Refertilization of highly depleted lithospheric mantle (Balkan peninsula, SE Europe): Evidence from peridotite xenoliths

H DOWNES[1], V CVETKOVIC[2,3], V HOCK[2], D PRELEVIC'[3] AND M LAZAROV'[3]

[1] Research School of Earth Sciences, Birkbeck, University of London, Malet St, London, UK. h.downes@ucl.ac.uk
[2] Dept of Geography and Geology, University of Salzburg, Austria.
[3] Faculty of Mining and Geology, Belgrade University, Serbia and Montenegro cvladica@mkpg.rgf.bg.ac.yu

Peridotite xenoliths from the Balkan Peninsula provide evidence of refertilization processes within a highly depleted part of the lithospheric mantle. They occur in 40-60Ma old basanites in East Serbia. They are mostly harzburgites and clinopyroxene-rich lherzolites with characteristics that are much more depleted than typical non-cratonic peridotites, orogenic ultramafic massifs and average abyssal peridotite (e.g. silicate Mg#s = 90-92; Cr# in spinel up to 0.7, Al_2O_3 in opx – 1-2 wt%). This highly depleted mantle is very similar in composition to arc-related mantle and also contains opx-rich lithologies that were formed by precipitation of boninitic melts [1]. Such supra-subduction zone oceanic mantle lithosphere was probably accreted to the European continent during Mesozoic collision. Refertilization has occurred in three ways: (1) Fe-rich dunites and clinopyroxene megacrysts, (2) fertile xenoliths with metasomatic spongy-rimmed Ti-Al-rich clinopyroxene and disintegrated spinels, sometimes in sheared zones, and (3) tiny discrete metasomatic assemblages in veinlets and pockets in the highly depleted xenoliths. The fertile xenoliths have low Mg#s in their silicate minerals (ca. 88), low Cr#s in spinels (<0.4), and high Al_2O_3 in orthopyroxene (2-6 wt%).

Trace element patterns of metasomatic clinopyroxene in the refertilized lithologies indicate that the inferred metasomatic melts are genetically related to the host basanites. The Fe-rich xenoliths are inferred to have formed from direct crystallisation of the alkaline magmas in the lithosphere, whereas the fertile xenoliths and discrete metasomatic assemblages formed by melt-peridotite reactions. Major element modeling shows that the fertile lithologies originated by addition of 5-20% basanitic melt to the refractory mantle. Textural relationships and compositional variations in the discrete metasomatic assemblages indicate the following reaction: opx + Cr-spinel + Si-undersaturated CO_2-rich alkaline melt = Ti-Al-cpx + Ti-spinel +/- carbonate +/- ilmenite +/- apatite. Refertilization probably occurred just prior to eruption of the host basanites.

[1] Cvetkovic V et al (in press) Modification of the subcontinental mantle beneath East Serbia: evidence from orthopyroxene-rich xenoliths. Lithos.