

Demonstrations to consider the importance of viscosity, bubbles and phenocrysts for volcanic eruption

Atsuko Namiki[1]

[1] UC Berkeley

<http://seismo.berkeley.edu/~namiki/>

Volcanic eruption is recognized as that melted magma erupts on the surface of the Earth. The viscosity of magma has variety so that eruption styles vary. The reason why magma can erupt, in spite of that magma usually has larger density than that of the crustal materials, is that magma evolves bubbles: i.e., existence of bubbles in magma is the one of the driving force of the volcanic eruption. The magma sometimes includes phenocrysts which might provide nucleation sites of bubbles and could increase the viscosity of magma. In this study, I introduce straightforward demonstrations to consider the basic physics of eruption, which are 1) an experiment to feel the difference of viscosity, 2) a series of vesiculating experiments in fluids with various viscosity, 3) vesiculating experiments with and without phenocrysts. As a viscous fluid, I use corn syrup. To make bubbles, I use baking soda (NaHCO_3) and citric acid. Reaction between them generates carbon dioxide (CO_2) to make bubbles. As phenocrysts, I use plastic particles. All of these materials used in these experiments are accessible easily. So these experiments can be provided in a classroom as a demonstration. In these experiments, however, the lifetime of each bubble depends on the gas diffusion from the inside bubbles to the atmosphere through the bubble films. This would not be an important process on real volcanic situation. We thus have to be careful to make a quantitative scaling law applicable to the vesiculation in real magma from these experiments.