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In situ bubble vesiculation in silicic magmas

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Abstract

Volatile degassing is a major process driving volcanic eruptions. Therefore, a full understanding of mechanisms ranging from bubble nucleation, growth, coalescence, to magma fragmentation is required. We have simulated magma degassing during ascent in the volcanic conduit by depressurizing hydrated haplogranite melts in high-pressure and high-temperature optical cells (a hydrothermal diamond-anvil cell and an internally heated pressure vessel fitted with sapphire windows). This allowed the whole process of bubble nucleation, growth, and coalescence to be directly observed in situ through images captured from the recording videos. Bubble nucleation pressures, number densities, growth laws, and characteristics of coalescence were estimated as a function of melt water content, decompression rate, and temperature. Melt/vapor surface tension during bubble nucleation and coalescence was calculated. Our data show good agreement with those previously obtained in classical vessels. Methodological improvements are proposed for the experimental simulation of magma degassing in volcanic conduits.

Keywords: Bubble vesiculation, rhyolite, high *P*-*T* experimentation