Book of Abstracts

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Video

Crystal chemistry and behavior at non-ambient conditions of natural REE–arsenates and –phosphates

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Rare earth elements (REE) represent a group of 15 elements, divided into LREE (La-Eu) and HREE (Gd-Lu) on the basis of their atomic weight coupled with decreasing atomic radii from La to Lu. REE are classified as critical raw materials by the European Commission, due to their elevated supply risk and high economic importance. Several studies have been dedicated to the chemical and physical properties of REE-bearing natural compounds, in order to better understand the conditions at which these minerals form, as well as to identify new strategies useful for mining and exploitation of mineral resources.
The present contribution belongs to a larger project, focusing on four mineralogical species occurring within the REE-enriched pegmatitic dikes and alpine fissures that crop out at Mt. Cervandone (Western Alps, Italy): monazite-(Ce), xenotime-(Y), chernovite-(Y) and gasparite-(Ce). These minerals have the general formula ABO_4, where A is populated by Y or a REE metal and B by P or As. Monazite-(Ce) (ideally $REEPO_4$) and gasparite-(Ce) ($REEAsO_4$) crystallize in the monoclinic *P21/n* space group, whereas xenotime-(Y) [(Y,REE)PO_4] and chernovite-(Y) [(Y,REE)AsO_4] show tetragonal symmetry (s.g.: *41/amd*). We aim to characterize: the crystal chemistry and crystal structures, (P,T)-phase stability and possible phase transitions, thermo-elastic behaviors and structural re-arrangements at non-ambient conditions of these minerals.
Here we present the preliminary data obtained so far, which include: 1) the crystal-chemical and structural characterization of samples of monazite-(Ce), xenotime-(Y), chernovite-(Y) and gasparite-(Ce) from Mt. Cervandone, by means of WDS-EPMA and single-crystal X-ray diffraction analyses; 2) the isothermal high-P behavior of gasparite-(Ce) (at ambient-T, investigated for the first time) up to 10 GPa, by means of in situ single-crystal synchrotron X-ray diffraction using a diamond anvil cell. Gasparite-(Ce) does not experience any P-induced phase transition within the P-range investigated. A II-order Birch-Murnaghan equation of state was fitted on the V-P data, yielding a refined bulk modulus KP0,T0 = 106.7(9) GPa and V0= 323.8(1) Å3. P-induced structural deformation mechanisms at the atomic scale will be discussed.