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## **Trace Metals are Retained during the Circumneutral Weathering of Pyritic Shale**

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Fine-grained sedimentary rock, such as shale, can release metals and nutrients into surface and ground water through chemical weathering, ultimately reaching freshwater used for irrigation or drinking water [1]. The Mancos Shale in the Upper Colorado River Basin contains variable amounts of sulphide minerals generated by primary precipitation in the sediment at the time of deposition and through hydrothermal alteration. The oxidation of sulphides leads to elevated inputs of main elements as Fe and trace contaminants as Mn and Se into shale-based watersheds such as the East River, CO. Metal contaminants, sulphate, salinity and nitrogen levels are also affected by weathering, but we lack models for where and how weathering mobilizes metals and for the net impacts on water quality [2].

Shale weathering generates clear sulphide, carbonate, and clay mineral weathering fronts at many length scales that we are studying with synchrotron and rock magnetic methods. These mineral and elemental alteration patterns are associated with redistribution of metals, but most potential contaminants are effectively retained within the weathered rock. The behaviour of Eh and pH sensitive elements paired with geochemical modelling indicate that weathering occurs under circumneutral conditions. Carbonate precipitation, clay transformations, and fine-grained iron oxyhydroxide mineral formation provide sinks for mobilized contaminants.

[1] Tuttle, M. L. W. *et al.* (2014) *Appl. Geochemistry* 46, 57–71. [2] Hubbard, S. S. *et al.* (2017) *Vadose Zone Journal* 17:180061.