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# Trace elements and Sr-Nd-Pb isotopes of K-rich, shoshonitic, and calc-alkaline magmatism of the Western Mediterranean Region and their relationships with metasomatised mantle xenoliths from Tallante, South-Eastern Spain.

by

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High-MgO ultrapotassic rocks are found in four different areas of the Western Mediterranean basin associated in space and time with shoshonitic and calc-alkaline rocks. They represent different magmatic events at the active continental plate margin from Oligocene to Pleistocene. These rocks are found within the Western Alps (Northern Italy), in Corsica (France), in Murcia-Almeria (South-Eastern Spain), and in Southern Tuscany (Central Italy). Ultrapotassic terms are mostly lamprophyres, but olivine latitic lavas with a clear lamproitic affinity are also found. Lamproite-like rocks range from slightly silica under-saturated to silica over-saturated, and they are characterised by low $Al_2O_3$, CaO, and $Na_2O$ contents. They are plagioclase-free rocks, but K-feldspar is abundant beside other K-bearing phases. Shoshonitic and calc-alkaline rocks are invariably space associated to lamproites, but they might either preceded or follow them. High-Mg ultrapotassic rocks are characterised by strong enrichment of incompatible elements, which prevent further enrichment due to shallow level crustal contamination. $K_2O$ and incompatible element contents decrease passing from high-Mg ultrapotassic to high-Mg shoshonitic and calc-alkaline rocks suggesting that K and incompatible trace elements enrichments are a primary characteristic. Ultrapotassic to calc-alkaline rocks from Western Mediterranean regions, in spite of their different age of emplacement, are characterised by similar incompatible trace elements distribution. Depletion of High Field Strength elements with respect to Large Ion Lithophile elements is observed. Positive spikes at Th, U, and Pb, with negative spikes at Ba, Nb, Ta, Sr, P, and Ti, are common characteristics of ultrapotassic (lamproitic) to high-K calc-alkaline rocks. Ultrapotassic rocks are extremely enriched in radiogenic Sr and unradiogenic Nd with respect to the associated shoshonitic and calc-alkaline rocks. Different isotopic values are distinctive of the different magmatic provinces irrespective of magmatic affinities. $^{87}Sr/^{86}Sr_i$ ranges between 0.71645 and 0.71759 for Western Alps lamproites, between 0.71226 and 0.71230 for Corsica lamproite, between 0.71642 and 0.72259 for Murcia-Almeria lamproites, and between 0.71578 and 0.71672 for Tuscany lamproites. Radiogenic Sr decreases

along with $K_2O$ through shoshonitic to calc-alkaline rocks. Conversely $^{143}Nd/^{144}Nd_i$ values increase with decreasing $K_2O$, with the highest value of 0.51243 found for the one samples from Murcia-Almeria. Contrasting trends are observed among initial values of lead isotopes, but all falling well within the field of upper crustal rocks. Different trends of $^{207}Pb/^{204}Pb_i$ and $^{208}Pb/^{204}Pb_i$ vs. $^{206}Pb/^{204}Pb_i$ for samples from the different provinces are observed. Several evidences indicate that most of the magmas of the different provinces have been generated in a depleted upper mantle (i.e., lithospheric) modified by metasomatism, but an asthenospheric component is also recognised in Corsica. At least two different subduction-related metasomatic agents re-fertilised the depleted original upper mantle source. Carbonate-free siliciclastic sediments and carbonate-rich sediments have been recycled within the upper mantle through subduction and partial melting. Assuming that metasomatic component is concentrated in a vein network. In South-Eastern Spain calc-alkaline magmatism preceded lamproitic ones, and might be generated by partial melting of mantle wedge metasomatised by fluids from oceanic slab prior to collission. Lamproitic magmas followed after melt-dominated metasomatic agents invaded the lithospheric upper mantle domain.

This hypothesis have been tested studying directly veined peridotitic xenoliths from the Cabezo Negro de Tallante volcano, a within plate volcanic episode occurring in the Cartagena area after a four million years time gap with the older orogenic-type magmas of the Murcia-Almeria provinces. The samples reveal the occurrence of a two step metasomatic enrichment. A first metasomatic domain has been recognised to have widely affected the peridotitic mineralogy, whereas a second and younger metasomatic domain has been confined in the veins. The latter metasomatic event has been produced by silica-rich potassic melt from the partial melting of recycled sediments.