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High-resolution Mg/Ca ratios in a coralline red alga as a proxy for Bering Sea temperature variations from 1902 To 1967

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ABSTRACT

We present the first continuous, high-resolution record of Mg/Ca variations within an encrusting coralline red alga, *Clathromorphum nereostratum*, from Amchitka Island, Aleutian Islands. Mg/Ca ratios of individual growth increments were analyzed by measuring a single-point, electron-microprobe transect, yielding a resolution of ~15 samples/year and a 65-year record (1902–1967) of variations. Results show that Mg/Ca ratios in the high-Mg calcite algal framework display pronounced annual cyclicity and archive late spring–late fall sea-surface temperatures (SST) corresponding to the main season of algal growth. Mg/Ca values correlate well to local SST, as well as to an air temperature record from the same region. High spatial correlation to large-scale SST variability in the subarctic North Pacific is observed, with patterns of strongest correlation following the direction of major oceanographic features that play a key role in the exchange of water masses between the North Pacific and the Bering Sea. Our data correlate well with a shorter Mg/Ca record from a second site, corroborating the ability of the alga to reliably record regional environmental signals. In addition, Mg/Ca ratios relate well to a 29-year $\delta^{18}O$ time series measured on the same sample, providing additional support for the use of Mg in coralline red algae as a paleotemperature proxy that, unlike algal-$\delta^{18}O$, is not influenced by salinity fluctuations. Moreover, electron microprobe–based analysis enables higher sampling resolution and faster analysis, thus providing a promising approach for future studies of longer *C. nereostratum* records and applications to other coralline species.