

Imaging the internal density structure of the lava dome in Unzen, Japan

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The latest lava dome in Mt. Unzen was formed in the eruption from January 1991 to early 1995 and the eruption activity was calmed down in 1995. The researchers kept to observe the eruption in this period precisely. Some of them proposed the growth model, another person proposed different model from their data (Nakada et al., 1995 and Ohta, 1996). It is significant for the growth model and the landslide prediction to investigate the density structure in the lava dome.

Cosmic-ray muon radiography is a new method that can be used to study the internal density structure of volcanoes. The original idea is very old. Many researchers tried to find something hidden in various structures. Unfortunately they couldn't find anything new at that time. Meanwhile the muon detection technology has been highly developed till today. The first successful work was done by Tanaka et al succeeded to observe the conduit in an active volcano, Mt. Asama (2007). They also succeeded to observe the root structure in lava dome in Showa-shinzan (2007). The second impressive work was the observation of the degassing magma in the conduit in Mt. Satsuma-Iwojima (2008). Mt. Satsuma-Iwojima is an active volcano and always emitting the volcanic gas. The result is compatible to the magma convection model by H. Shinohara.

The observation of the Unzen lava dome density 2D map was performed by using cosmic-ray muon and muon detector in Unzen. The muon detector, nuclear emulsion films which has high angular resolution (5mrad) and 1.0m² effective areas, was installed in a natural cave from early December 2010 to the end of March. The developed nuclear emulsion films have been scanned by automated muon readout system. The systematic analysis to detect the number of the penetrating muons and their direction were done by taking a pattern match and making a connection of muon tracks between several films. The systematic error of the muon detection efficiency and random noise ratio were estimated carefully. After removing unwanted low energy electron tracks, the density map of Unzen lava dome appeared. The performance of the detector and the result of radiography will be shown in this topic.