

Interactive comment on “High temperature decreases the PIC / POC ratio and increases phosphorus requirements in *Coccolithus pelagicus* (Haptophyta)” by A. C. Gerech et al.

J.-P. Gattuso

gattuso@obs-vlfr.fr

Received and published: 21 January 2014

I believe that there are two issues with the following statement of the abstract "*the ratio of PIC/POC determines whether coccolithophores act as a source (PIC / POC > 1) or a sink (PIC / POC < 1) of atmospheric CO₂*". Here PIC is the Particulate Inorganic Carbon and POC is the Particulate Organic Carbon.

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As mentioned in Gattuso et al. (1995), the air-sea CO₂ flux generated by net primary production and net calcification is:

$$F_{CO_2} = -P_n + \Psi \times G \quad (1)$$

where:

- F_{CO_2} : air-sea CO₂ flux
- P_n : net community production in molar unit
- G : net community calcification in molar unit
- Ψ : moles of CO₂ released for each mole of CaCO₃ precipitated

Ψ is about 0.6 when pCO₂ = 356 μatm, total alkalinity = 2.37 mEq kg⁻¹, T = 25°C and salinity = 35 (Frankignoulle et al., 1994).

The first issue has to do with the fact that is not the PIC/POC ratio that is determining the impact of biology on air-sea CO₂ fluxes, it is the ratio of $\frac{PIC \text{ production}}{POC \text{ production}}$ or the $\frac{G}{P_n}$ ratio to use the same terminology as above. This is a minor terminology issue without any consequence on the conclusion drawn in this paper. All cells were indeed collected at the end of the experiment, hence PIC and POC are in effect the PIC and POC productions (referred to ΔPIC and ΔPOC below).

The second issue is related to the fact that Ψ is not considered in the statement mentioned above. Hence the threshold value of ΔPIC/ΔPOC = 1 used in the abstract and discussion is incorrect. According to equation 1, the correct threshold is ΔPIC/ΔPOC = 1/0.6 = 1.67 under standard environmental conditions. It can easily be recalculated using Ψ values under other conditions, for example using the psi function of seacarb

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(Lavigne & Gattuso, 2013). Above that threshold, the balance between net primary production and calcification will favour CO₂ evasion while below that value, CO₂ invasion will be favoured. The discussion of the paper therefore needs to be reconsidered.

I would also suggest to indicate which "omega" is listed in Table 1. I assume that it is the saturation state of calcite, hence Ω_c .

References cited

Frankignoulle M., Canon C. & Gattuso J.-P., 1994. Marine calcification as a source of carbon dioxide- Positive feedback of increasing atmospheric CO₂. *Limnology and Oceanography* 39:458-462.

Gattuso J.-P., Pichon M. & Frankignoulle M., 1995. Biological control of air-sea CO₂ fluxes: effect of photosynthetic and calcifying marine organisms and ecosystems. *Marine Ecology Progress Series* 129:307-312.

Lavigne H. & Gattuso J.-P., 2013. seacarb: seawater carbonate chemistry with R. R package version 2.4.10. <http://CRAN.R-project.org/package=seacarb>.

Interactive comment on Biogeosciences Discuss., 11, 1021, 2014.