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. $^{44}\text{Ca}/^{40}\text{Ca}$ 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, $\Delta^{44/40}\text{Ca}_{\text{CaCO}_3(s)}-\text{Ca}_{(aq)}$ -values for the three modifications indicate an inverse correlation with $D_{Sr}$. Respective mechanisms and proposed models are discussed.

Reference