

GEOC 16: Adsorption and molecular fractionation of dissolved organic matter on iron-bearing mineral matrices of varying crystallinity



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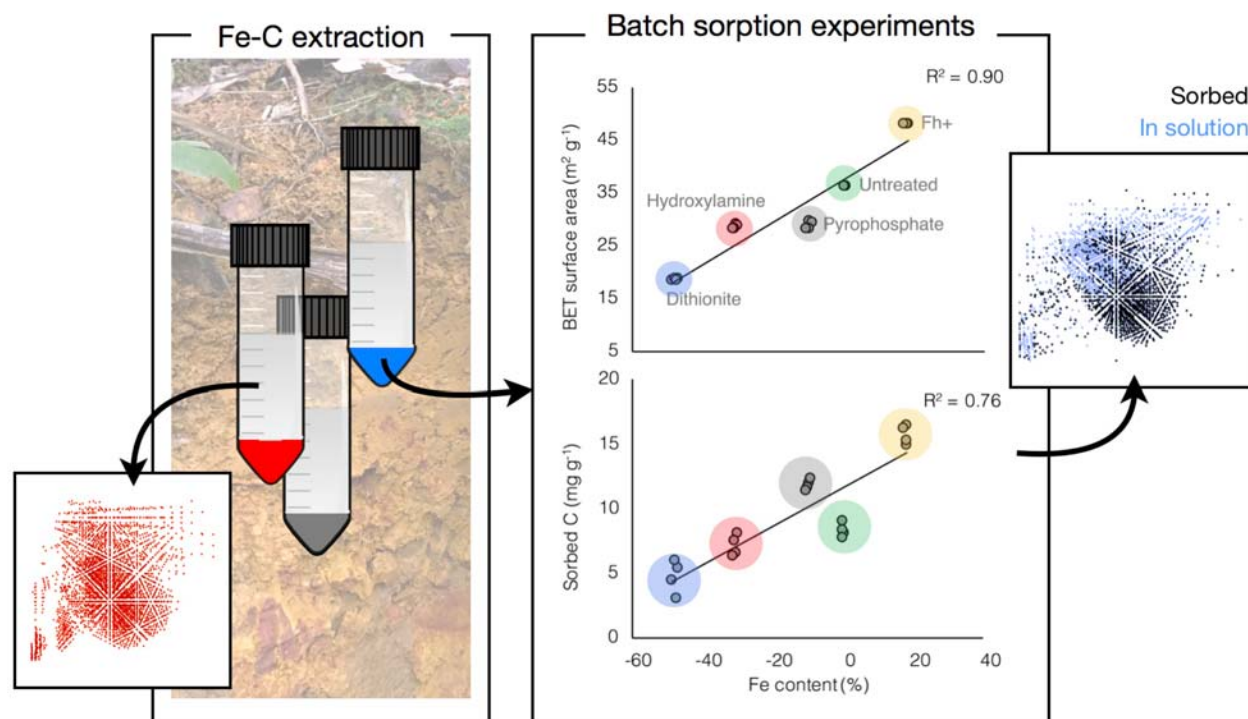
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Fe-bearing mineral phases contribute disproportionately to adsorption of soil organic matter (SOM), due largely to their high specific surface area (SSA) and chemical reactivity. The spectrum of mineral solid-phase speciation present in soil matrices, however, challenges analytic assessment of SOM-mineral interactions. The goals of this work were to: 1) quantify the contributions of Fe-bearing minerals of varying crystallinity to dissolved organic matter (DOM) sorption processes in soils, and 2) characterize molecular fractionation of DOM induced by reactions at the mineral interface, using a highly-weathered Oxisol from the Luquillo Critical Zone Observatory (LCZO). Three selective dissolution experiments targeting Fe phases were followed by SSA analysis of the residues and characterization of extracted DOM by high resolution mass spectrometry (FT-ICR-MS). Fe-depleted extraction residues, Fe-enriched ferrihydrite-coated and untreated control matrices were then subjected to a batch DOM sorption experiment. Results of selective dissolution experiments indicate a substantial proportion of soil SSA was derived from extracted Fe-bearing phases, and FT-ICR-MS analysis of extracted DOM revealed distinct chemical signatures across Fe-C association type. Sorbed C concentration in subsequent batch DOM sorption experiments were highly correlated with Fe content induced by treatments, suggesting that extracted Fe mineral phases, and associated SSA, are strong drivers of C sorption in these soils. Adsorptive molecular fractionation was observed via FT-ICR-MS across treatments, particularly those dominated by short-range-order (SRO) mineral phases, which preferentially adsorbed highly unsaturated aromatic compounds, and higher-crystallinity Fe phases, associated with more aliphatic OM. These findings are of particular importance to our understanding of reduction-oxidation

oscillations in humid forest soils, which dynamically alter both Fe mineral crystallinity and mobilize DOM, suggesting that molecular fractionation via organomineral complexation may act as a physicochemical filter of DOM moving through the critical zone.



Sessions



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Sunday, Mar 18 11:50 AM

Room 338, Ernest N. Morial Convention Center

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