Biogeosciences

Discussions

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Interactive comment on "On the barium-oxygen consumption relationship in the Mediterranean Sea: implications for mesopelagic marine snow remineralisation" *by* Stéphanie H. M. Jacquet et al.

Anonymous Referee #2

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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. 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. 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. 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. 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. 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 (1000m≈30pM) 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. 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. 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.

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. 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.

Finally, the data are never shown in tables, data should be presented in tables in the manuscript or at least in supplementary materials.

Specific comments:

Line 40: "In essence, the biological C pump is termed for the numerous processes involved in maintaining the vertical gradient in dissolved inorganic C." this sentence is not clear, please rephrase.

Lines 55–63: More references about the use of Baxs and recent studies about it will make this paragraph stronger.

Line 67: if this function has been "widely used", more than two references are expected, please add more references or change widely.

Line 68: "has never been tested in other oceanic provinces" is in contradiction with "widely used" and Lemaitre et al., 2018 used it in the North Atlantic. Please clarify.

Line 68 "significant progresses" what kind of progress? Please elaborate.

Line 69: "made in relating", not correct, it should be changed to "related to" or "In relation to"

Line 71: "related with" should be replaced by "related to".

Lines 71–73: how Baxs and PHP are related? What is the temporal progression of POC reminaralisation processes? Line 72: "the rate of change with depth" is not clear, please rephrase.

Line 75: "to derived JO2" should be replaced by "to JO2 derived"

Line 77: "convergence" is probably not the right word here maybe "agreement" would be better

Line 80: "Mediterreanean Sea" should be replaced by "Mediterranean Sea"

Lines 81-83: How the MedSea is different from the other studied regions? Please provide the fluxes from the cited references.

Line 84: "reviewing unsolved issues" should be rephrased

Line 116: "closeby" should be replaced by "close by"

Line 118: "Teflon" should be replaced by "Teflon"

Line 119: "After evaporation close to dryness" is not clear, does this mean that samples are almost dry? Please rephrase Line 124: "the sea-salt particulate Ba contribution was found negligible", what is the % of sea salt in samples? Line131-136: please provide more information and reference for this paragraph. Also explain the calculations

and/or show the equations to get the JO2-Opt. Line 137: "Over the time course experiments" should be "Over the time course of the experiments" Line 149: "pAl are low", please compare to literature data and reference for this statement.

Line 151: "distributed over different", one word is missing.

Line 154: "Baxs is mainly composed of barite formed during prokaryotic degradation of organic matter." Please add a reference for this statement.

Line 157: "background value of around 130 pM" Are values below 1000m constant? Why this value is lower than the southern ocean?

Line 160: "the Ba background" is this Ba or Baxs? Please make sure that all the occurrence of Ba and Baxs are the right one in all the manuscript.

Lines 165–166: How do you explain this differences in absorption between BARMED and ANTARES ?

Line 173: "centred" not clear, please rephrase

Lines 174–175: please elaborate the use of Depth-weight average

Line 177: "PHP100/500" this notation is different in figures and in the rest of the manuscript please unify all these notations

Lines 177–179: This sentence is not understandable, please rephrase

Line 209: Please justify why you choose 17450 in equation 1.

Line 210 : "confronted" should be replace by "compared"

Lines 240-241: How the Baxs will help to better balance the C budget in the MedSea ? Please elaborate that part.

Line 266 please precise the background value.

Line 267 : "(b) ANTARES ratio plot (green square) of integrated PHP in the up-

per 100 m over integrated PHP in the upper 500 m versus depth-weighted average (DWA)mesopelagic Baxs (pM) over the 150- 500 depth interval." is not clear it could be replace by "(b) ANTARES (green square) integrated PHP in the upper 100 m over integrated PHP in the upper 500 m versus depth-weighted average (DWA) mesopelagic Baxs (pM) over the 150- 500 depth interval"

Line 274: "confrontation" should be replaced by "comparison"

Line 277: unnecessary bracket.

Figures: Figure 1 c): The unit for missing potential temperature is missing. Some numbers are missing/hidden on the potential temperature axis.

Figure 2a): it would be great to see the profile deeper to see if the background stays constant below 1000m. pAl concentrations data don't have error bars, if not shown the errors should be described in the manuscript.

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