American Mineralogist, Volume 85, pages 1342–1348, 2000

Viscosities of granitic (*sensu lato*) melts: Influence of the anorthite component

D.B. DINGWELL,* K.-U. HESS, AND C. ROMANO

Bayerisches Geoinstitut, Universität Bayreuth, D-95440 Bayreuth, Germany

ABSTRACT

The viscosities of a series of granitic (*sensu lato*) melts have been determined in the range of 10^3 to 10^{12} Pa·s. The anhydrous melt compositions are based on the addition of 10, 20, 50, and 75 wt% of the anorthite component ($CaAl_2Si_2O_8$) to a haplogranitic melt (HPG8) whose composition lies near the 2 kbar water-saturated minimum melt composition in the system $NaAlSi_3O_8$-$KAlSi_3O_8$-SiO_2. Melts with 10 and 20 wt% normative anorthite were subjected to high-pressure hydration syntheses using a piston-cylinder apparatus to generate water contents up to 2 wt%. Viscosities were determined for the anhydrous melts using the concentric cylinder method in the viscosity range of 10^2 to 10^5 Pa·s, and for both anhydrous and hydrated melts in the range of 10^9 to 10^{12} Pa·s.

The results for the temperature dependence of viscosity in the anhydrous system indicate that the influence on melt viscosity, caused by the addition of normative anorthite to the haplogranitic melt composition, is strongly temperature-dependent. Viscosity-temperature relationships of the melts become much more non-Arrhenian with addition of normative anorthite. The addition of water to melts with 10 and 20 wt% normative anorthite results in strong nonlinear decreases in viscosity. In the high viscosity range, the results for hydrous melts with 10% normative anorthite are adequately reproduced using the calcalkaline melt viscosity model of Hess and Dingwell (1996), whereas those for hydrous melts with 20 wt% normative anorthite are higher than the model predictions by amounts that depend on the water content. It appears that, at the higher temperatures anticipated for intermediate granitic magmatism, the calcalkaline model can adequately deal with up to 15 wt% normative anorthite in the melt composition in the range of temperatures relevant for intermediate magmas in nature.