

## Sulfur Isotope Clues to Seasonal Changes in Flow Paths and Redox Conditions in a Sub-Alpine Watershed

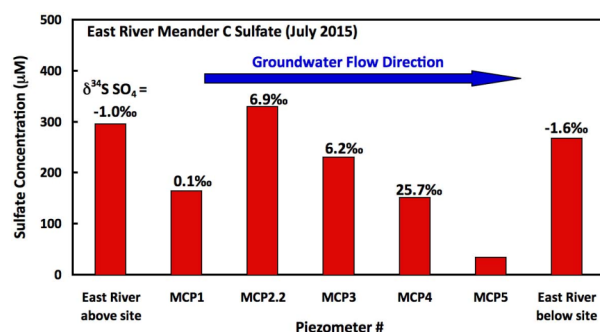
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The East River Watershed is located in the Rocky Mountains in central Colorado and is the subject of an intensive study designed to determine the sources and flow paths of water and how they couple to water quality and export of carbon, nitrogen and metals from the watershed.

The concentrations and  $\delta^{34}\text{S}$  of sulfate in the East River and its tributaries have been monitored for 3 years. The 2 main sources of sulfate in the watershed are oxidation of pyrite in the Cretaceous Mancos Shale ( $\delta^{34}\text{S} \sim -20\text{‰}$ ) and from dissolution of evaporites in Paleozoic sedimentary rocks ( $\delta^{34}\text{S} \sim 10\text{‰}$ ). Sulfate has also been measured in an intensive study transect down a hillslope and across the East River floodplain in the lower watershed where the Mancos shale is the dominant rock type. Large shifts in the  $\delta^{34}\text{S}$  of sulfate indicate that significant microbial sulfate reduction occurs in deeper groundwater (Figure 1). The  $\delta^{34}\text{S}$  of sulfate in the river shifts from lower values during spring snowmelt to higher values during the summer and fall as contributions of deeper groundwater to the river become dominant.



**Figure 1:** Sulfate concentrations and  $\delta^{34}\text{S}$  values in the groundwater across a meander in the East River floodplain.

These results suggest that pyrite in shale-dominated systems has a significant role in limiting oxygen transport into the subsurface. This maintains reducing conditions in the groundwater, limiting mobility of redox-sensitive metals.