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Metasomatism in mantle xenoliths from intraplate and suprasubduction settings

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Chemical composition of minerals and glasses in mantle xenoliths in alkaline basalts from intraplate (Cape Verde, Antarctica, Gran Comore, Lessini) and in calc-alkaline basalts from suprasubduction settings (Kamchatcka, Japan, Philippine, Grenada) are summarized, with the aim of highlighting the petrological features of the metasomatizing melts in the two environments. Two peridotites complexes (Finero and Val d'Ultimo) believed to represent subduction-metasomatized bodies are also included in the comparison.
It appears that, at comparable SiO2, subduction-related glasses are characterized by lower alkalies contents than glasses from intra-plate settings. The more SiO2-saturated character of the metasomatizing melts in this enviroment is also evidenced by the widespread presence of secondary orthopyroxene as small crystals or as veins. Subduction-related glasses may have Na2O content similar to carbonatite-metasomatised intra-plate glasses, but the latter presents consistently higher CaO and Nb abundances. Subduction-related glasses have also lower Rb, Ba, Zr, Ti and HREE contents than alkali-silicate intra-plate glasses, bearing some analogies with slab-derived melt. Chemical features of erupted calc-alkaline lavas (including adakites) are however unable to take into account the whole compositional range of minerals and glasses in subduction zone. Irrespective of textural positions, amphiboles in mantle xenoliths from intra-plate settings present much higher Nb and, to a lesser extent, Zr and Ti contents than amphiboles found in xenoliths from suprasubduction setting. Similar indications, although less robust for crystallographic and statistical reasons, can be found for clinopyroxene and orthopyroxene. These data strongly suggest that metasomatizing agents in the mantle wedge above a subduction zone are richer in SiO2 and depleted in Nb, Zr and Ti with respect to fluids migrating in intra-plate setting. The presence of accessory phases such as rutile and zircon in the downgoing slab, retaining HFSE during dehydration and/or melting and producing HFSE-depleted fluids seems to account for the observed geochemical features. The commonly observed occurrence of "plume-related" alkaline magmatism which follows in a time span of few to ten millions of years a subduction process, together with the position of the major volcanic province within Europe which seems to be correlated with the presence of a zone of high-velocity, presumed subducted slab material, at the base of the upper mantle point toward a link between subduction processes and alkaline basalts petrogenesis.