



Metasomatism in the lithospheric mantle beneath southern Patagonia, Argentina

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Mantle xenoliths from Gobernador Gregores, southern Patagonia are spinel- lherzolites, harzburgites and wehrlites. Composite xenoliths consisting of websterites, olivine-websterites and spinel- lherzolites or harzburgites are present as well.

The lithospheric mantle beneath Gobernador Gregores region was affected by multiple modal metasomatic events as can be inferred by the presence of amphibole, phlogopite and apatite. The existence of amphibole as inclusion in clinopyroxene suggests dehydration reaction of peridotites, which previously experienced modal metasomatism. This textural evidence records the earliest detectable metasomatic event.

A second distinct modal metasomatic event consists of disseminated up to 6 mm in diameter coarse grained amphiboles ($100^*mg\# = 89.9$) which show breakdown reactions and pseudomorphic replacement by glass and fine grained second generation of olivine, clinopyroxene and spinel. The intensity of the breakdown reaction is variable. In most cases amphibole occurs as a relict within these pseudomorphs. However, melt pockets of up to 10 mm in diameter are abundant, irregular in shape and having the same minerals such as in the pseudomorphs, indicate clearly amphibole breakdown because remnants of it were found enclosed by second generation clinopyroxene. Similar breakdown reactions experienced the phlogopite in the samples where is present. The Phlogopite ($100^*mg\# = 88.6$) breakdown produces the same mineral phases as the amphibole. The second generation minerals formed after breakdown of amphibole and phlogopite show minor differences in their composition. However, the chemical composition of glass varies considerably. The glasses formed after breakdown of amphibole and phlogopite have trachyandesitic and tephriphonolitic composition, respectively. Some harzburgites and composite xenoliths reveal another metasomatic event: peridotite, enriched in orthopyroxene (mainly orthopyroxenite veinlets, rare websterite), suggests interaction with silica-saturated melt. Veinlets up to 1 mm thick consisting mainly of second generation fine grained orthopyroxene (200-700 microns in diameter) propagate intergranular along coarse grained matrix of olivine and orthopyroxene. Other minerals found in the veinlets are amphibole, phlogopite and clinopyroxene. The primary phases (ol, opx) exhibit light to moderate intracrystalline deformation, such as undulose extinction, kink bands etc., whereas the second generation orthopyroxene (opx1) are strain-free, indicating that the metasomatic event took place after the deformation. Absence of glass suggests that the metasomatic event took place long before their entrainment in the ascending magma.

Textural evidences that show dissolution of orthopyroxene and formation of second generation olivine, clinopyroxene, spinel and glass, exhibit a third evident metasomatic event. This is the result of interaction with silica undersaturated melt. Since this metasomatic event affected both, primary and secondary opx it should be considered as the very last event.

Both dissolution of orthopyroxene and breakdown of amphibole and phlogopite took place en route since glass could not survive for long time in the lithosphere and will react with the matrix minerals.