Experimental determination of spinel/melt, olivine/melt, and pyroxene/melt partition coefficients for Re, Ru, Pd, Au, and Pt. K. Righter (Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721; righter@lpl.arizona.edu), A.J. Campbell and M. Humayun (Department of the Geophysical Sciences, The University of Chicago, 5734 S. Ellis Ave., Chicago, IL 60637)

Experimental studies of partitioning of HSEs between silicates, oxides and silicate melt are plagued by low solubilities and the presence of small metallic nuggets at oxygen fugacities relevant to magmas, which interfere with analysis of the phases of interest. We have circumvented these problems in two ways: 1) performing experiments at oxidized conditions, which are still relevant to natural systems but in which nuggets are not observed, and 2) analysis of run products with laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), allowing a combination of high sensitivity and good spatial resolution.

Partition coefficients for Re, Ru, Pd, Au and Pt have been measured using three different compositions. Ankaramite, doped with Cr_2O_3, encapsulated with AuPd tubing, and buffered with Fe_2O_3-Fe_3O_4 and MnO-Mn_3O_4, was used to study spinel/melt and olivine/melt partitioning. Two synthetic basalts, encapsulated by Pt and buffered with Ni-NiO and Ru-RuO_2, were used to study spinel/melt and clinopyroxene/melt partitioning. The 1 bar experiments were carried out in evacuated silica tubes, and the 20 kbar experiments were carried out in a piston cylinder apparatus. An electron microprobe was used to analyze major elements in all phases, and Ru and Rh in some spinels. Highly siderophile elements were measured by LA-ICP-MS, using 100 μm, 50 μm and 25 μm spot sizes, respectively. HSE abundances were determined relative to MgO contents of the phases, which were analyzed independently by electron microprobe. The absence of nuggets was inferred from the smooth quality of the time dependent LA-ICP-MS signals, the reproducibility of analyses in adjacent regions of the glass, and the agreement with solubility studies (Borisov and Palme, 1996).

When our new results for Ru (Table 1) are combined with previous results, it is evident that spinel/melt partition coefficients for Ru are highest at the lowest oxygen fugacities (Capobianco et al., 1994; Righter et al., 2001; D = 1100-2300), and/or when the spinel is inverse such as magnetite (# 118; D = 870). These results suggest that both inverse and chromian spinels can be important hosts for Ru at mantle oxygen fugacities, in agreement with partition coefficients inferred from komatiite lava lakes (Puchtel and Humayun, 2001; Table 1). On the other hand, Re is incompatible in all spinels produced experimentally so far. These trends may reflect higher valences for Re and Ru at oxidized conditions (6+ and 4+), compared to reduced conditions (3+?). Platinum is compatible, whereas Re is incompatible in clinopyroxene. All elements measured are incompatible in olivine, in agreement with previous experimental work (Capobianco et al., 1994).

Table 1: Summary of experimental conditions and partition coefficients

run	158	206	112	118	153	komatiitic basalt	
phase	sp, ol	sp, ol	sp, cpx	sp	cpx	sp	oliv
P, T (˚C)	1 bar, 1300	1 bar, 1260	20 kb, 1275	20 kb, 1275	1 bar, 1300		
buffer	Fe_2O_3-Fe_3O_4	MnO-Mn_3O_4	Ru-RuO_2	Ru-RuO_2	Ni-NiO		
logfO_2	-1.5	-3.5	-1.5	-1.3	-6.7		
D(Re)	-	0.001, 0.03	0.21, 0.21	-	0.18		
D(Ru)	76, 0.24	-	-	870	-	151	1.7
D(Pd)	0.14, 0.12	-	-	-	-	1.6	0.03
D(Pt)	-	-	-	-	1.50	3.3	0.08
D(Au)	0.08, 0.13	-	-	-	-		

References: Borisov and Palme (1996) *Mineral. Petrol. 56*, 297-312; Capobianco, et al. (1994) *Chem. Geol. 113*, 23-43; Puchtel and Humayun (2001) GCA65, 2979-2993; Righter et al. (2001) *Eleventh Annual V.M. Goldschmidt Conference*, Hot Springs, Virginina (CD-ROM).