Are coccoliths waste bins for toxic elements?

Cinzia Bottini, Giulia Faucher, Monica Dapiaggi, Nicola Rotiroti

University of Milan, Department of Earth Science, 20133 Milan, Italy; Cinzia.bottini@unimi.it, Giulia.faucher@unimi.it, Monica.dapiaggi@unimi.it, Nicola.rotiroti@unimi.it

Over the last few decades, several works have been dedicated to the study of coccolithophore mineralisation, including the factors that can alter it. Deciphering the regulating mechanisms of calcification under normal and stress conditions is fundamental to forecasting the evolution of the present-day ocean/atmosphere system. Although important advances in the understanding of biocalcification have been made, and we have information regarding how coccolith Sr/Ca and Mg/Ca values change with environmental conditions, very little is known about trace-element concentrations in coccoliths. The primary aim of this work was, therefore, to detect which elements, if any, enter into the calcite structure during coccolithogenesis. Because coccoliths are produced intracellularly, it is possible that some elements are incorporated into the calcite, and that their presence is related to the water composition in which the coccolithophore lived. If so, these elements could be important environmental tracers. We investigated the elemental composition of specimens of *Coccolithus pelagicus* and *Gephyrocapsa oceanica* that were cultured in a controlled environment under 'normal' conditions and excess trace-metal (V, Ni, Pb, Zn) concentrations. Isolated specimens were studied at a resolution of 50 nm^2 using X-ray fluorescence (XRF), performed at the European Synchrotron Radiation Facility in France.

The XRF analyses showed that, in addition to Ca and Sr, there were other trace elements that displayed distribution patterns different from Ca. Some elements (e.g. S and Se) had a homogenous distribution and were involved in cell and/or calcite growth. Others were localised, including Cl and 'toxic' metals (V, Ni, Pb, Zn). Their concentrations were proportional to those used in the cultivation solution, and may reflect their incorporation into the coccolith calcite or deposition on the coccolith surface. Thus, the preliminary data from this study suggest that some of the elements present in the cultivation solution interact with coccolithogenesis. However, further analyses are required to understand if their presence is systematic and if they can be used as environmental proxies.