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Mapping the distribution of volatile-bearing microphases in peridotite xenoliths from the Carpathian-Pannonian region using hyperspectral FTIR imaging

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'Water' in the upper mantle can occur either as H_2O in fluid or melt inclusions, or as structurally bound hydroxyl in mineral structures. The latter can be present in small concentrations (tens to hundreds of ppm) in the nominally anhydrous minerals (NAMS; olivine and pyroxenes in the upper mantle), or in higher concentrations ($\sim$2 wt %) in volatile bearing mantle minerals, out of which pargasite is the most abundant. However, pargasite is not stable above 1050-1150°C in water-undersaturated conditions (0.02 – 0.4 wt.%) generally characteristic for the upper mantle [1, 2]. Outside of pargasite stability, the excess water can be incorporated in the NAMs or occur as aqueous phase (e.g., in fluid inclusions) or dissolved in incipient partial melt. In the Pannonian basin, a young extensional basin, it is suggested that pargasite is stable below $\sim$1050°C either as an interstitial phase or as micro-lamellae within NAMS [3].
In this study we present how Fourier-transform infrared (FTIR) spectroscopy can be applied to create hyperspectral images to detect the presence and distribution of such pargasite lamellae within the NAMs of peridotite xenoliths from the northern part of the Pannonian Basin. Previously, in situ FTIR analyses were carried out on the same samples, revealing the occasional presence of pargasite lamellae within orthopyroxenes and clinopyroxenes. However, these analyses do not provide information on the distribution of such lamellae within the grain. Creating hyperspectral images does not only give insight on this matter, but can be used to pinpoint the areas where pargasite lamellae or sub-microscopic fluid inclusions appear for further, higher resolution analyses such as Raman spectroscopy, which offers advanced spatial resolution (few μm) and the production of 3D maps.

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