

## Melt Migration in the Mantle Wedge: A Case Study from Patagonia Back-Arc

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Silicate glass pockets and veins are now documented in lithospheric mantle xenoliths from world-wide occurrences and several attempts have been made in the last few years to constraint the processes responsible for their genesis and evolution (Schiano et al., 1994; Zinngrebe & Foley, 1995; Chazot et al., 1996; Wulff-Pedersen et al., 1999). Here we provide evidence for the evolution of silicate melts migrating through the lithospheric mantle wedge. We focus our attention on a silicate glass + carbonate vein cutting the harzburgite mantle xenolith GG25 sampled at Gobernador Gregores, in the Southern Patagonia back-arc region. At Gobernador Gregores, an anhydrous, spinel-facies, pre-metasomatic mineral assemblage (*assemblage 1*) fully recrystallises into a second, metasomatic amphibole ± phlogopite bearing assemblage (*assemblage 2*). A further event induces a near closed-system disequilibrium melting of *assemblage 2* and gives rise to a late *assemblage 3* (Laurora et al., in press). *Assemblage 3* is found either in pockets around amphibole or in veins originating from the pockets, and consists of Na-Si-rich glass and Ca-carbonate droplets. Euhedral olivine, clinopyroxene and spinel crystallise in the Na-Si-rich glass. Silicate glass + carbonate veins are often recognisable in xenoliths characterised by the *assemblage 1* mineralogy (see Norman, 1998 for comparison), suggesting that the *assemblage 3* melt can infiltrate into, and react with a segment of the stratigraphic column not previously affected by metasomatic episodes. Our purpose is to highlight the chemical effects of the reactions occurring during *assemblage 3* melt migration through *assemblage 1* mineralogy. Sample GG25 is about 10 cm in diameter and round-shaped; it shows a recrystallised

protogranular texture and is characterised by the presence of a pervasive network of silicate glass + carbonate veins. Little or no reaction occurs when the veins run at olivine grain boundaries, but large reaction ponds develop when the veins come into contact with orthopyroxene and spinel grains. We studied in detail a 2 cm long segment of a vein, where glass compositions from both NR (No Reaction) and R (Reaction) zones are represented. WDS and LAM-ICP-MS analyses of the glass, made in eight successive steps along the segment (Fig. 1), reveal that there is a smooth NR to R compositional gradient in terms of both major and trace element. SiO<sub>2</sub> concentration increases from NR (61.7 ± 0.9 wt%) to R (67.4 ± 2.2 wt%), whereas CaO, MgO, REE, Th concentrations decrease from NR to R. Nb and Zr do not conform to this behaviour and increase dramatically from NR1 (Nb = 2 ppm, Zr = 3 ppm) to R5 (Nb = 168 ppm, Zr = 43 ppm). The chemical variation throughout the segment can be modelled starting from a silicate-carbonated melt which segregates carbonate droplets during flow; the unmixed silicate component (NR melt) reacts with orthopyroxene (and subordinately with spinel), becoming enriched in SiO<sub>2</sub> and depleted in CaO, MgO, REE, Th (R melt). Mixing between NR and R melts induces the observed smooth chemical gradients. Residual phases of the reaction are clinopyroxene, olivine and spinel. Such a model does not account for the abrupt increase in Nb and Zr concentrations throughout the segment, which remains matter of speculation. Especially between zone NR3 and zone R5, a contribution from the breakdown of a specific Nb-Zr bearing phase (amphibole or rutile) is required.

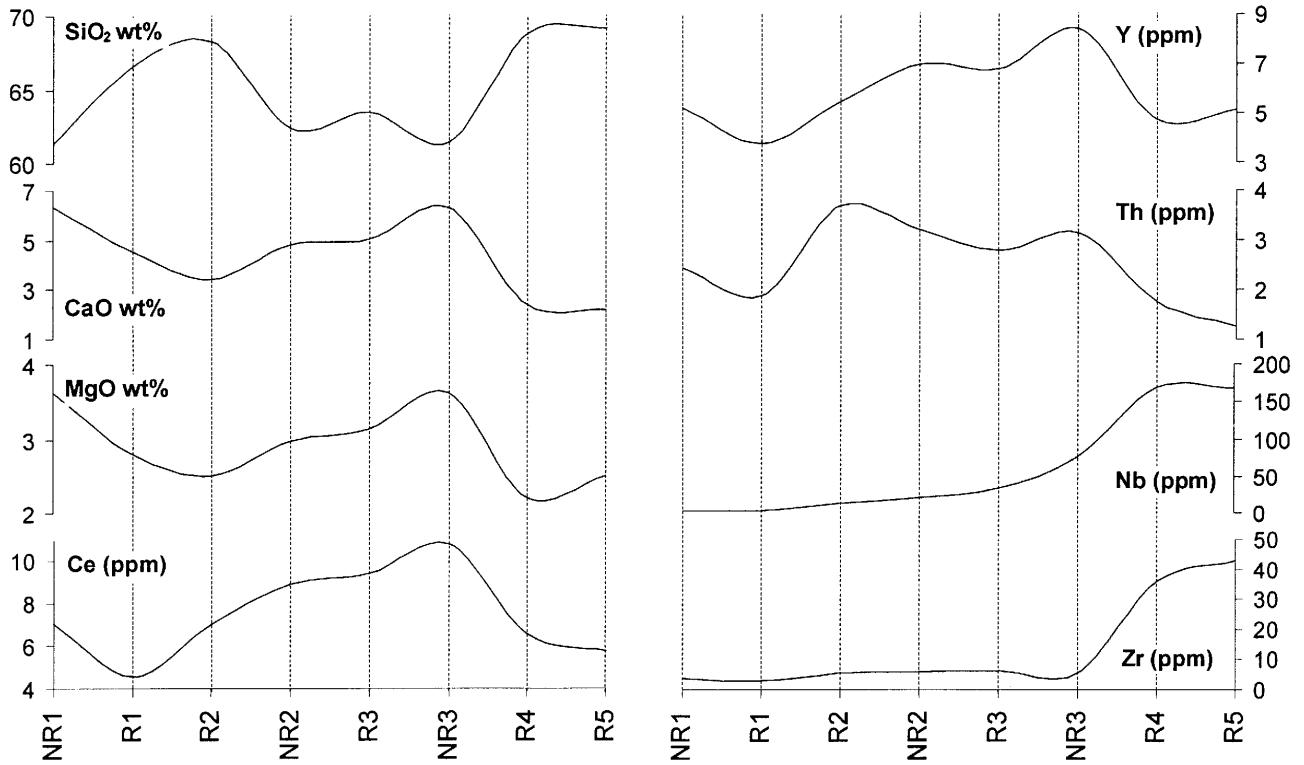


Fig. 1 - Variation of some major and trace element concentrations in eight successive steps along the selected segment.

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