Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28535

Multiple origins of peridotite xenoliths from Sal, Cape Verde

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Peridotite xenoliths in late-Tertiary alkali basalts from Sal, Cape Verde, show compositional and textural features which have been discussed for decades. Two contrasting interpretations on the cause of their unusual features are mantle metasomatism [1], and host magma infiltration [2]. We have undertaken a new study of Sal xenoliths to: (A) determine their different origins; (B) distinguish between the effects of mantle metasomatism and host magma interaction. Our collection includes anhydrous spinel lherzolites, harzburgites and wehrlites. We will show that many of these do not originate in the lithospheric mantle but are cumulate rocks, from both alkali basalt magmas and MORB magmas that formed the lowermost oceanic crust.

Mantle-derived samples contain vermicular spinel in clusters with clinopyroxene, interpreted to have formed by decompression of garnet. Spongy textures on some spinel and most clinopyroxene result from infiltration of a melt or fluid and are present in all lithologies. They occur as rims of variable thickness on spinel, but in clinopyroxene the entire crystal is altered. A second generation of clinopyroxene, intermingled with olivine, forms rims on primary olivine, orthopyroxene and clinopyroxene. Significant compositional variation in both clinopyroxene and spinel is seen within a single xenolith. Glass occurs in association with spongy clinopyroxene, in veins and in melt pockets co-existing with secondary K-feldspar, apatite and Ti-rich oxides. Compositions range from basaltic to phonolitic. Orthopyroxene frequently hosts clinopyroxene exsolution lamellae. Its range in Mg# is always narrow within a sample. The occurrence of orthopyroxene in cumulate xenoliths suggests that these are unrelated to the host alkali basalt magmas. Evidence for deformation is seen in olivine, characterised by porphyroclastic texture, undulose extinction and deformation lamellae.

Our study suggests that the same textural modifications have occurred in all xenolith types, implying that interaction with the host basalt has occurred.

[1] Bonadiman, C., et al., 2005. Kimberlite-like metasomatism and ‘garnet signature’ in spinel-peridotite xenoliths from Sal, Cape Verde... *JPet*, *46*, 2465-2493.

[2] Shaw, C.S., et al., 2006. The origin of reaction textures in mantle peridotite xenoliths from Sal Island, Cape Verde: the case for “metasomatism” by the host lava. *CMP*, *151*, 681-697.