

TEM-specimen preparation of cell/mineral interfaces by Focused Ion Beam milling

MARTIN OBST,^{1,*} PHILIPPE GASSER,² DENIS MAVROCORDATOS,^{†,3} AND MARIA DITTRICH¹

¹Limnological Research Center, Swiss Federal Institute for Environmental Science and Technology (EAWAG), Seestrasse 79, CH 6047 Kastanienbaum, Switzerland

²Swiss Federal Laboratories for Materials Testing and Research (EMPA), CH 6800 Dübendorf, Switzerland

³Swiss Federal Institute for Environmental Science and Technology (EAWAG), CH 6800 Dübendorf, Switzerland

ABSTRACT

Picocyanobacteria were found to play an important role in calcite precipitation in oligotrophic lakes. In this study, investigations on the interface between cyanobacteria and attached biogenic calcite crystals have been performed to gain further insights into the mechanisms of nucleation of these precipitates. Ultramicrotomy, the conventional preparation technique of thin sections for Transmission Electron Microscopy (TEM) investigations, often fails when working on heterogeneous samples containing soft organic material and hard minerals. Thus, in this study the thin sections were prepared using Focused Ion Beam (FIB) milling. This approach is usually applied in material sciences but until recently was not very common in environmental research. Different analytical TEM methods like Electron Spectroscopic Imaging (ESI) and Electron Energy Loss Spectrometry (EELS) were used to test the suitability of FIB-milling for the preparation of organic/inorganic interface specimens. With this approach we were able to analyze both organic and the inorganic phases of the same sample. Elemental maps of the samples were also calculated. By analyzing the structure of the C K-absorption edge, the different bonding forms of the organic carbon cell and the inorganic carbon of the crystal could be clearly distinguished.