Transformation of Mg bearing ACC to Mg-calcite traced by $^{18}O/^{16}O$ and clumped isotopes

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Traditional oxygen isotope values ($\delta^{18}O$) and clumped isotope signatures of calcite were used as environmental proxies in a broad range of carbonate-bearing environments comprising of ancient ocean, paleoclimate, carbonate diagenesis, speleothem, scaling and forensic tasks. Besides temperature reconstruction for a given calcite precipitate oxygen isotopic fractionation between calcite and water can also be used to estimate the isotopic composition of the precipitating fluid if the temperature of formation is known, e.g. by the application of clumped isotopes. Essential pre-requirements to use the above relationships are isotopic equilibrium during calcite precipitation and unaltered isotopic signals. In many surroundings an amorphous calcium carbonate precursor phase (ACC) has to be considered for the formation of calcite and/or Mg-calcite, e.g. in biomineralization and scalings, but isotopic evolution during (Mg bearing) ACC (trans)formation is still not sufficiently well known for many isotope applications.

Herein we present preliminary stable oxygen and clumped isotope data of Mg-calcite formed though ACC transformation at various molar Mg/Ca ratios of the precipitating solution. Formation and transformation were monitored by *in-situ* Raman spectroscopy at pH-stat conditions (8.30 ± 0.03) and 25 ± 0.02°C. Results from the experimental solutions and precipitates sampled during (trans)formation of Mg-bearing ACC indicate that $\delta^{18}O$ values of the precipitated Mg-calcite are affected by ACC (trans)formation pathway, whereas clumped isotopes seem to be unchanged. Data are discussed in respect to kinetically controlled isotopic effects due to rapid carbonate precipitation and redistribution of DIC species.