Comparison of three analytical techniques to measure Mg/Ca values in high-latitude encrusting coralline algae

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The long-lived encrusting coralline alga *Clathromorphum compactum* builds a high Mg-calcite skeleton over the duration of its lifespan. Changes in the alga's growth in response to temperature and seasonal reproduction produces annual growth layers in the skeleton. These layers provide chronological control of the skeletal growth. Distributed throughout the temperate to Arctic regions in the northern hemisphere, this alga documents changes in its ambient enviroment in the physical-chemical properties of its skeleton. Thus, this alga is a unique recorder of high-resolution, high-latitude environmental change.

One skeletal property that documents environmental change is the increased substitution of Mg in the place of Ca in the calcite lattice in direct response to ambient temperature. As a result, the skeleton's Mg/Ca ratio serves as a proxy for seawater temperature. Previous work has measured skeletal Mg/Ca values using a variety of techniques depending upon the specific study: laser ablation-inductively coupled plasma-optical emission spectometry (LA-ICP-OES), laser ablation-inductively coupled plasma-mass spectometry (LA-ICP-MS), and microprobe. To evaluate potential differences in Mg/Ca values resulting from the analytical techniques rather than the biology or environment of a specific algal specimen, we directly compare Mg/Ca values measured in immediately adjacent parallel transects in a single specimen. We find that all three techniques measure average Mg/Ca values of 0.08 ppm in the single specimen yet time-series variability along the transects varies amoung the techniques. We will quantify this variability and the uncertainty associated with the resulting reconstructed seawater temperatures. This research has direct implications for synthesis studies combining seawater temperature reconstuctions that are derived from Mg/Ca values measured using the different techniques.