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## **Boron isotope analysis of coral skeletons by laser ablation MC-ICP-MS: new insights into calcification and environmental reconstruction at high temporal resolution**

**Gavin L. Foster**, Thomas B. Chalk, and Christopher D. Standish

School of Ocean and Earth Science, University of Southampton, National Oceanography Center Southampton, Southampton, United Kingdom of Great Britain and Northern Ireland ([gavin.foster@noc.soton.ac.uk](mailto:gavin.foster@noc.soton.ac.uk))

Despite being some of the largest bio-constructions on the planet, coral reefs are made by many millions of cm- to mm-sized polyps of Scleractinian corals. Calcification occurs in a micron sized space sandwiched between the coral animal and the existing skeleton, known as the extra cellular medium (ECM). The coral animal has a tight control on the carbonate system in this space through deploying enzymatic pumps (e.g. Ca-ATPase) and secreting acidic-rich proteins. Tracking the state of the carbonate system in the ECM is therefore key to forming a mechanistic understanding of how environmental change, such as ocean acidification, influences skeletal formation and ultimately the growth and resilience of these important ecosystems.

Traditional means to examine ECM composition is through the use of micro-electrodes. While these approaches have revealed many key insights they are, by their nature, invasive. They also only provide snap shots of information for corals grown in the laboratory. The boron isotopic composition of the coral skeleton and its boron content (expressed as B/Ca ratio) have recently emerged as a viable alternative approach to fully characterise the carbonate system in the ECM. However, most studies employ bulk sampling techniques which require averaging across both structural elements of the coral skeleton and many months to years of growth. Laser ablation MC-ICP-MS approaches are now available as an alternative sampling protocol (e.g. Standish et al. 2019), and along with B/Ca (and other trace element) measurements this not only allows a reconstruction of the full carbonate system of the ECM from an analysis of the skeleton of any coral (cultured or wild) at unprecedented spatial and temporal resolution, but it also allows an examination of the influence of the carbonate system in the ECM on trace element incorporation.

Here we present boron isotope and trace element analyses of several tropical, reef-building, corals to examine the nature and magnitude of fine scale variation in ECM composition. By studying corals from locations where external seawater is well known we also gain insights into trace element incorporation and whether external seawater pH can be accurately reconstructed from the boron-based proxies at weekly (or better) resolution.

Standish, C.D., Chalk, T.B., Babila, T.L., Milton, J.A., Palmer, M.R., Foster, G.L. (2019) The effect of

matrix interferences in situ boron isotope analysis by laser ablation MC-ICP-MS, *Rapid Communications in Mass Spectrometry* 33: 959–968 <https://doi.org/10.1002/rcm.8432>