

Interactive comment on “Strain-specific responses of *Emiliana huxleyi* to changing seawater carbonate chemistry” by G. Langer et al.

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General reply

Both referees are in principle in favour of publication but also mention a number of points to be considered. We regard these points as highly valuable and think that, by addressing them, we have improved the manuscript. In the following we will address every point in detail and declare the changes we made.

Detailed reply to REFEREE #1 (Hanno Kinkel)

Hanno Kinkel suggests performing a method-comparison experiment to support the statement on page 4368 line 10. We perfectly agree insofar that this question can, in its entirety, only be answered on the basis of the requested dataset. We nevertheless

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refrain from including such a dataset for the following reasons. First, and most importantly, this statement is an aside in our paper, but the corresponding dataset is a stand alone dataset which deserves a separate paper. Second, our argument is already a pretty strong one. See Ridgwell et al. for an argument along the same lines (A. Ridgwell, D. N. Schmidt, C. Turley, C. Brownlee, M. T. Maldonado, P. Tortell, and J. R. Young (2009). From laboratory manipulations to earth system models: predicting pelagic calcification and its consequences *Biogeosciences Discuss.*, 6, 3455-3480, SRef-ID: 1810-6285/bgd/2009-6-3455). Third, it has very recently been shown that the method of carbonate chemistry manipulation does not affect the response pattern of another *E. huxleyi* clone (D. Shi, Y. Xu, and F. M. M. Morel (2009). Effects of the pH/pCO₂ control method in the growth medium of phytoplankton *Biogeosciences Discuss.*, 6, 2415-2439, SRef-ID: 1810-6285/bgd/2009-6-2415).

Hanno Kinkel and Referee #2 would like to see the temperature optimum growth curves for the clones used. We included the requested data and show that every clone was grown near its optimum growth temperature.

Hanno Kinkel suggests expanding the discussion on the morphotype (page 4370, second paragraph) with respect to the degree of calcification. We did so and the paragraph now reads: "..... Interestingly the two type A strains (RCC1238 and RCC1256) exhibit the weakest (RCC1238) and the strongest (RCC1256) responses. The intermediate responses are displayed by the type R (RCC1216) and type B (RCC1212). The type B morphotype is described as the more delicate form (compared to type A and type R) which is often assumed to be more vulnerable to acidification. Our data show that this is not the case. We think it more plausible to assume that the susceptibility to acidification related effects is connected with some physiological process, for instance a transmembrane transport of ions."

Hanno Kinkel and Referee #2 find the classification of the responses in table 4 subjective, although they agree with us in saying that the response patterns are indeed different. Since the latter point is crucial and we agree with the former, we removed ta-

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ble 4 (which was merely meant to be a shortcut to the data anyway) and reworded the text. Page 4366, line 27 to page 4367, line 3 now read: " Based on our results (Table 3, Figures 1-4), we distinguish three types of responses represented by the following clones: (1) RCC1212 and RCC1216 (2) RCC1238 (3) RCC1256."

Hanno Kinkel and Referee #2 justly request that we use one code per strain. We now use the RCC codes only.

Hanno Kinkel asks us to explain the errorbars in the figure captions. We did so.

Detailed reply to REFEREE #2

General comments

1. Referee #2 asks why DIC values differ although acid / base manipulation of the carbonate system was employed. The carbonate system presented in table 2 represents the state of the system at the end of the experiment. Commonly values from the end of the experiment are provided, because most of the biomass was produced under these conditions. There are usually differences in DIC values due to different DIC consumption over the course of the experiment. However, the highest consumption (i.e. lowest DIC value) still falls within the range of typical dilute batch experiments (see Material and Methods and e.g. Langer, G., Geisen, M., Baumann, K. -H., Kläs, J., Riebesell, U., Thoms, S., Young, J. R.(2006).Species-specific responses of calcifying algae to changing seawater carbonate chemistry, *Geochemistry Geophysics Geosystems*, 7, Q09006, doi:10.1029/2005gc001227, and Langer, G., Gussone, N., Nehrke, G., Riebesell, U., Eisenhauer, A., Thoms, S.(2007).Calcium isotope fractionation during coccolith formation in *Emiliania huxleyi*: Independence of growth and calcification rate, *Geochemistry, Geophysics, Geosystems*, 8, Q05007, doi:10.1029/2006GC001422.). There are no problems with DIC sampling. DIC measured can be regarded as DIC during incubation.

2. See answer to Hanno Kinkel

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3. See answer to Hanno Kinkel

4. See answer to Hanno Kinkel

Specific comments

1. Looking at the figures in Feng et al. 2008 we received that impression. Re-reading Feng et al. 2008, however, we realized that the authors interpret their data differently (i.e. confirming what referee #2 said). Since this sentence (p. 4363, l. 11-13) is not needed in our introduction we deleted it.

2. We agree with referee #2. It is probably not the sole explanation but the question whether different strains in principle display different response patterns or not is an important question. It was our objective to answer that question. Other factors are surely to be considered to explain apparently contradictory results but this is not the scope of our study.

3. See answer to Hanno Kinkel

4. We perfectly agree with referee #2, whose comment actually supports our conclusion (p. 4369, l. 26).

5. We agree. Details on this feedback can be found in the paper cited (Ridgwell et al. 2007). The absolute magnitude of this effect, however, is not relevant to our argument.

6. We agree. Therefore we changed the sentence p. 4371, l. 22: "Given that calcification actually is beneficial for coccolithophores (the function of calcification is still unknown)....".

7. This is correct. We changed the figures.

Interactive comment on Biogeosciences Discuss., 6, 4361, 2009.

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