

Carbon-13 natural abundance signatures of long-chain fatty acids to determinate sediment origin: A case study in northeast Austria

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Several recently published information from scientific research have highlighted that compound-specific stable isotope (CSSI) signatures of fatty acids (FAs) based on the measurement of carbon-13 natural abundance signatures showed great promises to identify sediment origin.

The authors have used this innovative isotopic approach to investigate the sources of sediment in a three hectares Austrian sub-watershed (i.e. Mistelbach). Through a previous study using the Cs-137 technique, Mabit et al. (Geoderma, 2009) reported a local maximum sedimentation rate reaching 20 to 50 t/ha/yr in the lowest part of this watershed. However, this study did not identify the sources. Subsequently, the deposited sediment at its outlet (i.e. the sediment mixture) and representative soil samples from the four main agricultural fields - expected to be the source soils - of the site were investigated. The bulk delta carbon-13 of the samples and two long-chain FAs (i.e. C22:0 and C24:0) allowed the best statistical discrimination.

Using two different mixing models (i.e. IsoSource and CSSIAR v1.00) and the organic carbon content of the soil sources and sediment mixture, the contribution of each source has been established. Results suggested that the grassed waterway contributed to at least 50% of the sediment deposited at the watershed outlet.

This study, that will require further validation, highlights that CSSI and Cs-137 techniques are complementary as fingerprints and tracers for establishing land sediment redistribution and could provide meaningful information for optimized decision-making by land managers.