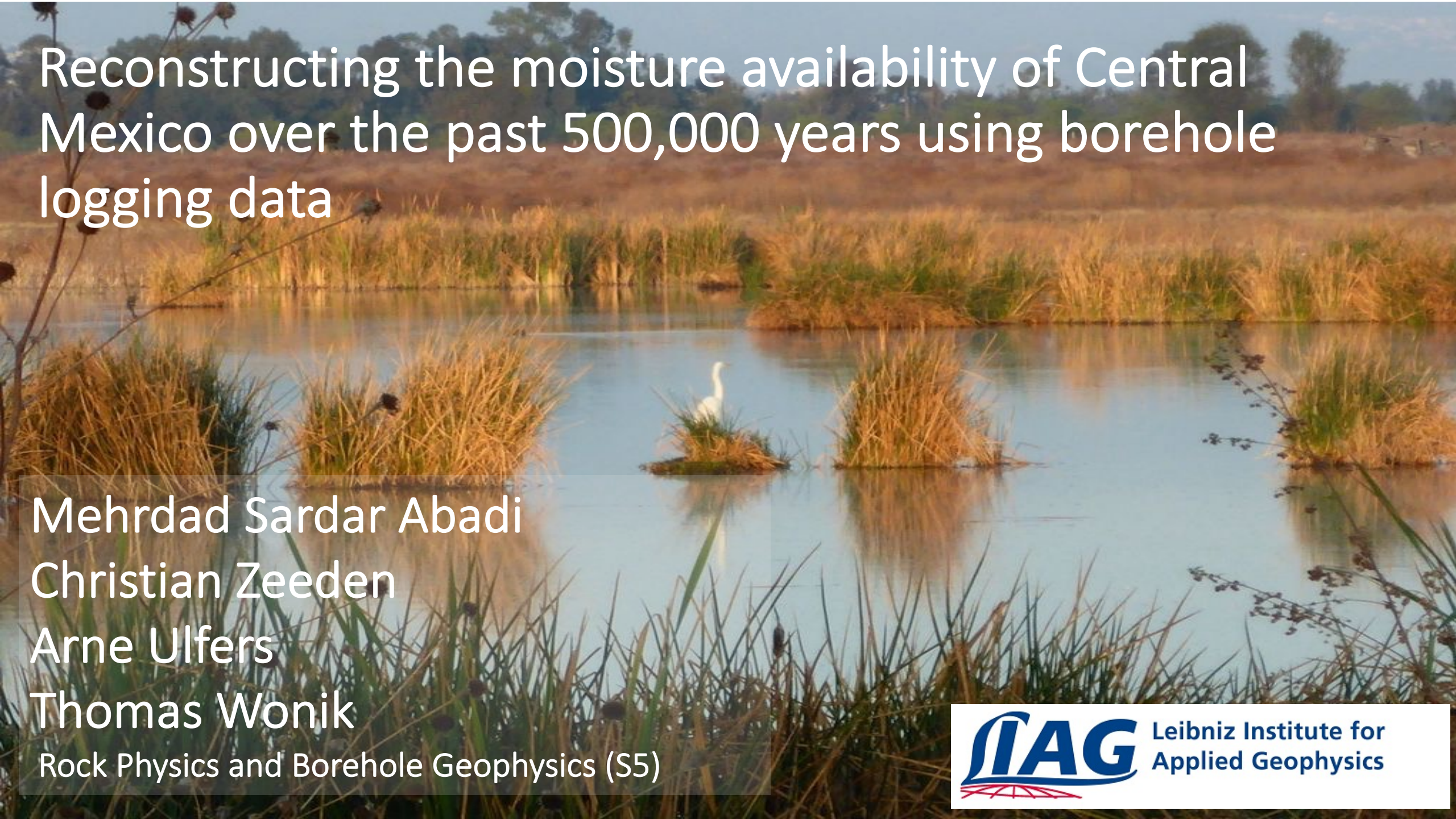
Reconstructing the moisture availability of Central Mexico over the past 500,000 years using borehole logging data



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Rock Physics and Borehole Geophysics (S5)

