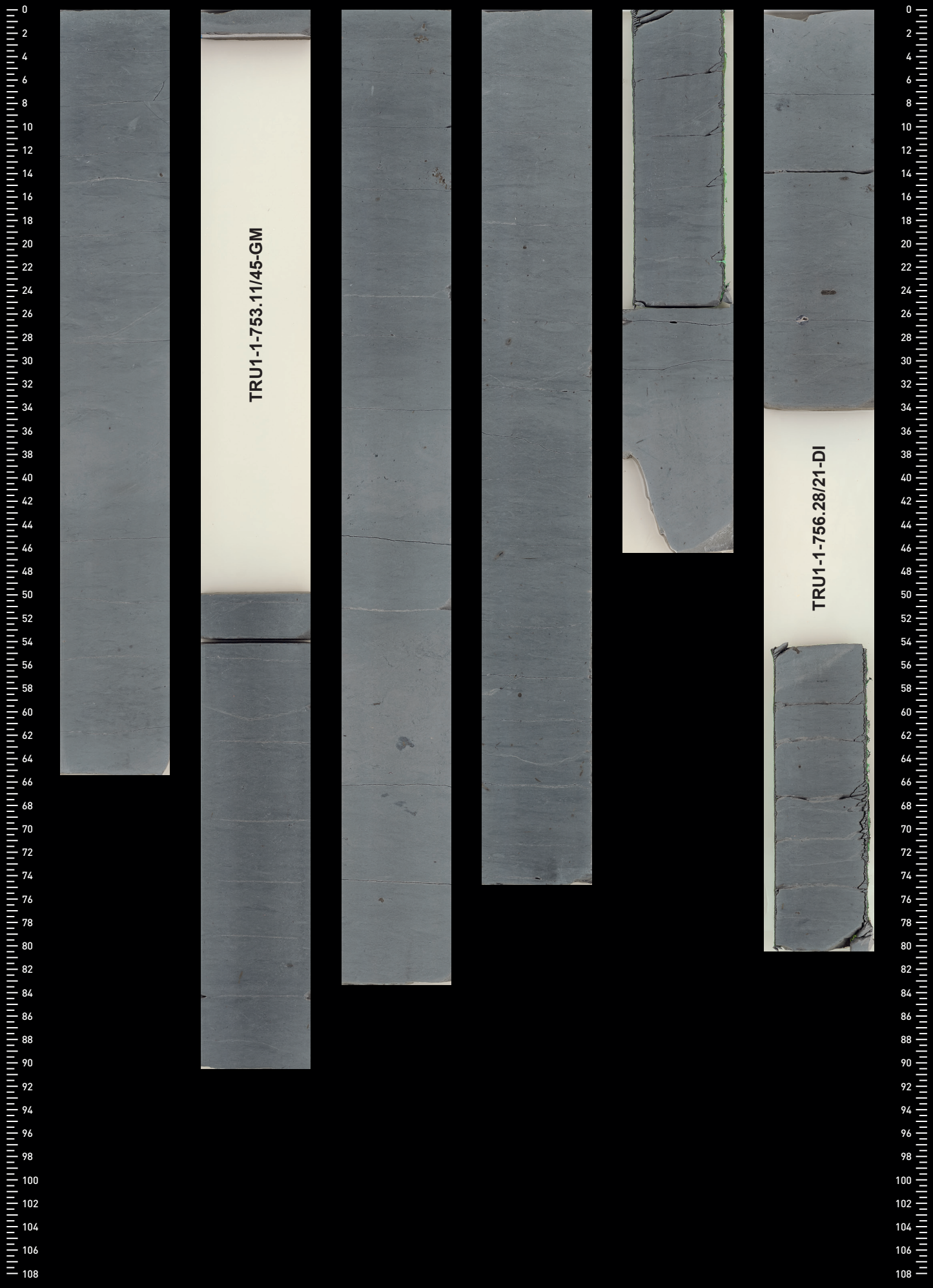
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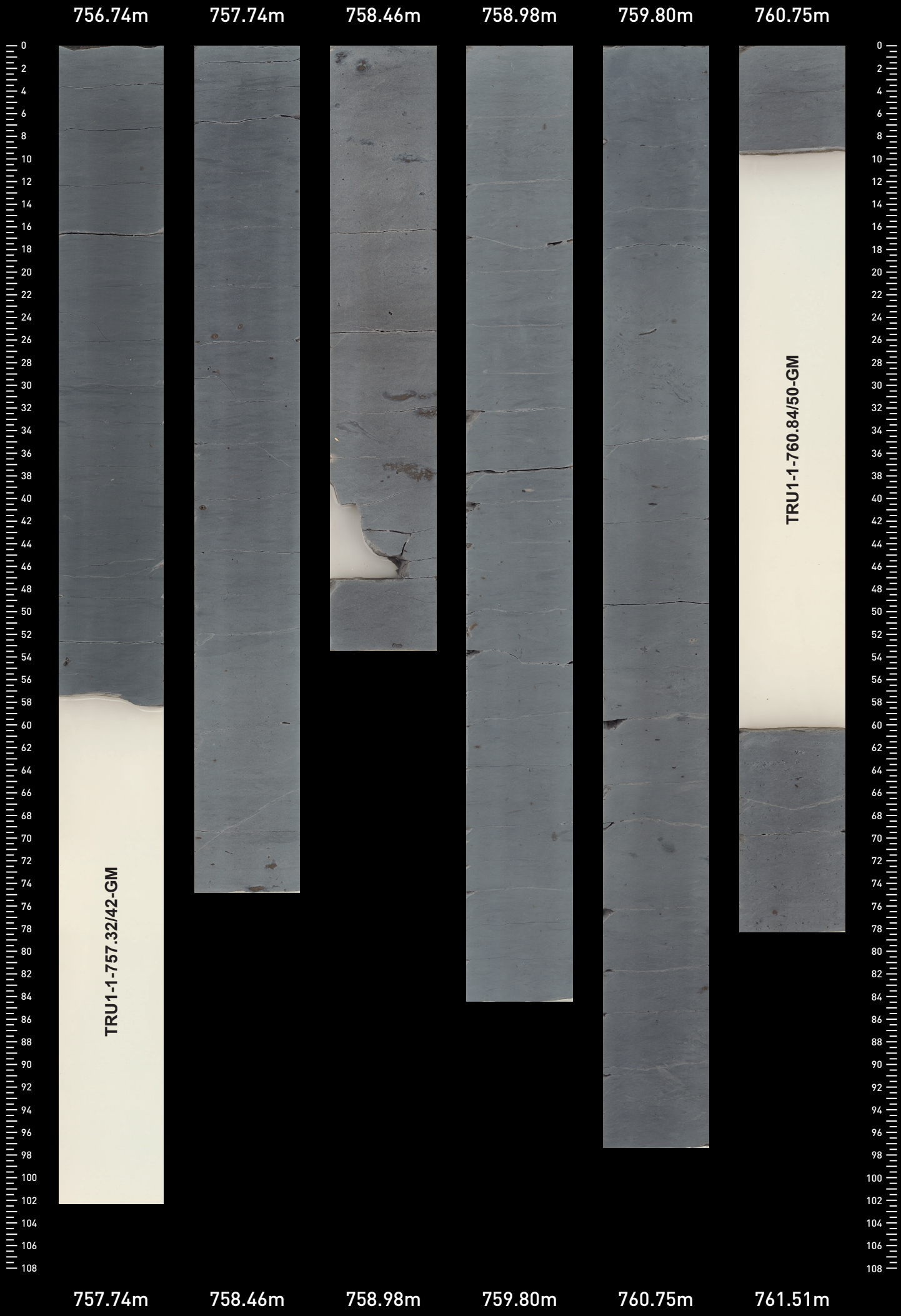
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TRU1-1-748.88/20-DI
TRU1-1-750.78/20-DI
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752.44m

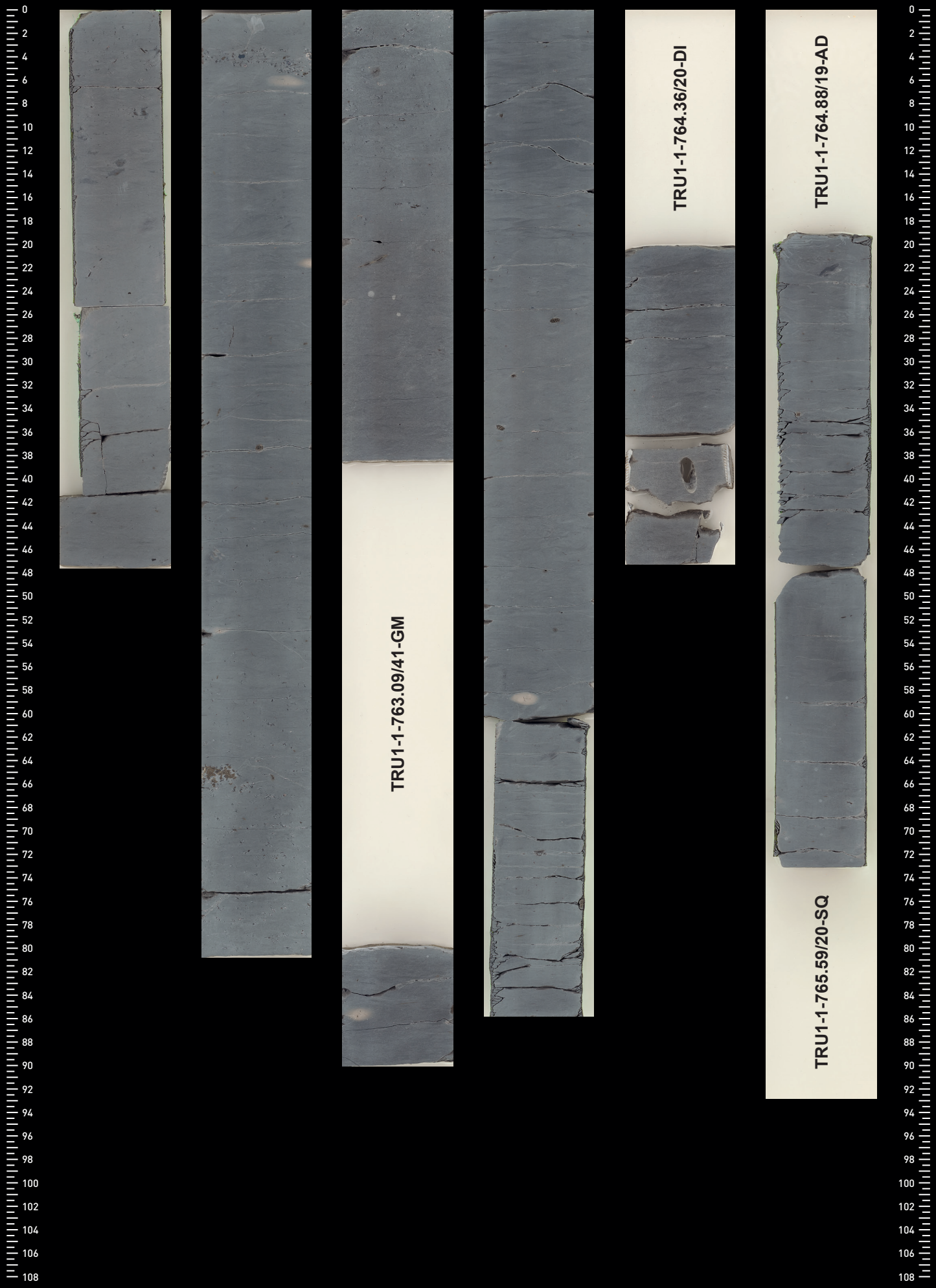
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753.09m 753.97m 754.78m 755.51m 755.96m 756.74m

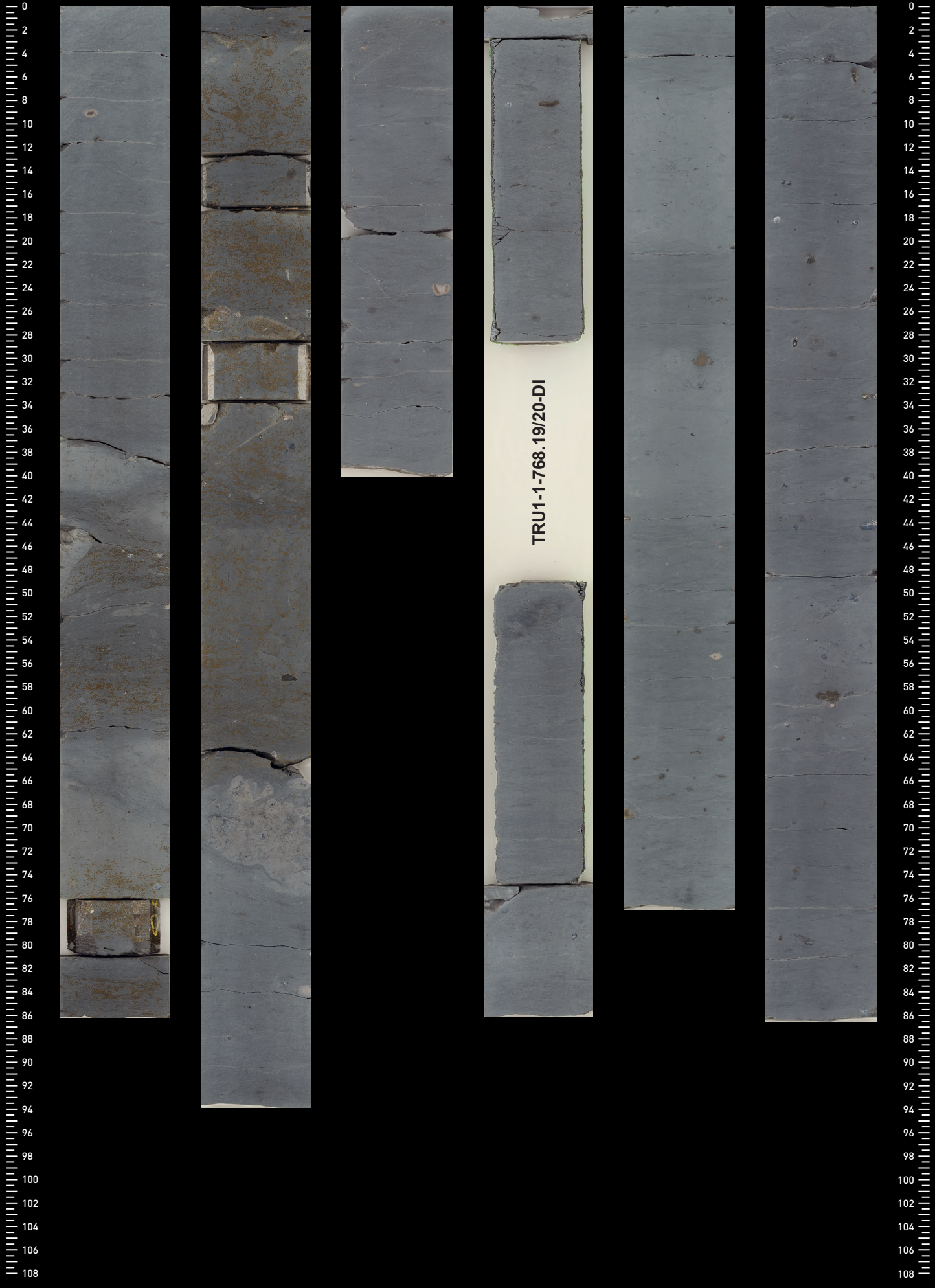

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757.74m
758.46m
758.98m
759.80m
760.75m
TRU1-1-757.32/42-GM
TRU1-1-760.84/50-GM
757.74m
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759.80m
760.75m
761.51m

761.51m 761.93m 762.72m 763.59m 764.42m 764.88m



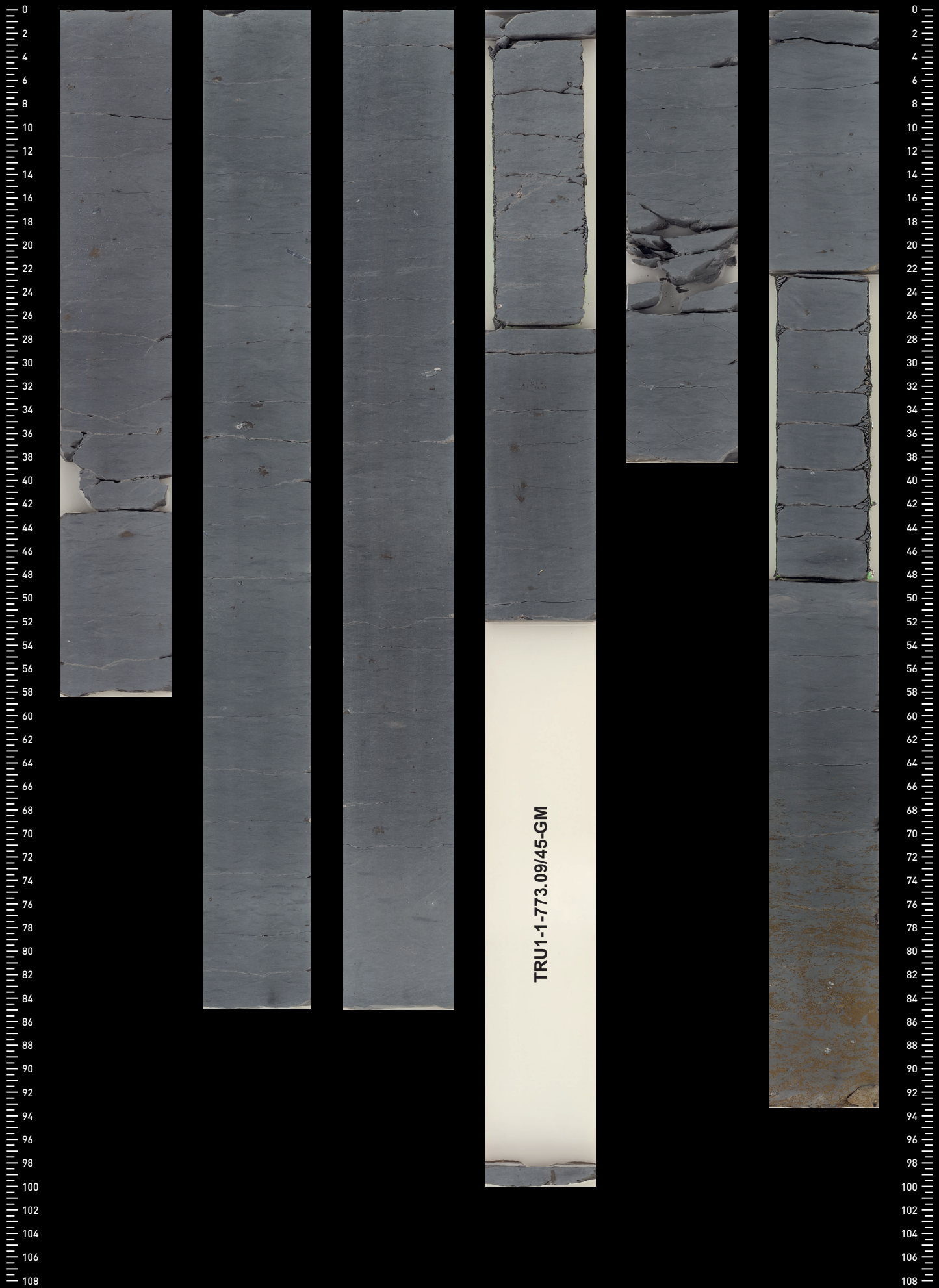
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766.67m 767.59m 767.92m 768.76m 769.51m 770.35m

