Emiliania huxleyi can't tell TA from DIC manipulation

Clara J. M. Hoppe, Gerald Langer and Björn Rost

Alfred Wegener Institute for Polar and Marine Research
Am Handelshafen 12, 27570 Bremerhaven, Germany

Introduction

- For the coccolithophore *Emiliania huxleyi*, apparently conflicting results regarding its sensitivity to ocean acidification have been published (Riebesell et *al*. 2000; Iglesias-Rodriguez et *al*. 2008; Fig. 1).
- As possible causes for discrepancies, intra-specific variability and different effects of CO_2 manipulation methods (TA or DIC manipulation) have been discussed.
- In this study, closed TA as well as open and closed DIC manipulation methods were compared with respect to *E. huxleyi*'s CO_2-dependence in growth rate, POC and PIC production.

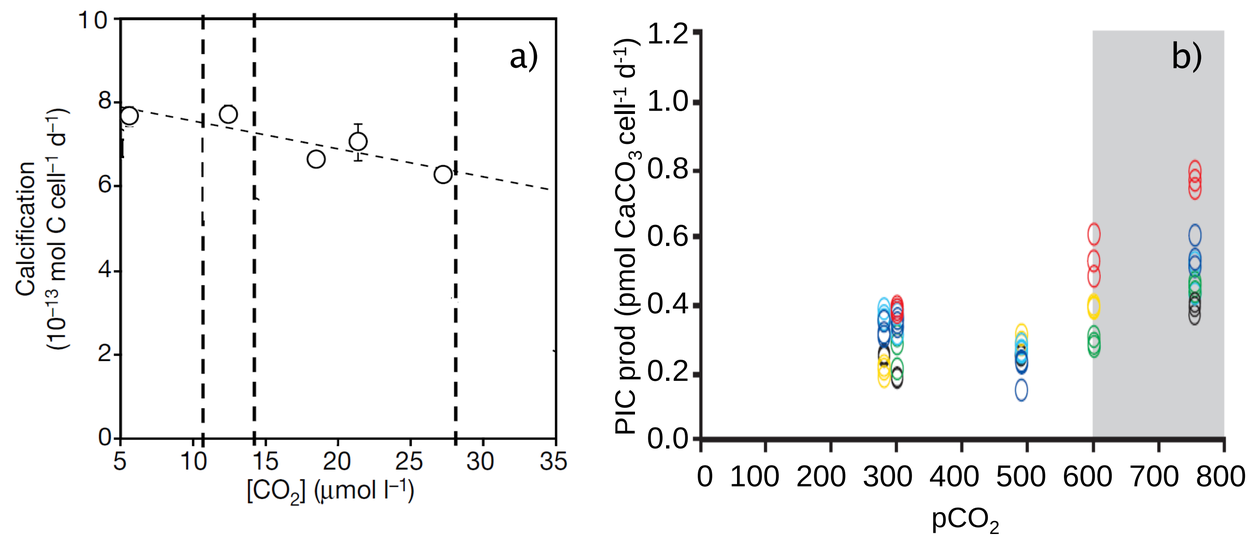

Fig. 1. Cacification rates of *E. huxleyi* in a) Riebesell et *al*. (2000) and b) Iglesias-Rodríguez et *al.* (2008).

