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New methods in trace element analysis of ostracod shells to determine postdepositional alteration

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Trace element analyses are a vital tool for paleoenvironmental reconstructions. However, there are some limitations to this method by aragonite overgrowth and diagenetic alteration. In a multi-technique inter-laboratory comparison study we plan to further advance trace element analysis. Using laser ablation ICP-MS, flow-through dissolution ICP-MS and conventional dissolution ICP-MS we aim at improving our understanding of shell calcification and hence any resulting hydrochemical reconstruction. The integration of results from these methods allows for the development of new approaches to assess ostracod shell chemistry.

The LA-ICP-MS method provides the advantage that (1) single shells can be analysed, (2) a variety of elements can be measured, and (3) the heterogeneity of individual shells can be resolved. The flow-through analysis technique allows to chemically separate mineral phases, original shell calcite and overgrowth calcite. This is needed because variations in trace element composition have been identified to be in the order of a magnitude range, likely associated with original and altered shell calcite.

Analyses will be carried out on single specimens of recent and fossil ostracod shells from Nam Co and Tangra Yum Co sediment cores. We plan to decode information about past lake water chemistry, precipitation-evaporation ratios and lake level changes (Mg, Sr), oxygenation cycles (Mn, Fe, U) and changes in productivity (Ba). Analysis of the trace element shell chemistry will be calibrated by major and minor ion composition analysis of host waters to assess trace element uptake by ostracod shells. Using flow-through dissolution, SEM micrographs of individual dissolution phases will show which parts of the shell are being dissolved at which point in time. In comparison to the trace element distribution within the ostracod shells, identified by laser ablation, we aim at advancing our understanding of ostracod shell calcification.

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