

## ***Interactive comment on “Calcium phosphate formation due to pH-induced adsorption/precipitation switching along salinity gradients” by J. F. Oxmann and L. Schwendenmann***

**Anonymous Referee #2**

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This paper presented interesting data for P speciation along salinity gradient in the Firth of Thame estuary and discussed the mechanisms controlling the P transformation and the effects of anthropogenic P inputs on P transformation – formation of less stable Ca-P.

However I found that the paper could be better structured: there is a lot of redundancy in the paper, for example, some parts in the Results section can be moved to discussion (see specific comments). The discussion part is difficult to follow as a lot of less relevant information is presented but not really serves the arguments of the paper. I suggest

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the author better streamline the manuscript and keep focus on the central theme (see also specific comments below).

Specific comments:

1. Abstract: (Line 12-13) “This marked upstream-to-downstream switch occurred at near-neutral pH was enhanced by increased P loads” – This sentence is a little misleading, or not fully discussed in the paper to make it conclusive, if true. My understanding, from the data, is that Al/Fe-P in the P-enriched system is higher and this leads to more transformation of Al/Fe-P to Ca-P with increasing pH (“upstream-to-downstream switch”). However only by comparing the percentage of Al/Fe-P is transformed to Ca-P downstream between P-enriched and P-unenriched systems may lead to such conclusion.

2. Introduction: The introduction reviews the speciation of sediment phosphorus, the mechanism of non-conservative behavior of DRP levels caused by desorption of P from sediments, and the possible controlling mechanisms. The useful references provided are appreciated. However I feel that it’s a little long and could be shortened. I would suggest holding the details for OCP formation kinetics (and/or their indication for P input) for discussion (also see comments below).

Materials and methods:

3. (Page 10238, line 0-5) “It comprised an area exhibiting physical-chemical sediment characteristic very similar to those of the Firth of Thames site. . .(analyzed separately; Sect. 3.4)” – I couldn’t find the analyses in Sect. 3.4. More information about the physical-chemical sediment characteristic for the Saigon River Delta is needed otherwise it’s not convincing that these two systems are comparable.

Results: 4. Be careful about using the term “linear” (Page 10239, line 23) and “exponentially” (Page 10240, line 6) given the large spread of the data, especially for the Al/Fe-P vs. pH plot.

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5. (Page 10240, line 9- 15) I suggest moving this to discussion (or remove if similar statement has been made in discussion).

6. (Page 10240, line 17) "Metastable Ca-P increase exponentially with pH (Fig. 4a)": state that this is only for sediments at 30- 35 cm. How about other depth? Is this statement still true?

7. (Page 10241, line 6- 10) I suggest remove this to avoid redundancy (explanations of results could go to discussion).

8. Sect. 3.5 and Fig. 5: Figure is confusing as different sites and sediments from different depths are mixed together. It looks like Ca-P decrease when pH >7.3, as opposed to what's stated in the paper: "The concentrations of more soluble Ca-P significantly increased with pH". Just need to be consistent between data and description.

Discussion 9. (Page 10242, line 16) I am surprised that salinity had no detectable correlation as the pH and Eh gradients are along with the salinity gradient. Also in Table 1 only Al/Fe-P vs. Salinity is shown. How about Ca-P vs. Salinity?

10. I suggest combining Sect.4.4 and Sect. 4.5 and the discussion here could be substantially shortened or better linked to the data presented. This may apply to other sections as well. For example, it's difficult to understand what's the focus of the paragraph (Page 10247- 10248) and what's the functionality of the paragraph for the story line and the central theme. This is not a review paper so to avoid distraction discussion should be focus on the findings/implications of this paper based on the data presented; only those references relevant to arguments of this paper is needed.

11. Sect. 4.6: I feel that this section should go to intro section, or removed as it doesnot serve the interests of the manuscript as stated in the introduction.

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