Evolution of the Lake Constance shelf and its relation to archaeological mounds

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Introduction

Over 170 mounds of loose rocks along the shelf of Lake Constance (NE-Switzerland) were recently discovered using a new bathymetric map. An underwater georadar survey suggested that the mounds were artificially deposited overlying a succession of Glacial till, Late Glacial clays and Holocene lake deposits. Investigating these sediments will help answer open questions about the age of the mounds and how the environmental conditions along the shelf area have changed in the context of their construction.

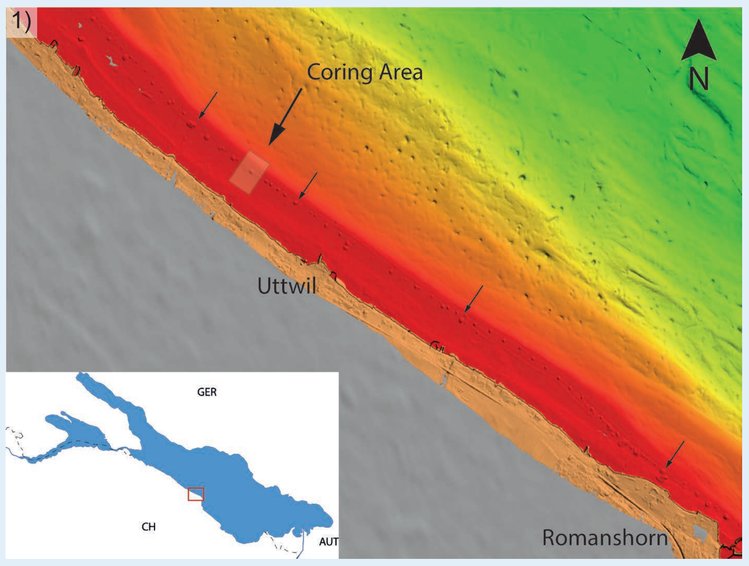


Fig. 1: Bathymetric map of the Lake Constance shelf area that led to the discovery of the mounds (mod. after Wessels et al., 2016). The chain of mounds is indicated by the small arrows.

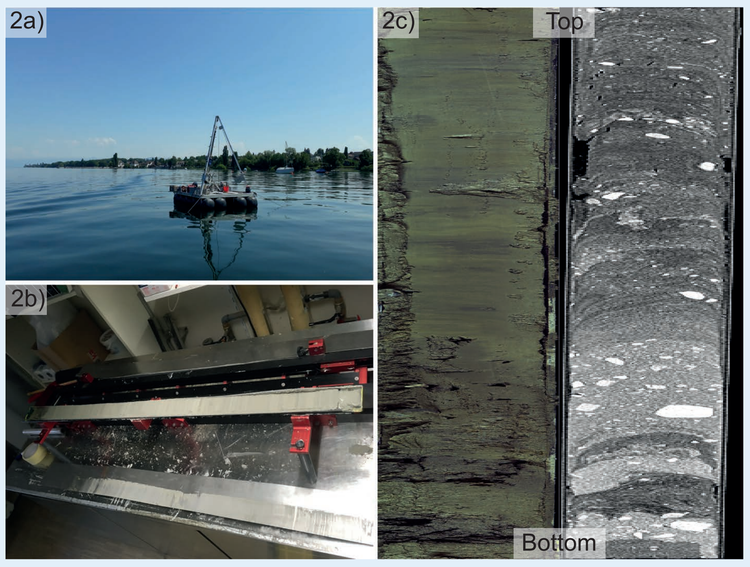


Fig. 2a-c: a) Coring platform "Helvetia" on Lake Constance (Photo S. Fabbri), b) freshly opened core, c) Line- and CT-Scan of core section BO19_100_3C

