



A table-top experiment on magma transport system: intermittent flow behavior in non-Newtonian fluids

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Our research group is developing table-top experiments named “Kitchen Earth Science”, which aims at understanding a natural phenomenon in Earth and planetary sciences by analogue experiments using goods and tools in our daily life. Analogue experiments have a function to unveil the fundamental physics governing the phenomenon. At the same time, they essentially include uncertainties so that unexpected results are frequently obtained, which have a potential for surprising discoveries. These findings also provide a good opportunity for deeply thinking and raise new questions to explore. Such experience is precious not only for young researchers in Earth and planetary sciences, but also non-expert people who need a scientific thinking to live wisely.

In this presentation, we will show an example of “Kitchen Earth Science” experiment using an acrylic tank filled with transparent hydrogel beads as an analogue of magma transport system. We introduced a buoyant sphere(s), air bubble(s), and a fluid droplet in the gel beads layer and observed stick-slip like motion of the sphere, the flow localization due to hysteresis, and time-dependent flow behavior, which give insight into the magma transport system. Our results indicate that the intermittent nature of the volcanic activity is inherent to magma transport in a partially molten zone, which explains the spatio-temporal patterns of volcanic activity.

This simple analog experiment costs only 100 Euro and is suitable for scientific education such as introductory educational experiments for Earth and planetary sciences in elementary and junior/high schools, general science education and interdisciplinary researches in post-high schools, and new approaches to citizen science and outreach.