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Petrological and geochemical evidence for multiple metasomatism of the SE Alps mantle lithosphere

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Ultramafic (mg# $>$ 88) xenoliths from the Tertiary Veneto Volcanic Province (VVP; SE Alps, Italy) are characterized by variable depletion in basaltic component and show significant trace element and isotopic heterogeneity that may be related to metasomatism of the local mantle lithosphere induced by both alkaline magmas upwelling to the surface (OIB-like mantle diapirism) and interaction with slab-derived material. Actually, some of the most incompatible element-enriched xenoliths display geochemical features similar to those of the VVP host basanites, e.g. significant Nb-Ta positive anomalies, K troughs, comparable trace element ratios and Sr, Nd, Pb and O isotope compositions. Such geochemical characteristics are clearly related to physical interaction with the host basanites and/or related to OIB-cryptic metasomatism. Conversely, the slightly incompatible element-enriched xenoliths show multi-element spectra (Ba-Nb-Ta negative anomalies and Rb peaks) that resemble those of the upper crust and are discordant with respect to the HIMU-OIB modified patterns. They are also characterized by high LFSE/HFSE ratios, relatively radiogenic Sr isotopic compositions, high oxygen isotope values and low 206Pb/204Pb ratios. These peculiarities point to recycling of a slab-derived component with a significant sediment signature. Using mass balance calculations we estimated that the geochemical compositions of such xenoliths can be obtained by the addition of (a) about 2-8% of a silica-poor, high Ca/(Mg, Fe) metasomatic agent (e.g. from terrigenous sediments) to a slightly depleted mantle source, or (b) about 2-5% of a silica-rich, low Ca/(Mg, Fe) metasomatic agent (e.g. from pelagic sediments) to a slightly fertile mantle source. Overlapping of metasomatic processes, i.e. OIB- and slab-type, is in agreement with both the lack of

Rb troughs even in samples showing geochemical patterns comparable to HIMU-OIB (VVP lavas) and the occurrence of Ti negative anomalies within the whole suite of xenoliths. Geochemical heterogeneity in the VVP xenoliths likely reflects a subcontinental mantle source developed in a mantle wedge overlying the subducted European crustal slab during the continent-continent collision of the Alpine orogeny.