The origin of lamproites revisited: A Mediterranean perspective

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Lamproites show strong enrichment in IE combined with variable and extreme radiogenic isotope compositions. General agreement exists that a normal four-phase peridotitic mantle cannot represent their source, because a K-rich hydrous mineral, in most models phlogopite, is required. The origin of the metasomatism responsible for the enrichment is, however, a puzzling issue, as lamproites typically show an "ancient" isotopic signature unrelated to known tectonic events: either the metasomatism is old and convective mantle-derived, or young but includes an old component such as terrigenous sediment. This view serves ultimately for a general distinction between anorogenic and orogenic lamproites.

In the Mediterranean area, lamproites are an integral part of Tertiary postcollisional volcanism within the Alpine-Himalaya belt, resulting from interplay of subduction/collisional and postcollisional/extensional processes. Lamproites are derived from melts that are mixtures of three mantle components, traceable in Sr-Nd-Hf-Pb isotope space: (i) a mantle source contaminated by crustal material, (ii) an ultra-depleted mantle component derived from oceanic-type mantle accreted to older lithosphere, and (iii) a component originating from the convecting mantle. These components demand multistage preconditioning of the lamproite mantle source, involving an episode of extreme depletion, followed by involvement of terrigenous sediments, and finally interaction with melts originating from the convecting mantle, some of which are probably carbonatitic.

Although the majority of Mediterranean lamproites have an orogenic affinity with radiogenic $^{87}Sr/^{86}Sr$, $^{207}Pb/^{204}Pb$, and unradiogenic $^{143}Nd/^{144}Nd$ and $^{206}Pb/^{204}Pb$, and high LILE/HFSE ratios, the lamproites from few localities exhibit geochemical features characteristic for anorogenic lamproites, with unradiogenic $^{87}Sr/^{86}Sr$, $^{207}Pb/^{204}Pb$, and radiogenic $^{143}Nd/^{144}Nd$ and $^{206}Pb/^{204}Pb$, coupled with smooth IE patterns with low LILE/HFSE ratios and high concentrations of Nb and Ti. The co-existence of anorogenic and orogenic lamproites in a single volcanic province suggests that the geodynamic distinction of lamproites based on geochemistry only is problematic.

In our contribution we review all available data of global lamproites and extend our multicomponent approach. Special emphasis is put on radiogenic isotope data in order to discuss the role of the upper crustal and convecting mantle components.

Geochemistry of websterites from the Aznares Volcano, Argentine Patagonia: Constraints on mantle metasomatism

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The chemical heterogeneity of the lithospheric mantle is documented by this petrographic and bulk rock chemistry study of six websterite xenoliths from the Aznares Volcano (41º01'S - 67º34'W), Rio Negro Province. The ultramafic xenoliths are hosted by alkali-basalts which comprehend the northernmost part of the Somun Curá Massif, an extensive plateau volcanism located in an extra-back arc tectonic setting. The websterites show variable amounts of clinopyroxene and orthopyroxene; olivine, when present, is in low abundance and spinel is absent in four samples. Major element chemistry allows sorting the websterites into two groups: Group I, represented by the four samples without spinel, with high amount of SiO_2 (51.10% to 52.54%) and MgO (21.05% to 30.37%); and Group II, with lower contents of SiO_2 (43.67% and 44.66%) and MgO (18.84% and 17.81%). Primitive Mantle of Sun & McDonough (1989) normalized multi-element diagram shows strong enrichment of calcophile elements (Pb, Sn, Sb, W), and smaller but still pronounced enrichment of K and Sr for both groups, which suggest the percolation of an aqueous fluid, possibly related to dehydration of a subducted slab. LREE enrichment and high Nb/Th ratios suggest a second metasomatic event by the interaction with a liquid of silicatic composition. High $^{87}Sr/^{86}Sr$ ratios, recalculated for 600Ma, based on Re-Os data (Schilling 2008, *in press*), are around 0,705878 to 0,706991. These websterites probably represent the residue of partial melting of an ancient subducted oceanic crust, or the percolation of fluids on mantle lithologies, or crystal accumulation during the ascent of magma of primordial composition.