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Amphibole incongruent melting under Lithospheric Mantle conditions in spinel peridotites from Balaton area, Hungary

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Pliocene alkali basalts from the western Pannonian Basin carry mantle xenoliths comprising hydrous and anhydrous spinel peridotites. We studied coarse and fine grained fertile to depleted spinel lherzolites, spinel harzubrgites and dunites from Szentbékálla, Balaton, in detail, using XRF, EPMA and LA-ICP-MS and MC-ICP-MS techniques.

Pliocene alkali basalts containing mantle xenoliths with three major types of textures are widespread in the studied area: fine-grained primary and secondary equigranular, coarse-grained protogranular and transitional between equigranular and protogranular textures.

Melt pockets, are common in the studied xenoliths. The shape of several melt pockets resembles euhedral amphibole. Other samples have thin films of intergranular glass attributed to the host basalt infiltration. Calculations have shown that such xenoliths experienced an up to 2.4% host basalt infiltration.

The bulk rock $Al2O_3$ and CaO concentrations vary from 0.75 to 4.1 and from 0.9 to 3.6 wt% respectively, and represent residues after variable degrees of partial melting. Using bulk rock major element abundances, the estimated degree of partial melting ranges from 4 to 20%..

The Primitive Mantle normalized clinopyroxene trace element abundances reveal a complicated evolution of the Lithospheric mantle underneath Balaton, which range from partial melting to modal and cryptic metasomatism. Subduction-related melt/fluids and/or infiltration of percolating undersaturated melts could be account for the metasomatic processes. The radiogenic isotopes of Sr, Nd and Hf in clinopyroxene suggest that this metasomatism was a relatively recent event. Textural evidence suggests that the calcite filling up the vesicles in the melt pockets and in veinlets cross-cutting the constituent minerals is of epigenetic nature and not due to carbonatite metasomatism.

Mass balance calculations have shown that the bulk composition of the melt pockets is identical to small amphibole relics found as inclusions in second generation clinopyroxene within the melt pockets. Evidently the melt pockets represent amphibole, which have been incongruently molten. The necessary heat for the amphibole breakdown was derived from the host basalt. The estimated time for diffusive Ca exchange between matrix olivine and olivine overgrowth in contact with the melt pockets is very short, ranging between 21 and 200 days, indicating that amphibole breakdown took place immediately before or during the xenolith entrainment in the alkali basalt.