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Leading Brand of IMDEX

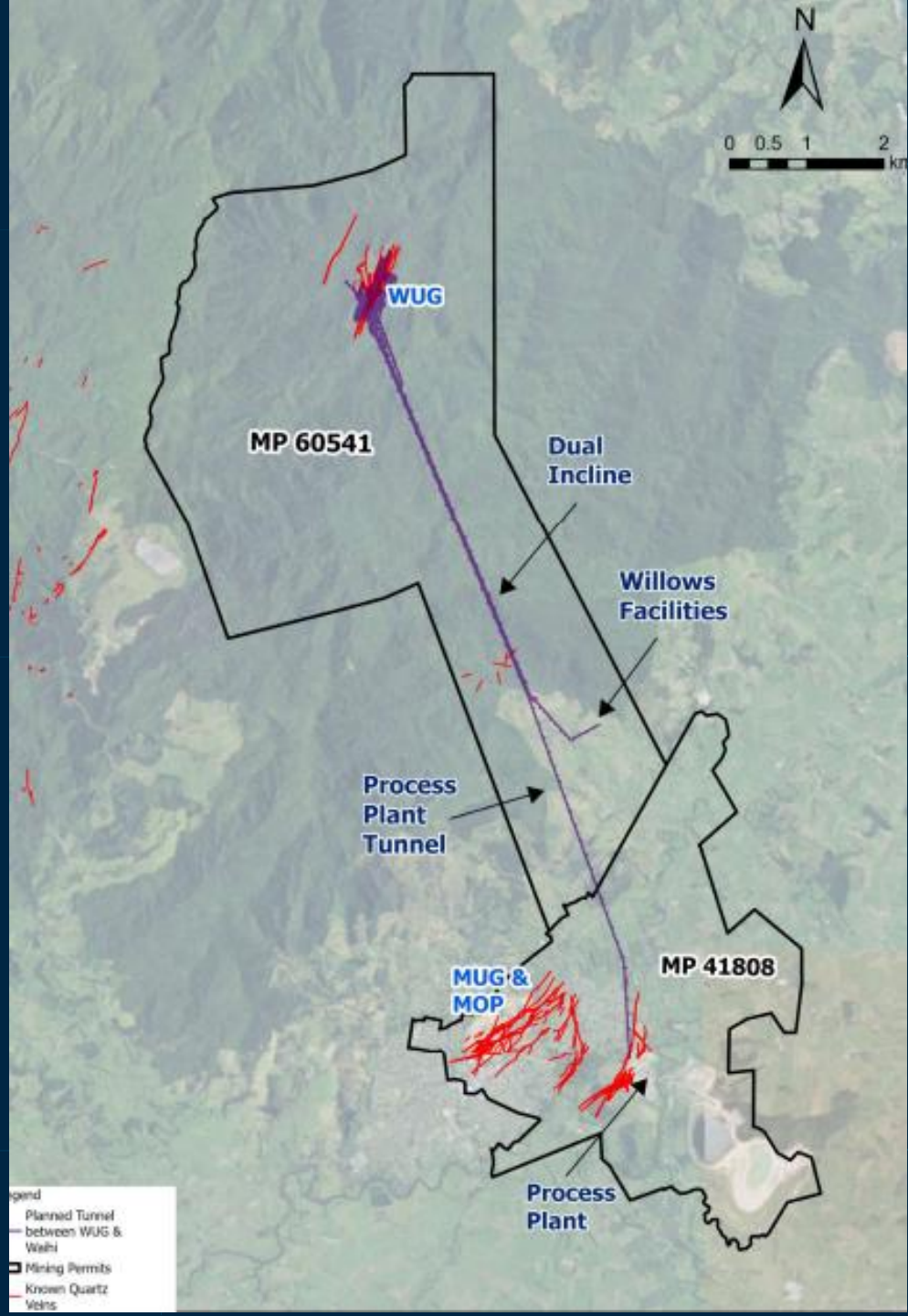
# Improving Geotechnical Confidence at Waihi North

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Datarock/IMDEX

With thanks to Steve Webber & OceanaGold

# Overview

- Waihi North Underground Development
- Datarock Core Products:
  - RQD
  - Joint Set Analysis
  - Roughness
  - Geological Strength Index
  - Fracture Orientation
- Benefits
- Future applications



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# Waihi North Underground Development

## Environmentally sensitive area

- Limited access for drill sites
- Need to extract the most value from data collected as possible
- Multiple sense checks run to give more confidence on drilling data





# Datarock Core

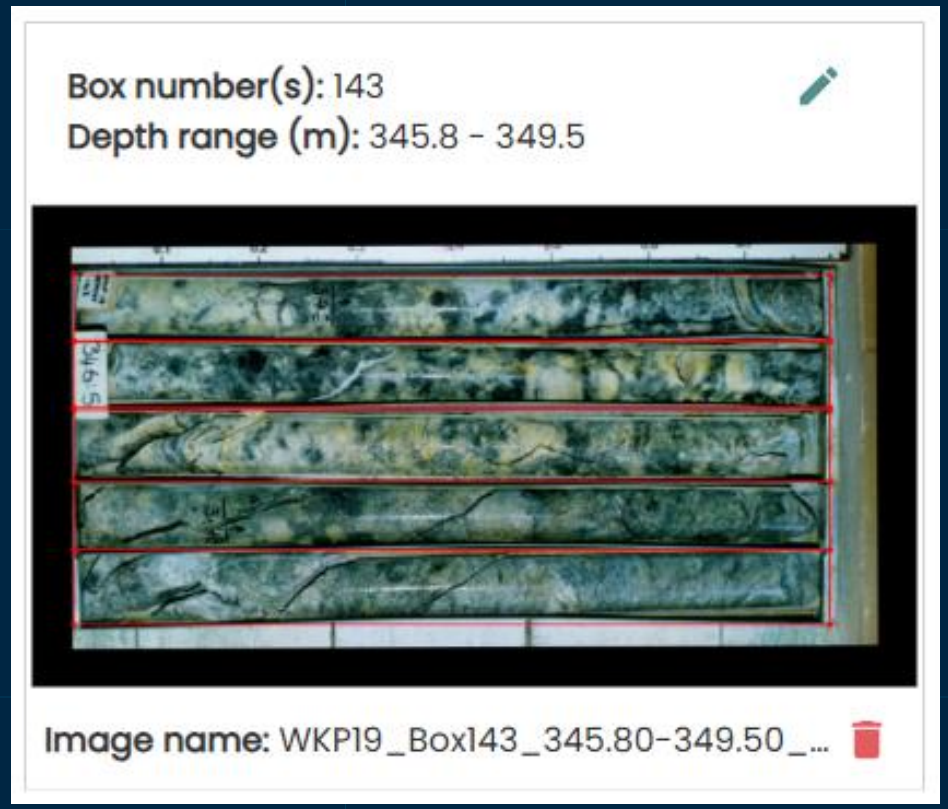
- Analytics Ready Data (Image Preparation + Depth Registration)
- Geotech Products
  - RQD
  - Fractures
  - Joint Set Analysis
  - Dominant Colour

