

Review on the manuscript entitled „Beyond the Fe-P-redox connection: preferential regeneration of P from organic matter as a key control on Baltic Sea nutrient cycles“ submitted for publication in „Biogeosciences“ by T. Jilbert et al.

This is a very interesting and well-written paper dealing with an important topic in marginal seas. Especially in the Baltic Sea the P-cycle needs more attention when considering the variable redox-conditions and cyanobacteria blooms, respectively. Therefore, I recommend publication in Biogeosciences with only some minor revisions as given in the comments below. In particular, I would like to see some more details about the flux calculations (interference of PO₄ adsorption on Fe-oxides at oxic sites) and at least one statement about the term “Hypoxia” from a geochemical view.

Specific comments:

Abstract: Although, the preferential remineralisation of P seems to be depth dependent, I would suggest putting stronger focus on redox conditions. In my opinion, the apparent correlation with depth is due the site selection. For instance, if you would take samples in the Aland Sea, you will find a water depth comparable to the Gotland Basin but different redox conditions.

Introduction: Very often you are using the term “Hypoxia”. Do you really think that this biological classification is of significant relevance for your geochemical study? In my opinion, this border value of 2 mL/L or about 90 µM O₂ does not change that much for the redox cycles. Obviously it is important for organisms but if you think e.g. about Fe²⁺ it will be oxidized at 1 mL/L or 3 mL/L. Please comment on this also with respect to the Results and Discussion section.

Methods:

In which way did you handle the interference of H₂S during photometric PO₄ determination? Is it possible that you used PO₄ data from the ICP-OES?

Please also add the accuracy of your measurements – only precision is not sufficient. Which reference materials are used?

Concerning the acid digestions:

-Does the acid mixture completely dissolve the sediment at 90°C? Did you use a open or closed system?

- is it really true that you evaporated the acids until complete dryness (“precipitate”)? Such a procedure would cause the partial formation of “refractory” minerals (e.g. Al oxides) and thus an underestimation of especially 3+ elements.

Results and Discussion:

Chapter 3.1

I miss some details about the calculation of the fluxes (e.g. possible sources of error), which can be added for instance in the methods section. At oxic sites, I am uncertain whether the calculation really works only by using the bottom water and uppermost pore water value. In which way did you

consider that some upward diffusing PO₄ is possibly trapped by Fe oxides between 0.5 and 0 cm?
Please comment on this.

What is the reason for the extremely high bottom water concentrations of PO₄ at sites F80 and GOF6 (Table A)?

Chapter 3.2

In Figure 1 and Table A you show some sites which are not included in Fig.5. What is the reason for this selection?

P667/L5: Do you see any indications for preferential release of P related to C and N in deeper sediments? This older material should have other C:P and N:P ratios.

P667/L11: As shown by Dellwig et al. (2010) GCA, vertical PO₄ profiles are influenced by strong coupling to the cycles of Mn and Fe at the redoxcline. Therefore, it is important to know the position of the sediment traps and the O₂ concentration as the relation between Mn, Fe, and P is restricted to a limited depth interval.

Chapter 3.3

This chapter appears like a review and I miss supporting data from the present study. Therefore I would suggest some shortening.

Chapter 3.4

P672/L22: Site LF3 appears a bit different when compared with sites LF1 and 2 (Fig. 8).

Chapter 3.5

I would like to see a bit more discussion about upwelling e.g. in the Gotland Basin, which is likely of importance for the P cycle (e.g. Nausch et al. ECSS 2009).

Table A: Bottom water oxygen concentrations should be added. It is a bit difficult to see them in Fig. 2.

Fig. 2: What is the reason for some SO₄ scattering? Analytical errors or artifacts during sampling?

Fig. 3c: Is it really possible to calculate Fe fluxes for oxic sites with your method?

Fig. 4a: Which year?

Fig. 4b: Is the upper gradient due to diffusion or oxidation of Fe²⁺? What is Fe-P, iron bound P?

Fig. 5a: Where are the fluxes of sites 1-7?

Fig. 7: Please exchange "Corg and Porg concentration data" by "Corg and Porg contents".