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N Isotope Composition of the Soil Microbial Biomass Reflects N Mineralization and C and N Availability

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It has been an open question for several decades whether N mineralization is a fractionating process. This question is important for N cycling in terrestrial ecosystems because even a small fractionation during N mineralization could potentially have a large influence on the N isotope composition of other ecosystem N pools, since N mineralization represents the largest N flux in ecosystems. Fractionation during N mineralization should result in a difference between the N isotope composition of the soil microorganisms and that of its substrates.

We analyzed the N isotope composition of the soil microbial biomass in a variety of ecosystems, and found that it was ^{15}N enriched compared to that of other soil N pools, such as soil soluble, organic and inorganic N (Dijkstra et al. 2006a,b). We observed a negative correlation between the ^{15}N enrichment of the microorganisms and the relative C and N availability for soil from ecosystems in Hawaii and Arizona, across a broad range of climates, grasslands and forests, and more than four million years of ecosystem development. This result suggests that during N dissimilation (and associated transaminations) and N export, the lighter ^{14}N isotope is preferentially removed in a manner similar to that proposed for animals and ectomycorrhizae. This was further confirmed by the positive correlation between microbial ^{15}N enrichment and net N mineralization rate (Dijkstra et al. 2008) and by culture experiments with *Escherichia coli* (Collins et al 2008).

Since mineralization is the largest flux of N in ecosystems, fractionation during N mineralization has the potential to influence and even determine the N isotope composition of other N pools, such as inorganic N, plant N and soil organic matter N. We will show that the N isotope composition of these ecosystem N pools exhibit differences that are consistent with fractionation during N mineralization.

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