The origin of reaction textures in mantle peridotite xenoliths from Sal Island, Cape Verde: the case for "metasomatism" by the host lava

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Reaction zones around minerals in mantle xenoliths have been reported from many localities worldwide. Interpretations of the origins of these textures fall into two groups: mantle metasomatic reaction or reaction during transport of the xenoliths to the surface. A suite of harzburgitic mantle xenoliths from Sal, Cape Verde, show clear evidence of reaction during transport. The reactions resulted in the formation of olivine – clinopyroxene Si- and alkali-rich glass around orthopyroxene and sieve-textured clinopyroxene and sieve-textured spinel, both of which are associated with a Si- and alkali-rich glass similar to that in the orthopyroxene reaction zones. Reaction occurred at pressures less than the equilibration pressure and at temperatures close to the liquidus temperature of the host magma. In addition, there is a clear spatial relation of reaction with the host lava: reaction is most intense near the lava / xenolith contact. The residence time of the xenoliths in the host magma, determined from Fe-Mg interdiffusion profiles in olivine, was approximately four years. Our results contradict a recent model for the evolution of the mantle below the Cape Verde Archipelago. We contend that alkali-rich glasses in the Sal xenoliths are not remnants of a kimberlitic melt, but rather they are the result of reaction between the host lava or a similar magma and xenolith minerals, in particular orthopyroxene. The formation of a Si- and alkali-rich glass by host magma – orthopyroxene reaction appears to be a necessary precursor to formation of sieve-textured spinel and clinopyroxene.