

## Characterizing soil organic matter in a biostimulated aquifer and zones of natural bioreduction

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The Integrated Field Research Challenge Site at Rifle, Colorado, (RIFRC) has been the subject of intensive research into stimulating microbially mediated Uranium reduction, through acetate injection. [1, 2] A unique component of the RIFRC site is the presence of zones in which Uranium is being reduced naturally. Natural organic matter (NOM) plays an important role in the mobility and bioavailability of dissolved Uranium [3]. Understanding the character of NOM in systems with natural attenuation may thus help predict the long-term, post-stimulation stability of a bioremediation site. This study characterized and quantified the soil organic matter in biostimulated areas and compared it to NOM found in zones of natural bioreduction. Core samples from 2 biostimulated wells and 7 naturally reduced wells were taken at depths between 8 and 20 ft. Total organic carbon measurements for all samples were measured by a UIC total organic carbon analyzer, while humic and fulvic content were determined via an acid-base extraction scheme. SUVA analyses at 254 nm provided further insight into the functional character of the organic matter. Additionally, C14 labeled acetate will be used to identify produced carbon pools. Preliminary results suggest that operationally defined carbon fractionation methods are able to isolate bioavailable organic carbon pools

[1] Yabusaki *et al.* (2005) *Jnl Cont Hydr* **93**. 216–235.

[2] Anderson *et al.* (2003) *App Env Microb* **69**. 5884–5891.

[3] Gu *et al.* (2005) *Environ Sci Tech* **39**. 5268–5275

## Integrating monazite and xenotime thermochronology to determine the timing and nature of the Al<sub>2</sub>SiO<sub>5</sub> triple-point metamorphism in the Picuris mountains, New Mexico, USA

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Al<sub>2</sub>SiO<sub>5</sub> reaction textures in quartzite and schist from the Picuris mountains, New Mexico show Ky replaced by Sil, followed by And, consistent with a clockwise path around the triple point. Mzt from Ky-Sil bearing quartzite preserve 2 or 3 compositional domains characterized by high Th, low U cores and high U and low Th rims. Matrix Mzt from quartzite are embayed suggesting partial dissolution. Mzt inclusions within Ky are approximately euhedral, and dominated by a core domain suggesting they were largely protected from dissolution. Mzt within the quartzite are aligned in the dominant S<sub>1</sub>/L<sub>1</sub> fabric and contain aligned inclusions of titanhematite. Mzt cores formed prior to or simultaneous with Ky. Mzt rims postdate kyanite and likely predate sillimanite.

Mzt within Ky-Sil-And schists are subhedral and preserve three chemical domains with high Th and U cores, a relatively low U and Th mantle, and enriched U and Th rims. Zoning is identical between matrix Mzt and Mzt inclusions within And. Mzt within the schist are aligned in S<sub>2</sub> and predate andalusite growth.

Ion microprobe U/Pb ages from Mzt cores and rims record a spread in ages from 1434 Ma ± 12 Ma to 1390 ± 20 Ma. Mzt-Xt thermometry yields rim temperatures (°C, 2 sd) of 517 ± 18 and 501 ± 36 for the schist and quartzite, respectively. These data are interpreted to show that metamorphism occurred over a single metamorphic cycle, during a clockwise P-T loop between ~1450 Ma and ~1400 Ma.