P-induced crystal fluid interaction: the case of ERI and OFF topology

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The P-induced intrusion of molecules or solvated ions within the nanocavities of open-framework minerals, such as zeolites, has been extensively investigated during last decades (e.g., Gatta et al., 2018, and references within). This peculiar property might be exploited to tailor new multifunctional materials or to enhance industrial catalytic processes involving zeolites (Comboni et al., 2020). In addition, from a geological point of view, a constraint of this phenomena might shed light on the role played by zeolites as fluid carriers in the upper Earth crust, e.g., during the early subduction of altered basalts or oceanic sediments. The aim of the present study is to characterize the high-pressure behavior, promoting the crystal-fluid interaction, on two different natural zeolites species belonging to the ABC-6 family: erionite (AABAAC) and offretite (AAB) (ERI and OFF topology, respectively). Similarities of the framework between these two species resulted in quite common intergrowth, at least in natural samples (Passaglia et al., 1998). Samples were compressed in non-penetrating and penetrating *P*-transmitting fluids (PTFs).

Investigations were conducted via in-situ high pressure single-crystal synchrotron X-ray diffraction, using a diamond anvil cell (DAC), at the ID15b beamline of ESRF (Grenoble, France) and P02.2 of PETRA-III (Hamburg, Germany). Different PTFs have been employed during the experiments: non-penetrating *i*) silicone oil and daphne oil (7575) and potentially penetrating, *ii*) alcohols: water mixtures, *iii)* pure H_2O, *iv*) Ne.

The obtained unit-cell P-V patterns revealed the adsorption of H_2O molecules within the structural cavities; in addition, the structure refinements allowed to describe the deformation mechanisms as well as the location of the adsorbed molecules. Interestingly, the magnitude of the absorption phenomena in natural erionite appeared to be comparable with what observed in synthetic zeolites (i.e., $AlPO_4$-5, Lotti et al., 2016), highlighting the great potential of erionite as a mineralogical carrier of fluids in the upper Earth crust.

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