

Abiotic Dissolved Organic Matter-Mineral Interaction in the Karstic Floridan Aquifer

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Dissolved organic matter (DOM)-mineral interaction (e.g. adsorption, desorption, mineral dissolution) in groundwater is a significant factor controlling geochemical, subsurface environmental and microbial processes and may be used to track groundwater sources and contaminant fate. Despite its importance, these abiotic interactions remain poorly understood.

This study models the OM-mineral interactions that takes place in the Floridan aquifer through laboratory adsorption-desorption experiments using DOM (groundwater, river water, soil extracts) and carbonate minerals (calcite, dolomite) collected in north Florida. High performance liquid chromatography-size exclusion chromatography (HPLC-SEC) and UV-fluorescence excitation-emission matrix (EEM) spectrophotometry was used to examine the organic compound types exhibiting preferential affinity for carbonate minerals.

DOM-carbonate adsorption/desorption isotherms were well-described by the Freundlich model. Freundlich exponents (0.6488 on average) were less than one indicated a filling of adsorption sites occurred. Ocala Formation carbonate had greater DOM-adsorption affinity as well as adsorption capacity than that of the Suwannee Formation. Two fluorescent signals, indicative of a fulvic-like (at excitation wavelength 295-310 nm, emission 400-420 nm) and a protein-like (275/345nm) moiety were detected in DOM. A reduction in the fulvic-like peak intensity occurred following carbonate adsorption while the protein-like peaks remain almost unchanged indicating the preferential adsorption of fulvic acids. HPLC-SEC results (DOM properties as a function of molecular weight) will also be discussed as will mineral dissolution, which likely occurred during these experiments. Spatiotemporal variations in the chemical properties of DOM in field groundwater samples from a north Florida sink-spring system will also be evaluated in light of the above experimental results.

Keyword: DOM; HPLC-SEC; EEM; Karstic Floridan Aquifer

Challenge: Public health, wildlife health, ecosystem health and water resource sustainability

Issues: Nutrient enrichment of surface, ground and coastal waters