Advances in the Mg/Ca-temperature proxy in coralline algae: a case study in the genus *Clathromorphum*

BRANWEN WILLIAMS[1], SIOBHAN WILLIAMS[2], ELENI ANAGNOSTOU[3,4], JUSTIN RIES[4], DOUG RASHER[5], ISAAC WESTFIELD[4], JOCHEN HALFAR[2], AND WALTER ADEY[6]

[1] Claremont McKenna-Pitzer-Scripps Colleges, 925 N. Mills Ave, Claremont, CA 91711, USA (bwilliams@kecksci.claremont.edu)
[2]University of Toronto, 22 Russell St., Toronto, ON M5S 3B1, Canada
[3]GEOMAR Helmholtz Centre for Ocean Research Kiel, Wischhofstr. 1-3, 24148 Kiel, Germany
[4] Marine Science Center, Northeastern University, 430 Nahant Rd, Nahant, MA 01908, USA
[5] Bigelow Laboratory for Ocean Sciences, 60 Bigelow Drive, East Boothbay, ME 04544, USA
[6] National Museum of Natural History, Smithsonian Institution, Washington, DC 20013, USA

The coralline alga *Clathromorphum* spp. grows for hundreds of years, forming significant carbonate build-ups throughout the mid-to-high latitudes of the northern hemisphere. This alga creates annual bands in its high-Mg calcite skeleton and geochemical measurements of this skeleton reflect conditions at the time of calcification. Thus, *Clathromorphum* serves as a proxy archive of past environmental change. One such proxy is skeletal Mg/Ca values, which change in response to ambient seawater temperature such that measured Mg/Ca values yield reconstructed seawater temperatures over the lifespan of a specimen. Yet, in wild-collected specimens, changes in temperature typically explain less than half of the variability in skeletal Mg/Ca values. This limits the precision with which we can reconstruct past seawater temperature. Here, we combine recent culturing experiments and analysis of wild collected specimens to evaluate the relationship between Mg/Ca and temperature in two species of the genus *Clathromorphum*. We find that ambient light levels and specimen-specific growth rates affect skeletal Mg/Ca values, in addition to seawater temperature. Through quantification of this relationship, we can improve interpretation of measured Mg/Ca values. This work advances our understanding of a significant proxy archive for sub-annually resolved variations in seawater temperature with the potential to yield significant reconstructions of past high-latitude change.