On the barium-oxygen consumption relationship in the Mediterranean Sea: implications for mesopelagic marine snow remineralization

Authors: Jacquet et al.

Response to Referee #2

The authors present new data concerning the relation between biogenic barium (Baxs), the O2 consumption and prokaryotic heterotrophic production (PHP) in the Mediterranean Sea. The purpose of this paper is to improve our understanding of the relation between barium and oxygen and to test the validity of the Dehairs transfer function in the Mediterranean Sea. This relation has never been tested in the Mediterranean Sea. They also investigated further the relation between PHP and Baxs distribution. I think the paper has nicely approached these issues with their new dataset. Although I think the dataset and the statistics of the study are weak and the paper is missing some important information.
Reply: As also reported by Referee #1, we agree that statistical analyses are needed to reinforce the ms.

Nevertheless, such information is still valuable for the community and may help to improve our understanding of barium cycle in the ocean. I would recommend the manuscript for publication in Biogeosciences.
Reply: great!

However, I list issues below, which I think the authors should consider in their revision: My main concern for this paper is that the authors conclude that there is strong relationship between Baxs and JO2 rates and that the transfer function can be apply with no restriction in the MedSea. The authors should be more moderate about these statements considering that there are not that many data and the lack of statistical analysis for these relationships.
Reply: we should indeed add statistical analysis and moderate/reformulate our conclusion.

Indeed, linear regressions in figures 2b), 3a) and b) should take into account the errors bars. The errors on the slope and intercept should be shown, as well as the p value to show if the relations are significant.
Reply: error bars and p value are added in Fig. 2 and 3

On figure 2a), only data from KEOPS 2 are considered for the regression. The regression should take all the data (KEOPS 1; KEOPS 2 and PAP). Error bars of these data should be taking into account. Then, a 95% confidence interval could also be added to show that the ANTARES data point is in that interval.
Reply: the aim is to compare KEOPS1 regression and our new MEDSEA data. KEOPS2 data are compared to KEOPS1 in Jacquet et al., 2015.

Concerning the JO2 from optode vs JO2 from Baxs (Figure 3a and the associated paragraph (lines 198–203)), the fact that the intercept matches the background is an interesting feature. However, this feature is biased by the fact that the regression is taking into account the value at 1000m (130pM). Indeed, this value from 1000m is used as the background and then use in the regression to prove that the background is close to 130pM. It is a circular reasoning. Indeed, this value (1000mâˇAˇT30pM) forces the regression and so should not be used for that regression. The regression should take only value at 175m, 250m and 450m. The error bars for these values should also be taking into account in that regression. Errors on the slope and intercept should be provided especially if you are discussing the fact that the intercept match the background value.
Reply: even if we remove the value at 1000 m, bkg reaches a very close value, not significantly

different, i.e. 141 pM. 130 pM is an artibrary value, taken looking at profiles shape (i.e. value reached below 500 m at DYFAMED and ANTARES). It is reasonable to keep it in the regression.

In this figure, it will also be interesting to see the data from the Southern Ocean (Dehairs et al., 1997) and the North Atlantic (Lemaitre et al., 2018) as a comparison.
Reply: comparison with Dehairs data is now done in Fig3c.

For the JO2 Ba vs JO2 measured relationship (figure 3b), the authors say that MedSea data are 3 times higher than KEOPS data. And there is only one point for the MedSea with important error bars. Considering all of that it seems hard to say that the MedSea show the same relationship than the Southern Ocean and even more saying that this support the universal validity of the Dehair's transfer function. Maybe a 95% interval would be useful in this figure too. This interval would show that the ANTARES value is good agreement with the relationship from KEOPS data. More data would be needed to state the universal validity of the Dehair's transfer function.
Reply: we re-worked on correlations, and provided statistical analyses. We added missing errors bars and comparisons between med Sea and SO data. We also added discussion on Background values.

Concerning the analyses part, different information is missing. First, only few information is provided on how pAl data have been generated. The authors should provide more information on the sampling, the analysis of these data and their accuracy.
Reply: the sampling and analysis parts have been completed with more details.

Moreover, the authors should elaborate why and how pAl used to correct Ba from the lithogenic fraction would help the reader. The authors do not provide any references for the measurement of the O2 consumption rates. More explanations and references are needed to help the reader understand how these data have been generated. Please also explain how from oxygen concentrations you obtain the consumption rates (linear model calculations), maybe with equation. Provide the accuracy of these data. In the same way, more information and references on PHP measurements and why PHP are interesting to compare to Ba and O2 (in the introduction) will make the rest of manuscripts easier to understand for the reader. Also the accuracy these data should be provided. In the manuscript and figures, different units are used the O2 consumption data, please verify and unify.
Reply: we added the necessary references for Al corrections, for O2 measurements and calculations, as well as for PHP. Units have been verified.

Finally, the data are never shown in tables, data should be presented in tables in the manuscript or at least in supplementary materials.
Reply: as also reported to referee #1, a supplementary table is not necessary and Figures have been completed.