

SVC047-16

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発泡したマグマの流動・変形その場観察 In-situ observation of flowing magma at high temperature and pressure

奥村 聡¹, 中村 美千彦^{1*}, 上杉健太郎², 中野司³, 土山 明⁴

Satoshi Okumura¹, Michihiko Nakamura^{1*}, Kentaro Uesugi², Tsukasa Nakano³, Akira Tsuchiyama⁴

¹ 東北大学地学専攻地球惑星物質科学講座, ² 高輝度光科学研究センター, ³ 産業技術研究所, ⁴ 大阪大学宇宙地球科学専攻
¹Dept. Earth Science, Tohoku Univ., ²SPring-8/JASRI, ³AIST/GSJ, ⁴Dept. Earth Space Science, Osaka Univ.

The vesiculation and degassing of magma ascending in volcanic conduits control the explosivity and style of volcanic eruptions. To understand these processes, the vesiculation and degassing processes have been simulated by performing decompression and deformation experiments. Previous experiments were carried out using a quench technique in which magma was decompressed and deformed at high temperature and pressure, then cooled to room temperature and atmospheric condition to analyze run products. The quench experiments provided important information for processes whose timescale is relatively long. However, some processes cannot be observed directly. For example, it is difficult to observe brittle fracturing during magma deformation by the quench experiments, which seems to occur during short period and induce efficient degassing through the fractures. In addition, a sequential process of magma vesiculation, degassing, and compaction has not been observed experimentally, although it has been thought to be an origin of effusive eruptions.

In this study, we originally made a deformation apparatus to simulate decompression and shear deformation of magma. This apparatus can be combined with synchrotron radiation X-ray radiography and computed tomography of SPring-8 in Japan. In the apparatus, a sample is placed in a graphite cylinder and sandwiched between two pistons. An upper piston can be rotated by a rotating motor. The sample and graphite cylinder are externally heated using cartridge heaters. A small hole (ca. 10 mm in diameter) is created in the path of X-ray in the apparatus, except for the graphite cylinder which is X-ray-transmissive. To obtain three dimensional image (CT image), the sample is rotated on a theta stage and transmission images are taken from all direction. The approximately 10 degree images cannot be taken in this system because the deformation apparatus has two load frames which support internal pressure in the cell. Thus, the 10 degree images have to be obtained by interpolation. As a preliminary experiment, we performed a torsional deformation experiment at a temperature of ca. 1000 degrees C for vesicular rhyolite. The vesiculation and shear deformation of rhyolite was successfully observed using the X-ray radiography. In future studies, we will perform in-situ observation of shear fracturing and degassing-compaction processes of magma.

キーワード: マグマ, その場観察, 流動変形, 発泡

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