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Piston-cylinder experiments on H_2O undersaturated Fe-bearing systems: An experimental setup approaching f_{O_2} conditions of natural calc-alkaline magmas

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ABSTRACT

In this study, we present a modified double-capsule technique to perform experiments on H_2O undersaturated, Fe-bearing systems at elevated pressures and temperatures and oxygen fugacities (f_{O_2}) relevant for natural calc-alkaline magmas. Welded shut, Fe-preconditioned $Au_{90}Pd_{10}$ capsules were placed in an outer Pt capsule that contains the same starting material. Experiments were performed at 1.0 GPa and 1200 °C using a synthetic, hydrous basalt and run with either boron nitride (BN) or MgO surrounding the welded capsules. Optimum results were obtained by using Fe-preconditioned $Au_{90}Pd_{10}$ inner capsules in combination with MgO assemblies. The application of the modified double-capsule technique with Fe-preconditioned inner AuPd capsules reduced Fe loss to less than 3% relative, conserved H_2O within the error of ion-microprobe analyses, and kept the f_{O_2} (QFM+1.1) within 1 log unit of the initial value constrained by the Fe_2O_3/FeO ratio of the starting material (QFM+0.43). These conditions are similar to estimates of f_{O_2} during the crystallization of natural calc-alkaline magmas.