Mirdita ophiolites, Albania: Refertilization of spinel-plagioclase-peridotites in the shallow Mantle Lithosphere

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The Albanian ophiolites are located between the Dinarides (N. Macedonia and Serbia) in the east and the Hellenides in the west. The Mirdita Ophiolites in Albania are divided into two units namely the western ophiolitic unit with MORB geochemical affinity and the eastern ophiolitic unit with SSZ affinity. The western unit consists of the Krabbi, Puka, Comsique and Skenderbeu massifs where intrusives and dykes are present as well. All massifs represent upper mantle, variably serpentinized spinel and plagioclase peridotites.

The Krabbi massif with a diameter of 30 km is a piece of upper mantle ultramafic body consisting of spinel-plagioclase lherzolites and harzburgites with bulk-rock Mg# ranging from 89.5 to 91.8 and Ca/Al ratio varying from 1.13, that is slightly higher than the Primitive Mantle ratio of 1.1, to 1.26 indicating an excess of Ca in the studied samples. Minor and trace elements trends such as Ni, V and Yb versus Mg# are very similar to those of the orogenic peridotites. The chondrite normalized REE abundances have convex upward patterns where the majority of the samples show that the Yb_N is slightly higher compared to La_N suggesting moderate metasomatic events affecting the LREE.

Besides the rock forming mineral olivine, orthopyroxene, clinopyroxene and spinel there are also disseminated plagioclases and kaersutites. Strongly tectonized samples show secondary protogranular and porphyroclastic textures. Rounded spinel occurs mainly as inclusion in olivine and orthopyroxene whereas holly-leaf shaped spinel is interstitial.

The plagioclase neither coexists nor surrounds spinel, which precludes any subsolidus transition from spinel- to plagioclase-peridotite stability field. However, the clinopyroxene, as can be inferred from their negative Eu-anomaly in the chondrite normalized REE patterns, appears to be in equilibrium with coexisting plagioclase. Apparently, the plagioclase-rich residual melt affected the peridotites in the spinel-peridotite field but crystallized and equilibrated with clinopyroxene at shallow depths.

A striking textural feature is the frequent replacement of olivine grains by orthopyroxene with simultaneous formation of Ti-rich diopside and Al-rich spinel, suggesting metasomatic infiltration of a melt with tholeiitic composition. This feature has been observed in the samples with Mg# = 89.5, Al_2O_3 = 4.3 wt% and CaO = 3.77 wt% similar to the composition of the Primitive Mantle.

The existence of fertile peridotites with similar to the Primitive Mantle composition suggests that the otherwise strongly depleted oceanic lithospheric mantle has been refertilized after metasomatic introduction of melts with tholeiitic composition.