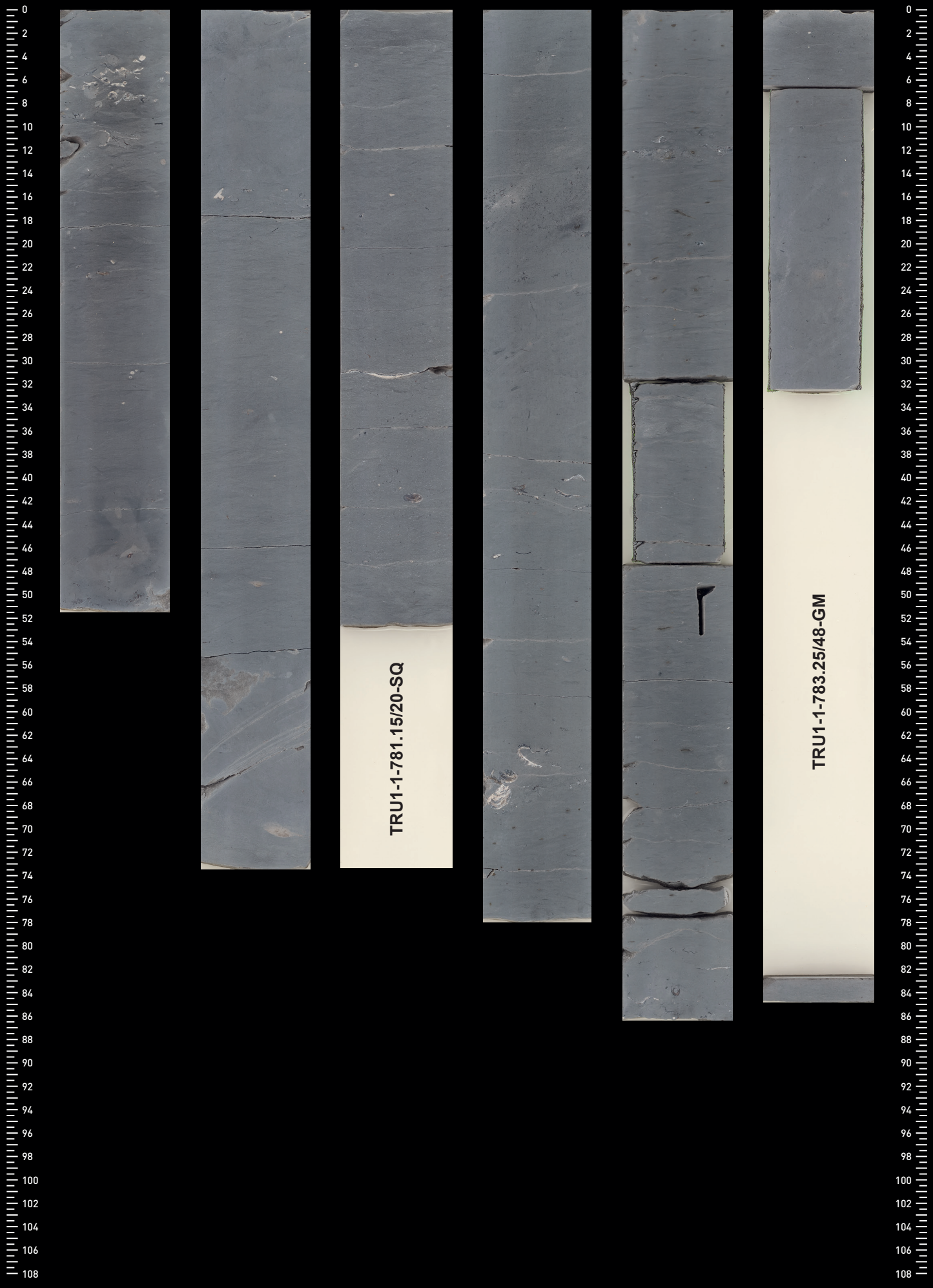
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774.83m
775.63m
776.36m
776.92m
777.80m
778.54m
TRU1-1-775.23/40-GM
TRU1-1-778.22/20-DI
775.63m
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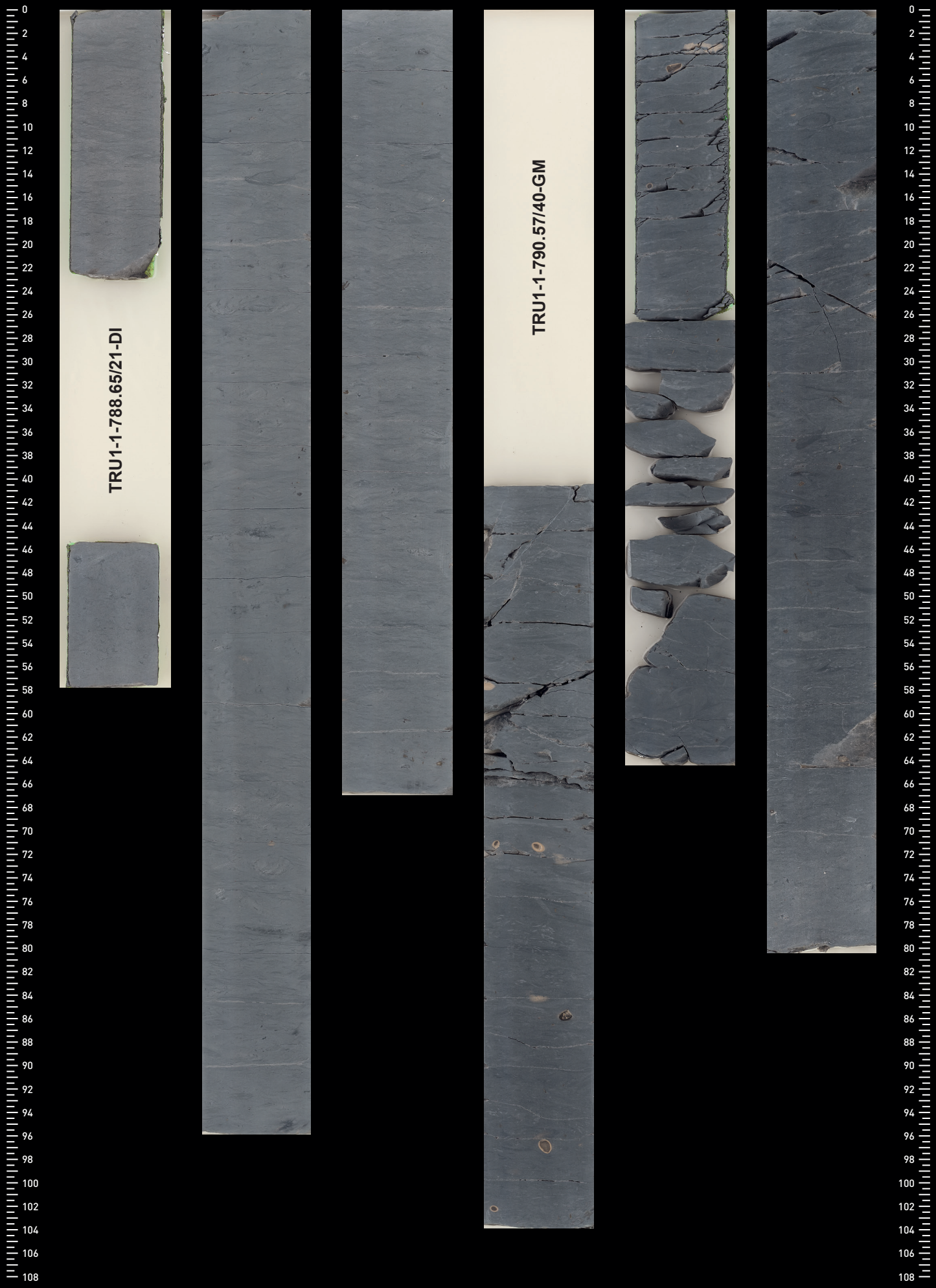
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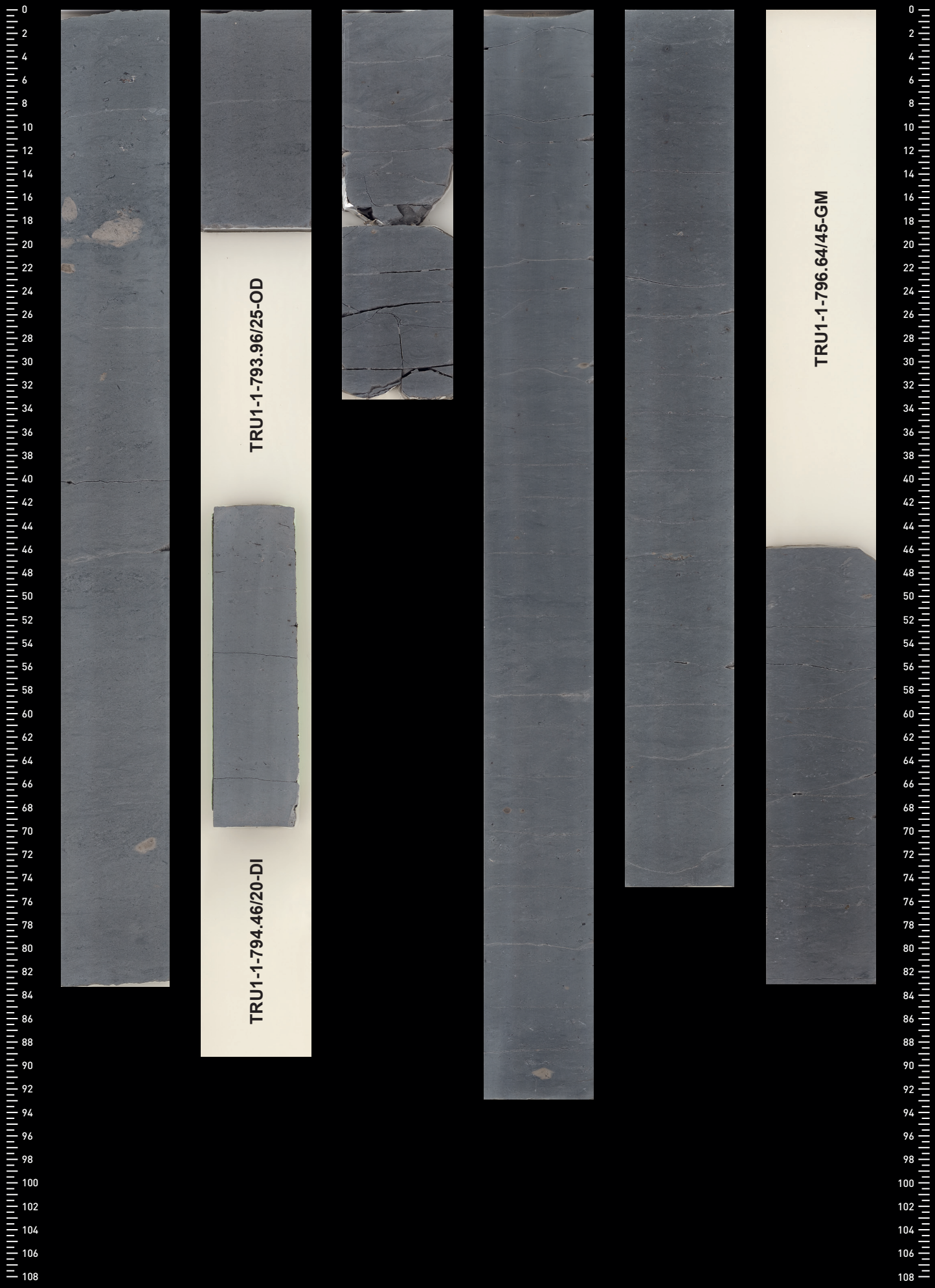
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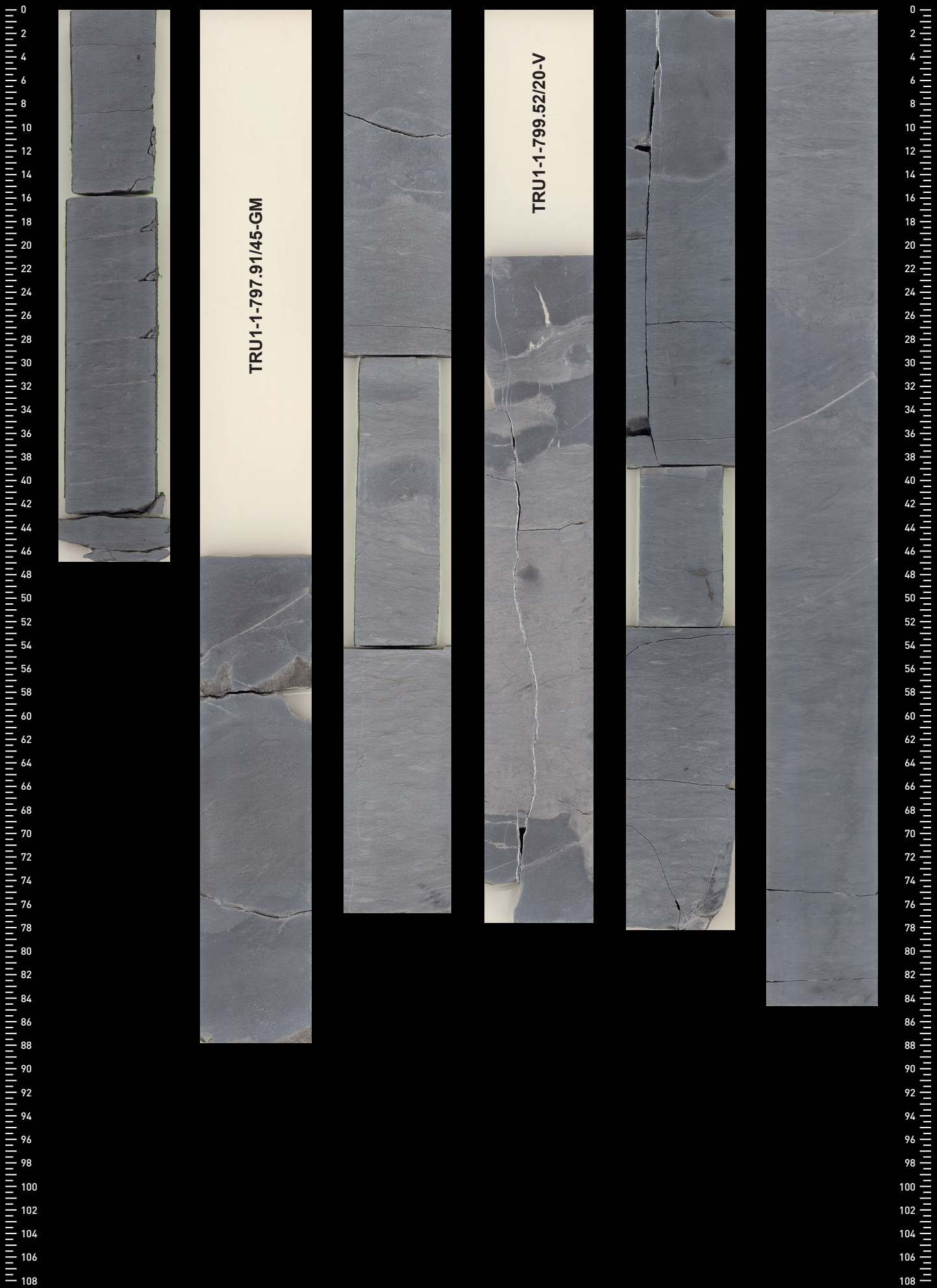
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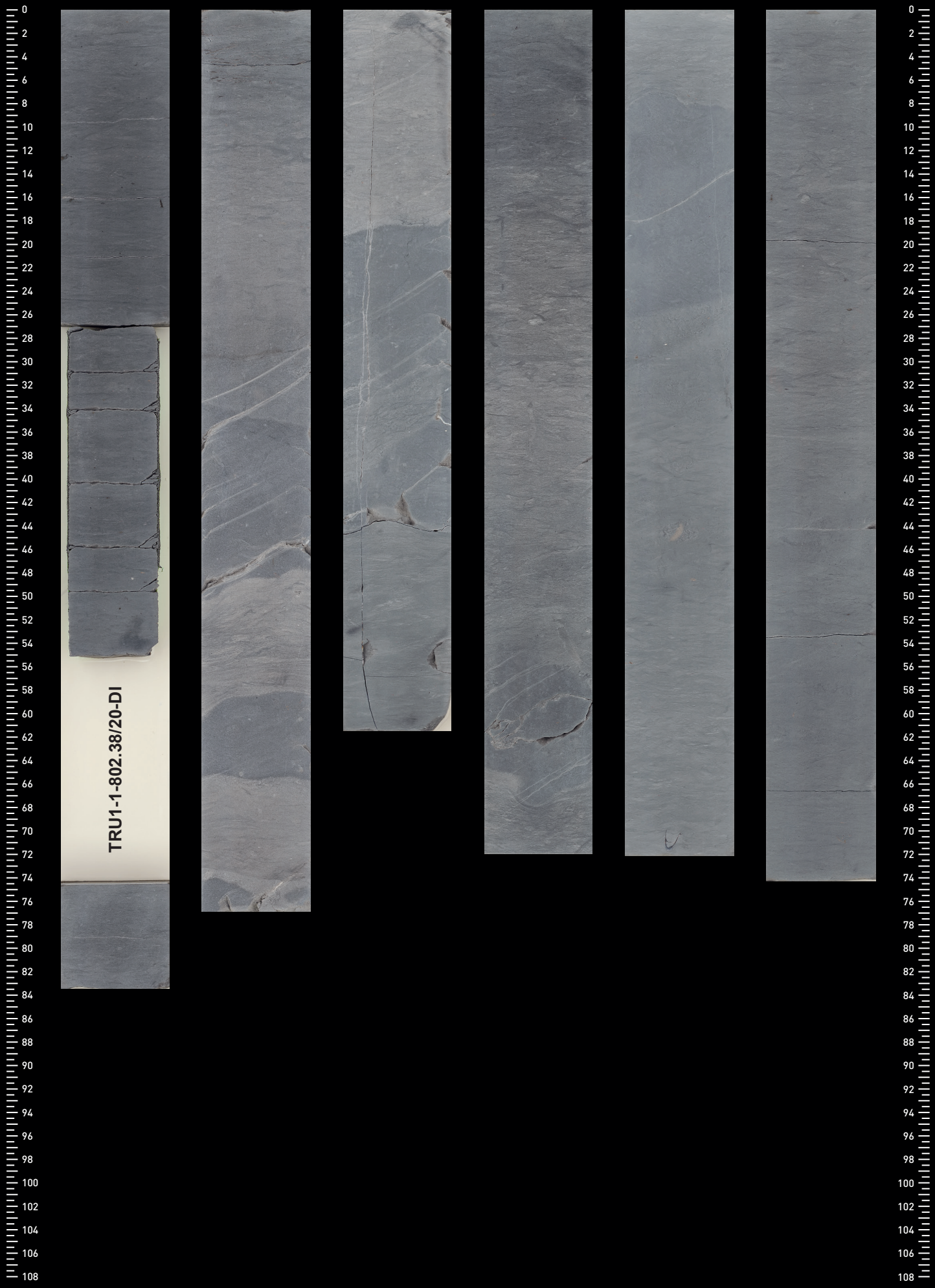
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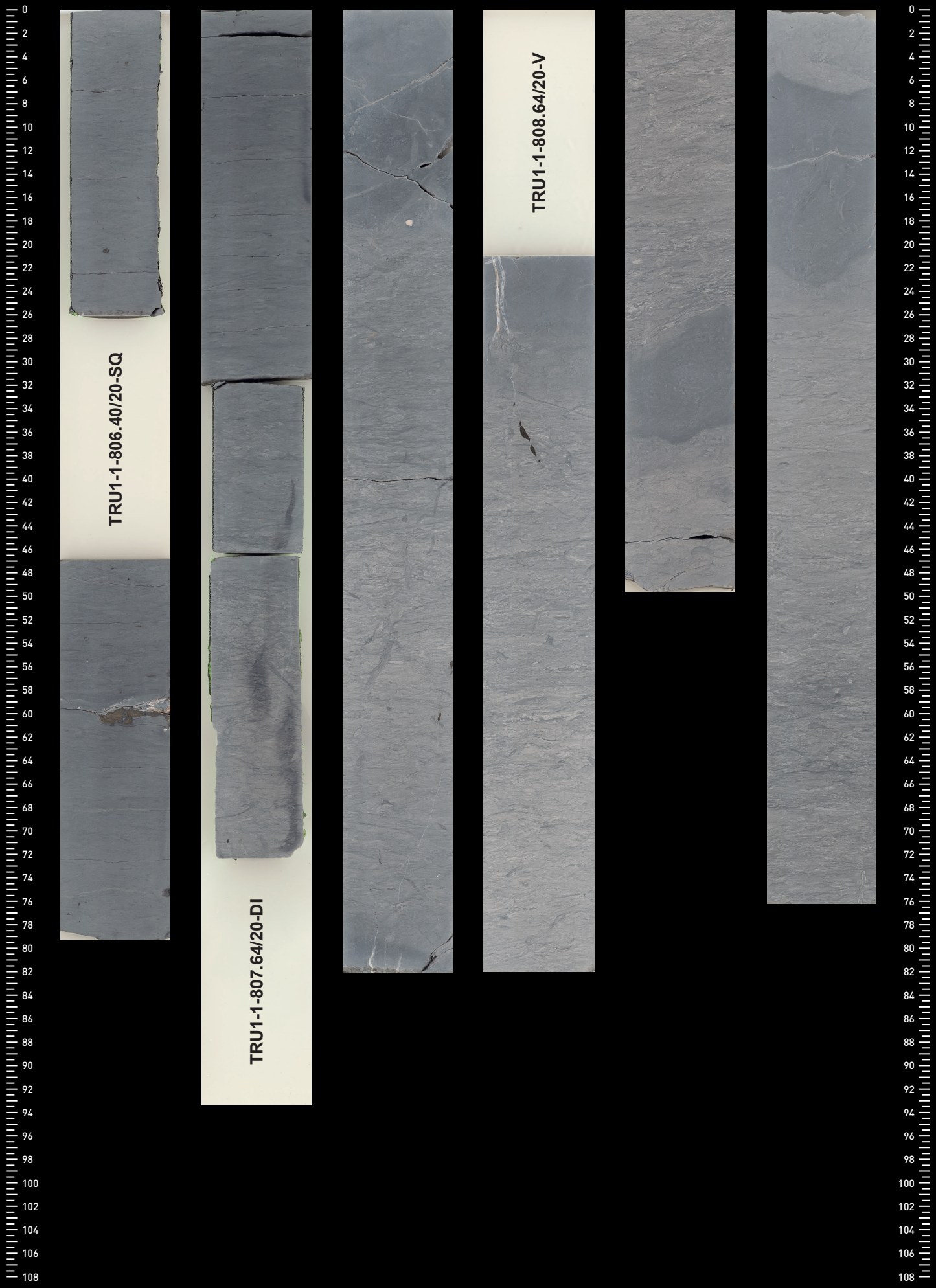
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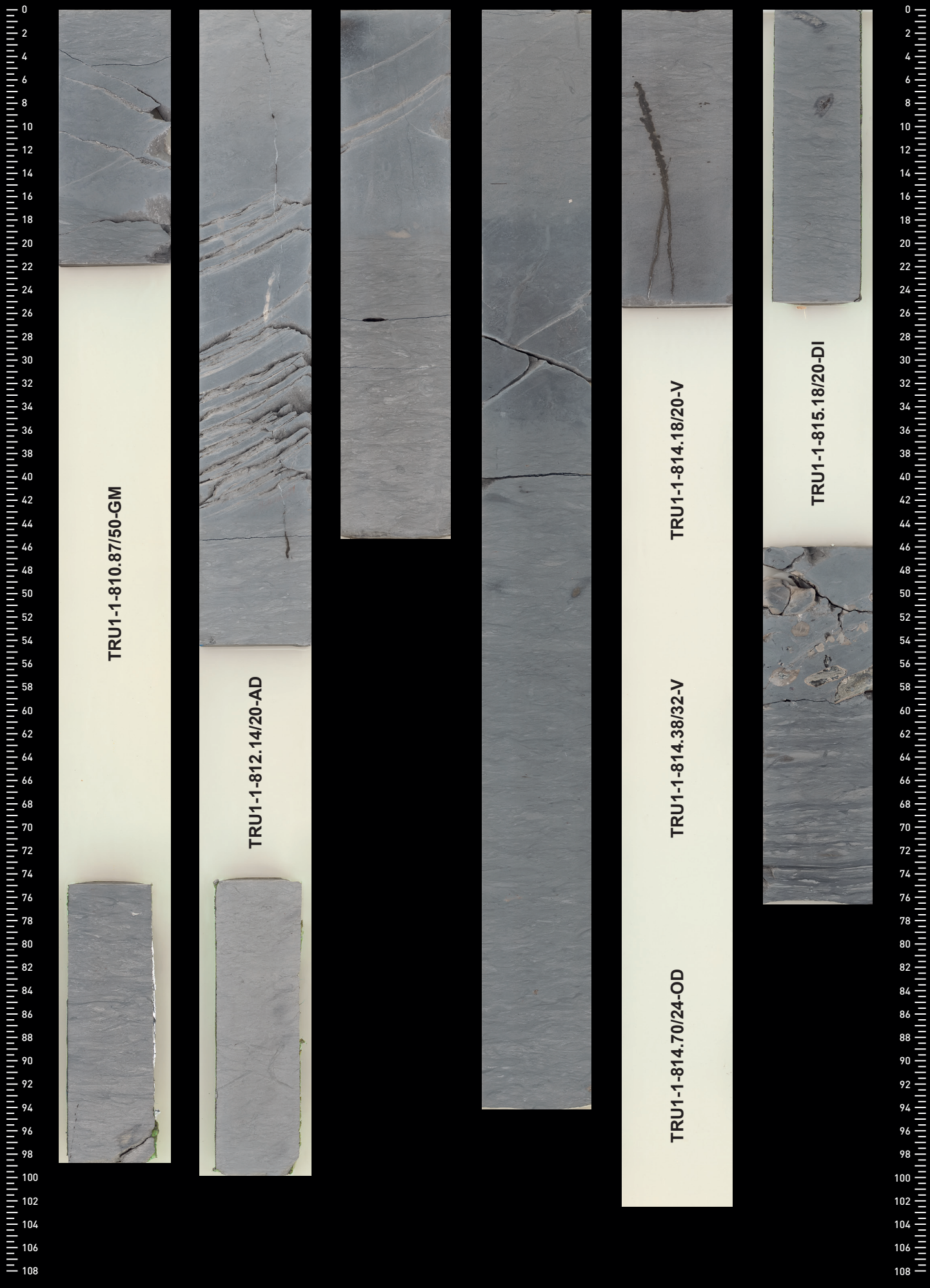


