



## **Geochemical spatial variability in mantle xenoliths in Austral Patagonia: trace elements and water contents**

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Several areas of mantle xenoliths can be found in Austral Patagonia, related to Miocene to Pleistocene alkaline volcanism in the back-arc region. The distribution of mantle xenoliths from the active volcanic arc in the west to the back-arc region in the east offers an opportunity to evaluate the spatial geochemical variability related to magmatic and metasomatic processes in the Austral Andean mantle wedge. In addition to major and trace element geochemistry, this study focuses on water concentrations of nominally anhydrous minerals (NAMs), specifically olivine, orthopyroxene and clinopyroxene. Water in NAMs, even in small concentrations, has an important effect on mechanical and thermodynamic properties, such as melting behavior, diffusion rate, viscosity and rheology. We present preliminary results on two localities and compare the geochemical variability. The major and trace element measurements were made with an Electron Probe Micro-Analyser (EPMA) and a Laser ablation ICP-MS, respectively. The water concentrations and speciation were determined by Fourier Transformation Infrared spectroscopy (FTIR) on doubly polished single crystals of olivine, orthopyroxene, and clinopyroxene. FTIR generates absorption bands corresponding to a range of O-H stretching modes related to the stoichiometry of the hydrogen-bearing crystallographic point defects. Four main hydrogen substitution mechanisms in olivine were identified by experimental studies<sup>1</sup> (1) Si vacancies, (2) Mg vacancies, (3) Ti and H co-substitution in a titanoclinohumite-like point-defect, and (4) the co-substitution between H and a trivalent cation. These mechanisms are identified through their characteristic absorption bands.

We studied xenoliths from Las Cumbres in the Sierra Baguales (Chile), where mantle xenoliths were collected in an alkaline lava flow. The second locality (Tres Lagos, Argentina), located ~200 km north-east provided mantle xenoliths in a scoria cone surrounded by lava flows. The mantle xenoliths are sp-bearing harzburgites, with a few sp-bearing dunites and lherzolites. They have variable olivine Mg# (0.890 and 0.925) and different spinel Cr# (between 0.15 and 0.60 in Tres Lagos and 0.25 and 0.50 in Las Cumbres). Cpx and Opx trace element patterns from Tres Lagos show a greater enrichment in LREE, indicating a higher degree of metasomatic overprint than the Las Cumbres peridotites, where partial melting signatures are more significant. In Las Cumbres peridotites, olivine crystals are 'dry' (<1 ppm H<sub>2</sub>O) with no detectable absorption peaks. In Tres Lagos, substitution mechanisms (3 and 4) are evident through the absorption spectra, but correspond to very low water concentrations (~1 and 2 ppm H<sub>2</sub>O). The absence of Si vacancies-related bands are consistent with both the high silica activity of the opx-buffered assemblage, and the low water activity expected of upper mantle metasomatic fluids. Orthopyroxene has higher water contents in Tres Lagos (80-100 ppm) compared to Las Cumbres (10 to 20 ppm). The significant differences in opx water concentrations most likely reflect a combination of spatially variable degrees of partial melting and metasomatism in the Patagonian mantle lithosphere.

<sup>1</sup> Kovacs I, O'Neill HSC, Hermann J, Hauri EH (2010) Site-specific infrared O-H absorption coefficients for water substitution into olivine. *Am Mineral* 95(2-3):292-299