The calcification response of multiple species of coccolithophore to elevated ocean alkalinity

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The alkalinity of seawater sets the overall capacity of the ocean to hold carbon dioxide in dissolved forms. Variations in past alkalinity, related to changing weathering or carbonate compensation, may have played an important role in moderating or controlling past variations of atmospheric pCO_2. Future manipulation of ocean alkalinity by direct addition of suitable chemicals to seawater, or through enhanced weathering on land, has also been suggested as one possible route to intentionally draw CO_2 from the modern atmosphere and mitigate the impacts of future climate change [1]. Although we know an increasing amount about how species and ecosystems respond to changes in pH, we know much less about their response to changes in alkalinity. Calcifying plankton play a crucial role in modulating the surface ocean carbonate system and its buffering of alkalinity perturbations [2]. Here we investigate the growth and calcification response of multiple species of coccolithophores to elevated ocean alkalinity through a series of carefully designed batch culture laboratory experiments. Alkalinity is raised by two different methods during the experiments: by (i) addition of $NaHCO_3$ and (ii) addition of $Ca(OH)_2$. These differing elevated alkalinity treatments allow us to constrain whether factors other than raised alkalinity affect plankton growth and/or calcification; $NaHCO_3$ addition raises DIC in solution without altering the Ca^{2+}, whereas addition of $Ca(OH)_2$ raises Ca^{2+} with possible impact on calcification (Ca has also been suggested to be toxic in high levels to several species of plankton [3]). We will show how physiology and calcification respond to these two different modes of alkalinity manipulation.

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