Rocktype classification and domaining of complex stratiform Zn-Pb-Ag mineralisation at the George Fisher Mine using high resolution XRF Core scanning

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Introduction

- The aim is to find solutions to automate aspects of geological drill core logging based on the multi-element geochemistry of the rock

- The samples for this study were provided by Glencore plc from the George Fisher Mine in Mt Isa

- 31 drill holes were scanned with an X-Ray Fluorescence (XRF) Scanner

- The XRF scanning was performed with a Minalyzer CS (core scanner)

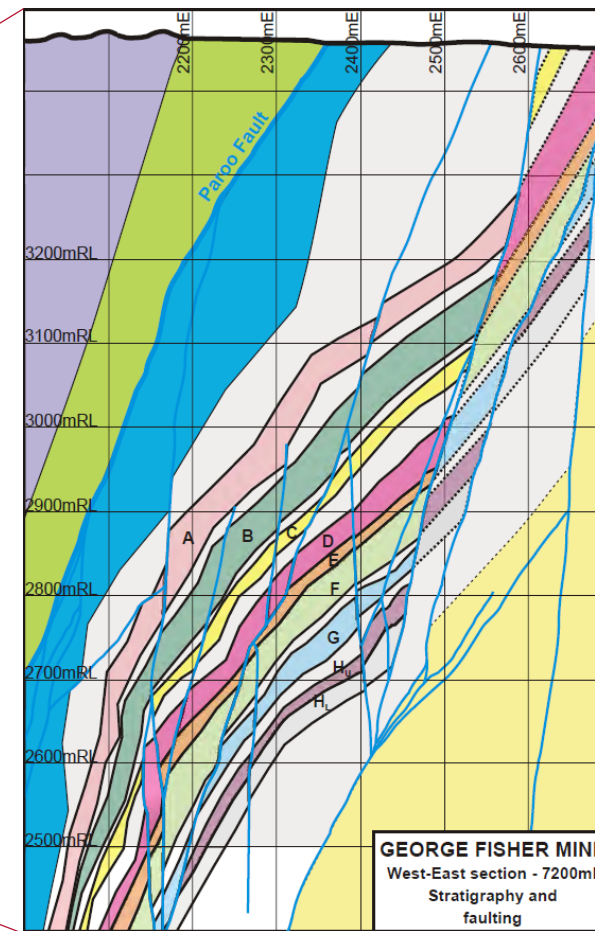# Introduction Geology

glencore.com

Murphy, 2004

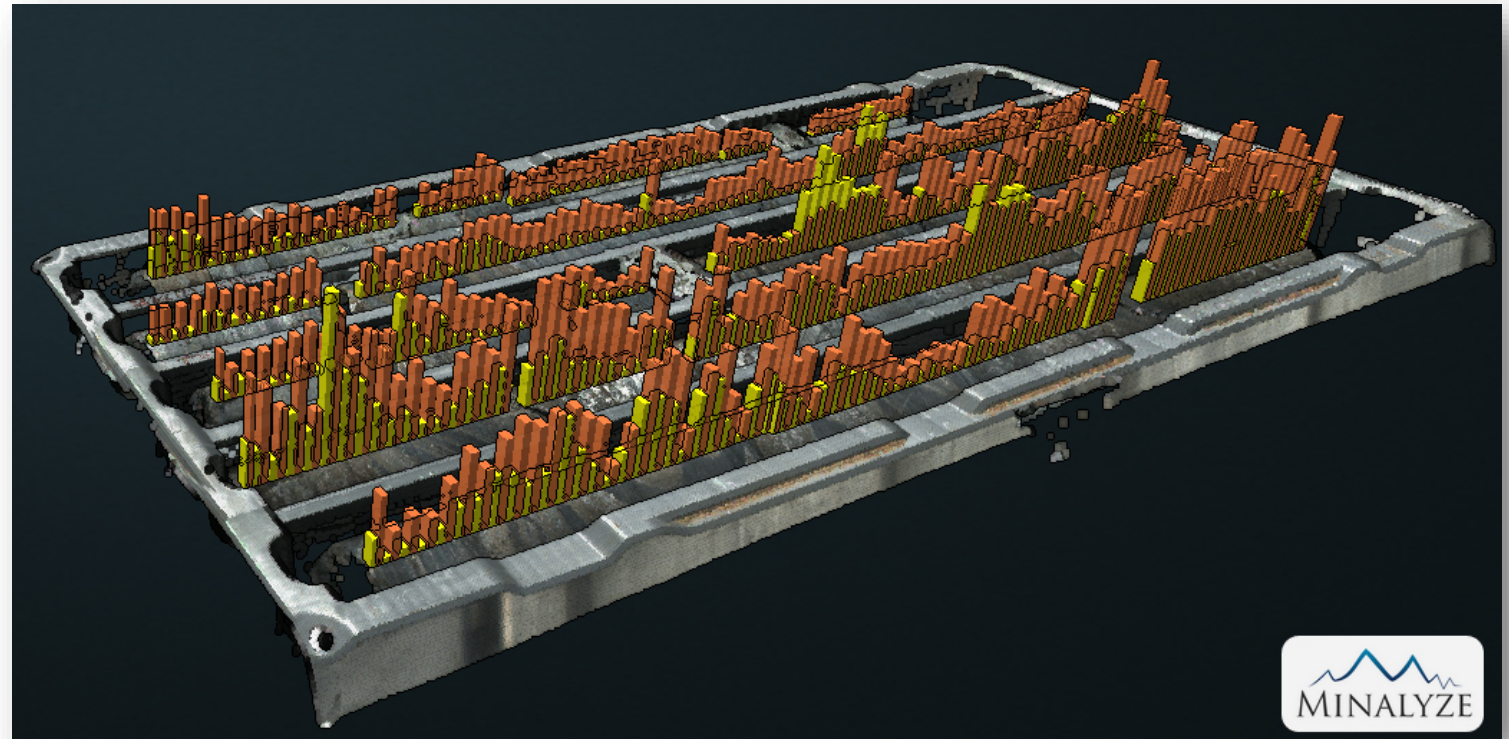# Introduction Minalyzer CS

chalmersventures.com

The Minalyzer CS provides:

- Chemical Assays

  - From Mg to U

- Photography

- Topography

- Rock Quality

- Structural Logging

- Specific Gravity
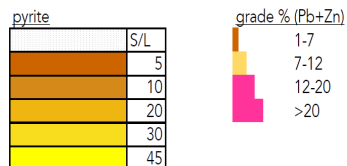
Data Acquisition

- Non-destructive XRF scanning on full core length

- Scanning on the core in trays

- Scanning rate: 1 cm/s

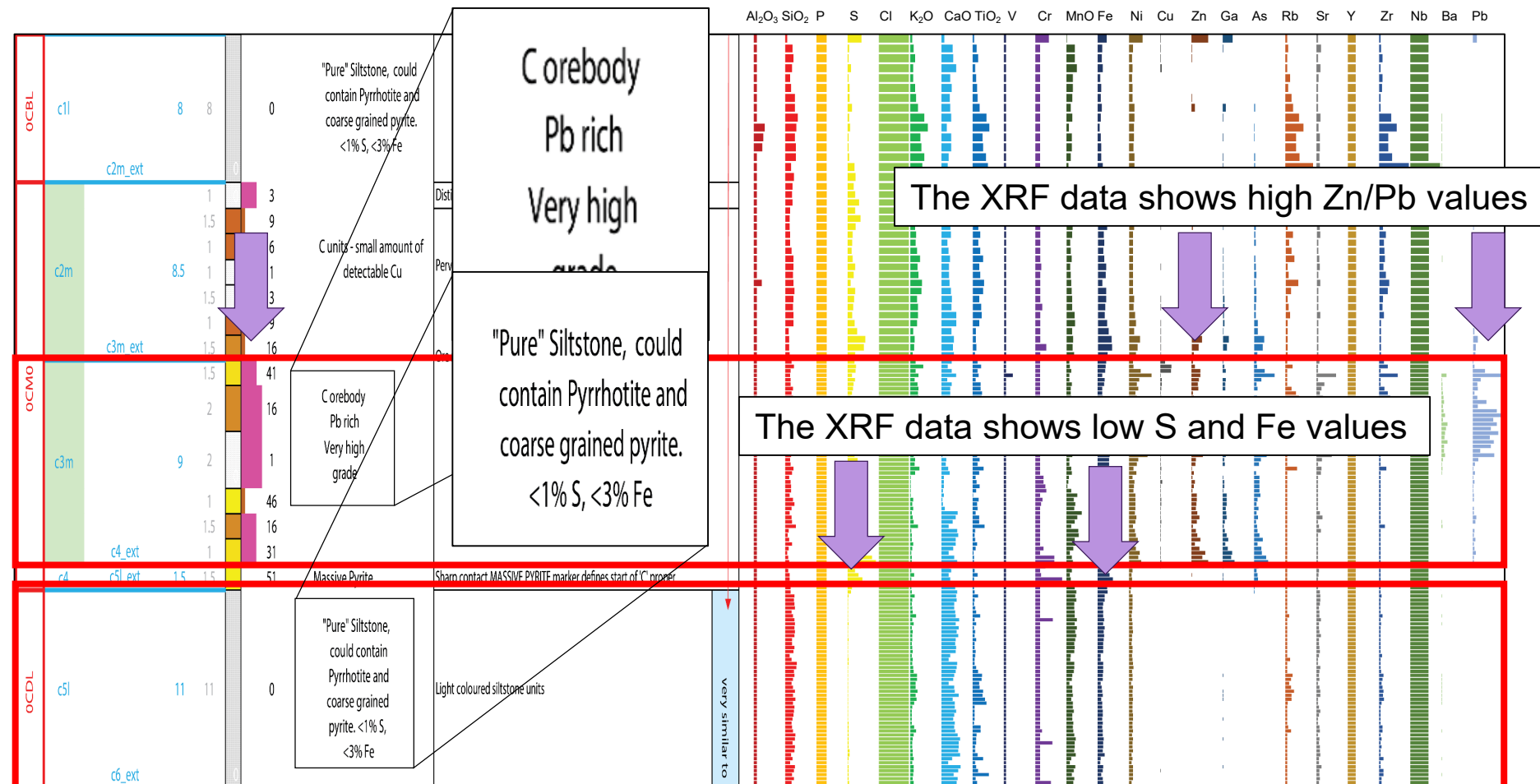- Outcome data intervals:
    - 1 cm / 10 cm / 1 m

