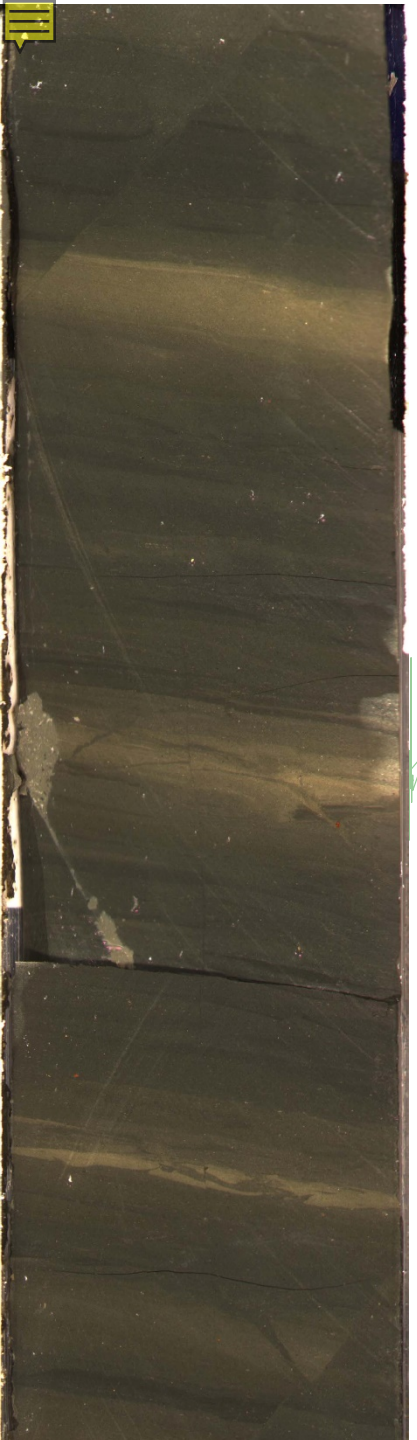
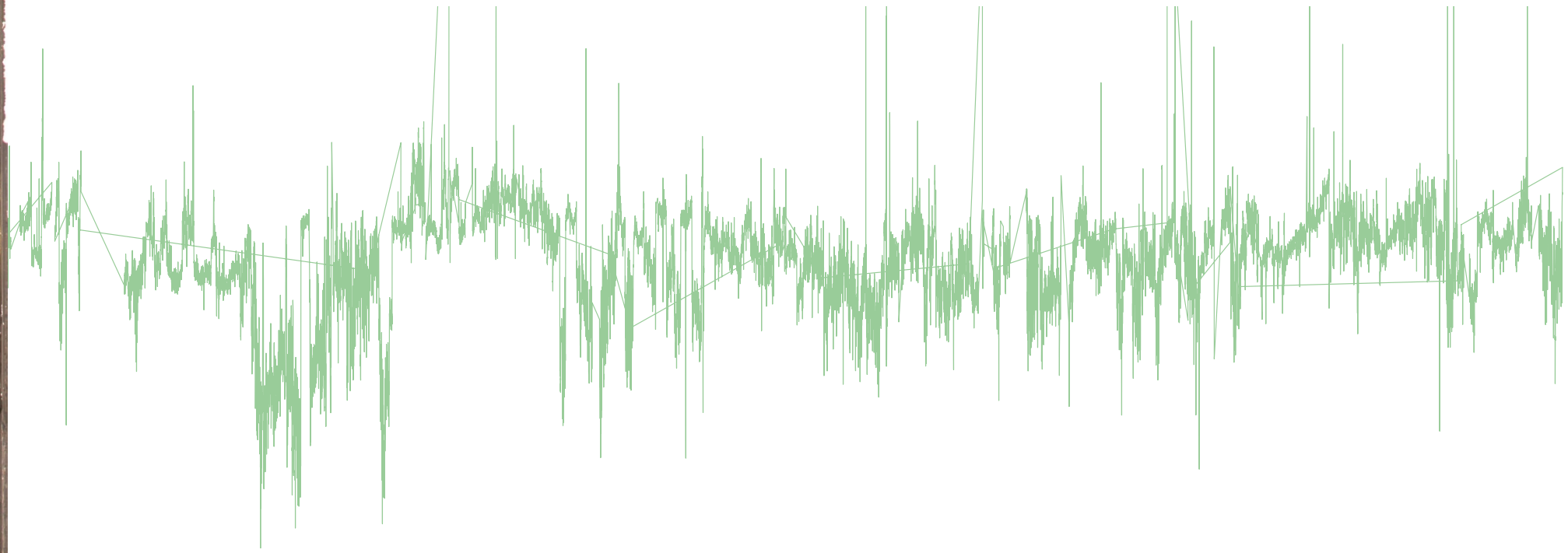


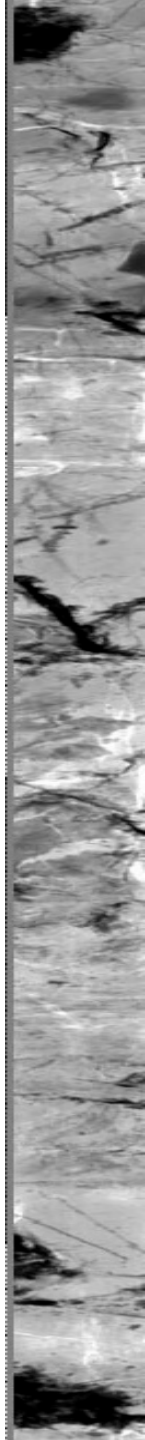
Sediment Structures and Elemental Variability of the HSPDP Drill Cores

X-Radiography and XRF Scanning



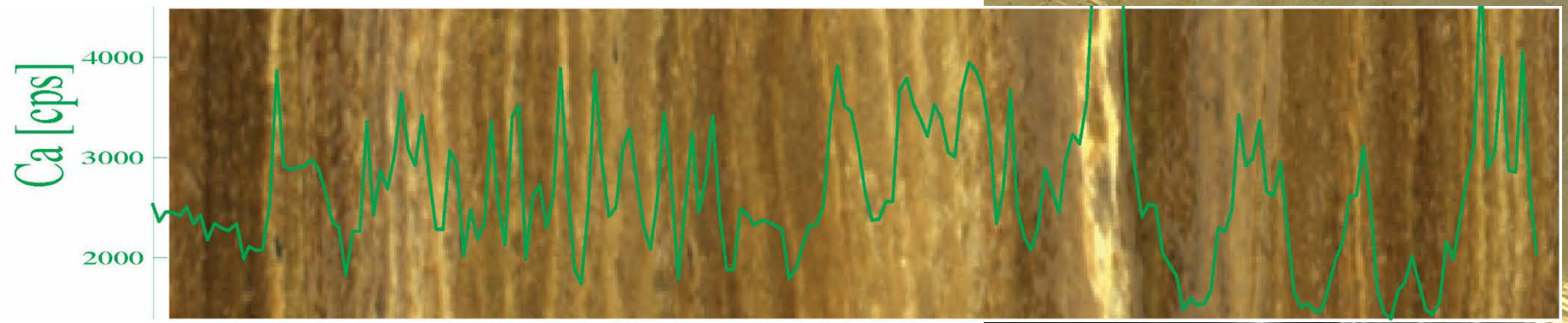
Mona Stockhecke and Erik Brown

Large Lakes Observatory, Duluth/MN



ITRAX X-ray Fluorescence (XRF) corescanner

- X-ray beam size is 20x0.1 mm at maximum
- **HSPDP standard scanning** we use a **2x1 cm** beam size, equivalent to a **1 cm** downcore resolution of a **2 cm** downcore strip
- Elements: Al, **Si,** P, **S,** Cl, Ar, **K, Ca, Ti, Mn, Fe,** Co, Ni, Cu, Zn, Se, Br, **Rb, Sr, Zr, Ba Pb (robust)**

