Geophysical Research Abstracts
Vol. 20, EGU2018-15844-1, 2018
EGU General Assembly 2018

Different factors control organic matter degradation in bulk and rhizosphere soil from the top- and subsoils of three forest stands.

Michael Herre, Julian Heitkötter, and Bernd Marschner
Ruhr-University Bochum, Institute of Geography, Chair for Soil Science and Soil Ecology, Germany (michael.herre@rub.de)

More than 50% of the global carbon stocks are stored in subsoils where the C distribution is much more heterogeneous than in the topsoil due to greater relevance of preferential flow paths and roots for C input. Thus, it is assumed that C-turnover in subsoils is restricted to small areas, forming hotspots of microbial life. One suggested hotspot is the rhizosphere where the physico-chemical properties of the soil are directly altered through the influences of the roots. Up to now, very little is known about C-dynamics and microbial activity in the subsoil rhizosphere. However, this knowledge is needed for gaining new process understanding and for improving the accuracy of soil carbon models.

In our ongoing study, we are investigating the differences of organic matter degradation in bulk and rhizosphere soil. Samples from two depths (0-10 cm and 30-50 cm) were taken from three beech forest sites with different parent materials (Pleistocene sand, Triassic sandstone, Loess). Rhizosphere soil was considered as soil material adhering to the roots after gently shaking. All bulk and rhizosphere samples where incubated for 82 days and received different 14C labeled substrate (glucose and palmitic acid) or nutrient (N, P and N+P) additions.

Results of the laboratory incubation, so far, showed an average 150% higher SOC mineralization rate in both rhizosphere topsoil and subsoil compared to respective bulk samples at the Loess site. However, positive priming effects were only observed for the subsoil rhizosphere, where the addition of glucose and palmitic acid caused a rise in SOC mineralization. The SOC mineralization at the Triassic sandstone site was around 20% higher in the topsoil rhizosphere but 1100% higher in the subsoil rhizosphere compared to the bulk samples. The addition of N led to a decrease of SOC mineralization at all sites, indicating N-mining. Again, a positive priming effect through the addition of glucose and palmitic acid was observed.

Dehydrogenase activities in bulk and rhizosphere were not significantly different in the topsoil, but showed an up to 250% higher activity in the subsoil rhizosphere compared to respective bulk samples. All substrate and nutrient additions in the subsoil led to a decrease in dehydrogenase activity.

We also found significant higher peroxidase activity in the subsoil bulk and rhizosphere samples compared to the topsoil. The substrate and nutrient additions had no significant effect on the peroxidase activity.

The results show that (1) rhizosphere SOC is much more labile than bulksoil SOC, (2) N-mining is a major reason for microbial SOC mineralization in all samples and (3) the microbial community in the subsoil rhizosphere appears to be adapted to more easily available substrates than the bulksoil microbial community.