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Differences in organic matter properties and microbial activity between bulk and rhizosphere soil from the top- and subsoils of three forest stands.

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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 physio-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 and microbial activity distribution 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.

For all bulk and rhizosphere samples, basic soil properties, basal respiration, microbial biomass (Cmic) and 14C age were determined. Further, extracellular enzymes involved in C-, C/N-, N- and P-cycle were analyzed.

Results, so far, showed significant differences between bulk and rhizosphere in top- and subsoil. The microbial biomass (Cmic) in the rhizosphere was up to 80% higher in the topsoil and an average 200% higher in the subsoil (SOC normalized), compared to the respective bulk samples. The biggest differences were found at the Loess site where the subsoil rhizosphere contained around 450% more Cmic than the bulk soil (SOC normalized).

We also found an average 100% and 300% higher SOC content in the rhizosphere in both top- and subsoil. The SOC-normalized basal respiration at the Triassic sandstone site showed no significant differences between bulk and rhizosphere in both depths. At the Loess site however, a significant higher respiration in the subsoil bulk compared to the rhizosphere soil was detected.

These results show that the rhizosphere is a hotspot for microbial activity, which is more pronounced in the subsoil where the relevance of these hotspots is important for the C-turnover.