Cleaning of the data

- Example of Stratigraphy Log and XRF Scan

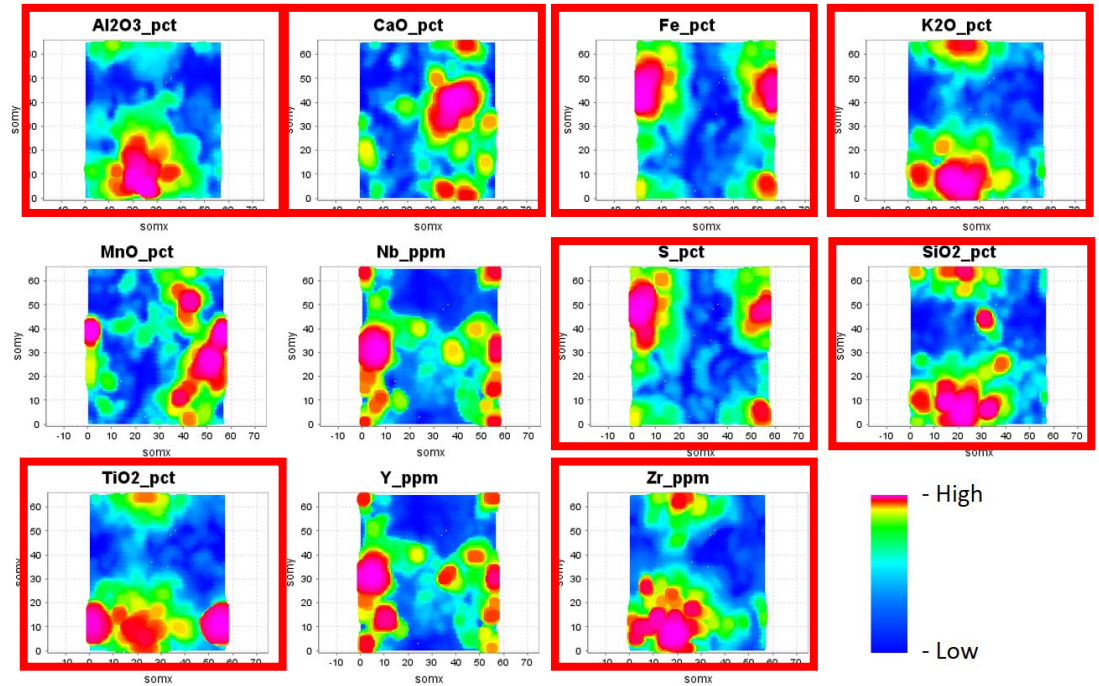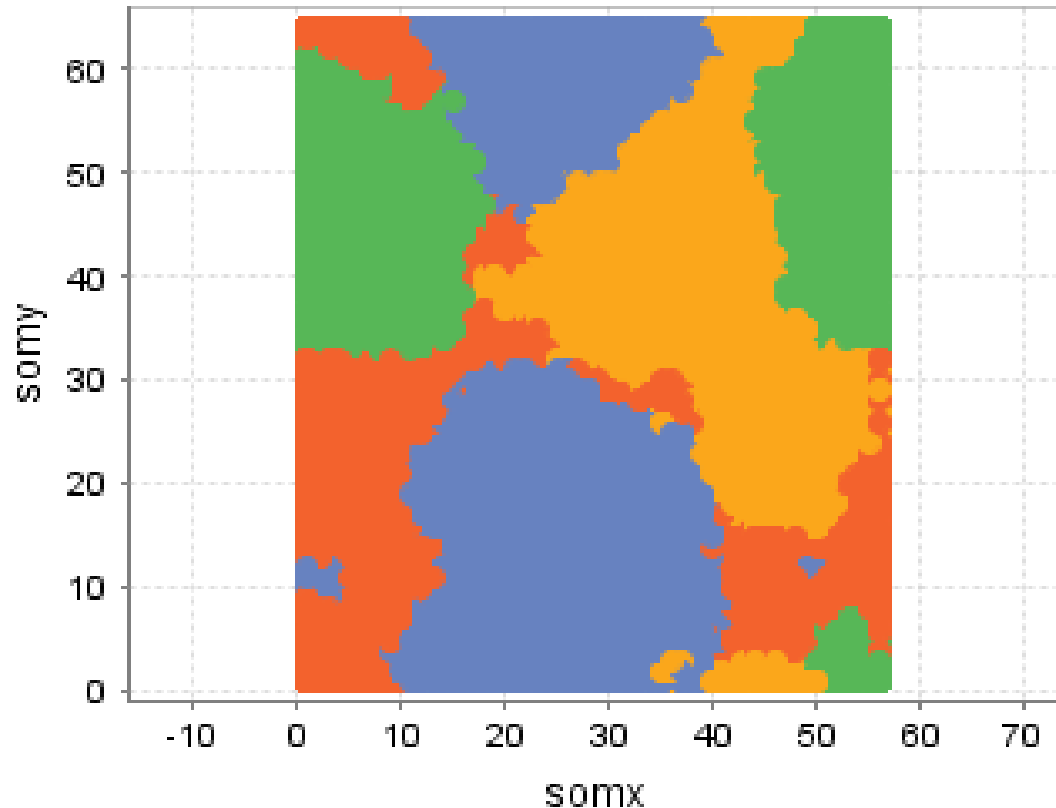- The log includes important geological information

