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Magma migration and channeling during melting of the subcontinental lithospheric mantle: layered dunite-harzburgite-lherzolite bodies below the recrystallization front of the Ronda peridotite massif, southern Spain

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The processes that take place during the transport of melts through the convecting mantle are the least understood and, therefore, state-of-the art problems among a series of processes of formation and evolution of mantle magmas. It is widely accepted that, dunite channels might be pathways by which mantle melts easily pass through the overlying mantle (e.g. Kelemen et al., 1997). However, accepted models explain formation of dunitic lithology mostly in oceanic environment, but one would face several challenges trying to apply them to the subcontinental lithospheric mantle.

The Ronda massif (southern Spain) is the largest (ca. 300km2) of several orogenic peridotite massifs exposed in the Betic and Rif (northern Morocco) mountain belts in the westernmost part of the Alpine orogen that was tectonically emplaced during early Miocene times. One of the most remarkable features of the Ronda massif is the 'recrystallization front' that represents the transition from the spinel-tectonite to the coarse granular peridotite domain corresponding to a narrow boundary of a partial melting domain caused by thinning and coeval asthenospheric upwelling formed at the expense of former subcontinental lithospheric mantle and associated with melting and kilometer-scale migration of melts by diffuse porous flow through the 'asthenospherized' domain (Van der Wal & Bodinier, 1996; Lenoir et al., 2001; Vauchez & Garrido, 2001). In the vicinity of the recrystallization front, coarse granular peridotites pass into layered granular peridotites with a typical layered structure composed of plagioclase lherzolites, depleted lherzolites, harzburgites and dunites.

Here, we present preliminary structural, petrophysical and geochemical data of these layered bodies. The main scientific goals of this study are to test new mechanism(s) for the formation of dunites and dunite-harzburgite-lherzolite layered bodies in the subcontinental lithospheric mantle on the example of Ronda peridotite massif (Spain), and to introduce new processes that are expected to lead the evolution of the subcontinental lithospheric mantle in extensional settings.

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