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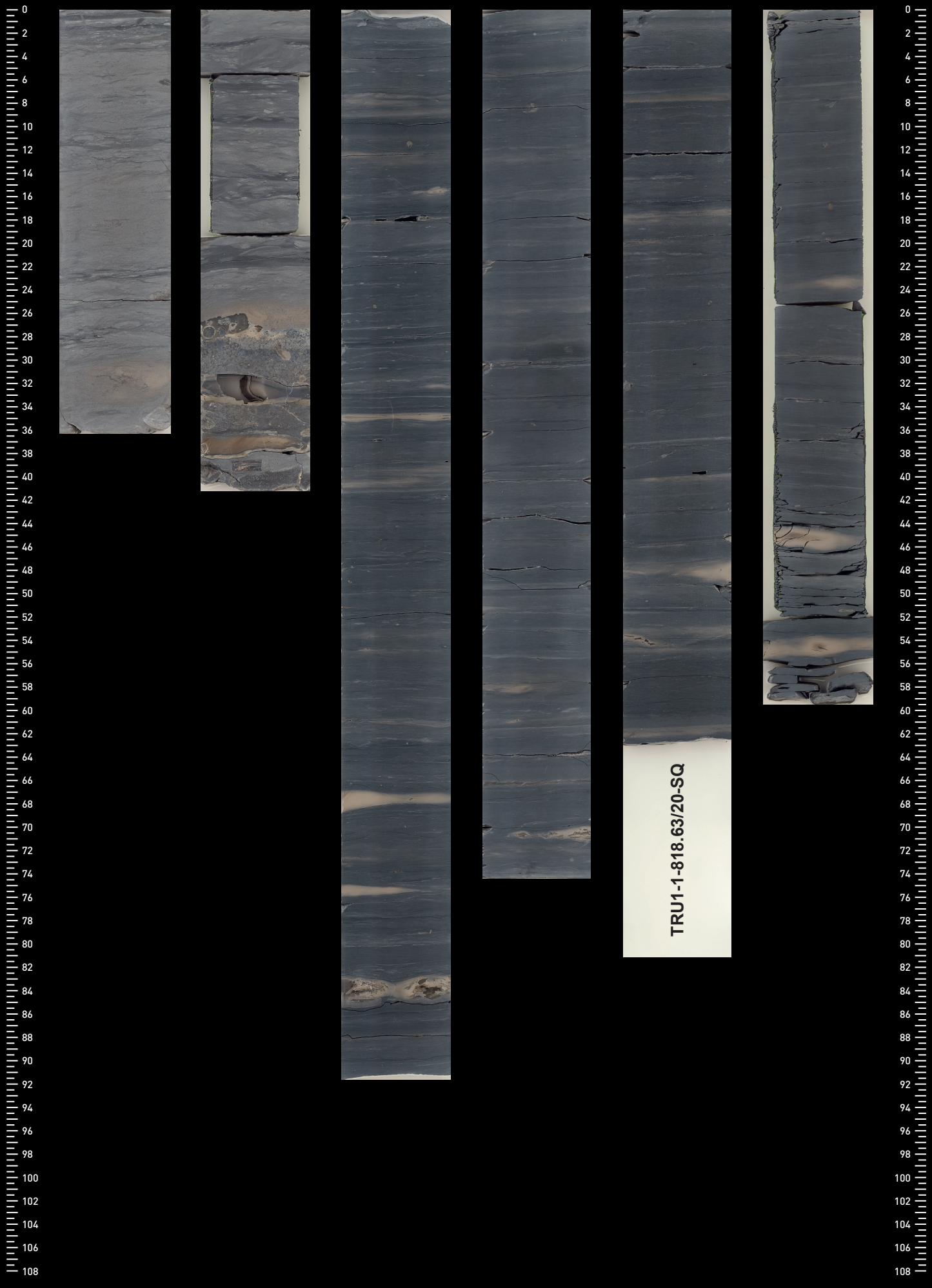
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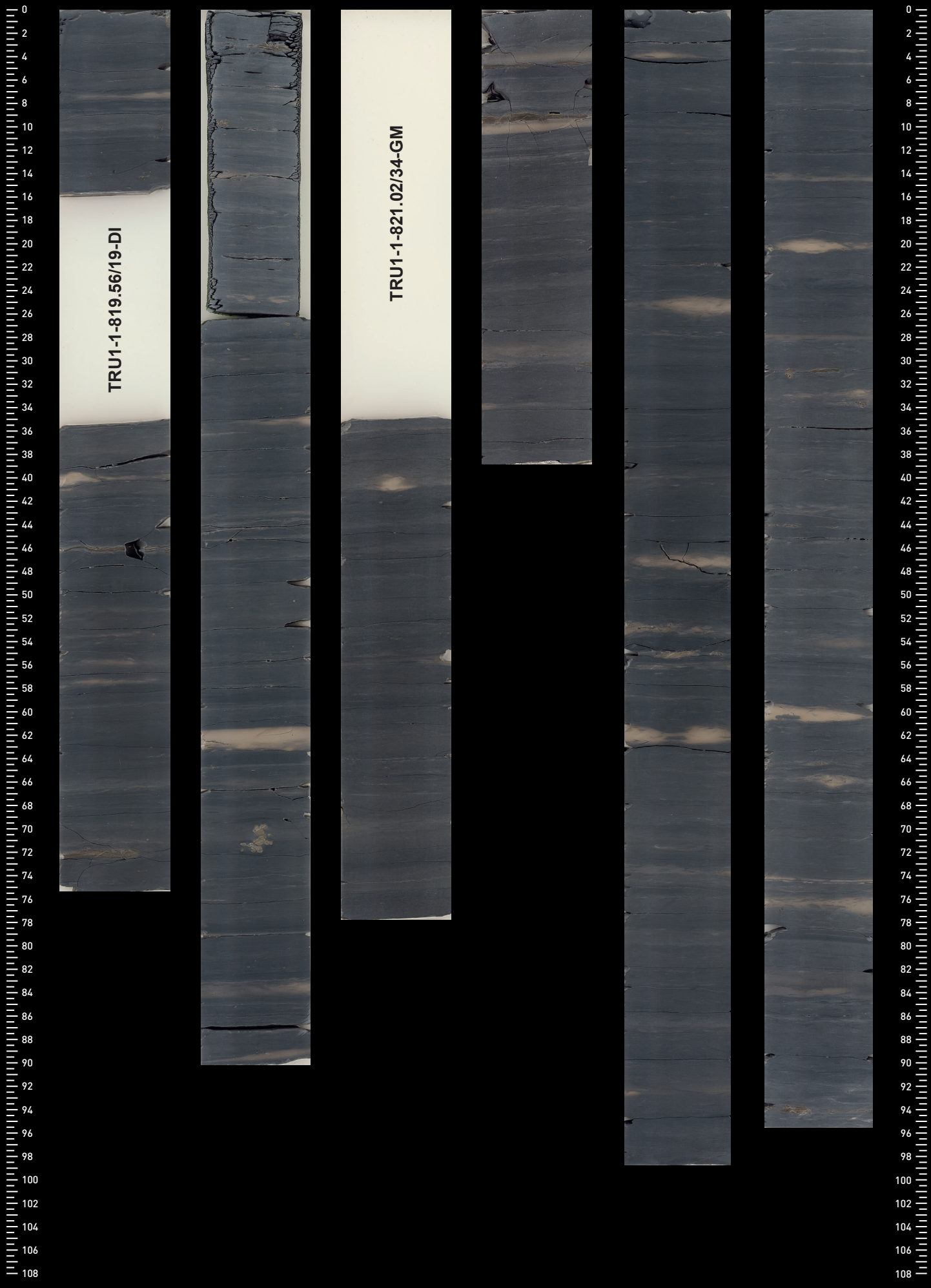

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TRU1-1-812.14/20-AD
TRU1-1-814.18/20-V
TRU1-1-814.38/32-V
TRU1-1-814.70/24-OD
TRU1-1-815.18/20-DI
811.62m
812.59m
813.03m
813.94m
814.94m
815.68m

815.68m 816.02m 816.42m 817.32m 818.04m 818.83m



816.02m 816.42m 817.32m 818.04m 818.83m 819.41m

819.41m 820.15m 821.02m 821.78m 822.15m 823.11m



820.15m 821.02m 821.78m 822.15m 823.11m 824.04m

824.04m 824.92m 825.57m 825.66m 826.48m 826.82m



824.92m 825.57m 825.66m 826.48m 826.82m 827.75m

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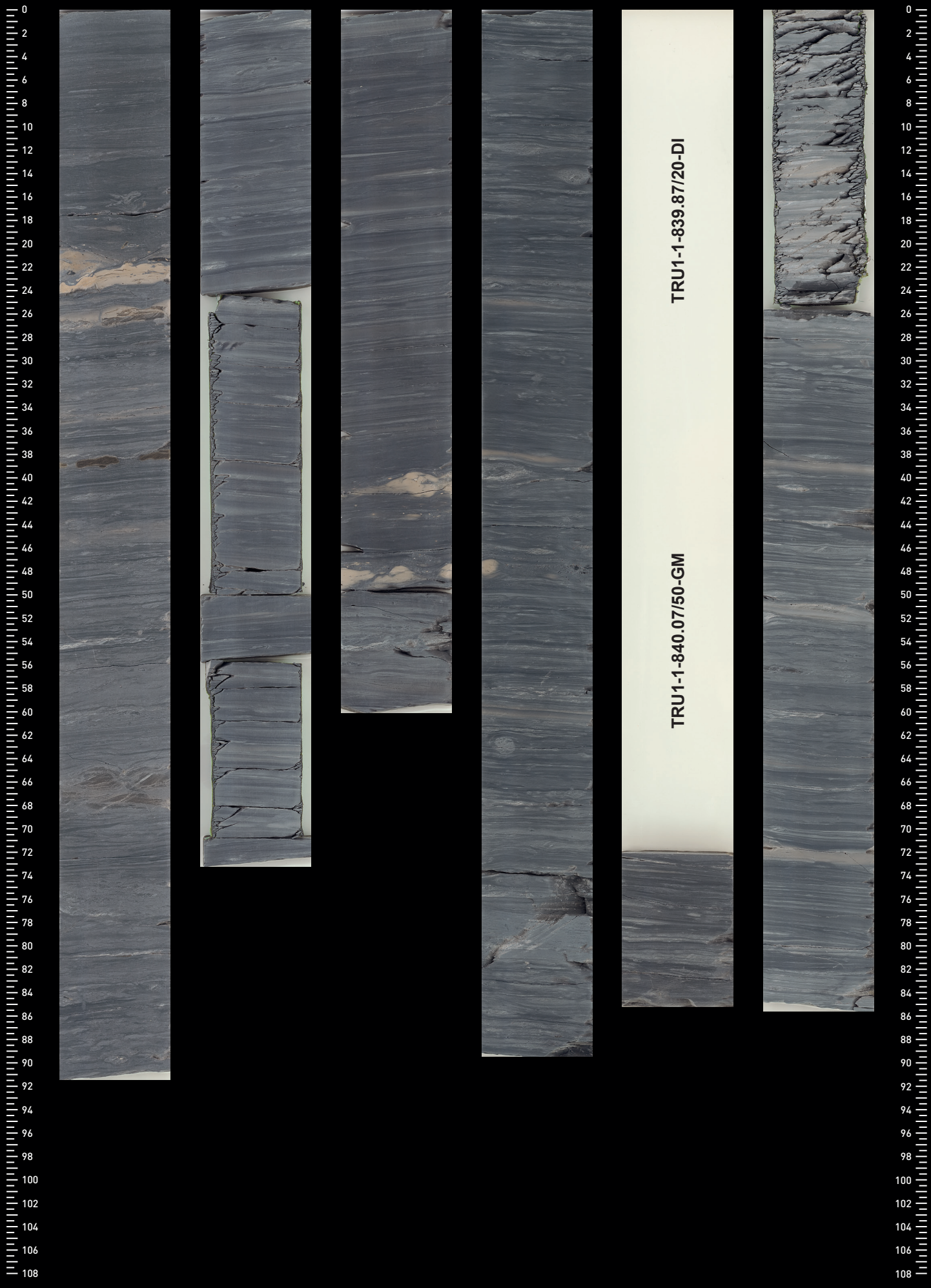
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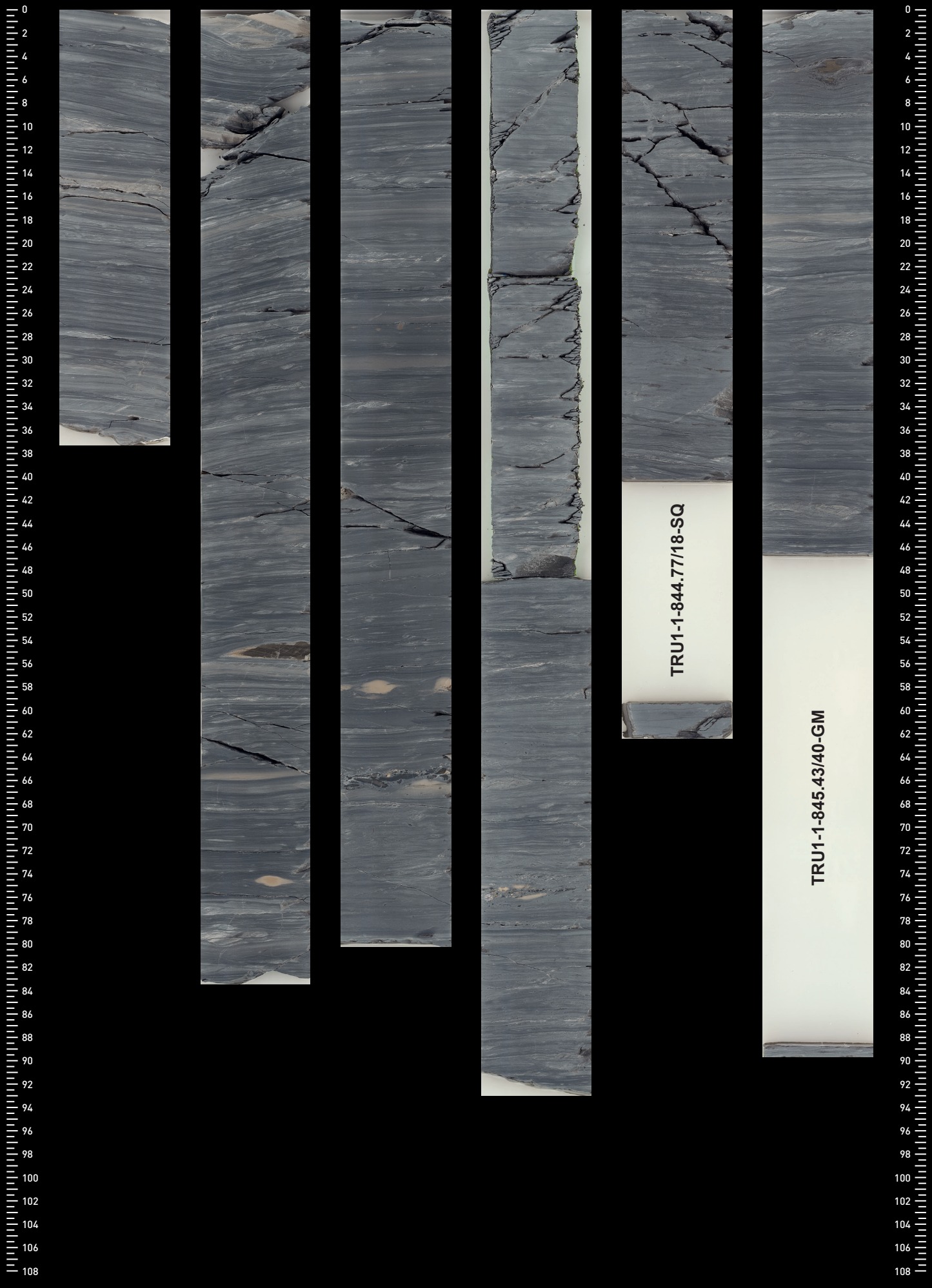
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836.82m 837.72m 838.42m 839.00m 839.87m 840.70m

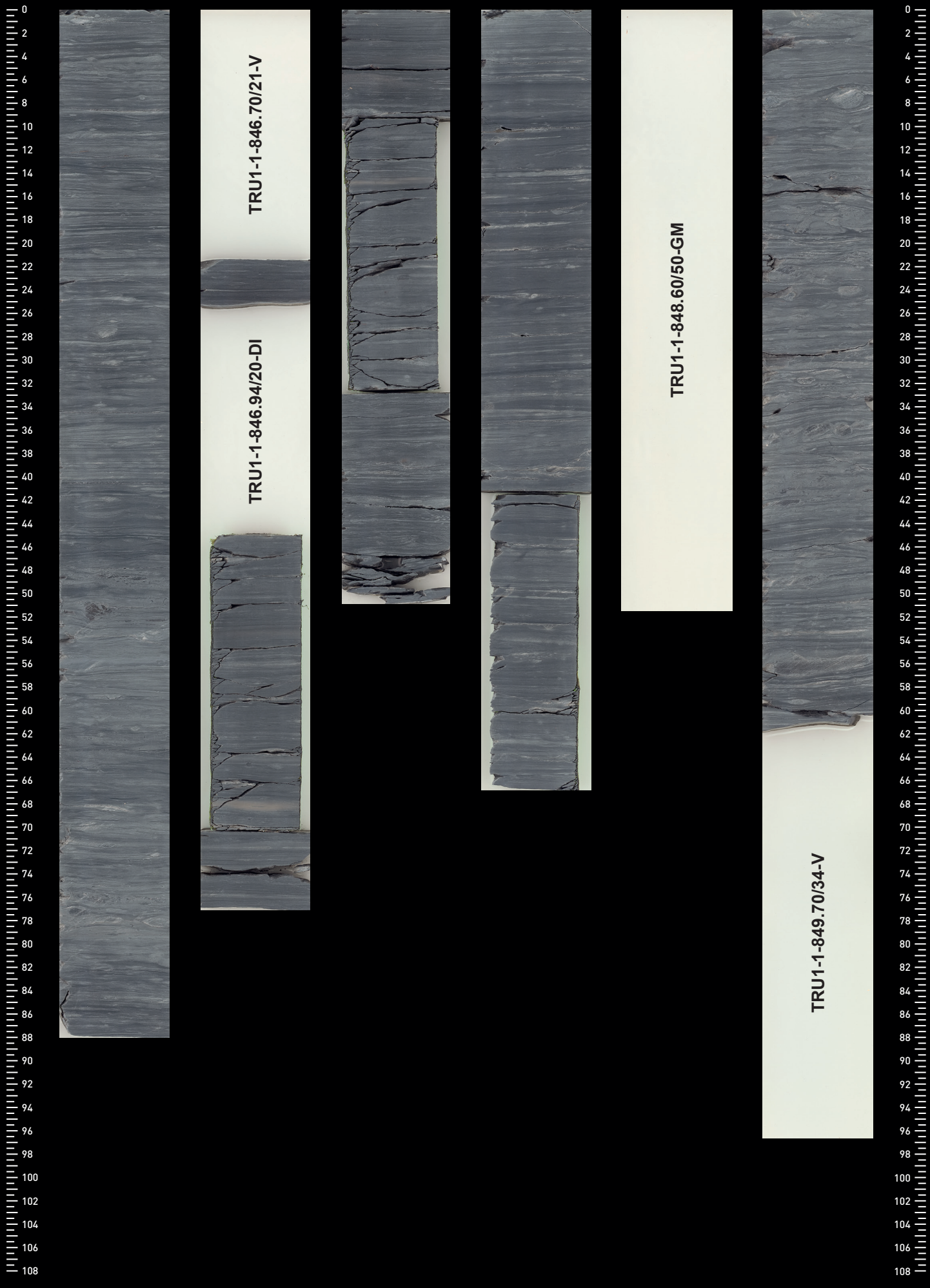


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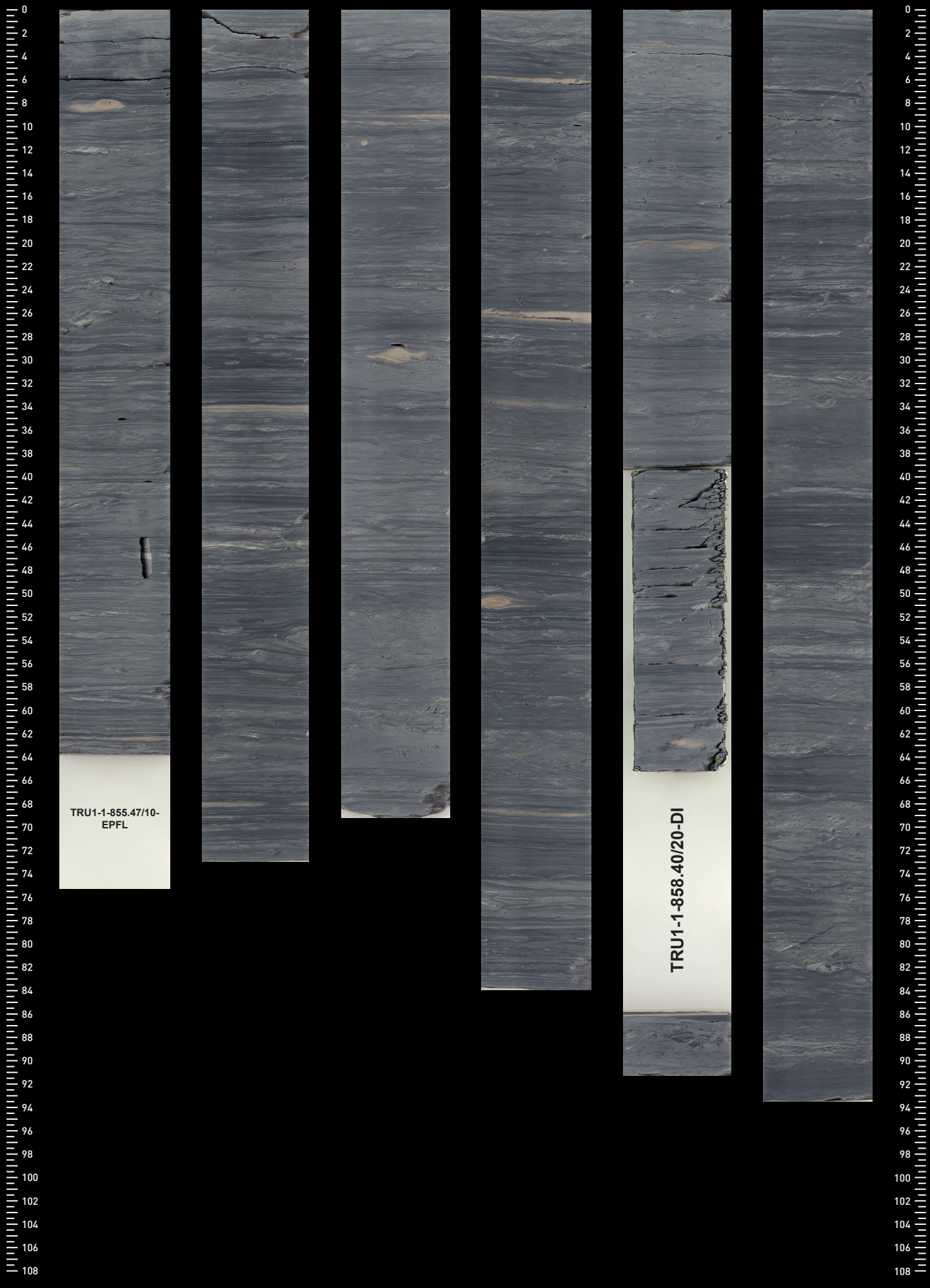
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845.84m
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847.44m
847.94m
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849.10m
TRU1-1-846.70/21-V
TRU1-1-846.94/20-DI
TRU1-1-848.60/50-GM
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850.04m

