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Folding and shearing of the lithospheric mantle prior to Ronda peridotite intracrustal emplacement

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The Ronda massif (S Spain) is the largest (ca. 300 km2) of several subcontinental mantle peridotite massifs tectonically emplaced during the early Miocene in the Betic-Rif chain, the westernmost limb of the Alpine orogen. Exhumation of large bodies of subcontinental peridotites in the western Mediterranean has been attributed to diverse tectonic processes including pure extension, transpression, or alternating contractive and extensional processes related with continental subduction followed by extension, before final contractive intracrustal emplacement. Many of these models have relied on the structural and petrological evolution of the crustal units spatially associated with these peridotite massifs. Any comprehensive lithospheric model for the emplacement of extensive peridotite bodies requires though an integrated study of the structural and petrological evolution of the peridotite structures that may record the final unroofing and intracrustal emplacement of mantle peridotites.
Previous structural, petrological and geochemical studies have shown that the Ronda massif is a complete lithospheric mantle section composed of, from top to bottom, garnet-spinel mylonites, spinel tectonites, recrystallization front, coarse granular spinel peridotites and an underlying plagioclase tectonite domain. Whereas most of the structures described by the literature in the mantle section resulted from the thinning of a thick subcontinental lithosphere, the plagioclase tectonites have been interpreted as shear zones with opposing kinematics and directly related to the final intracrustal emplacement of the massif. New structural data in NW Ronda peridotite show that the peridotite layering is deformed by a large-scale fold and associated mylonitic shear zones developed in the plagioclase lherzolite facies. We show that the planar fabric of the plagioclase tectonites at the base of the massif represents an axial-plane foliation developed mainly in the overturned limb of the fold. The overturned limb is stretched by plagioclase-mylonitic and ultramylonitic shear zones with top to the SW sense of shear that coincide with the westward fold vergence. Under present geographical coordinates the fold axial surface dips 60° towards the north (average orientation of the plagioclase foliation) and the fold hinge plunges approx. 50° towards the NE. Undoing the late extensional tilting (García-Dueñas et al., 1992) and paleomagnetic rotations (Villasante-Marcos et al., 2003) that affected the massif, results in a gently plunging and gently inclined fold with SW vergence that was likely formed in the lithospheric mantle in a back-arc type setting. We hence propose that these structures record the kinematics of the Westernmost Mediterranean arc-subduction system just before the early Miocene intracrustal emplacement of the Ronda peridotites.

References

Garcia-Dueñas, V., Balanyá, J.C. & Martínez-Martínez, J.M. (1992). Miocene extensional detachments in the outcropping basement of the North Alborán Basin (Betics) and their tectonic implications. Geol. Marine Lett. 12: 88-95

Villasante-Marcos, V., Osete, M.L., Gervilla, F. & Garcia-Dueñas, V. (2003). Palaeomagnetic study of the Ronda peridotites (Betic Cordillera, southern Spain). Tectonophysics 377: 119-141