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Does DOM properties or the amount of DOC induces iron reduction in topsoil porewater?

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Iron content of porewater in hydromorphic soils shows high temporal variability. This usually correlates with dissolved organic carbon (DOC) content, but the correlation can be weak in some cases. Some studies suggest that ferrous iron stabilizes organic carbon in dissolved state. On the contrary, other papers report about dissolved iron stabilization by dissolved organic matter (DOM). Present study focuses on this apparent contradiction and on the interaction of organic carbon and iron in hydromorphic soils.
Studied gleyic Phaeozems (3 profiles) and mollic Gleysols (3 profiles) are located in Geresdi-dombság (Hungary) and in Danube-Tisza Interfluve (Hungary) respectively. Dynamics of porewater pH, EH, have been recorded by field stations at 20, 40 and 100 cm depth during the growing season with 10 min temporal resolution. Porewater occasionally have also been sampled in each depth. The presence of ferrous iron was detected by dipyridil field test. DOC, dissolved nitrogen (DN) and iron were measured by TOC analyser and fl-AAS. Molecular size and molecular weight were measured by photon correlation spectroscope (DLS and SLS). Textural and mineralogical properties of studied soils were also determined. Relationships among studied parameters were tested by Spearman's rank correlation.
The seasonal dynamics of redox potential is primarily controlled by saturation, but spatial differences are also driven by vegetation. The environment is usually reductive for iron oxides between March and July, but intensive daily redox fluctuations could be measured in June and July in some topsoils. Short term temporal variability of redox conditions is depended on the physiological activity of plants. Most of the papers published a range between +100 and +50 mV for iron reduction in aquatic systems. Topsoil porewater measurements show three redox ranges where concentration of dissolved iron has been increased: +320 to +200, +80 to +20 and below-160 mV. These ranges were identified independently from each other in various topsoils and subsoils. DOC was correlated with dissolved iron only in the most oxidative topsoils. Therefore we did not find correlation between DOC and dissolved iron in the studied topsoils of Gleysols. Molecular size and molecular weight of DOM have correlated with dissolved iron in all topsoils. We did not find any relationship between dissolved iron and any other properties at 100 cm depth.
Presence of colour reaction and the colour intensity of dipyridil test also did not show correlation with measured dissolved iron in all studied topsoils. High ratio of dithionite and oxalate extractable iron of the solid phase and the molecular size measurements suggest that this observation can be explained by an intensive complex formation of ferric iron with low molecular size DOM.
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