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Interactive comment on “The impact of seawater calcite saturation state by modifying Ca ion concentrations on Mg and Sr incorporation in cultured benthic foraminifera” by M. Raitzsch et al.

Anonymous Referee #1

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Review of the manuscript "The impact of seawater calcite saturation state by modifying Ca ion concentrations on Mg and Sr incorporation in cultured benthic foraminifera" by Raitzsch, Duenas-Bohorquez, Reichart, de Nooijer, and Bickert. This manuscript provides an interesting piece of the puzzle to unravel the influence of environmental impacts on the incorporation of Mg and Sr into benthic foraminiferal tests. The manuscript is well written, clearly and in detail providing the set-up of the experiments and exploring the different explanations. Below I have listed some major and minor comments which still need to be addressed, but I definitely recommend this paper to be published in Biogeosciences.

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Major comments: The part on the influence of Mg/Casolution, DMg, and Mg/Cacc concerning *A. tepida* is slightly confusing. Page 11355, lines 13-15 starts with that the change in Mg/Cacc is negligible indicating no influence of the hardly changed solution Mg/Ca. Indeed, the Mg/Ca in the solution is within errors constant. But, according to Table 2 Mg/Cacc is decreasing from 2.41 to 1.60 (not including the outlier). That is a change of 65%, comparable to temperature change (following general temperature dependency) of 5+°C. I would not call that a negligible change. Later in the discussion (4.1, 11358, first lines) you state that DMg (and therewith of course Mg/Cacc) indeed decreased significantly, but as an effect of increased (Ca²⁺). Then in section 4.2 further evidence is given that not Mg/Casolution but indeed Ca concentration is the controlling factor. I suggest to rephrase the first part on page 11355 to make it more in line with the rest of the discussion.

At several places the importance of these experiments with regard to reliably reconstruct paleotemperatures is mentioned. The abstract (beginning and end) mentions the importance of knowing the Ca concentration and how this has changed over time. The last part of discussion says that Mg/Ca is more dependent on the Mg/Ca ratio of the sea water than on the Ca concentration. And in the conclusion Sr/Ca is mentioned as potential recorder of past sea water Sr/Ca. But, where is the link which shows how relevant these experiments are for paleoreconstructions? The introduction says that Ca behaves conservatively in the ocean with a residence time of 1.1 Myr. Does this mean then that the remark from the abstract is only valid for records which cover longer time periods? And are there any indications on how the Ca concentration changed in the past? Is this comparable to the range which is used in the experiments? The same goes for Mg/Ca and Sr/Ca of seawater. How did they change in the past? Mg/Casw, for example, changed from 5.2 to over 6 in one of the experiments. But in nature the modern Mg/Ca of 5.2 is the highest for the whole Cenozoic. Most of the time values have been a lot lower. Taking this together with the fact that some experiments have suggested that at higher omega the response of DMg is not that strong anymore, could it be that a much larger effect could have been detected when Ca concentration (or



accidental Mg/Casolution) were lowered instead of increased?

How representative are these results for the reconstruction of paleotemperatures? These two shallow living species were used as they are robust and can be subjected to many conditions, but which are never used in paleotemperature reconstructions. However, one of the results is the difference response of them to certain environmental changes. Is it okay to transfer behavior of a shallow living benthic foraminifer to a deep living benthic foraminifer because their Mg/Ca ratios occupy a similar range?

Minor comments: p.11353, line 10: why was *A. tepida* kept in the dark?

p.11354, line 11: You mention B and U here, but they are not in the results?

p.11355, line 24: Fig. 4a should be Fig. 5a?

p.11359, line 2: replace “are” with “is”.

p.11361, line 4: replace “implies” with “imply”.

Table 1 and 2: Just an idea: it seems to me that it would have been more convenient to make one table with all data for *H. depressa* and one for *A. tepida*.

Figure 4: make a c) plot from the inset in part a). That makes it a bit clearer.

I'd like to point out that I have made this review before reading any online reviews or comments.

Interactive comment on Biogeosciences Discuss., 6, 11347, 2009.

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