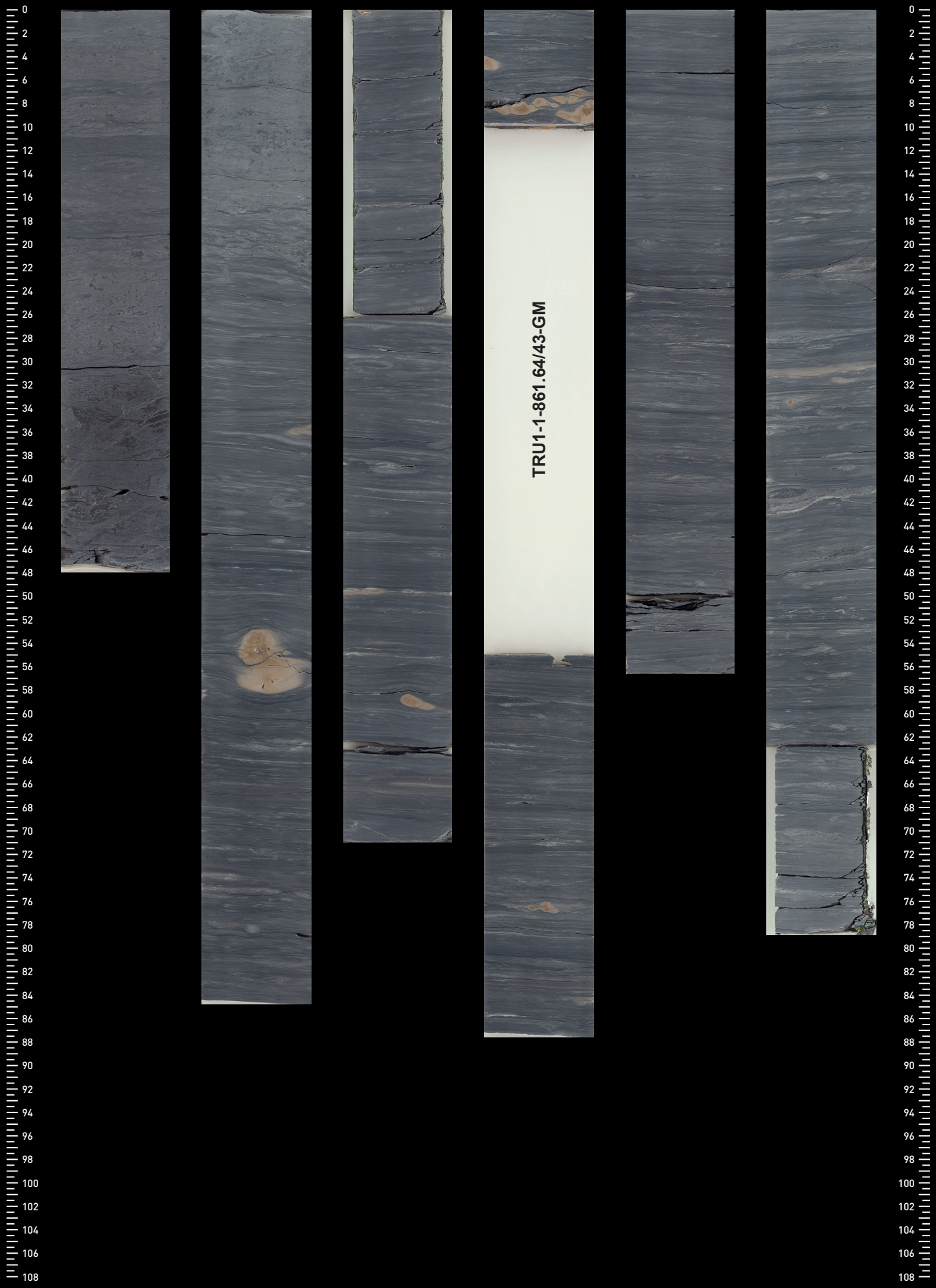
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850.95m 851.70m 852.30m 853.13m 854.05m 854.84m

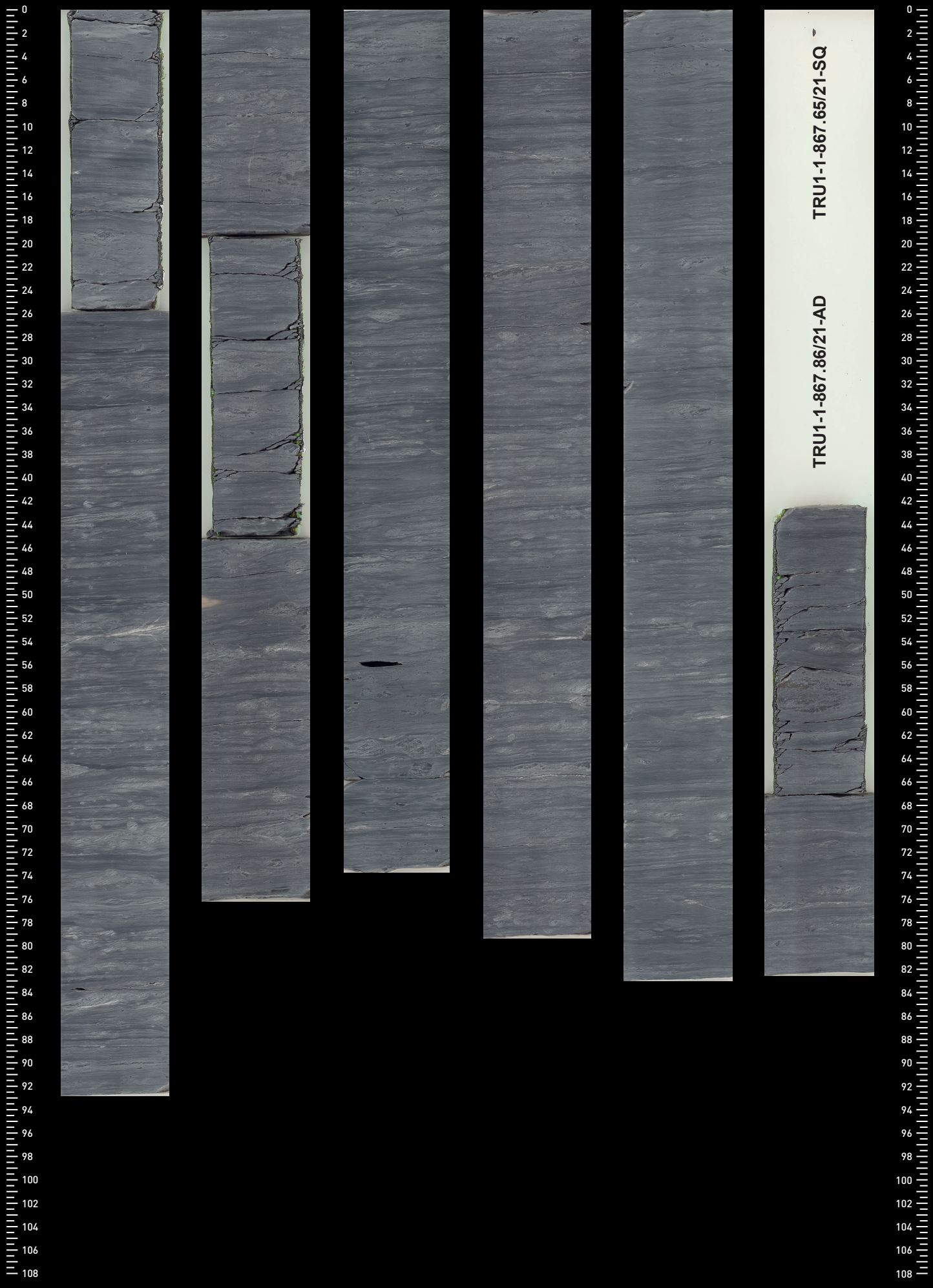

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858.66m
859.57m

859.57m 860.03m 860.85m 861.54m 862.39m 862.95m



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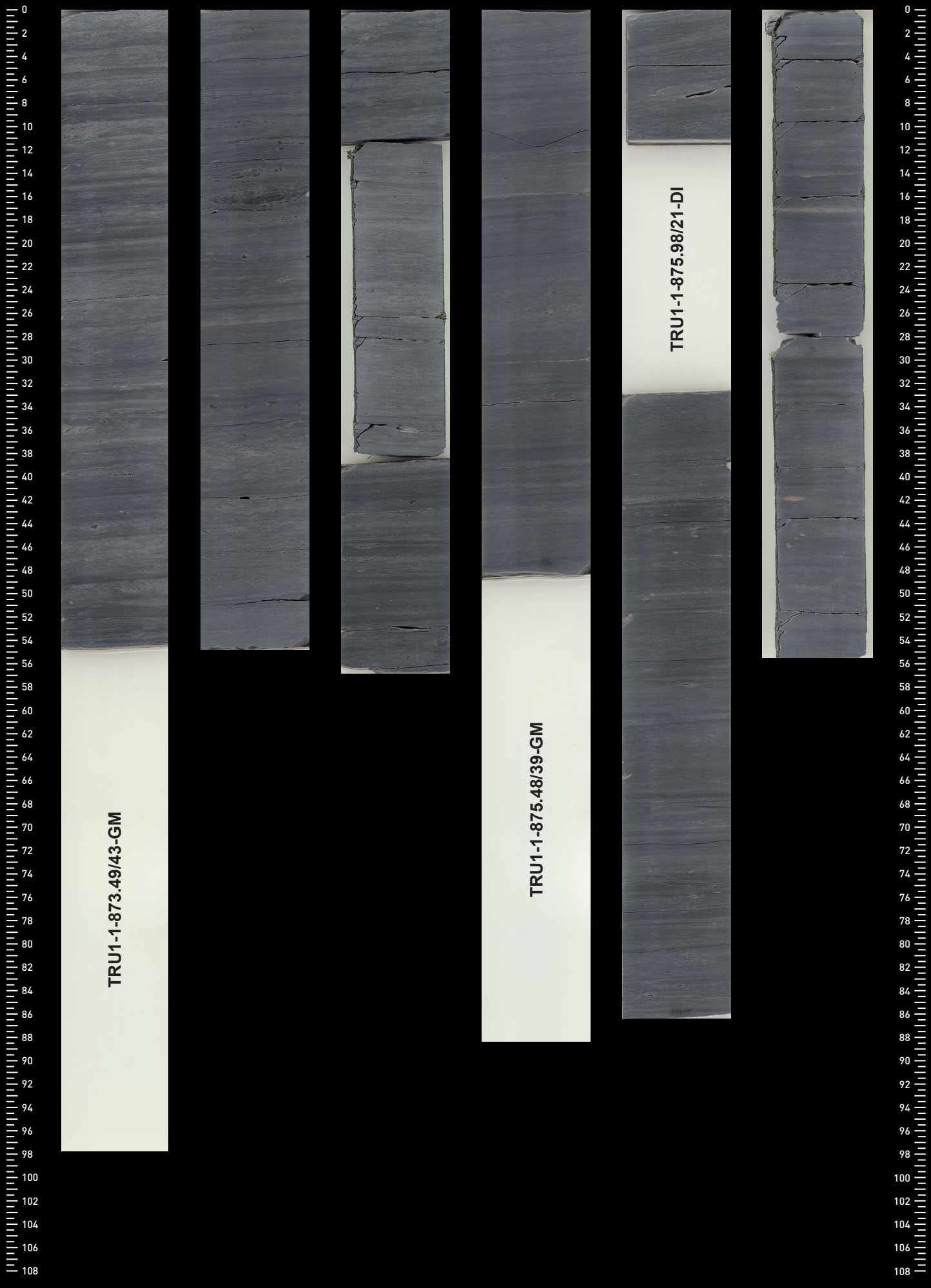
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868.45m 869.08m 869.88m 870.33m 871.21m 871.99m



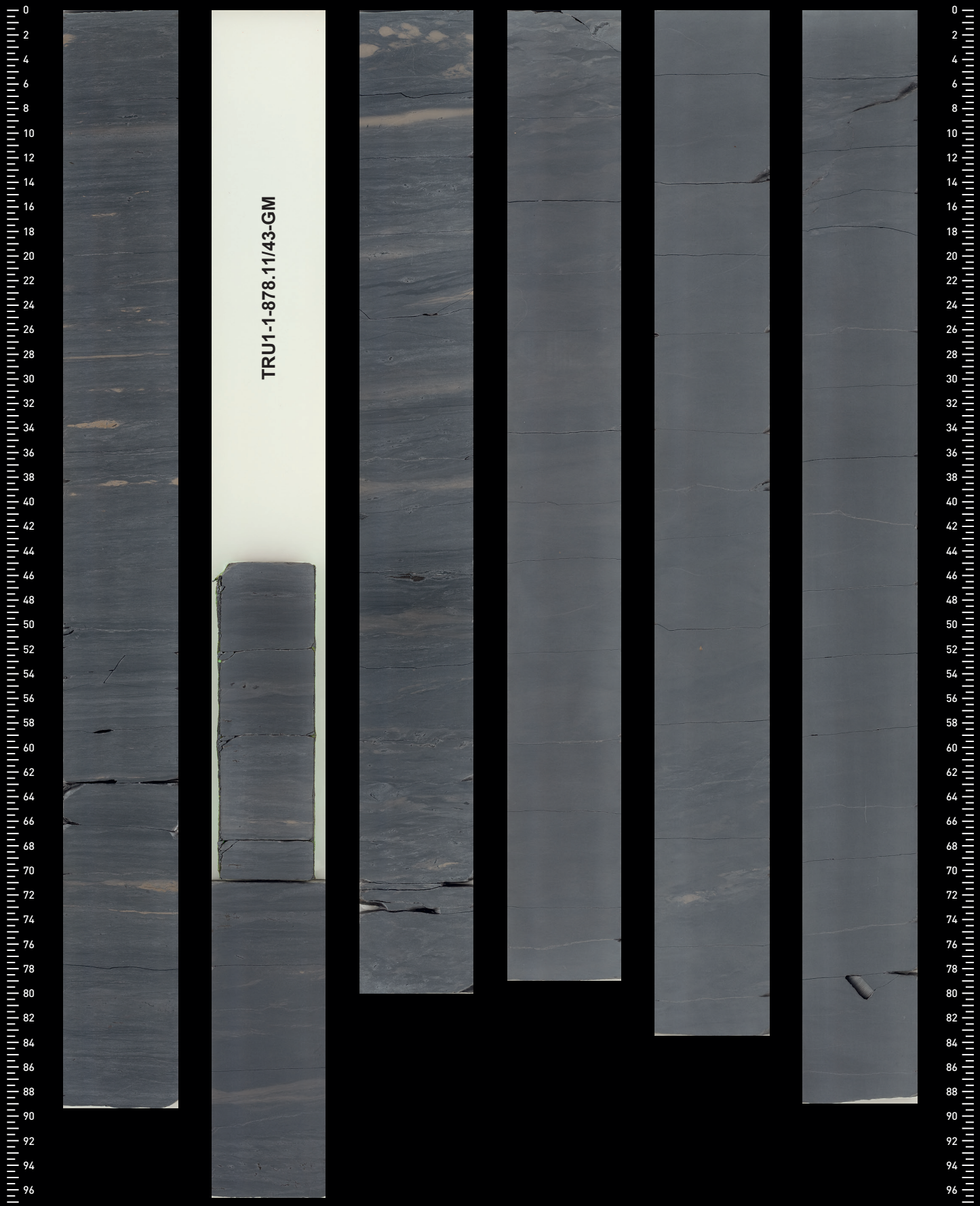
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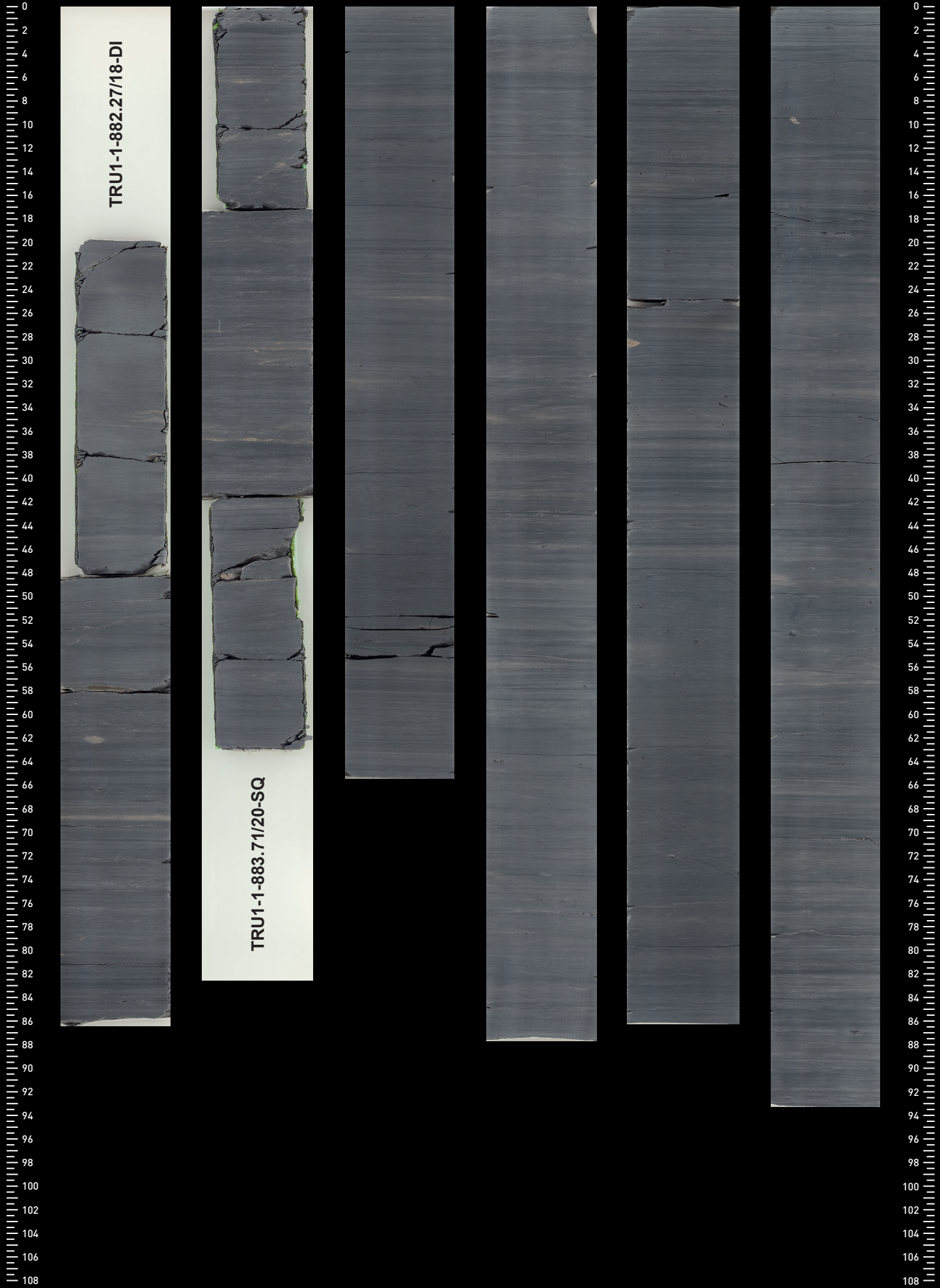
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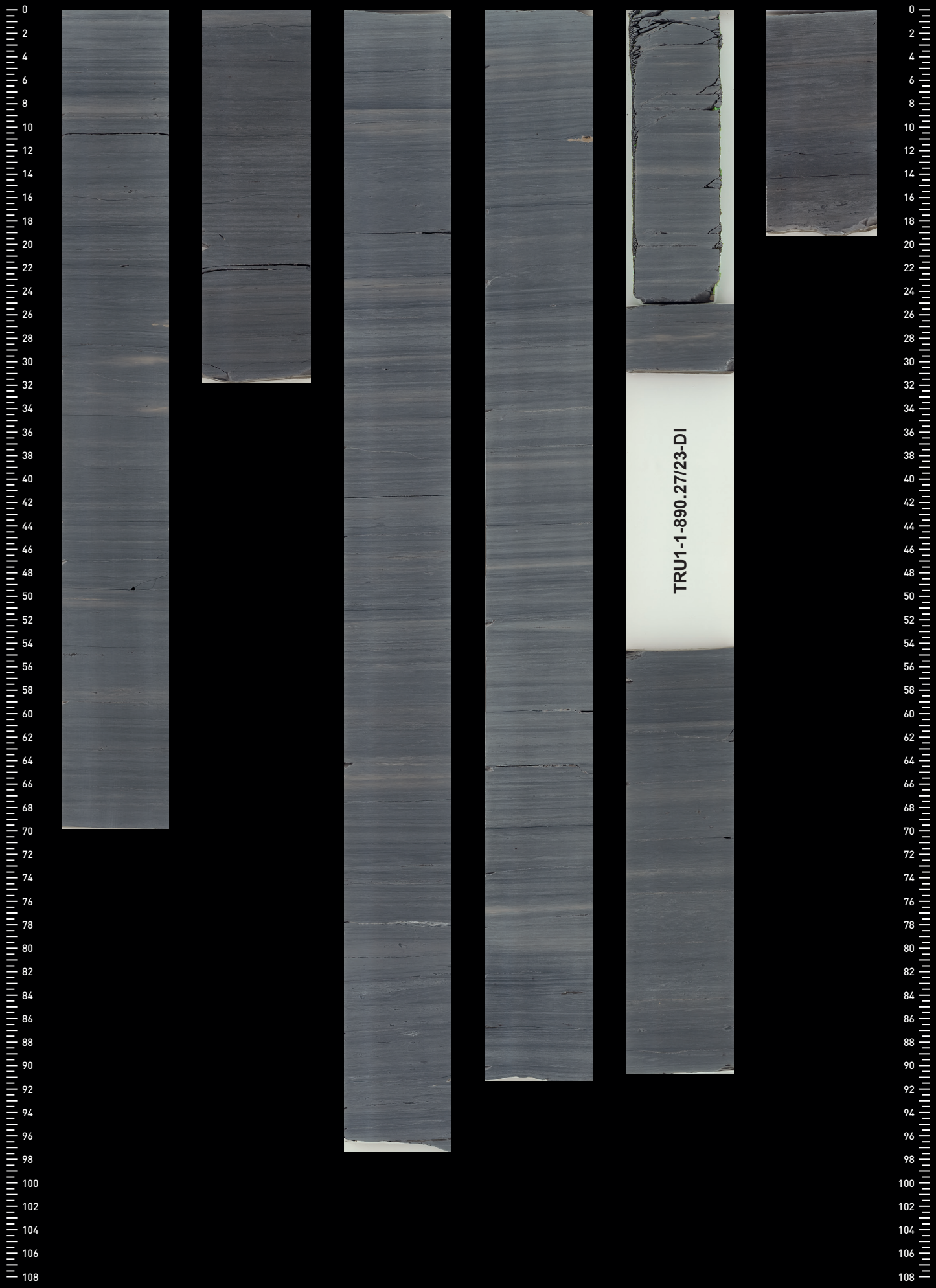
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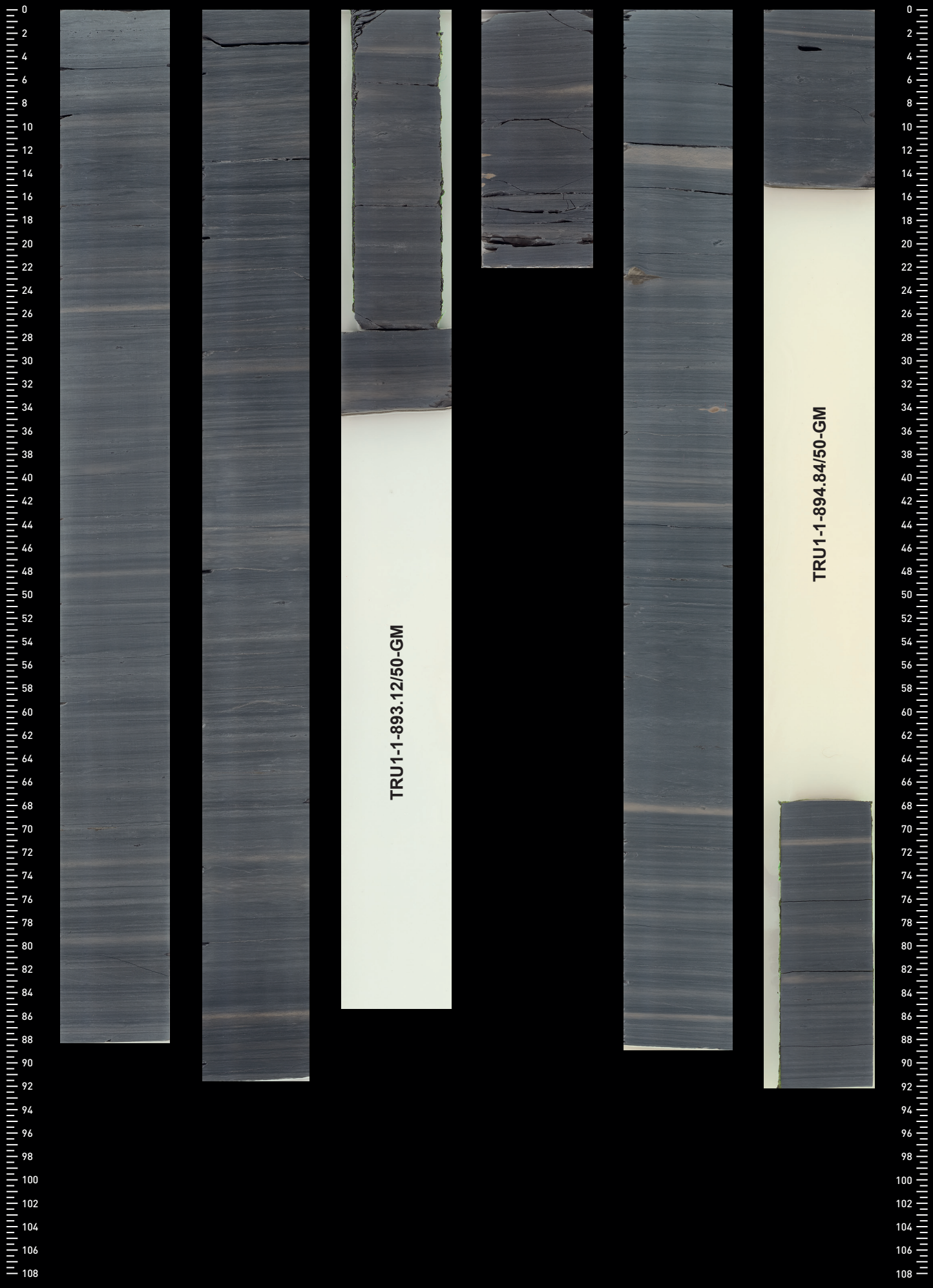
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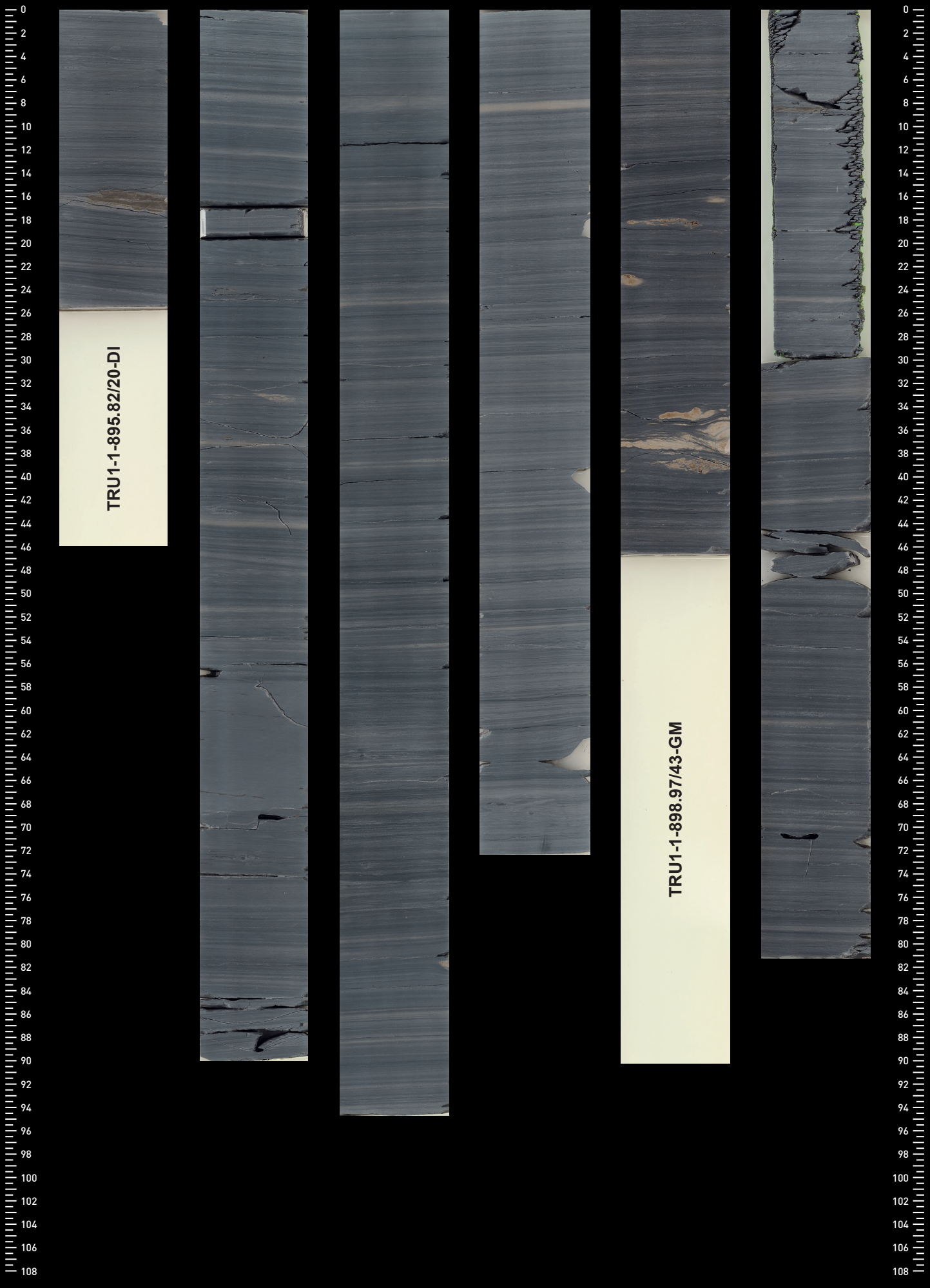
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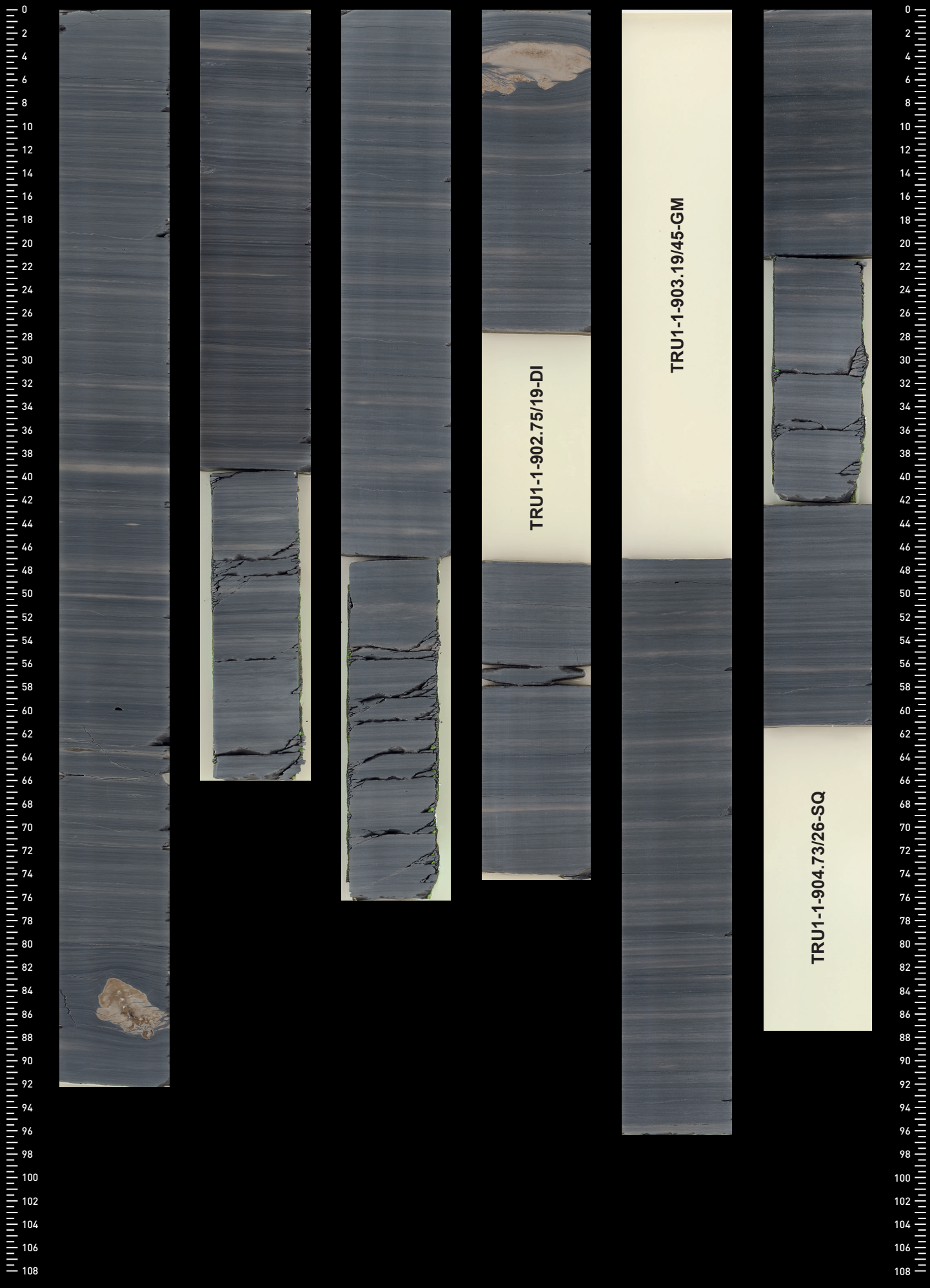


