PUBLIC ABSTRACT
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Title: The Viscosity of Dacitic Liquids Measured at Conditions Relevant to Explosive Arc Volcanism: Determining the Influence of Temperature, Silicate Composition, and Dissolved Volatile Content

Viscosity is a major control on magma transport, differentiation, and eruptive style. Silicate liquid viscosity varies by orders of magnitude as a function of temperature, composition and dissolved volatiles. There is no predictive model for the viscosity of hydrous dacitic liquids, and these compositions play an important role in explosive volcanism. This study investigated the effects of variable bulk composition and water content on anhydrous and hydrous dacites.

Ten iron-free dacitic glasses were synthesized, with varying degrees of silicate polymerization. Five hydrous samples were made for two of the different anhydrous base compositions, with water contents varying from nominally anhydrous to about 5 wt.%. The viscosity of all samples was measured using parallel plate viscometry in the glass transition range (10^{9} to $10^{12.5}$ Pa.s). Anhydrous samples were measured by concentric cylinder viscometry at super-liquidus temperatures ($10^{1.2}$ to 10^{5} Pa.s). TVF equations, of the form $\log \eta = A + B/(T-C)$, allow liquid viscosities at magmatic temperatures and water contents to be estimated.

At 1100 K, the viscosity of anhydrous dacitic liquids decreases from 10^{10} to 10^{9} Pa.s with decreasing melt polymerization. At 1100K, liquids containing 1 and 5 wt.% dissolved water are about 5 and 7 orders of magnitude less viscous than anhydrous liquids, respectively. The results demonstrate that varying polymerization state of the liquids affects viscosity to a much lesser degree than water content and temperature. At magmatic temperatures of 1100K and water contents greater than 0.5 wt.%, dacite liquids are less viscous than either rhyolites or andesites.