



Source and compositional changes of soil organic matter in an acidic forest soil - from top- to subsoil

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Subsoils can significantly contribute to the terrestrial C pool. While processes of C turnover and storage in topsoils are generally well understood, little is known about subsoils.

Our project, embedded within the DFG research group FOR 1806, aims to contribute to the knowledge about subsoil C by differentiating soil organic matter (SOM) in terms of its origin and its composition. In order to obtain a meaningful sample set we studied three soil ditches, 3.15 m in length and 2.15 m in depth, in a podzolic Cambisol under European beech (*Fagus sylvatica* L.) north of Hannover, Germany. In a to date unique sampling approach we took 64 soil samples in a regular vertical grid in each of the soil profiles, thus identifying possible gradients between top- and subsoil.

The samples were subjected to a combined density and particle size fractionation to separate particulate organic matter (POM) from mineral compartments. We especially aimed at obtaining the combined fine silt and clay fraction which is thought to be most important in the long term stabilization of SOM.

The chemical composition of the so obtained fractions and the bulk soil was revealed by C, N and ^{13}C CPMAS NMR measurements. The source of OM in the soil was investigated by tracing the biopolymers cutin and suberin across the soil profile. Cutin occurs mainly in the cuticula of leaves while suberin mainly constitutes the endodermal cell walls of plant roots. In soils the two polymers can thus be used as proxies for above and belowground OM input respectively. To release the constituting monomers of the two biopolymers from the soil samples the latter were pretreated with organic solvents to extract free lipids. The soil residues were subsequently subjected to a base hydrolysis and the so obtained extracts were measured with GC/MS.

The organic C contents of the bulk soil decrease significantly with depth in all transects from around 15 mg g^{-1} to 2 mg g^{-1} . This is likely associated with the very high sand and low clay concentrations and the decreasing POM content at greater depths in the soil profiles. The highest C contents were found in the POM fractions with 400 mg g^{-1} and the combined fine silt and clay fractions with 6 mg g^{-1} .

Interestingly the NMR spectra display an already highly processed POM in the uppermost soil horizon as indicated by high alkyl/O-alkyl C ratios. This, together with the absence of POM in greater depths, points towards a decomposition of aboveground OM predominantly in the upper zones of the soil and a confined root input to deeper soil regions.