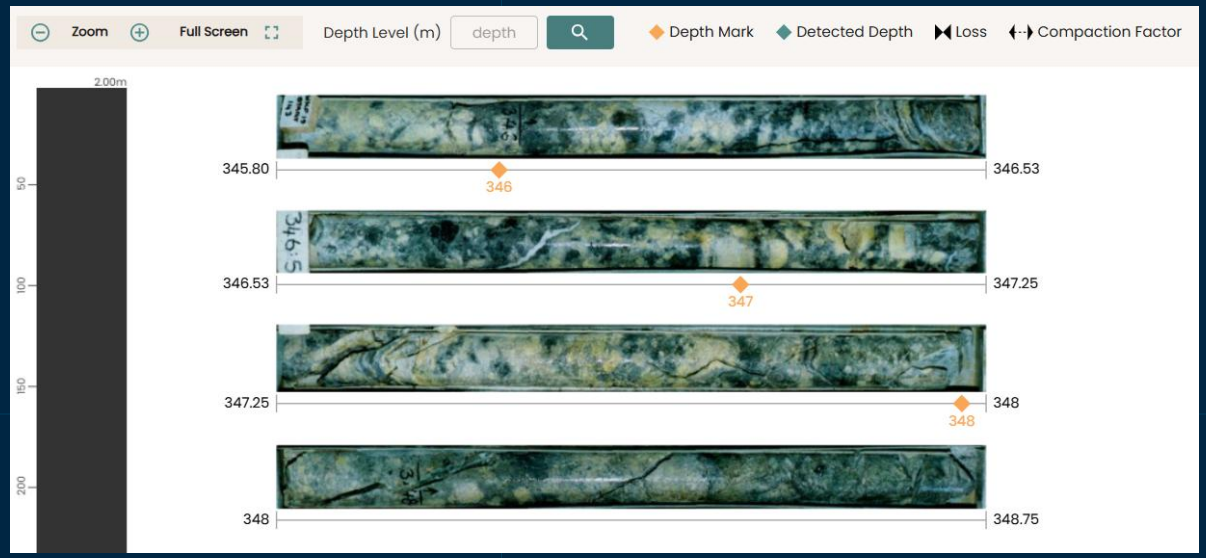
- Advanced Geotech Products
  - Weighted Joint Density
  - RQD Weighted Joint Density
  - Geotechnical Weathering Intensity
  - Joint Roughness Coefficient (Proxy)
  - Geological Strength Index (Proxy)
  - Fracture Orientation

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# Image prep and depth registration

- Metadata upload
- Box / Tray cropping
- Row cropping
- Coherent and incoherent rock identification
- Core block and empty tray
- Depth detection (OCR)



