

Impact of water sources and flow paths on carbon in streams of seasonally snow-covered catchments

JULIA PERDRIAL^{1*}, PAUL BROOKS², JON CHOROVER¹,
ADRIAN HARPOLD², INGO HEIDBUECHEL²,
JENNIFER MCINTOSH², JAMES RAY³
AND XAVIER ZAPATA-RIOS²

¹University of Arizona, SWES, Tucson, AZ, USA

(*correspondence: jnperdri@email.arizona.edu)

²University of Arizona, HWR, Tucson, AZ, USA

³University of Puget Sound, Tacoma, WA, USA

Stream waters from seasonally snow-covered catchments of the Jemez River Basin Critical Zone Observatory in northern New Mexico are characterized by two distinct main water sources. While groundwater from deeper flow paths dominates the streams throughout the year, snowmelt and monsoon inputs additionally enter the streams through shallow soil flow paths. To investigate how changes in water sources influences dissolved carbon characteristics, 5 flumed streams at catchment outlets located around Redondo peak were sampled 10 times between March and October 2010 to analyze for total dissolved organic and inorganic carbon (DOC and DIC), DOC quality and stable isotopes of DIC. Stream water DOC showed a flushing pattern in all catchments, with highest concentrations during peak snowmelt and low concentrations during the dry season. SUVA₂₅₄ confirms presence of organic soil constituents of lignin based precursors during snow melt and monsoon season. Preliminary results of organic matter (OM) PARAFAC quantification identified a component with fluorescence in region II that dominates when shallow flow paths are activated. DIC concentrations show a dilution pattern with low concentrations during snowmelt. $\delta^{13}\text{C}$ values of DIC progressively increase with time since snowmelt, suggesting increasing inputs of groundwater enriched in ^{13}C , possibly from microbial cycling of carbon in long transit time reservoirs. In waters from deeper flow paths, low SUVA₂₅₄ values and a PARAFAC component with fluorescence in region I dominate. Those results indicate that differences in source waters, flow paths and residence times have important impacts on stream water carbon characteristics.

Predicting the fate of radionuclides at the Hanford tank farm using analog sediments

N. PERDRIAL^{1*}, A. THOMPSON², N.A. RIVERA³,
Y.-T. DENG², P.A. O'DAY³ AND J. CHOROVER¹

¹SWES, University of Arizona, Tucson, AZ 85721, USA

(*correspondence: perdri@email.arizona.edu)

²Crop and Soil Science, University of Georgia, Athens, GA 30602, USA

³School of Natural Sciences, University of California, Merced, CA 95343, USA

Due to challenges in studying *in situ* samples induced by the extreme conditions encountered at the USDOE facility at Hanford (WA, USA) and in order to predict the impact of the cleanup strategy on contaminant transfer, we investigated the geochemical behavior of Hanford sediments impacted by a synthetic tank waste (i.e. 'analog contaminated sediments') before and after removal of the waste source.

The reaction of pristine Hanford sediments with synthetic waste containing Sr, Cs and I led to the production of 8 analog sediments reflecting different contamination scenarios. Amongst the variables tested (contaminant concentrations, pCO₂, reaction time), the level of trace contaminant had the greatest effect on the mineral transformation reactions that gave rise to sequestration of Sr and Cs. Reaction product formation was correlated with trace contaminant (mM vs. μM) concentration. Sodalite/cancrinite formation at μM levels and chabazite formation at mM levels affected the binding environment of incorporated Sr and Cs.

The effect of source removal was investigated by infiltrating the sediments with a synthetic porewater solution that reflected aquifer recharge, and monitoring elemental release in dissolved and colloidal pools, as well as solid phase transformation, over time. The observed release mechanisms helped constrain a contaminant transport model used as a predictive tool for contaminant release at Hanford. Contaminant stability differed according to the reaction time and contaminant levels, consistent with neophase ripening and structural modifications occurring during desorption. Cs and Sr release depended on neophase stability, whereas I was rapidly desorbed. Elemental release monitored during wet-dry cycling did not significantly modify desorption rates. Sr particulate ($\text{Ø} < 20\mu\text{m}$) transport was observed in some cases.

The observation of contaminant dynamics in analog Hanford sediments helps predict the fate of contaminants, and highlights the strong potential for long-term natural sequestration of Sr and Cs (not I) after retrieval of the sources.