Uranium(IV) colloids in near-neutral solutions: Influences on particle size

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Uranium(IV) is only sparingly soluble in near-neutral solutions [1]. As a consequence, uranium is expected to be immobile (deposited) under reducing conditions. However, we found out that under certain conditions U(IV) formes stable colloids which leads to a mobilization of the uranium. The colloids were generated by galvanostatic reduction of a 20 mM $UO_2(ClO_4)_2$ solution in 1 M $NaHCO_3$. The stock solutions were diluted to 1 mM uranium using solutions of dissolved silicic acid (2 – 5 mM). Then they were neutralized with perchloric acid. Measurement of the scattered light intensity (SLI), photon correlation spectroscopy (PCS) and ultracentrifugation (UC) were carried out.

Typically, the colloids produced did not reach their final particle size immediately but showed a certain growth phase of about one week. This could be seen from both PCS and simple SLI measurements.

It turned out that the highest SLIs occurred in the solutions of the lowest silicate content and vice versa. All samples exhibited an increase in SLI with decreasing pH. Obviously, very small colloidal particles are generated at high pH and/or high silicate concentration and larger ones at low pH and/or low silicate concentration. At the highest initial silicate concentration applied, the colloids were still stable at pH values below 7.

This silicate and pH dependency of U(IV) colloid particle size was also confirmed by our UC results. The smaller the colloids, the longer the time they needed for separation at the given centrifugal acceleration of 170000 x g. After 1 h of UC the supernatants of samples with higher silicate content still contained significantly higher U concentrations than samples with low silicate content. After 5 h UC time the uranium was almost completely removed from all samples, indicating that truly dissolved uranium did not play a significant part in the system, i.e. almost all the U was colloidal.

[1] Silva *et al*. (1995) *Radiochim. Acta* **70/71**, 377-396.

U-series systematics of axial seamount, Juan de Fuca ridge

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Axial Seamount is the most volcanically active portion of the Juan de Fuca (JdF) ridge, and the easternmost extension of the Cobb-Eickelberg seamount chain. Variations in major and trace element and long-lived radiogenic isotopes are minimal in Axial Seamount lavas [1], reflecting processes operating in its atypically large, stable magma chamber [2, 3]. However, U-series data from the JdF ridge indicate source composition, melting, transport, accumulation, and/or eruption processes vary on the segment-scale over a few decades [3]. Existing data show Axial Seamount lavas have the lowest $^{230}Th/^{232}Th$ on the JdF ridge, and (^{230}Th)-excesses are similar to adjacent segments but lower than the Endeavour segment [4]. Large (^{226}Ra)-excesses observed at Axial Seamount indicate short magma residence times [3, 5], and (^{210}Pb)-excesses from Axial Seamount may imply ^{222}Rn gas or plagioclase accumulation in the magma chamber; this contrasts with (^{210}Pb)-deficits at adjacent North Cleft (and MORB in general) [3].

To further investigate petrogenetic timescales and clarify relationships with the JdF ridge and global MORB, we have conducted a systematic U-series study of Axial Seamount. Multibeam and sidescan surveys and ROV ground-truth observations were used to create high-resolution (sub-meter) bathymetric and geologic maps. Well-located glass samples from individual pre- and post-caldera lava flows were collected during ROV dives, including the extensive 1998 flow [6] that improves the quality of U-series model ages. New Axial Seamount glass compositions are consistent with published data (e.g., average Th/U = 2.82 ± 0.16, 2σ, n=19). Flow ages will be compared to relative ages derived from flow contacts and combined with independent eruption age constraints planned for the near future (^{14}C ages of basal sediment, paleomagnetic intensity of lava flows). This data will aid in understanding the chemical and physical dynamics of the Axial Seamount magma chamber within a temporal framework, and will serve as a foundation for *in situ* time-series biologic and hydrothermal studies of the oceanic crust.

[1] Chadwick *et al.* (2005) *JGR* **110**, B03101. [2] West *et al.* (2001) *Nature* **433**, 833-6. [3] Rubin *et al.* (2005) *Nature* **437**, 534-8. [4] Goldstein *et al.* (1991) *EPSL* **108**, 25-42. [5] Volpe and Goldstein (1993) GCA **57**, 1233-41. [6] Embley *et al.* (1999) *GRL* **26**, 3425-8.