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Isotopic and elemental mapping of bamboo corals – reference to calcification mechanism and proxy applications

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Bamboo corals are calcitic octocorals dwelling in a broad range of water depths and in all ocean basins. Their skeletons could give insight into the temporal variability of environmental parameters at their growth locations, in areas where long-time observations are often lacking. A thorough understanding of calcification mechanisms is essential to interpret the chemical composition of their high-magnesium calcite skeleton regarding environmental fluctuations of the deeper ocean. To address this issue, we employed electron microprobe analysis, confocal Raman spectroscopy, laser ablation-ICPMS and solution based multi collector-ICPMS that together provide insights into the fine-scale spatial heterogeneity of the coral chemical composition. We investigate the spatial distribution of Na, S, and Ca, as well as organic matter in skeletal sections of specimens of *Keratoisis grayi* (family Isididae) from the Atlantic Ocean. Two bamboo coral samples from the Atlantic and Pacific Ocean were further used to create laser ablation-based maps of $\delta^{11}\text{B}$ and boron to carbon ratios (B/C) over the sample radii. These maps are compared with results obtained via solution based $\delta^{11}\text{B}$ analyses on drilled samples.

An inverse correlation between Na and S is observed while S seems to be positively correlated with organic matter. We will discuss the ability of a qualitative physicochemical model to explain the observed Na and S distribution and the potential role of organic matter and amorphous calcium carbonate. Our results indicate that skeletal Na/Ca in bamboo corals is largely driven by physiological processes rather than environmental salinity variability. The spatial distribution of $\delta^{11}\text{B}$ shows a positive correlation with B/C. The observed range of bulk $\delta^{11}\text{B}$ - partly falling below the theoretical borate fractionation curve in seawater - is larger than the conventional measured $\delta^{11}\text{B}$ of the calcite fraction alone. The latter cannot be explained with a spatial smoothing of the distribution during sample drilling but is rather associated with a loss of an isotopically highly variable B fraction during sample bleaching. Potential reasons for the observed differences in B isotopic range and their implications will be presented. We conclude that skeletal $\delta^{11}\text{B}$ as a proxy for pH_{SW} is dependent on the applied technique and investigated material fraction.

