Geophysical Research Abstracts, Vol. 8, 04106, 2006
SRef-ID:

The temperature dependent strontium isotope fractionation ($\delta^{88/86}$Sr) during calcium carbonate precipitation

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In order to study the influence of stable isotope fractionation during inorganic and biologically controlled $CaCO_3$ precipitation we´ve developed the analytical principles for the measurement of Strontium (Sr) isotope fractionation. We´ve established a measurement protocol for the application on a MC-ICP-MS (*AXIOM)* using the common bracketing standard technique. The Sr-standard CRM NBS987 was used as reference material for all measurements and to calculate the Sr fractionation. Latter value is expressed by the δ-notation defined as:

$\delta^{88/86}\mathrm{Sr} = [(^{88}\mathrm{Sr}/^{86}\mathrm{Sr})_{sample} / (^{88}\mathrm{Sr}/^{86}\mathrm{Sr})_{standard}] * 1000 - 1.$

A first set of experiments focused on the temperature dependency of Sr-isotope fractionation. For this purpose inorganically precipitated aragonite and calcite prepared under controlled conditions in a temperature range from 10 to 50 ˚C. In addition, cultured and naturally grown corals were analyzed for their $\delta^{88/86}$Sr values.

Repeated measurements of IAPSO seawater standard showed a mean $\delta^{88/86}$Sr value of 0.383 ± 0.008 (2SEM) being the isotopically heaviest material measured so far. The first results of the inorganically precipitated aragonite and the natural corals revealed a clear temperature dependency of the $\delta^{88/86}$Sr values. For inorganic aragonite the slope of this correlation is about 0.0055 permil/˚C. However, for naturally grown corals (*Pavona clavus*) a 6 fold steeper slope of 0.033 permil/˚C was determined. This strong temperature dependency implies the potential to use stable Sr isotopes as a new marine (paleo)temperature proxy.