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Tracing subsoil organic matter compositional changes by radiocarbon and plant leaf wax distributional changes

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The carbon pool in subsoils is thought to be considerably larger than in the upper 30 cm. However, factors like turnover, stabilization and distribution of organic matter (OM) are less well understood than in topsoils. The investigation of changes in OM composition with depth enables a better understanding of the peculiarity of subsoil OM in contrast to the already extensively studied topsoil OM. Analysis of long chained n-alkanes and n-fatty acids in soil profiles sampled in high resolution, combined with radiocarbon data of bulk soil, is a tool to demonstrate spatial distribution and the degradation of plant leaf wax-derived material as a defined source of soil organic.

We analysed the OM in 3.15 m long soil transects under an even aged European beech (Fagus sylvatica L.) forest in Northern Germany (Grinderwald, Lower Saxony) for lipid and radiocarbon analysis. Samples were taken from a grid raster with eight sampling points increasing in distance to the main tree (45cm grid dimension) and from five depths (10, 35, 60, 85, 110 cm) resulting 40 samples per transect. Organic carbon contents in the podzolic Cambisol decrease from 1.69 % in the A-horizon to 0.02 % in the C-horizon at 110 cm depth. The distribution of organic carbon contents shows no significant trend with increasing distance to the beeches in all transects. We compare the distribution of long-chain n-alkanes (C27, C29 and C31) and n-fatty acids (>C20), known as components mainly derived from leaf waxes of higher plants, in the different transect/depth intervals. Distributional and quantitative changes in the transects, combined with bulk soil 14C-analyses, reflecting apparent mean residence time of OM, are used to identify how fast OM is degraded from surface to subsoil horizons. Furthermore, spatial OM heterogeneity in the transects is investigated.

We expect a more significant heterogeneity in the lipid distribution and nearly similar decreasing contents for n-alkanes as well as n-fatty acids. Furthermore, the comparison between these two compound classes with increasing depth gives information on the accumulation of more resistant (aliphatic) and more easily degradable (carboxylic acids) OM components.