

## Calcite formation by picoplankton

M. OBST<sup>1</sup>, M. DITTRICH<sup>1</sup>, D. MAVROCORDATOS<sup>2</sup>,  
B. WEHRLI<sup>1</sup>

<sup>1</sup>EAWAG, Limnological Research Center, CH 6047

Kastanienbaum, Switzerland (martin.obst@eawag.ch)

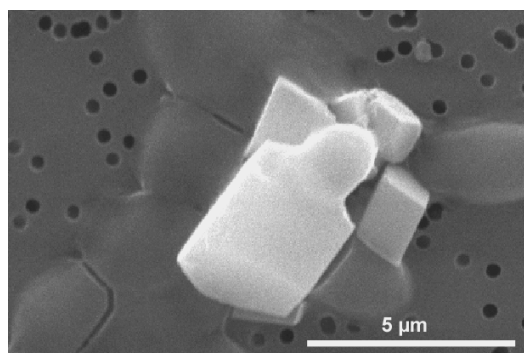
(maria.dittrich@eawag.ch) (bernhard.wehrli@eawag.ch)

<sup>2</sup>EAWAG, Swiss Federal Institute for Environmental Science  
and Technology, CH 8600 Dübendorf, Switzerland  
(denis.mavrocordatos@eawag.ch)

### Introduction

Calcite precipitation by picoplankton in hardwater lakes has been observed in a few recent studies. Biologically induced precipitation due to a change of the chemical environment near the cell wall or the biologically controlled process where the cell surface acts as a nucleation site are both possible mechanisms for biomineralization. However, not only the details of the mechanism but also the role of the calcite saturation state in precipitation still remain unclear.

Figure 1: SEM-image of calcite crystals on the cell surface of *Synechococcus* deposited on a 0.2µm filter.



### Experiments and results

In order to investigate the influence of the saturation state we performed biomineralization experiments under controlled chemical conditions.

Crystal formation was induced by adding a culture of *Synechococcus* to supersaturated solutions of CaCO<sub>3</sub> (CaCl<sub>2</sub>/NaHCO<sub>3</sub>) of different concentrations. An abiotic calcite solution was used as a reference system. Due to the photosynthetic activity the uptake of CO<sub>2</sub> (corresponding to a rise of pH) by the microorganisms lead to an increase of CaCO<sub>3</sub>-supersaturation. Precipitations occurred within 20 hours. The pH was monitored by an electrode. Within the precipitation period, samples were taken at a high time resolution to gain insights into the process itself.

The morphology of the precipitates was studied by Scanning Electron Microscopy (SEM, Fig.1) and in-situ Atomic Force Microscopy (AFM).

As illustrated in Fig1, cells are either incorporated in the crystals or aggregate with them. Thus, the biomineralization of calcite is most probably a combination of biologically induced and controlled mechanism.

## Mineral chemistry of mafic and ultramafic xenoliths from Jurassic basalts in southern Sweden

K. OBST AND T. REHFELDT

Institut für Geologische Wissenschaften, Universität

Greifswald, Germany (obst@uni-greifswald.de)

About 100 volcanic necks occur in the central part of the S-Swedish province Scania. The alkaline magmas of basanitic to melanephelinitic composition (Tappe et al. 2001) produced at the southern margin of the Fennoscandian Shield carried a variety of xenoliths from several levels in the Earth's mantle and crust.

Based on the mineralogical composition and textural features, two major groups of ultramafic to mafic xenoliths can be distinguished. One group comprises deformed porphyritic peridotites, the other consists of granular or banded rocks which represent cumulates. The samples of the first group are lherzolites or wehrlites, while the cumulates can be subdivided into ±olivine bearing websterites and clinopyroxenites, lherzolites and gabbros or anorthosites.

Microprobe analyses emphasize the differences between the various xenolith types. The deformed peridotites are both characterized by primary spinel phases, Mg-Al chromites and chromites, respectively. Especially in the wehrlites a secondary fine-grained Cr spinel phase occurs which is associated with olivine, clinopyroxene, glass and a hydrous mineral in discrete patches. Recalculation of all phases together points to existence of a former amphibole phase.

The ultramafic cumulates are characterized by relative large Cr-free spinel crystals, the gabbros and anorthosites contain tiny ilmenite or titanomagnetite grains. The olivine and both pyroxenes of the cumulates have lower Mg-numbers than those of the deformed peridotites, decreasing from pyroxenites towards gabbros as typical for layered intrusions. The distribution of pyroxene analyses in the quadrilateral and various bi-variate element plots, however, does not support the idea of belonging to one single layered sequence. Further, there seems no proof for a genetic relationship between gabbros and anorthosites.

Results of geothermometry calculations using two-pyroxene thermometer of Wells (1977) and Brey & Köhler (1990) range from 1000 to 1100°C for the deformed lherzolites – this is in accordance with values given by Griffin & Kresten (1987) – but scatter between 900 and 1200°C for the ultramafic cumulates.

### References

- Brey G.P. and Köhler T. (1990), *J. Petrol.* **31**, 1353-1378.  
Griffin W.L. and Kresten P. (1987), *John Wiley & Sons*, 101-106.  
Tappe S., Obst K. and Solyom Z. (2001), *Terra Nostra* **5/01**, 65-68.  
Wells P.R.A. (1977), *Contrib. Mineral. Petrol.* **62**, 129-139.