

## Produced water quality: Implications for treatment and beneficial use

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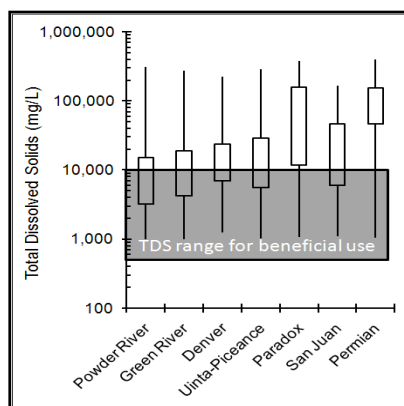
Approximately 100 million gallons of produced water are generated per day in the Western US from oil and gas extraction. In many areas of the Western US, conventional water supplies are fully allocated and a need exists for additional water resources. Produced water, if it meets the necessary quality standards, has the potential to be used for stream flow augmentation, irrigation, live stock watering, municipal and industrial uses, recreation, and environmental restoration [1].

### Produced Water Quality

Produced water TDS concentrations range from 1,000 mg/L to over 400,000 mg/L. Sodium chloride and sodium bicarbonate are the dominant salts in produced water [2]. Minor ions in produced water may also be problematic for treatment and beneficial use.

### Treatment and Beneficial use of Produced Water

Desalination will often be required to reduce the total dissolved solids concentration of produced waters to meet beneficial use requirements (Figure 1).



**Figure 1:** TDS range for oil and gas produced water and beneficial use.

[1] ALL Consulting (2003). [2] Benko & Drewes (2008) *EES*, **25** (2): 239-246.

## Mineral control on organic carbon and nitrogen biogeochemistry

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The mechanisms involved in interactions of organic carbon (OC) and nitrogen (ON) with minerals still remain poorly understood. Using density fractionation together with biomarker and spectroscopic methods, we studied the role of minerals on the composition and dynamics of mineral-associated OC and ON along the Hawaiian basaltic weathering gradient.

Mineral-organic associations (MOAs) at the youngest 0.3-kyr site were mainly composed of primary minerals with small amounts of attached OM, the 20–400-kyr sites with prevailing poorly crystalline (PC) minerals had larger sorbed OM concentrations, which dropped towards the oldest sites (1400 and 4100 kyr) comprising crystalline secondary minerals [1]. At the 0.3-kyr site, compounds linked to microbial activity, i.e. peptides/proteins and carbohydrates were enriched in sorbed OM. Lignin phenols preferentially accumulated as PC minerals form due to their larger affinity towards variable-charge mineral surfaces. Likewise, acidic peptide/protein structures were more effectively retained by PC minerals [2]. The D/L ratio of lysine revealed an active cycling of the peptidic ON fraction in biologically active topsoil MOAs. In the subsoil, <sup>14</sup>C and D/L signature indicated a longer turnover of proteinous components strongly bound to minerals [2]. Hence, stabilization of OC and ON not only depends on the mineral composition but also on the location of MOAs in the soil profile.

Our results call for a pedogenic approach in assessing the biogeochemistry of mineral-associated OC and ON.

[1] Mikutta *et al.* (2009) *GCA* **73**, 2034–2060. [2] Mikutta *et al.* (2010) *GCA*, in press.