Leibniz Institute for Applied Geophysics

MEXIDRILL: The Basin of Mexico Drilling Program — ICDP project

- Central Mexico consisted of several extensive lake systems
- Primary civilization c.a. 12,000 years ago
  Aztec city: Tenochtitlan
- Spanish drained the lake system in the 1600s
- ICDP Mexidrill project started in 2016
- LIAG conducted geophysical downhole logging

The Valley of Mexico at the time of the Spanish conquest, c. 1519

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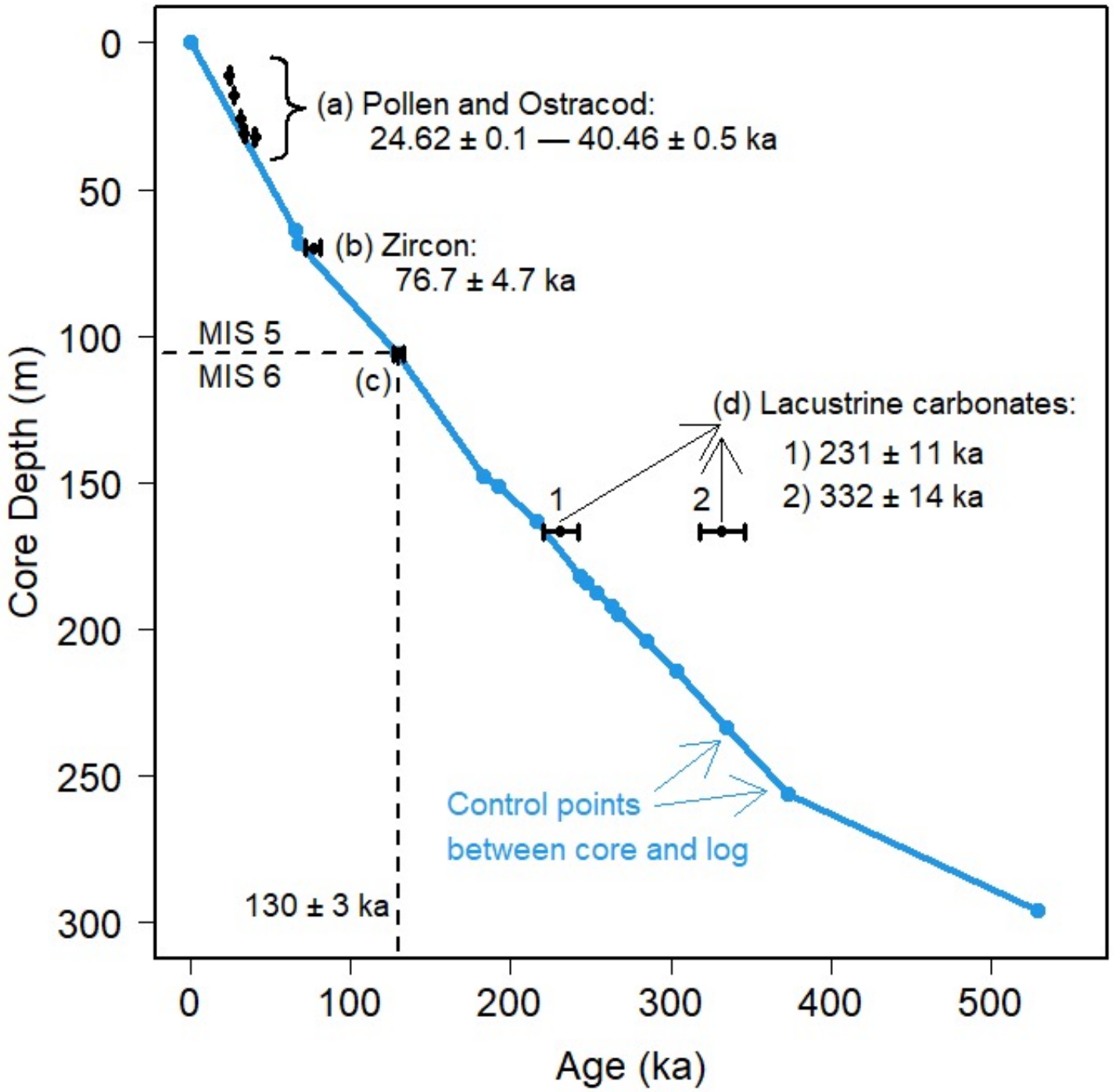
Stratigraphy

