

Interactive
Comment

Interactive comment on “Soil redistribution and weathering controlling the fate of geochemical and physical carbon stabilization mechanisms in soils of an eroding landscape” by S. Doetterl et al.

Anonymous Referee #1

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General comment

The manuscript represents a very interesting contribution to the understanding C dynamics in eroding landscapes. It aims to clarify the effect on soil redistribution on minerals properties impacting C stabilisation. To reach their objective, the authors have combined investigations of minerals and organic matter properties at different positions and depths along a hillslope transect.

Specific comments

Introduction:

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P16230, I4: revised, or more simply, remove the comment saying that inherent biochemical recalcitrance is related to “poor nutrient” content. Biochemical recalcitrance is much more complex. Depends on microbial metabolic potential, on their needs and on the environment. . . you gave indeed a good view of the current strong debate that is going on a couple of lines below.

Last paragraph of the introduction. You present here your objectives and the methods carried out to try to achieve them. While description of the methods for characterisation of SOC are well detailed, there is no information on the way you characterise the weathering status of soil material. Similar: you mentioned your expectations for SOC properties at the deposit site, but nothing is said about expected weathering status of minerals.

Methods

SOC fractionation: It should be better explained, start by mentioning the fractions of interest for you that will be investigated in the rest of the study. It is not clear for me right now: On the one hand, according to Figure 1, I understand that microaggregates are different from the “s+cm” fraction: Microaggregates are more than 53 microns while s+cm are less. but I don’t understand the meaning of the arrow between the microaggregates and the “s+cm”. On the other hand, according to Table 1, I understand that microaggregate could be the s+cm fraction. Indeed, s+cm is nowhere, whereas the sum of % of bulk SOC in the macro, micro and non-aggregate = 100%. (please check sums: column 1 is 99%)

Modify the title of 2.6. it should be “Age of C” instead of “turnover”

Results

You discuss about C content in pyrophosphate extract p16242, I22. C content for each extract should be given in Results section if this is of interest for discussion.

P16240, I 12 to 20: these results should be in Supplementary Information. The unit

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for the results on aminosugar is not clear. I assume you mean AS-C per g of C in the fraction, instead of AS-C per g of SOC (what refers to bulk total SOC).

Discussion

Could you clarify the fate of organo mineral complexes when eroded from the stable position. Broken apart due to pH?

Discussion on old 14C age is bizarre. According to me, it is not necessary to mention charcoal, or this need to be supported by analysis, NMR for example. If you assume that high AS content in macroaggregate contribute to their stability, it can explain the age. High respiration rate is not contradictory, it just indicate there are different pools of C.

I would not insist too much on the fact that macroaggregates are proper habitat for microbes in conclusion and in the abstract, this is only a suggestion you make according to Denef 2001) and (Kolb 2009). You have no evidence of living microorganisms and you do not know if aminosugar are young or old.

Please correct p16246 “microbial biomass can be found. . . driven by the abundance of C as nutrient source.” C is not a nutrient itself.

Illustrations

Table 1. Give the unit in mg/ g fraction, not in %fraction

Table 5 is not very useful.

Figure 2. To which depth corresponds this Figure? Could you make subpanels for each depth? It would be very useful.

Figure 3: what is really the unit? g per kg of SOC, what refers to TOTAL soil C, or g per kg of C in each fraction. Could you use distinct dots for each location and depth.

Figure 4: does it correspond to the clay size fraction?

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Figure 5: what is the unit? see similar question above. It looks like you do not recover all AS after fractionation. Could provide details about that? Also for parameters relative to minerals.

I really like your new Figure 6. It would still benefit from some improvements. Some suggestions.

- Try to always provide for each location-depth information on (i) amount of secondary minerals, (ii) amount of aggregates, (iii) amount of organo-mineral complexes (you could indicate “isolated by PyroP, to make sure there is no confusion with aggregates).
- Clarify if the information on the level of weathering indicated above or below the soil line should be taken respectively for top and subsoil.
- The distribution of AS in the various fractions is impacted by the size of each fraction at each deposit site and depth. I would suggest another graphical representation if your intention is to show that macroaggregate have a high content in AS compared to other fractions.
- The figure on the top right: What’s about having a vertical line, with the age of subsoil at its right, and the age of topsoil at its left. Or use plot graph instead of cumulative bars.

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