Melt percolation in mantle xenoliths from Lanzarote (Eastern Canary Islands): Evidence from highly siderophile elements

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A suite of mantle derived peridotite xenoliths has been analyzed for highly siderophile elements (HSE) to investigate the behaviour of HSE during melt percolation in the suboceanic lithospheric mantle beneath the Canary archipelago.

The Canary archipelago is located approximately 100 km off the northwestern coast of Africa. Lanzarote, a relatively young manifestation of the Canary hotspot, rises approximately 6500 m from seafloor composed of Jurassic-aged (155 Ma) Atlantic oceanic crust and lithosphere. It consists dominantely of alkalic basalts and basanites, that have been erupted from 4 Ma until present. Basalt born spinel-harzburgite xenoliths from Lanzarote represent fragments of highly refractory, old suboceanic lithospheric mantle. This mantle has been modified through a combination of melt extraction and metasomatism caused by infiltration of Fe-Ti-rich silicate melts and CO_2 fluids, probably in association with the formation of the Canary Islands. Spinel harzburgite, lherzolite, dunite and wehrlite mantle xenoliths from the Canary Islands (Lanzarote) contain a spectrum of silicate glasses as inclusions in minerals, along grain boundaries, and in interstitial glass pockets. The silicic glasses are interpreted as the products of reactions between infiltrating alkali basaltic magmas and peridotitic wall-rocks. Low K_2O concentrations and K_2O/Na_2O ratios in glasses in anhydrous xenoliths suites from Lanzarote are believed to result from reactions between infiltrating melts and anhydrous and/or amphibole-bearing mantle wall-rocks. The silicic melts appear to have been mobile over distances exceeding the diameter of a xenolith, that is, at least 20-30 cm [1].

Temperature estimates indicate a high geothermal gradient in the upper mantle under Lanzarote. A possible explanation for this is the presence of a mantle plume under the Canary Islands, which causes thermal erosion at the base of the lithosphere, whereas ascending plume melts are responsible for heating, partial melting and metasomatism in the overlying mantle [1].

We present HSE data on xenoliths and from a alkaline basalt (La120-ba), bearing xenolith sample La120 from Lanzarote (Table 1). Osmium abundances of the xenoliths range from 0.61 to 4.77 ng/g. All samples show fractionated PGE ratios ($\mathrm{Os/Ir}=1.03\pm0.33$; $\mathrm{Os/Ir_{CI}}=1.06$; $\mathrm{Rh/Ir}=1.49\pm1.24$; $\mathrm{Rh/Ir_{CI}}=0.31$; $\mathrm{Ru/Ir}=2.33\pm0.61$; $\mathrm{Ru/Ir_{CI}}=1.56$). The basaltic sample is depleted in all HSE (except Pd). Os/Ir ratios from the xenoliths range from subchondritic to suprachondritic. Sample La2/2 is depleted in Os whereas samples La101 and La120 are enriched in Os relative to Ir. Sample La108 is depleted in all HSE.

Table 1: HSE abundances of Lanzarote xenoliths and basalt

	Os	Re	Ir	Ru	Rh	Pd	Au
Sample	ng/g	pg/g	ng/g	ng/g	ng/g	ng/g	ng/g
La 2/2	0,61	110	1,10	2,59	1,84	1,90	0,3
La108	0,63	80	0,51	1,56	1,62	2,30	0,2
La104	<2,5	<40	2,45	<5	<1	<0,3	0,2
La101	4,77	<10	4,52	7,03	2,54	1,80	0,3
La120	3,93	<20	3,10	7,31	1,68	<0,6	0,2
La120-ba	0,30	<60	0,22	0,84	0,06	1,00	0,2

Some xenoliths (Table 1) have significantly higher concentrations of all PGE (except Pd) in comparison to literature data reflecting the mobility of these elements in a metasomatized oceanic mantle. Two samples (La2/2 and La108) have lost a large fraction of PGE. Melt percolation may have removed intergranular sulfides and reduced the PGE content of these samples. PGE bearing phases have been dissoluted and precipitated by melts in these rocks. Partially melts from recycling of subducted crustal material into the mantle may have infiltrated and reacted with the overlying oceanic mantle.

[1] E.-R. Neumann et al. Lithos **35**, 83 (1995)