# Are lipids better preserved in earthworm casts compared to soils? A mesocosm experiment with $^{13}$C-labeled litter

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Organo-mineral associations favor organic matter (OM) preservation in soils. Among them, earthworm casts constitute key biogenic macroaggregate as they concentrate important amounts of OM and are more stable than non-biogenic aggregates. However, the fate of OM within earthworm casts still needs investigations, especially at the molecular level. The present study compared the fate of lipids in earthworm casts and the surrounding soil in order to determine wether earthworm casts enhance OM preservation. $^{13}$C-labeled litter (ryegrass) was thus incubated for one year in the presence of earthworms in a soil mesocosm experiment. The fate of apolar lipids was investigated thanks to compound specific isotope analysis with a focus on biomarkers typical for plants (long chain *n*-alkanes) and bacteria (hopene).

After one year of incubation, *n*-alkane chain length pattern evidenced higher litter incorporation in casts than in soils. However, determination of the percentage of carbon derived from the $^{13}$C-labeled litter, yielded similar values for long chain alkanes in casts and soils. Therefore, in spite of higher incorporation of plant debris in casts, the preservation of plant alkanes is not favored in casts when compared to soils (likely due to active degradation counterbalancing litter incorporation). Hopene was the most $^{13}$C-labeled biomarker of casts. As initial litters were devoid of hopene, these results show that cast-associated bacteria assimilated $^{13}$C-labeled plant litter in their biomass. The $^{13}$C-content of hopene was higher in casts than in the surrounding soil, evidencing enhanced litter metabolism by bacteria in casts than in the surrounding soil (likely due to concentrating effect of earthworms on OM and/or enhanced bacterial activity in earthworm gut and casts).

To conclude, this one year mesocosm experiment suggests that in comparison with the surrounding soil, earthworm casts (1) do not favor the preservation of initial litter lipids, but (2) enhance bacterial activity and their lipid contribution to cast OM, and more generally to soil OM.