

## Phytoplankton response to increased atmospheric CO<sub>2</sub>

Surface oceans are taking up a proportion of the increasing atmospheric pCO<sub>2</sub>. Two consequences of this increased flux are 1) an increase in dissolved inorganic carbon concentration and 2) a decrease in pH. Both of these consequences can affect phytoplankton, the organisms which transform inorganic carbon to organic carbon using light energy and are responsible for generating the carbon gradient between the surface mixed layer and the deep ocean referred to as the “biological pump”. Although the role of biology in the overall global carbon cycle may be proportionately small, it is significant because of its capacity to contribute to negative feedbacks and non-steady state conditions. Therefore, a question of major environmental importance is, “How do biological responses to increased concentrations of dissolved inorganic carbon contribute to the oceanic carbon cycle?” Phytoplankton growth and primary productivity are generally not thought to be limited by inorganic carbon availability, however, small changes in phytoplankton physiology could have indirect effects on the biological community. Some changes have been reported in the literature (see Fig. 1). Andy Juhl and I have run a successful pilot experiment and would train a student to run additional experiments which could test some of the following hypotheses or other hypotheses devised by the student.

- H1: Particulate C:N increase is due to a change in physiological allocation of substrates (i.e. intracellular or exudates) in an extant phytoplankton assemblage rather than due to a change in the assemblage characteristics.
- H2: Photosynthetic efficiency and maximum photosynthetic capacity are improved due to more efficient functioning of the RuBisCo enzyme.
- H3: Phytoplankton species or strains which employ obligate carbon concentrating mechanisms have a reduced competitive advantage and will not dominate a phytoplankton assemblage.

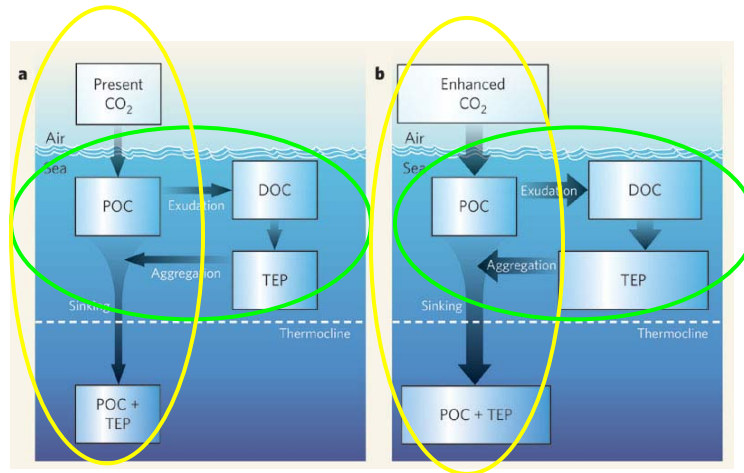


Fig. 1 borrowed from Arrigo, K. R. (2007). "Carbon cycle - Marine manipulations." *Nature* **450**: 491-492.

Ovals added here. Green ovals represent the focus on the phytoplankton physiology and related biological processes. Yellow ovals represent the focus on ecosystem and biogeochemical cycling.