

Initiation and improvement of urethane volcanic eruption experiment

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1.Introduction

A volcanic eruption experiment was devised using two-component urethane foam. Since then, the method has been improved for four years. Here we introduce the details of the principle and method, and introduce the points of experiments in classrooms and outdoors. This experiment is. This is an experiment that clearly shows that a volcanic eruption is caused by magma foaming.

2.Eruption mechanism

Magma contains volatile components (volcanic gases such as H₂O and CO₂). When magma is deep underground, it melts due to high temperature and high pressure, but when it starts to rise, it evaporates into bubbles due to decompression and expands further as it rises. As the size of the bubbles increases, the apparent density decreases, increases at an accelerated rate, and eventually erupts from the crater. This is how a volcano erupts. Therefore, the solidified lava often contains many bubbles. Volcanic eruptions are dangerous and difficult to explode, as they are often exploded when released from the crater into the atmosphere. In addition, crustal deformation such as uplift also occurs with the expansion of the magma, but it was difficult to reproduce the situation by analog model experiments. It was also difficult to understand that bubble growth was the main cause of the eruption.

3. Rigid urethane foam

Urethane foam is widely used as insulation for wooden houses and as a cavity filler. In particular, the two-component hard urethane foam solidifies in about 5 minutes after mixing the two components, during which the volume expands about 50 times. It is a stable building material that does not change over the long term. The hand mixing method is a method adopted in the JIS standard, in which the same amount of two kinds of foaming stock solutions is charged into a container and stirred to foam. This time, by using a container with a narrow mouth with irregularities on the wall as a container, we succeeded in efficiently foaming and easily ejecting a stable bubble flow. In addition, they discovered that the urethane that erupted simply dropped in the air, but could rise by buoyancy in the powder, and devised a series of analog model experiments.

4.experiment

First, it is expanded in a normal beer cup, impressing the high expansion rate. Next, the same amount of urethane is foamed in a single vase, and if the cross-sectional area of the outlet is reduced to one tenth, the speed will be increased by a factor of ten. Next, after showing the situation of simply hanging down in the air, the powder is foamed at the bottom of each powder put in the bucket. If the surroundings are styrene beads, a spherical foam appears around the outlet. In the meantime, in cat sand where the apparent density is larger than urethane, urethane rises and forms a lava dome on the surface. Just before that, crustal deformation can be observed. Explosive eruptions can be easily reproduced using corks.

5. Finally

The experiment was also shown at the Open University of Tokyo Earthquake Research Institute 2017. Since then, conducting classes and teacher training at Shizuoka University, Tokyo University of Science, and Fujisan Lab.

Reference site (manual)

<http://uretan-eruption.blogspot.com/2017/10/1.html>

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