Peering into the architectures of $CaCO_3$ particles by 3D synchrotron X-ray tomography

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Porous calcium carbonate particles are attracting large attention wide world due to their biocompatibility and possibility to be used in drug delivery. Such particles can be synthesized by direct precipitation or by using different organic templates and/or additives. The shape of such particles, their structure and their porosity depend on the precipitation pathway. These properties can be adjusted by playing with the precipitation conditions and by thermal treatment. In nature, they are most of the time produced via the use of biomolecules that direct the formation of a specific polymorph. Here we show how it is possible to analyze the morphology of precipitated calcium carbonate and of natural Coccospheres. Coccospheres are produced by coccolitophores that are unicellular marine phytoplankton that inhabit the upper layers of coastal waters and the open ocean. Coccolithophores are the primary calcite producers in the ocean, constructing elaborate calcite plates or liths. Recent studies indicate that decreasing pH levels associated with increased oceanic carbon dioxide uptake may imperil coccolithophore species in the future. One expects that a doubling of present-day concentrations of carbon dioxide could result in 20-40% reduction in biogenic calcification of coccolithophores, resulting in malformed calcareous plates and layers of plates. We show in an unprecedented way how CXDI can unveil the shape of these wonderful objects and how it can be further used to monitor the mass of coccoliths.

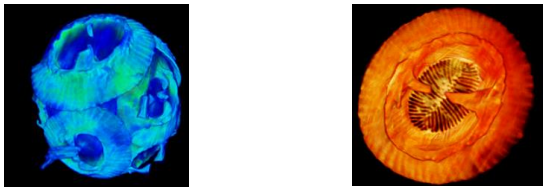

Figure 1: 3D image of coccospheres and of a coccolith

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