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Interactive comment on "Geogenic organic carbon in terrestrial sediments and its contribution to total soil carbon" *by* Fabian Kalks et al.

Anonymous Referee #2

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The paper on "Geogenic organic carbon in terrestrial sediments and its contributions to total soil carbon" by Fabian Kalks et al. is a very interesting contribution, and fits well with the journal topics. It is a good paper, but the authors are omitting the possibility that a fraction of the geogenic organic carbon (GOC) in deep soil can be assimilated by bacteria. This has been shown to occur in district environments such as in very isolate environments (please cite (Schwab et al. 2019)) or in deep soil (please also (Seifert et al. 2011)). Bacterial assimilation of GOC will generate 14C-dead easily accessible C (here labile pool), which can easily become a part of C dynamic in soil. This has important implications on the author discussion/conclusion (e.g. age of the soil, model) and needs more thorough discussion. Based on the results of the incubation experiments, the authors concluded that GOC mineralization and thus bacterial assim-

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ilation is very low or insignificant. However, as already noted by the first referee (point 5), “the incubation of 533 days is a long time without additions”. In deep soils, inputs from surface are expected to fuel bacterial activity which would favor the mineralization and the assimilation of GOC. Incubation without addition most likely underestimated mineralization rate (bacterial assimilation) of GOC in soil. More emphasis has to be put on this in the manuscript. I give more detail on this below.

Introduction: Bacteria fixing GOC will produce fresh 14C-depleted organic matter. The method mentioned here will thus overestimate GOC.

Method: More details on land-use history of the sampled soils are needed. What about the soil samples from agriculture field? What about the effects of the different vegetation/land-use history on soil weathering, DOC, root input? What about O2 during the incubation? It is difficult to follow the soil treatments before incubations. Why only show the incubations with the intact rocks in Fig.3, as crushed rocks better estimated the effect of weathering and showed significant higher respiration rates.

Line 203: please delete under optimal conditions.

It is important to mention that the calculation (eq. 7) assumes that no labile faction is derived from 14C-dead bacterial biomass.

Discussion Line 495-499: This is again assuming no bacterial assimilation. Please discuss this. Also, delete the last sentence line 499, as this would argue the opposite Line 512-524: same as before. 14C values of the respired CO2 could help here.

Conclusion: Line 565: change to” Incubation of sediments seem to indicate that this geogenic contribution. . .

Schwab, V.F., M.E. Nowak, C.D. Elder, S.E. Trumbore, X. Xu, G. Gleixner, R. Lehmann, G. Pohnert, J. Muhr, K. Küsel and K.U. Totsche. 2019. 14C-Free Carbon Is a Major Contributor to Cellular Biomass in Geochemically Distinct Groundwater of Shallow Sedimentary Bedrock Aquifers. Water Resources Research. 55:2104-2121. Seifert,

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