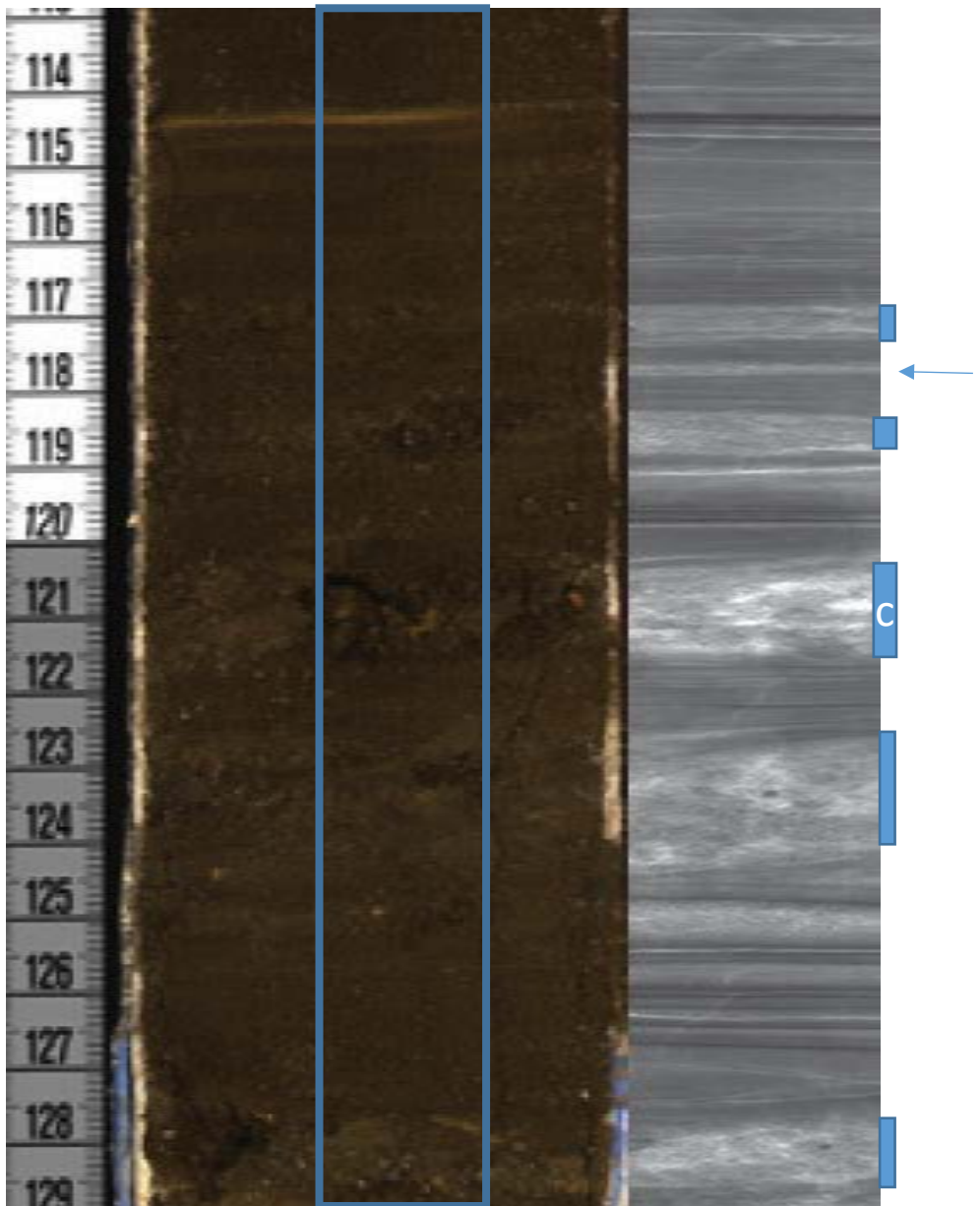


3.5 cm long sediment section

Applications of **X-radiography**: Qualitative measure of density of the sediment to detect **sediment structures and inhomogeneities**

Downcore
resolution 0.2 mm

Image
width is 20 mm



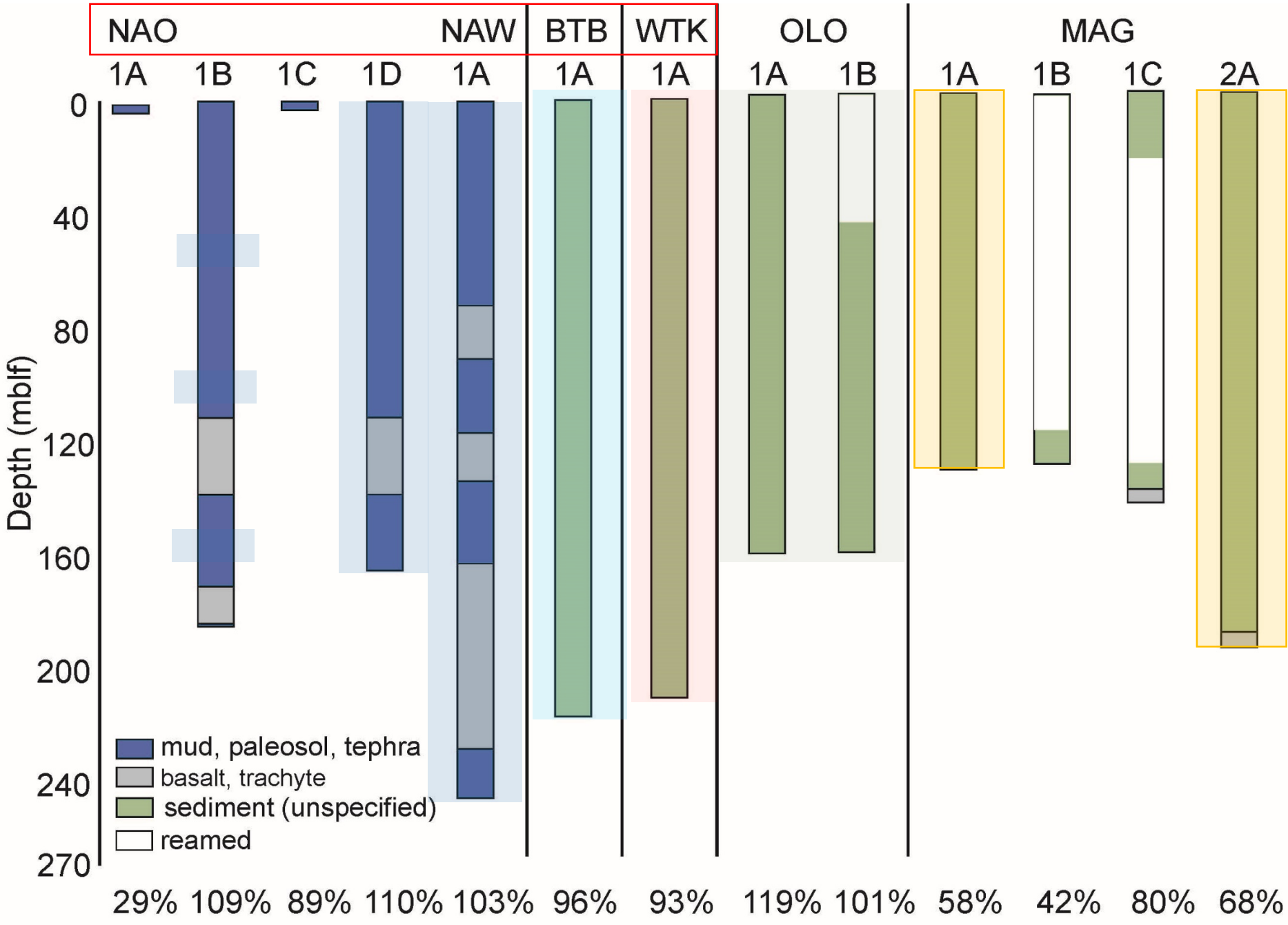
Status
1 cm resolution XRF scanning
and X-radiography

Scanning completed, data processing and interpretation is ongoing

- ✓ OLO
- ✓ WTK
- ✓ BTB
- ✓ NA (run with NEW DETECTOR!!!, 4 times higher sensitivity)
- ✓ MAG
- ✓ CB