- Sediments of Lake Chalco deposited during the last 500 ka
- An astronomically-tuned stratigraphic series (blue line)
- Absolute ages of radioisotopes (Herrera-Hernández, 2011; Ortega-Guerrero et al., 2017; Martínez-Abarca et al., 2021)



Source of GR in lacustrine sediments

- Silicate-weathering rate in source

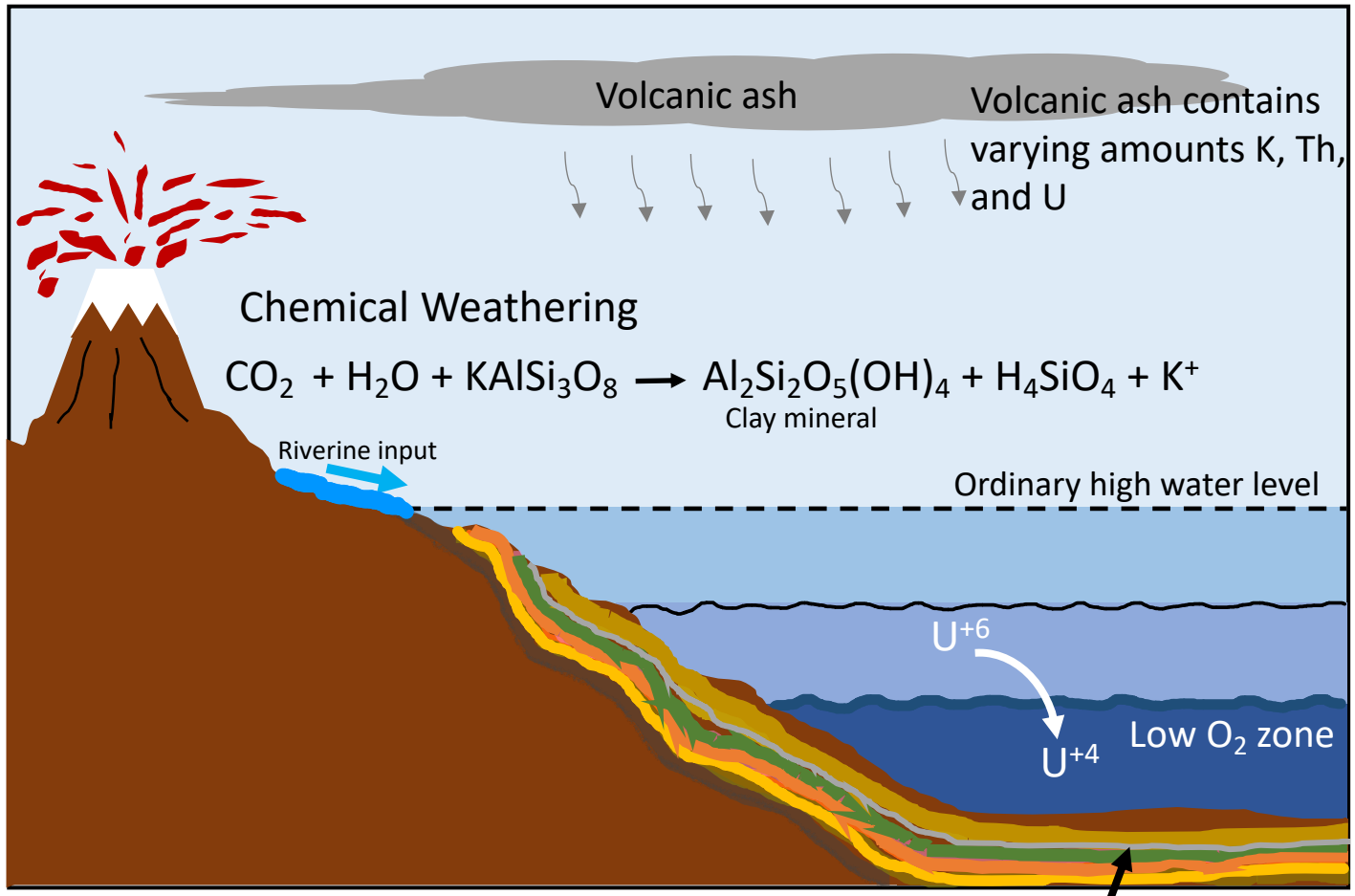
  detrital input ↑ → GR ↑

  detrital input ↓ → GR ↓

- Tephra layer → GR↑

- Redox condition in bottom water → U^{+4} → GR↑

- Salinity enhance concentration of K and Th ions



lake sediments contain **tephra layers**

Tephra is comprised of unconsolidated pyroclastic particles of magma caused by volcanic eruptions

Moisture Proxy!

Higher probability of authigenic uranium formation!

