Archean lithospheric mantle: Plume-arc interaction

R. KERRICH[1], D. WYMAN[2] AND A. POLAT[3]

[1]University of Saskatchewan, Saskatoon, Canada S7N 5E2 (robert.kerrich@usask.ca)
[2]School of Geosciences, University of Sydney, NSW 2006, Australia (d.wyman@usyd.edu.au)
[3]Earth Sciences, University of Windsor, Canada N9B 3P4 (polat@uwindsor.ca)

The 2.7 Ga Abitibi-Wawa greenstone belt provides constraints on the origin and timing of Archean lithospheric mantle. Neither subcretion stacking of ocean lithosphere nor plume-only models resolve the aparent paradox of arc-dominated crust but plume residue for refractory mantle lithosphere. There are two dominant volcanic sequences tectonically imbricated in a subduction-accretion complex: komatiite-tholeiite basalt sequences erupted as ocean plateau derived from mantle plumes, and bimodal tholeiitic to calc-alkaline basalts and dacites erupted as intraoceanic arcs. In the model of plume-arc interaction, a migrating arc captures thick contemporaneous plateau crust which imbricate to yield the dual volcanic sequences. At 2.7-2.68 Ga TTG, that traversed a mantle wedge, were emplaced, as were diamondiferous lamprophyres constraining the PT regime of the mantle wedge. By 2.5 Ga the bouyant refractory residue of melting in the plume coupled with the crust, timed by resetting of isotopic systems in reactivated faults [1]. Later subduction-related metasomatism of domains of refractory mantle lithosphere reset the lithosphere to lower P values.

[1] Wyman *et al*. (2002) *Precamb. Res,* **115**, 37–62.

Subsurface transport of Pu on nanominerals: Teasing out biogeochemical controls in field environments

ANNIE B. KERSTING[1], MAVRIK ZAVARIN[1], ZURONG DAI[1], ANDY FELMY[2], RUTH A. KIPS[1], DUANE MOSER[3], BRIAN A. POWELL[4], RUTH TINNACHER AND PIHONG ZHAO[1]

[1]Glenn T. Seaborg Institute, Physical & Life Sciences, Lawrence Livermore National Laboratory, Livermore, CA 94550 (Kersting1@LLNL.gov)
[2]Pacific Northwest National Laboratory, Richland, WA 99352
[3]Desert Research Institute, Las Vegas, NV 89119
[4]Clemson University, Clemson, SC 29625

The ability of colloids (< 1 micron particules) to transport strongly sorbing radionuclides, such as plutonium (Pu), has been shown in a number of seminal field studies [1, 2, 3]. Despite the recognized importance of colloid-facilitated transport, little is known about the geochemical and biochemical mechanisms controlling Pu-colloid formation and association. The major challenge in predicting the mobility and transport of plutonium (Pu) is determining the dominant biogeochemical processes that control its behavior at the water-mineral interface. The reaction chemistry of Pu (*i.e*. aqueous speciation, solubility, sorptivity, redox chemistry, and affinity for colloidal particles, both abiotic and microbially-mediated) is particularly complex.

Current research at the Nevada Test Site (NTS) has shown that the transport of Pu detected in deep groundwater with low organic carbon is associated with the inorganic colloidal fraction, specifically clays. In addition, greater than 70% of the total Pu is associated with the smallest particulates, 10-100 nm. Yet, in shallower NTS groundwater with high dissolved organic carbon, the Pu is mostly dissolved and not colloidal. In contrast, Santachi *et al*. [2] has shown that at Rocky Flats the Pu is associated with the microbial fraction of the surface water. At Hanford the vertical transport of Pu in the vadose zone appear to be mineralogically controlled. We will compare results from different biogeochemical environments at NTS to elucidate the dominant controls on transport of Pu in the subsurface.

[1] Kersting A.B. *et. al*. (1999) *Nature* **397**(6714) 56–59. [2] Santschi P. *et. al*. (2002) *Env. Sci. & Tech*. **36**(17) 3711–3719.. [3] Novikov A. P *et al*. (2006) *Science* **314**(5799) 638–641.