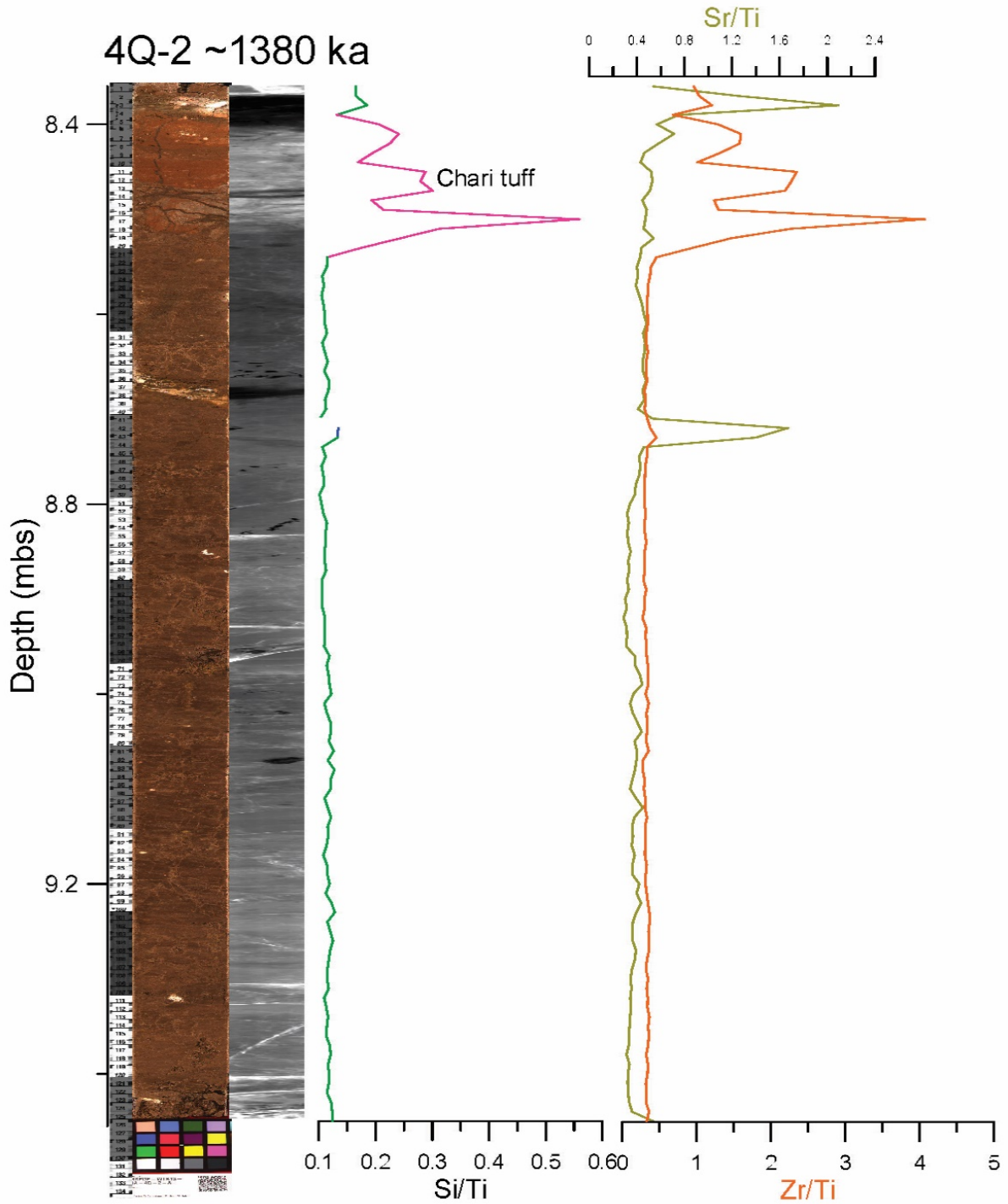
High-resolution in prep

- MAG (May/June)

