Exploring the chemical controls on boron incorporation in synthetic calcite

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Boron to calcium (B/Ca) ratios in foraminiferal calcite have been recognized as a potential proxy for the ocean carbonate system. However, data from calibration campaings (field, core-top, culture) show that foraminiferal B/Ca ratios co-vary with multiple environmental parameters.

In this project, we intend to unravel the key chemical control(s) on the B/Ca proxy based on inorganic calcite precipitation experiments. We previously reported that B/Ca ratios in synthetic calcite increase with solution pH and concentration of total dissolved B, DIC and Ca^{2+} ions. These novel results collectively suggest apparent kinetic effects related to the precipitation rate on B/Ca ratios in synthetic calcite [1]. These experiments were run with relatively simple solutions ($NaCl–CaCl_2–Na_2CO_3–B(OH)_3$), which are now replaced by artificial seawater in order to close the gap between simplified experimental conditions and *in-situ* marine settings. This presentation provides a compilation of new results from our experiments using artificial seawater. We aim to put a special emphasis on re-evaluating the influence of [DIC] on B/Ca ratios. In our previous experiments, B/Ca ratios increased with [DIC] presumably due to kinetic effects (calcite grew more rapidly and hence incorporated more B at higher [DIC]). In contrast, B/Ca ratios of cultured planktonic foraminifers decreaed with [DIC], which may suggest a competition between dissolved B and DIC species in the calcite lattice [2, 3]. We will test this hypothesis by running experiments at different [DIC] yet at relatively constant precipitation rates via simultaneous [Ca^{2+}] adjustments to eliminate kinetic effects.

[1] Uchikawa *et al*. (2015) *GCA* 150, 171-191. [2] Allen *et al*. (2012) *EPSL* 351-352, 270-280. [3] Haynes *et al*. (2015) Abstract PP31F-03, 2015 AGU Fall Meeting, San Francisco, CA, USA, 14-18 December 2015.