

Automation of boron purification for $\delta^{11}\text{B}$ analysis in CaCO_3 : Removing an analytical bottleneck

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The boron isotope ratio ($\delta^{11}\text{B}$) measured in carbonates such as planktic foraminifera and coral skeletons has been shown to be a reliable proxy of past ocean pH and by extension atmospheric CO_2 [1,2]. However, the accurate measurement of $\delta^{11}\text{B}$ by MC-ICPMS requires the extraction of boron from the carbonate matrix prior to measurement, this step is time intensive and currently rate limiting. The purification is traditionally performed manually by ion exchange chromatography with homemade Teflon columns and Amberlite resin [2]. Considerable training is also required for the production and use of the columns and the entire purification methodology carries a risk of isotopic fractionation and contamination. Here we present a new automated technique developed in collaboration with Elemental Scientific Inc. using the prepFAST system that enables the automatic extraction and purification of boron from a calcium carbonate matrix in approximately 60 minutes per sample. We present a set of tests conducted on a variety of standards and carbonate samples and discuss the accuracy of the prepFAST system, its reproducibility and level of blank contamination.

Results conducted on seawater, boric acid and carbonates (foraminifera and tropical corals) over a range of $\delta^{11}\text{B}$ from -20 to $+40$ ‰ show comparable accuracy and reproducibility to standard column-based methods (typically ± 0.2 ‰). These results show the capacity of the prepFAST to generate accurate and reproducible $\delta^{11}\text{B}$ measurements without the challenging manual purification step. This is the first step towards rapid throughput boron isotope analysis of carbonates and other suitable sample matrices.

[1] Sanyal et al. (2001) *Paleoceanography* 16, 515-519. [2] Foster (2008) *EPSL* 271, 254-266