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# Subduction initiation, recycling of Alboran lower crust, and intracrustal emplacement of subcontinental lithospheric mantle in the Westernmost Mediterranean

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Unraveling the tectonic settings and processes involved in the annihilation of subcontinental mantle lithosphere is of paramount importance for our understanding of the endurance of continents through Earth history. Unlike ophiolites —their oceanic mantle lithosphere counterparts— the mechanisms of emplacement of the subcontinental mantle lithosphere in orogens is still poorly known. The emplacement of subcontinental lithospheric mantle peridotites is often attributed to extension in rifted passive margins or continental backarc basins, accretionary processes in subduction zones, or some combination of these processes. One of the most prominent features of the westernmost Mediterranean Alpine orogenic arcs is the presence of the largest outcrops worldwide of diamond facies, subcontinental mantle peridotite massifs; unveiling the mechanisms of emplacement of these massifs may provide important clues on processes involved in the destruction of continents.
The western Mediterranean underwent a complex Alpine evolution of subduction initiation, slab fragmentation, and rollback within a context of slow convergence of Africa and Europe In the westernmost Mediterranean, the alpine orogeny ends in the Gibraltar tight arc, which is bounded by the Betic, Rif and Tell belts that surround the Alboran and Algero-Balearic basins. The internal units of these belts are mostly constituted of an allochthonous lithospheric domain that collided and overthrusted Mesozoic and Tertiary sedimentary rocks of the Mesozoic-Paleogene, South Iberian and Maghrebian rifted continental paleomargins. Subcontinental lithospheric peridotite massifs are intercalated between polymetamorphic internal units of the Betic (Ronda, Ojen and Carratraca massifs), Rif (Beni Bousera), and Tell belts. In the Betic chain, the internal zones of the allochthonous Alboran domain include, from bottom to top, polymetamorphic rock of the Alpujarride and Malaguide complexes. The Ronda peridotite massif —the largest outcrop (> 300 km2) of subcontinental lithospheric mantle peridotite in westernmost Mediterranean— occurs at the basal units of the western Alpujarride. Late, intrusive mantle, high-Mg pyroxenite dykes in the Ronda peridotite (Betic Cordillera, S. Spain) show geochemical signature akin to high-pressure (> 1 GPa) segregates of high-Mg andesite and boninite found in island arc terrains and ophiolite, where they usually witness nascent subduction and/or oceanic accretion in a forearc setting. These pyroxenites point to a suprasubduction environment prior to the intracrustal emplacement of subcontinental peridotites drawing some parallels between the crustal emplacement environment of some ophiolites and that of sublithospheric mantle in the westernmost Mediterranean.

Here, we present new Sr-Nd-Pb-isotopic data from a variety of crustal rocks that might account for the crustal components seen in high-Mg Ronda pyroxenites. This data allows the origin of this crustal component to be unveiled, providing fundamentally constraints on the processes involved in the emplacement of large massifs of subcontinental mantle lithosphere in the westernmost Mediterranean.

In order to test the hypothesis that the crustal component in Ronda high-Mg pyroxenites was acquired during the Alpine evolution of the Betic-Rif orogen, we selected samples from crustal sections that might have been underthrusted beneath the Alboran lithospheric mantle before the putative Miocene intra-crustal emplacement of peridotites. Samples are from the western Betics and comprise sediments from the Gibraltar Arc Flysch Trough units, which forms a fold-and-thrust belt between the Iberian paleomargin and the allochthonous Alboran domain, and metasedimentary rocks from the Jubrique and Blanca units of the Alpujarride complex, which underlie and overlie the Ronda peridotite and constitute the crustal section of the Alboran lithosphere domain to which the Ronda peridotite pertains. Sr-Nd-Pb systematic of sediments strongly support Alboran geodynamic models that

envisage slab roll-back as the tectonic mechanism responsible for Miocene lithospheric thinning, and consistent with a scenario where back-arc inversion leading to subduction initiation of crustal units at the front of the Alboran wedge