Establishing the reliability of GDGT-based climate proxies in the 250-ka Lake Chala record by integrating basin evolution information

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reference list & proxy calculation

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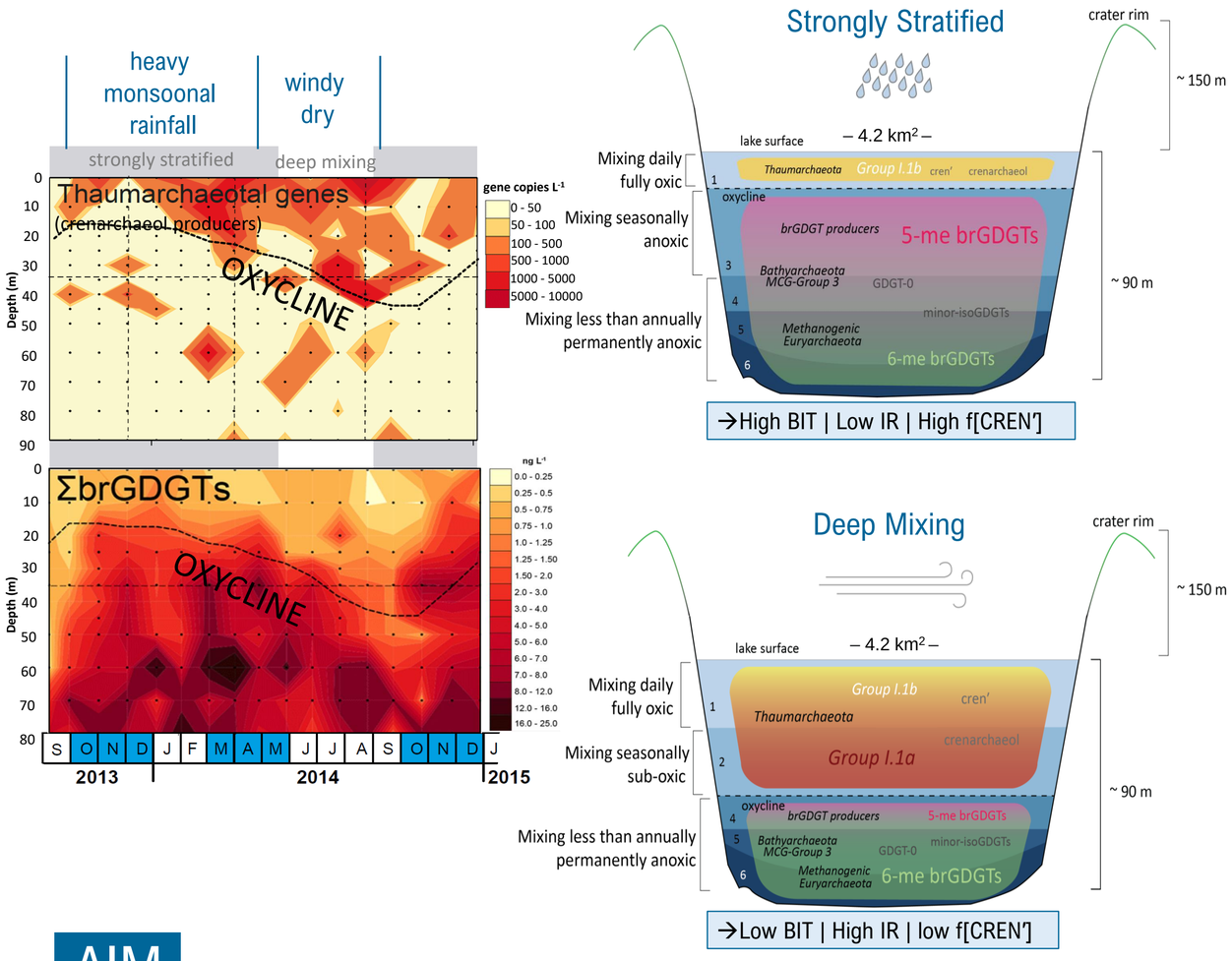
BACKGROUND

Biomarkers, like glycerol dialkyl glycerol tetraethers (GDGTs), in sedimentary records of long-lived lakes are a popular tool for paleoclimate reconstruction. Such reconstructions generally rely on correlations between biomarkers detected in recently deposited sediments and measured climate variables (e.g., air temperature). However, water-column properties such as oxygen availability and light penetration depth have a confounding influence on proxy-climate relationships. Hence, modern lake-system studies are vital to validate biomarker proxies. Additionally, beyond seasonal to interannual time scales, long-term lake-basin development must have significantly impacted the reliability of such proxies but is most often overlooked.

MODERN SYSTEM STUDIES

Multi-year studies of GDGTs in the water column of Lake Chala[1-2] show strong links between seasonal lake mixing (oxygen penetration depth) and GDGT distribution in the water column. In Lake Chala, mixing is associated different climate states.



AIM

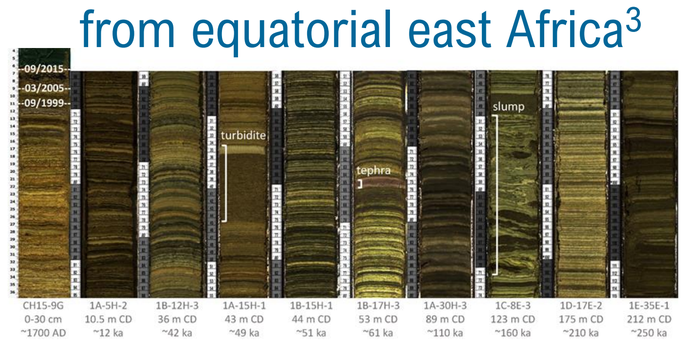
We use a comprehensive approach to assess the reliability of GDGT proxies to reconstruct long-term climate change from the DeepCHALLA sediment sequence. In order to fully develop our interpretation of down-core GDGT variability, we build upon the crucial findings from modern-system studies using comparisons to major phases in basin evolution as indicated by independent proxies.

GDGT CLIMATE PROXIES

GDGTs are membrane lipids of bacteria and archaea. The molecular structures of these lipids are related to environmental conditions, such as temperature, pH and moisture balance, making them a powerful tool for paleoclimate reconstruction.

ICDP PROJECT DEEPCHALLA

Lake Chala: a long climate record from equatorial east Africa[3]



the heart of the tropics | 215-m (250-kyr) laminated sediments | independently dated

RESULTS

Here we present GDGT measurements from nearly 1000 sediment horizons throughout the DeepCHALLA lake sediment sequence.

Long-term changes in the lake basin and water chemistry (indicated by seismic reflection data[4], lithology[5], and diatom assemblages[6]) **strongly influenced GDGT proxies in early phases.**