

COMPOSITION AND EVOLUTION OF LITHOSPHERIC MANTLE BENEATH THE PANNONIAN BASIN: A PETROGRAPHIC AND GEOCHEMICAL REVIEW

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Introduction

Knowledge of the lithosphere beneath the Carpathian-Pannonian Region (CPR) have been greatly improved by petrologic, geochemical and isotopic studies of upper mantle xenoliths hosted in Plio-Pleistocene alkali basalts of Styrian Basin, Little Hungarian Plain, Bakony-Balaton Highland, Nógrád-Gömör and East Transylvanian Basin (EMBEY-ISZTIN *et al.*, 1989; DOWNES *et al.*, 1992; SZABÓ & TAYLOR, 1994; VASELLI *et al.*, 1995, 1996). The CPR mantle xenoliths are mostly spinel lherzolites, however subordinate pyroxenites, websterites, wehrlites, harzburgites and dunites are also present. Garnet-bearing mantle fragments have not been reported, however breakdown products of garnet were recognized in some mantle xenoliths (TÖRÖK, 1995; FALUS *et al.*, 2000).

Textural features

The peridotite (basically spinel lherzolite) xenoliths, representing residual material of the mantle with complex history, show variable textural features. In order of increasing deformation, protogranular, porphyroclastic and equigranular textures can be distinguished. Also, minor secondary recrystallized xenoliths have been found as a result of mantle relaxation. The lithospheric mantle is more deformed in the central part of the CPR than towards the western and eastern edges. The deformation could have been associated with asthenospheric upwelling and extension in the late Tertiary affected strongly the central part of the subcontinental lithosphere of the CPR.

The pyroxenite xenoliths, composed of mostly clinopyroxene, are also widespread in the CPR but in low number. Textures of these xenoliths are slightly variable: coarse-grained igneous textural features can be observed; sign of recrystallization and deformation is not common.

Geochemical features

The peridotite xenoliths have a bulk compositions ranging from 36 to 46 wt% MgO, 0.5 to 4.0 wt% CaO and 1.0 to 4.5 wt% Al₂O₃. There are no significant chemical differences among the xenoliths of the major localities. Nevertheless, mineral composition, particularly in case of clinopyroxene, varies according to the xenolith textures. Less deformed xenoliths have clinopyroxene with higher content of basaltic major elements (Al, Ti, Na and Fe) compared to the more deformed samples. However, clinopyroxenes in the more

deformed xenoliths are enriched in strongly incompatible trace elements (e.g. light rare earths elements).

Chemical composition of the pyroxenite xenoliths shows enrichment in basaltic and light rare earths elements. These rock fragments represent mafic melts crystallized as pyroxenite dykes or cumulate bodies in the lithospheric mantle.

Hydrous phases, pargasitic and kersutitic amphiboles and phlogopitic micas occur as evidence of modal metasomatism in both peridotite and pyroxenite xenoliths. Amphiboles, occurring as interstitial phases, veins and selvages, are more common than phlogopites. A portion of both hydrous phases is texturally and chemically in equilibrium with the anhydrous mantle minerals in the peridotites. However, amphiboles frequently in veins and pyroxenites show enrichment in K, Fe and light rare earth elements.

Existence of carbonate-bearing melt pockets and veins related to melting of amphiboles and clinopyroxenes, and existence of silicate melts, sulfide and CO₂ inclusions, trapped in the anhydrous mantle minerals, indicates the presence and migration of melts and/or fluids, which caused metasomatic interactions at different time and under different PT conditions (BALI *et al.*, 2002). The source of the metasomatic melts/fluids might have related to subduction, occurred beneath the CPR during the late Tertiary times.

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