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Do coralline red algal growth increment widths archive paleoenvironmental information?

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Over the past decade coralline red algae have received increased attention as archives of paleoclimate information. Encrusting coralline red algae, which deposit annual growth increments in a High-Mg calcite skeleton, are amongst the longest-lived marine organisms. In fact, a live-collected plant has recently been shown to have lived for at least 850 years based on radiometric dating. While a number of investigations have successfully utilized geochemical information obtained from coralline red algal skeletons to reconstruct climate, no study has yet examined the potential of using growth increment widths as a proxy for past water temperatures. Here we explore the relationship between growth and environmental parameters in Clathromorphum nereostratum from the Bering Sea. A 120-year long annual growth record shows a significant but weak correlation to regional sea surface temperature data (r=0.24), which requires much of the observed annual growth increment width variability to be explained by other factors. We therefore examined coralline red algal growth for a 20-year period in multiple specimens collected along a depth transect from 10 to 35 m water depth. Results demonstrate a significant decrease in average annual growth increment widths with increasing water depth. Due to intense wind-induced mixing in the region the upper water column exhibits near uniform temperatures and salinities, leaving the decreasing amount of light with depth as the dominant variable influencing vertical extension. This was further tested by examining specimens collected at 10 m water depth at different locations receiving distinct amounts of shading provided by 100%, 50%, and 0% kelp canopy coverage. Results indicate a negative relationship between percent kelp canopy coverage and annual growth increment width. It can therefore be concluded that the dominant factor controlling vertical growth in C. nereostratum is light, with temperature only accounting for a small portion of growth variability. This relationship has now to be tested for other species of coralline red algae.