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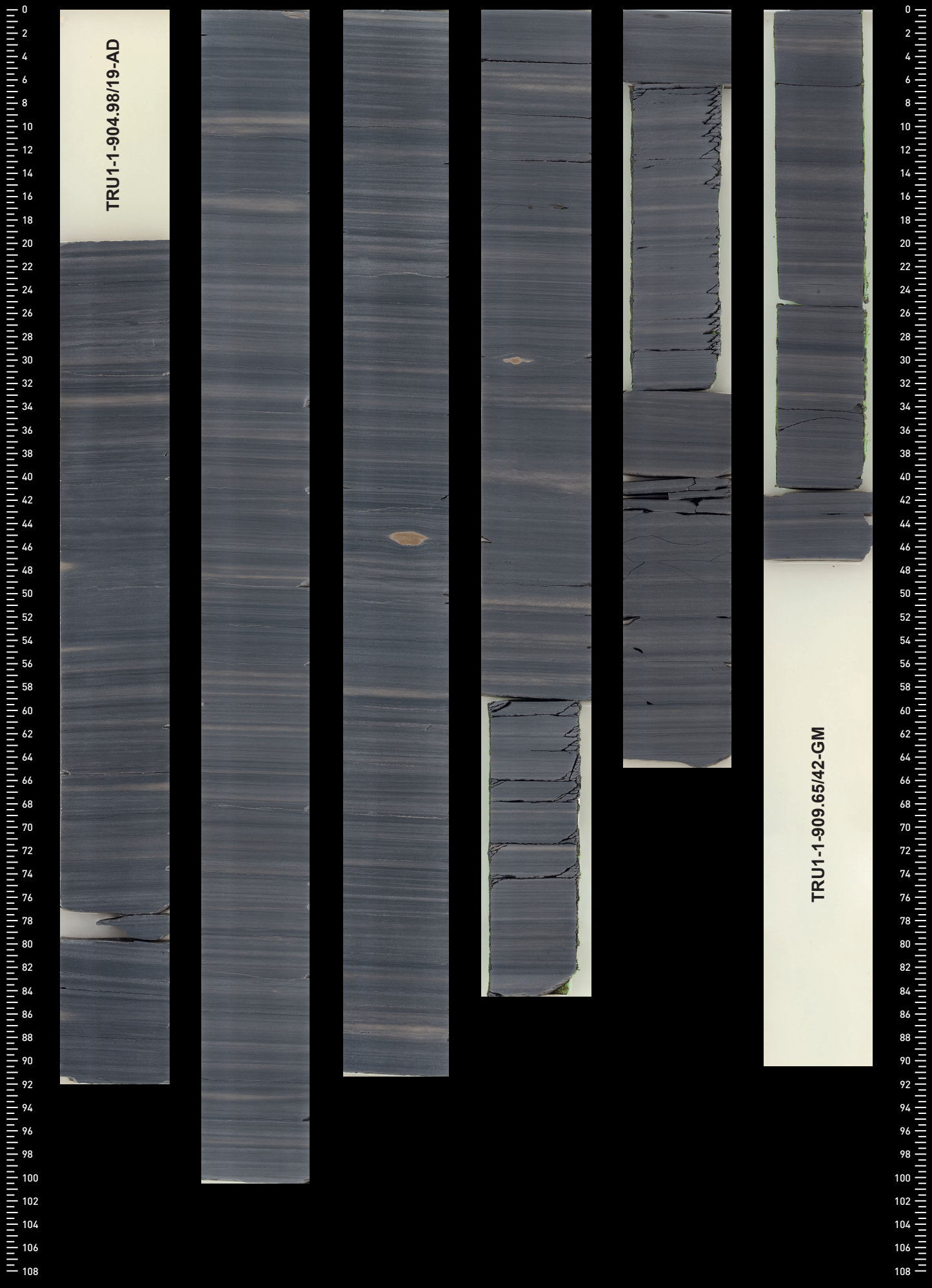
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900.19m
901.09m
901.74m
902.47m
903.19m
904.13m
TRU1-1-902.75/19-DI
TRU1-1-903.19/45-GM
TRU1-1-904.73/26-SQ
901.09m
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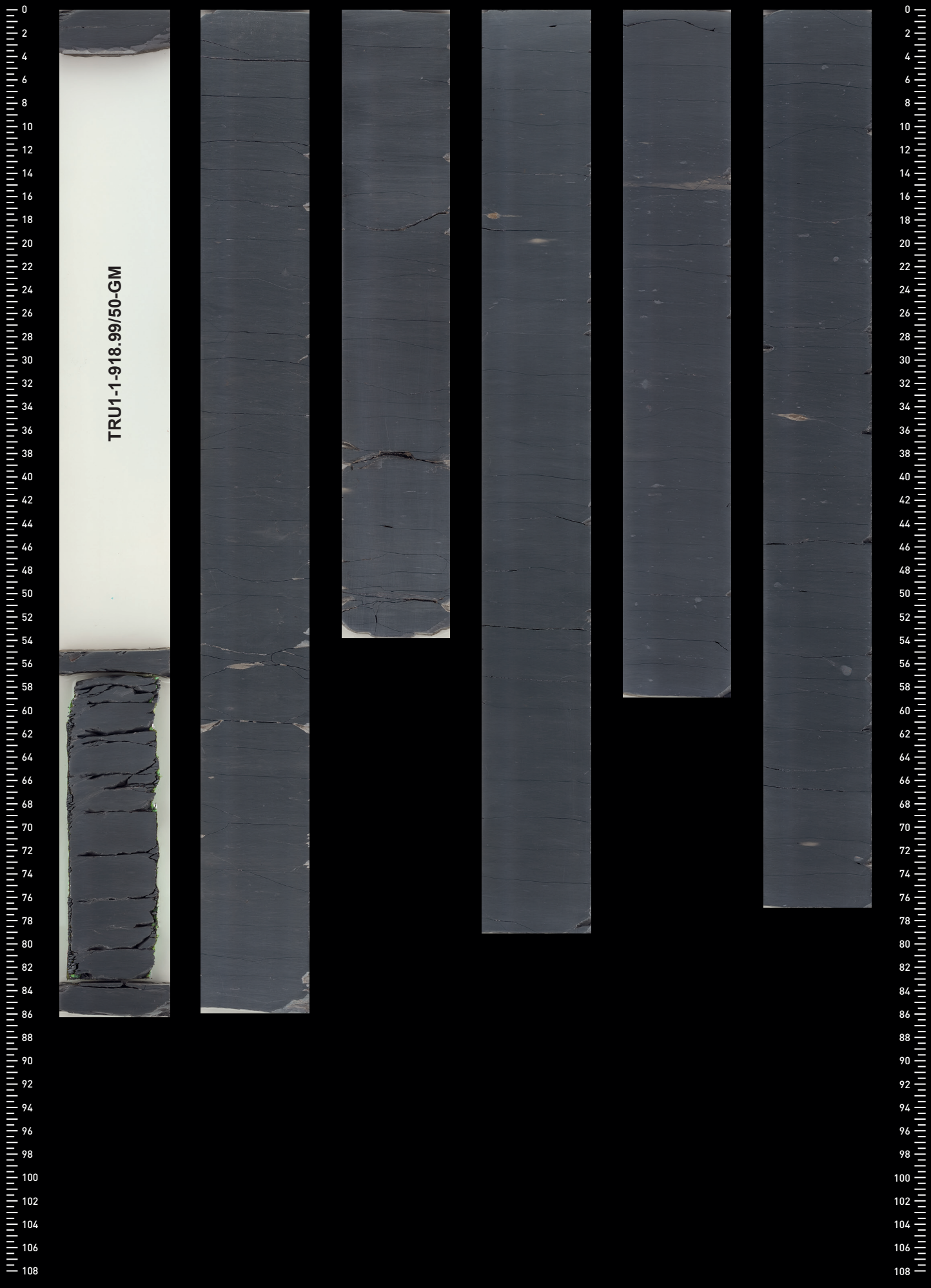
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914.01m

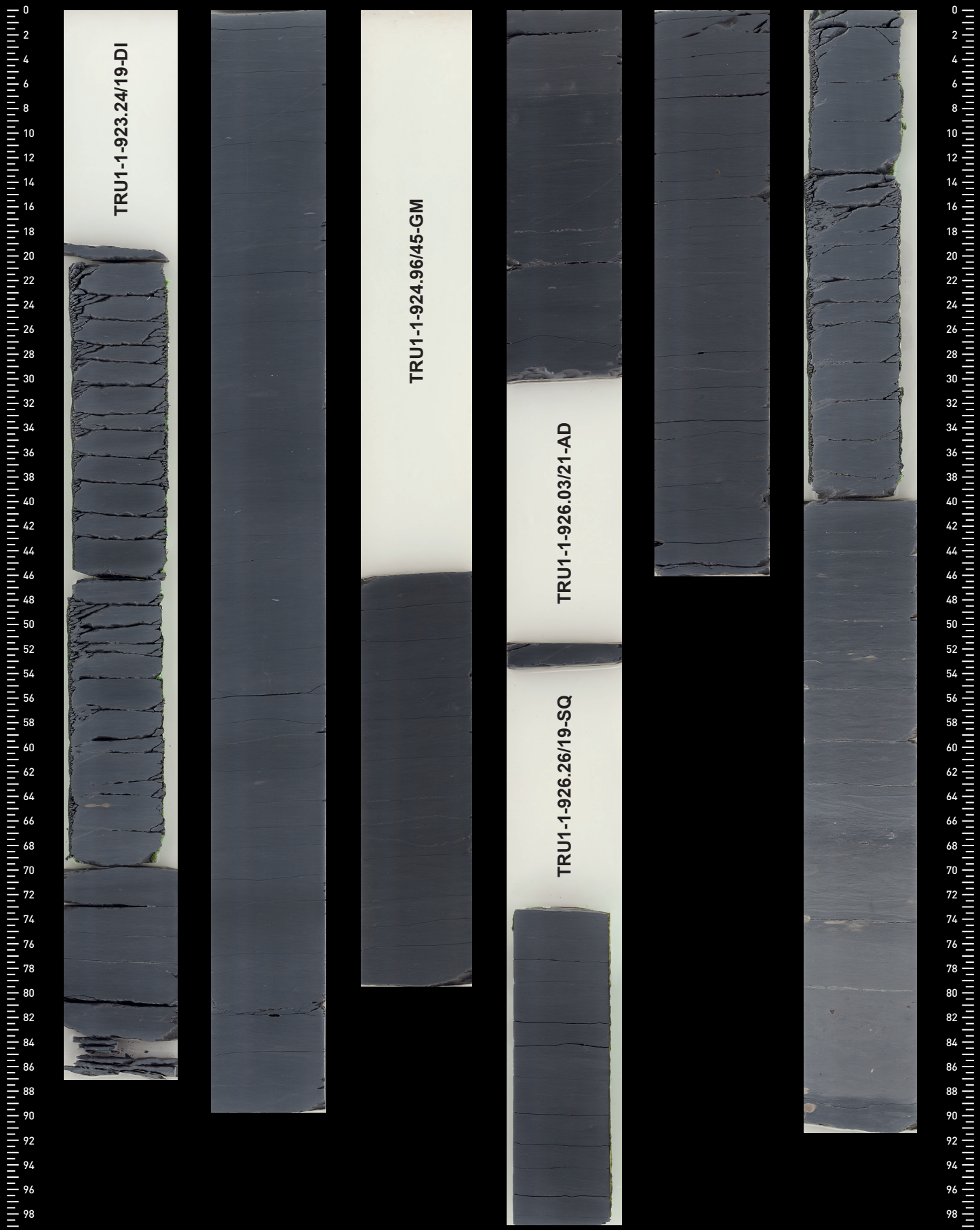
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914.82m 915.72m 916.71m 917.44m 918.09m 918.96m