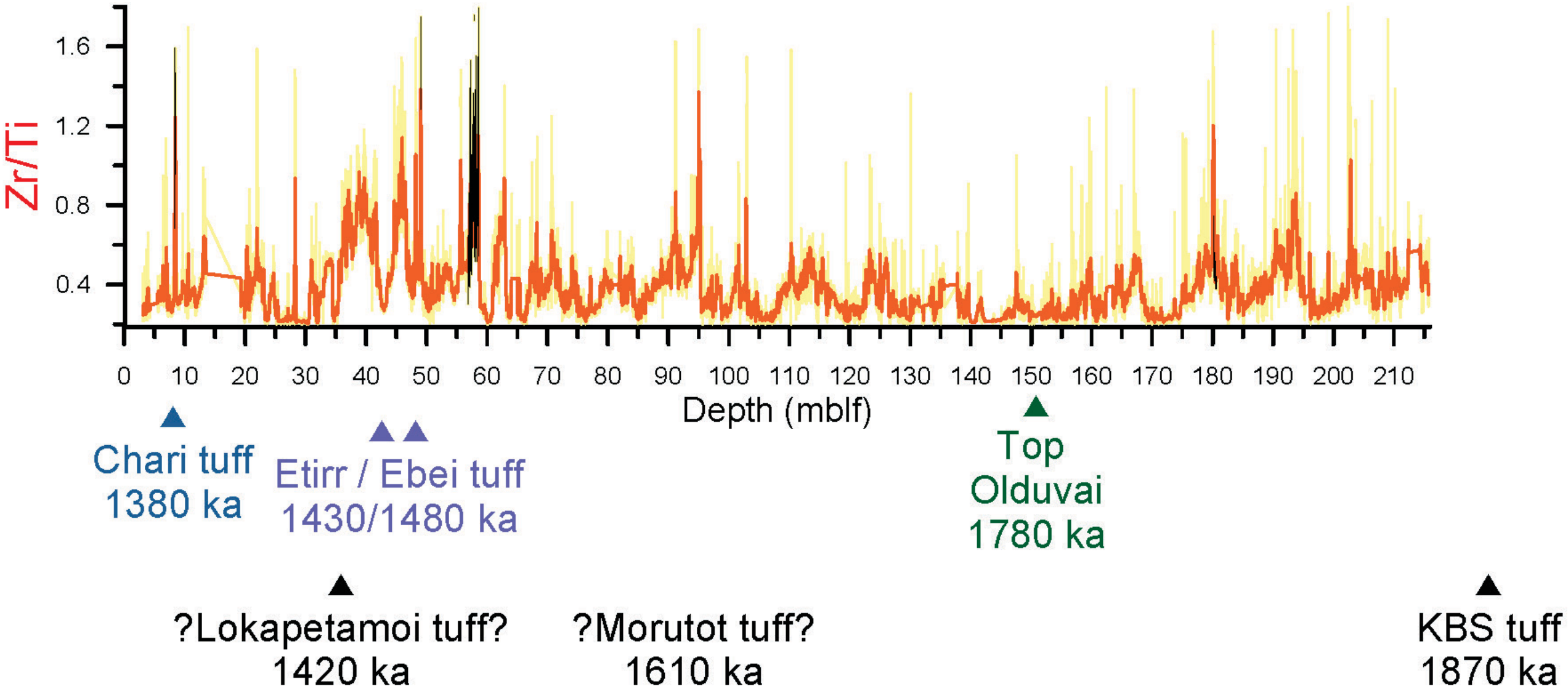


Zr/Ti – identification of Tephras

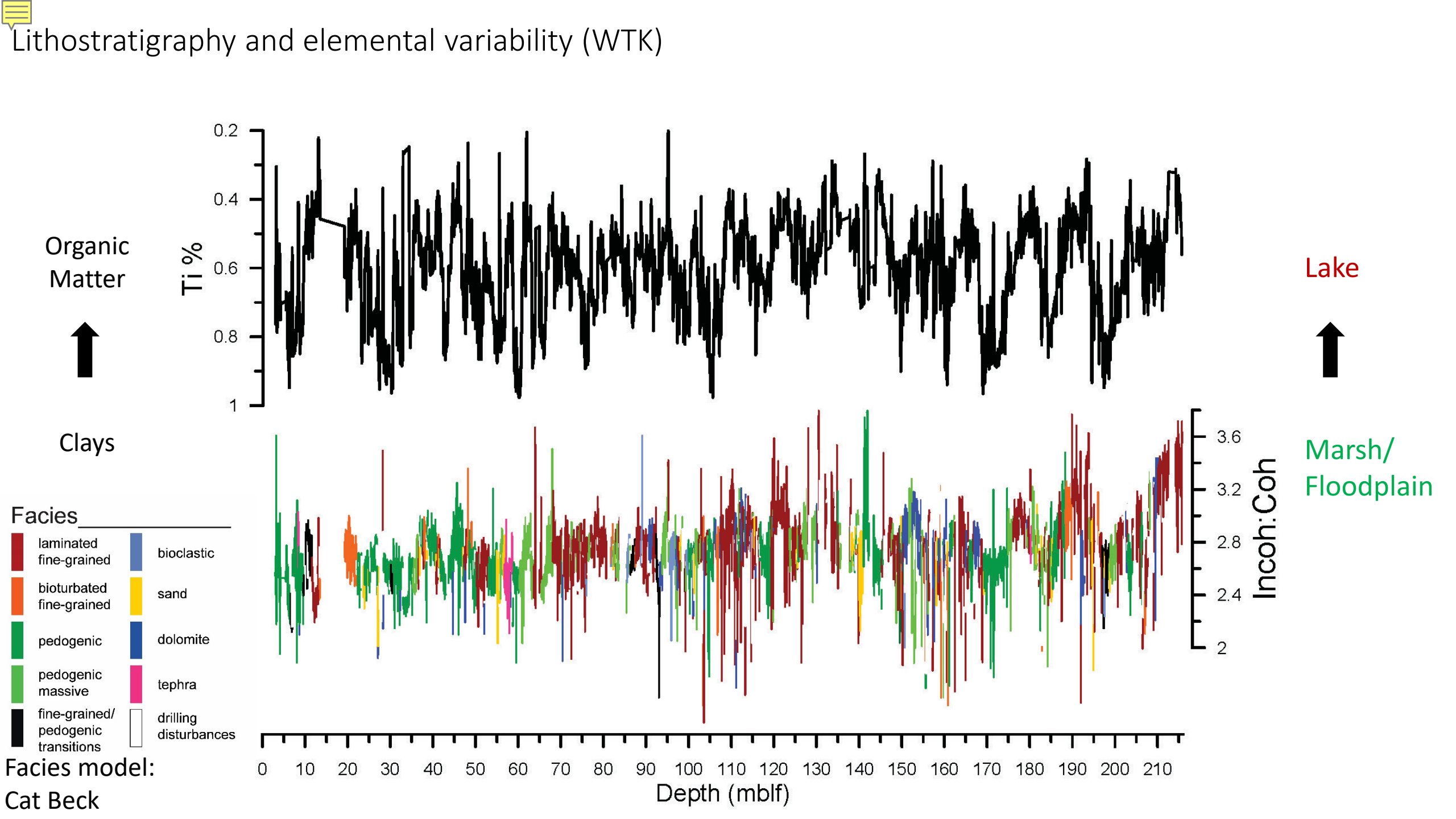
WTK



Zr/Ti – identification of Tephras - “updated”



Lithostratigraphy and elemental variability (WTK)



Facies model:
Cat Beck

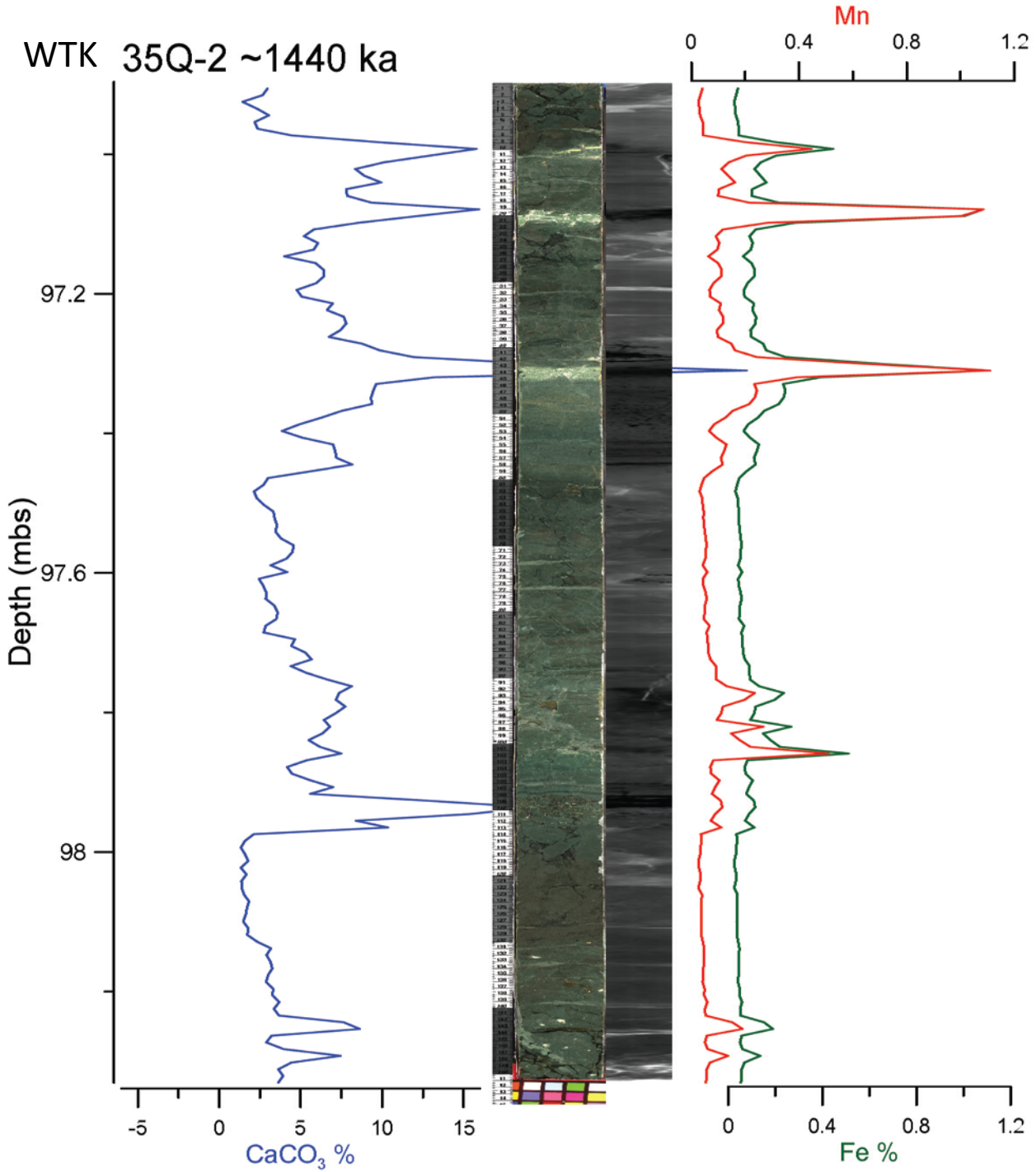
Pedogenic overprinting and mineral alteration

