**Anoxia-Induced Release of Colloid-bound Phosphorus:**
**The role of nanoparticles, iron reduction, & associated pH shifts**

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Crop & Soil Science Seminar
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Room 2401, Miller Pant Sciences Building

Phosphorus (P) released from soil can leach into ground water and move to surface water, potentially causing eutrophication. Studying the cause of P release from soil is necessary to understand this process. Soil P is organic and inorganic. Organic P is comprised of phospholipids and humus substances. Inorganic P consists of orthophosphate ($PO_4^-$) and fixed mineral P. Fixed mineral P is comprised of P either a) bound to Fe or Al (oxy)hydroxides, or b) tied up in Ca or Mg minerals. The conversion of fixed mineral P to soluble orthophosphate is governed by the interaction of pH and redox potential. Redox processes dissolve Fe-oxides bonded to P. Reduction occurs when a soil becomes saturated and molecular oxygen is absent. Under anoxic conditions, Fe(III) can serve as electron acceptors for the oxidation of C and can be reduced to soluble Fe(II). This reduction process can release P bound to Fe(III) into the soil solution. These reductions also result in the production of hydroxide ions thereby increasing the soil solution pH. Highly weathered soils become enriched with Fe and Al (oxy)hydroxide minerals that have reactive $OH^-$ groups and are called variable-charge soils. For these soils, net proton charge dominates the permanent structural charge, and thus shifts in pH strongly alter the surface charge characteristics of the soil. The stability of colloids can be strongly affected by pH. Altering the pH can significantly affect the flocculation/dispersion dynamics of variable-charge particle surfaces. Colloids have a specific area of $>10\ m^2\ g^{-1}$ making them important sorbents for nutrients. Changes in soil solution chemistry are the most common source of mobile colloids in soil and groundwater. My first objective is to determine the extent to which colloid-bound P contributes to total P released when soils become anoxic. My second objective is to determine what controls the release of colloid-bound P. A field study will be conducted at Eatonton, GA to correlate reduction events with colloidal P release. In the laboratory, anoxic incubations will determine the pH change associated with Fe reduction, and pH edge experiments will be conducted to determine the isolated effect of pH on P mobilization, and colloid dispersion.

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