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Proxy calibrations in the cold-water coral *Desmophyllum dianthus*

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Element-calcium ratios in the skeleton of cold-water coral *Desmophyllum dianthus* represent potential archives for paleo-reconstruction of several ocean properties including temperature and nutrient concentrations. However, relatively large uncertainties in these proxy calibrations and heterogeneity in the skeletal composition have limited its application to date. We address these issues by analyzing corals cultured under systematically varied seawater conditions (phosphate, barium, temperature, pH, feeding frequency) over a two-year period, and refine the calibration of P/Ca, Ba/Ca, U/Ca, and Li/Mg proxies for seawater phosphate, barium, carbonate ion concentration, and temperature, respectively. Composition of the corals is determined using laser-ablation ICPMS, with robust plasma conditions established using the Normalized Argon Index [1], and proxy element incorporation is evaluated for influences of temperature, pH, and feeding frequency. The aragonite precipitated during the stages of the culturing experiment is identified using fluorescent and geochemical labelling of the skeleton through calcein and lead isotopes, respectively. This approach allows us to resolve monthly and annual increments in these slow growing (1-2mm/year) organisms, and also to evaluate the influence of calcification rate on the composition. We address the issue of heterogeneity by adapting methods for LA-ICPMS imaging to create macroscale images to reveal the full pattern of skeletogenesis and related compositional variability of *D. dianthus*. Preliminary images suggest that heterogeneity stems from the asymmetric precipitation of aragonite, and from centers of calcification (also known as early mineralization zones) that complicate the interpretation of elemental signals throughout the skeleton, but also help to identify new skeletal regions suitable for proxy measurement. Finally, we also discuss the role of endolithic organisms in some of these specimens.

[1] Fietzke, J. & Frische, M. (2016), *J. Anal. At. Spectrom*. 31, 234–244.