Impact of cyanobacteria *Gloeocapsa* sp. on calcium carbonate precipitation rates

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The present study is aimed at determining the physico-chemical factors governing calcium carbonate precipitation rates and mechanisms in the presence of cyanobacteria metabolic activity. The cyanobacteria *Gloeocapsa* sp. f-6gl were cultured for 2-14 days in calcite supersaturated, phosphate-free, Castenholz media at 25°C with and without air bubbling at pH from 7.8 to 10.8. Initial concentrations of Ca and HCO_3^- ranged from 0.01 to 0.001 M. pH, optical density (cell biomass), [Ca], and [Alk] were measured as a function of time during the experiments. Adsorption of Ca on live and dead cyanobacteria was studied as a function of pH (2 to 12), Ca concentration in solution (0.1 µM to 1 mM), duration of exposure (1 hr to 2 days), and the metabolizing state of the culture (e.g. actively growing photosynthesizing cells under the light, non-photosynthesizing cells in the darkness, poisoned by contact with NaN_3/formaline and sterilized biomass). These measurements allowed quantification of the number of surface sites able to participate in $CaCO_3$ precipitation via Ca^{2+} binding at the cell surface. The number of Ca^{2+}-active surface sites is higher for inactivated cells and it does not depend on pH from 8.2 to 11.5. $CaCO_3$ precipitation rates appear be controlled by bulk solution pH and supersaturation state rather than live bacterial surfaces. SEM and XRD observations demonstrate that the cells are embedded in the calcite matrix stemming from non-metabolic mediated precipitation.

Selenium isotopes: a new oceanic paleoredox proxy?

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Previous work on selenium has tended to focus on understanding the biogeochemical cycle of selenium, driven by the need to understand and manage its environmental behaviour due to its toxicity in moderate concentrations. Due to their redox-sensitive nature, and the tendency for mass-dependent fractionation to be induced by redox reactions, some authors have begun investigating whether the isotopes of elements such as Mo, Fe and Se can be used in palaeoredox studies (e.g. Mo [1]).

A record of sedimentary selenium isotope ratios ($^{82/76}Se$), spanning the last 500 ka, has been produced. We propose differences in the cycling of Se due to variations in water column oxygen content will affect seawater selenium isotope ratios and sediment components deposited from the seawater. Sediments deposited under an anoxic water column are dominated by organically - bound Se which has little fractionation with the water. In contrast, samples deposited under an oxic water column have an increased proportion of authigenic Se which should be enriched in light isotopes relative to the water.

Oxygenation of the oceans is difficult to constrain. Determination of past ocean oxygenation provides important constraints on atmospheric O_2 and the overall "health" of the oceans, information crucial for understanding the development of life.

[1] Siebert *et al.* (2003) *Earth & Planetary Science Letters* **211,** 159 – 171.