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The impact of a pre-existing gas phase on the degassing of magma during explosive eruptions.

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Evidence is accumulating that magmas are usually saturated with gas at depth before they erupt, including the observations that too much gas is emitted for the volume of magma erupted and that volatile contents in melt inclusions often follow open-system degassing trends. Such gas is most likely to occur, at least in more viscous magmas, as small bubbles dispersed throughout the magma, meaning that even before it erupts a magma is already a bubbly liquid. Whether such a distribution of bubbles exists could have profound impacts on how magma degasses during its ascent to the surface. One of the most important roles that such pre-existing bubbles could play is to allow silicate melt to degas. Having a population of bubbles already present allows magma to lose volatiles, especially water, as it decompresses, and hence magma viscosity can increase, leading to an accelerating velocity during ascent. Such degassing will also profoundly influence whether more bubbles can nucleate during ascent. If, for example, explosive eruptions are driven by homogeneous nucleation of bubbles during ascent, then magmas that contain pre-existing bubbles may need to rise faster to allow the melt to become super-saturated enough to trigger bubble nucleation. How much faster must they rise, and at what depths would nucleation be triggered? Another impact that pre-existing bubbles could have is how those bubbles change bubble growth and coalescence. Depending on their sizes and numbers, some bubbles could impede growth of others, but they could also allow chains of bubbles to coalesce to allow magmas to become permeable. Once permeable, magmas could lose their gas to their surroundings, which can control whether the ascending magma erupts explosively or effuses passively. This study, therefore, seeks to place constraints on some of

the likely impacts that pre-existing bubbles have on influencing volcanic eruptions. We will present experimental results examining the degassing behavior of viscous silicate melts that contain a pre-described bubble population during decompression at variable rates, and compare them to similar results for degassing of melts that lacked such pre-existing bubbles. An important goal is to discern which experimental conditions lead to bubble populations that most closely mimic vesicle populations in volcanic pumice, the only physical recorders of magma degassing during explosive eruptions.