Field & Laboratory Work

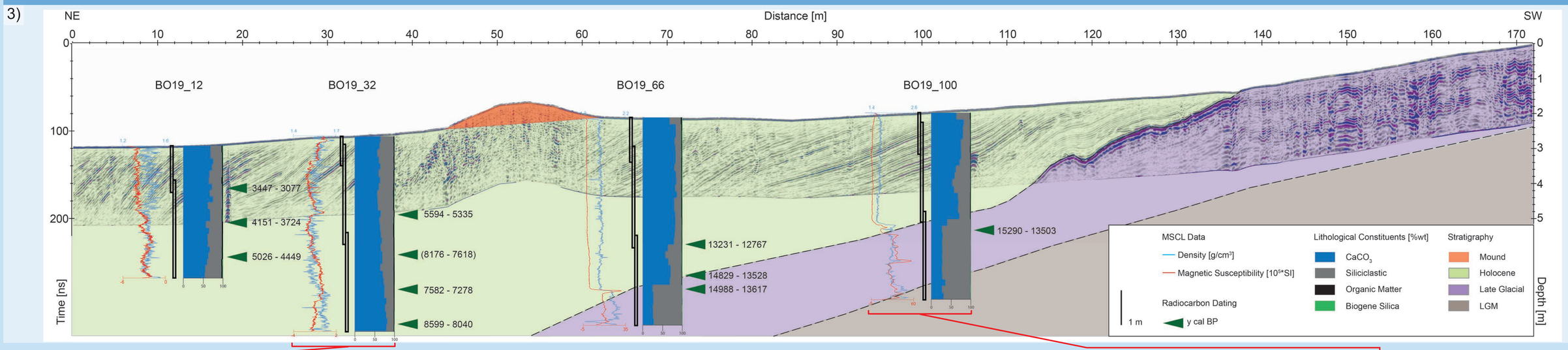
Coring took place on four locations along a georadar transect. The transect runs from the shoreline towards the shelf edge and crosses a mound (Mound No. 5). The four cores reach sediment depths from 3.7 to 5.9 m and were recovered in overlapping 3 m sections and later cut to 1 m pieces.
Analysis of the sediment cores included:

- Multi-sensor-core-logging (MSCL)
- CT-Scans
- Line-scans
- Sedimentological description
- Geochemical analysis (CNS and FTIR)
- AMS-14C

Additionally, 12 surface samples were taken along a water depth transect from 0.5-6.0 m and analysed with CNS and FTIR.

Fig. 3: The four coring locations along the underwater georadar line across mound no. 5. For each coring location, results from MSCL, CNS, FTIR and radiocarbon dating are shown. Three depositional sequences (Last Glacial Maximum – Late Glacial – Holocene) were established (mod. after Hornung et al., 2018).

First Results: Cross-Section of the Lake Constance Shelf



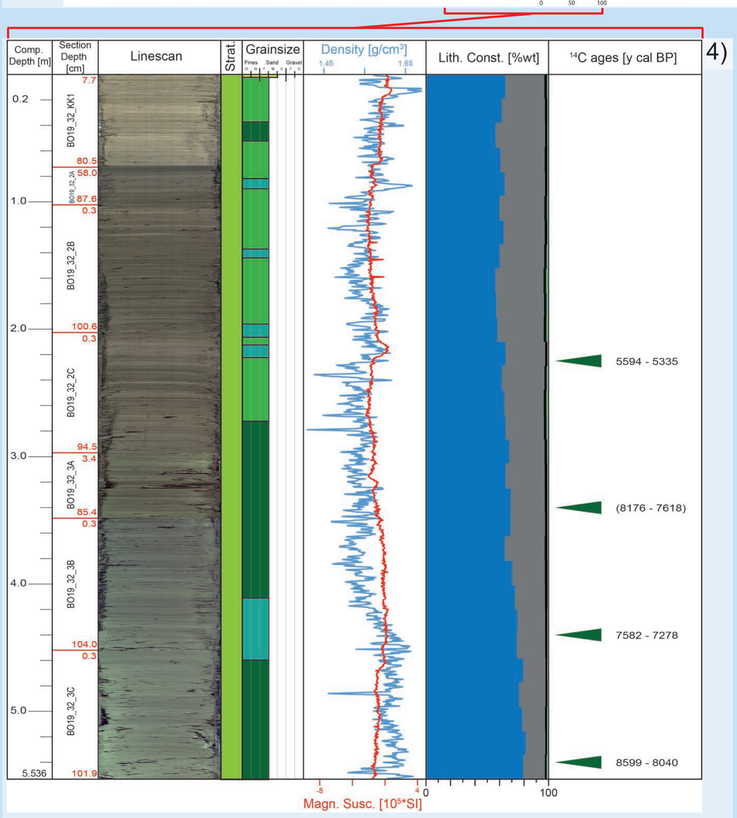


Fig. 4: Logsheet of composite section BO19_32. The whole section consists of mostly laminated, carbonate-rich Holocene lake deposits. Geochemical analysis shows a maximum in siliciclastic-content around 5'500 BP, i.e. the time the mounds were constructed.