Conducting a rolling correlation between K-Th content and U

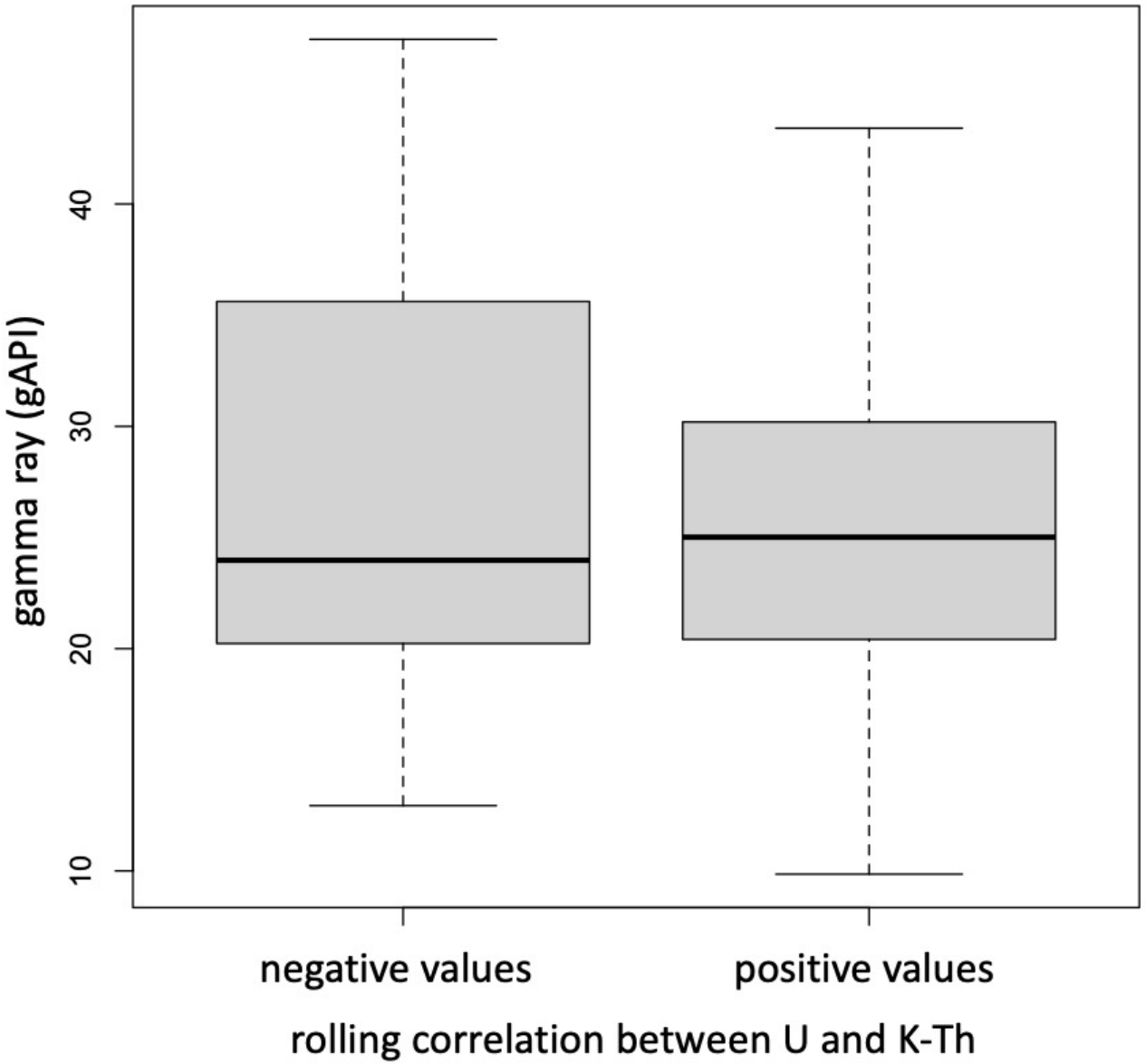
-1 ← 0 → +1

High likelihood of authigenic U

low likelihood of authigenic U

