Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-355-AC1, 2019

Biogeosciences Discussions

Interactive comment on "Vertical distribution of planktonic foraminifera in the Subtropical South Atlantic: depth hierarchy of controlling factors" *by* Douglas Lessa et al.

Douglas Lessa et al.

dvolessa@id.uff.br

Received and published: 13 November 2019

We thank Dr. Antje Voelker for her review, which will help to improve the manuscript. We have carefully read the comments and we tried to answer all queries clearly and concisely. We also checked carefully the supplement of the comment and all found small issues will be corrected in both main text and appendix.

Lessa and co-authors analyzed the planktonic foraminifera fauna in vertical plankton tows along a transect crossing the subtropical South Atlantic where a dearth of such data exists. They correlate the faunal observations to physical and chemical water column data to unearth water mass specific assemblages and environmental properties

controlling species presence/abundance. In addition, they infer average living depths for the foraminifera species encountered. This study is an important contribution to our understanding of planktonic foraminifera diversity and environmental conditions controlling their presence and abundance in different regions of the world oceans. The paper is well written and well-structured and I do not have any major comments. My comments -listed below- just point out small improvements. There are a few grammatical issues in the listed that I marked in the uploaded pdf file. Many of them occur in the Appendix with the species description.

One important correction is in the first paragraph of the Conclusions: it needs to say "assess" instead of "access".

R: The requested correction will be done.

Specific comments: 1) Figure call-outs/ order of Figures: a) Figure 4 (p. 4, line 28; p. 5, line 30) before Figure 3 (p. 5, line 51).

R: In order to organize the order of figures, we will insert the sea surface height variation on figure 2 as a new panel and we will update each panel call-outs of the figure 2 along the text.

b) Figure 6 is only referred to in the discussion (p. 9, line 21) and thus after all the others.

R: We will carry out some modifications in this part of the text in order to insert Fig. 6.

2) For the reader it would be helpful if the Results would have sub-headers, i.e. the lengthily text gets subdivided.

R: Sub-headers will be inserted in the results section.

3) relationship between pH values and planktonic foraminifera: this relationship or better said the indirect relationship that you infer between organic carbon degradation, microbial respiration and pH needs more explanation and references supporting this.

In general, I am missing a text "justifying" why including pH in the CCA makes scientific sense (and is not just done because the parameter was measured).

R: We thank Dr. Voelker for her comment. We consider pH as an important parameter to be evaluated since this parameter is closely linked to CO2 chemistry (Clayton et al., 1995), whose one of main natural factors is the biologic respiration (Hofmann et al, 2011). The pH has also been evaluated in studies focusing not only the current ocean acidification, but also reconstruction of CO2 levels by pH proxies (Manno et al, 2012, Rae, 2012). Our data showed a zonal variation of the pH opposed to the total chlorophyll-a, with effect over planktonic foraminifer's community composition at the permanent thermocline (Fig. 2a, 2e, 7). Then, the pH can help to identify habitats and environmental processes that could determine the distribution of species at the permanent thermocline layer. We will add more explanation about the importance of pH in the Material and Methods section.

4) p. 2 lines 26-27: it would be helpful (for future studies), if you could specify which are the relevant environmental parameters and depth ranges a study should cover.

R: The requested statements will be done

5) p. 3 1st paragraph: please provide details on the CTD manufacturer (Seabird??) and the sensors used to measure oxygen, chlorophyll a and pH. Identifying the particular sensor is also relevant information for the data uploaded to Pangaea, so that other uses (or oceanographic databases like GLODAP) can judge the quality of the data.

R: Information about the CTD's manufacturer and sensor types will be inserted at Material and Methods section.

6) p. 3 lines 28 and following: include here references to the appendix and the plates. The same could be done in the first paragraph of the Results.

R: References for the appendix and plates will be added

7) p. 5 line 7: you are not delimitating water mass boundaries, but the mixed layer and

the permanent thermocline. R: "water masses" will be replaced by "mixed layer and permanent thermocline" at this part of the text. 8) p. 5 line 10: DO anomaly: mention here why you calculated it and how (just mention the "how" in the figure caption is not enough).

R: Information about the calculation of the DO anomaly plot will be inserted at this part of the text.

9) p. 5 line 12: I would point out that station 202 is in the Benguela upwelling, i.e. make it easier for the reader.

R: We will insert "Benguela region" inside brackets at this part of the text.

10) p. 6 line 1: List the names of the cold water species and specify if you mean the adult or total fauna. I have trouble following your argument/ seeing this in Fig. 3b.

R: The requested corrections will be carried out.

11) p. 6 line 15: refer to Fig. 4 at the end of the paragraph.

R: The Fig. 4 will be cited at the end of the paragraph.