- XRF data is presented in bars for each cell (high value = long bar)

The XRF data shows high Zn/Pb values

The XRF data shows low S and Fe values

C orebody
Pb rich
Very high grade

"Pure" Siltstone, could contain Pyrrhotite and coarse grained pyrite. <1% S, <3% Fe

Clustering

Attribute Map

- **4 Clusters** (yellow/orange/blue/green) based on the 'heat-maps' and associated trends

- *Blue:* high values of Al_2O_3, K_2O, SiO_2, TiO_2, Zr
- *Green:* high values of Fe and S
- *Yellow:* high values of CaO
- *Orange:* Traces of all major elements/oxides

Rocktype classification

- *Blue:* Shales (high values of Al_2O_3, K_2O, SiO_2, TiO_2, Zr)

- *Yellow:* Calcareous Siltstones (high values of CaO)

- *Green:* Pyrite (high values of Fe and S)

- *Orange:* Mixture of lithologies (traces of all elements/oxides)

- The Pyrite-rich layers can be further distinguished
    - high content (>20% Pyrites)
    - low content (5-20% Pyrites)

- The samples in the orange cluster were associated with adjacent clusters
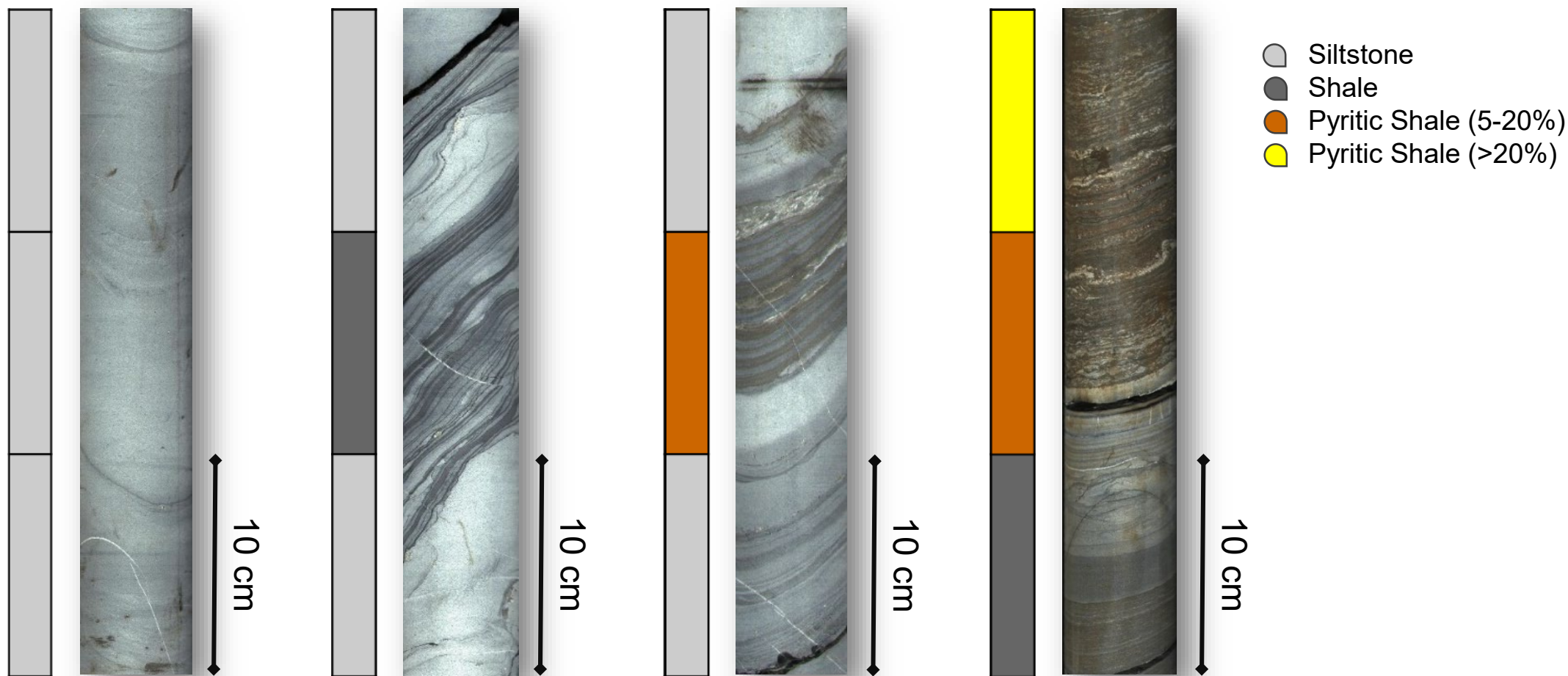