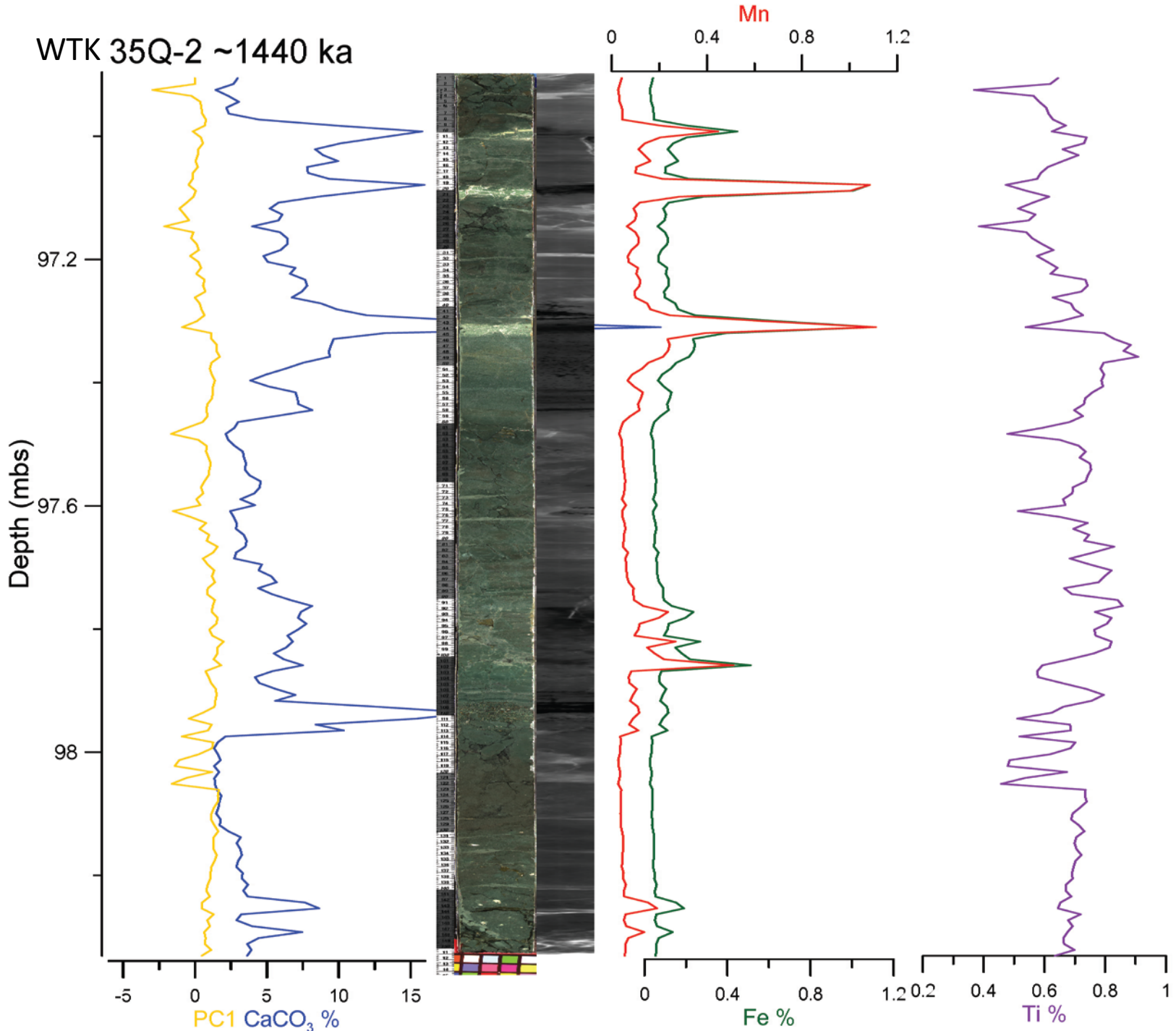
Carbonate layers
Ostracodes

Dolomite

Carbonate nodules

Mn/Fe-oxides

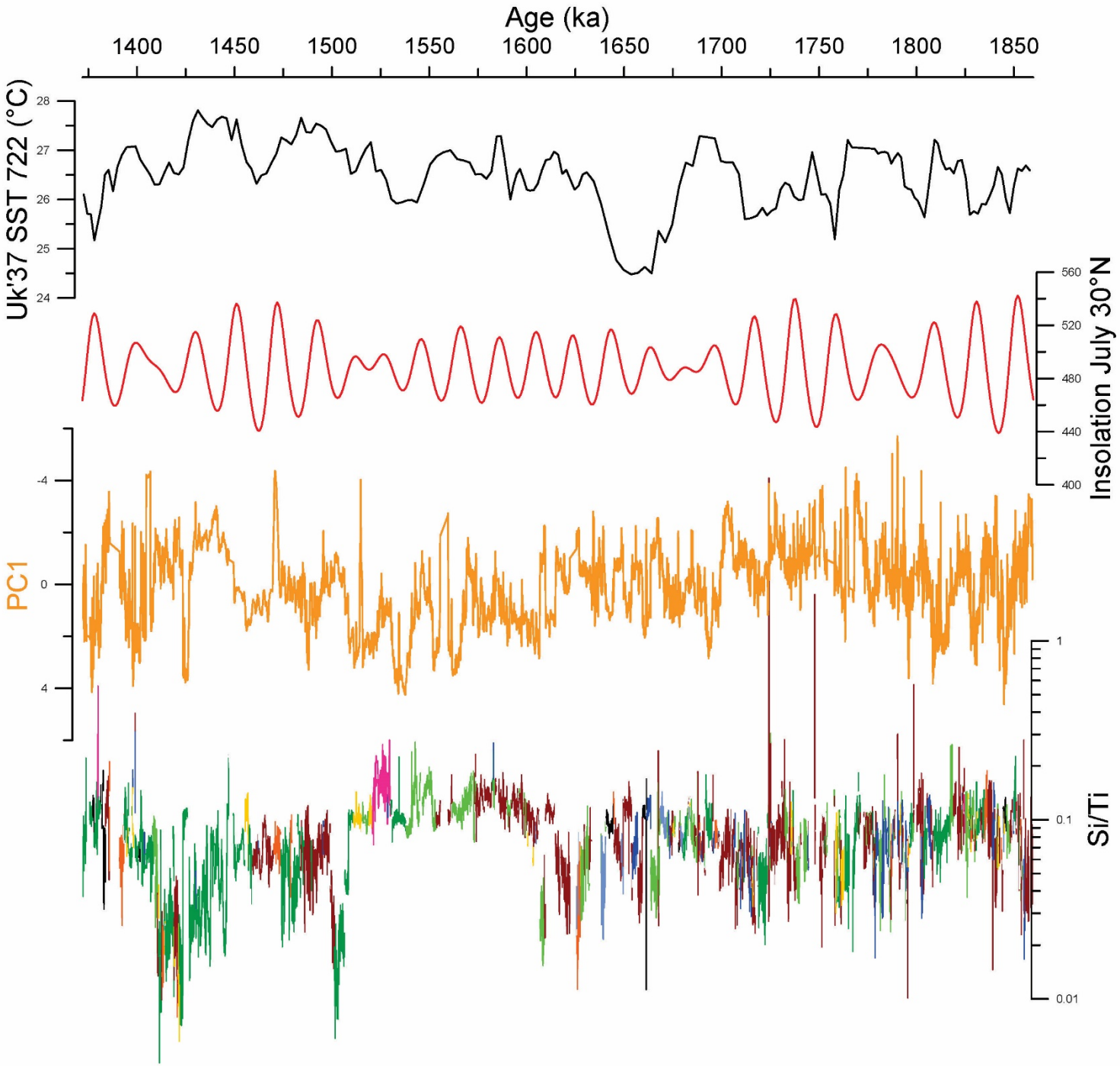



WTK 35Q-2 ~1440 ka
Depth (mbs)
97.2
97.6
98
-5
0
5
10
15
PC1 CaCO3 %
Mn
0
0.4
0.8
1.2
0
0.4
0.8
1.2
Fe %
0.2
0.4
0.6
0.8
1
Ti %

