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Discussions
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Interactive comment on "Autotrophic fixation of geogenic CO$_2$ by microorganisms contributes to soil organic matter formation and alters isotope signatures in a wetland mofette" *by* M. E. Nowak et al.

Anonymous Referee #2

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The manuscript describes a study investigating the autotrophic CO2 fixation by soil microorganisms and their contribution to soil organic matter (SOM) in mofette soils compared to reference soils. The particular composition of the geogenic CO2 at these sites allows estimating the contribution of plant-derived, SOM-derived and CO2-derived C in soil microbial biomass and SOM. The approach taken by the authors includes tracing the isotopic composition (both 13C and 14C) into soil microbial biomass and SOM, but also molecular analyses of genes involved in autotrophic CO2 fixation. This allows the authors to study the process and relate it to potentially responsible microorganisms.

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The results show that a significant percentage of soil C in the investigated mofette soils is derived from geogenic C, and that cbbL 1C was more abundant than the other genes investigated. The manuscript thus describes an important process which has been mostly neglected in the past. It is well written and organized, and thus it should be published. However, some relatively minor revisions to the manuscript will further improve it.

Here are some more detailed comments:

Labelling experiments: Were unlabelled controls included or are analyses of the starting materials used to correct for background values? Also, how were the different CO2 concentrations in the air during the labelling experiment accounted for when assessing the data?

p. 14571, top paragraph: When looking at Fig. 1, I wonder whether the effect of radioactive decay need not be taken into account already here. For the reference soils, delta13C is almost constant, whereas Delta14C varies, indicating different ages. How would this affect the relationship between the two isotopic signatures?

p. 14575, line 5-bottom of page: I certainly agree with the authors that radioactive has to be taken into account when estimating the contribution of the different pools to SOM or microbial biomass. However, I have some doubts about how good their approach to do so was. The authors claim that after correction for radioactive decay, all but one calculated value for delta13C in the horizons deeper than 10 cm match the measured values. In total, however, this means that 3 out of 6 calculated values match the measured ones, the other 3 don't. So it is difficult to judge whether this correction really did a good job. The authors mention different organic matter dynamics in the mofette and the reference soils as a potential source of error. If there are any indications for this, this should be discussed more in detail.

p. 14578, line 1-11: An additional potential reason for the increase with depth of CO2 fixation normalized to C in the reference soil, which could be included in the discussion,

might be that the deeper parts of the profile are adapted to higher CO2 concentrations in the soil air.

minor editorial comments:

p. 14556, line 2: I think it is a bit too ambitious to claim quantifying the actual contribution of autotrophic microorganisms to SOM formation. I suggest to speak about "potential contribution".

p. 14559, line 25 (and other places): Check for consistent use of either "form I RubisCO" or "type I RubisCO"

p. 14559, line 28: reword "cbbL 1A comprise obligate autotrophic bacteria"; this sounds odd to me.

p. 14562, line 16: "unlabelled": up to now, no label was mentioned. Maybe: "To obtain background values for the isotopic compositions..."

p. 14564, equation 3: Check if this complex equation is printed correctly.

p. 14564, line 20: Replace "Mofette" by "Soil"

p. 14567, line 13 (and other places): "anoxic restrictions": Should that be "anoxic conditions"?

p. 14570, line 1 and 3: Not all of the values given here are consistent with Table 1.

p. 14572, line 19: I could not find these numbers in the corresponding table.

p. 14576, line 1: replace "alternation" by "alteration"

p. 14577, top paragraph: I suggest to focus on the decay corrected data here.

Table 3: At least in the printed version, this table is difficult to read because the columns are too small and therefore the averages and the standard deviations were printed in two lines. Maybe a different layout would help.

General: The numbering of the Figures does not match their first occurrence in the text.