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The role of mineral composition regulating the turnover of organic matter in 13 forest soils from Hungary

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The organic matter stability is regulated by the different protection mechanisms of the soil matrix and soil minerals. In spite of that, beyond the determination of the amount of fine fractions, relatively little research studied the mineralogical composition of these fractions and their organic matter stabilizing effects. Therefore, the aim of my work was to investigate the influence of the soil mineral phases on the decomposition of soil organic carbon pools of soils under forest vegetation.

Maize residues were added to the 13 soil samples (depth of 0−20 cm) collected from Hungary. The samples were incubated at 20°C and 70% field capacity during 163 days. The soil respiration was measured at specified intervals (on day 3, 8, 15, 30, 51, 79, 107, 135 and 163) and trapped in 2M NaOH and quantified by titration with 1M HCl. Another aliquot of NaOH was mixed with 2M$SrCl_2$ to get $SrCO_3$ for $\delta^{13}C$ analysis.

The samples were analysed with an X-ray diffractometer (Rigaku Miniflex 600), a microwave plasma-atomic emission spectrometer (4200, Agilent Technologies) and an isotope ratio mass spectrometer (Delta plus XP, Thermo Finnigan). Carbon mineralization kinetics was modelled by fitting a first-order two pools model.

The results showed that 1−6% and 2−18% of the organic carbon content of the soils was mineralized in the control and amended samples during the incubation, respectively. Carbon mineralization was mostly reduced by the illite content (R^2=0,797; p<0,001), Al-oxide content (R^2=0,708; p<0,001) and clay content (R^2=0,475; p<0,05) of the soils. The decomposition rates of the two carbon pools were found to be influenced to the greatest extent by the illite and total Al-oxide content of the soils investigated. Whereas the decomposition rate constant of the slowly mineralizable C pool was only affected by the Al-oxide and illite content, the decomposition rate constant of the easily mineralizable carbon pool was also sensitive to the other soil parameters (aromaticity, Fe-oxide content, C/N ratio, pH and clay content).

The priming effect was found to be influenced to the greatest extent by the pH (R^2=0,715; p<0,05), whereas weaker negative relationship with the content of non-swelling clay minerals (R^2=0,396;

p<0,05), illite content (R^2=0,389; p<0,05) and the C/N ratio (R^2=0,345; p<0,05) of the soils was also detected.

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