Characterization, Transformation, and Mobilization of Sediment-Associated Natural Organic Matter in Subsurface Sediments

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In this study, we investigated natural organic matter (NOM) associated with shallow alluvial aquifer sediments in a floodplain of the Colorado River in Rifle, Colorado, USA. Total organic carbon (TOC) contents in these subsurface sediments are typically around 0.1%, but can range from 0.03% up to approximately 1.0%. Total organic carbon content is largely correlated with sediment texture, which is highly heterogenous in this aquifer, with the highest TOC contents associated with naturally-reducing zones. Even at the typical TOC values of 0.1%, the sediment-associated OC is many times higher than the dissolved OC pool. The goal of this study was to better understand the exchange between the dissolved and sediment-bound OC pools under various biogeochemical conditions.

We have characterized the sediment-bound natural organic matter from several locations within the floodplain with differing physical and geochemical properties using a combination of *in situ* techniques, such as FTIR, and chemical extractions in order to determine the relative reactivity of the NOM and asssociations with mineral phases. Additionally, we have performed batch incubation experiments using both sterilized and un-sterilized sediments in order to characterize the release of NOM into the dissolved phase. Results from these experiments indicate that the reactive pool of NOM is limited to a small fraction of the total NOM, likely through chemical and physical protection mechanisms. During batch experiments, most of the OC is released to the dissolved phase during the first 24-hours, with very slow release thereafter. Further experiments will assess the effects of changing redox conditions on NOM release and transformation. Such fluctuating redox conditions may occur in a shallow aquifer such as this during the rise and fall of the water table associated with rainfall, snowmelt, and changing river stage, all of which may occur seasonally or with the onset of climate change.