High CO_2 impact on the growth and trace metal quota of *Emiliania huxleyi*

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Introduction

Elevated CO_2 concentrations in the atmosphere leads to the decrease of pH in surface ocean, which is likely to make the calcification of coccolithophores more energy consumption. *Emiliania huxleyi* (*E. hux.*) is the most abundant coccolithophore in the ocean (Fig. 1). *E. hux* actively calcifies their exoskeleton (Fig. 2), making them a crucial contributor to C cycle (Fig. 3). Based on previous research, Zn is known as a key cofactor in carbonic anhydrase which is used for the transformation of different inorganic carbon species and is thus related to photosynthesis. Here, we have designed an experiment to exam the effects of elevated CO_2 (or pH) on the growth rate and cellular metal quotas of *E. hux.*

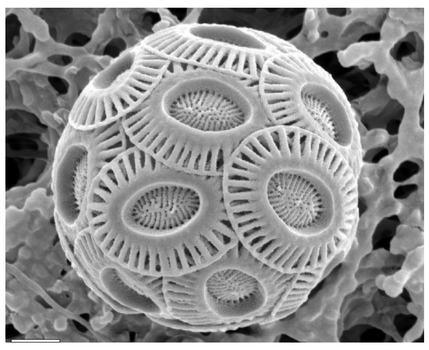


Fig. 1 SEM image of *Emiliania huxleyi* (Young et al., 2003)

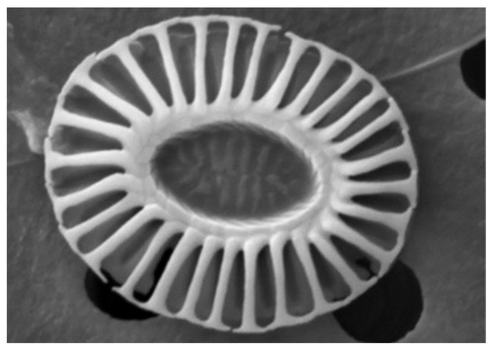


Fig. 2 Coccolith of *E. hux* (Roberto, 2021)

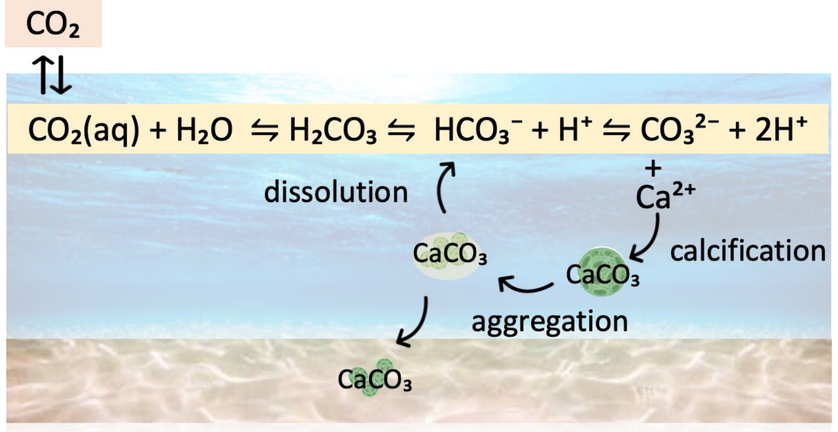


Fig. 3 Biological pump and marine carbon cycle

Material & method

- Temperature 20°C
- Salinity 35‰
- Photon flux 330 µmol m^{-2} s^{-1}
- Light/dark cycle = 12/12h
- Cell density is measured by Coulter counter
- Concentration of Zn is measured by Inductively Coupled Plasma Mass Spectrometry(ICP-MS).
- Trace metal (Fe, Cu, Mn, Co, Mo, Ni, Cr, Zn, V, Se), major nutrients and vitamin were replete in the culture medium.

