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Biogeosciences Discussions

Interactive comment on "Benthic phosphorus and iron budgets for NW-African slope sediments; biogeochemical processes and the importance of bioturbation" *by* K. Küster-Heins et al.

Anonymous Referee #3

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This study investigated controlling factors for the benthic behavior of P and its general distribution in sediment-pore water systems. Pore water data and results from sequential sediment extractions indicate a close relationship between the benthic cycles of P and iron in marine sediment samples.

I have the following general comments that should be addressed before this paper would fit well into Biogeosciences:

(1) The introduction part of the manuscript could be strengthened if also the significance of iron, as an important element involved in the cycling of P in marine sediments, is introduced.

(2) Figure 1 and 4 as well as table 2 are redundant and could be explained and integrated to the relevant text parts. In general, the amount of 7 tables and 8 figures is too much for this manuscript.

(3) The figure and table legends are in part a bit sloppy. They should have a concise but descriptive legend which describes the content figure/table in more detail, e.g. Table 1: What is meant with surface carbon and CaCO3? What does the number (. . .-3 and so on) following the GeoB sites means (same for Figure 2)?; Table 4: What are the mean values are based on (total core length?)?; Figure 2: The legend is not consistent with chapter 2.2. The authors should be more specific according to results obtained from squeezer and rhizons (e.g. GeoB 9510).; Figure 3: The caption is too short and for better comparison same scales for x-axes should be used.; Figure 5 and 6: All symbols and abbreviations used in the figure must be defined (e.g. Fetot, PCDB, Fetot-CDB, symbols for TOC and C:P ratio).

(4) As no oxygen profiles were measured by the authors, expected penetration depth of oxygen and literature data should be added to support the discussion about the relevance of oxygen in general and the potential zone where re-oxidation processes may occur (chapter 4.1).

(5) The authors mentioned in chapter 2.2, that results obtained from squeezer samples were underestimated caused by high sensitivity of ferrous iron to oxygen. I can not follow this argumentation because samples were operated under anoxic conditions in a glovebox (p. 5377,l. 13). However, squeezer samples are not used for further calculations and discussions and thus, results and method should be omitted.

(6) The authors gave no methods for drying and milling of sediment samples (see specific suggestions). However, if sediment samples were dried and milled under oxic conditions, I have concerns that sequential extraction of sediment samples gives authentic values for remaining pore water P and reducible/reactive Fe-bound P as ferrous iron is very redox sensitive and co-precipitation of P may occur. Thus, the first would

be extremely underestimated and the latter would be overestimated. I would suggest weakening your statements or add supportive data and references.

(7) I think it would be worthwhile to consider the implications of the findings beyond this study site. Would these results apply to all marine sediments? Are there any implications for the C cycling in the sediment or the P and Fe cycling in the overlaying water body?

Some specific suggestions for improvement are given below (usually by page: line):

5377:9 Please provide more information about filtration of water samples (e.g. pore size of filter material).

5377:12 correct spelling of "squeezer" (check whole text!)

5378:15 What do you mean with $\sim$0.4 μm?

5378:16 The wet bulk density is calculated by mass of wet sediment divided by volume of wet sediment and values for sediments and soils are typically above 1. Please check your calculations.

5378:22 Method for GeoB 9510 and 9519 is given in the text but how did you examine the solid-phase speciation of P for GeoB 9518?

5378:29 Please provide more information about drying and grounding the samples (e.g. temperature, oxic or anoxic conditions).

5380:15 There is just one visible maxima of phosphate over depth in Fig. 2, respectively.

5382:2 A discussion why the 14C age determinations do not display a linear increase in age with increasing sediment depth is missing.

5382:20 The writing needs to be improved (. . . produced in the C. . .)!

5384:7 How did you measure the oxic zone and what was its distribution?

Table 3 change "reducable" to "reducible"

Table 6 Why did you calculate the diffusive fluxes for both C:P ratios? As presented in Fig. 6, only 350 would be representative for your sites.

Figure 2 As mentioned before, results obtained from squeezer samples did not reflect the in situ porewater concentrations and should be omitted. Caption: A solid line was used to represent pore water concentrations of ferrous iron.

Figure 5 replace solid lines for Fetot-CDB with dashed lines

Figure 7 part B is redundant as you never refer to Catot data in the manuscript

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Interactive comment on Biogeosciences Discuss., 6, 5373, 2009.