Metasomatic modification of lherzolite during slab rollback in NW Anatolia

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Ultramafic xenoliths in Late Miocene alkali basalts from Thrace, NW Turkey comprise spinel-bearing lherzolites and subordinate dunites. Host basalts are sparsely olivine-phyric with ~2 mm pheno- and xenocrysts in a hypocrystalline groundmass of plagioclase, olivine, trace titanomagnetite and minor glass. Olivine in xenoliths and host basalts have core compositions ranging between Fo71-95.

Pristine xenoliths from this area record variable degrees of depletion presumably related to removal of mafic silicate melt (Aldanmaz et al. 2005) seen from trends in Cr# (atomic Cr/[Cr +Al]) from coexisting cpx and spinel.. We present new petrographic, SEM and electron microprobe analyses on a subset of the xenoliths have been infiltrated by a metasomatic fluid rich in both C and CaO. Reaction between this fluid and the lherzolite produced intergranular textures in olivine (reduced grain size in narrow zones presumably related to fluid flow) and chemical modification of Cr-spinel. Spinels show kelphytic rims and sharply reduced Cr contents consistent with a highly reducing metasomatic fluid interaction. Cr# variations from core to rim of spinels in metasomatized xenoliths (~0.48) are much higher than those of fresh samples (0.01) and calculated fO_2 in metasomatized samples are lower (FMQ-1) than those of fresh samples (FMQ+1). Results of geothermobarometry on coexisting cpx and opx (Mg# 82-90) in xenoliths (Brey & Kohler 1990, Putirka 2008) indicate P ~0.9 GPa, T ~975 ºC for pristine samples and 3.3 GPa, 1275 ºC for metasomatized xenoliths.

Host basalts have some of the lowest Sr isotopic values recorded across Anatolia, and Sr-Nd-Pb-Hf signatures within the range of the C mantle component (Aldanmaz et al, in review), consistent with evidence that the pristine xenoliths sample anhydrous DMM or OIB-like peridotite. We suggest that the metasomatic fluid records interaction between this mantle and slab-derived fluids at the onset of slab rollback.