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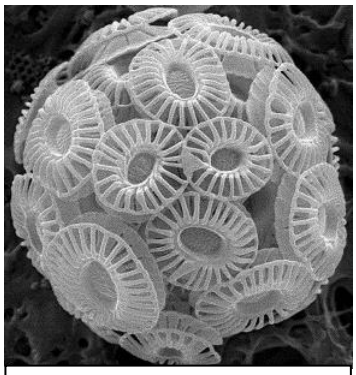
Calcareous nannofossils – Key to ancient marine ecosystems

In a time when dinosaurs were in an early evolutionary stage over 200 million years ago, a much smaller organism appeared in the fossil record. Coccolithophores are unicellular microorganisms that have contributed significantly to primary production at the bottom of the food chain. The scales of these tiny plankton, coccoliths, surrounds the coccolithophore in an exoskeleton known as a coccosphere. Coccoliths make up a significant part of microscopic calcareous nannofossils, which usually are <30 µm in size. The chalk in the White Cliffs of Dover in England largely consists of coccoliths. By studying calcareous nannofossils and associated fossils, we can correlate these finds with past marine ecosystems through history.

Coccolithophores help to reduce carbon dioxide (CO_2) through photosynthesis. However, they also produce CO_2 when they create their calcium carbonate ($CaCO_3$) coccoliths. Most of the CO_2 that coccolithophores produce is consumed through photosynthesis, but some of it is not. Blooms of coccolithophores could therefore potentially have devastating short-term effects on the climate. Nonetheless, coccolithophores bind carbon (C) into organic matter and the net effect of their presence ultimately reduces the amount of carbon in the oceans and in the atmosphere.



Emiliania huxleyi. The most prominent coccolithophore living today.

When coccolithophores die they decompose, and their coccoliths sink towards the bottom of the ocean with carbon safely stored in the scales ($CaCO_3$), often making it all the way to form sediments and eventually sedimentary rocks. This is an essential ocean carbon sink process and a part of the biological pump, which counters global warming and ocean acidification. The biological pump also involves photosynthetic fixation of carbon into tissue by planktonic organisms, and bacterial decomposition of fixed carbon.

The calcareous nannoplankton that are preserved become excellent biostratigraphic tools in the form of calcareous nannofossils. This means that they can be correlated with recognised associated fossils within sediments to be able to determine their age. The dating of sediments and identification of ancient marine ecosystems makes calcareous nannofossils particularly useful for better understanding previous environments and past climatic conditions.

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