Anoxic condition ⟶ Oxic condition

Lake become shallower



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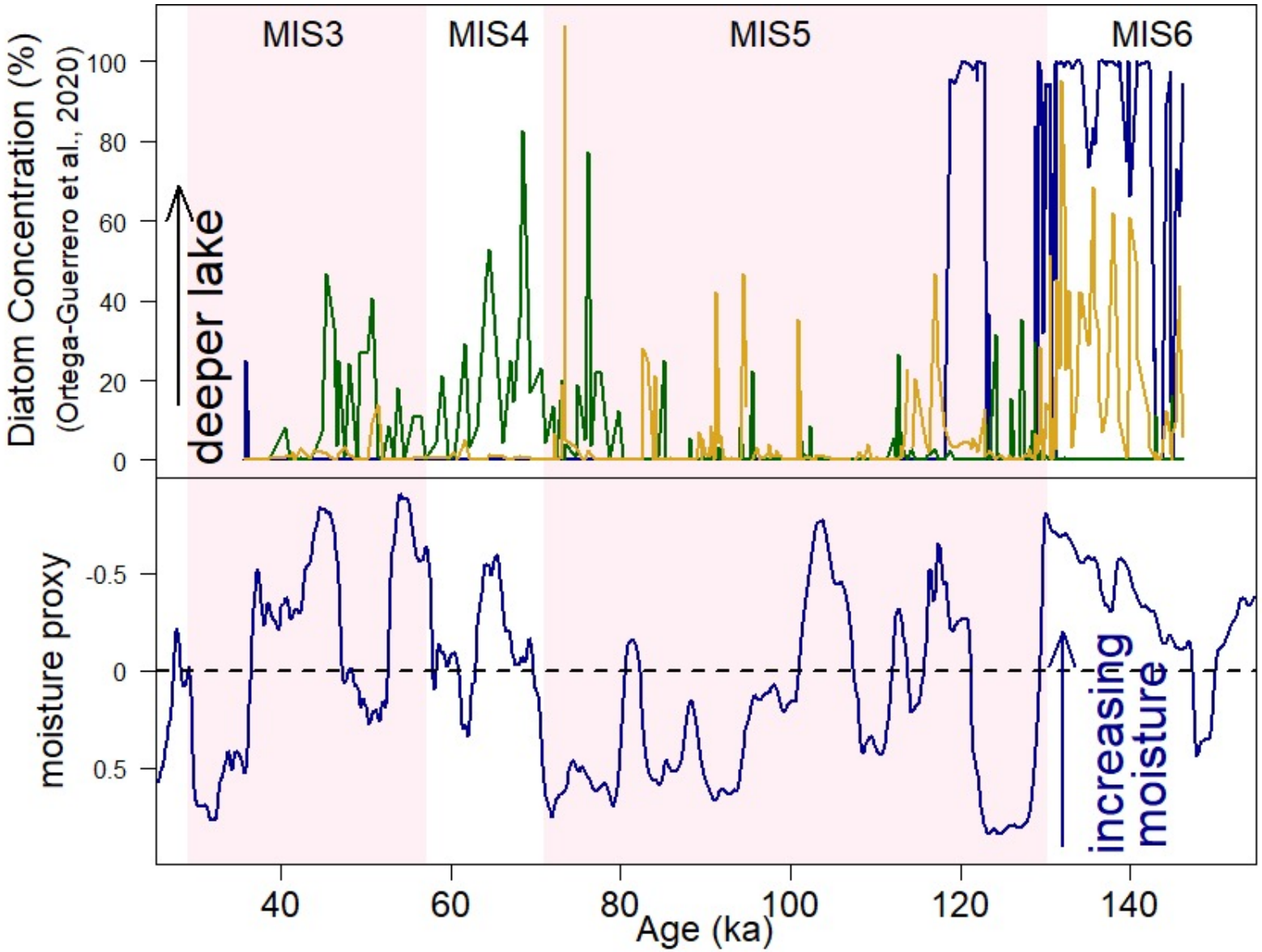
