FACULTY OF SCIENCES

DEPARTMENT OF BIOLOGY
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A 260 000-year reconstruction of diatom community dynamics and photosynthetic pigments in Lake Chala, a tropical crater lake

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PROTISTOLOGY AQUATIC ECOLOGY

LIMNOLOGY

Meise Botanic Garden

0° N/S — DeepCHALLA — 250 kyr

EGU General Assembly 2020

ICDP DeepCHALLA

- Lake Chala is a c. 90 m deep meromictic, oligotrophic crater lake near Mt. Kilimanjaro in equatorial East Africa
- A 215-m long fine-resolution continuous sediment sequence was recovered in 2016
- This provides a unique opportunity to study tropical long-term climate dynamics and aquatic ecosystem response during the past c. 260 000 years, covering two glacial-interglacial cycles

This study is aimed at reconstructing millenial-scale diatom community dynamics and analyzing photosynthetic pigments in Lake Chala for the past c. 260 000 years

- Diatoms respond to lake level fluctuations in response to changes in habitat availability, water column mixing and the subsequent changes in internal nutrient supply
- Pigment remains can reflect total phytoplankton productivity and community composition including that of 'soft' algal groups, but also preservation conditions

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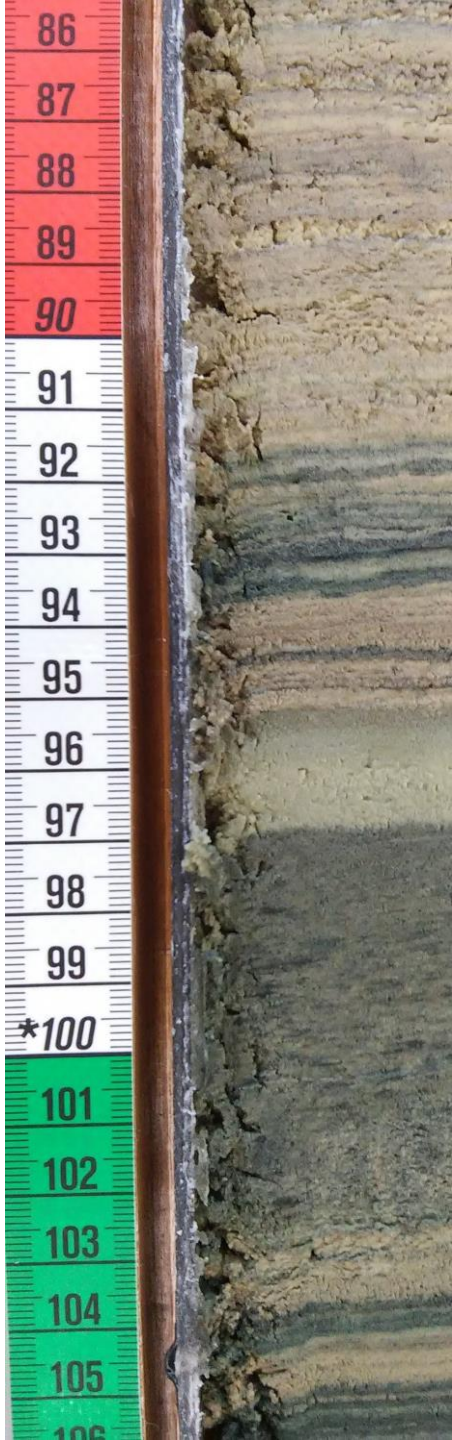