Attribute Map
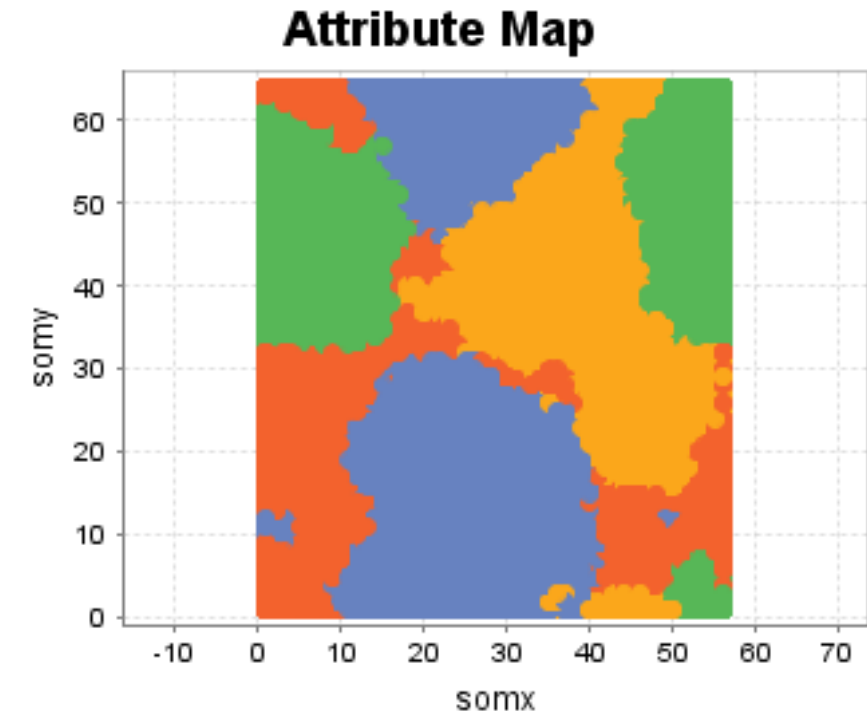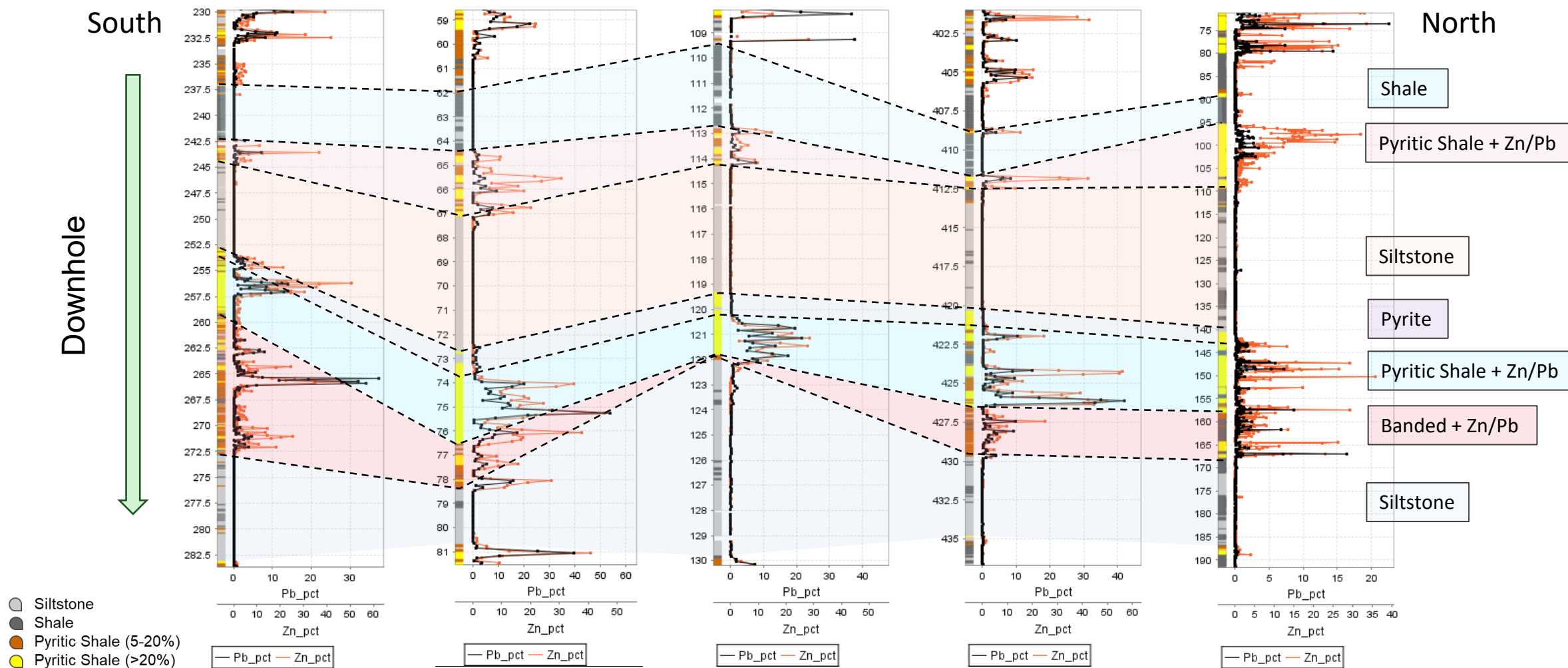
Automated drill core logging

