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Depleted and metasomatized oceanic lithosphere beneath La Palma, Canary Islands

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Due to the inaccessibility of Earth's interior, xenoliths became the best possibility to study the chemical composition of the earth mantle as well as its various processes. Three samples out of the sample suite of mantle peridotites from San Antonio Volcano on La Palma, Canary Islands, have been chosen to illustrate three examples of diverse mantle metasomatic events.
The first sample, a pyroxene-hornblende-peridotite, was influenced by an alkali-rich, silicic-hydrous undersaturated melt and/or fluid forming a conspicuous cross-cutting amphibole-apatite-dyke with several veins percolating through the rock. Forsterite content in olivine varies between 82.5 – 85.5 and 86.0 – 89.0, suggesting at least two different occurrences of metasomatic overprint. Clinopyroxenes are mostly found in association with amphibole and in textural equilibrium hinting that both minerals may have grown together, while orthopyroxene have only been found as remnant inclusions in olivine. These clinopyroxenes are Cr-Diopsides with En43.40-50.97-Wo43.99-48.64-Fs4.30-8.22 and Mg# between 85.54 and 92.36. Secondary clinopyroxenes are Ti-Augites with En39.86-46.81-Wo46.65-51.98-Fs5.86-8.72 and Mg# of 82.44 – 89.09.
The second sample, a sp-dunite, is characterized by haüyne-bearing melt veins which clearly indicate host-basalt infiltration. The haüyne is always in contact with amphibole, spinel and clinopyroxene denoting that they have been formed at the same time because there is no evidence for reaction among these phases. The melt infiltration apparently took place prior to xenolith entrainment in the host basalt. Primary olivine has Fo content of 89.57 – 89.67 with NiO ranging from 0.32 – 0.334, in contrast Fo content in secondary olivine varies from 89.05 – 90.86 and NiO fluctuates between 0.24 – 0.31. Cr-Diopside compositions are in range of En41.63-47.05-Wo47.83-51-90-Fs4.93-6.64 and Mg# between 86.48 – 90.50.
The third sample is also a sp-dunite and marked by a network of phlogopite-amphibole veins cutting through pre-existing olivine implying a formation of the veins prior to xenolith entrainment in the host basalt. During ascend melt infiltrated the peridotite mostly along these veins forming a reaction zone causing growth of secondary clinopyroxene and altering contiguous olivine. Amphiboles found in the matrix have a slightly different chemical composition compared to amphiboles forming the veins indicating that these are the result of melt influence. Clinopyroxenes are secondary Ti-Diopsides with En40.82-49.42-Wo45.20-51.63-Fs4.99-7.56 and Mg# of 84.51 – 91.09 within the phlogopite-amphibole veins and secondary Cr-Diopsides with En43.32-49.64-Wo45.85-51.61-Fs4.16-5.55 and Mg# ranging from 88.77 – 92.48 apart from the phlogopite-amphibole-veins. Olivines within the veins show Fo values of 88.18 – 89.68 whereas Fo content in primary olivines is more homogeneous and varies between 90.03 and 90.66.
Amphiboles in all three samples are pargasites and kaersutitic pargasites.