3D Raman mapping of fluid and melt inclusions in amphibole-rich upper mantle xenoliths from the Styrian Basin (NW Hungary).

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The Styrian Basin, representing a possible supra-subduction setting is situated in the westernmost unit of the Carpathian-Pannonian region, in the intermediary zone between the Pannonian Basin and the Eastern Alps1,2. The evolution of the Styrian Basin was influenced by the dynamics of the Carpathian-Pannonian region. The Plio-Pleistocene alkali basalts brought mantle xenoliths to the surface derived from the subcontinental lithospheric mantle beneath the basin. Several xenoliths are amphibole rich, which indicates extensive modal metasomatism at mantle depth1,2. Our study focuses on strongly amphibolized harzburgite where enstatite hosts fluid and melt inclusions (Figure 1). The studied secondary inclusions (1-30 μm) show irregular to negative crystal shapes in the host enstatite, whereas the melt inclusions are rounded to negative crystal shaped and glass-rich (Figure 1).

Preliminary results of Raman spectroscopy, SEM-EDS, and FIB-SEM have shown that the fluid dominantly consists of CO2 (0.71 g/cm3) and liquid H2O. Besides the identified fluid phases, solid phases (i.e., sulfides, magnesite, sulfates, quartz, and glass) were also identified in the inclusions. Furthermore, it has been revealed that the glass is SiO2-rich and often occurs together with a bubble within the melt inclusion. With the Raman we were capable to map in 3D not only the solid phases within the inclusions but also the CO2-rich and the H2O-rich phases. These initial findings imply that CO2-H2O fluid (where the amount of H2O is high relative to mantle fluids) and SiO2-rich coexisting melt could have been circulating in the mantle above a subducted slab and could have played role in amphibole formation as well.

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Figure 1. Photomicrograph of fluid and melt inclusions hosted in enstatite in amphibolized harzburgite from the Styrian Basin (NW Hungary).

References