

## Poster #21-62

### **A Last Line of Defense: Understanding Unique Coupled Abiotic/Biotic Processes at Upwelling Groundwater Interfaces**

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The shallow interface sediments that line surface water bodies can host beneficial bacteria that naturally filter contaminants from groundwater as it passes through pores on the way to the surface. When water that is low in dissolved oxygen reaches the oxygenated surface water, metal (typically Fe, Mn) oxides may be precipitated within pores and on grain surfaces. These deposits of metal oxides, which are also observed in abundance within mine-impacted watersheds, act as “contaminant sponges” that sorb toxic compounds. However, dissolved oxygen levels in surface and shallow groundwaters are highly dynamic, and if oxygen with shallow interface sediments is decreased, metal oxides may dissolve and their contaminants released. We have been studying interface sediment-related metal oxides in the laboratory and within mountain watersheds in Colorado to: (1) better understand how dissolved metals, carbon, and contaminants pass from groundwater to surface water, and (2) capitalize on the ability of natural systems to adsorb and sequester contaminants.

In Year 1 of our research at the East River SFA we used fiber-optic distributed temperature sensing (FO-DTS) along with hand-held and Unoccupied Aerial System (UAS)-based thermal infrared surveys to locate focused groundwater discharges to the East River corridor, Oh-Be-Joyful Creek, and Coal Creek; the latter two streams being mine-impacted. We found little evidence of direct groundwater discharge to the river over approximately 4 km of the East River; instead the floodplain seems dominated by lateral exchanges through various meander bends and beaver ponds. A subset of these exchange points showed strong metal oxide deposition. These points were sampled for water chemistry, geophysical properties, and vertical flux rates. In contrast, the smaller mine-impacted streams had numerous direct groundwater discharges to surface water of varied type such as focused fracture flow and diffuse flow through organic-rich sediments.

Geophysical measurements may be sensitive to the metal oxides formed on and within anoxic interface sediments. We have performed extensive laboratory analysis of basic thermal and geophysical materials properties of metal oxide-impacted natural and synthetic (controlled coating) sediments. Our preliminary results indicate that the presence of metal oxides does not reliably induce a magnetic susceptibility response, but does modify the electrical polarization of grain surfaces. Electrical and thermal properties are highly influenced by grain size and sediment type. We plan to utilize this lab-based understanding to refine field geophysical techniques for the efficient spatial mapping of anoxic groundwater discharge zones to streams across the East River SFA.