Geophysical Research Abstracts
Vol. 16, EGU2014-13214, 2014
EGU General Assembly 2014

Application of the flow-through time-resolved analysis technique to trace element determination in ostracod shells

Nicole Börner (1), Bart De Baere (2), Roger Francois (2), Peter Frenzel (3), and Antje Schwalb (1)

(1) Institut für Geosysteme und Bioindikation, Technische Universität Braunschweig, Braunschweig, Germany (nicole.boerner@tu-bs.de), (2) Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada, (3) Institut für Geowissenschaften, Friedrich-Schiller-Universität Jena, Jena, Germany

Trace element analyses of ostracod shells are a vital tool for paleoenvironmental reconstructions from lake sediments (Börner et al., 2013). Conventional batch dissolution ICP-MS is the most common way for analyzing trace elements in ostracod shells. However, due to dissolution or secondary overgrowth the primary signal may be masked. Resulting variations in trace element composition have been identified to be in the order of a magnitude range. Therefore, the application of the newly developed flow-through technique will be assessed.

The flow-through time-resolved analysis technique allows to chemically separate mineral phases of different solubility such as, in particular, original shell calcite from overgrowth calcite, and thus to correct the measurements for the biogenic signal. During a flow-through experiment, eluent is continuously pumped through a sample column, typically a filter in which the ostracod valves are loaded. The gradual dissolution of the substrate is controlled by a combination of eluent type, eluent temperature and eluent flow rate. The dissolved sample then flows directly to a mass spectrometer. The resulting data is a chromatogram, featuring different mineral phases dissolving as time progresses. Hence, the flow-through technique provides a detailed geochemical fingerprint of the substrate and therefore additional data relative to conventional methods.

To calibrate this technique for the application to ostracods we use ostracod shells from Southern Tibetan Plateau lakes, which feature an alkaline environment but show highly diverse hydrochemistry. Cleaned as well as uncleaned ostracod shells show similarity in their trace element signals, allowing measurements without prior cleaning of the shells, and thus more time-efficient sample throughput. Measurements of unclean shells are corrected for the biogenic signal using an equation from Klinkhammer et al. (2004). Another advantage is that the measurements can be carried out on single ostracod shells, as not every single sediment sample contains enough adult intact specimens of all required genera, making batch cleaning dissolution impossible.

The flow-through time-resolved analysis technique gives an accurate and high-resolution dataset. The trace elemental data for living ostracods compared to the hydrological data from each sampling site provides a calibration dataset for further hydrological and thus climatological reconstruction of a sediment core from Nam Co. Mg/Ca and Sr/Ca ratios in ostracod shells will provide information about past water temperature and salinity resulting from changes in precipitation vs. evaporation ratios and monsoon activity. Further, we will exploit Mn/Ca, Fe/Ca and U/Ca ratios as redox indicators to reconstruct oxygenation cycles and Ba/Ca ratios to detect changes in productivity and/or salinity. This reconstruction should provide a more extensive insight in past climatic change, e.g. precipitation – evaporation balance, lake level and circulation changes, and the recording of environmental signatures by ostracod shells.

Börner, N., De Baere, B., Yang, Q., Jochum, K.P., Frenzel, P., Andreae, M.O., Schwalb, A., 2013. Ostracod shell chemistry as proxy for paleoenvironmental change. Quaternary International 313–314, 17-37.

Klinkhammer, G.P., Haley, B.A., Mix, A.C., Benway, H., Cheseby, M., 2004. Evaluation of automated flow-through time-resolved analysis of foraminifera for Mg/Ca paleothermometry. Paleoceanography 19, PA4030.