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THE EFFECT OF CHLORINE INCORPORATION ON THE THERMAL STABILITY OF POTASSIC-HASTINGSITE

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Experimental research on calcium amphiboles has been done at Binghamton University in recent years exploring crystal chemical controls on Cl acceptance into hastingsitic amphiboles. To best demonstrate the effect of Cl content on thermal stability, the Cl content of the synthesized amphibole should be maximized and compared to its hydroxyl counterpart. Cl content has been demonstrated to increase with both Fe^{2+} and K content making K- hastingsite ($K\,Ca_2\,(Fe_4^{2+}, Fe^{3+})\,Al_2\,Si_6\,O_{22}\,(OH, Cl)_2$) an ideal candidate for research.

Amphiboles and their corresponding high temperature breakdown products were synthesized from reagent grade materials. The fO_2 was constrained to lie near Ni-NiO. Thermal stability was determined by conducting reversal experiments which treat the reversal mixtures at elevated P and T. The run products were analyzed using XRD and the patterns refined using GSAS to determine the wt.% of each phase present.

The anhydrous treatment of potassic-chloro-hastingsite (PCH) bulk composition produced an amphibole with a mean composition of $(K_{0.74}\,Ca_{0.08})\,(Ca_{1.78}\,Fe_{0.21}^{2+})\,(Fe_{3.51}^{2+}Fe_{0.93}^{3+}Al_{0.57})\,Al_{1.58}\,Si_{6.42}\,O_{22}\,(O_{0.4}\,Cl_{1.19})$. Elemental compositions were determined using EMP and calculated setting O+Cl+OH=24 and fixing $Fe^{3+}/Fe_{total} = 0.20$. The breakdown reaction was calculated to be 1.0 PCH ↔ 1.12 Cpx + 1.04 An + 1.55 Fay + 0.53 Qtz + 0.70 KCl + 0.25 $FeCl_2$. The upper thermal stability was determined to be 773°C ± 10 at 0.3 GPa, 735°C ± 8 at 0.2 GPa, and 730°C ± 7 at 0.1 GPa.

The potassic-hydroxyl-hastingsite (PHH) bulk composition produced an amphibole with a mean composition of $(K_{0.91}\,Ca_{0.05})\,(Ca_{1.88}\,Fe_{0.12}^{2+})\,(Fe_{3.46}^{2+}Fe_{0.90}^{3+}Al_{0.64})\,Al_{1.97}\,Si_{6.03}\,O_{22}\,(O_{0.3}\,(OH)_{1.42})$. The breakdown reaction of PHH was calculated to be 1.0 PHH ↔ 0.60 Cpx + 0.87 Sanidine + 1.27 Mt + 0.31 Gt + 0.60 An. The upper thermal stability was determined to be 845°C ± 8 at 0.3 GPa, 845°C ± 8 at 0.2 GPa, and 670°C ± 13 at 0.1 GPa. These results show that at deeper (> 0.13 GPa) geological settings PHH has a greater thermal stability than PCH and would form first during hydrothermal metamorphism or possibly from a cooling magma. Cl enrichment at these pressures occurs as the geologic complex cools anhydrously. Cl enrichment would also be possible during progressive (dry) metamorphism at pressures < 0.13 GPa where the thermal stability of PCH surpasses PHH.

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D29. Petrology, Metamorphic (Posters)
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