

The evolution of Carbon isotopes in calcite in the presence of cyanobacteria

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Stable isotopic compositions in carbonates are widely used as indicators of environmental conditions prevailing during mineral formation. This reconstruction is substantially based on the assumption that there is no change in the mineral composition over geological time.

However, recent experimental studies have shown that carbon and magnesium isotopes in hydrous Mg-carbonates undergo continuous re-equilibration with the ambient solution even after mineral precipitation stopped ([1] and [2], respectively).

To verify whether this holds true for anhydrous Ca-bearing carbonates which readily form at earth's surface environments, a series of batch system calcite precipitation experiments were performed in the presence of actively growing cyanobacteria *Synechococcus sp.* The bacteria were grown at ambient temperature in a BG11 culture medium (SIGMA C3061) and continuous stirring, air-bubbling and illumination. Calcite precipitation was initiated by the addition of 8.5mM CaCl₂ and 0–50 mM NaHCO₃ or NaHCO₃-Na₂CO₃ mixtures.

The presence of cyanobacteria is on one hand promoting CaCO₃ formation due to increasing pH resulting from photosynthesis. On the other hand, actively growing cyanobacteria drastically change carbon isotope signature of the aqueous fluid phase by preferably incorporating the lighter ¹²C isotope into biomass [1].

This study explores the effect of continuously changing carbon isotope compositions in dissolved inorganic carbon (DIC) on precipitated calcite which is in chemical equilibrium with the ambient fluid phase.

[1] Mavromatis et al. (2015). The continuous re-equilibration of carbon isotope compositions of hydrous Mg-carbonates in the presence of cyanobacteria. *Chem. Geol.* 404, 41-51

[2] Mavromatis et al. (2012). Magnesium isotope fractionation during hydrous magnesium carbonate precipitation with and without cyanobacteria. *Geochim. Cosmochim. Acta* 76, 161-174