Conclusions and Outlook

Radiocarbon dating of the stratigraphically corresponding lake sediment shows that the mounds were constructed at around 5'500 y BP (*Neolithic Age*). This age is consistent with radiocarbon dating of poles stuck in the surrounding mound (Leuzinger et al,2021).

Surface samples show that the siliciclastic content of the sediments increases with decreasing water depth. The peak of siliciclastic content at around 5'500 BP therefore might indicate a Holocene lowstand.

We aim to better constrain the fluctuations of the lake level by a grain-size analysis on the composite sections and comparison to the surface samples.

Eventually, the four composite sections from each coring location will be merged into a single composite section, covering the whole depositional period from the last glaciation until the Late Holocene.

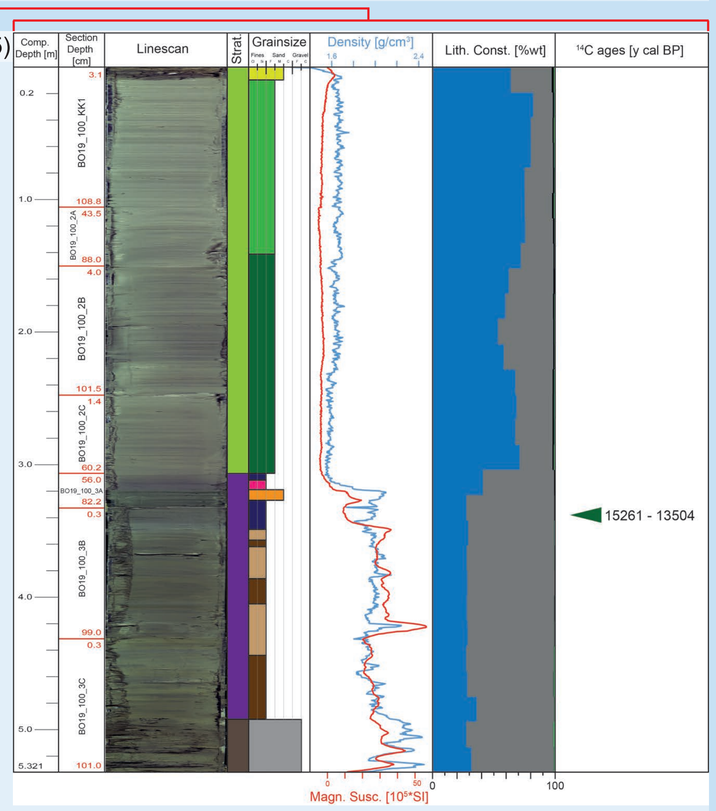


Fig. 5: Logsheet of composite section BO19_100. The section shows the transition from coarse siliciclastic-rich till and Late Glacial clays to overlying carbonate-rich lake deposits at ~15 to 13 ka BP, coinciding with the Bolling-Allerod interstadial. The following increase in siliciclastics content could correlate to the Younger Dryas.

References

- Hornung, Jens (2018): Unterwasser-Georadaruntersuchungen an den «Hügeli» offshore vor Uttwil, Güttingen und Romanshorn. Unpublished research report. Technische Universität Darmstadt
- Leuzinger U., Anselmetti, F., Benguerel, S., Degel, C., Ehmann, H., Gilliard, F., Hipp, R., Hornung, J., Keiser, T., Müller, E., Muigg, B., Nigg, V., Perler, D., Schnyder, M., Sturm, M., Szidat, S., Tegel, W., Wessels, M., Brem, H. (2021): «Hügeli» im Bodensee – Rätselhafte Steinschüttungen in der Flachwasserzone zwischen Romanshorn und Altnau, Kanton Thurgau (Schweiz). Jahrbuch Archäologie Schweiz 104: 101-116
- Wessels, M., Anselmetti, F., Baran, R., Hilbe, M., Gessler, S., Wintersteller, P. (2016) Tiefenschärfe – Hochauflösende Vermessung Bodensee – Bericht Nr. 61. Internationale Gewässerschutzkommission für den Bodensee (IGKB), Blaue Reihe, Bericht Nr. 61

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