

Interactive comment on “Speciation and distribution of P associated with Fe and Al oxides in aggregate-sized fraction of an arable soil” by X. Jiang et al.

Anonymous Referee #4

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General comments

The authors have done solid work which I think is useful to progress our understanding of the biogeochemistry of P in relation to soil aggregation. A big merit is that they tried to link the distribution of different P forms to soil absorbants, mainly Fe oxides. I believe a refinement of the work would contribute more to the study of the coupling between different soil elements (P, Fe, Ca, etc) in different size classes of soil aggregates. My major concern is about the methodology they used to infer the Fe-associated P in NaOH-Na₂EDTA extracts:

The authors used an indirect method (Fig. 1) to "infer", not measure directly, the P

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fractions bound to Fe oxides. This might be problematic because the pretreatment of soil with oxalate and DCB could have changed the extraction efficiency of NaOH-EDTA. For example, direct extraction with NaOH-EDTA (alkaline) might target for different soil components to that after pretreatment with oxalate (acidic). This can be partly seen from Table S3, where Ca_N (in the extract of NaOH-EDTA) differed greatly from Ca_{ox}. Was it possible that oxalate and DCB attacked different fractions of P to NaOH-EDTA? To partly examine this, I suggest the authors directly extract Fe (with oxalate or DCB) from the residual soil, after first extraction with NaOH-EDTA, and then compare the extracted P from residual soil with their present results calculated by Equ (4)-(6).

In addition, the present discussion did not pay adequate attention to the linkage between aggregate size and various P forms. Although the proportion of P forms was relatively constant, their contents differed with aggregate size. What is its significance for the management of P in arable soils or other ecosystems? The data can be discussed in relation to some ecological issues at broad scales.

Specific comments:

1. P9891, L7-8: The authors should explain why a large amount of orthophosphate (36–41% of total P) was extracted while only a trace amount of Fe was mobilized by NaOH-EDTA.
2. P9892, L2-4: If 43-98% of total Ca was dissolved in NaOH-Na₂EDTA and DCB extracts (Table S3), why did Ca not retain a large proportion of P? Why should Fe be superior to Ca in the holding capacity of P in such an alkaline soil (pH 7.64)?
3. P9893, L4-5: I could not understand how the percent (12-18%) was derived, i.e. why this percent could be attributed to Ca-P?
4. P9893, L22-24: The conclusion should better be more conservative. The released P after treatment with oxalate or DCB was not necessarily attached to the surface of oxides. It might be associated with other agents attacked (e.g. Ca, see Table S3), or

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simply detached from clay surfaces. As mentioned above, the sequential extraction method could be problematic. The acidic oxalate and DCB could mobilize P from soil minerals, and thus the difference between PN and PN-I (or PN-II) was possibly not equal to Fe/Al-bound P in the NaOH-EDTA extracts.

5. Table1: Data presented here probably refer to the results calculated by Equ (1-6). Perhaps it is better to explain this in the title of the table.

6. Figure 3: I am still puzzled by the figure. Were NaOH-P and residual P fractionated into different forms of P like orthophosphate and monoester? If so, the present figure might lead readers to misunderstand NaOH-P and residual P as counterparts of orthophosphate, monoester-P, etc.

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