Towards a Predictive Relationship between Sediment Mineralogy and Contaminant Mobility

Contact: Melanie Mayes, *mayesma@ornl.gov*, 865-574-7336

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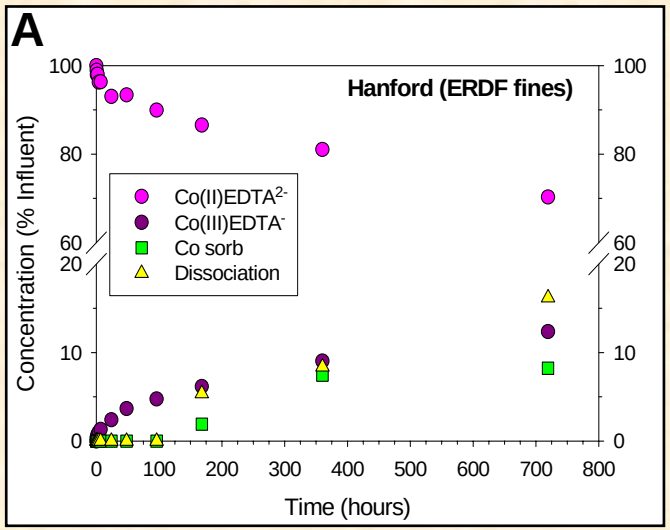
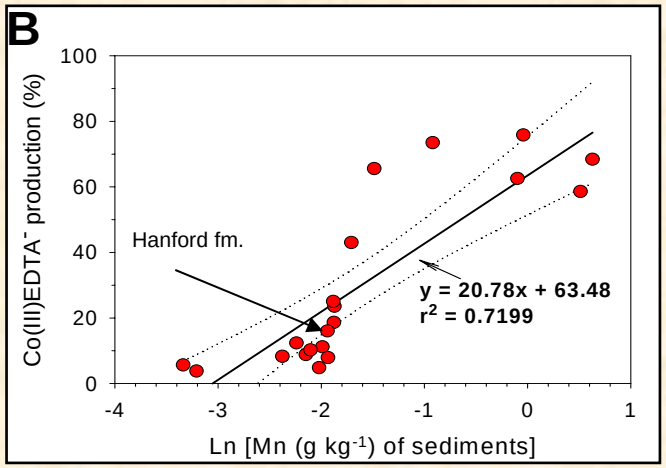
- **Heterogeneities in physical and chemical properties of geologic materials may complicate realistic predictions of contaminant migration.**
- **Identical experiments utilizing 20 different sediments from the Hanford region were performed with $Co(II)EDTA^{2-}$, an aqueous radionuclide-organic complex (Fig. A).**
- **The oxidation of $Co(II)EDTA^{2-}$ to $Co(III)EDTA^{-}$ was correlated with sedimentary Mn content (Fig. B).**
- **The correlation ($r^2 = 0.72$) constitutes a predictive tool for subsurface Co mobility given known sedimentary composition.**
- **The first publication to demonstrate a predictive relationship between sediment mineralogy and contaminant mobility at Hanford.**





OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

UT-BATTELLE

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Heterogeneities in chemical or physical properties of subsurface media complicate our ability to make adequate predictions of contaminant mobility. We performed identical experiments using an approximately 20 different sediments from the Hanford Reservation. The contaminant was Co(II)EDTA^{2-}, a component of nuclear processing wastes produced from the association between radioactive ^{60}Co and the organic chelate EDTA. It was found that some of the complex was oxidized to Co(III)EDTA^{-} in the presence of Hanford sediments, and that the importance of the transformation was statistically correlated to the Mn-oxide content of the sediment. The oxidative process is important because of the high degree of stability and mobility of the Co(III)EDTA^{-} reaction product (log K = 40) in the subsurface environment. The significance of this study, however, lies in the generation of the relationship between Mn-oxides and Hanford sediments, which can be utilized to predict *a priori* the mobility of Co(II)EDTA^{2-} given known sedimentary geochemical properties. Such geochemical characterization exists for hundreds to thousands of samples from the Hanford Reservation.

Reference: Mayes, M.A., Yin, X.L., Pace, M.N., and Jardine, P.M. 2005. Rates and mechanisms of Co(II)EDTA^{2-} interactions with sediments from the Hanford site. *In:* ACS Symposium Series 910: Biogeochemistry of Chelating Agents, Nowack, B. and Van Briesen, J., Eds. *(in press)*, pp. 278-296.