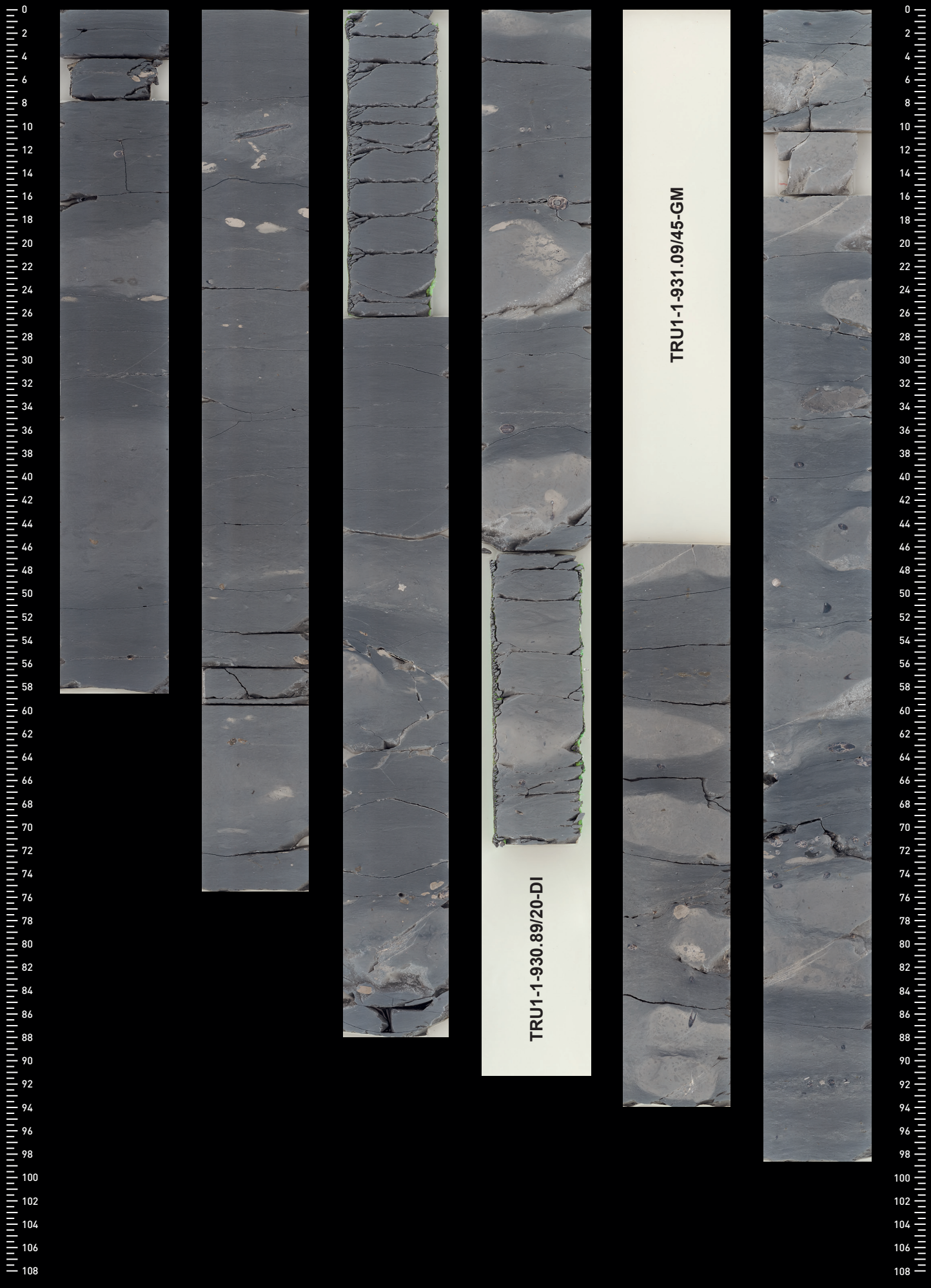

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920.64m
921.14m
921.91m
922.49m
923.24m

923.24m 924.08m 924.96m 925.74m 926.70m 927.15m



924.08m 924.96m 925.74m 926.70m 927.15m 928.03m

928.03m 928.62m 929.34m 930.20m 931.09m 932.00m



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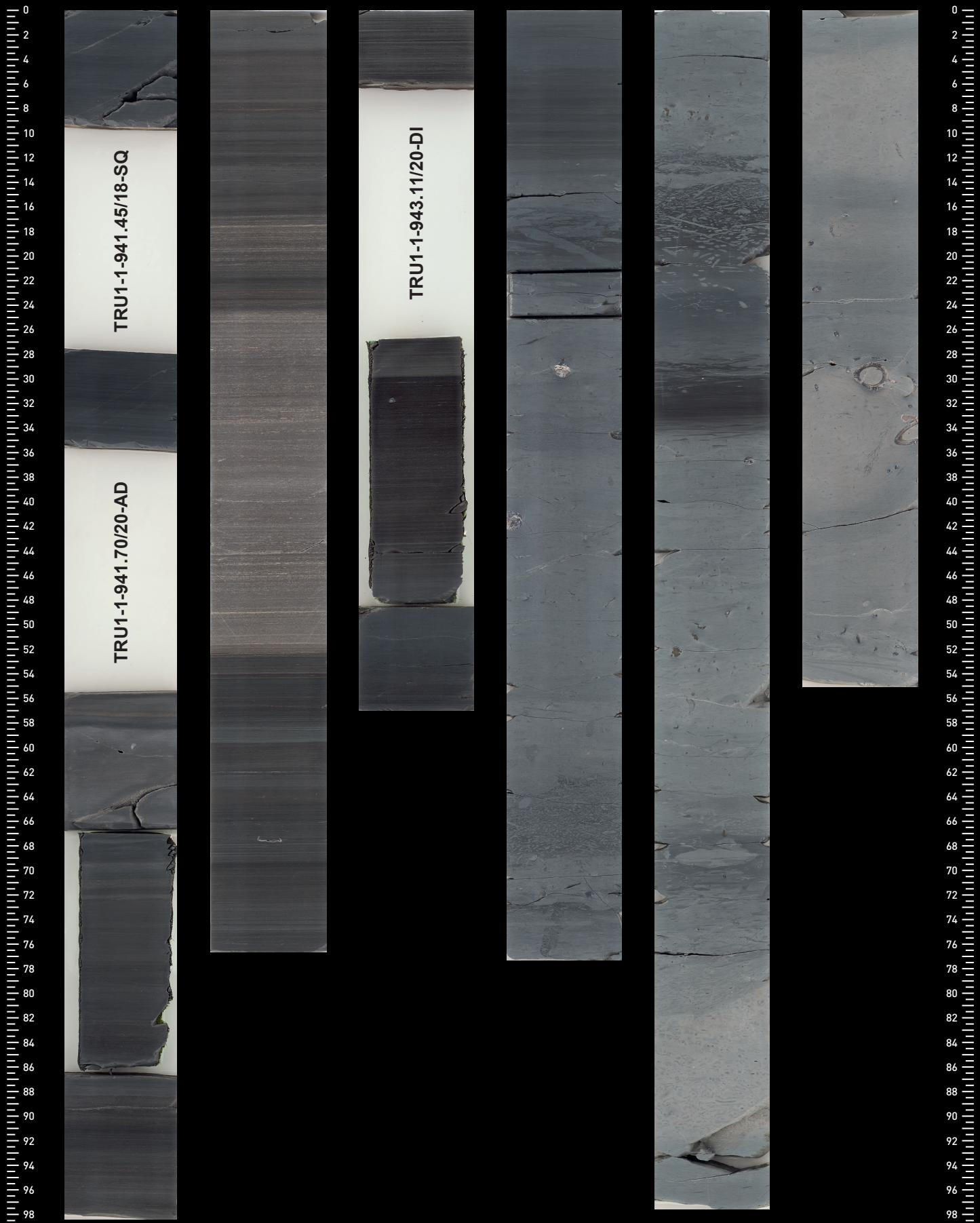
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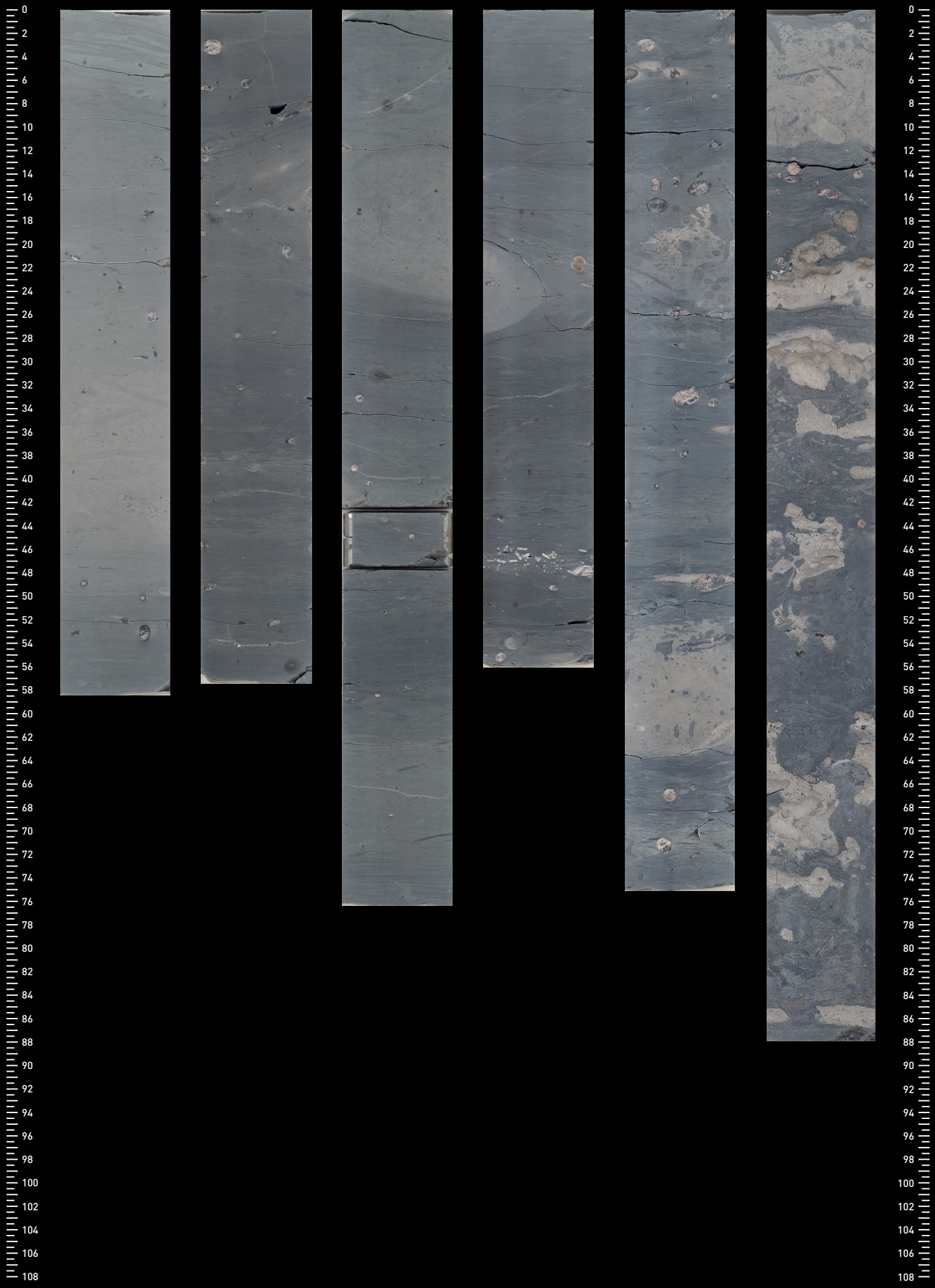

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940.62m
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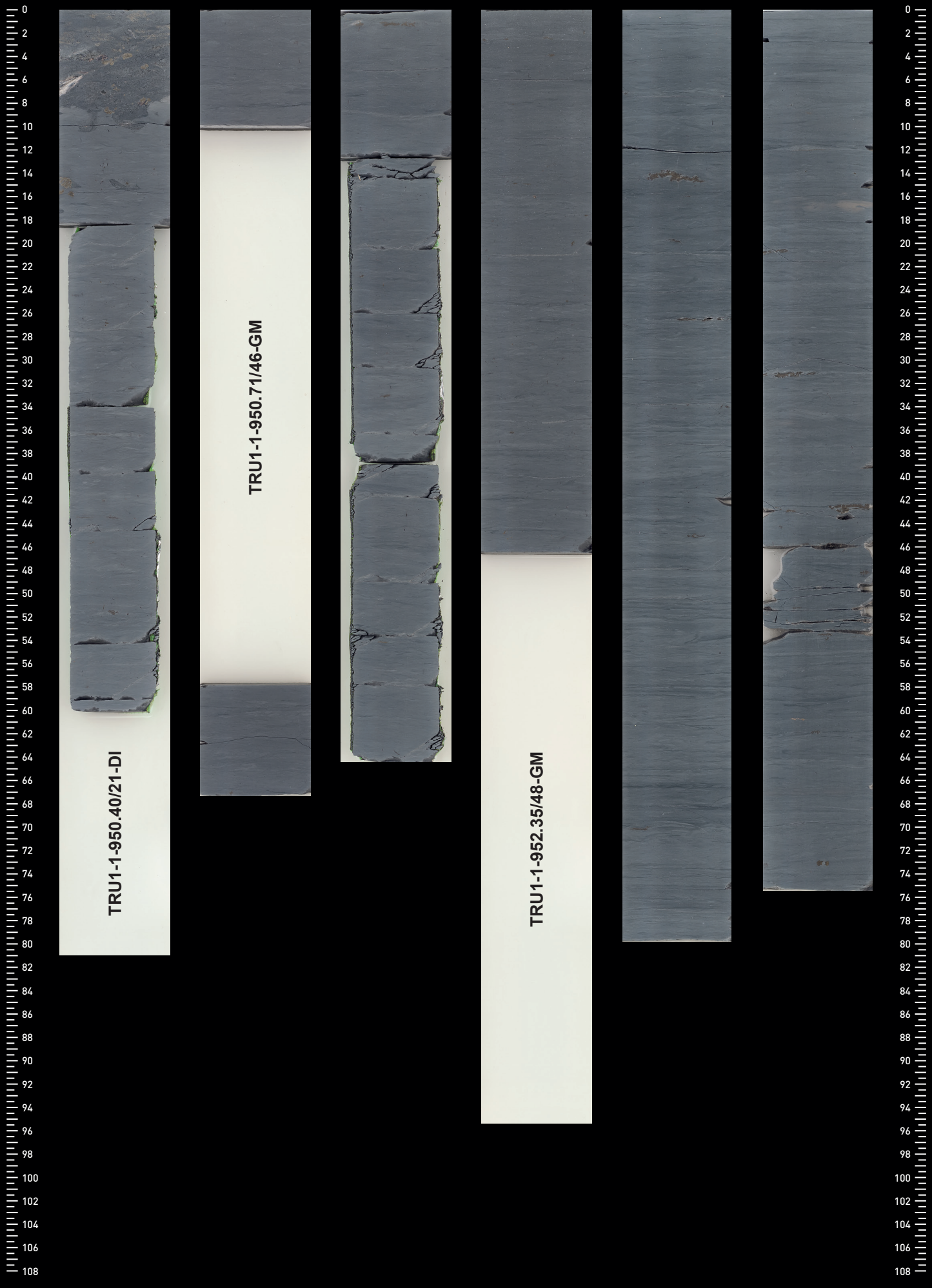
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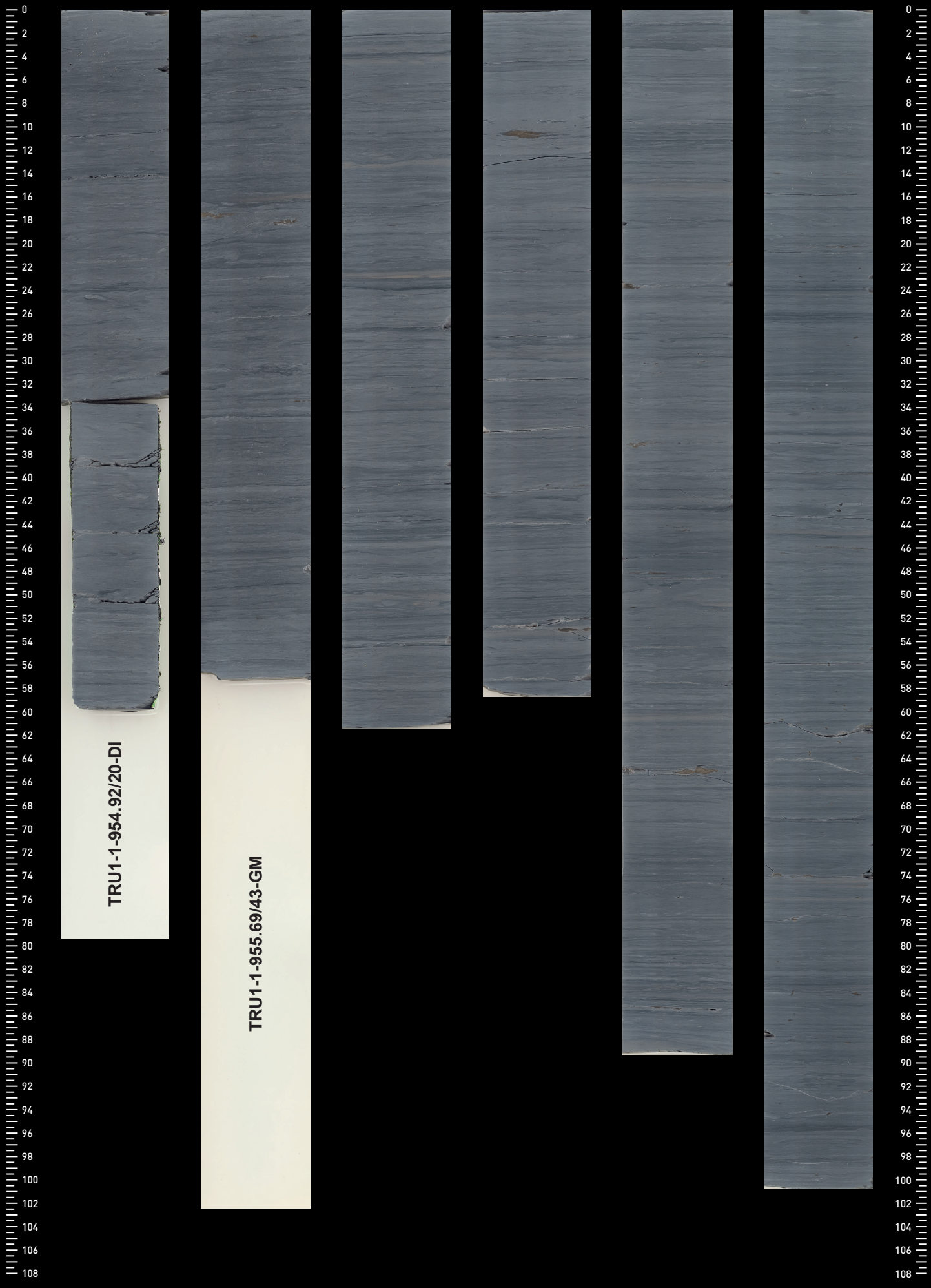
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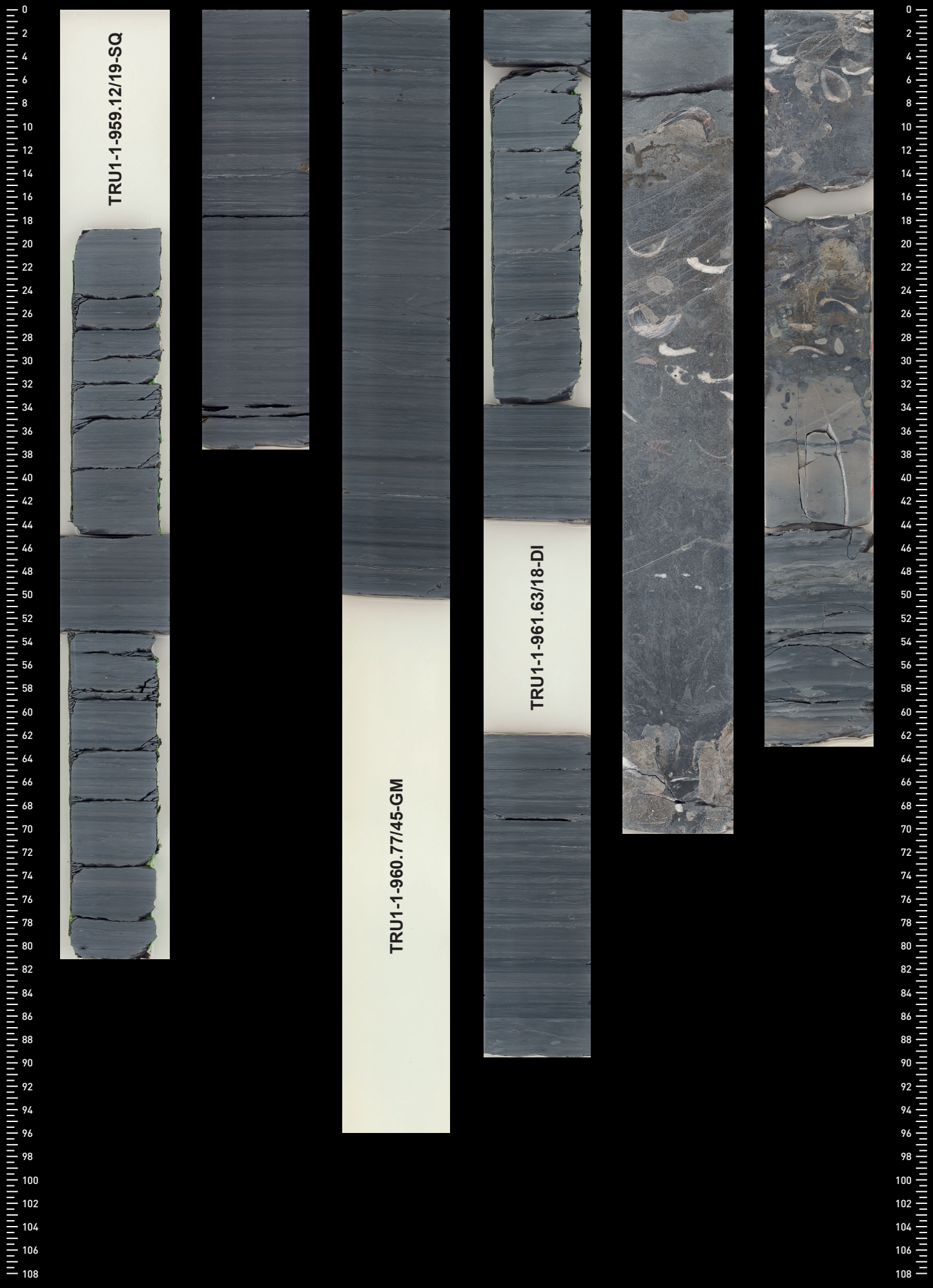
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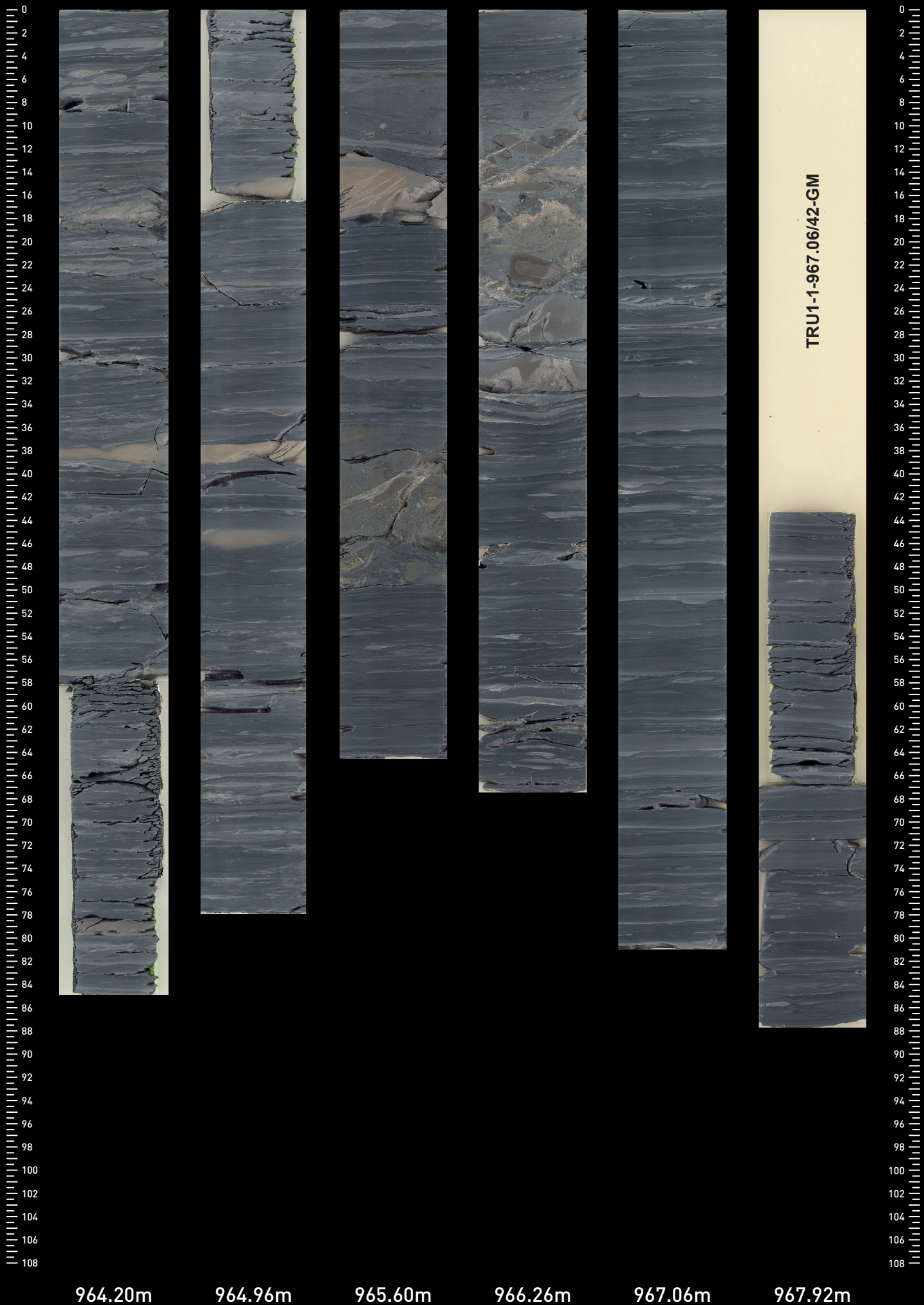
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959.12m 959.91m 960.27m 961.21m 962.08m 962.76m



