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Microstructural and Geochemical Record of Wehrlitization in the Shallow Subcontinental Lithospheric Mantle (Oran, Tell Atlas, N-Algeria)

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The Betic-Rif-Tell arc-shaped mountain belt in the westernmost Mediterranean is formed during the Miocene collision between the Alborán domain and the south Iberian and Maghrebian passive margins. In this area, subcontinental lithospheric mantle (SCLM) is outcropped either as exhumed ultramafic massifs [1] or as mantle xenoliths [2-4]. Plio-Pleistocene alkali basalts in the southern limb of the mountain belt contain large amounts of plagioclase- to spinel-facies peridotite mantle xenoliths.

Here we report geochemical and microstructural data of metasomatized mantle xenoliths from the Oran area of the Tell Atlas (North Algeria). We focus on rock samples where orthopyroxene dissolution and crystallization of clinopyroxene±olivine (i.e. wehrlitization) is suggested by textural observations, resulting in transitional lithologies from spinel-facies, coarse-grained lherzolite and harzburgite protolith (TCpx-Opx: 980-1050°C) to fine-grained, spinel/plagioclase-facies clinopyroxene-rich wehrlite. In the nearly unaffected coarse-grained protoliths, constituent phases reflect usual SCLM major and trace element geochemical compositions with Mg# in the range of 90-92 but orthopyroxene is rimmed by clinopyroxene. In these orthopyroxene-clinopyroxene assemblages, the formation of clinopyroxene after orthopyroxene is supported by the embayed contact and the identical crystallographic preferred orientation (CPO) of these two phases. In the more evolved textures, secondary clinopyroxene±olivine±accessory phases form along veins and modify the geochemical composition of the minerals, shifting Mg# towards values in the range of 88-86. Wehrlitic lithologies also show an important enrichment in LREE in clinopyroxene yet with MREE/HREE ratios comparable to those in protolith. This geochemical variation is coupled to the dispersion of olivine CPO in the wehrlitic samples, with respect to the relatively strong axial-[100] CPO type of the protolith.

The lithological, textural and geochemical variations in the studied xenoliths from N-Algeria indicate that wehrlite-forming melt-rock reactions took place in the shallow SCLM beneath the southern limb of the Betic-Rif-Tell orogenic belt during the latest Neogene geodynamic evolution of the westernmost Mediterranean.

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