- Automated detection of 4 host-rock lithologies

  - ✓ Calcareous Siltstones (light grey)
  - ✓ Shales (dark grey)
  - ✓ Pyritic shale (5-20% Pyrite) (brown)
  - ✓ Pyritic shale (>20% Pyrite) (yellow)

- Consistent interpretation of the data

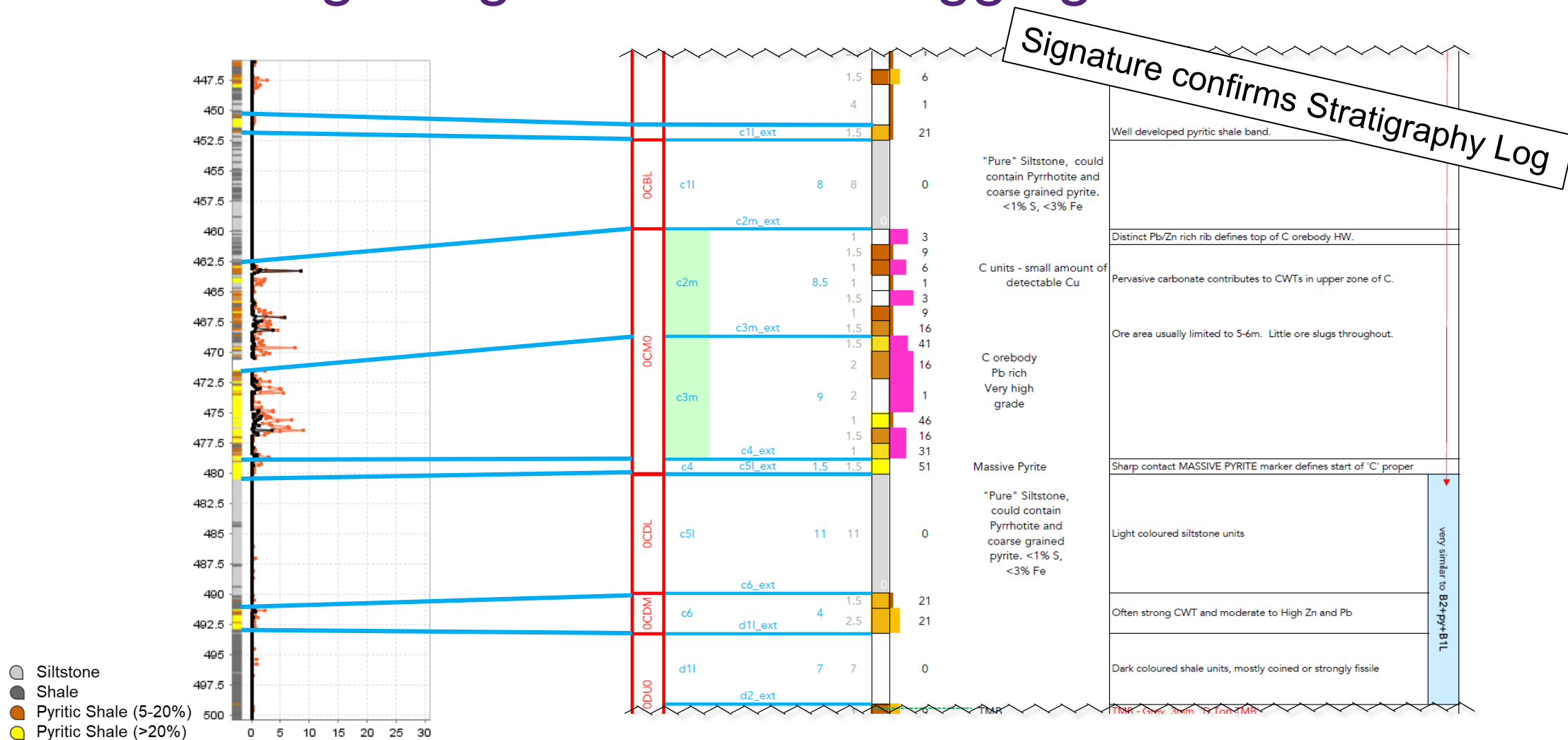- Interpretation based on actual scanned XRF data and correlation between elements/oxides