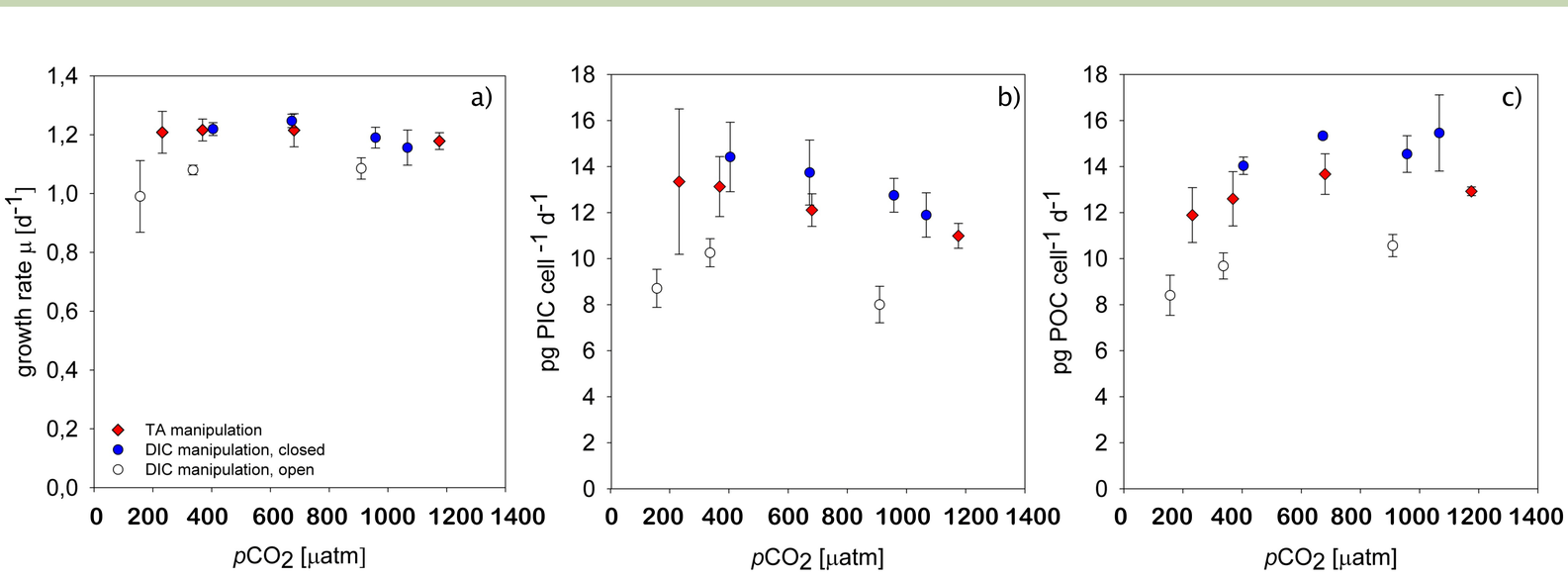

Fig. 2. a) Growth, b) PIC and c) POC production of *E. huxleyi* strain NZEH in response to different pCO_2 levels as found for different CO_2 pertubation methods. Data for strain RCC1256 not shown.

Responses to the different CO_2 perturbation methods

- The differences in carbonate chemistry between the two manipulation methods cause no substantial differences in the general ecophysiological responses of two strains of *E. huxleyi* (Fig. 2, Fig. 3).
- The two strains investigated showed different sensitivities to ocean acidification, RCC1256 being more negatively affected in growth rates and PIC production than NZEH (Fig. 3).

Conclusions

- Differences between TA and DIC manipulations do not cause differences in the ecophysiological responses of *E. huxleyi* to changing pCO_2 levels.
- Although strain-specific differences and overall trends were confirmed, the CO_2-dependent sensitivity within single strains of *E. huxleyi* seems to vary over time (cf. Langer et *al*. 2009). This favours the analysis of the sensitivity of this species in a semi-quantitative way, i.e. in terms of trends.
- After comparing the ecophysiological responses of all *E. huxleyi* strains described in the literature (Fig. 3), this species can be regarded as moderately sensitive to ocean acidification.

Study	Strain	Growth	PIC production	POC production	PIC:POC ratio
Riebesell et *al.* 2000	PLYB92/11	–	\	\	\
Sciendra et *al.* 2003	TW1	–	\	\	–
Feng et *al.* 2008	CCMP371	–	\	–	\
Iglesias-Rodriguez et *al.* 2008	NZEH	\	\	\	–
Langer et *al.* 2009	RCC1212	–	\	–	\
	RCC1216	–	\	–	\
	RCC1238	–	–	)	–
	RCC1256	\	\	)	–
Shi et *al.* 2009	NZEH	–	\	\	\
This study	RCC1256	\	\	–	\
	NZEH	–	\	\	\

Fig. 3. Overall sensitivity of *E. huxleyi* ecophysiological parameters to changes in carbonate chemistry as found in seven independent studies.

References

Feng et *al.* : Interactive effects of increased pCO_2, temperature and irradiance on the marine coccolithophore *Emiliania huxleyi* (Prymnesiophyceae), European Journal of Phycology, 43, 87 - 98, 2008.
Iglesias-Rodriguez et *al.* : Phytoplankton Calcification in a High-CO_2 world, Science, 322, 336-340, 2008.
Langer et *al.* : Strain-specific responses of *Emiliania hulxeyi* to changing seawater carbonate chemistry, Biogeosciences, 6, 2637-2646, 2009.
Riebesell et *al.* : Reduced calcification of marine phytoplankton in response to increased atmospheric CO_2, Nature, 407, 364-367, 2000.
Sciandra et *al.* : Response of coccolithophorid *Emiliania huxleyi* to elevated partial pressure of CO_2 under nitrogen limitation, Marine Ecology Progress Series, 261, 111-122, 2003.
Shi et *al.* : Effects of the pH/pCO_2 control method on medium chemistry and phytoplankton growth, Biogeosciences, 6, 1199-1207, 2009.