



Mantle metasomatism vs host magma interaction at Sal Island (Cape Verde Archipelago)

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The Cape Verde Islands lie in the Atlantic Ocean off West Africa, in a clearly oceanic setting. Xenoliths from Miocene (16Ma) neck in the northern part of Sal Island bear extensive evidence of metasomatic reactions, characterized by secondary parageneses (ol+sp+cpx+glass+K-feld) around primary orthopyroxene, clinopyroxenes and spinel. These textures are commonly observed in many xenolith populations worldwide, independently of the nature of the carrying alkaline magma (i.e. basalts, lamproitic or kimberlitic melt). The interpretation as a product of metasomatism has been recently put under discussion by Shaw et al. (2006) and Shaw & Dingwell (2008) who consider that most of these textures are imposed on the xenoliths during magma transport and/or residence in a magma chamber. This contribution aims at emphasizing the criteria which allow to discriminate between the metasomatic and host magma infiltration processes, reinforcing the concept and validity of metasomatism within the mantle. To pursue this, various petrographic and geochemical criteria from a selected well-studied suite of mantle xenoliths that clearly testify for an interaction of the peridotites with silicate melts at depth (metasomatized samples) or during the transport to the surface (host basalt infiltration samples) will be presented. Few pristine samples (two lherzolites and one harzburgite) devoid of any textural evidences for basaltic infiltration or metasomatic processes were also used for comparison. The metasomatized samples are constituted by three lherzolites and one harzburgite whose metasomatic textures include glassy pools, patches or veins with secondary parageneses made up of ol, cpx, sp and K-feld or spongy rims and sieved crystals of pyroxenes and spinels. The infiltrated samples are represented by one lherzolite and one harzburgite cut by glassy veinlets filled with euhedral to subeuhedral ol + plag + magnetite crystallites. In the metasomatic samples the secondary olivines at similar mg# [$Mg/(Mg + Fe) \cdot 100 = 86.7 - 91.5$.] tend to have higher Ca and lower Ni contents with respect to the primary unmetasomatized grains. Feldspar are characterized by very high K₂O content (up to 10.50 wt%, Bonadiman et al., 2005) very peculiar for mantle environment even for continental settings. Glasses are rather homogeneous in composition and characterized by relatively high SiO₂ (55.73–67.13 wt %), Al₂O₃ (14.33–21.4 wt %) and alkali contents (Na₂O 2.49–7.14 wt %; K₂O 5.50–8.78 wt %). Their compositions are similar to those of most mantle xenolith glasses worldwide, apart from the exceptionally high K₂O contents, which have never been found in oceanic settings before and have rarely been matched even in continental xenoliths. In the infiltrated samples secondary olivine are distinctively enriched in FeO relative to those primary and secondary of the peridotite assemblage. NiO –Fo composition of these crystallites are compatible with those calculated for olivine in equilibrium with a progressively fractionated melt. Feldspars are Ca-rich plagioclase (An 75)). Glasses of the infiltrated samples are systematically richer in FeO (and MgO), TiO₂ and depleted in K₂O with respect to those of metasomatized samples. Hf and Nd isotopic analyses on separated cpxs from pristine and metasomatized samples are distinctly higher of those recorded both southern and northern lavas of Cape Verde Archipelago (Martins et al., 2010) [Xenoliths: $^{176}\text{Hf}/^{177}\text{Hf}$ 0.283038– 0.2831012; $^{143}\text{Nd}/^{144}\text{Nd}$ 0.512837 to 0.512955. Lavas: $^{176}\text{Hf}/^{177}\text{Hf}$ =0.28284–0.28297; $^{143}\text{Nd}/^{144}\text{Nd}$ =0.51261–0.51287].

References:

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