# Evidence of dehydration in mantle-derived orthopyroxene from San Carlos

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From experimental studies, it is known that a significant part of the water of our planet may be stored in the form of hydrogen dissolved as point defects in nominally anhydrous minerals of Earth's mantle. Such hydrogen defects embedded in the mineral atomic structures are easily detectable using Fourier transform infrared spectrometry (FTIR) even at low concentration levels (ppm). Here, we report hydrogen concentration in upper mantle minerals from a composite spinel-bearing peridotite (dunite cross-cut by a pyroxenite vein) from San Carlos (Arizona, USA) equilibrated at 1122°C (Ca-in-opx). The hydrogen concentration is quantified using Fourier transform infrared spectroscopy (FTIR). Core analyses yield 0.5, 23-35 and 18-42 ppm wt. $H_2O$ for olivine, enstatite and diopside, respectively. Core to rim analyses indicate that the hydrogen concentration is homogeneous in both olivines and clinopyroxenes (cpx), but is heterogeneous in orthopyroxenes (opx). Profiles analyses (more than 1 mm long) using both unpolarized and polarized infrared radiation across opx grains reveal hydrogen-depleted rims. These observations corroborate the relative hydrogen diffusivities inferred from experiments at high pressure and high temperature. Indeed, the latter indicate that hydrogen diffusion in olivine is significantly faster than in opx and cpx. Also, from the present results, hydrogen diffusivity in cpx seems slower than in opx. We will also try to combine these new results with concentration profiles in major (Fe, Mg, Al) and traces elements (REE) at both the scale of the grains and the scale of the thin section. This study suggests that the bulk hydrogen concentration for the upper mantle based solely on measurements of mantle-derived peridotites might underestimate the true water content of the equilibrated uppermost mantle if distribution concentrations are not studied with care.