Recent to past record of lacustrine chalk deposition and diagenesis in lake Weissensee (Carinthia, Austria)

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Introduction

Lake Weissensee, located in Carinthia (Austria) at 930 meters above sea level, is widely known for its light-coloured, lacustrine chalk deposits that are partially seaming the shore of the lake. Recent findings indicate that the formation of these calcitic chalk deposits is closely related to calcium carbonate mineralization mediated by extracellular polymeric substances (EPS). However, the interactions between ambient lake water and EPS, as well as the influence of different environmental parameters on the formation mechanisms of $CaCO_3$ are not fully understood. The potential of this sedimentary archive as an important local sink for CO_2 demands further research.

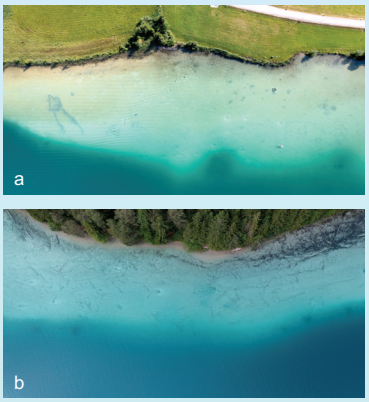


Fig.2 (a + b): Aerial images of the core sampling sites obtained by drone photography (Courtesy C. Strasser, Weissenseefoto) highlighting the spatial extension of the marginal chalk deposits in the eastern basin.

Approach

Down-core sediment sampling on two cores, recovered from two different locations within Weissensee, allows the investigation of recent to past deposition and its underlaying processes.

Mineralogy, geochemistry and micro-structures of the sediments are studied via a multi-proxy approach, in order to examine the core's potential as reliable carrier for environmental (paleo-) proxies. Methods applied include XRD, XRF, SEM, macrophotography and stable isotopes.

Sampling sites

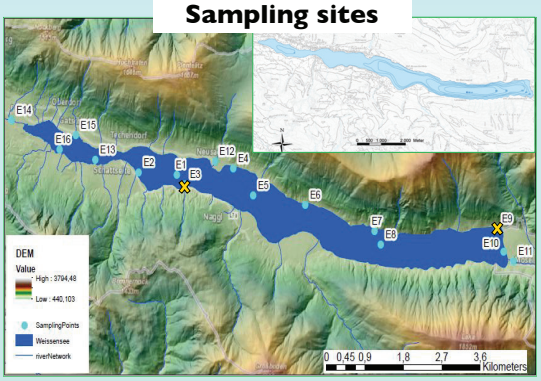
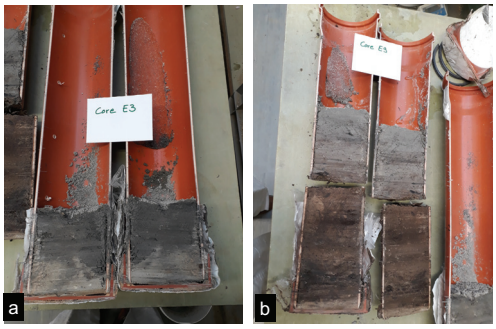


Fig.1: Bathymetry of Weissensee (Kärntner Institut für Seenforschung), geographical overview and sampling sites of the sediment cores at Weissensee, Carinthia (Austria), modified after Kranawetter [Masterthesis, in preparation].

Aim of the study

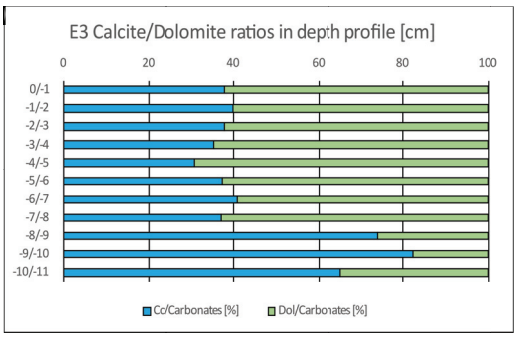
Therefore, this master project aims to gain a better understanding of the underlying processes for (1) EPS-mediated carbonate production in lake Weissensee, (2) diagenetic alteration of the lacustrine chalk, and (3) the role of potential precursor calcium carbonate phases and their transformation with time and burial.

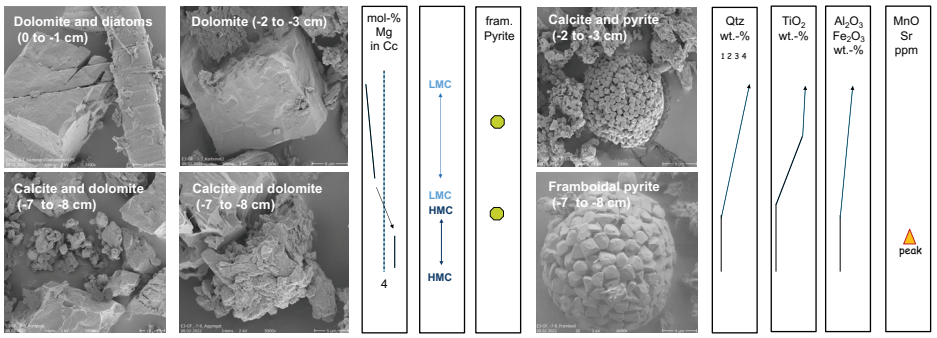
Sediment cores



Core E3 (a) contains 12 cm of fine-grained, grey-colored sediment with only a weak observable lamination. Organic matter is finely disseminated. Core E9 (b) reveals a sharp color and lithological boundary in 13-14 cm depth. Total length is approx. 40 cm. The study focuses on the upper part.

E3 - Sediment core composition – First results





Preliminary findings of the western part of the lake (core sample E3) show that - besides biogenic components - the sediments of the upper 10-15 cm of the core are mainly composed of authigenic calcite and detrital dolomite, with a distinct shift in the calcite/dolomite ratio. This shift correlates with a change from low-Mg calcite (LMC) to high-Mg calcite HMC). Framboidal pyrite can be observed throughout several layers of the sediment core, indicating bacterial sulfate reduction. Moreover, X-ray fluorescence data suggest an increase in the detrital fraction in the upper part of the core.

Transformation/ recrystallization of calcitic mesocrystals	Dolomite allochtonous	Diagenetic shift to most stable calcite	Bacterial sulfate reduction	Slight increase in the detrital fraction	?

Outlook – Light stabe isotopes and radiocarbon dating

- Stable C and O isotope analyses of the sediment, particularly of the authigenic calcite
- Radiocarbon dating of organic compounds (see macrophotography stacking images below)

Organic material extracted from core E9,

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