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Experimental and petrological constraints on brine (H_2O-KCl) apatite interactions in hornfelses

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Brines are increasingly recognized as playing an important role in high pressure and temperature metamorphic and magmatic systems. Apatite ($Ca_5(PO_4)_3(OH,F,Cl)$) is a ubiquitous accessory mineral in many crustal rocks and is of major geochemical importance, being one of the minerals in which the light rare-earth elements (LREE) and halogens concentrate. This study focuses on the petrology of a hornfels from the diorite contact aureole at the Kloster Säben, South Tyrol, Italy which contains the contact metamorphic mineral assemblage plagioclase + K-feldspar + biotite + quartz ± pyrite ± rutile ± titanite ± ilmenite. In addition to this assemblage abundant texturally and chemically zoned F-apatite showing two stages of apatite growth was found in the hornfels. Monazite formed both as an inclusion within the second LREE-poor generation of apatite as well as on its rims. These textures can be explained by metasomatic activity involving apatite and an externally derived brine-rich fluid. Hence in agreement with the petrographic evidence for fluid mobility and metasomatism in the hornfels sample we investigate the hypothesis that aqueous fluids in the systems KCl-H_2O influence the solubility behaviour of synthetic F- and Cl-apatite and natural Durango F-apatite at fixed *P-T* conditions of 800°C and 1 GPa in a piston cylinder apparatus. The first experimental results in the system F-apatite-H_2O-KCl yielded a strong increase in solubility at low X_{KCl} but in contrast to the NaCl-H_2O system the solubilites at high salt concentrations are much lower in our system since we use pure synthetic F-apatite.