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Metasomatism in the oceanic lithosphere beneath La Palma, Canary Islands

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La Palma is the most active island within the Canary archipelago with historical eruption along the Cumbre Vieja Rift. Mantle peridotite xenoliths brought to the surface during the eruption 1677/78 at the site of San Antonio Volcano, close to Fuencaliente in the south of the island, gives us an excellent opportunity to study an old oceanic lithosphere. The collection of xenoliths comprises sp-harzburgites, sp-lherzolites, sp-dunites and pyroxenites but only the first three were used for this work.
Metasomatic processes are evident in all samples. A common feature is a variable channelling of melt flow through the mantle xenoliths displayed in variations from pervasively metasomatized, through veined to dyke intruded peridotites. Orthopyroxene breakdown into olivine, clinopyroxene and glass is evidence for anhydrous melt percolation. Furthermore, fine-grained veins in various thicknesses consisting of olivine, pyroxene as well as amphibole with apatite and phlogopite reveal additional anhydrous and hydrous metasomatic processes, respectively. Peridotites mainly influenced by anhydrous metasomatism exhibit locally phlogopite and/or amphibole around spinel or in glass-veinlets. Pentlandite has been found in all veined samples. Amphiboles are mostly pargasites but kaersutites are also present in the amphibole-bearing veins.
Two different types of amphibole veins have been recognized. The first type is an amphibole-apatite-glass-bearing amphibolite, forming a cross-cutting vein that propagates through the xenolith. The amphiboles in this vein are coarse-grained while the disseminated amphiboles are fine-grained. Clinopyroxene always occurs in association with amphibole and in textural equilibrium suggesting that both minerals have grown together. The glass is of tephritic/basanitic to trachy-basaltic composition. The second amphibole-vein contains phlogopite and traces of apatite. Textural evidence (cross-cutting olivine grains and the absence of hydrous minerals in the host basalt) indicate that these veins have been formed prior to their transport to the surface. During to their transport to the surface host basalt infiltration propagated along these veins leading to the breakdown of the amphibole and/or phlogopite and the formation of glass, secondary clinopyroxene and spinel. The glass is of tephra-phonolitic composition in the peridotite and foiditic along the amphibole-phlogopite-veins.
Mantle xenoliths from San Antonio reveal that the oceanic lithosphere beneath La Palma has been affected by different metasomatic processes. The metasomatic agents were silicate melts causing the formation of secondary clinopyroxenes and the breakdown of orthopyroxenes, whereas hydrous silica fluids formed the various amphibole and/or phlogopite veins-veinlets. Additionally, the presence of a veinlet containing haüyne and glass is a strong indication for host basalt infiltration since these basalts are haüyne bearing.