

Interactive comment on “Iron and aluminum association with microbially processed organic matter via meso-density aggregate formation across soils: organo-metallic glue hypothesis” by Rota Wagai et al.

Anonymous Referee #1

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The paper "Iron and aluminum association with microbially processed organic matter via meso-density aggregate formation across soils: organometallic glue hypothesis" proposed by Rota Wagai and co-authors shows the fundamental role that organo-metallic complexes play for two essential soil functions:

- interactions with OM that contribute to soil C stock and
- their structuring role in aggregation processes.

The soils used allow the hypotheses to be tested on 4 different soils. They allow to test

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different mineralogies and different climates. This work is based on an experimental approach by densimetric fractionation. The number of fractionated samples is very important. The experimental component therefore represents a large-scale laboratory work that seems to have been carried out rigorously.

The results are presented in a very synthetic and clear manner. The article is well written and well structured. The discussion is well conducted and convincing.

I really appreciated this work and I congratulate the authors. It's a fairly original approach that seeks to bring together knowledge on the mechanisms of organo-mineral interactions with aggregation processes. In this sense, it seems to me that it is an innovative approach that certainly deserves to be published without delay. Moreover, this article is one in a series of recent innovative papers that show the importance of poorly crystallized mineral phases and metals in soil C dynamics.

However, there are a few points that I think can improve the paper. My main comments to be taken into account in a revised version are:

- It is essential that the authors provide all data for each fraction of each soil. It is impossible to verify the calculations proposed by the authors, it is impossible to know what are the losses during densimetric fractionation for individual soils, it is impossible to re-use the data for other works. My recommendation is to provide a summary table of all the data as additional information.
- The title needs to be changed because evidence that the organic matter of "nanocomposites" has been biotransformed by the microbial compartment is "light". This argument is only based on the value of C:N which shows quite variable values (shown only in the supplementary informations graphs). Even if the trend is probably true, the authors have not investigated enough to state it with certainty.
- In the introduction, last paragraph: the scientific questions asked must be made explicit.

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In details :

Abstract :

- Indicate the regions of origin of the samples.
- L 24 -27 Sentence too long
- L27 : remove stable : there's no argument that the OM is "stable."

Methods

- The soils choices could be better justified.
- Give more details on the fractionation protocol.
- Explain why the number of fractions is different from one soil to another?
- SPT is very acidic (pH down to 2); what could be the effect of such a pH on the "nanocomposites" ?

Chemical analyses

- Instead of adding weight bas concentration ($Al + 1/2 Fe$) to approximately normalize the atomic mass difference between Al and Fe, working with atomic concentration would be more rigorous!

Peak density determination

- To my mind, "peak density" is a term which is not really appropriate

Result

- I would suggest to first present the data (see previous remark) before presenting the recovery
- L230 Fig A1 : left panel
- L290 : I may add an additional sentence to be sure that the reader understand prop-

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erly the difference between fig 2 concentration and fig 5 distribution

Discussion - L326 what are the "non-centrifugeable colloidal Fe/ Al oxide phases?"

- L328-331 : no data on Si were provided in the result part. (I think you may add a short section also on Si in the results)
- L345 : Is a graph Al:Fe as a function of pH interesting? I would have enjoyed to see it !
- "nanocomposite" could also have been called "nanoCLICS" as proposed by Tamrat et al. 2019.
- Fig 7a : position of the peaks is not consistent with fig 5
- I do enjoy Fig 7 b !

Interactive comment on SOIL Discuss., <https://doi.org/10.5194/soil-2020-32>, 2020.

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