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New insight on coccolithophore response to environmental stress

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A large number of studies performed over the last decades were dedicated to a better understanding of the response of coccolithophores to environmental perturbations such as ocean acidification, altered concentrations of biolimiting elements and changes in surface water temperature. The importance of these studies is related to the crucial role of coccolithophores in the oceans since they do both photosynthesis and calcification. Coccolithophores are unicellular micro-algae which build around the cell an exoskeleton constituted by platelets ca. 5 micron long (called coccoliths) made of low-Mg calcite. Several studies highlighted how biocalcification, in some coccolithophore species, is reduced or strongly affected under altered physical/chemical conditions of surface waters. Since the failure of coccolithophores would have a large impact on marine biota and global CO_2 budget, deciphering the regulating mechanisms of calcification under normal and stress conditions can improve the use of coccolithophores as paleoenvironmental tracers and it can help to forecast the evolution of present-day ocean/atmosphere system.
In this perspective, information was and is gained through investigation of the geological record and from experiments on living coccolithophore species. New insights can be achieved via the investigation of single coccolith properties, such as the size, the isotopic composition and the mineralogy. For example, very little is known about coccolith chemical composition and element incorporation mechanisms under different environmental conditions.
In this work we performed a X-ray fluorescence (XRF) study at Synchrotron (ESRF) of single specimens of Coccolithus pelagicus and Gephyrocapsa oceanica to gain their chemical composition and detect the element distribution in the coccoliths. The specimens were selected from different culturing experiments conducted under “normal” and “trace metal excess” conditions. This allowed the comparison of coccolith composition and element incorporation.