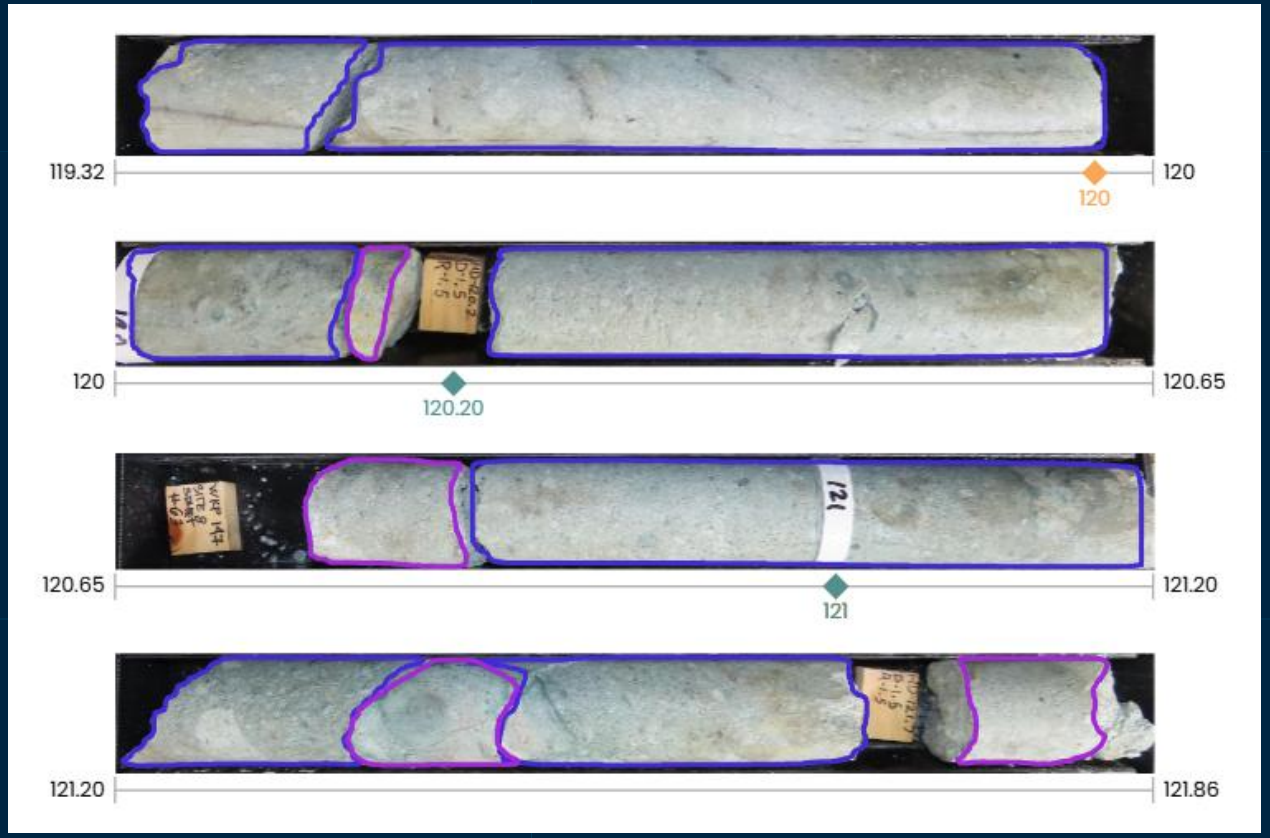



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# RQD

- Measures coherent core pieces against standard RQD thresholds
- Uses coherent rock detection to measure intact core lengths
- Uses driller break detection to separate natural and mechanical breaks
- Outputs RQD by metre intervals or custom user-defined intervals

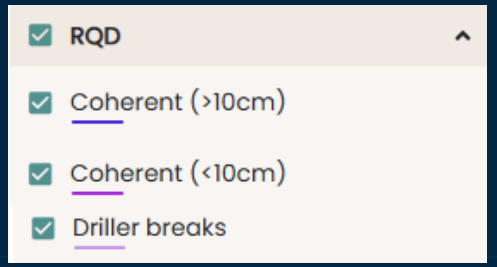
  - >10cm (blue)
  - <10cm (magenta)



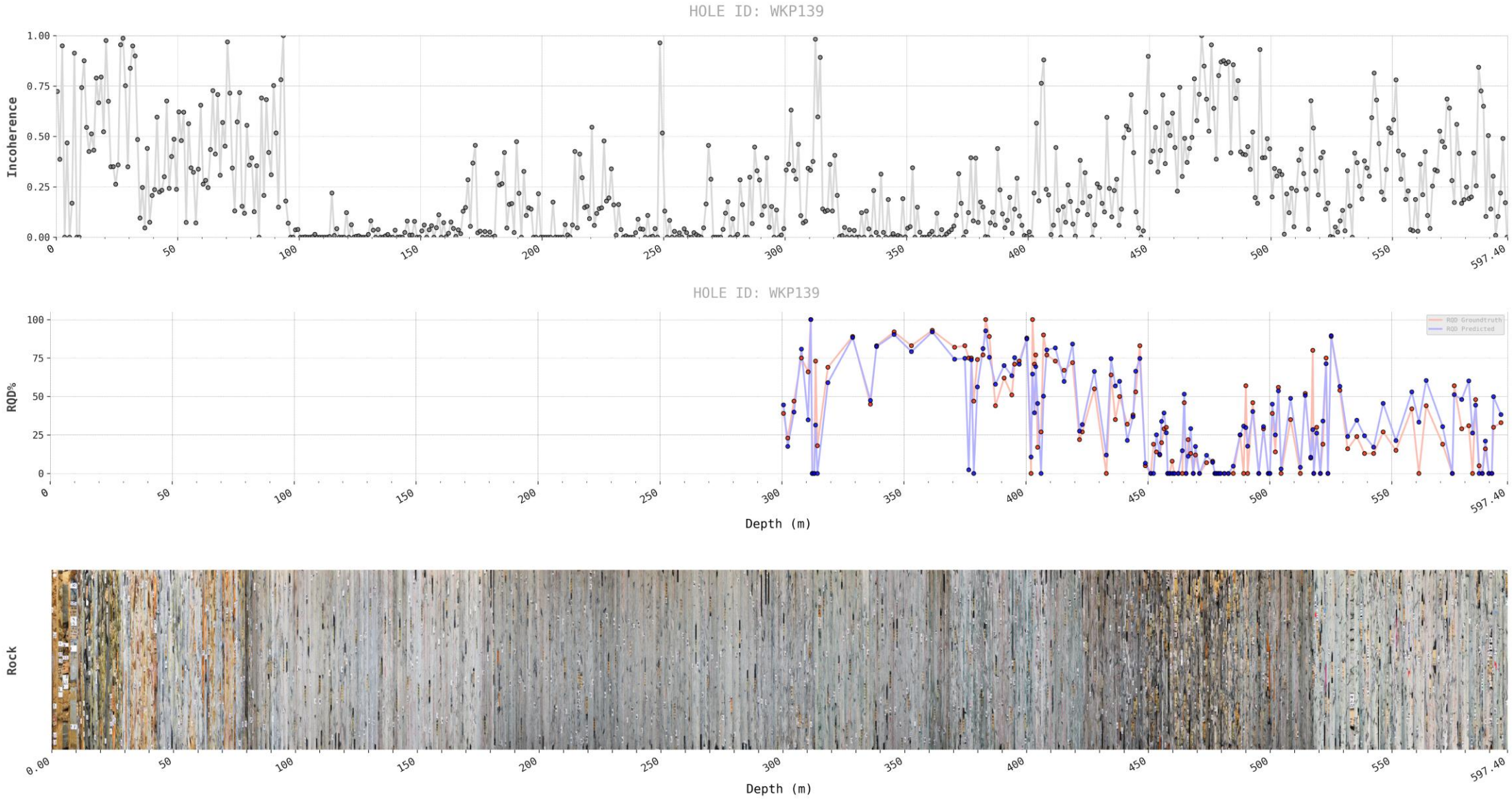

RQD is calculated by following:

$$\text{RQD} = \frac{\text{Total Length of >10cm coherent rock}}{\text{Total Length of run (all segments + compacted broken rock)}}$$

