

Interactive comment on “Mg/Ca, Sr/Ca and stable isotope from planktonic foraminifera *T. sacculifer*: testing a multi-proxy approach for inferring paleo-temperature and paleo-salinity” by Delphine Dissard et al.

Anonymous Referee #2

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Review of “Mg/Ca, Sr/Ca and stable isotope from planktonic foraminifera *T. sacculifer*: testing a multi-proxy approach for inferring paleo-temperature and paleo-salinity” by Dissard et al. for Biogeosciences

Dissard et al. utilize a North-South transect of plankton tow samples of *T. sacculifer* from the eastern side of the tropical/subtropical Atlantic to develop new calibrations for temperature and salinity based on Mg/Ca, Sr/Ca, and $\delta^{18}\text{O}$. They develop a new SST calibration based on Mg/Ca ratios, and one based on both Mg/Ca and Sr/Ca that also accounts for the slight influence of salinity on Mg/Ca ratios. They also develop a

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calibration to reconstruct $\delta^{18}\text{O}_{\text{sw}}$ and salinity based on measured calcite Mg/Ca and $\delta^{18}\text{O}_{\text{c}}$.

Overall, I find this paper to be confusing, not overly novel, and missing key related studies:

As the authors point out, their Mg/Ca-SST calibration results in similar a similar regression to studies published by Nurnberg et al. 1996. What makes this present study novel is their attempt to combine Mg/Ca and Sr/Ca measurements to further improve the SST calibration by accounting for the minor influence of salinity. However, it is not until section 4.2 that the basis for including Sr/Ca is explained. This should be put in the introduction of the paper, and more emphasis should be placed on this. I am concerned though because in lines 224-240, when Mg/Ca and Sr/Ca are combined, it is unclear how this is done. I do not understand how the combined regression was created, and how an R-squared of 0.92 is obtained.

The paper does not mention the Bayesian calibration for *T. sacculifer* from Tierney et al. (2019, *Paleoceanography and Paleoclimatology*). For completeness, I think an examination of this calibration should be included in the paper. Also, the study of Gray and Evans 2019 is discussed on lines 260-266, but then not used in the comparisons later in the paper. Both of the calibrations for *T. sacculifer* from these two studies should be used later on in the paper when the different available calibrations are compared for “reconstructions”.

There is no mention of the study by Thirumalai et al. 2016 (*Paleoceanography and Paleoclimatology*) that developed a program called PSUSolver that uses a similar Monte Carlo approach to propagate the error of Mg/Ca and $\delta^{18}\text{O}_{\text{c}}$ measurements for $\delta^{18}\text{O}_{\text{sw}}$ convolution.

I find the section 5 on “reconstructions” to be confusing. The authors go through an exercise of trying to determine the best Mg/Ca calibration to use, and then use Nurnberg et al. for their “reconstruction”. I do not understand why they do not use the Mg/Ca

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calibration they created in the current paper? I also find their use of “reconstruction” to be confusing. Paleoceanographers tend to use the term reconstruction for the creation of a long-term record. I think a term like “calibration testing” would make more sense for what the authors are trying to do. The term “successive reconstructions” is also found throughout the paper, but I don’t think this is the correct term.

On lines 241 the authors discuss the relationship between Mg/Ca and Sr/Ca and salinity, but these relationships are not shown in any figures. I think these would be useful figures to include.

The equation shown on line 250 should be solved for Mg/Ca and put into the same form as the equation on line 259 to enable comparison of the two equations.

Lines 580-587 are a duplicated of lines 569-576.

Table 2: it says 5 to 9 specimens per station but on line 165 it says 5 to 8 were used.

Throughout the whole paper, the 18 is $\delta^{18}\text{O}$ needs to be superscript.

In table 1, it says World Ocean Atlas 2005 was used, but this is a quite old version of WOA.

In table 3 and 4, decimals should be used instead of commas.

Figure 1 – I think it would make more sense of a map of temperature was used rather than the gridded $\delta^{18}\text{O}_{\text{sw}}$ product. Also, the color bar needs to be labeled with units. I would also try to avoid using a “rainbow” colorbar.

Figure 4 and 5: the d needs to be replaced with the delta symbol on the axis labels

The title of the paper does not seem to be grammatically correct. It needs the word “the” between “from” and “planktonic”. I would also say $\delta^{18}\text{O}$ instead of “stable isotope” to make it more specific.

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