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Subduction initiation and recycling of Alboran domain derived crustal components prior to the intra-crustal emplacement of mantle peridotites in the Westernmost Mediterranean: isotopic evidence from the Ronda peridotite

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During Late Oligocene-Early Miocene different domains formed in the region between Iberia and Africa in the westernmost Mediterranean, including thinned continental crust and a Flysch Trough turbiditic deposits likely floored by oceanic crust [1]. At this time, the Ronda peridotite likely constituted the subcontinental lithospheric mantle of the Alboran domain, which mantle lithosphere was undergoing strong thinning and melting [2] [3] coevally with Early Miocene extension in the overlying Alpujárride-Maláguide stacked crust [4, 5].

Intrusive Cr- rich pyroxenites in the Ronda massif records the geochemical processes occurring in the subcontinental mantle of the Alboran domain during the Late Oligocene [6]. Recent isotopic studies of these pyroxenites indicate that their mantle source was contaminated by a subduction component released by detrital crustal sediments [6]. This new data is consistent with a subduction setting for the late evolution of the Alboran lithospheric mantle just prior to its final intracrustal emplacement in the early Miocene Further detailed structural studies of the Ronda plagioclase peridotites—related to the initial stages of ductile emplacement of the peridotite—have led to Hidas et al. [7] to propose a geodynamic model where folding and shearing of an attenuated mantle lithosphere occurred by backarc basin inversion followed by failed subduction initiation that ended into the intracrustal emplacement of peridotite into the Alboran wedge in the earliest Miocene. This hypothesis implies that the crustal component recorded in late, Cr-rich websterite dykes might come from underthrusted crustal rocks from the Flysch and/or Alpujárrides units that might have been involved in the earliest stages of this subduction initiation stage.

To investigate the origin of crustal component in the mantle source of this late magmatic event recorded by Cr-pyroxenites, we have carried out a detail Sr-Nd-Pb-Hf isotopic study of a variety of Betic-Rif cordillera crustal rocks that might have been potentially subducted beneath the Alborán domain before the emplacement of Ronda peridotites. Isotopic data rules out potential crustal sources coming from pre-early Miocene Flysch Trough sediments and crustal rocks from the Blanca Unit currently underlying peridotite. Crustal rocks from the Jubrique Unit overlying the Ronda peridotite are the only crustal samples that may account for the relatively high ^{207}Pb-^{208}Pb/^{204}Pb and low ^{206}Pb/^{204}Pb characteristic of the crustal contaminant added to the mantle source of late Cr-pyroxenites. These data strongly support Alboran geodynamic models that envisage slab roll-back as the tectonic mechanism responsible for Miocene lithospheric thinning, and provides a scenario where back-arc inversion leading to self-subduction of crustal units at the front of the Alboran wedge.

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