Geophysical Research Abstracts
Vol. 13, EGU2011-8696, 2011
EGU General Assembly 2011

Mg and Sr banding in the shell of the benthic foraminifer Ammonia tepida revealed by NanoSIMS

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Trace element, e.g. magnesium and strontium, to calcium ratios in foraminiferal shells are widely used as proxies, i.e. stand-in variables, for environmental parameters (the so-called target variable). The calibration of these proxies relies on empirical relationships providing the algorithm to convert proxy values to target values. In practice it is often difficult to apply a given proxy, because the latter is, more often than not, subject to secondary influences, i.e. environmental parameters other than the target variable. A reliable interpretation of proxy signals, therefore, requires an understanding of the physiological and inorganic processes leading to incorporation of trace elements into foraminiferal shells. One issue of relevance in this context is the distribution of these trace elements within the shell. While an even distribution of trace elements would suggest that one set of processes is always employed in the same way, an uneven distribution would indicate discrete phases of shell formation governed by different, or a different combination of, processes. Here we present distribution maps of Mg/Ca, Sr/Ca, and Mg- and Ca-isotopes measured by means of NanoSIMS. These data reveal Mg as well as Sr enriched layers in cross-sections of A. tepida shells cultured at a range of Mg/Caseawater and Sr/Caseawater.