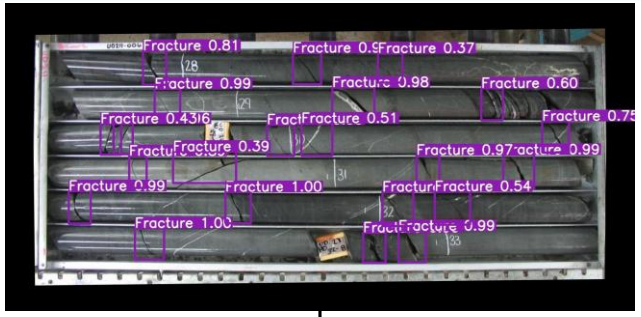




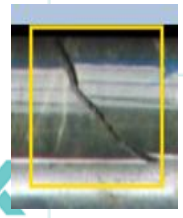
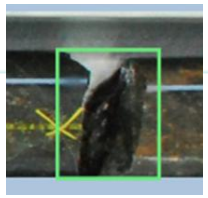
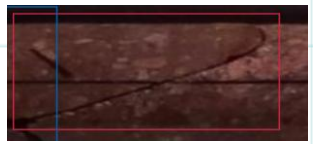
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HOLE ID: WKP139
Incoherence
1.00
0.75
0.50
0.25
0.00
0
50
100
150
200
250
300
350
400
450
500
550
597.40
HOLE ID: WKP139
RQD%
100
75
50
25
0
RQD Groundtruth
RQD Predicted
Depth (m)
Rock
0.00
Depth (m)

# Fracture classification




- **Simple**
  - **Vertical**
    - **Measurable**
    - **Displaced**
  - **Horizontal**
    - **Measurable**
    - **Displaced**
- **Complex**
  - **Jigsaw**
  - **Broken**
  - **Rubble**
  - **Discing**

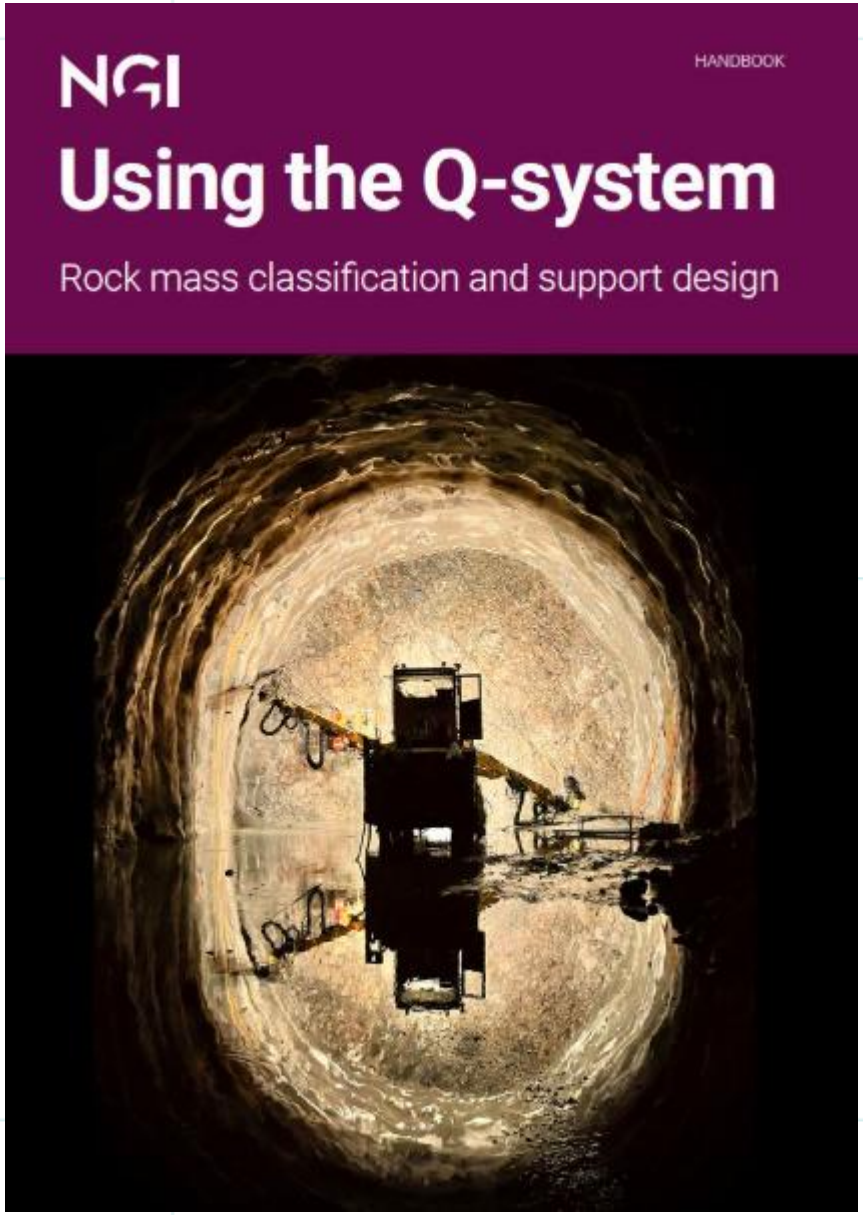









# Joint Set Analysis

- Detects fractures and separates natural breaks from driller breaks
- Measures fracture angle and curvature from simple fracture profiles
- Groups fractures into joint sets over standard **3 m intervals**
- Classifies intervals using Q-System Joint Set Number logic
- Outputs joint set number, fracture counts, complex fracture percentage and rubble percentage



