Interactive comment on “Coccolithophore response to climate and surface hydrography in Santa Barbara Basin, California, AD 1917–2004” by M. Grelaud et al.

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We thank Regina Krachler for her constructive criticism that helped to improve the manuscript substantially.

1- Page 4143 line 24: (The authors wrote: When the pH is controlled by CO2 injection, rather than by acid addition, the production of dissolved inorganic carbon (DIC) is greater and the production of bicarbonate which is the source of DIC for calcification in coccolithophores is enhanced.)

\[ \text{Ca}^{2+} + 2\text{HCO}_3^- = \text{CaCO}_3(s) + \text{CO}_2 + \text{H}_2\text{O} \]

Increasing pCO2 shifts the above equilibrium to the left side, leading to higher DIC and
Ca\textsuperscript{2+} concentrations, provided that solid CaCO\textsubscript{3} is present (e.g. colloidal particles) which can act as a reaction partner. However, with no suspended CaCO\textsubscript{3} particles in the water column, addition of CO\textsubscript{2} will shift the pH as well as the carbonate concentration to lower values, creating less favourable conditions for calcification, since carbonate rather than bicarbonate is needed for the precipitation of CaCO\textsubscript{3}. On the other hand, coccolithophores need CO\textsubscript{2} to carry out photosynthesis, and their productivity may be controlled by the availability of CO\textsubscript{2}. Increasing pCO\textsubscript{2} in seawater could therefore be compatible with an increase in coccolith weight.

Answer: we completely agree that the CO\textsubscript{2} should help the algae for photosynthesis. However the link between photosynthesis and calcification is not clear, the coccolithophores using essentially bi-carbonate to precipitate the calcium carbonate. Moreover there are no apparent exchanges of carbon during the process. Our results suggest that an increase in pCO\textsubscript{2} and pH could be favorable to calcification of coccolithophores. Equivalent results have been described by Iglesias-Rodriguez et al. (2008).

Reference:


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