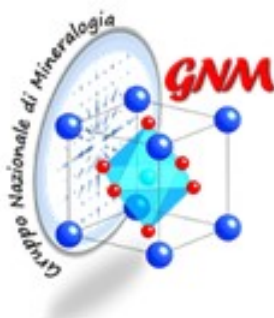


Mineralogical School of the  
National Mineralogical Group (GNM) and  
Italian Society of Mineralogy and Petrology (SIMP)



GNM-SIMP School, Bressanone 2018, 12<sup>th</sup> - 15<sup>th</sup> February



BOOK OF ABSTRACTS

## A NATURAL NANOSPONGE: CRYSTAL-FLUID INTERACTIONS IN LAUMONTITE

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Laumontite,  $[(Ca_{4-x}Na_x)K_x(H_2O)_n] \cdot [Al_8Si_{16}O_{48}]$ , space group  $C2/m$ , is one of the most common natural zeolite occurring in a wide range of geological environments, including sedimentary deposits, deep-sea sediments and in sedimentary deposits related to oil reservoirs. Remarkably, it is also present in oceanic basalts as well as in vugs of plutonic and volcanic rocks and in sedimentary rocks. Fully hydrated laumontite contains 18 H<sub>2</sub>O molecules per formula unit. However, laumontite can lose up to 4 H<sub>2</sub>O molecules per formula unit if exposed to air at relative humidity (RH) < 50%. Such a partially-dehydrated laumontite is formally referred as leonhardite (Yamazaki *et al.*, 1991).

To date, a number of studies investigated, mainly *via* X-ray powder diffraction, the processes of hydration/dehydration controlling the RH or submerging samples in pure water or increasing temperature (*e.g.*, Yamazaki *et al.*, 1991; Fridriksson *et al.*, 2004). Lee *et al.* (2004) investigated the high-pressure behavior of laumontite up to 7.5 GPa, by *in-situ* synchrotron powder diffraction with a diamond anvil cell, using the 16:3:1 methanol-ethanol-H<sub>2</sub>O pressure medium, and observed an instantaneous over-hydration effect at a relatively low pressure (< 0.5 GPa) with a potential additional phase transition at about 3 GPa (Lee *et al.*, 2004). However, a number of open questions remain still open about: i) the possible phase transition observed by Lee *et al.* (2004) at about 3 GPa, ii) the elastic parameters of the leonhardite, which both thermodynamic calculation and geological observations suggest being the stable form of laumontite under diagenetic and low-grade metamorphic conditions (*e.g.*, Neuhoff & Bird, 2001; Coombs *et al.*, 1959), and iii) the single-crystal hydration kinetics in H<sub>2</sub>O mixture.

These parameters are valuable considering the fact that laumontite is one of the most common zeolite in the oceanic basalts and, thereby, it can be an important H<sub>2</sub>O-carrier in the very first kilometers of the subduction zones. Moreover, it is worth to note that the *KV* of leonhardite is a critical parameter needed in order to model the thermodynamic stability of this mineral in geological environments of economic relevance (*i.e.* deposits related to oil reservoirs). In this light, we performed *in-situ* single-crystal synchrotron X-ray diffraction experiments using different pressure transmitting fluids, as well as a number of *in-situ* single-crystal experiments at ambient pressure in different H<sub>2</sub>O-rich mixture. On the base of these studies, we are able to describe: 1) the hydration mechanisms and kinetics of laumontite in large single-crystals; 2) the bonding configuration of the adsorbed H<sub>2</sub>O molecules and the structural deformation of the framework in response to the overhydration at ambient pressure; 3) the elastic parameters of leonhardite; 4) the different deformation behavior between leonhardite and the hydrated-laumontite.

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