

EGU21-5066

<https://doi.org/10.5194/egusphere-egu21-5066>

EGU General Assembly 2021

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## High-pressure crystal chemistry of four natural REE(As,P)O<sub>4</sub> minerals from Mt. Cervandone, Italy

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REE orthoarsenates and orthophosphates are common accessory minerals characterized by the general chemical formula REEXO<sub>4</sub>, where REE represents one of the lanthanides (La-Lu series), Y, Sc, Ca or Th, whereas X stands for As, P or Si. In the framework of a long-term project on the high-*T*/high-*P* crystal-chemistry and phase-stability of REE-bearing minerals, the high-pressure behavior of chernovite-(Y) (nominally YAsO<sub>4</sub>), xenotime-(Y) (nominally YPO<sub>4</sub>), gasparite-(Ce) (nominally CeAsO<sub>4</sub>) and monazite-(Ce) (nominally CePO<sub>4</sub>), has been studied. Chernovite-(Y) and xenotime-(Y) show a HREE- (Gd-Lu series) and Y-enrichment, and the same tetragonal symmetry (space group *I4<sub>1</sub>/amd*), whereas gasparite-(Ce) and monazite-(Ce) share the same LREE (La-Eu) enrichment and monoclinic cell (space group *P2<sub>1</sub>/n*). All these minerals occur at Mt. Cervandone (Western Alps, Italy), a renowned Alpine REE-bearing mineral deposit. The crystal chemistry of the four minerals has been studied via EPM-WDS analysis. Excluding gasparite-(Ce), which formation is bound to the replacement of the mineral synchisite-(Ce) (CaCe(CO<sub>3</sub>)<sub>2</sub>F), a sensible enrichment in Gd and Ho is observed. Moreover, the majority of the chernovite-(Y) show a variable amount of ThO<sub>2</sub>, up to 13 wt%, and phosphorous as substitute for arsenic in almost every proportion. In the case of the monoclinic series between monazite-(Ce) and gasparite-(Ce), no solid solution has been observed. Experiments at high-pressure were performed by in situ synchrotron X-ray diffraction using a diamond anvil cell. The high-pressure behavior of single crystals of xenotime-(Y), gasparite-(Ce) and monazite-(Ce) has been studied up to ~20 GPa, whereas that of chernovite-(Y) has been studied by powder diffraction up to 8.20(5) GPa. A II-order Birch-Murnaghan equation of state was fitted to the *V-P* data, within the phase stability field of the minerals, yielding the following bulk moduli:  $K_{P_0,T_0} = 125(3)$  GPa ( $\beta_{V_0} = 0.0080(2)$  GPa<sup>-1</sup>) for chernovite-(Y);  $K_{P_0,T_0} = 145(2)$  GPa ( $\beta_{V_0} = 0.0069(1)$  GPa<sup>-1</sup>) for xenotime-(Y);  $K_{P_0,T_0} = 106.7(9)$  GPa ( $\beta_{V_0} = 0.0094(1)$  GPa<sup>-1</sup>) for gasparite-(Ce),  $K_{P_0,T_0} = 121(2)$  GPa ( $\beta_{V_0} = 0.0083(1)$  GPa<sup>-1</sup>) for monazite-(Ce).  $K' = \partial K_V / \partial P = 4$  (fixed) for all the minerals. Deformation mechanisms, at the atomic scale, were described on the basis of structure refinements.

Acknowledgments: This research was partly funded by the PRIN2017 project "Mineral reactivity, a key to understand large-scale processes" (2017L83S77).