# Joint Sets

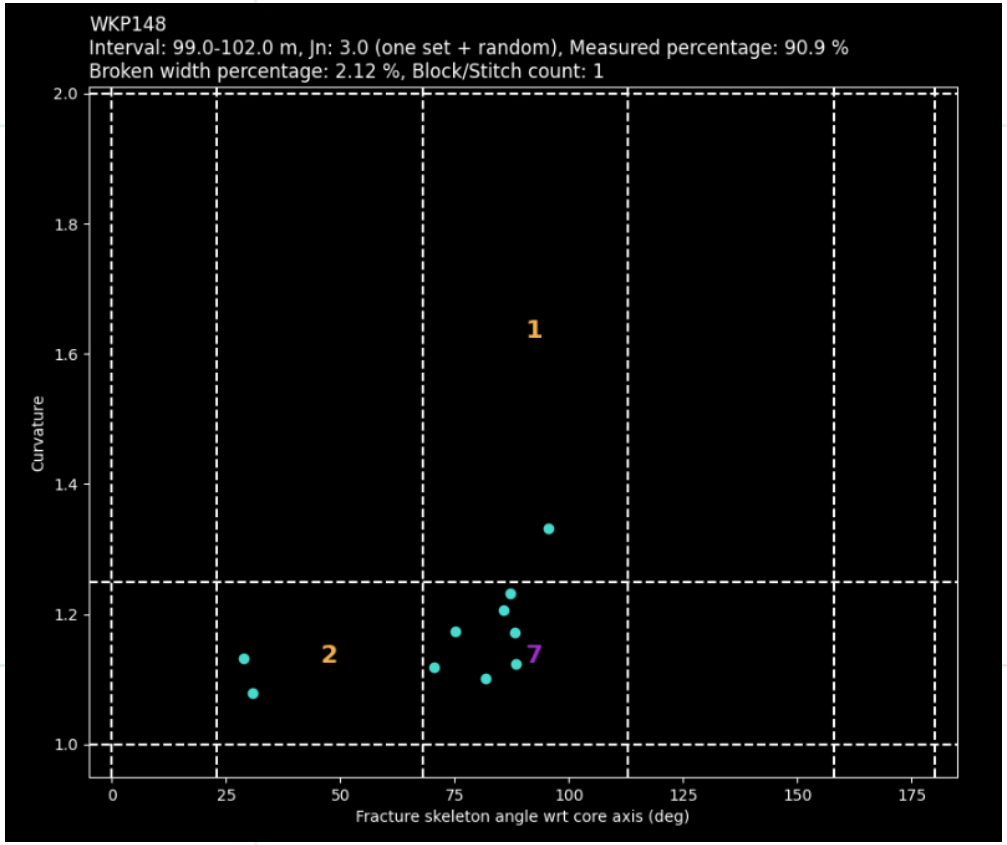
Segmentation Mask

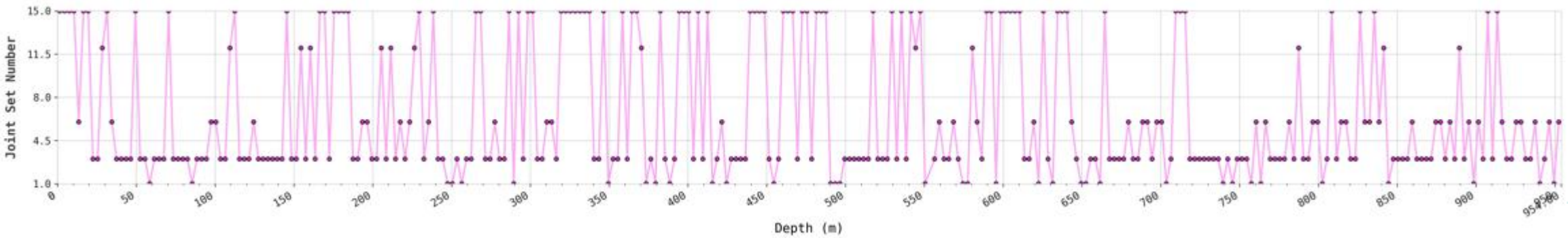


Fitted Angle





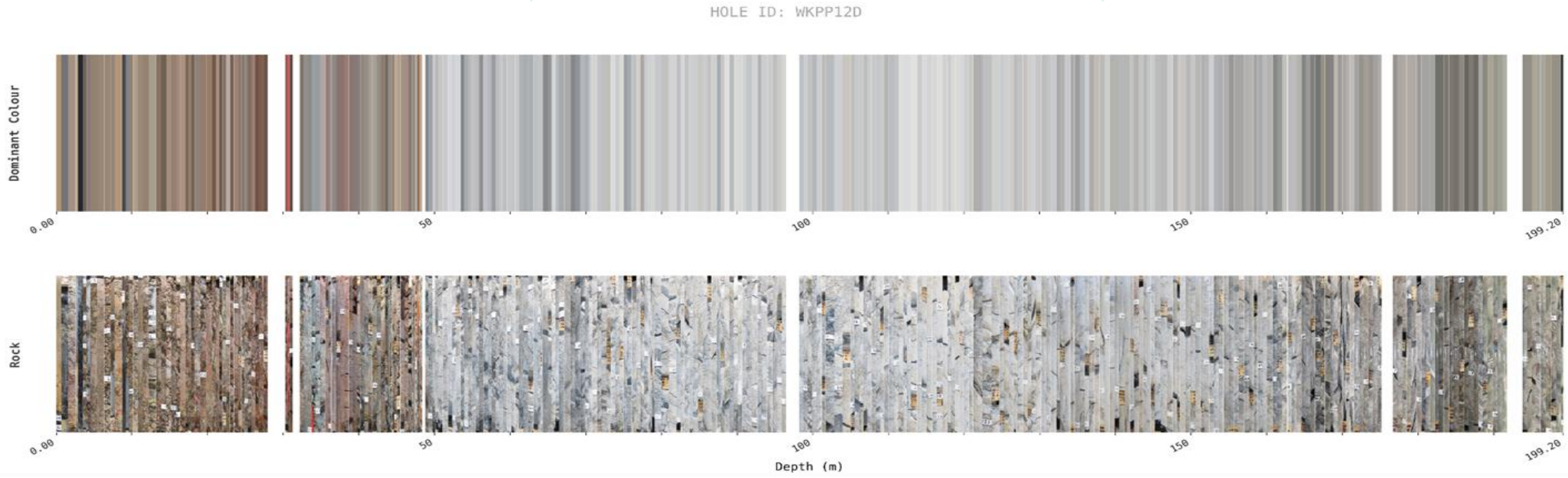



# Dominant Colour

The dominant colour is calculated by assessing every pixel in the image and determining the most significant colour.

This provides a single colour output  (R,G,B) that allows for a simple colour representation of the borehole and is particularly useful output that most 3D modelling packages can handle.



