Review paper

Reconciling single chamber Mg/Ca with whole test $\delta^{18}O$ in surface to deep dwelling planktonic foraminifera from the Mozambique Channel

by J. Steinhardt et al.

The paper of J. Steinhardt "Reconciling single chamber Mg/Ca with whole test $\delta^{18}O$ in surface to deep dwelling planktonic foraminifera from the Mozambique Channel" is supposed to be published in "Biogeosciences". Primary goal of the submitted paper is to reconstruct calcification and migration patterns of various planktonic foraminiferal species based on single-chamber Mg/Ca and single foraminiferal test $\delta^{18}O$ and $\delta^{13}C$. Sample material is from a deep (~2.250 m) sediment trap from the Mozambique Channel. The novel analytical results have been supported by a convincing depth-resolved mass balance model. The overall topic is of quite large interest to the paleoceanographic community, which is commonly using foraminiferal tests as biotic carriers for geochemical proxy parameters.

The manuscript shows that the authors spent quite a lot of work into this study, and the results for sure deserve publication. The paper is very well-written, concise, and clearly structured, and the figures are mostly of high quality. Error calculation and statistics are exemplary!

Nonetheless, I hesitate to recommend this paper for publication without explicit improvement and thorough revision. First, the manuscript is very complex, and it affords very thorough reading. It could gain from shortening by leaving out the last chapters on foraminiferal $\delta^{13}C$. Second, the advantage to infer calcification and migration patterns of planktonic foraminifers from deep (>2000m) sediment trap material raises criticism as long it is not shown that results clearly differ from studies based on sediment surface material directly from below the trap. Sediment surface material should in fact be available in this region! Also and in particular with respect to the foraminiferal Mg/Ca data, it needs at least to be discussed whether and how foraminiferal Mg/Ca could have been altered by calcite dissolution processes during settling from the ocean surface to depths below >2000 m. Overall, the study pinpoints the necessity to strengthen efforts to carry out plankton net studies. Third and similarly important, the author should cautiously avoid any suspicion on plagiarism. Large parts of Chapter 2 (Oceanographic setting) and Chapters 3.1, 3.3, and 3.4 were one-to-one taken from Steinhardt et al., 2014 (Marine Micropaleontology 113, 20-33). Plagiarism in science, in fact, is an important issue and is very precisely defined. Official guidelines should be considered by the author.

In the following, I added a few comments and suggestions that may be useful to the author to improve the manuscript:

Abstract: The abstract needs to be shortened and focussed. Avoid "too long" introductory passages. Avoid repetitions as "Here we present….".

Methods Chapter, p. 17265, line 4: Provide exact information on $\delta^{18}O_{sw}$ database from the South Indian Ocean: chart, table, e.g. in supplement.

Chapter 4.1: Although the Mg/Ca data were already published in Steinhard et al. (2014), a diagram summarizing those results would have been helpful.

Conclusions: Change the ordering of conclusions. First, describe $\delta^{18}O$ and Mg/Ca, then $\delta^{13}C$, in accordance with the structure of the paper.

Further:

Fig. 1: I would suggest to present a detailed chart showing the eddies in the Mozambique Channel in much higher resolution, e.g. as seasurface height anomaly map or so. The overview chart could then be taken as inlet. Also, the exact positions of the sediment trap PP5 and the CTD location Imc5A need to be shown in detail. Provide info on: How large is the distance between both: 0.3° = 20 nm? How is that in relation to the diameter of an eddy (~300 km?).

Fig. 2: Provide regression line for *G. scitula*.

Fig. 4: I would recommend to use different symbols for different species. The author should clarify in the figure caption whether the data – at least parts - were published elsewhere. Add an introductory sentence summarizing the intention of the figure.

Fig. 5: The figure caption should appear more self-explanatory and should provide more information on how the temperatures were calculated. Refer to the text or provide equations/references. Legend could be taken out, if the according information would be included into the figure caption. Add an introductory sentence on the intention of the figure.

Fig. 6: Symbols are difficult to distinguish! Make larger. Enlargen fond! Indicate in figure caption, which symbol belongs to which species (squares = *N. dutertrei*?). Indicate what the large boxes mean: calcification depth ranges, color-coded for different species (green = *G. scitula*?)? Colored frames of boxes should be thicker. Check figure captions for typos. Add a introductory/summarizing sentence, e.g., “Apparent calcification depths of species are generally shallower during non-eddy conditions”.

Fig. 7: Although this figure is very complex, it nicely brings together the major outcome of this paper. Unfortunately, the figure/labels/symbols are much too small and the authors need to find a way to considerably improve the figure. The many legends may be taken out and explained in the figure caption.

Reference list: The list is not yet complete and should be checked (e.g., Hut et al., Regenberg et al.). The list would gain from additions of still missing important contributions of others to the topic.

The paper should include a statement, in which databank the data will be electronically stored.

Page 17268, line 11: Must be Eq. 3 instead of Eq. 4
Page 17268, line 21: Full stop missing after *G. scitula*.
Page 17268, line 24: Must be Eq. 3 instead of Eq. 4
Page 17268, line 11: Consistently use the term T_{iso} or $\delta^{18}O$-derived temperature in text and figures.
Page 17269, line 27: If I interprete Fig. 6 correctly, the calcification depths of *N. dutertrei* range between ca. 20 m and 130 m (blue squares????). Overall, the specifications of calcifications depths in the text should be congruent to what is shown in Fig. 6.
Page 17272, line 10: check wording of sentence!
Page 17273, lines 22-24: Support these results by figure or reference. It is not obvious from where these results originate from.
Page 17273, line 27: Check for typo.
Page 17274, line 14: Check for typo.
Page 17276, line 7: Check wording.
Page 17279, line 7: Check for typo.
Page 17279, line 13: Check for typo and wording.
Page 17282, line 17: Change FS into R/V.
Entire text: Stay consistent with wording: either foraminiferal “test” or “shell”.