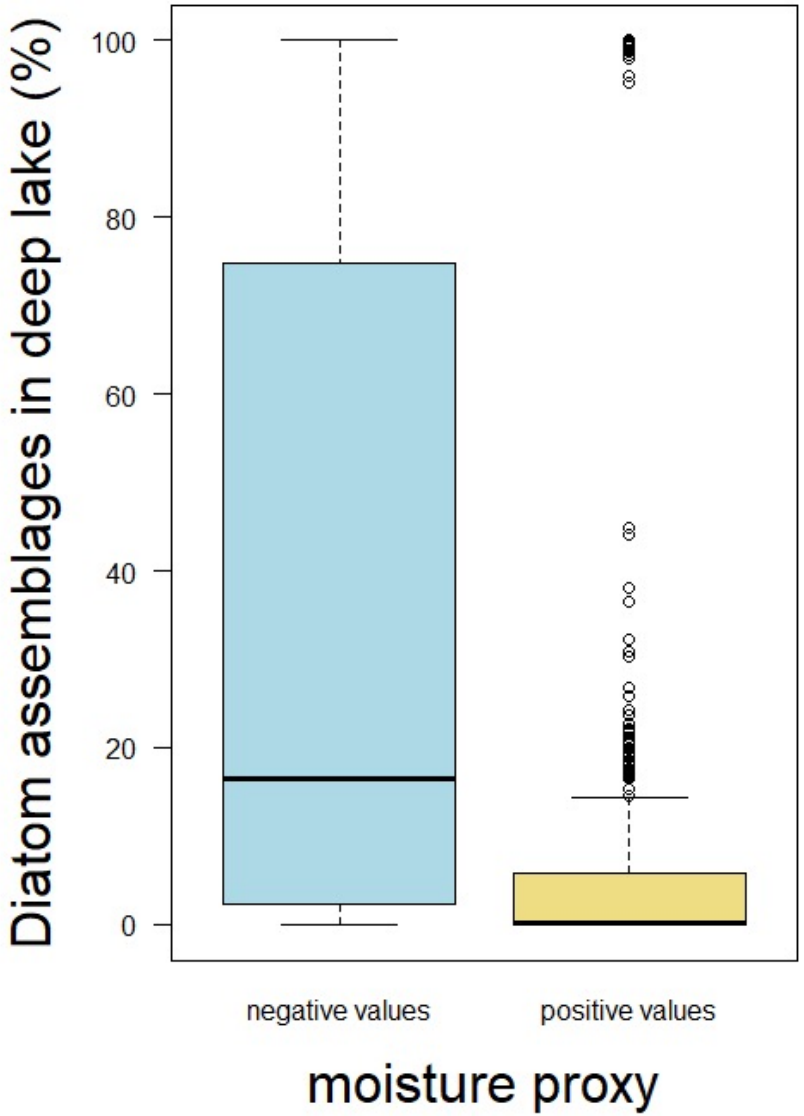
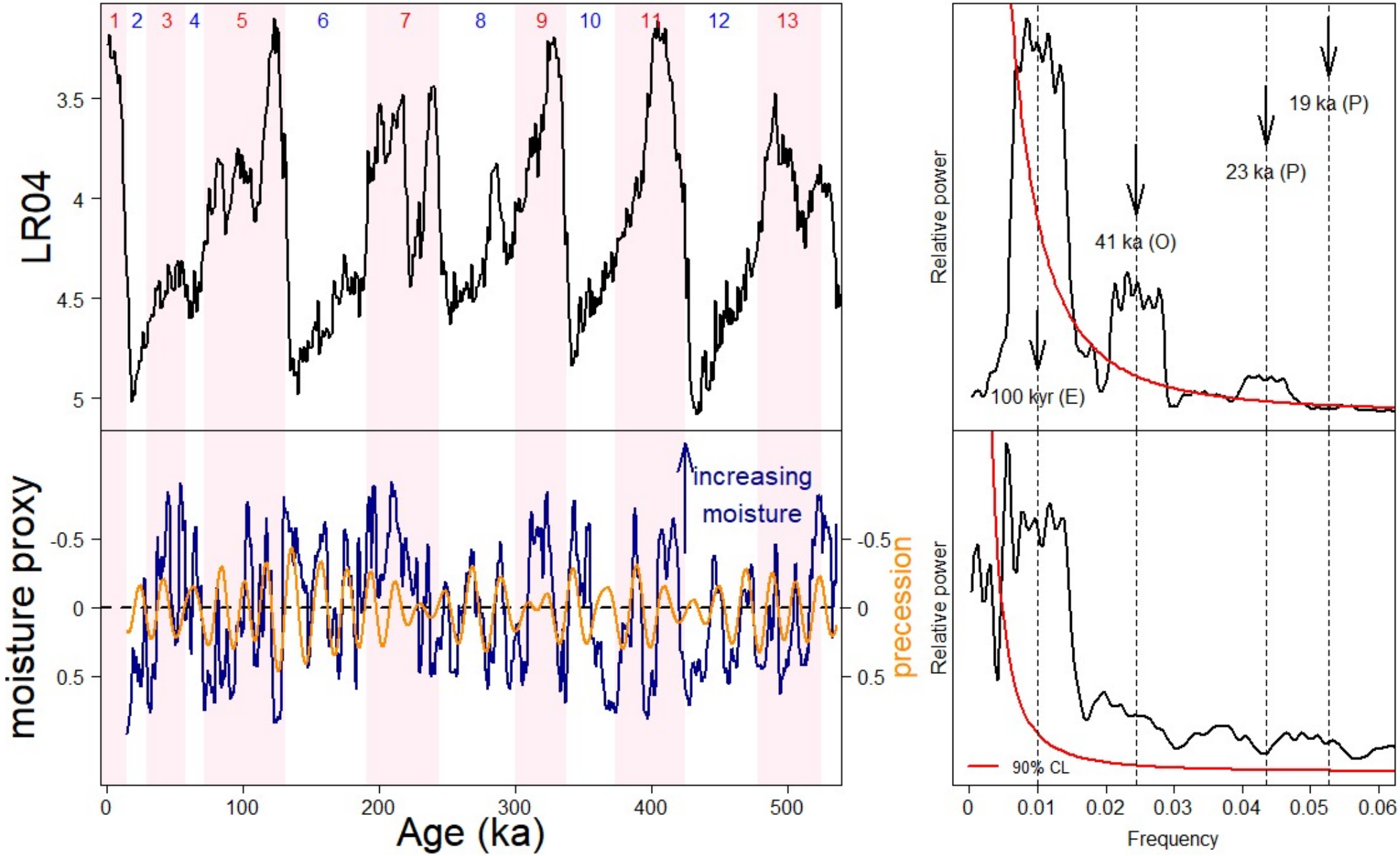
Validation of Moisture Proxy





Negative values of moisture proxy indicate higher moisture content.

Moisture variations across glacial and interglacial periods



Thank you

Thomas Grelle
Carlos Lehne
Jan-Thorsten Blake

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