Hydroclimate reconstruction

PC1 as indicator of hydroclimate variability

Si/Ti – bioproductivity

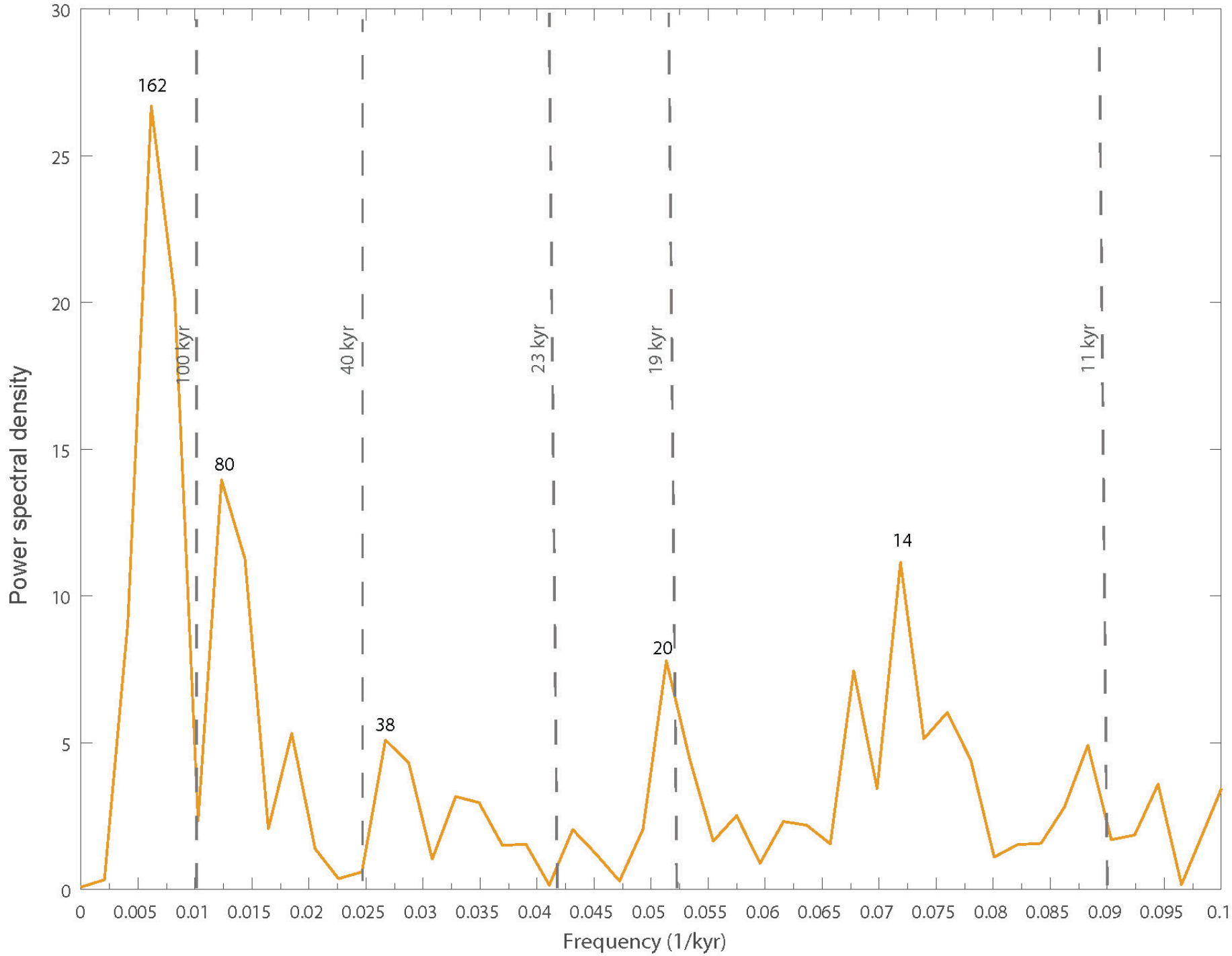


Lithology by Beck

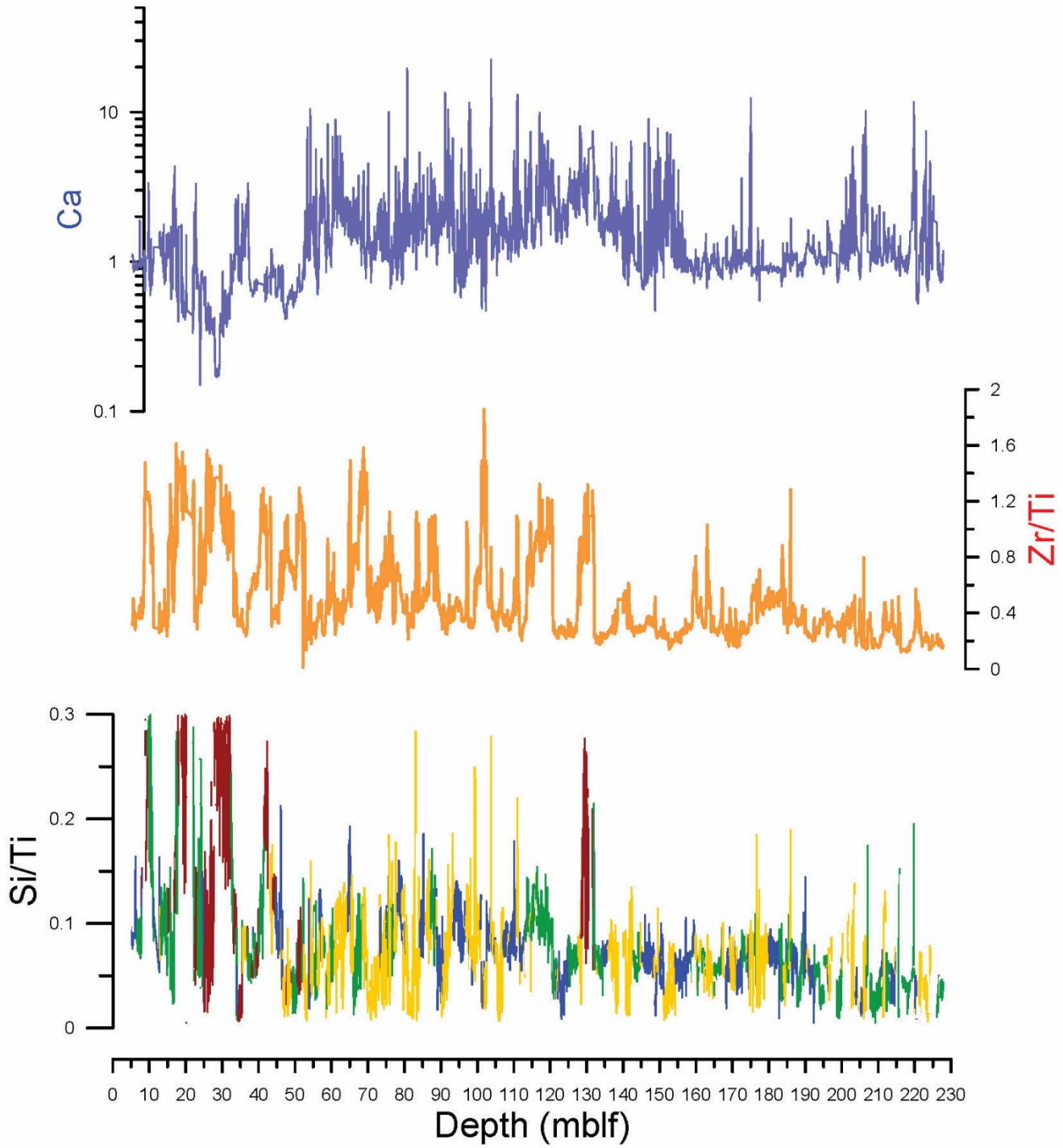
FFT analysis of WTK PC1– new age model

Precession

Obliquity



BTB



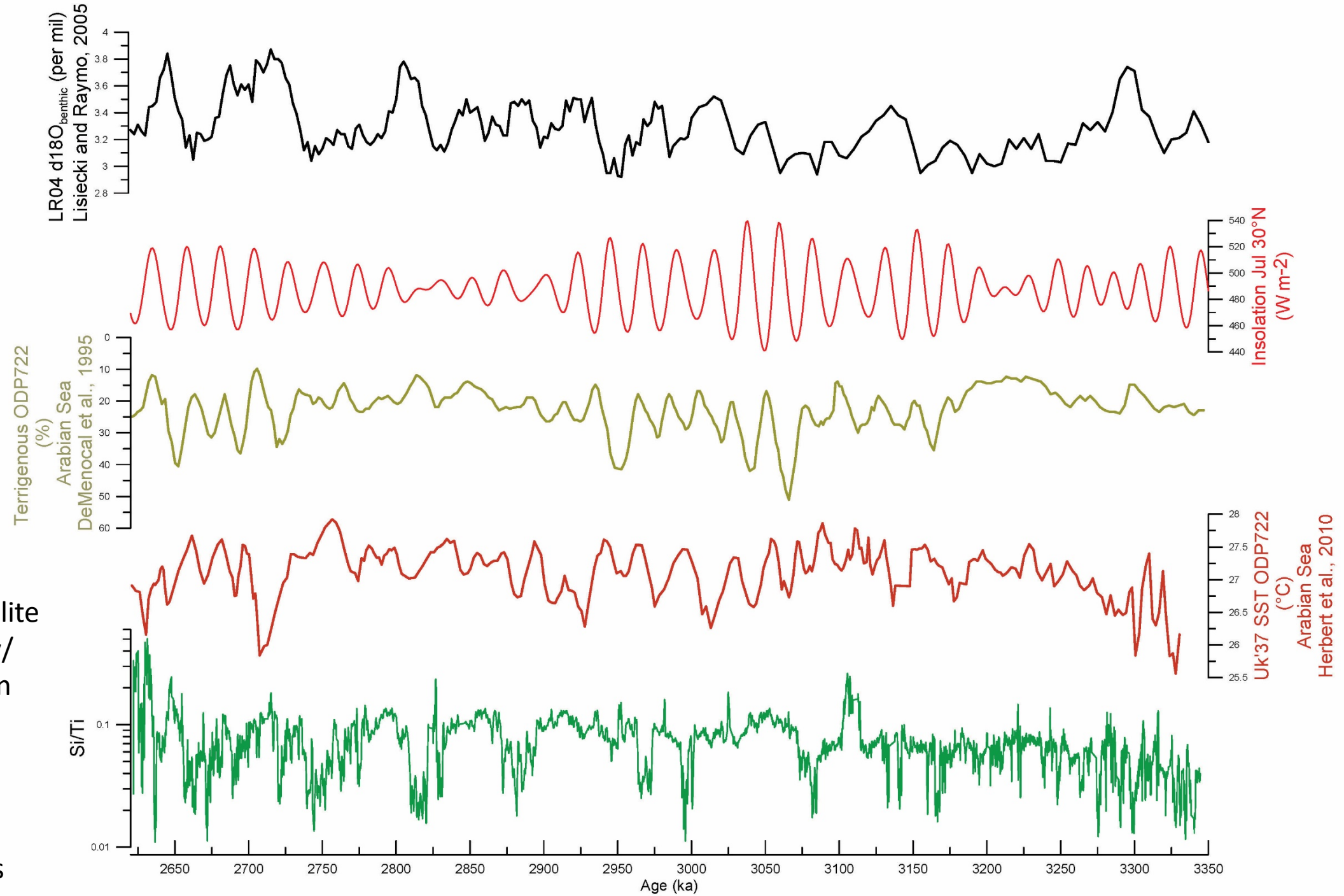
Signal changes in amplitude and frequency at 130 mblf or 3.1 Ma

