

Interactive comment on “A culture-based calibration of benthic foraminiferal paleotemperature proxies: $\delta^{18}\text{O}$ and Mg/Ca results” by H. L. Filipsson et al.

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Dear Dr. Bijma,

With pleasure I reviewed the manuscript submitted by Filipsson and co-workers entitled “A culture-based calibration of benthic foraminiferal paleotemperature proxies: $\delta^{18}\text{O}$ and Mg/Ca results”. This manuscript is clearly written and the presented results and conclusions are the consequence of well-executed culturing experiments. With no major concerns, I therefore recommend publication of their paper in *Biogeosciences*, provided that they consider the following comments.

On the text:

C4

Page 352, line 2: “foraminiferal $\delta^{18}\text{O}$ and Mg/Ca” should read “foraminiferal calcitic $\delta^{18}\text{O}$ and Mg/Ca”

Page 352, line 3: “*Bulimina* species . . . were most successful”. The species were not successful themselves, but growth and reproduction in these species were highest under certain laboratory conditions.

Page 353, line 15: “Foraminifera were obtained” better reads as “Living foraminifera were obtained”

Page 353, line 20-21: “maintained near bottom-water temperatures” should probably be “maintained at near bottom-water temperatures”

Page 354, line 16- page 355 line 1: Use of abbreviations for genusnames is inconsistent.

Page 360, line 1: same as earlier comment.

Page 362, line 25: same as earlier comment.

Page 370, line 11-16: both references are from 2002, please include ‘a’ and ‘b’ here, as well as in the text.

Other comments:

Were foraminifera cleaned at all after retrieval from the culture vessels? Specimens that were alive at the end of the experiments likely contained cytoplasm that may have influenced the elemental and isotope analysis.

Why do the authors focus on the culturing conditions from Feb to May? Variability in T, sal, etc was not high in the excluded timespan (Dec – Feb), compared to the rest of the experimental period. Besides, the cultured specimens may well have grown most of their calcite in the first half of the experiment and died during as the incubation progressed.

C5

Whatever happened to the Sr/Ca ratios? Since Sr counts were also recorded, it would be interesting to present these data along with the Mg/Ca ratios.

To compare their data with published Mg-T relationships, the authors plotted their Mg/Ca data twice: in the second figure (no 8), a core-top calibration is included from Lear et al. (2002). The calibration curve reproduced by Lear and others, however, is based on results from different species than that of Filipsson et al. (namely *Cibicides* spp.). Is there a special reason why the authors chose this particular calibration curve? The same reference also gives curves for other genera (e.g. *Uvigerina* spp.; figure 9b) and the references named by Filipsson et al. all list results for genera other than *Bulimina*. I don't think there is a published calibration for *Bulimina*'s so far and therefore, I suggest that either the authors either do not plot and discuss their results in relation to the *Cibicides*-curve of Lear et al. (2002) or that they include other calibrations in their figure 8 as well. Also, figures 5 and 8 may better be combined into one.

There are some references missing in the discussion on the relatively high variability of Mg/Ca ratios (section 4.4). Anand and Elderfield (2005) and Sadekov et al. (2005) show that Mg/Ca ratios display much higher variabilities than other trace elements (e.g. Sr) between and within specimens. In the latter's figure 3, high values of Mg can easily be 10x higher than minimum values. Could this be an explanation for the high Mg/Ca values at 4°C? If not, please discuss in the light of 'natural' Mg-variability. There is also a paper on Mg/Ca from cultured benthic foraminifera (Dissard et al., 2010) showing that there is no significant difference in the Mg/Ca from calcite grown at 10 and 20 °C. Please include in the discussion.

Since the Introduction starts with the application of foraminiferal calcite in paleoceanography: could the authors discuss the implication of their results for the use of calcitic Mg/Ca and $\delta^{18}\text{O}$? Do the ontogenetic trend in $\delta^{18}\text{O}$ and the large overall variability in Mg/Ca from this study change the way benthic foraminifera are used as proxies?

C6

Perhaps tables 2, 4 and 5 could be added to the paper as appendices.

Literature

Anand P, Elderfield H, 2005. Variability of Mg/Ca and Sr/Ca between and within the planktonic foraminifers *Globigerina bulloides* and *Globorotalia truncatulinoides*. *Geochemistry, Geophysics, Geosystems* 6(11).

Dissard D, Nehrke G, Reichart GJ, Bijma J, 2010. Impact of seawater pCO₂ on calcification and Mg/Ca and Sr/Ca ratios in benthic foraminifera calcite: results from culturing experiments with *Ammonia tepida*. *Biogeosciences* 7: 81-93.

Lear CH, Rosenthal Y, Slowley N, 2002. Benthic foraminiferal Mg/Ca-paleothermometry: a revised core-top calibration. *Geochimica et Cosmochimica Acta* 66(19): 3375-3387.

Sadekov AY, Eggins SM, deDecker P, 2005. Characterization of Mg/Ca distributions in planktonic foraminifera species by electron microprobe mapping. *Geochemistry, Geophysics, Geosystems* 6(12): Q12P06, doi:10.1029/2005GC000973.

Interactive comment on *Biogeosciences Discuss.*, 7, 351, 2010.

C7