12) p. 6 last paragraph: please refer to Cluster numbers for the different oceanographic provinces/faunas. Relating Table 3 to Figure 7 is not easy. I would also recommend to provide the province/fauna information together with the cluster number in Table 3, especially as subsequent cluster numbers do not necessary refer to the same province/fauna.

R: The respective clusters will be inserted in brackets after the fauna entries. The final faunal groups will be inserted in the first column of the table 3.

13) p. 6 line 52: it would be good if you sometimes specified again that you mean the permanent thermocline when you write thermocline.

R: For better clarification, we will check all thermocline entries and we will specify them

as “seasonal” or “permanent” thermocline. We will also highlight that the “thermocline group” refers to “communities below the seasonal thermocline” for better clarification.

14) p. 7 line 15: correct/complete the Morey references.

R: The reference will be updated at this part of the text.

In line 17, can you provide a reference for the influence of temperature on respiration and growth rates?

R: The reference Sandnes et al (2005) will be inserted at this part of the text.

15) p. 7 line 49: specify here (or earlier; see comment 3) how respiration contributes to pH and in which direction the change is – does higher respiration cause a lower pH?

R: More information about the relationship between microbial activity and pH will be inserted at this part of the text.

16) I would have liked to see in the manuscript short comments on/references to: a) how does the Agulhas leakage fauna you identify compare to the one defined by Peeters et al. (2004; Science) or seen in the Loncaric (2006) paper you are citing?

R: We will add a short comparison between our Agulhas Leakage fauna and the ones from Peeters et al (2004) and Loncaric (2006) at the cluster analysis paragraph.

b) may be highlighting that your Benguela upwelling fauna includes few G. bulloides, the species most often associated with upwelling.

R: We will insert information about the small contribution of others cold water species linked to Benguela fauna at page 7.

c) can you specify/distinguish if the shape of (some of) your G. truncatulinoides specimens agrees with the shape of sp. 3 (or others) defined by de Vargas et al., 2001. Pleistocene adaptive radiation in Globorotalia truncatulinoides: genetic, morphologic, and environmental evidence. Paleobiology 27, 104-125. It looks to me as if the speci-

mens depicted in the plate could belong to sp. 3. However, the presence of right coiling specimens in your samples would point to the presence of sp. 2 as well. You could mention that in your species description in the appendix.

R: A short comment about the genetic type (cryptospecies) will be inserted at G. truncatulinoides description in the appendix A.

Supplement pdf: RC1 comment: Figure 1b: station 193 or 293:

R: This station is defined as 193 in the cruise report (Karstensen et al., 2016). Based on this, we will keep the current station numbering.

References Clayton, T. D., Byrne, R. H., Breland, J. A., Feely, R. A., Millero, F. J., Campbell, D. M., murphy, P. P., and Lamb, M. F. (1995). The role of pH measurements in modern oceanic CO2-system characterizations: Precision and thermodynamic consistency. Deep Sea Research Part II: Topical Studies in Oceanography, 42(2-3), 411-429. Hofmann GE, Smith JE, Johnson KS, Send U, Levin LA, Micheli F, et al. (2011) High-Frequency Dynamics of Ocean pH: A Multi-Ecosystem Comparison. PLoS ONE 6(12): e28983. https://doi.org/10.1371/journal.pone.0028983 Karstensen, J., Speich, S., Morard, R., Bumke, K., Clarke, J., Giorgetta, M., Fu, Y., Köhn, E., Pinck, A., Manzini, E., Lübben, B., Baumeister, A., Reuter, R., Scherhag, A., de Groot, T., Louropoulou, E., Geißler, F., and Raetke, A. (2016). Oceanic & atmospheric variability in the South Atlantic Cruise No. M124. DFG-MARUM, Bremen, 59 p. Lončarić, N.(2006). Planktic Foraminiferal Content in a Mature Agulhas Eddy from the SE Atlantic: Any Influence on Foraminiferal Export Fluxes?, Geologia Croatica, 59(1), 41–50. Manno, C., Morata, N., and Bellerby, R. (2012). Effect of ocean acidification and temperature increase on the planktonic foraminifer Neogloboquadrina pachyderma (sinistral). Polar Biology, 35(9), 1311-1319. Peeters, F. J., Acheson, R., Brummer, G. J. A., De Ruijter, W. P., Schneider, R. R., Ganssen, G. M., Ufkes, E., and Kroon, D. (2004). Vigorous exchange between the Indian and Atlantic oceans at the end of the past five glacial periods. Nature, 430(7000), 661-665. Rae, J. W. (2018). Boron isotopes in foraminifera: Systematics,

biomineralisation, and co 2 reconstruction. In Boron Isotopes (pp. 107-143). Springer, Cham., 107-143.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-355, 2019.