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# Joint Roughness Coefficient (Proxy)

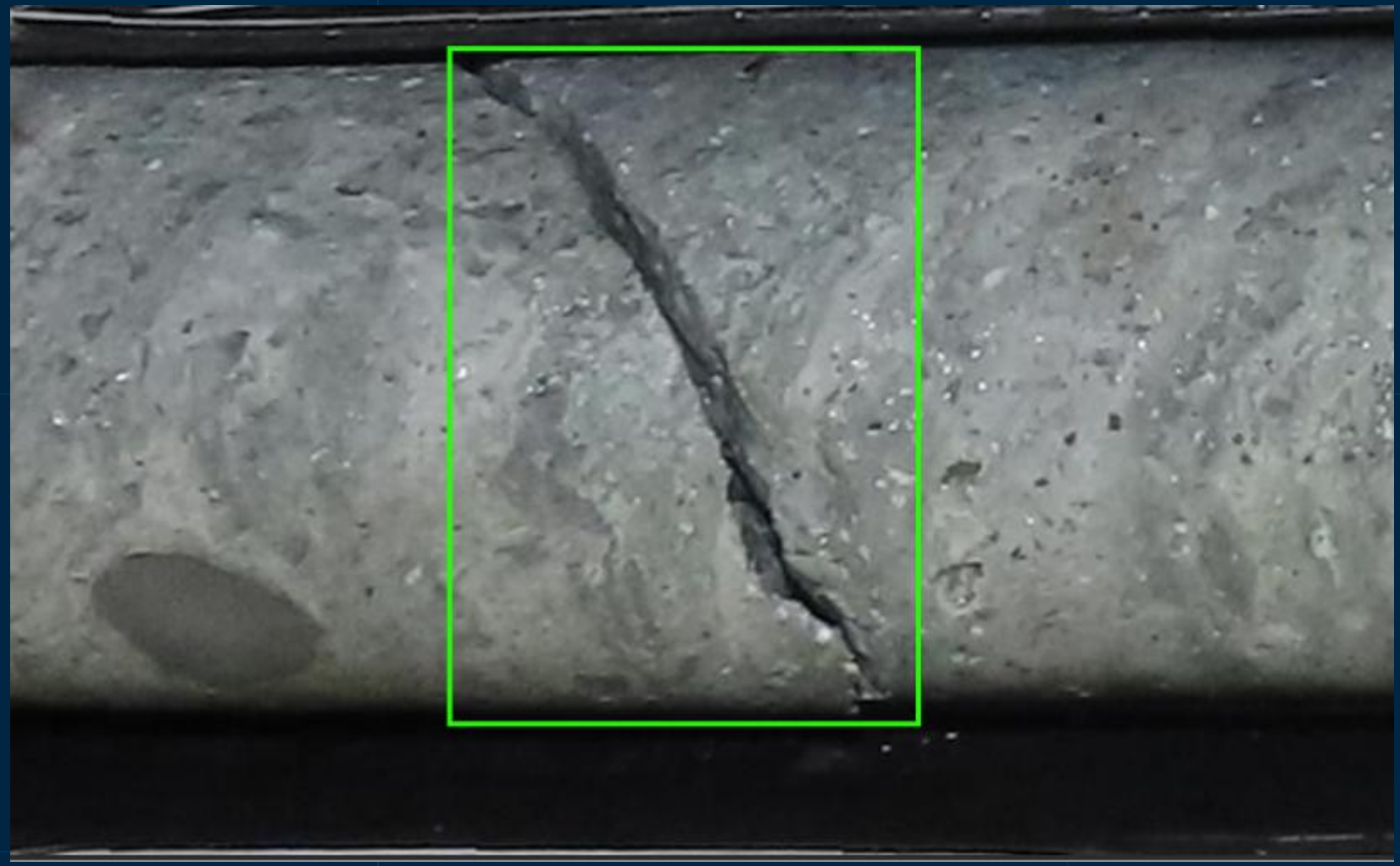
*Estimating likely fracture roughness from visible core-edge profiles*

- Provides a **proxy** for JRC, rather than a direct surface measurement
- Uses the visible fracture trace around the core edge as an indicator of roughness
- Measures simple, single-interface fractures only
- Calculates a JRC-style score from **0–20**
- Outputs an upper-bound and lower-bound values per fracture

