

Interactive comment on “Evidence for vivianite formation and its contribution to long-term phosphorus retention in a recent lake sediment: a novel analytical approach” by M. Rothe et al.

Anonymous Referee #3

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The authors provide convincing evidence of recent and ongoing vivianite formation in Lake Gross-Glienicke (upper sediment layers of the deepest site of 11 m) by a suite of techniques including a novel approach of combining high density centrifugation with XRD and microscopy. Further, they suggest that iron addition (to bind P) some 20 years ago is the trigger for this mineral formation. This argument is also convincing because no (or very little) vivianite is detected below 23 cm depth (the depth where Fe concentration peaks) even if porewater concentrations of SRP, Fe²⁺, and H⁺ suggest supersaturation in all 30 cm sediment depth. Finally, the authors estimate the contribution of vivianite to the burial flux of P to be 40% and by mentioning that diatom frustules are seen in vivianite crystals they argue convincingly that the vivianite is an authigenic

mineral.

To my knowledge this is the first time that such an estimate has been provided for recent lake sediments. In all, this is a very interesting paper that provides important new knowledge on P diagenesis in lake sediments. The paper is definitely qualified for publishing.

I could not figure out how the number of 40% vivianite contribution to total P-burial was reached. Deeming from Fig. 6a I would say that the number was far less because the bars contribute at maximum 1 mg P g⁻¹ dw of 4 mg P g⁻¹ dw. The calculation of 40% needs further explanation.

Depth profiles (in bulk sediment as well as in high-density sediment) of several elements are provided and used well in the discussion, however, I missed comments on:

- 1) Why is Ca concentration decreasing after the iron addition? Less precipitation from surface water? Is the majority of Ca present as CaCO₃?
- 2) Why is S concentration increased after Fe addition? Was (reduced) S in surplus to Fe in the burial flux before Fe addition?
- 3) Has the redox state of the sediment changed since the iron addition? To which extent is oxidized Fe being buried before and after the Fe addition? Maybe Mn should also be included in Fig. 6 because a general higher concentration could be an indicator of a more oxidized sediment.

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