Zinc and silicon isotope fractionation by deep-sea sponges

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Dissolved Zn is an important micronutrient essential for the growth of marine phytoplankton, and exhibits a seawater depth profile similar to that of major nutrients, such as dissolved Si. Previous work has shown that diatoms Zn/Si ratios relate to the availability of free Zn^{2+} ions in surface seawater, and their Zn and Si isotopic composition relates to surface opal productivity and nutrient utilization. Conversely, the Zn/Si ratio of deep-sea sponge opaline spicules, among the earliest multicellular fossils to appear in the geological record, has been shown to related to the rain of Particulate Organic Carbon (POC). Here, we present a new calibration of sponge Si isotopes from different species and different ocean basins, showing a strong relationship between Si isotope fractionation and ambient dissolved Si concentrations. We also present new Zn concentration and isotope data from deep-sea sponges collected from the Southern Ocean. Our results highlight some species-specific differences in Zn uptake. The isotope data suggest, unlike for Si, sponges acquire some Zn from dietary sources, and some directly from seawater i.e. reflect both the dissolved and particulate pool of Zn. We discuss the consequences of these different uptake mechanisms for the use of sponge spicules as chemical palaeoenvironmental indicators.

Boron isotopes ($\delta^{11}B$) in coral: Energy budgets and pH control at the site of calcification

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The rate of water flow around a coral colony has a dramatic effect on diffusive boundary layer thickness and thereby colony physiology and skeletal formation. A controlled flow rate experiment was used to test whether these responses to environmental conditions influenced skeletal $\delta^{11}B$ as a measure of the pH at the site of calcification. Coral nubbins of *Pocillopora verrucosa* were grown for 2 years on stages within a reef and exposed to one of two flow regimes; flow enhanced by underwater pumps (15-20 cm s^{-1}) or reduced-flow, near stagnant conditions (~ 1 cm s^{-1}). Colonies in the enhanced-flow condition developed a more compact morphology, denser skeleton and calcified faster, in addition they had significantly higher tissue protein and chlorophyll concentrations, a higher density of zooxanthellae and higher reproductive output in terms of both quantity of oocytes and their size. We will present MC-ICPMS $\delta^{11}B$ analyses of the skeletons to explore colony control of the pH at the site of calcification and the allocation of energy resources by coral to the fundamental processes of skeletogenesis, growth, maintenance and reproduction.