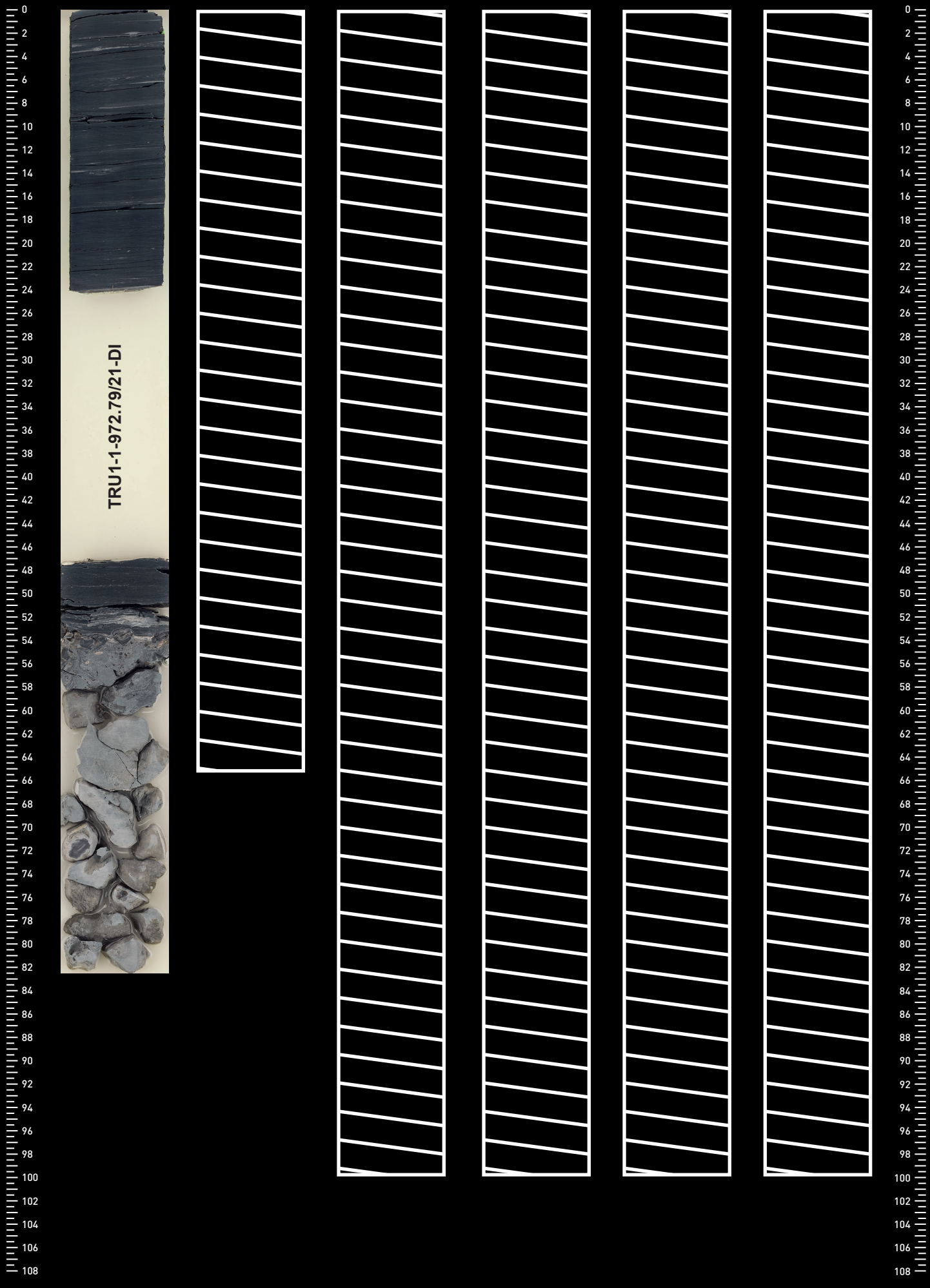
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963.38m 964.20m 964.96m 965.60m 966.26m 967.06m

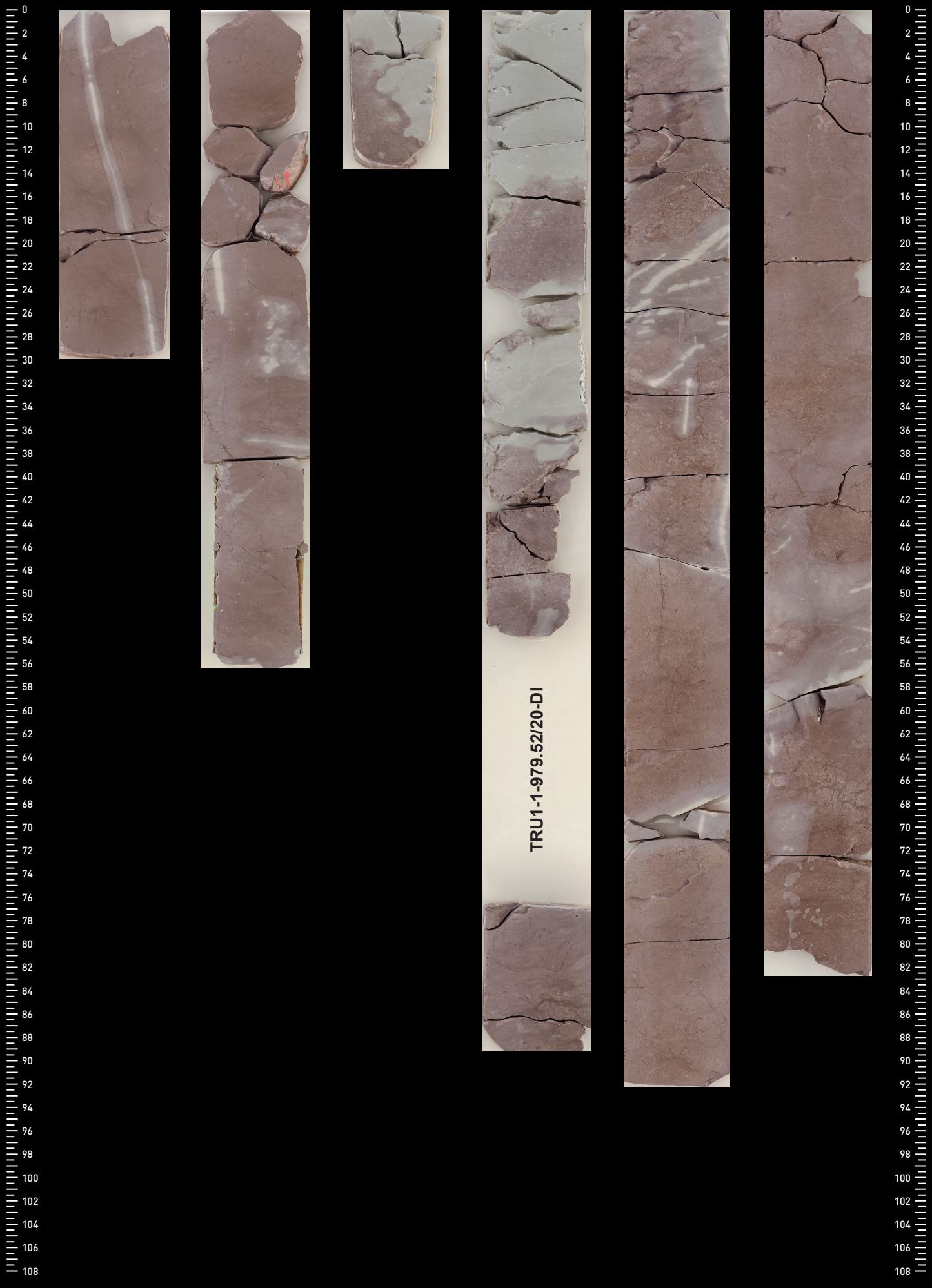


964.20m 964.96m 965.60m 966.26m 967.06m 967.92m


967.92m
968.51m
969.32m
970.26m
971.24m
971.78m
TRU1-1-970.76/48-GM
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969.32m
970.26m
971.24m
971.78m
972.54m

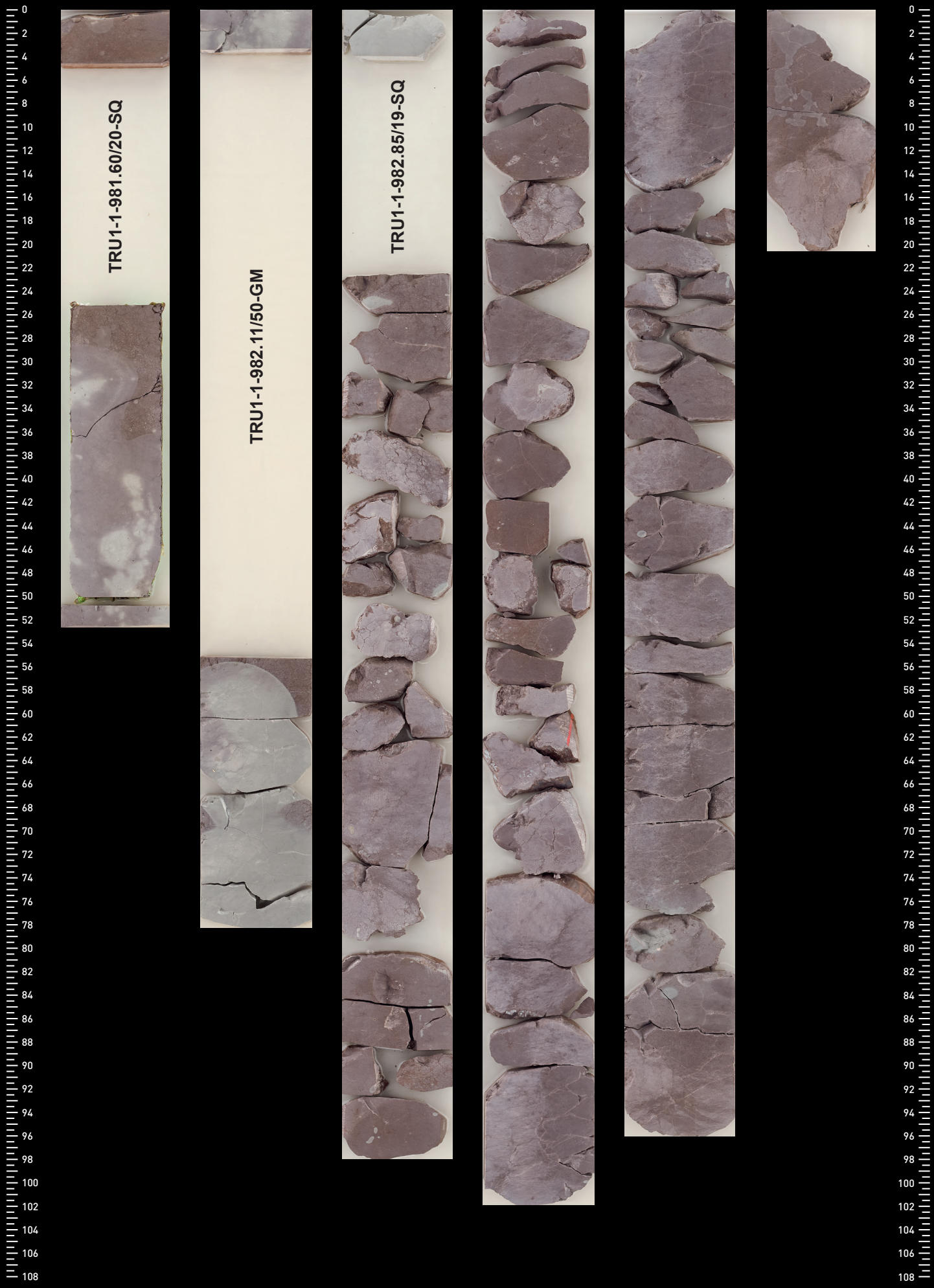

972.54m
973.34m
974.00m
975.00m
976.00m
977.00m
TRU1-1-972.79/21-DI
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974.00m
975.00m
976.00m
977.00m
978.00m

978.00m 978.30m 978.84m 978.97m 979.84m 980.74m



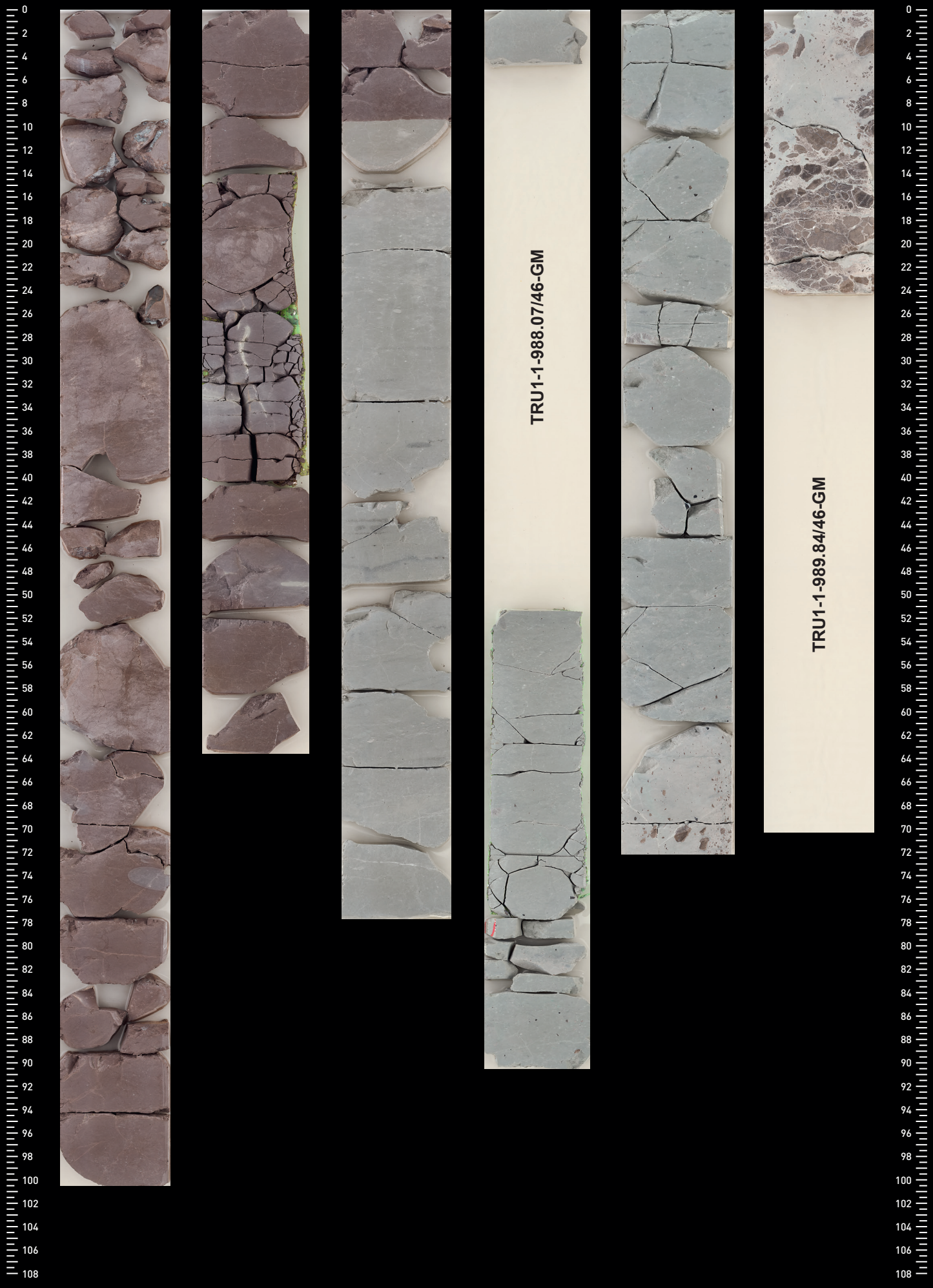
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981.55m 982.07m 982.82m 983.77m 984.76m 985.70m



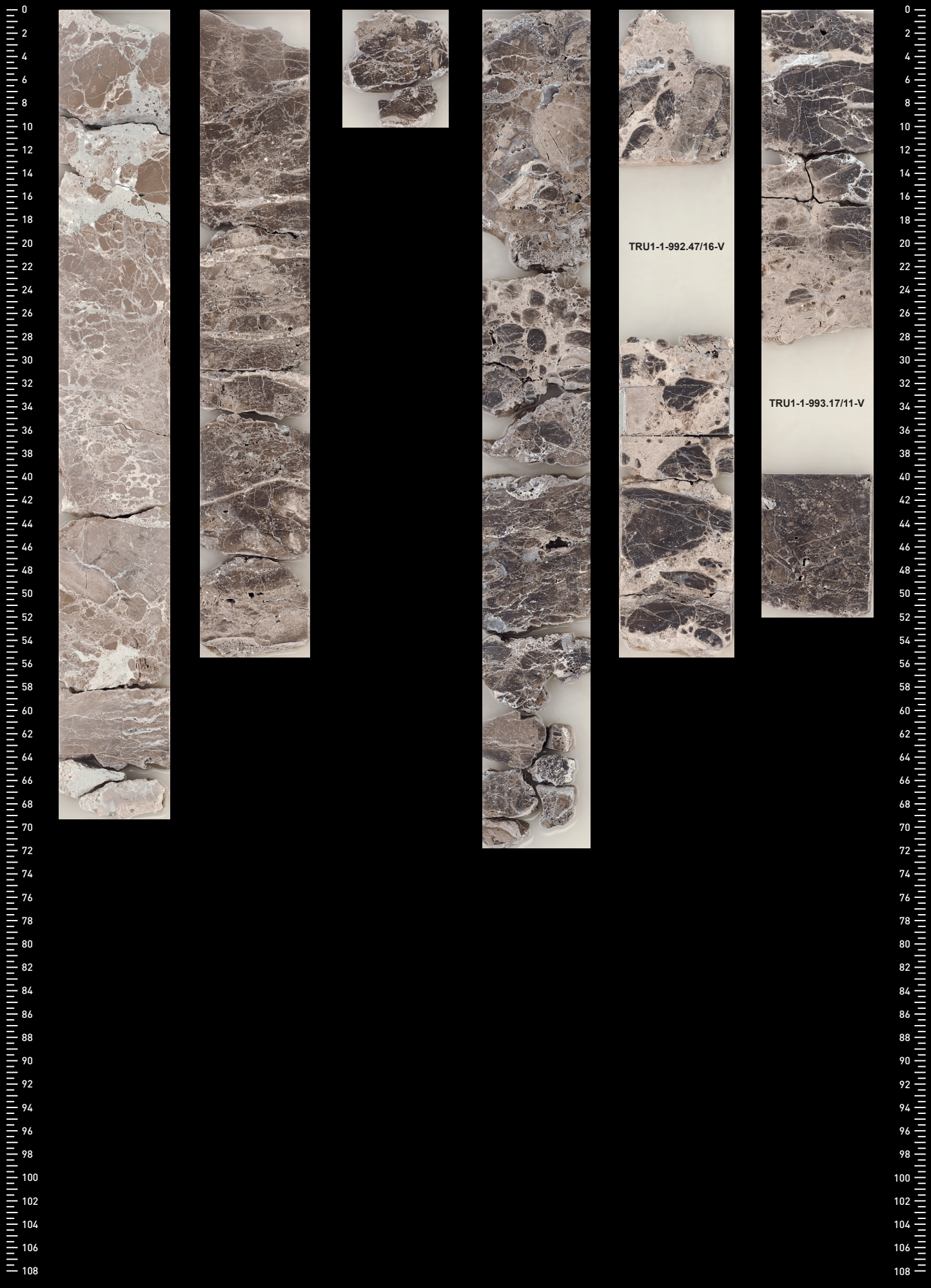
982.07m 982.82m 983.77m 984.76m 985.70m 985.86m

