Osmium behavior in a subduction zone setting elucidated from Cr-spinel sands of boninites and tholeiite in Bonin islands

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Osmium (Os) isotope is a sensitive tracer of crust and sediment as its eroding form, because of significant contrast between a high Os isotope ratio of crust and sediments ($^{187}Os/^{188}Os>0.5$) and a low ratio of mantle ($^{187}Os/^{188}Os<0.13$). Therefore, Os isotope provides information on slab components contribution to the mantle source of island arc lavas (Brandon *et al*., 1999; Borg *et al.*, 2000; Alves *et al.*, 2002). Radiogenic Os isotopic compositions are commonly found in volcanic lavas and peridotite xenoliths in a subduction zone setting. Though most of the authors had attributed these high $^{187}Os/^{188}Os$ to the input of the slab component to the mantle source, some pointed out that assimilation of crustal materials during magma ascent possibly reproduce the elevated Os isotope ratios of the arc lavas (Lassiter and Luhr, 2001; Woodhead and Brauns, 2004). Since then, whether the high Os isotope ratios of arc lavas are caused by contribution of slab component or by assimilation of the overlying crust has long been highly debated.

Here we report the unradiogenic Os isotopic ratios of Cr-spinel sands from Chichi-Jima and Yome-Shima boninites and the significantly high $^{187}Os/^{188}Os$ of Cr-spinels of the Mukoo-jima tholeiite, Izu-Bonin arc. As Cr-spinel is resistant to later alteration and weathering and, more importantly, is the early stage crystal in the fractional crystallization, it preserves the chamical and isotopic compositions of very primitive magma in its melt inclusion and spinel itself without any later stage crustal contamination. Therefore, extremely high $^{187}Os/^{188}Os$ of 0.1429 of Mukoo-jima tholeiite is most likely caused by inputs from slab components, not by assimilation of the overlying crust. Unradiogenic $^{187}Os/^{188}Os$ of Cr-spinel of Yome-shima and Chichi-jima boninites (0.1232 and 0.1242, respectively) indicate that Os is not mobile under a boninite formation condition. As a result, we demonstrate that Cr-spinel is the most useful mineral to decode the Os isotopic compositions of primitive arc magmas.

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Reduction of U(VI) by *Shewanella putrefaciens* in the presence of organic acids

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Introduction

The oxdation state of uranium is one of the important factors that affect its migration in the environment. Although microbial reduction of U(VI) has been extensivly investigated, limitted information is available of the effects of organic acids. We examined the reduction behavior of U(VI) by *Shewanella putrefaciens* in the organic acid solutions.

Experimental

Shewanella putrefaciens was incubated in anarobic medium at pH 7 that contained 1mM UO_2^{2+}, 50 mM lactic acid and 100 mM organic acids (acetic, oxalic, malonic, succinic, adipic, malic, tartaric, citric acid or EDTA). Aliquots of medium were periodically withdrawn, and filtered. Dissolved uranium concentrations and UV-vis spectra of the aliquots were measured. Precipitates generated were analyzed by XANES and SEM. The medium without organic acid (except for lactic acid) was examined as a control.

Results and Disccussion

In the control medium and the media containing acetic or adipic acid, dissolved uranium decreased with time, and precipitates were obserbed. The XANES spectra of the precipitates showed that the precipitates contained U(IV). The SEM analysis showed that the precipitates was uraninite (UO_2). In the other media, dissolved uranium was almost constant. The UV-vis spectra showed that dissolved U(VI) was reduced to U(IV), and it was present as U(IV) organic complex in the medium containing oxalic, tartaric, citric acid or EDTA. No evidence of U(VI) reduction was observed in the media with succinic or malic acid. These results suggest that the reduction behaviors of U(VI) by *S. putrefaciens* are categorized into three cases depending on organic acid.