

We are grateful for this reviewer's comments on our manuscript which have greatly improved the quality and readability of our paper. Based on these comments and suggestions, we have revised our manuscript in an effort to improve it and address the concerns.

Below is our response to the reviewer's comments (written in bold).

**16230, 14: revised, or more simply, remove the comment saying that inherent bio-chemical recalcitrance is related to “poor nutrient” content. Biochemical recalcitrance is much more complex.**

We deleted the statement in question.

**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.**

We added the following text to the introduction:

*“We use the total reserve in base cations (TRB in  $\text{cmol}_c \text{ kg}^{-1}$ ) to characterize the weathering status of the soils along the transect and complement this with a qualitative and quantitative analysis of clay minerals. If changes in the mineralogical composition of the investigated soils due to soil redistribution act at a faster pace than weathering related changes, distinct mineralogical differences between profiles along the slope should be identifiable.”*

**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%.**

In our previous work along the investigated slope we extended the fractionation scheme to derive more detail in C fractions within the major aggregate and non-aggregated fractions. s+cm is hence a subfraction of the microaggregates. To clarify our motivation for the analysis of the respective fraction, we added the following text to the methods section on SOC fractionation:

*“For our analysis on the microbial composition and  $^{14}\text{C}$  age of the fractions we analyzed the environment in which C is stabilized, hence analyzing macro- and microaggregates as a whole. For the mineralogical analysis we are focusing on comparable fractions for the mineralogical analysis, hence comparing aggregated and non-aggregated silt and clay fractions.”*

**(please check sums: column 1 is 99%)**

Corrected

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

Corrected

**You discuss about C content in pyrophosphate extract p16242, l22. C content for each extract should be given in Results section if this is of interest for discussion.**

We added the SOC content as a second y axis to Panel I of Figure 2 and refer to it in the text accordingly.

**16240, l 12 to 20: these results should be in Supplementary Information.**

We argue that the information in line 12 to 20 should stay in the main text of the manuscript and not go into the Supplement. With this text we can give a valuable guideline to what in our opinion are the key findings presented in figure 4.

**The unit 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)**

We corrected the units according to the reviewers suggestion. AS in fractions is now addressed as AS- per g of C and for the bulk soil as AS-C per g of SOC.

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

We think it is too complex and uncertain to give a precise answer based on the gathered data in this study. Indeed the remobilization of organo-metallic complexes can be due to too many interconnected processes. Some could be the microbial decomposition of organic matter used in the formation of organo-metallic complexes (i.e. *Lundström et al. 1995. Eur. J. Soil Sci. 46, 489–496.*), or the impact of soil solution composition (i.e. *Berggren et al. 1998. Eur. J. Soil Sci. 49, 305-316*), or the re-complexation of new and fresh DOC by amorphous metals in organo-metallic complexes (i.e. *Schneider et al. 2010, Geochimica et Cosmochimica 74, 1606-1619*). But as it is not the focus of this paper to clarify the exact mechanism, we tried to avoid speculating on this.

**Discussion on old  $^{14}\text{C}$  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.**

We greatly revised the according section and removed the statements referring to charcoal and the postulated contradiction of high respiration and  $^{14}\text{C}$  age.

**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 52001) and (Kolb 2009). You have no evidence of living microorganisms and you do not know if aminosugar are young or old**

We feel that this statement can be justified, as our respiration data (presented in our former work [Doetterl et al. 2012, GCB] clearly shows that soils with large amounts of macroaggregate C also respire at a higher rate than soils low on macroaggregate C. We added a paragraph explaining this to the manuscript at the position in question.

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

Corrected, we replaced “C” with “organic matter”

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

We corrected the unit (now:  $\text{g kg}^{-1}$ )

**Table 5 is not very useful.**

We removed the table from the manuscript and the according references and discussion in the text.

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

We clarified in the legend of figure 2 that it includes samples from all depths and profiles. The main purpose of this figure is to show the distinct differences between pyrophosphate, oxalate and DCB concentrations between s+c and s+cm. depth or slope related changes are addressed in the correlations of table 3, and often not significant. We believe, therefore, that a three panel figure is the better choice than extending this to a 9 or 18 panel figure including all depths.

**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**

We clarified in the figure caption that the unit is g SOC per kg soil and revised the figure according to the reviewers suggestion.

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

Yes, and we added: *“of the clay sized fraction”* to the caption.

**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**

We clarified the unit according to the reviewer's earlier suggestion for figure 3. Losses of AS after the fractionation have not been further investigated. We argue that these losses are related to free, floating POM and free AS that has been removed during the fractionation procedure. As we do not provide further data on this, and the focus of our work are the relative differences and trends along the hillslope for samples treated the same way, we did not add any (speculative) assumptions on this into the manuscript.

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

**- Clarify if the information on the level of weathering indicated above or below the soil line should be taken respectively for top and subsoil.**

We clarified in the figure caption that the: *“Statement on the level of soil weathering along the transect refers to both 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.**

We modified the pie charts to show the relative contribution of AS in each fraction to total AS by multiplying AS per g C in a fraction with C stock estimates of the respective fraction given in table 1. The size of the pie chart now indicates the absolute AS content of these fractions combined in g per m<sup>2</sup> and per cm depth of a profile.

**- 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.**

We followed the reviewers advice and replaced the figure with a plot graph instead of cumulative bars.

**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).**

We added a scatter plot to the figure showing the amount of secondary minerals in top and subsoils along the slope. The amount of Cpyr in the bulk soil is now given as a column next to each AS pie char. The Amount of aggregates has not been stated in this figure. We feel that the figure is already loaded with information but we state this information in Table 1. Furthermore, information on aggregates is derived from the former GCB data while we think this figure should focus on the new insights of this paper.

Once again thank you very much for your time with this review,

The authors.