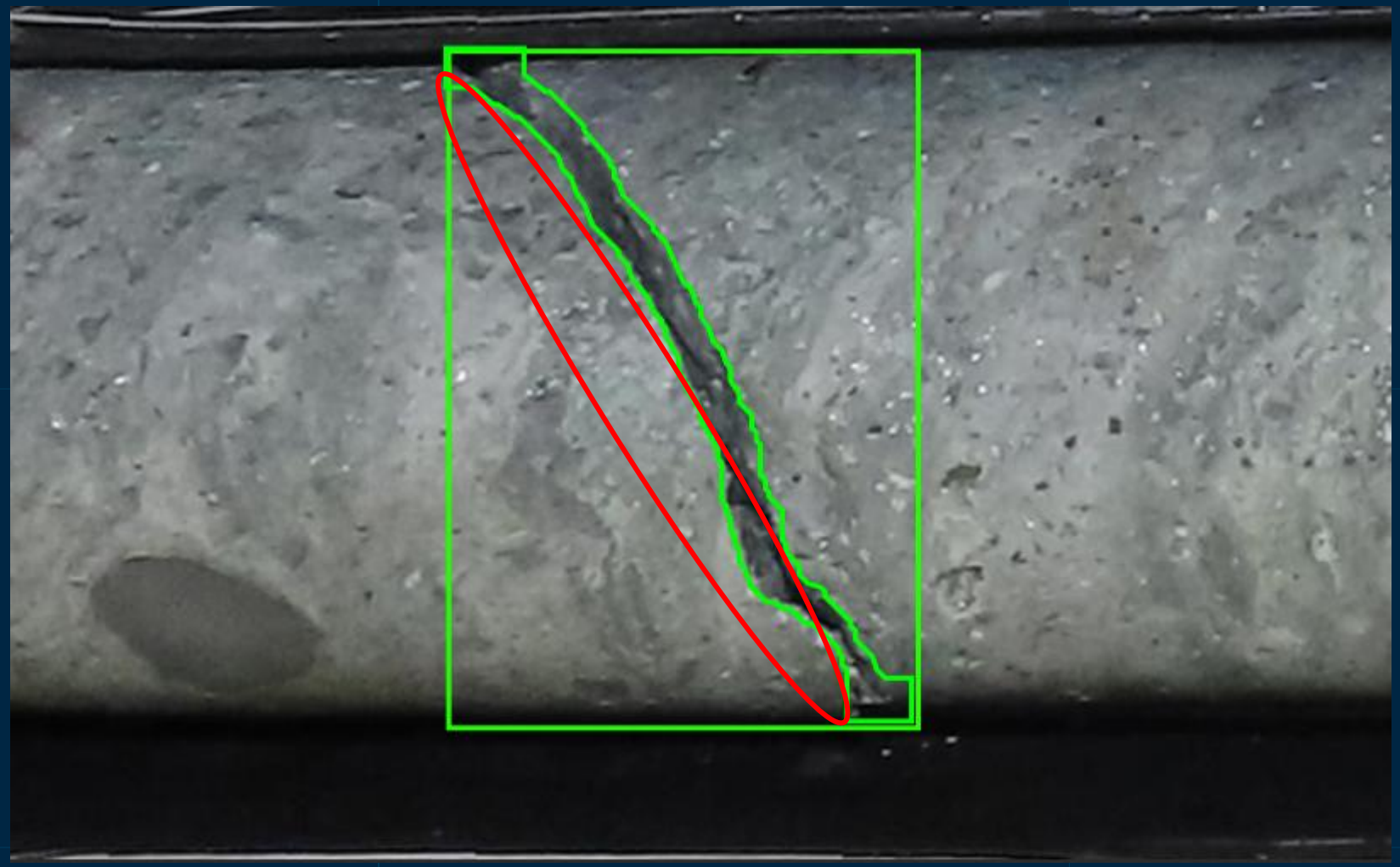
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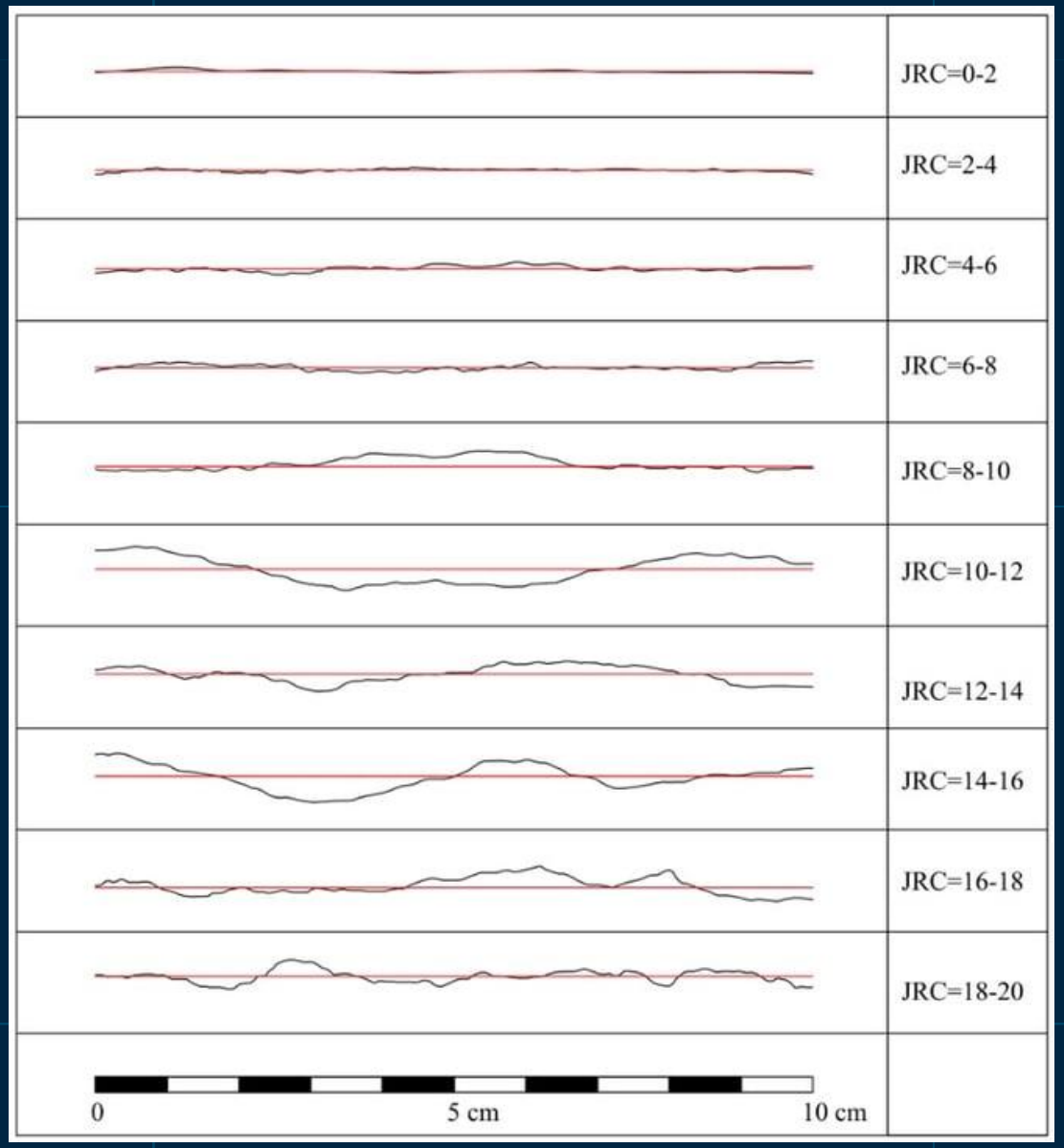
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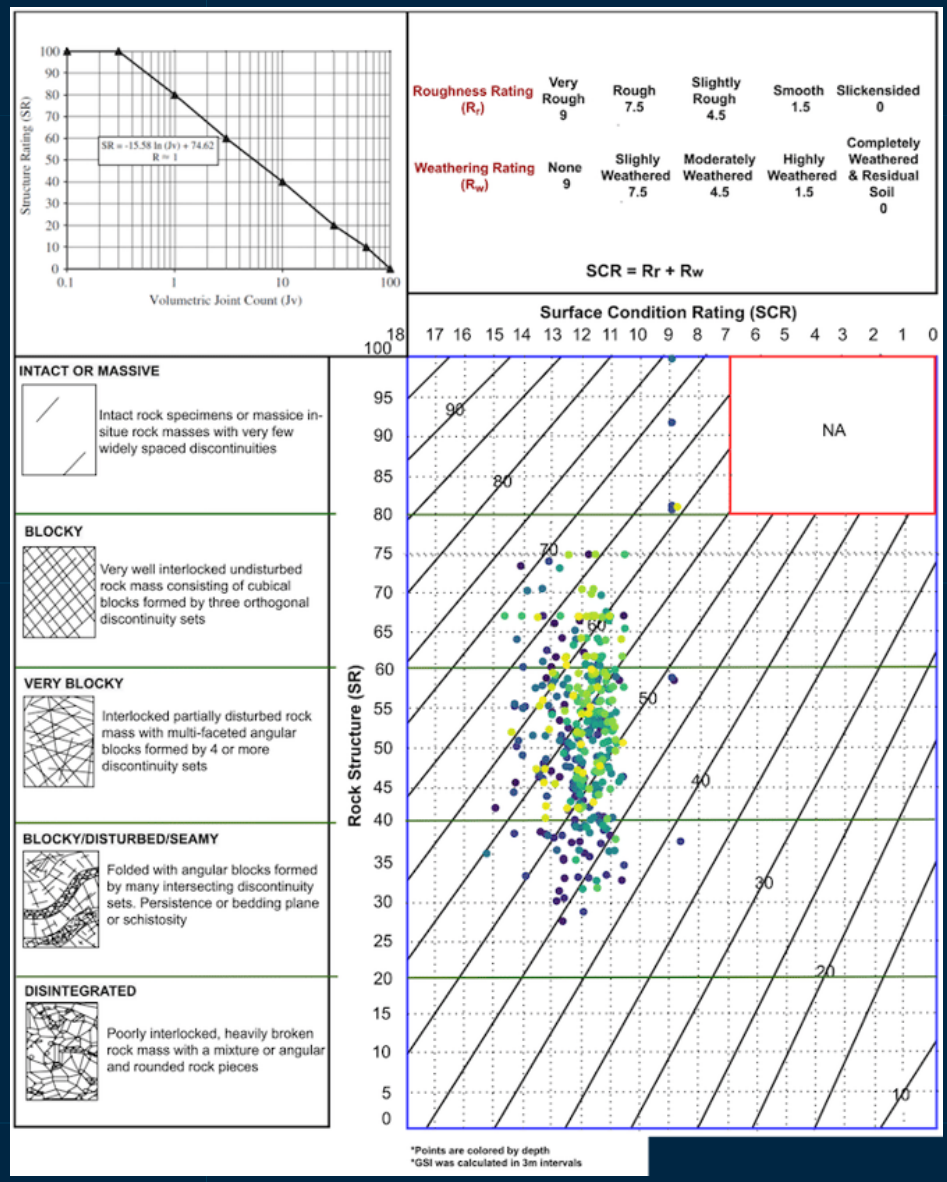


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# Geological Strength Index Proxy (GSI)

- Uses Weighted Joint Density as the basis for structural rating
- Uses weathering and JRC proxy to estimate surface condition
- Reported over standard **3 m intervals** or custom user intervals

Main caveat: **joint infill cannot be reliably assessed from core photos**, which is why this is labelled as a proxy.



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# Benefits

- Deployed at scale, quickly and consistently
- Outputs can be imported to work with regular workflows
- Less manual data collection
- Geologists can do the ‘real’ work instead of counting fractures.
- Capture data from drill core as soon a practical for best results



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# Future Applications

- Once the imagery is analytics ready it is much easier to run other models
  - Fracture Oreintation
  - Vein segmentation
  - Geological classification
- Incorporate geochemical datasets with segmentation and classification outputs
- Process legacy data



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Thanks to the team at Waihi