Reply to second comment by Reviewer#1

The authors defended their thermal approach with the fact, that only organic nitrogen is involved in the Maillard reaction and it is not converted into inorganic nitrogen. At the same time they mentioned, that the highest reaction rates are already at 140-160°C. Figure 2 clearly shows, that very little organic N is lost after ramped heating. My point is, that the lower heating transformed (condensated) the organic N into more thermo-stable forms (exactly as reported in the mentioned paper), which then survived the higher temperatures, while C did not. I therefore still have a fundamental doubt, that the approach can be used to test the interesting hypothesis of the authors. I recommend to test it with an alternative approach to exclude a potential artefact.

The reviewer repeated her/his argument that we cannot exclude that the Maillard reaction occurred in the soils during the fractionation procedure. Our main argument against the concerns of the reviewer is not that only organic nitrogen is involved in this reaction, but that a change in thermostability of the compounds, caused potentially by the Maillard reaction, does not affect the conclusions of our manuscript. The conclusion of our manuscript is NOT that organic nitrogen is thermostable, but that some of the organic nitrogen is very old. This conclusion is based on the radiocarbon results. Since the Maillard reaction does not affect the radiocarbon signature of the organic matter, our results do not depend on whether the Maillard reaction occurred in the soil samples or not.

If we assume for a moment that all organic matter in the fractions obtained by thermal fractionation had been created by the Maillard Reaction, the low $\Delta^{14}C$ would still show that the carbon in this fraction is old. If the organic matter of a compound formed by the Maillard reaction has a low $\Delta^{14}C$, this is due the $\Delta^{14}C$ of the reactants.

We found that the fraction gained by heating the soil to 450°C is very rich in organic nitrogen. In fact, the total organic carbon:total organic nitrogen (TOC:TON) ratio of this fraction is in the range of the TOC:TON ratio of amino acids, peptides, and proteins. For each organic nitrogen atom there are on average less than five organic carbon atoms. The carbon of this fraction has a low $\Delta^{14}C$, indicating that it has gone through substantial radioactive decay, and thus is very old.

It seems unlikely that the Maillard reaction (which is the reaction of an amino acid and a sugar) caused the formation of an organic matter fraction that has a C:N ratio that is in the range of the C:N ratios of amino acids, peptides, and proteins. The product of the Maillard reaction has a C:N ratio that is higher than the C:N ratio of the amino acid that reacts in this reaction due to the incorporation of the carbon from the sugar. Thus, the Maillard reaction does not lead to formation of organic matter with a very low C:N ratio (as found in our study), but to the formation of organic matter that has a C:N ratio which is higher than the C:N ratio of amino acids, peptides, and proteins.

In the manuscript, we refer to the organic matter fractions as the thermostable organic matter fractions. We understand that this might be misleading, and we will change the names of the two fractions in the manuscript to avoid misunderstandings. In the revised version of the manuscript, we will call them old fraction and intermediate fraction (similarly as in other studies about soil organic matter fractions). In addition, we will include a section in which we discuss the Maillard reaction.