New approach for the determination of a mantle end-member of N-MORB-like component in oceanic basalts: Metallogenic implications

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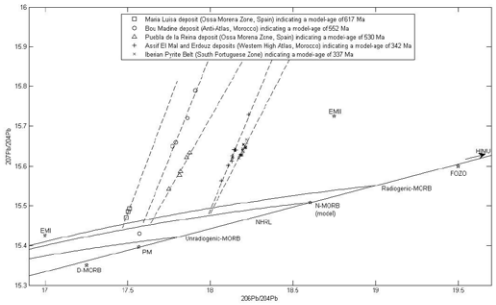
Pb isotope data for the Bou Madine volcanogenic deposit, located in the Anti-Atlas domain of Morocco, display a linear trend, on a standard $^{207}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$ plot, with a MORB-like component. Considering the age of 552 Ma of rhyolites associated Bou Madine, together with calculations based on U/Pb systematics, the present-day Pb isotopic composition of the mantle source intercept with the northern hemisphere reference line (NHRL) is: $^{206}Pb/^{204}Pb$ = 18.6043 and $^{207}Pb/^{204}Pb$ = 15.5078. We regard these values to be the best estimate for the mantle end-member of oceanic basalts lying between the primitive mantle and the FOZO mantle on the NHRL. This model, when applied to other deposits related to mantle-derived rocks in North Africa and West Europe



(e.g., Assif El Mal and Erdouz deposits in western High Atlas of Morocco, Maria Luisa and Puebla de la Reina deposits in Ossa Morena Zone of Spain, and Iberian Pyrite Belt in the south Portuguese Zone), provides ages in good agreement with ages determined by independent methods. Consequently, we recommend this model for dating deposits that are associated with N-MORB-derived magmatic rocks and whose Pb isotope data fall along mixing lines with N-MORB-like components.

Diffusion retardation due to decreasing micro-channel width in a 2-D micromodel

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Introduction and Methods

Dissolution of uranium minerals within fractures has been found to be a diffusion rate limited process; thus, diffusive mass transfer in sediment micro-factures significantly affects the fate and transport of uranium in the subsurface [1]. In 1-10 μm micro-fractures, the diffusion coefficient of uranium contaminated waste water into pore water has been estimated as low as 10^{-11} m^2 s^{-1} [1], which is 2% of the measured diffusion coefficient for uranyl, $4.26\times10^{-1\circ}$ m^2 s^{-1} [2]. The objective of this investigation is to investigate diffusion retardation as a function of micro-fracture size.

A micro-fluidics model was engineered by inductively coupled plasma-deep reactive ion etching system [3]. It had a linear main channel with micro-channels, 0.5 mm long and 5 μm - 30 μm wide, coming off the main channel. A continuous stream of water was pumped through the main channel. Water was spiked with fluorescent dye tracer, microspheres, or uranium phosphorous complex. Diffusion was calculated from image analyses obtained using a Nikon Epiphot 200 epi-fluorescent microscope with 10× objective, and a RT Spot CCD digital camera [3].

Results and Discussion

Initial results demonstrate that diffusion of fluorescein dye into a 5 μm channel was reduced by 19% at 30 seconds and 30% at 7 minutes, compared to a 30 μm channel. While the time frames of these experiments are short, the results suggest the significance of microfractures in subsurface sedimentary material on the transport and fate of contaminants. Knudsen diffusion, surface drag, and adsorption can combine to reduce effective axial diffusion. Consequently, dissolution of intraparticle contaminant source phases and release to pore fluids will be reduced. Moreover, local saturation indices within the microfractures will result in precipitation of secondary phases, which, in turn, will sustain contaminant concentrations beyond conventional transport models predictions.

[1] Liu *et al*. (2006) *Water Resour. Res*., **42** 1-15. [2] Lide (2003) *CRC Handbook of Chemistry and Physics*. [3] Willingham *et al* (2008) *Environ. Sci. Technol*. **42**, 3185-3193.