985.86m 986.84m 987.45m 988.03m 988.91m 989.61m



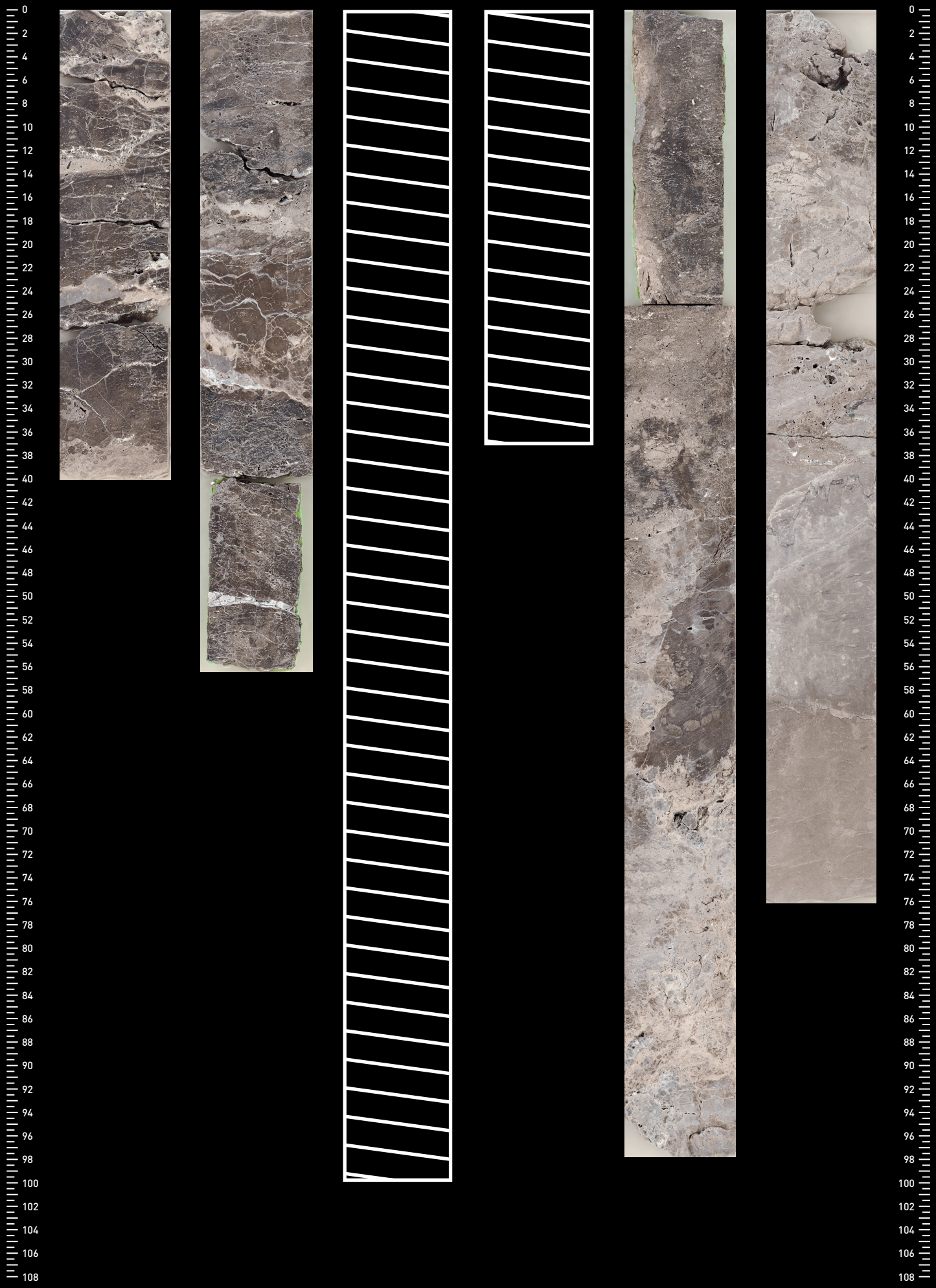
986.84m 987.45m 988.03m 988.91m 989.61m 990.30m

990.30m 991.01m 991.55m 991.64m 992.34m 992.89m



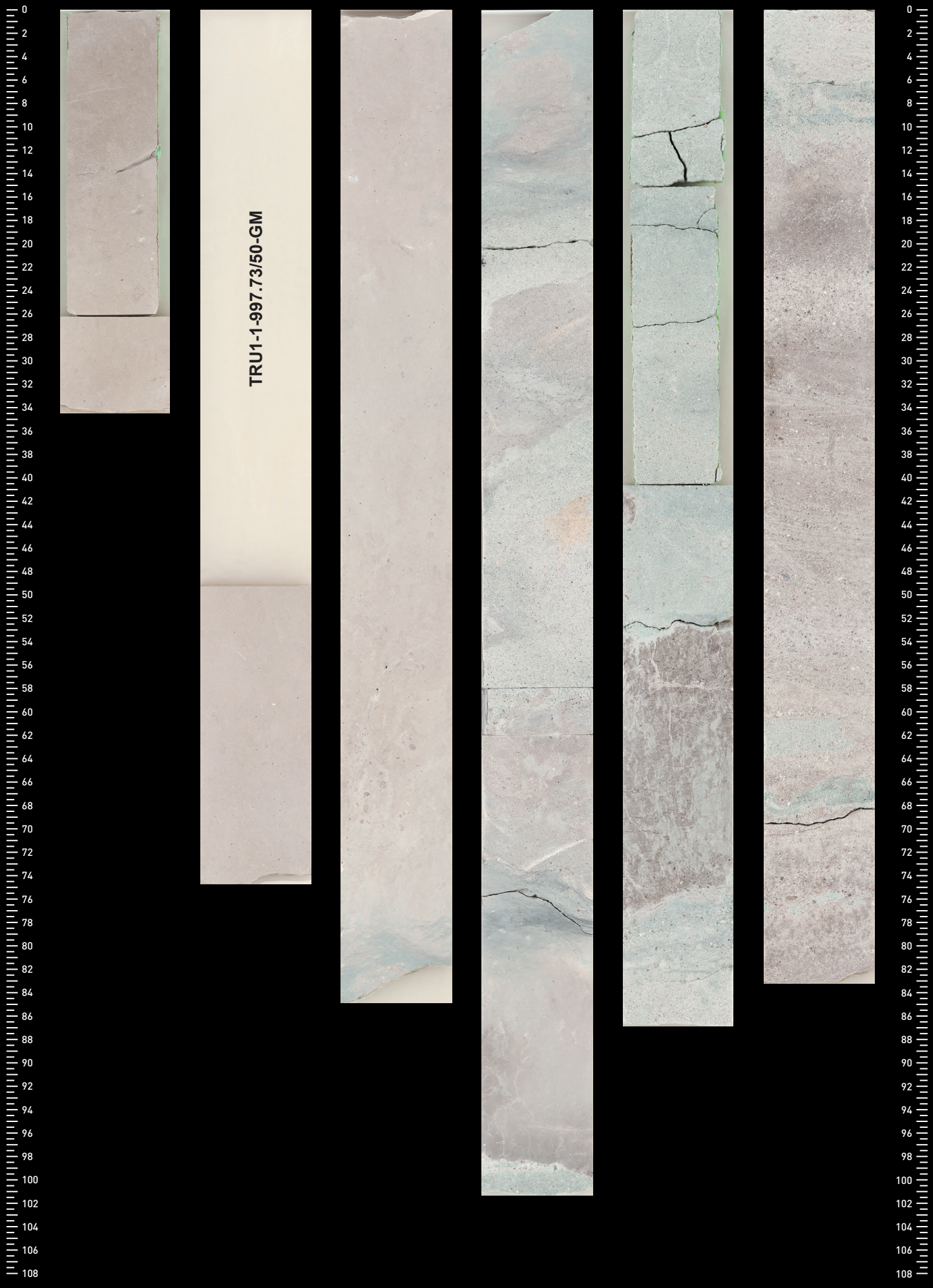
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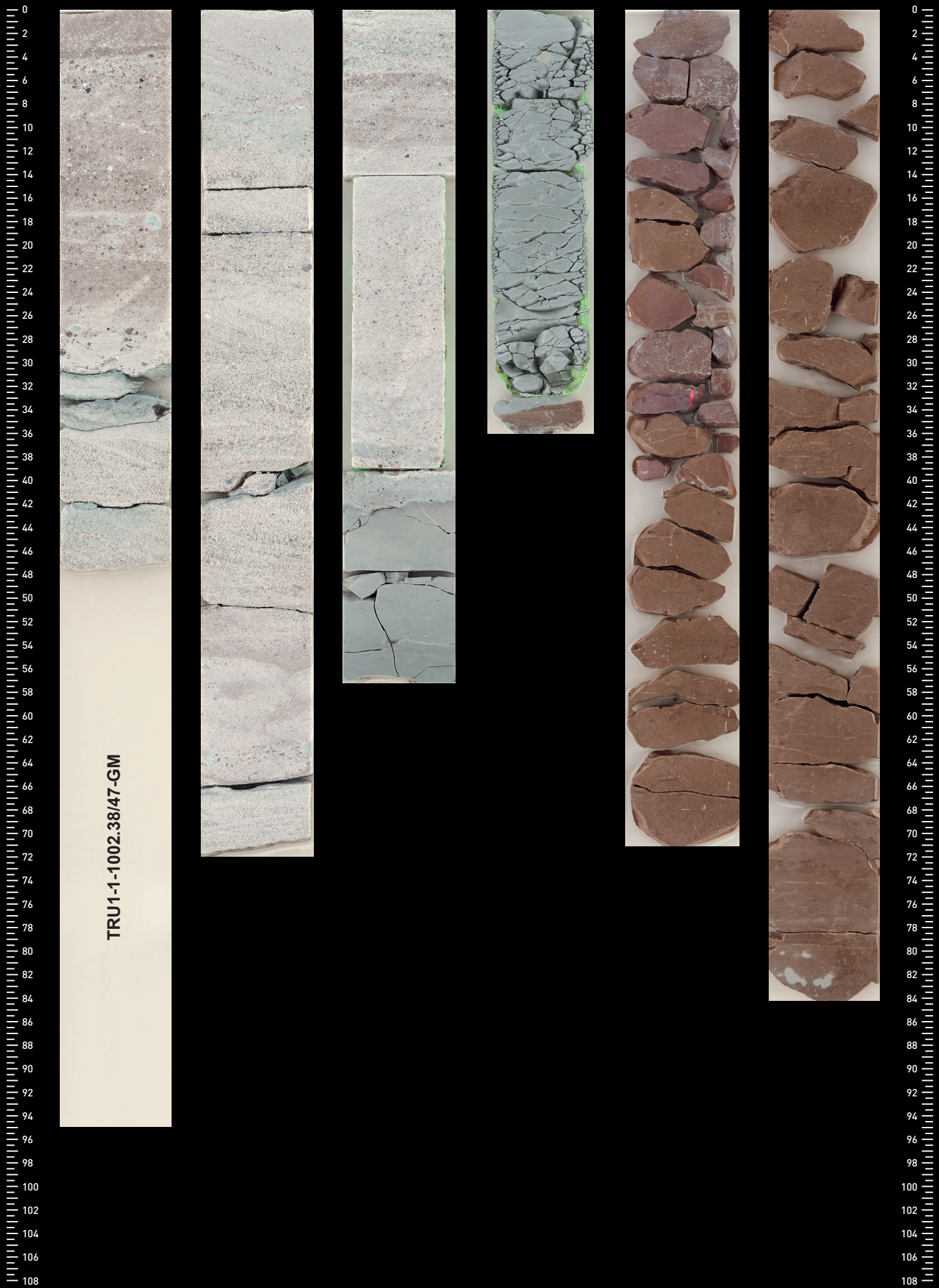
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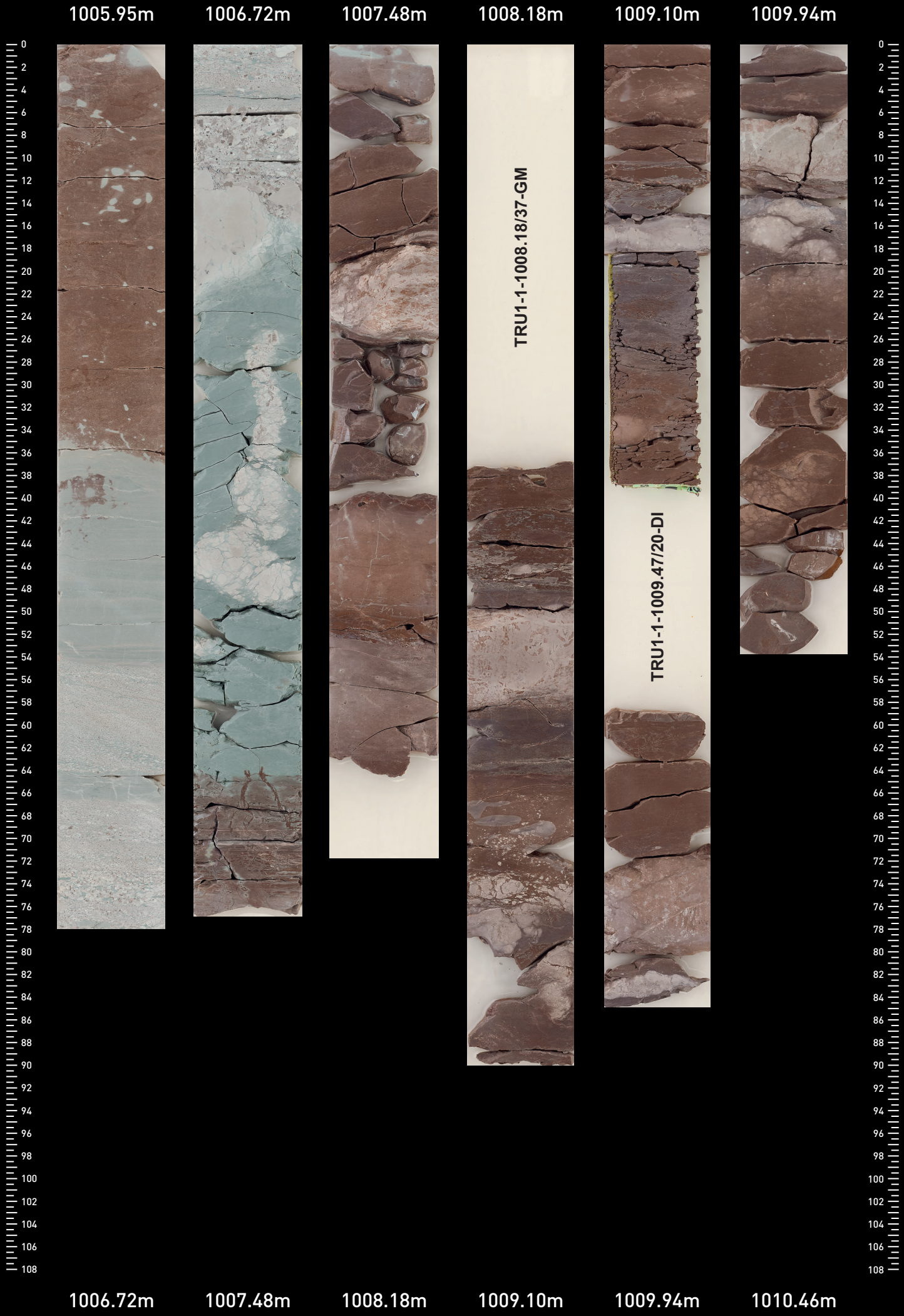


997.73m 998.47m 999.28m 1000.26m 1001.11m 1001.92m

1001.92m 1002.85m 1003.56m 1004.11m 1004.45m 1005.14m



1002.85m 1003.56m 1004.11m 1004.45m 1005.14m 1005.95m


1005.95m
1006.72m
1007.48m
1008.18m
1009.10m
1009.94m
TRU1-1-1008.18/37-GM
TRU1-1-1009.47/20-DI
1006.72m
1007.48m
1008.18m
1009.10m
1009.94m
1010.46m

1010.46m 1011.40m 1012.22m 1013.17m 1014.10m 1014.88m



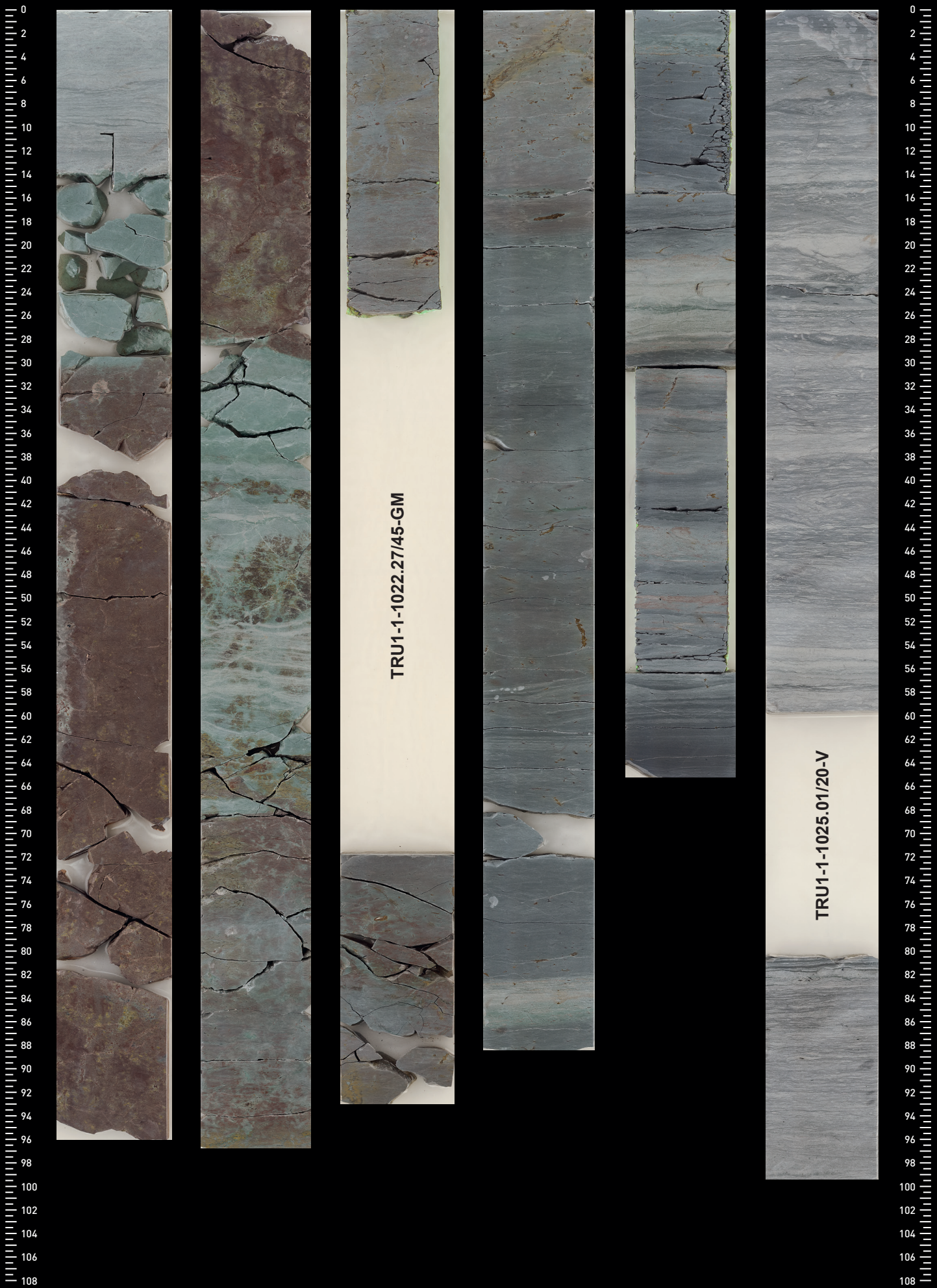
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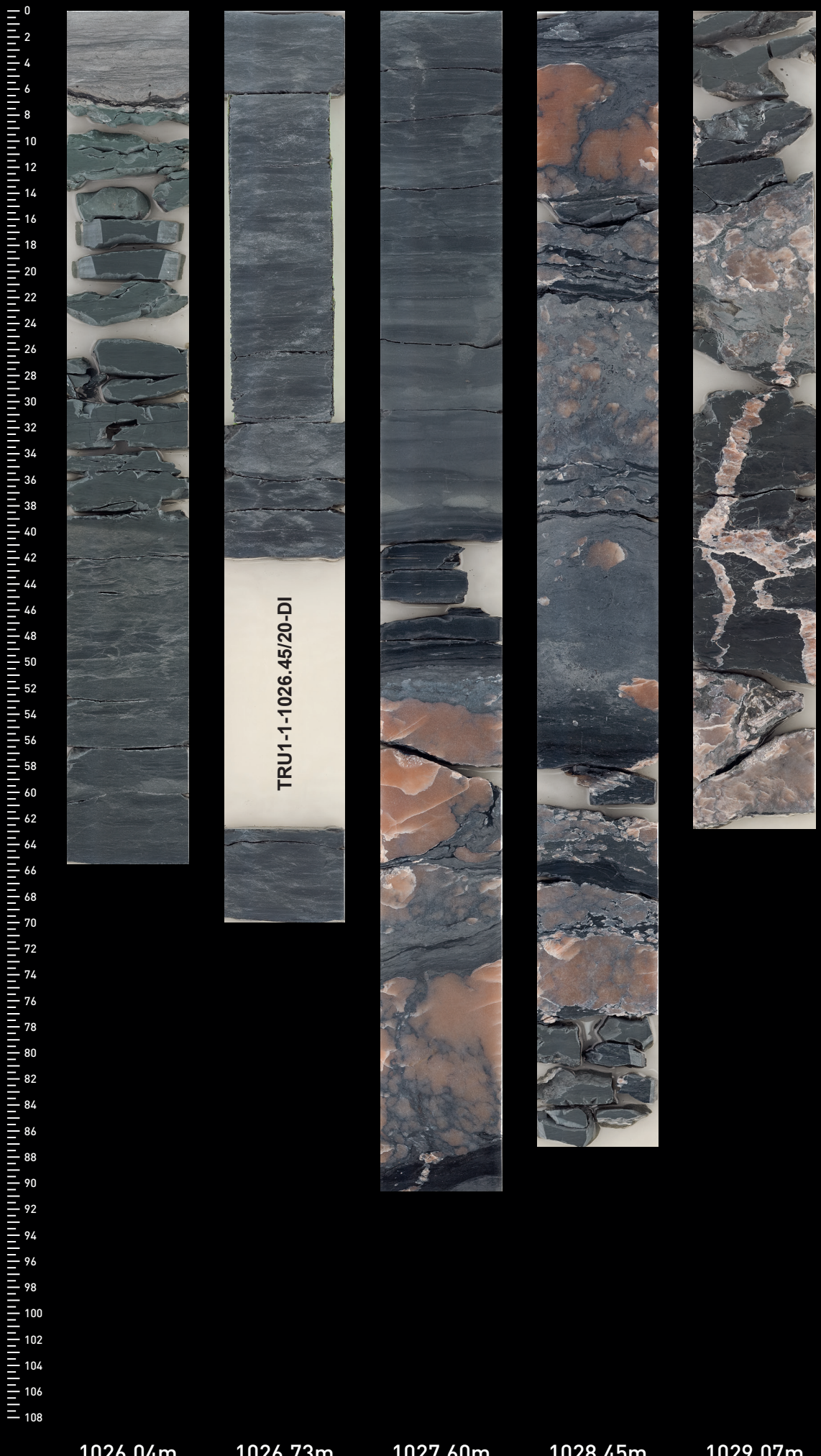
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1021.11m 1022.02m 1022.92m 1023.79m 1024.43m 1025.40m

1025.40m 1026.04m 1026.73m 1027.60m 1028.45m



1026.04m 1026.73m 1027.60m 1028.45m 1029.07m

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