



No impact of ionic strength/salinity on divalent cation fractionation during inorganic calcite precipitation

J. Tang (1), A. Niedermayer (1), S.J. Köhler (1), M. Dietzel (1), F. Böhm (2), B. Kisakurek (2), and A. Eisenhauer (2)

(1) Institute of Applied Geosciences, Graz University of Technology, Graz, Austria, (2) Leibniz-Institut für Meereswissenschaften, IFM-GEOMAR, Kiel, Germany

In order to apply divalent cation fractionation ($^{44}\text{Ca}/^{40}\text{Ca}$, Sr/Ca, etc.) during calcium carbonate formation as a proxy to reconstruct paleo-environments, it is essential to evaluate the impact of various environmental factors. In this study, the CO_2 Diffusion Technique (Dietzel et al., 2004) was used to crystallize inorganic calcite from aqueous solutions at different ionic strength/salinity by the addition of NaCl.

Results show that at 25°C the discrimination of Sr/Ca in the precipitated calcite is controlled by the precipitation rate (R in $\mu\text{mol}/\text{m}^2/\text{h}$). The apparent Sr distribution coefficients ($\log D_{Sr}$) of calcite are positive linear related to the log R values. However, the data points of $\log D_{Sr}$ vs. log R fall in the same line for all experiments done at I = 0.0353, 0.292, and 0.8353, respectively. This indicates that Sr/Ca fractionation during inorganic calcite formation is not significantly influenced by ionic strength/salinity.

In analogy to Sr/Ca, the $^{44}\text{Ca}/^{40}\text{Ca}$ fractionation is not influenced by ionic strength/salinity either. At 25°C the calcium isotope fractionation between calcite and aqueous calcium ions ($\Delta^{44/40}\text{Ca}_{\text{calcite-aq}} = \delta^{44/40}\text{Ca}_{\text{calcite}} - \delta^{44/40}\text{Ca}_{\text{aq}}$) correlates negatively with log R values for all the experiments, independent of the respective I value.

Tang et al. (2008) reported a negative linear relationship between $\Delta^{44/40}\text{Ca}_{\text{calcite-aq}}$ and $\log D_{Sr}$ during calcite formation, which is independent of temperature, precipitation rate, and aqueous (Sr/Ca)_{aq} ratio. The results of our recent experiments at 25°C and various I values indicate that this general behavior is not affected by ionic strength/salinity.

References

Dietzel M., Gussone N., and Eisenhauer A. (2004) Co-precipitation of Sr²⁺ and Ba²⁺ with aragonite by membrane diffusion of CO₂ between 10 and 50°C. *Chemical Geology*, **203**, 139-151.

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