Major and trace element characteristics of Fe-wehrlites formed by mantle metasomatism beneath the Nógrád-Gömör Volcanic Field (Northern Pannonian Basin)

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There are locations throughout the world where alkali basaltic, lamprophyric or kimberlitic magmas brought ultramafic xenoliths to the surface, which provide unique opportunity to gain direct information about the evolution of the upper mantle. In addition to the dominant lherzolite suite, significant amounts of wehrlite, dunite and harzburgite also appear among subcontinental lithosphere derived rocks, showing different stages of enrichment and depletion geochemical processes.

Assemblages of clinopyroxene-rich ultramafic xenoliths, basically wehrlites, can be interpreted as high-pressure cumulates crystallised from trapped melts near the crust-mantle transitional zone (Frey & Prinz, 1978) or as result of pervasive metasomatism triggered by fluid-peridotite interaction. The ephemeral metasomatic agent of wehrlitization can be carbonatitic melt originating from the deep mantle, producing magnesian wehrlites (Yaxley *et al.*, 1991), or silicic melt forming Fe-rich wehrlites (Peslier *et al.*, 2002).

There are five different locations within the Carpathian-Pannonian region where Plio-Pleistocene alkali basalts enclose great number of upper mantle xenoliths. The northernmost occurrence is the Nógrád-Gömör Volcanic Field (NGVF), where both peridotites (Szabó & Taylor, 1994) and cumulates (Kovács *et al.*, 2004) have been studied, however only cumulative wehrlite xenoliths were announced.

Our study presents a suite of non-cumulate wehrlites owning special petrographic and geochemical features. All wehrlites consist of clinopyroxene-rich and olivine-rich assemblages. The former parts contain tiny rounded olivines (100-200 µm) and vermicular spinel inclusions girdle by irregular shaped, elongated, relatively large (1-3 mm) clinopyroxenes. In course-grained clinopyroxenes ortopyroxene remnants can be determined (Fig. 1.). Under crossed nicols, the large clinopyroxenes extinct all at once, implying simultaneous crystallization. The olivine-rich parts can be characterized with coarse-grained olivines having straight grain boundaries and occasionally enclosing rounded orthopyroxenes and minor spinel.

Major element geochemistry of the rock forming minerals was carried out by electron microprobe analyses. As a result, Fe and Mn enrichment in olivines, Ti, Al and Fe enrichment in clinopyroxenes, and Fe and Ti enrichment in spinels can be observed compared to lherzolite xenoliths from the same localities.

Trace element geochemistry of clinopyroxenes in wehrlite xenoliths was determined by LA-ICP-MS analyses and show similar pattern in multi element diagrams for the different localities. The highly incompatible elements, as well as Pb, Hf, and Zr, show strong depletion. Most of the other elements show a flat distribution profile, except for the compatible ones, from which Sc, V, and Cr are slightly enriched, whereas Co and Ni are strongly diminished compared to the primitive mantle. The REY elements depict a relatively flat pattern with a slight enrichment in such LREE as Ce, Pr, Nd, Sm and Eu.

Summarizing our results, the Fe-wehrlites were formed by an alkali mafic melt-wallrock interaction in the subcontinental lithospheric mantle beneath the NGVF. During this event the original lherzolitic upper mantle went through stealth metasomatism, meaning clinopyroxene is introduced to the system that is mineralogically indistinguishable from common upper mantle peridotites. Together modal variation chemical composition of the rock forming minerals was also changed. Our study provides information on the migrating melts at mantle depths beneath the NGVF in relation to regional geodynamic processes.

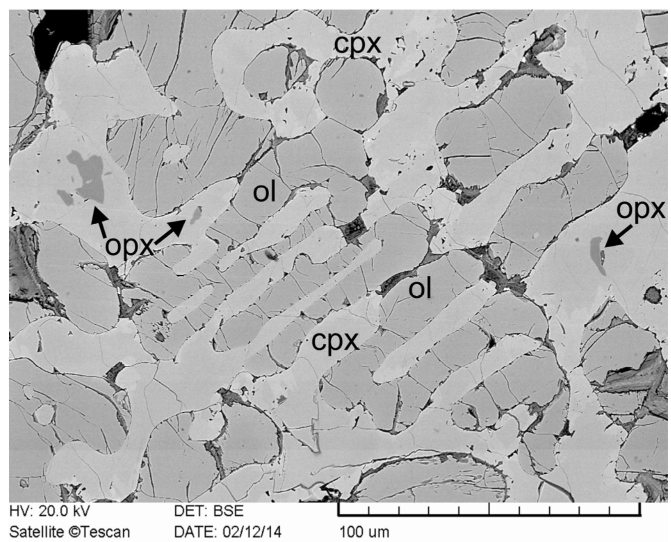

Fig. 1.: Scanning electron microscope image of a clinopyroxene-rich part of a wehrlite with elongated olivine and clinopyroxene grains. Course-grained clinopyroxenes contain orthopyroxene remnants (cpx – clinopyroxene, ol – olivine, opx – orthopyroxene).

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