



Characterization of soil organic matter composition at intact preferential flow path surfaces

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In structured soils, the interaction of percolating water and reactive solutes with the soil matrix is mostly restricted to surfaces of preferential flow paths. Surfaces of flow paths that are formed by cracks, decayed root channels or worm burrows are often covered by clay-organic coatings (i.e. cutanes), in which the outermost layer is mainly organic matter (OM). The composition of OM finally controls wettability, sorption, and transfer properties. However, the in-situ local distribution of OM properties along such surfaces is largely unknown to date because experimental techniques to study the relatively thin and vulnerable coatings at intact structure surfaces were not available. The objective of this study was to analyze the local mm-scale distribution and composition of SOM at preferential flow paths. The Fourier transformed infrared spectroscopy in diffuse reflectance mode (DRIFT) was used to determine spectral information of the intact structural surfaces (cracks and biopores). With the DRIFT-mapping technique, potential flow path types, such as earthworm burrows, root channels, and cracks of structured subsoil horizons were analyzed in 1 mm steps along transects of 15 up to 65 mm length. The distribution of OM composition was characterized by evaluating the ratios of the absorption band intensities of the alkyl- (C-H-) and carbonyl (C=O-) functional groups (CH/CO), which represent a measure of the potential wettability of the OM of the surface. Samples of different soil types (Luvisol, Regosol, Stagnosol, Cambisol), of different geological provenance (till, loess, mudstone, limestone), and of different land use (arable, forest) were analyzed. The CH/CO-ratio was generally higher for earthworm burrows and root channels as compared to crack surfaces and the soil matrix. Differences between flow path types could be observed with respect to soil type, parent material, and land use. The local distribution of the OM properties may affect sorption and mass transfer during preferential flow in structured soils.