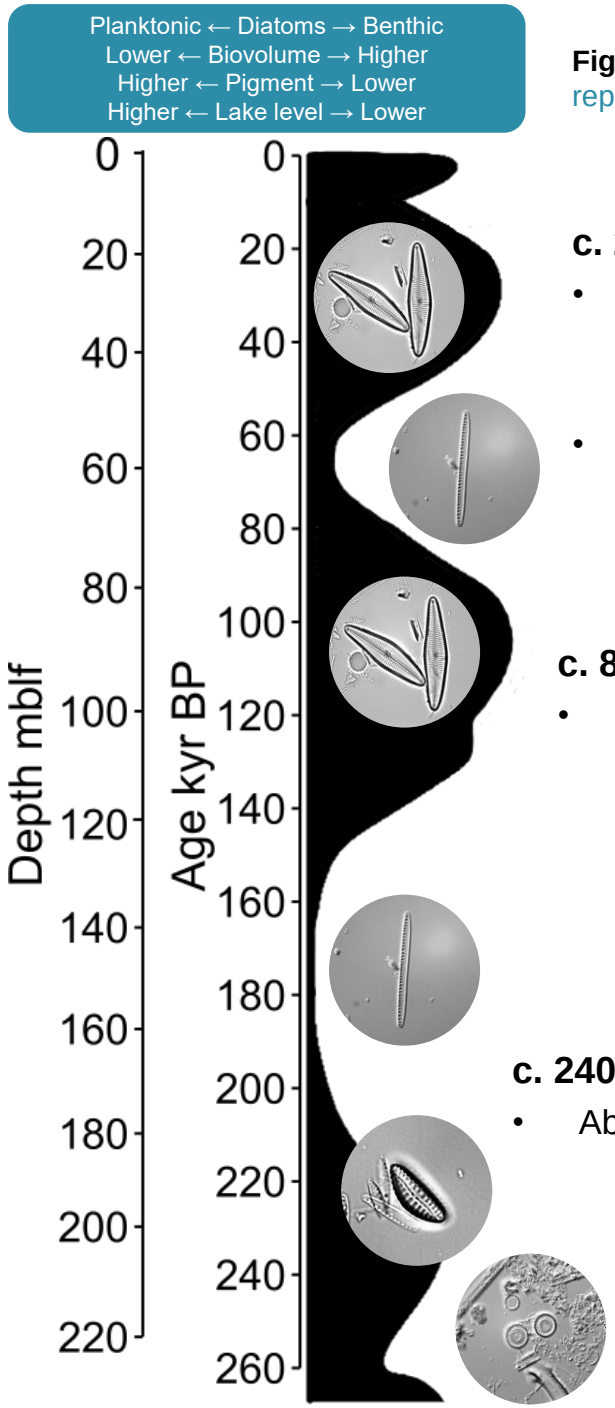


Figure: A simplified visualization of the diatom types, biovolumes and pigment concentrations combined. This is not a formal representation of the reconstruction. The preliminary chronology is based on an extrapolated age-model of Moernaut et al. (2010).

c. 22–17 ka BP and c. 110–90 ka BP

- High abundances of *Afrocymbella barkeri*, high diatom biovolumes and low pigment concentrations
  - deeper relative mixing which enhances internal nutrient cycling and supports diatom production
  - oxygen injection to hypolimnion facilitates pigment degradation
- These periods broadly coincide with the Last Glacial Maximum and the MIS5 African megadrought

