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Study on the turnover time of different soil organic matter fractions from Hungary

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Soil organic matter (SOM) is a complex mixture of materials from various sources and with different stabilization and decomposition processes. The SOM is often divided into several pools with different turnover times and recalcitrance. Models describing the dynamics of accumulation and decomposition of organic carbon generally differenciate components of SOM that turn over on less than 10 years (active pool), 10-100 years (slow pool) and more than 100 years (passive pool) time scales. Analyzes of the carbon isotopic (14C and δ13C) composition of SOM pools are widely used methods to study the turnover rates of these pools. In addition, physical fractionation procedures are used to separate these chemically and physically different SOM compartments from the bulk soil. In general, the SOM associated with the sand fraction can be related to the active pool and the silt- and clay-associated SOM represents the relatively stable pools. However, several studies reported contradicting results. Our aim was to determine the different SOM pools by physical fractionation and to measure the turnover time of the separated fractions in order to test the hypothesis that the SOM associated with the finer particles are the most stable.
The studied soil sample is a silt loam textured Luvisol from West Hungary with 2.97 % soil organic carbon, 0.145 % total nitrogen content and pH (KCl) 3.72. The soil is collected from the A horizon from deciduous forest vegetation. The soil was incubated for 163 days in constant temperature (20°C) and moisture (70% water holding capacity) conditions. Maize residues were added to the soil in order to get natural 13C enrichment for stable isotope measurement purposes. The separation into differently stabilized SOM fractions (sand and stable aggregate (S+A), silt plus clay sized (S+C) and chemically-resistant carbon fraction (rSOC)) was done by the method of Zimmermann et al. (2007). The separated fractions were analyzed for 14C and δ13C values.
Preliminary results suggests that recent organic matter input does not change the S+C associated SOM. Ages of the SOM in various pools varied in a wide range hence more detailed SOM fractionation would provide more precise results.

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References

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