

Water in natural olivine—determined by proton-proton scattering analysis

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ABSTRACT

Here we present water concentration data for olivine from different host rocks, measured with a nuclear technique using proton-proton scattering. This method, which is used here for the first time on olivine, is very powerful for determining trace amounts of water. The studied olivine specimens differ in their H₂O contents, ranging from 4 to 51 wt ppm (=10–117 atom ppm H). The lowest concentrations are found in olivine from spinel peridotite xenoliths, the highest concentrations in olivine from alpine-type peridotite; the contents of an ophiolitic and a hydrothermal olivine are intermediate. Infrared spectroscopy was applied to ensure that the measured water contents stem solely from hydroxyl defects in the mineral structure. The infrared spectra differ from sample to sample. Five of six olivine specimens show absorption bands typical of hydroxyl groups associated with Ti defects. These olivines differ in their Ti contents by two orders of magnitude. However, a correlation of water and Ti content was not observed.

Keywords: Hydroxyl defects, olivine, peridotite, proton-proton scattering, nominally anhydrous minerals, water content