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Geochemical and Textural Constraints on Wehrlite Formation by Melt-rock Reaction in the Shallow Subcontinental Lithospheric Mantle (Oran, Tell Atlas, N-Algeria)

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As a result of the Miocene collision between the Alborán domain and the south Iberian and Maghrebian passive margins, the Betic and the Rif-Tell mountains form an arc-shaped orogenic belt in the westernmost Mediterranean (e.g. [1]). This belt is characterized by the presence of subcontinental lithospheric mantle exhumed as orogenic peridotites [2-4], and entrained by basaltic magmatism. Mantle xenoliths entrained in Plio-Pleistocene alkali basalts in the innermost Betics in South Spain provided invaluable data to study the structure and composition of the subcontinental lithospheric mantle beneath the northern limb of this mountain belt [5-7]. In contrast, information from the southern limb is scarce, even though alkali basalts of the same age (< 4 Ma) in the Oran area of the Tell Atlas (North Algeria) contain large amounts of plagioclase to spinel facies peridotite mantle xenoliths with lherzolitic, harzburgitic and wehrlitic modal compositions [6].
Here we report detailed geochemical and textural study of metasomatized mantle xenoliths from this area. The studied spinel-facies mantle xenoliths normally have coarse granular and porphyroclastic textures, whereas in the plagioclase-bearing lithologies fine-grained equigranular fabric becomes abundant. Olivine and orthopyroxene of the coarse-grained lherzolites and harzburgites reflect usual major element geochemical compositions with Mg# in the range of 90-93. Clinopyroxene in these rocks have an overall depleted LREE pattern with slight variation in the most incompatible elements indicating cryptic metasomatism. The Crystal Preferred Orientation (CPO) of olivine shows an axial-[100] pattern characterized by a strong alignment of [100]-axes near or parallel to the peridotite lineation. Wehrlitic lithologies show more variable major element compositions and an important enrichment in LREE in clinopyroxene yet with MREE/HREE ratios comparable to those in harzburgite and lherzolite. Modal enrichment in clinopyroxene and development of fine-grained equigranular texture are both accompanied with a dispersion of olivine CPO.
The lithological, textural and geochemical variations of these xenoliths indicate that wehrlite-forming melt-rock reactions took place in the shallow subcontinental lithospheric mantle beneath the southern limb of the Betic-Rif-Tell orogenic belt during the Neogene geodynamic evolution of the westernmost Mediterranean.

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