Adaptation of coccolith calcification to sea-water carbonate chemistry

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Coccolithophores are major calcifiers and through calcification cause feedbacks to atmospheric CO_2 cycling. The formation of $CaCO_3$ in seawater, in fact, causes a shift of the carbonate system towards CO_2, which in turn affects atmosphere/ocean CO_2 exchange. A change in marine calcification provides a concomitant feedback in organic carbon export and would lead to a change in the drawdown of atmospheric CO_2.

Coccolithophore culture experiments and field observations showed controversial results regarding the response of calcification to high CO_2. The three strains of *Emiliania huxleyi* (the most abundant living coccolithophore species) tested so far show both increased and decreased calcification at high CO_2 levels (lower pH).

Living *E. huxleyi* is known to have a large variability in both size and degree of calcification content, resulting in very large variation in coccolith mass, from about 1 to 5 pg. Recent field observations have suggested that the distribution of *E. huxleyi* coccolith morphotypes is related to carbonate saturation state, even though the morphotypes are known to be under strong genotypic control. This hypothesis can be tested by comparing the morphology of coccolith strains, and especially their degree of calcification, with the sea-water carbonate chemistry from which they were isolated. We selected 25 strains of *E. huxleyi* maintained at the Roscoff culture collection, collected from different oceanographic settings with different carbon speciation. Although the strains are maintained at similar temperature and carbonate chemistry, they still preserve a morphology similar to the one of the original ocean samples. The selected strains have been grown at the same carbonate chemistry. The culture temperatures mimicked the temperatures of the sites from where the strains were collected. With these experiments, we test the importance of the calcification strain adaptation to carbonate chemistry. Size and possibly different responses to carbonate chemistry variations will also be discussed.