Abstract

Effect of rigid crystals on the experimental sintering of rhyolitic ash under shallow conduit conditions

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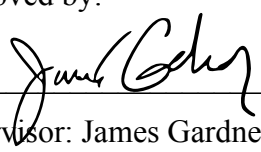
Outgassing mechanisms at shallow levels in the Earth's crust are critical to understanding the eruptive activity of silicic volcanoes. Viscous sintering and densification are important because they influence the emplacement of volcanic products through their effect on particle coherency, mechanical strength, and permeability. To understand how viscous sintering is affected by the presence of rigid inclusions, we investigate surface tension-driven sintering and associated densification of crystal-bearing rhyolitic ash under shallow volcanic conduit conditions. Suites of isobaric (40 MPa) experiments with a 50/50 mixture of rhyolitic glass powder and quartz crystals were held at a constant temperature of 675 to 850 °C for durations of 30 minutes to 9 hours. All samples evolved similarly, from loose, cohesion-less particles to sintered particles forming a friable, agglutinated framework with an interconnected network of pores of ≥20 vol.%. Samples sintered more quickly at higher temperatures and with coarser crystals. Estimates for permeability indicate that these crystal-rich mixtures are as permeable as natural vesiculated samples of equivalent porosity. Our experimental results suggest that solid particles retards sintering while holding porous networks open, allowing for sustained degassing. Therefore, solid particles may have important consequences for outgassing in the shallow conduit if the material is sintered together.

Approved by:



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