Geophysical Research Abstracts,
Vol. 11, EGU2009-10842-1, 2009
EGU General Assembly 2009

Sr Incorporation and Calcium Isotopic Fractionation during Calcium Carbonate Precipitation

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Element substitution and calcium isotopic fractionation can provide information about the mechanisms of $CaCO_3$ precipitation, precipitation rates, temperatures and solution chemistry. In the present study precipitation experiments for the formation of the $CaCO_3$ polymorphs: calcite, aragonite and vaterite were carried out. Calcium carbonates are formed at various Mg/Ca ratios or in presence of polyaspartic acid at temperatures between 5 and 40˚C at pH 8.3 by using an advanced CO_2-diffusion technique (Tang et al., 2008).

The results indicate elevated Sr distribution coefficients (D_{Sr}) during calcite and vaterite formation at increasing precipitation rates, whereas D_{Sr}-values decrease only slightly with increasing rate during the formation of aragonite. $^{44}Ca/^{40}Ca$ fractionation increases for aragonite and calcite formation as precipitation rates increase. Preliminary results show less calcium isotopic fractionation for vaterite compared to calcite and aragonite. However, $\Delta^{44/40}Ca_{CaCO_{3(s)}-Ca_{(aq)}}$-values for the three modifications indicate an inverse correlation with D_{Sr}. Respective mechanisms and proposed models are discussed.

Reference

Tang J., Köhler S.J., and Dietzel M. (2008) Sr^{2+}/Ca^{2+} and $^{44}Ca/^{40}Ca$ fractionation during inorganic calcite formation: I. Sr in corporation, *Geochimica et Cosmochimica Acta*, **72**, 3718-3732.