Geophysical Research Abstracts
Vol. 20, EGU2018-3706, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Effects of light and temperature on Mg uptake in the coralline algal climate proxy archive Clathromorphum compactum

Siobhan Williams (1), Jochen Halfar (1), Walter Adey (2), Andreas Kronz (3), Patrick Gagnon (4), David Bélanger (4), and Merinda Nash (2)

(1) CPS-Department, University of Toronto Mississauga, Mississauga, Canada (siobhan.williams@mail.utoronto.ca), (2) National Museum of Natural History, Smithsonian Institution, Washington DC, USA, (3) Geowissenschaftliches Zentrum, Universität Göttingen, Göttingen, Germany, (4) Ocean Sciences Centre, Memorial University of Newfoundland, St. John's, Canada

The shallow benthic coralline alga Clathromorphum compactum is an important annual to sub-annual resolution archive of Arctic and Subarctic environmental conditions, allowing reconstructions going back >600 years. Specifically, $MgCO_3$ in the high Mg calcite algal growth increments has been used as a proxy for past temperatures and, in combination with annual growth rates, sea ice conditions. While field calibration studies of Clathromorphum in different regions of the northern hemisphere have yielded significant correlations between $MgCO_3$ ratios and sea surface temperature, the Mg – temperature calibration varied among locations. At the same time the influence of other environmental controls, such as light, on algal Mg uptake has received little attention. Light received by algal specimens can vary with latitude, water depth, sea ice conditions, water turbidity, and shading. Here, we present results from a long-term mesocosm experiment showing that both light and temperature significantly affect $MgCO_3$ in C. compactum. At lower temperature (2°C) the effects of light are slightly smaller (1.4 mol % $MgCO_3$ increase from low (<17 lux) to high light conditions (<400 lux)), than at higher (10°C) temperature (1.8 mol% $MgCO_3$ increase from low to high light). Moreover, at higher light levels the correlation is stronger between $MgCO_3$ and temperature than at low light. Hence, in order to take into account the effects of light when generating Clathromorphum-derived temperature calibrations, site and possibly specimen specific temperature calibrations need to be applied. Furthermore, specimens grown for a period of two months in complete darkness show that growth and cell wall calcification can occur without light, presumably as long as stored photosynthates are available to support growth and calcification. Calcification in the dark is an important strategy to ensure survival of C. compactum under sea ice cover and in Arctic winter darkness. In summary, our findings on the influence of light on algal Mg uptake place considerable constraints on the biogeochemistry of calcification in corallines.