New technique to promote unseeded precipitation of inorganic calcium carbonate crystals from artificial seawater

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Marine calcium carbonate ($CaCO_3$) polymorphs, as calcite and aragonite (e.g., foraminifera and corals), have an important role to reconstruct past climate and past ocean circulation, in particular when stable isotopes (e.g., O, C, B) and trace elements (e.g., Li, B, Mg, Sr) are analyzed. The investigation of trace element uptake and stable isotope composition of abiotic calcite crystals is already a developed field of study [e.g., 1-2] and the comparisons between biotic and abiotic systems [e.g., 3] is a very useful strategy to better characterize trace element incorporation in biological systems, where "vital effects" could complicate data interpretation.

In order to improve our understanding of trace element incorporation in $CaCO_3$ crystals, we developed a new technique to promote unseeded precipitation of inorganic $CaCO_3$ crystals in a closed system from a non-mechanically stirred artificial seawater solution. Because $CaCO_3$ solubility is lower at higher temperatures, in our system $CaCO_3$ precipitation is induced by the development of a thermal gradient between a small, warmer area (where crystals precipitate over a substrate) and the colder surrounding medium (artificial seawater), which composition remains nearly constant throughout each experiment. We emphasize that the growth rate of crystals precipitated with our technique is relatively low. To test our method, we characterized the chemical composition (i.e., Li, B, Mg, Mn, Sr, Ba) of calcium carbonate crystals precipitated in our experimental setting at different temperatures and pH values. Chemical analyses were conducted using LA-ICP-MS technology and two standards: 1) the glass reference material NIST612; and 2) a calcite matrix-matching secondary standard (marble).

[1] Gabitov *et al* (2012) *Chem. Geol.* **306-307**, 92-102 [2] Watson (2004) *Geochim. Cosmochim. Ac.* **68**, 1473-1488 [3] Marriott *et al* (2004) *Earth Planet. Sci. Lett.* **222**, 615-624