

## The role of temperature in P-induced crystal fluid interaction: the case of LAU and HEU topology

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Zeolites are a class of open-framework aluminosilicate minerals commonly present in soil, oceanic basalts and sediments and diagenetic environments. Zeolites may act as fluid carriers in the upper Earth crust during the early subduction stage thanks to their unique features: the reversible hydration (i.e., the ability of adsorb and release H<sub>2</sub>O molecules or other small molecules, e.g., CO<sub>2</sub>, CH<sub>4</sub>, SO<sub>2</sub>) and the ability to overhydrate. During the last decades, the high-pressure (HP) and high-temperature (HT) behavior of natural and synthetic zeolites have been intensively investigated but, at the best of our knowledge, no experiments have ever been conducted combining the effects of both thermodynamic variable. Experiments at these conditions (i.e., simulating the PT gradient), using a H<sub>2</sub>O-based solution as P-transmitting fluids (PTFs), provide a realistic description of crystal-fluid interaction phenomena.

In this study, we have investigated the HPHT behavior of heulandite and laumontite, two of the most common natural zeolites, whose presence have been described in a wide range of natural environments. The characterization of the crystal-fluid interaction induced by P in these two species has already been performed by Comboni et al. (2018) and Seryotkin (2015) for laumontite and heulandite, respectively, and was adopted as reference in order to evaluate the T gradient effect. In-situ HPHT single-crystal synchrotron X-ray diffraction experiments were performed at the ID15b beamline, at the ESRF, Grenoble (France). The set-up, easily reproducible, consist of a membrane-driven diamond anvil cell (DAC) placed in a resistive heater which allowed to increase the T up to 150(2)°C. Pressure was determined by the ruby fluorescence method, while temperature was measured using a thermocouple located very close to the P-chamber, allowing a precise determination of both (results were consistent with the values calculated by the Au-powder pattern).

Results of the P-V pattern in laumontite clearly indicated that temperature enhances the H<sub>2</sub>O adsorption, giving rise to a volume expansion at P < 5 kbar. Previous experimental finding highlighted that hydration of laumontite occurs at ambient condition after ~ 24h, while with the presence of a T gradient required no more than 20 min. Concerning heulandite, preliminary data seems to suggest a higher H<sub>2</sub>O adsorption. if compared to that governed by the effect of P only.

Comboni D., Gatta G.D., Lotti P., Merlini M. & Hanfland M. (2018) - Crystal-fluid interactions in laumontite. *Microp. Mesop. Mater.*, 263, 86-95.

Seryotkin Y.V. (2015) - Influence of content of pressure-transmitting medium on structural evolution of heulandite: Single-crystal X-ray diffraction study. *Microp. Mesop. Mater.*, 214, 127-135.