Seasonality in calcification, sclerochronology, and geochemistry in the encrusting coralline alga *Clathromorphum compactum*

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The skeletons of marine crustose coralline algae yield significant datasets of mid-to-high latitude seawater temperature, surface freshwater fluxes, seawater carbon dynamics and duration of seasonal sea ice. Abundant in coastal regions throughout the Northwest Atlantic, the Canadian Arctic Archipelago (CAA), and the northern North Pacific, the alga *Clathromorphum* spp. forms an annually layered structure in specimens reaching ages of 850 years. Here, we synthesize current information on calcification, growth rates, and Mg/Ca geochemistry in specimens of *Clathromorphum compactum* collected across a latitudinal transect from the Gulf of Maine to the CAA with the goal to reduce the significant sub-annual dating uncertainty. Improved sub-annual chronologies will expand the use of this climate archive to mid-to-high latitude reconstructions of oceanic and climatic seasonal variability.

Clathromorphum sp. develops high-Mg calcite crystals integral with the organic wall of each cell (inner-wall crystals). *C. compactum* also precipitates a secondary crystal type, inter-filament crystals, between the innerwall crystals within the cell walls during the summer months indicating a dual mode of calcification in this species. Mg/Ca content of the calcite crystals doubles from approximately 0.06 to 0.12 mol/mol in response to changes in seawater temperature and possibly light levels reaching the seafloor. Monthly growth rates vary from zero to greater than 50 μm month^{-1}. Summer temperatures of 12-14 °C and increased grazing by invertebrates decreases summertime growth and determines the southern extent of *C. compactum*. Winter growth rates at the Arctic end of the *C. compactum* range reach nil due to low temperature and winter darkness enhanced by sea ice cover. We will apply this improved understanding of sub-annual chronologies to existing paleoceanographic records from *Clathromorphum* sp. to address important questions of changes in high-latitude seasonality.