Contemporaneous with major changes in global climate (closure of Panama isthmus, strengthening of NH glaciations)

diatomites
clays
silts
sand/gravel
tephra
drilling disturbances

Lithology by Kingston and others

BTB

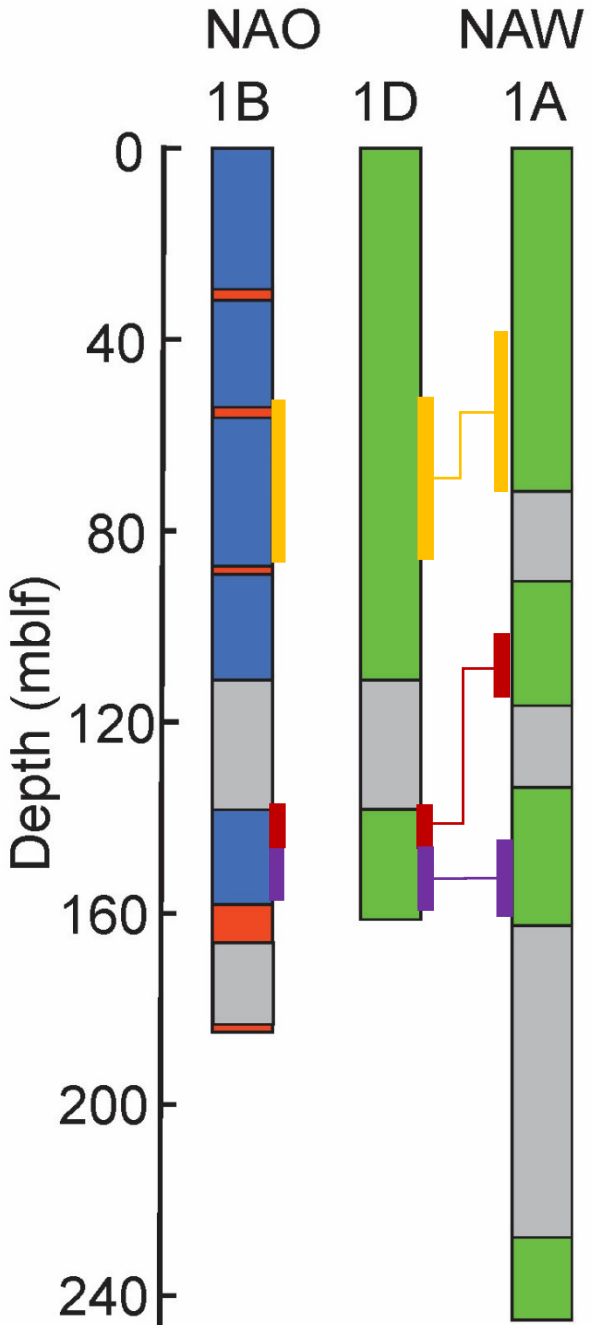


Diatom/phytolite productivity/ preservation

↑

Siliciclastics

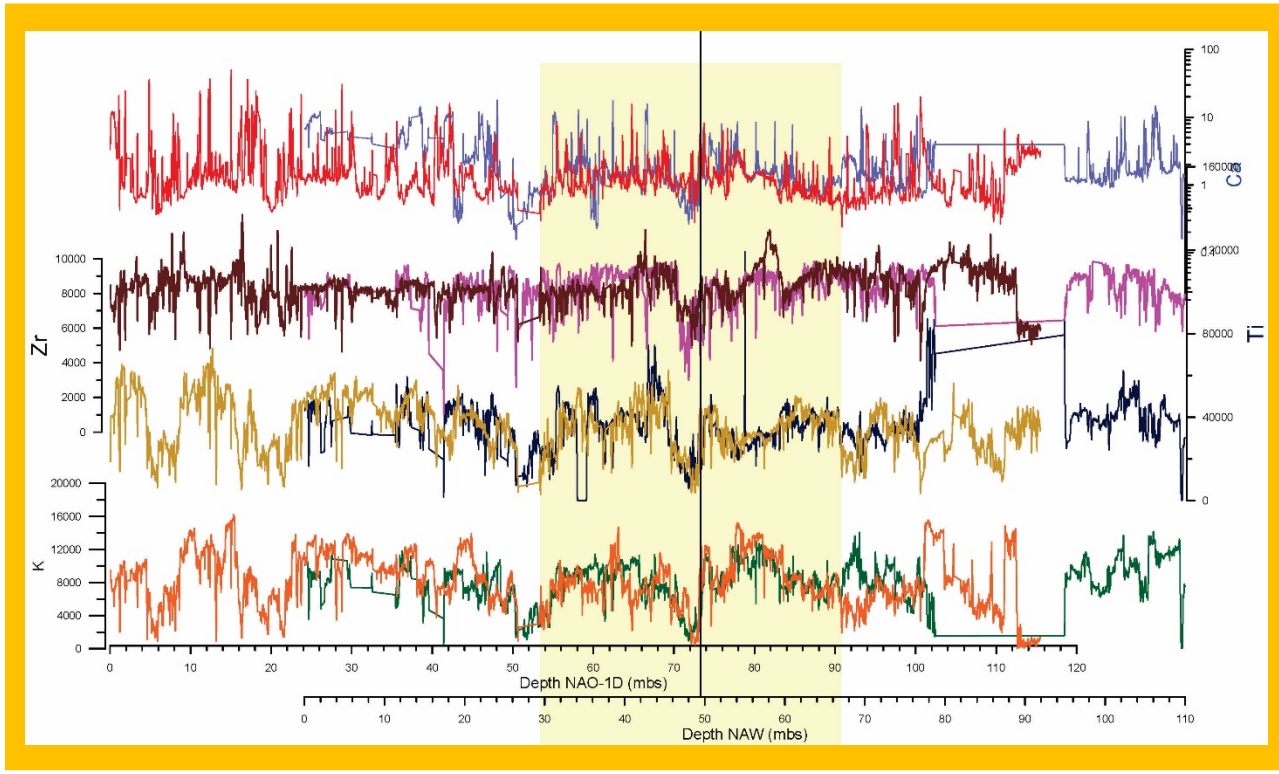
NA drill site correlation



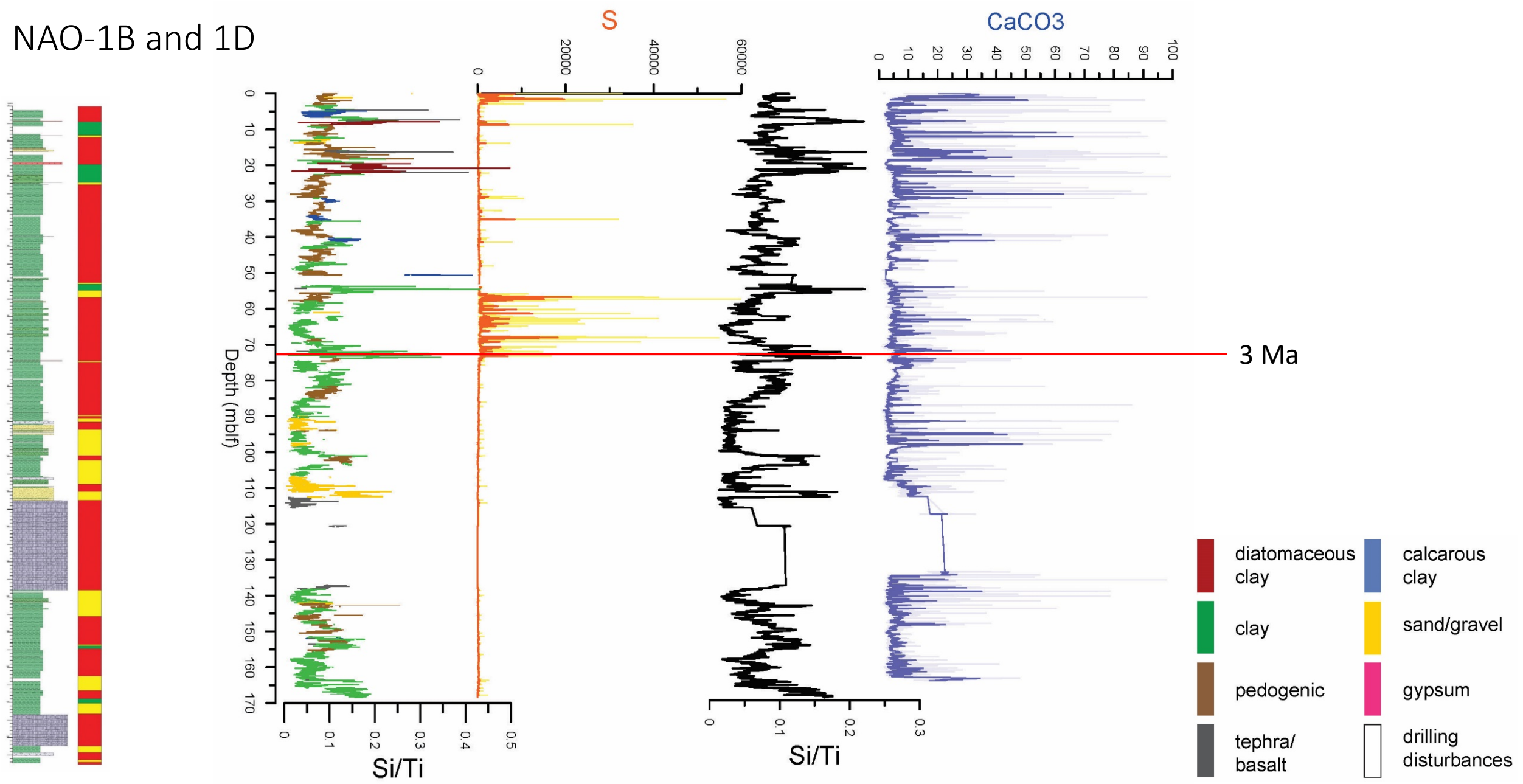
Consistent ties from Ar/Ar, geochemistry of tephra, lithology and pattern over 40 m of XRF data

