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Effects of humus quality on the spatial iron distribution in hydromorphic topsoils

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Soil organic matter (SOM) has an effect on the fertility, nutrition and buffer function of the soils. As a reservoir of carbon SOM plays an important role in the global carbon cycle. Hydromorphic soils (generally located in low-land areas with a high groundwater table level) are characterized by accumulation of great amounts of humic substances due to inhibited decomposition of SOM. Long-term water saturation has a significant effect on the evolution of humic substances, causing particular traits in the SOM quality of waterlogged soils.
In our study we investigated a wetland with a maximum of 1.5 m vertical difference in topography. This way the water-controlled processes of soil development, including the transformations of SOM, follow the patterns of the centimeter-scale variations of the micro-relief. Our aim was to find correlations between the effects of hydromorphy (driven by micro-relief) and the quantitative and qualitative characteristics of SOM. Considering iron distribution among the profile can unfold further interactions within the system of groundwater, SOM and iron.
Samples were collected from the upper 20 cm and from the deepest part of the solum. Total soil organic carbon (SOC) and nitrogen content were determined by non-dispersive infrared spectroscopy. Humic substances were qualified by UV-Vis spectrometry, based on specific spectral absorbances (E4/E6, E2/E3). The determination of total iron content was carried out via X-ray fluorescence spectroscopy. Selective dissolution method and atomic absorption spectrometry were performed to measure free iron content. Particle size distribution was determined by laser diffraction.
Our results show that intensive SOM accumulation has taken place in the studied area. High values of SOC were found even in the depth of 50-60 cm. The high proportion of C/N suggests that the aerobic decomposition of SOM is significantly inhibited. In the lower spots greater amount and higher polimerisation degree was measured contrary to the higher elevations. Among the soil profiles the proportion of C/N and E4/E6, E2/E3 values reflect advanced humification, resulting humic substances of higher aromacity and molecular weight. Quantity and quality of humic subtances seem to correlate also with iron distribution. The abundance of iron is strongly affected by the intensity of waterlogging and vegetation patterns as well.
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