Example of automated log

- ⬤ Siltstone
- ⬤ Shale
- ⬤ Pyritic Shale (5-20%)
- ⬤ Pyritic Shale (>20%)
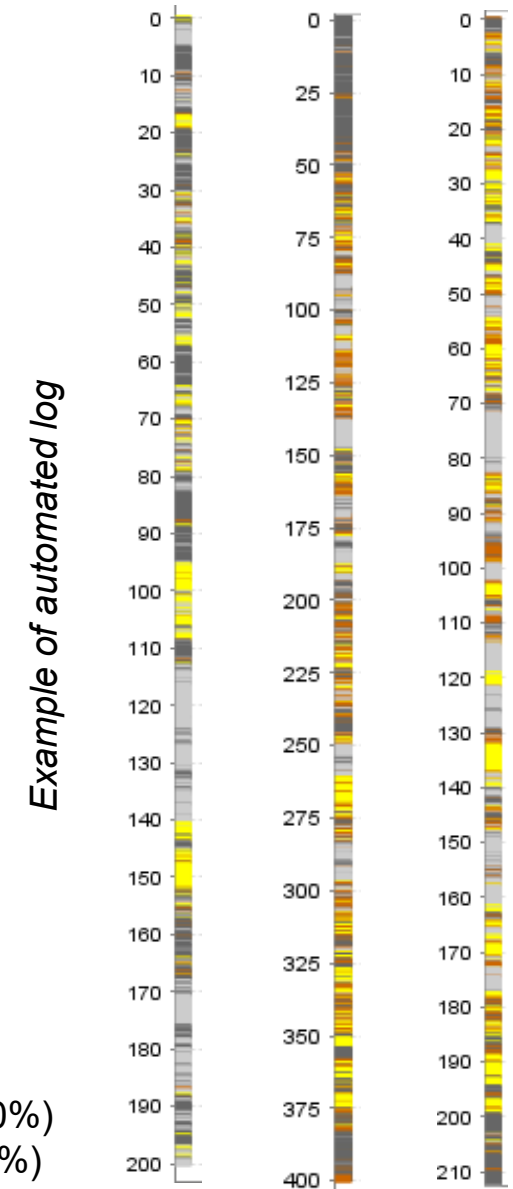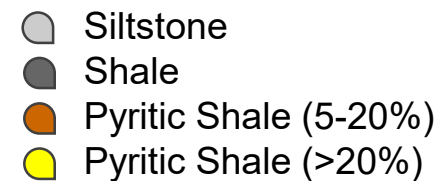
Automated detection of host-rock lithologies

Siltstone
Shale
Pyritic Shale (5-20%)
Pyritic Shale (>20%)

10 cm

Enhanced geological drill core logging

Enhanced geological drill core logging

Signature confirms Stratigraphy Log

Siltstone
Shale
Pyritic Shale (5-20%)
Pyritic Shale (>20%)

