

Interactive comment on “The global marine phosphorus cycle: sensitivity to oceanic circulation” by C. P. Slomp and P. Van Cappellen

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We thank Gabriel Filippelli for his comments and provide our response below.

Comment 1

Differential P recycling in the coastal versus the open ocean is indeed accounted for in the model. This can be seen from Table 4 and Figure 2 by comparing the rates of P burial versus P-uptake during primary production for each compartment. Thus, only 0.5% of the P fixed in primary production is ultimately retained in distal sediments while the rest is recycled. For the open ocean, this value is 0.07%. We have now added a statement to make this clearer at the bottom of page 1592 (line 11):

“Notethat the recycling efficiency of P is higher in the open ocean than in the coastal ocean (Table 4).”

Since we do not explicitly include a term for export from surface to deeper waters in the coastal ocean, it is not possible to compare the f-ratio for both environments. The new statement on the recycling efficiency should cover this point sufficiently.

We agree that our model is very well-suited to assess the effects of varying shelf area on the marine P cycle. This aspect is beyond the scope of the present paper, which focuses on the effects of changes in oceanic circulation on the marine P cycle. We currently have a second paper near-completion in which our model is used to assess the effects of separate and concurrent changes in circulation, sealevel and weathering on the marine P cycle on millennial time scales (“Glacial-interglacial variations in the marine P cycle” by Tsandev, Slomp and Van Cappellen).

Comment 2

We agree that there are interesting parallels between the Mediterranean Sea during sapropel formation and the global ocean during oceanic anoxic events. See for example the work from one of us, on sediment P dynamics before and after formation of the most recent eastern Mediterranean sapropel S1 (e.g. Slomp, C.P., Thomson, J., G.J. de Lange, 2002, Enhanced regeneration of phosphorus during formation of the most recent eastern Mediterranean sapropel (S1). *Geochimica et Cosmochimica Acta* 66, 1171-1184). However, we believe that care should be taken in directly comparing our model results for the global ocean to those for the Mediterranean Sea, given the differences in, for example, the relative importance of shallow coastal areas versus deep sea environments.

Comment 3

We agree that increased formation of Ca-P on shelves is not the only factor contributing to the formation of phosphorite deposits. This is why we write that “The transfer of reactive P accumulation from the open ocean to the continental margins, may help explain the massive phosphorite deposits” and that “ancient phosphorites may in part reflect a global scale redox-dependent sink-switching.” To ensure that there is no fur-

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ther misunderstanding, we have added an additional statement on page 1606, line 13.

“Note that formation of phosphorite deposits also involves sediment reworking in order to concentrate the authigenic Ca-P (e.g. Filippelli and Delaney, 1992; Follmi, 1996).”

Comment 4

See our response to comment 1: we have a paper near-completion that addresses the effects of separate and concurrent changes in circulation, sealevel and weathering on the marine P cycle on millennial time scales (“Glacial-interglacial variations in the marine P cycle” by Tsandev, Slomp and Van Cappellen”). We hope that our efforts and those of the reviewer will help raise awareness about the functioning of the P cycle during glacial-interglacial cycles.

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