Peridotite xenoliths from Calatrava (Spain): Insights on the genesis of Fe-rich mantle domains

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Mantle xenoliths from Calatrava (CLV), have a wide compositional range, including lherzolites (prevalent) as well as rare harzburites and dunites, generally displaying Mg#<89 in both bulk-rock and constituent minerals. Intra-suite variation of the modal proportions is inconsistent with that expected by melting models whatever the starting composition, as also indicated by bulk-rock variation diagrams showing misfit between the CLV compositions (enriched in Fe-Ti) and those predicted by partial melting of primordial mantle material. The bulk-rock REE budget, characterized by LREE enrichments (La_N/Yb_N up to 6.7), is probably related to the occurrence of metasomatic reactions. CLV mantle cpxs display fractionated REE patterns with upward convex shapes, characterized by low HREE (Tm-Lu) concentration, typically < 6 x chondrite, and enrichments in M/LREE (Nd_N/Yb_N up to 7, La_N/Yb_N up to 5). These “enriched” compositions result from the re-equilibrium of pristine cpxs with an incoming metasomatic melt, and/or represent products crystallising directly from the metasomatic agent. The latter was plausibly generated at greater depths in the presence of residual garnet (from peridotite or eclogite starting materials).

Sr-Nd-Hf Isotopic analyses (on separated cpxs) reveal that unlike mantle xenoliths and alpine-typeperidotites from other Iberian occurrences, whose compositions range from Depleted Mantle (DM) to Enriched Mantle (EM), the CLV lherzolites approach the composition of the HIMU end-member, generally interpreted as the result of long-term recycling of oceanic basalts/gabbros (or their eclogitic equivalent) via subduction. This suggests that under the CLV district, sublithospheric convective instabilities (possibly triggered by the neighbouring Betic subduction) could have remobilized deep mantle domains from the mantle Transition Zone (410-660 km) which possibly included eclogitic rocks, i.e. relicts of older subducted slabs.

The lithospheric mantle beneath the Hyblean area – Insights from mantle xenoliths

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The Hyblean area (SE Sicily) represents the foreland of the Apennine-Magrebide belt, and is considered the northernmost sector of the African plate. It consists of a ~10 km thick Mesozoic-Cenozoic carbonate sequence, overlain by Quaternary clastic sediments. Several volcanic levels, interlayered within the sedimentary succession, can be ascribed to Cretaceous, Upper Miocene and Plio-Pleistocene cycles characterized by the eruption of wide spectrum of basic magmas. Sr-Nd-Pb isotope analyses of the Hyblean lavas, carried out at the Carleton University under the supervision of Keith Bell, provided first order constraints for the characterization of the relative magma sources, contributing to a better understanding of the tectono-magmatic evolution of the area [1]. To integrate this research, we are currently studying ultrafemic xenoliths of mantle provenance exhumed by the Hyblean alkaline volcanics. These mainly consist of anhydrous spinel-facies lherzolites and harzburgites ([2] and references therein), and subordinate pyroxenites. The paragenesis of the latter is extremely variable in terms of modal proportions and mineral composition, resulting in websterites, clinopyroxenites, orthopyroxenites, with clinopyroxene composition ranging from Cr-diopside to Al-augite, and variable amount of spinel ± garnet [3, 4]. Some pyroxenites preserve relics of the former igneous texture, and are generally interpreted as crystallization products (± re-equilibrated at mantle depths) of uprising basic melts. New Sr-Nd isotopic analyses on peridotites and pyroxenites are currently in progress in the Geothermal Research Laboratory of Beppu (Japan) and will be presented and discussed at next Goldschmidt Conference, in order to test petrogenetic models proposed to explain the Hyblean volcanism [5, 6].

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