Cold-water coral biomineralization in high resolution

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Deep-sea scleractinian skeletons are primarily precipitated along a longitudinal growth axis but also expand radially forming layers. A LA-ICP-MS track at a resolution of 15 µm across radial layers revealed sharp peaks in U^{238} concentrations and almost perfect antithetical behaviour of Mg^{25} and U^{238} (fig. 1). The peaks are preceeded by slightly offset minima in Ba^{137} which generally follows Mg for most of the growth. Uranium peaks align with the last precipitates of visible layers before the onset of the next (often white) layer and increase of U^{238} values.

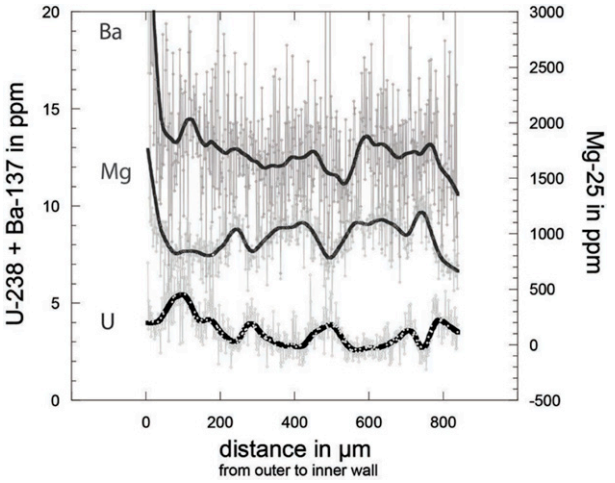

Figure 1: Ba, Mg and U concentrations (weighted at 8%) across the coral wall from outside (left) to inside (right).

The strong antithetical behaviour of U^{238} and Mg^{25} and the known negative correlation of U/Ca concentrations in corals and CO_3^{2-} in seawater [1] invite an interpretation as variations in growth rates in the corals. The short steep increases in U^{238} concentrations will be discussed as phases of low CO_3^{2-} and Mg^{2+} availability, and accordingly lower growth rates. The U peaks are preceeded by minima in Ba^{137} which functions as a nutrient proxy [2]. Repeating peaks in Barium might connect variations in growth rate with regular nutrient input from surface primary production or nepheloid layers. $\delta^{13}C$ ratios will be included in those discussions.

[1] Anagnostou *et al*. (2011) *Geochim. Cosmochim. Ac*. **75**, 2529-2543. [2] Lea *et al*. (1989) Nature **340**, 373-376.

Oxygen and carbon cycling in basaltic crust

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Oceanic crust is the largest potential habitat for life on Earth and may contain a significant fraction of Earth's total microbial biomass, yet little is known about the form and function of life in this vast subseafloor realm that covers nearly two-thirds of the Earth's surface. A deep biosphere hosted in subseafloor basalts has been suggested from several lines of evidence; yet, empirical analysis of metabolic reaction rates in basaltic crust is lacking. The first measure of oxygen consumption in young (~ 8 Ma) and cool (<25 ºC) basaltic crust is calculated from modeling oxygen and strontium profiles in basal sediments collected during Integrated Ocean Drilling Program (IODP) Expedition 336 to 'North Pond', a sediment 'pond' on the western flank of the Mid-Atlantic Ridge (MAR). Dissolved oxygen concentrations increased towards the sediment-basement interface, indicating an upward diffusional supply from oxic fluids circulating within the crust. Furthermore, evidence of biological carbon fixation in basalt biofilms comes from stable isotope incubations, with implications for carbon cycling in oceanic crust. Long-term microbiology experimentation in crustal subseafloor observatories at the Juan de Fuca Ridge flank and at North Pond are poised to yield exciting new discoveries about the dynamics of microbial activity and community structure in the crustal subsurface.

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