c. 80–50 ka BP and c. 220–140 ka BP

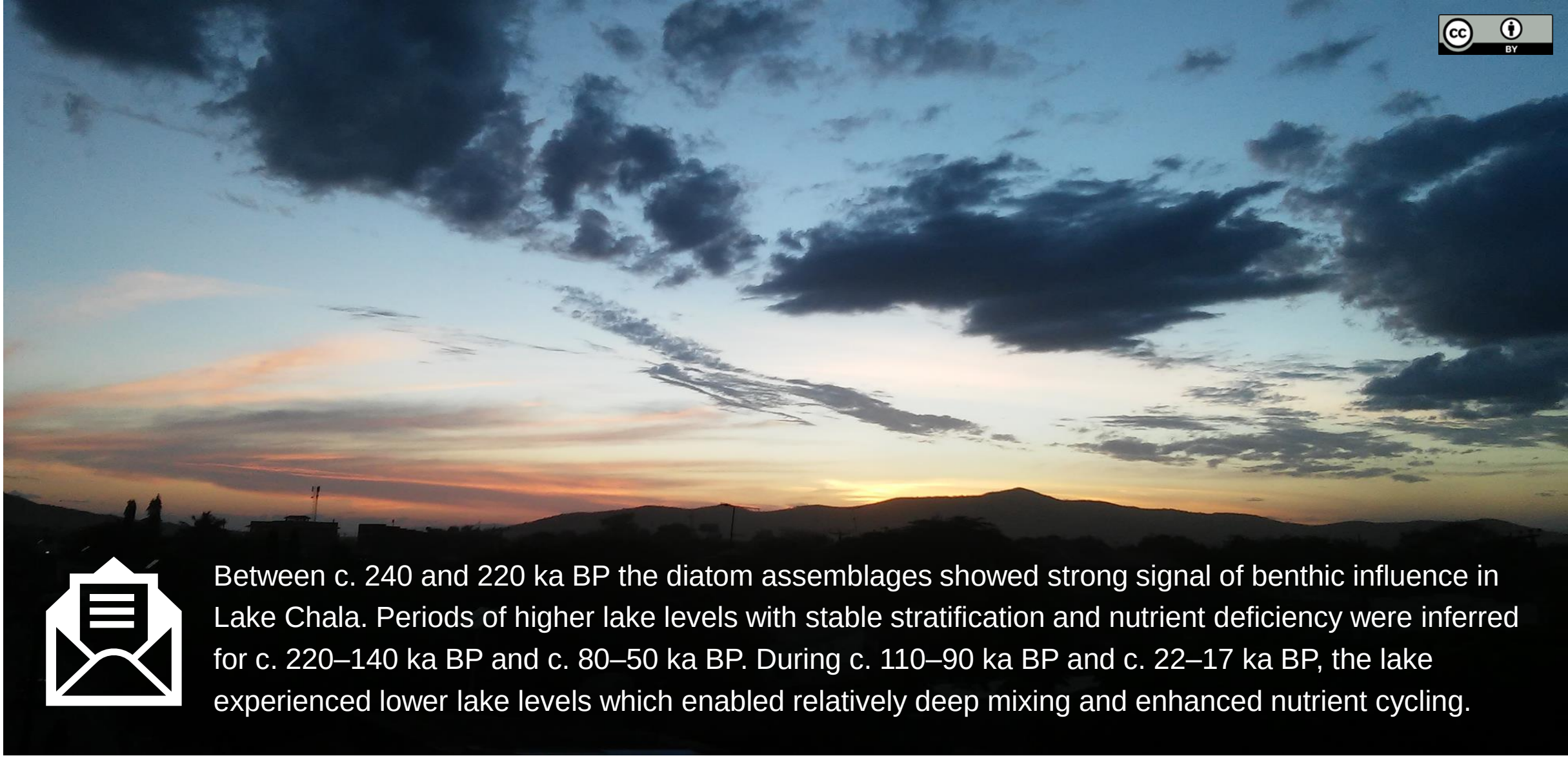
- Dominance of needle-like long and small *Nitzschia* taxa with higher but fluctuating pigment concentrations (mainly zeaxanthin and lutein → cyanobacteria and green algae)
  - indicates stable stratification and nutrient deficiency
  - favorable pigment preservation conditions

c. 240–220 ka BP

- Abundant benthic *Encyonema* sp. indicates continuing lower lake levels and increased availability of littoral habitats

c. 260 ka BP

- Facultative planktonic *Discostella* cf. *stelligera* suggests open-water conditions with the near presence of littoral habitats



Between c. 240 and 220 ka BP the diatom assemblages showed strong signal of benthic influence in Lake Chala. Periods of higher lake levels with stable stratification and nutrient deficiency were inferred for c. 220–140 ka BP and c. 80–50 ka BP. During c. 110–90 ka BP and c. 22–17 ka BP, the lake experienced lower lake levels which enabled relatively deep mixing and enhanced nutrient cycling.

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THANK YOU!

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