

## ***Interactive comment on “Effects of ocean acidification on calcification of symbiont-bearing reef foraminifers” by K. Fujita et al.***

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Received and published: 12 April 2011

Dear Editor,

The manuscript presented by Fujita et al., ‘Effects of Ocean Acidification on Reef Foraminifers’, is well-written and documents an important set of results showing the effect of simulated ocean acidification on calcification rates in three species of large, tropical foraminifera. Contrary to the review posted by Dr. Hohenegger, I think the manuscript (particularly the Discussion) can be improved substantially. I recommend the paper to be published in Biogeosciences after major revisions (see below).

Sincerely,

Lennart de Nooijer

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Revision step-by-step: 1. Throughout the manuscript, the authors refer to the three species by their genus-names. I recommend adopting the standard annotation (i.e. *B. sphaerulata*, *C. gaudichaudii* and *A. hemprichii*). 2. Since this is the first paper in which their culturing set-up is described, I suggest that a schematic drawing is included that shows the relation between towers, gas mixers, culture vessels, water bath, lights, etc. 3. The data may be presented a bit more condensed. The difference between the two clone populations is generally low and therefore the two figures from one species may better be combined somehow. Where is the dotted line in clone population  $\alpha$  of *Calcarina* (Fig 2, upper panel)? 4. Could the authors assess whether the foraminifera grew throughout the experiment? Since the weight and size were only determined after 12 weeks, it may be that eventual growth rates are underestimated (i.e. when all growth occurred in the first weeks). Because future culture studies may use the data presented here to compare to, I recommend stressing the uncertainties in the estimated growth/calcification rates. 5. Looking at all the results together, there seems no clear response of the cultured foraminifera to the supplied pCO<sub>2</sub>'s. It may be that the introduction of altered seawater carbonate chemistry caused stress (particularly at the beginning of the experiment) and thus impacted determined growth rates. On the other hand, Langer et al. (2009, Biogeosciences 6: 2637) have shown that different strains (subspecies) of coccolithophores may respond differently to induced ocean acidification. If such results are valid for foraminifera too, the difference between the clone populations may thus be (partly) explained. These alternative explanations for the observed responses have to be included in the manuscript. 6. The introduced ocean acidification has also altered the [DIC]. Could increased DIC concentrations have had a positive effect on the growth rates? Please include these values in Table 1. 7. The discussion about the possible difference in utilization of inorganic carbon species is highly speculative. Modifications of the internal (and external) pH by foraminifera show that the ratio between dissolved carbon dioxide/bicarbonate/carbonate is easily modified. Therefore, the supposed use of bicarbonate vs carbonate between species should be omitted. 8. Could it be that production of new chambers (i.e. calcification) only takes place as the foraminifer's

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cells grow? In that case, the inorganic carbon availability and pH may have a small effect on calcification compared to cell growth. . . This possibility should be mentioned. 9. Were there any observed differences in the appearance of the foraminifers between the different conditions? Are there SEM pictures available? Could the authors extend their results by estimating chamber wall thicknesses (are the results presented here somehow comparable to the inferred relation between OA and planktic chamber wall thickness suggested by Moy et al. (2009. *Nature Geosciences* 2: 276), de Moel et al. (2009. *Biogeosciences* 6: 1917) and Barker and Elderfield (2002. *Science* 297: 833))? 10. What do the results imply for the use of large benthic foraminifers as “first indicators” in reef ecology as OA continues (as mentioned in the Introduction)?

In summary, I think the Discussion should be less speculative, can be condensed considerably and instead should focus more on 1) variability in the data as such, 2) possible problems associated with culturing studies and 3) other factors than pH that may impact calcification rates.

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Interactive comment on *Biogeosciences Discuss.*, 8, 1809, 2011.