# Behavior of selenium and tellurium in the terrestrial mantle

STEPHAN KÖNIG[1]*, MORITZ LISSNER[2], JEAN-PIERRE LORAND[3] AND AMBRE LUGUET[2]

[1]Department of Geosciences, University Tuebingen, Germany, stephan.koenig@uni-tuebingen.de

[2]Steinmann Institut für Mineralogie, Universität Bonn, Germany

[3]Laboratoire de Planétologie et Géodynamique de Nantes, Université de Nantes, France

Constraining the behavior of the chalcophile and volatile elements Se and Te during petrogenetic processes in the terrestrial mantle may significantly help to unravel the origin of volatiles on Earth. We show that the whole rock Se-Te budget of mantle residues, that are devoid of base metal sulfides (BMS) after high degrees of partial melting ($F \approx 23\%$), is almost completely controlled by olivine-hosted micro-inclusions and intergranular fractions of platinum group minerals (PGMs). PGM micro-inclusions in olivine with residual-type CI-chondrite normalized HSE patterns and suprachondritic Se/Te ratios between 30 and 218 ($Se/Te^{CI}_{chondrite}$ = 9) host close to 100% of the bulk rock Se. Interstitial fine components up to 125$\mu$m grain size may contribute only minor amounts of Se, but up to 50% of Te to the bulk harzburgite and show subchondritic Se/Te ratios of ca. 4, resembling metasomatic PGM signatures. In dependence on increasing proportions of interstitial and metasomatic PGMs vs. olivine-hosted, residual PGMs, the bulk rock Te contents may increase and the Se/Te ratios decrease. The Se-Te vs Te systematics seen in mineral separates of harzburgites resemble the signatures of all suites of peridotites and host phases so far published. The results are consistent with a higher compatibility of Se in covalent monosulfides (MSS, laurite-erlichmanite) compared to Te that prefers sulfide melts. It is further consistent with the stabilization of residual PGMs after MSS exhaustion, as well as with formation of metasomatic PGMs in a Cu- and volatile-rich sulfide melt. Altogether our results reconcile a higher incompatibility of Te over Se during partial mantle melting under S-undersaturated conditions, subsequent removal of Te over Se with Cu-Ni-rich sulfide fractionation from sulfur-saturated partial melts, and explains the similar Te but higher Se abundances in MORBs compared to peridotites that is globally observed.