Incorporation and preservation potential of boron isotope signals in cold-water octocorals

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Cold-water corals are valuable archives that are increasingly used for paleoclimatic and paleoceanographic studies from sub-centennial to multi-millennial timescales. Yet the geochemical or isotopic signal contained in these biogenic carbonates is not always straightforward to interpret due to small-scale biomineralisation and/or post-mortem alteration processes. For example, boron isotope compositions (expressed in $\delta^{11}B$) in aragonitic hexacorals provide evidence for internal pH-upregulation and micro-scale variability [e.g. 1, 2]. Calcitic octocorallia yield $\delta^{11}B$ values closer to seawater borate ion (and thus seawater pH), though rare published studies similarly suggest resolvable small-scale variability [3].

Using a selection of scleraxonian cold-water corals from the Amunden Sea in the Southern Ocean (~123°W, ~69°S, 2500 m to 1430 m water depth) [4], we aim to constrain two major unknowns in cold-water coral research. First, solution-based $\delta^{11}B$ obtained from (i) a modern, (ii) a late deglacial (~12.6 ka) as well as (iii) a coral dating back to MIS3 (~42 ka) are compared to their respective laser ablation-based $\delta^{11}B$ using a boron imaging technique [5]. Electron microprobe-based Ca, Mg, S, C and Mn concentration maps enable us to distinguish pristine from altered sections within each specimen, while also highlighting areas enriched or depleted in organic material. Particular emphasis is placed on identifying boron isotopic trends characteristic for diagenetic alteration as evident from EMP images that are situated either in the outermost parts of coral sections, within cracks or clearly observable hotspots of bioerosion.

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