Northern North Atlantic sea ice, temperature, and carbon cycle interactions through the Common Era using coralline algae

E. ANAGNOSTOU[1,2]*, B. WILLIAMS[3], P. MOFFA-SANCHEZ[4], G.L. FOSTER[5], W.H. ADEY[6], I. WESTFIELD[2] AND J. RIES[2]

[1] ETH Zurich, 25 Clausiusstrasse, ZH 8092, Switzerland (*correspondence: eleni.anagnostou@erdw.ethz.ch)
[2] Marine Science Center, Northeastern University, 430 Nahant Rd, Nahant, MA 01908, USA (j.ries@northeastern.edu, i.westfield@northeastern.edu)
[3] Claremont McKenna-Pitzer-Scripps College, 925 N. Mills Ave, Claremont, CA 91711, USA (bwilliams@kecksci.claremont.edu)
[4] Cardiff University, Cardiff CF10 3AT, UK (moffasanchezp1@cardiff.ac.uk)
[5] Ocean and Earth Science, European Way, Southampton SO14 3ZH, UK (gavin.foster@noc.soton.ac.uk)
[6] National Museum of Natural History, Smithsonian Institution, Washington, DC 20013, USA (adeyw@si.edu)

The growth rate of Arctic and Subarctic coralline alga *Clathromorphum compactum* has been linked to sea ice extent, considering its dependence to temperature and light, at least in the short term. In this new study, we focus on two newly developed proxies in aquaria linking the boron isotopic composition of the algal high magnesium calcite skeleton to seawater pH and its Mg/Li ratio to seawater temperature. We applied these proxies on algae collected from two locations: one within the Canadian Arctic and the other on the Labrador Coast influenced by the Arctic Labrador Current. At both locations we see significant changes in pH and temperature over the last ~ 600 years. In the earlier part of our record, within the Medieval Warm Period and the Little Ice Age, these changes are linked to sea ice growth and retreat. Post 1850 CE, boron isotopes and Mg/Li ratios document a progressive ocean acidification and warming signal. This trend was interrupted by further decline in sea ice extent and increase in Greenland meltwater, that enhanced algal growth in the region, resulting in increasing seawater pH. During the same time, the algal Mg/Li ratios indicate cooler temperatures in the Labrador region, potentially linked to the coeval Atlantic Meridional Overturning Circulation decline post ~1950. We will discuss our seawater pH and temperature reconstructions in light of changes in growth and calcification, ocean warming and acidification, and variations in North Atlantic atmospheric and oceanic circulation.