

## ***Interactive comment on “The effect of organic matter (OM) quality on the redox stability of OM-Fe association in freshwater sediments” by Nana O.-A. Osafo et al.***

### **Anonymous Referee #1**

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In this manuscript the authors aim to understand how OM-Fe associations respond to different chemical treatments in lake sediments, in order to improve our understanding of the fate of OM and Fe in freshwater sediments with different sources and characters. To do so, they characterized OM concentration and composition (using optical approaches), as well as Fe concentrations, for 4 sediment cores taken in a reservoir found in the Czech Republic. They compared the effects of different chemical treatments (water, acid, base) over different times, and found that their simple method allowed to extract different amounts and characters of OM and Fe for sequential and bulk samples. They found that large differences among treatments, and conclude that humic-like DOM was associated to active Fe pools whereas protein-like DOM was as-

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sociated stable Fe pools. They argue that these findings have implications for global change given the expected changes in source, concentrations and quality of DOM fluxes to aquatic environments.

I found the topic of importance, but that the study was insufficiently developed to convincingly support the main conclusions of the manuscript. The manuscript is very short and does not deeply develop the core ideas in the introduction and discussion, and is hard to read in several instances. Overall I found that there was a mismatch between the broad conclusions on the role of the rusty OM sink in the face of global change vs the very specific information provided from 4 cores of a single reservoir (which are some times interpreted as replicates, some times interpreted as 4 independent samples on a spatial gradient). Moreover, given the lack of environmental gradients covered in these 4 cores, it is hard for the reader to appreciate how the authors results convincingly contradict previous findings on the role of DOM composition on the Fe-OM associations. Below I provide more detailed comments.

1- The introduction is very short and very specific, and it is unclear what the broadly interesting knowledge gaps are, and whether the study addresses fundamental knowledge gaps or hope to confirm known patterns with a simpler approach

2- Section 2.3: More details are needed to appreciate the chemical treatments, and what they mean for adequate interpretation of the results. I acknowledge that a reference is provided, but at least the reasoning behind the treatments is needed in this manuscript to understand the coming results. This is important because there is barely any difference among cores (or this is not shown), and from surface to bottom of the cores; most of the variation comes from across treatments

3- L100: I did not understand this sentence, and what the reference actually refers to

4- L102-104: I did not understand what was done

5- L109: But does not pH affect fluorescence?

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6- Paragraph at L131: There is a huge difference among treatments, but without further explanation of what they mean, in the Methods, it is hard to appreciate these findings

7- L154-156: Where is this coming from? No result, or description of the cores was provided to appreciate this statement

8- Section 3.2.1: This section is too superficial and is barely interpreted

9- 3.2.2: same

10- 3.3: Here the authors go at length in describing the PARAFAC components, with a level of details that greatly differs from previous sections. I believe the idea is to interpret how specific components may mean a particular chemical composition, which is then used in the following section to interpret associations with Fe, but the ideas are not explicitly connected in my opinion; there is a leap in the level of information provided by the optical approaches in section 3.3 vs the detailed chemical interpretation provided in section 3.4. For example, on what basis, specifically, can you conclude the following: "The structure of both C1 and C2, however, possesses a redox behavior that makes their reaction with Fe-oxyhydroxide reversible leading to the solubilization of the DOM or both Fe and DOM, with the latter subsequently being biodegradable (Burdige, 2007; Keil and Mayer, 2014)". I am not saying that this interpretation is wrong, but I believe that there is not enough information in the manuscript that supports this interpretation based on the authors findings.

11- L223-225: I do not think these studies have identified C3 specifically (at least they are not presented in Table 1), so this wording is misleading

12- L228-229: What is "appreciable time", and why is it important? Also, it is weird to end the discussion saying that in the end we are not sure what is going on hence more studies are needed, I would suggest concluding on a more "positive" note in terms of your main contributions to this topic.

13- The conclusion overall is interesting to read, but I found it unsupported by the

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results and insufficiently developed in key places of the manuscript. I suggest using sentences from the conclusion as key points (maybe paragraphs topics) that guide the development of the introduction and discussion

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