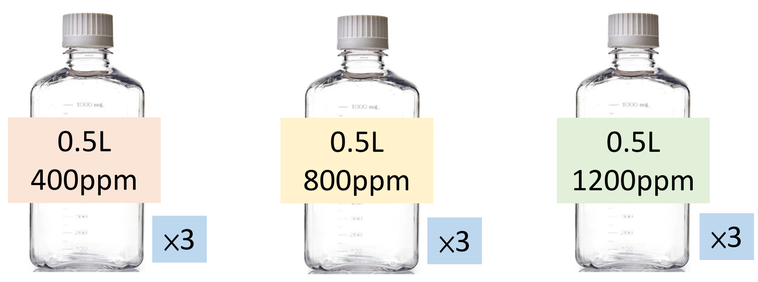


Fig. Triplicate polycarbonate bottles used in this experiment

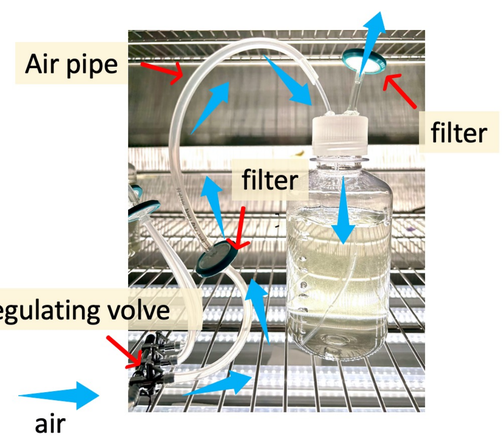
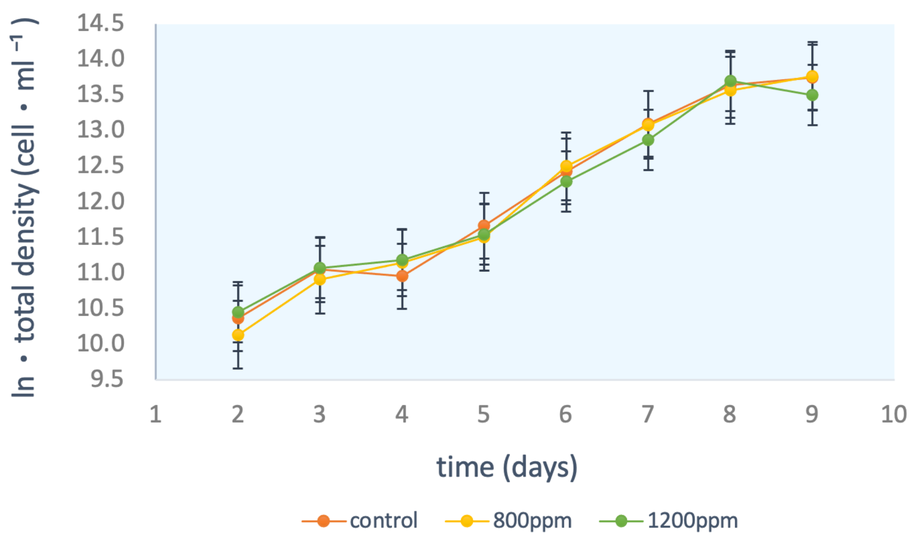


Fig. air pumping system

Fig. Experimental setup in a temperature & light controlled growth chamber

Result

Growth curves and rates

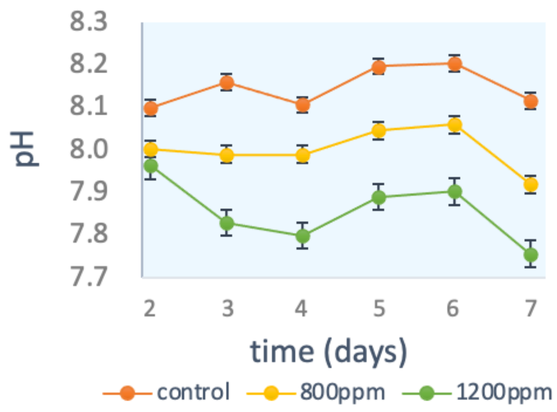


Growth rates

400ppm	**0.67±0.005**
800ppm	**0.61±0.029**
1200ppm	**0.63±0.118**

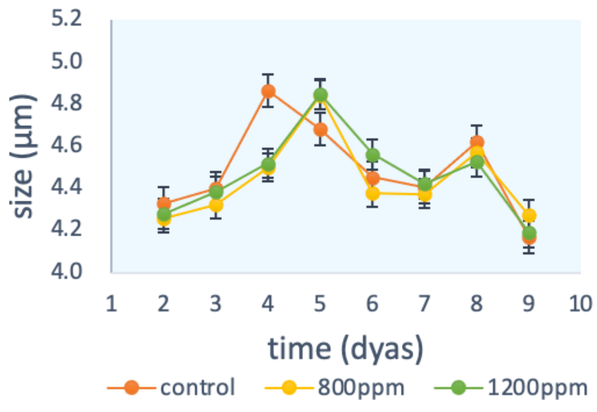
- There is no significant variations for the growth rates in different CO_2 concentration treatments.
- The cells from day 4 to day 8 were under exponential growth. We thus calculated the rates during these 5 days.

pH



- pH variations with time for the three CO_2 concentration treatments

Cell size



- The variations of the cell sizes in the three treatments measured by Coulter counter

Conclusion

- The degree of pH drop in seawater is proportional to the concentration of carbon dioxide pumped into seawater culture medium.
- The growth rates of *E. hux* were comparable among the 3 treatments. We suspect that the experimental duration (9 days) is not long enough to observe the impact.

Acknowledgement

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Reference

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