Mineral control of dissolved organic matter sorption in a tropical soil

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While the importance of adsorption onto mineral surfaces for soil organic matter (SOM) stabilization has been well-elucidated, selectivity of various mineral and organic phases remains poorly understood. Fe-bearing mineral phases contribute to sorption processes due to their high surface area and reactivity. The goals of this work were to: 1) quantify the contributions of Fe-minerals to dissolved organic matter (DOM) sorption, and 2) characterize chemical fractionation of DOM induced by sorption.

Three selective dissolution experiments targeting Fe-mineral phases were followed by specific surface area (SSA) analysis of the residues and characterization of extracted DOM by high resolution mass spectrometry (FT-ICR-MS). Extraction residue samples, along with synthetic ferrihydrite-coated soil and an untreated control soil were then subjected to a batch sorption experiment with litter-derived DOM.

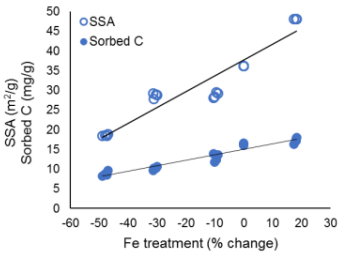

Fig. 1: Relationships between Fe treatments, SSA and amount of sorbed C

Results of selective dissolution experiments indicate a substantial proportion of soil SSA was derived from extracted Fe-bearing phases (Fig. 1), and FT-ICR-MS analysis of extracted DOM revealed distinct chemical signatures. Amounts of sorbed C in subsequent batch DOM sorption experiments were well correlated with Fe contents induced by treatments (Fig. 1). These findings suggest that extracted Fe minerals, and associated SSA, are strong drivers of preferential C sorption and may aid in reconciling the unusually long ^{14}C ages observed in these soils (Pett-Ridge, pers. comm.).