OH-INCORPORATION IN SYNTHETIC FLUORAPATITE IN AQUEOUS FLUIDS AT LOWER CRUSTAL CONDITIONS

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Apatite ($Ca_5(PO_4)_3(OH, F, Cl)$) is a ubiquitous accessory mineral in many crustal rocks that is widely used to evaluate petrogenetic processes (SPEAR et al., 2002) and plays a unique role by monitoring fluid-rock interaction as it incorporates halogens and OH from hydrothermal aqueous fluids to form a ternary solid solution of the endmembers F-apatite, Cl-apatite and OH-apatite. The F, Cl and OH contents of apatite, coexisting with a variety of fluids at high P and T, provide better constraints on the chemical composition of aqueous fluids which may exist in the lower crust. In this study experiments of the synthetic fluorapatite single crystals were conducted at 800 °C and 1.0 GPa using the piston-cylinder apparatus under aqueous conditions with moderate KCl (X_{KCl}) and NaCl (X_{NaCl}) mole fractions (X_i = 0.1 – 0.5). The OH-incorporation in synthetic fluorapatite ($Ca_5(PO_4)_3F$) was studied by FTIR-spectroscopy. All IR spectra of experimentally treated apatite crystals showed a maximum absorption band at the same position (3540 cm^{-1}). The OH-contents in fluorapatite were calculated from IR absorption spectra measured on oriented single crystals, expressed as ppm water, using the calibrations of LIBOWITZKY & ROSSMAN (1997) and WANG et al. (2011). According to the calibration of WANG et al. (2011), the calculated OH-contents in fluorapatite treated in moderate KCl and NaCl mole fractions are 2.3 times larger than those of LIBOWITZKY & ROSSMAN (1997). Referring to the calibration of WANG et al. (2011) the OH-concentrations in the system H_2O-KCl decrease with increasing KCl from 244 ± 2 ppm (X_{KCl} = 0.000) to 165 ± 13 ppm (X_{KCl} = 0.520). In the system H_2O-NaCl the OH-concentrations decrease with increasing NaCl from 244 ± 2 ppm (X_{NaCl} = 0.000) to 205 ± 5 ppm (X_{NaCl} = 0.306), but at X_{NaCl} > 0.3, the OH-contents increase with increasing NaCl from 205 ± 5 ppm to 253 ± 6 ppm (X_{NaCl} = 0.509). Best fit equations for the OH-content in fluorapatite in the system H_2O-KCl and H_2O-NaCl are: $m_{OH} = - 130\ X^2_{KCl} – 82\ X_{KCl} + 244$ and $m_{OH} = - 785\ X^2_{NaCl} – 380\ X_{NaCl} + 244$, where m_{OH} represent OH-contents in fluorapatite in ppm, and $X_{KCl} = n_{KCl} / (n_{KCl} + n_{H2O})$, $X_{NaCl} = n_{NaCl} / (n_{NaCl} + n_{H2O})$ where n is moles.

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