Fair evidence from lithology (mostly paleosol, lacking marker horizons), consistent match in XRF data, *in progress*

Consistent ties from lithology and XRF pattern



NAO-1B and 1D

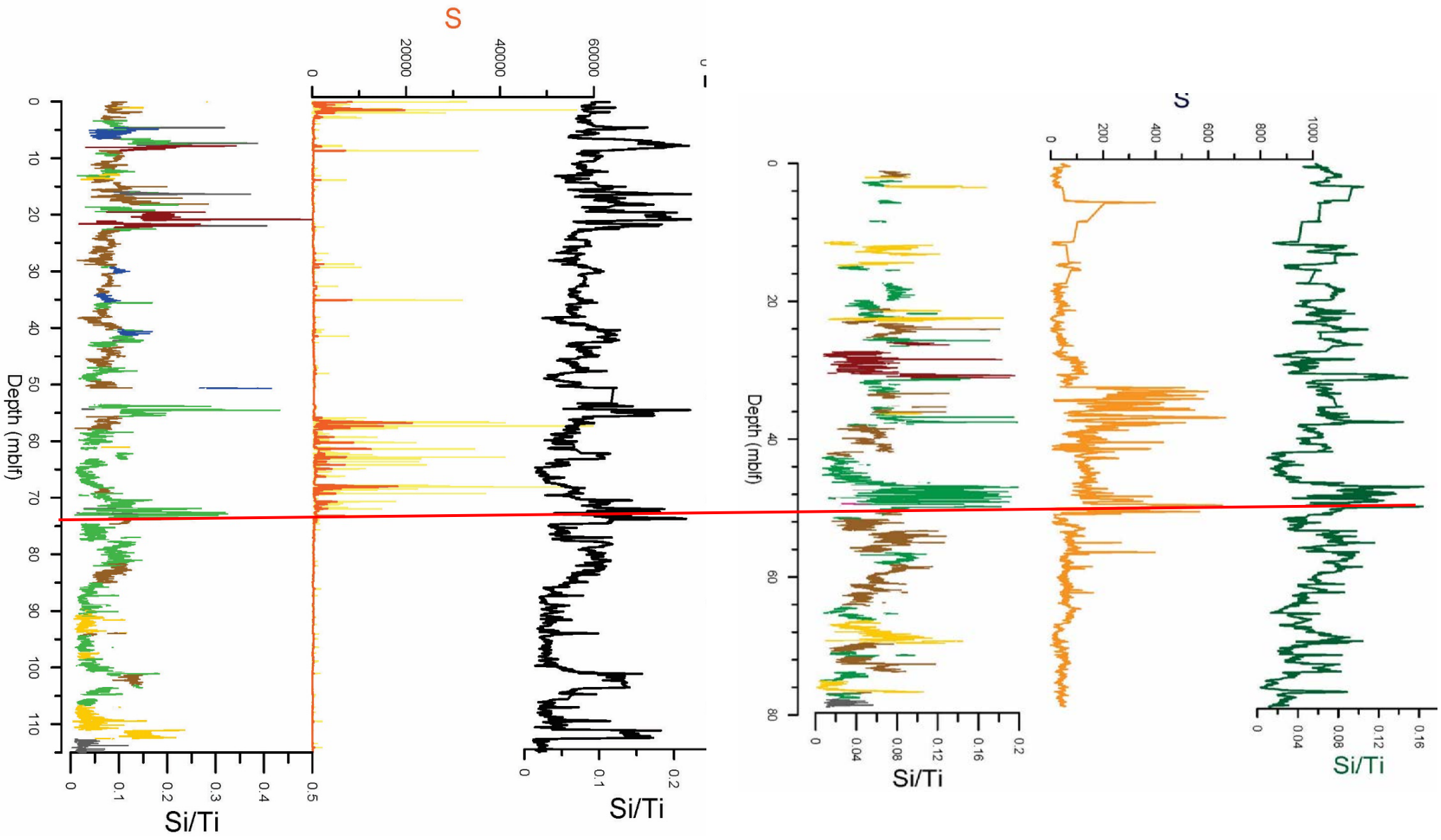


Diatom indicator by Stone

Lithology by Campisano, Garello, Stockhecke, Wynn
gypsum only 49mblf NAW

NAO

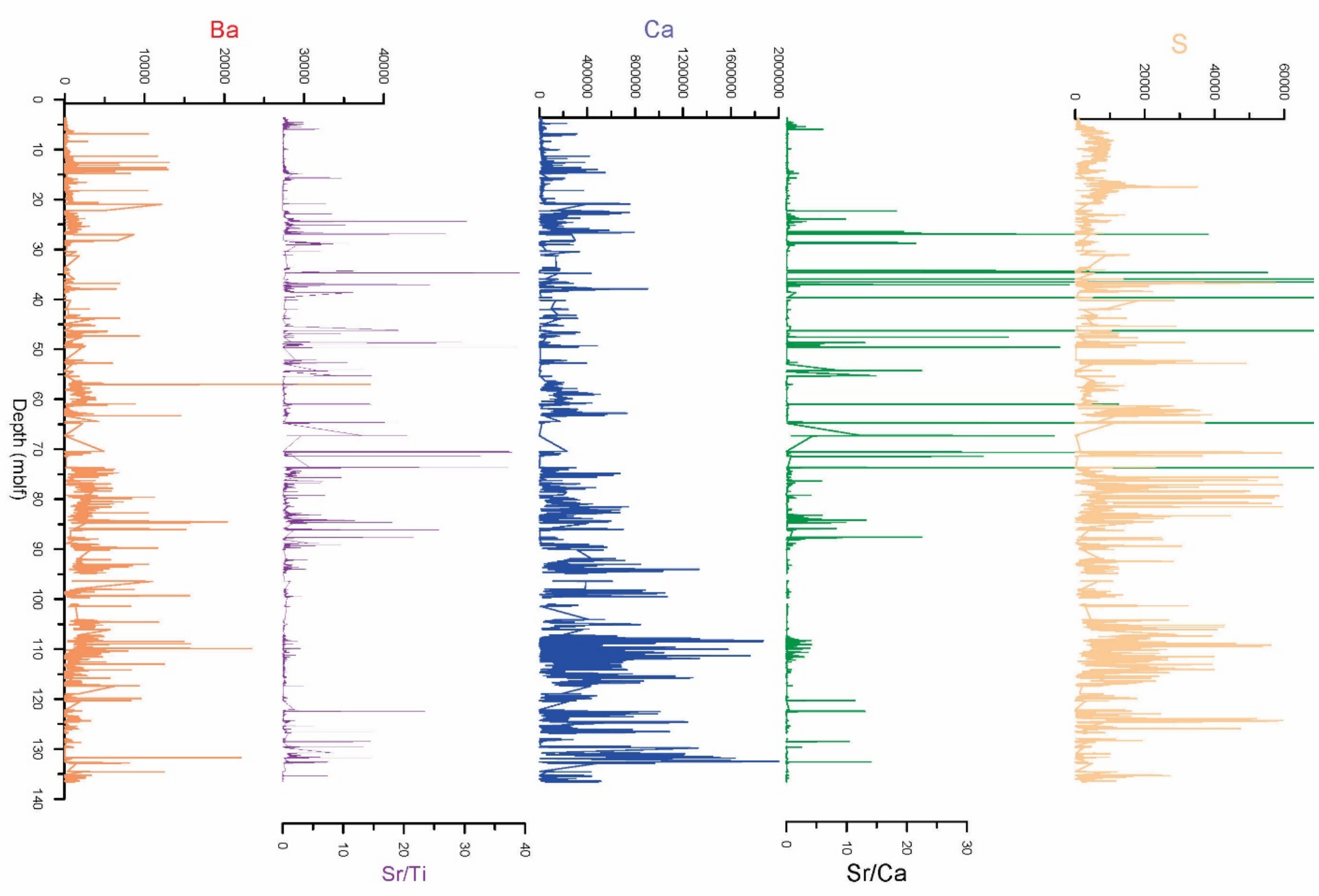
NAW



diatomaceous clay
calcarous clay
clay
sand/gravel
pedogenic
gypsum
tephra/ basalt
drilling disturbances

Lithology by Campisano, Garello, Stockhecke, Wynn
gypsum only 49mblf NAW

MAG-1A



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