Characteristic of Epidote at High Pressure and High Temperature

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Hydrous minerals have long been considered to be the major source for transporting and storing water in the Earth's mantle. Epidotes, $Ca_2(Al, Fe)_3[Si_2O_7][SiO_4]O(OH)$, are of particular interest for the study of hydrous minerals because they concern: (1) the manner in which water is retained in the upper mantle of the planet; (2) are important Ca-Al-silicates in many metabasites, metapelites and metacherts that are characterized by high *P*/*T* ratios. Such high *P*/*T* ratios are typical for subduction zones and the HP and UHP metamorphism during continent-continent collisions. (3) the role they may play in subduction dynamics due to their anomalous rheology; (4) are the most important Sr and REE reservoirs at HP and UHP conditions where they are a major Ca-Al-silicate, and their stability strongly controls the recycling of Sr and REE in HP-UHP environments or during subduction.

The hydroxyl bound within the crystalline structure of hydrous minerals, as well as changes in hydrogen bond symmetry, can impact the bulk properties of these minerals. In this study, a natural epidote sample was probed with micro-Raman, mid-infrared spectra and synchrotron X-ray diffraction in situ in a diamond-anvil cell (DAC) with externally heater as a function of high pressure (up to 20 GPa) and high temperature (700 C°): pressure and temperature dependences of defect structures, IR/Raman frequencies, relative energies, crystal structure, etc. We also discuss effects of pressure and temperature on hydrous epidote phases. This study will advance our understanding of stability of epidotes and circle of hydrous phases in the subduction.