Enhanced geological drill core logging
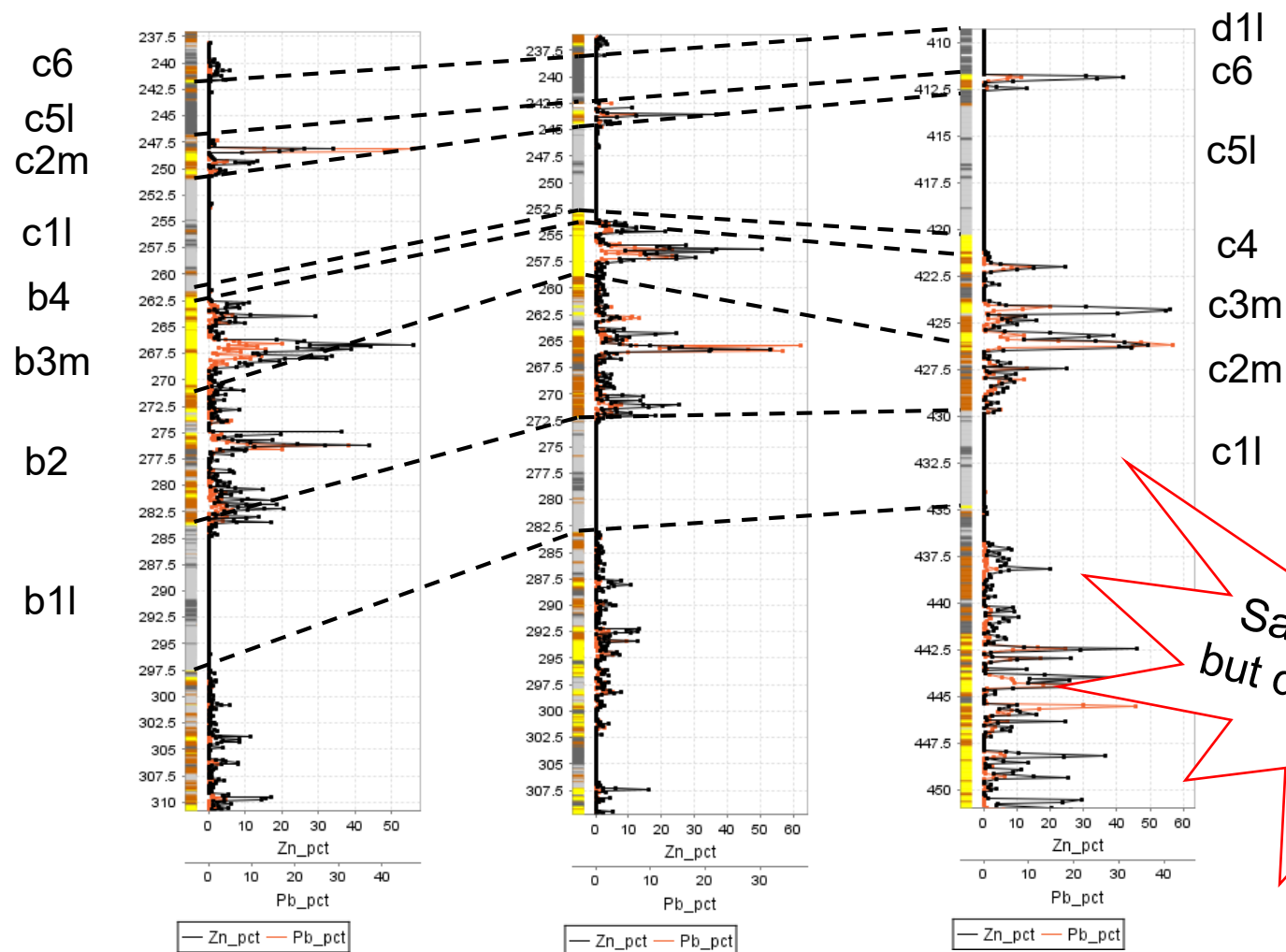
Enhanced domaining
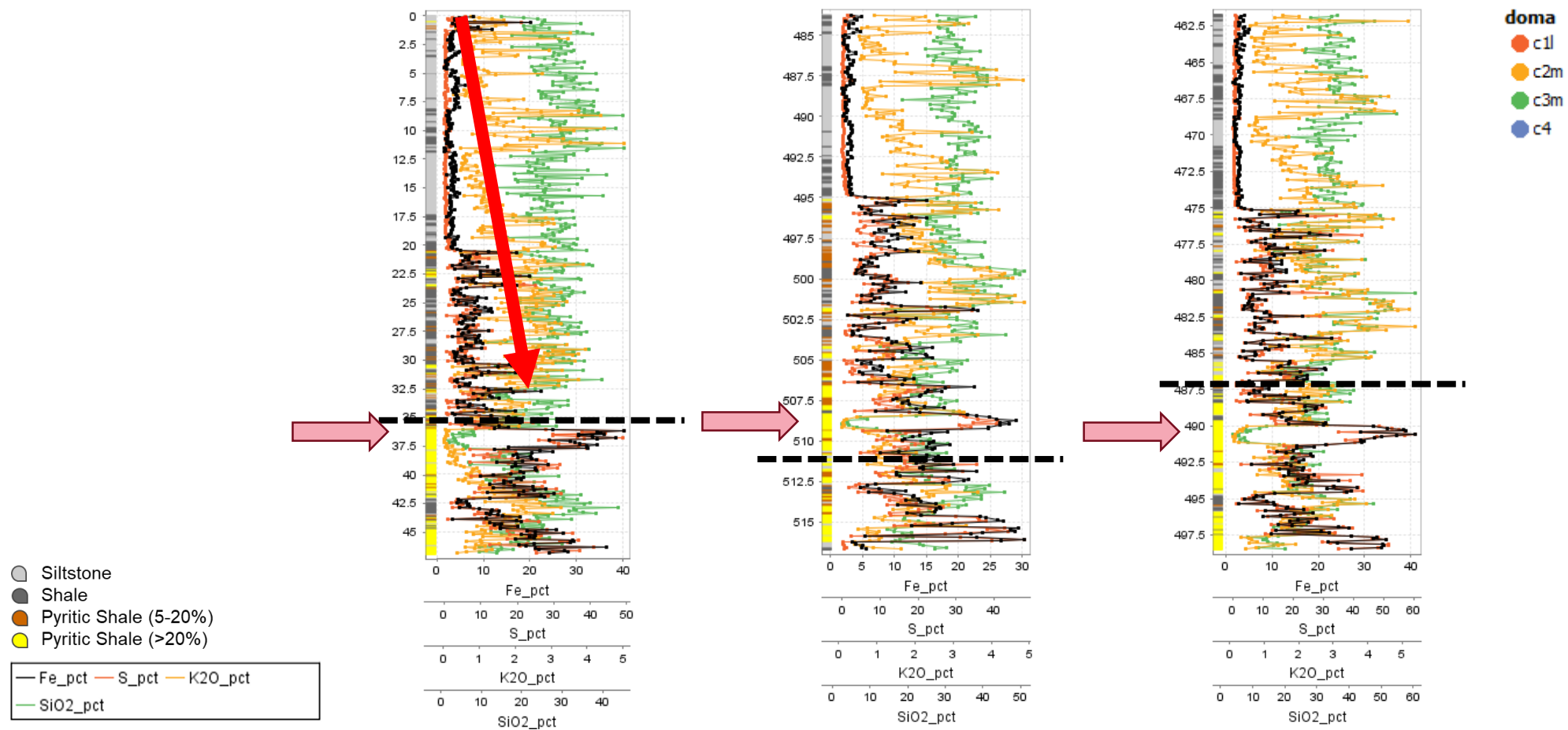
Outcome

- Enhanced geological drill core logging

  - *Rocktype classification and domaining*

- Consistent interpretation of the data

  - *Interpretation based on actual scanned XRF data*

- Enhanced detection of domain boundaries

  - *Based on geochemical signatures and rocktype recognition*

- Detection of unique geochemical signatures

  - *Decrease the risk of error*

- Enhanced discrimination between ore and waste material

Thank you

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