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高温溶岩と水の接触で形成される地形の多様性
Variety of morphologies which are formed by molten lava-water interaction

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There exists 2 types of responses when molten lava interacts with water environment: explosive and non-explosive. However, during eruption, it is difficult to make a judgment on whether explosion occurs or not. For example, in Nornahraun, Iceland, lava flowed into a river, but no explosion occurs to this day. This is a same as Nishinoshima Island. However, previous studies presented explosions which relate with lava-water interaction occurred in many places including Japan in the past [e.g. Mattox and Mangan, 1997; Ito and Taniguchi, 1996]. Its disaster risk has not been recognized; its explosivity would reach the degree of maar (magma-water interaction), and it is possible to generates low-concentration pyroclastic density current [Fagents and Thordarson, 2007]. Thus, it is important to understand this explosion mechanism for us Japan because of not only interesting of volcanic explosion but also prevention and reduction of disaster when lava flow into water environments near distinct of residence.

Today, it is known that there exists 3 types of morphometry which relates to lava-water interaction: rootless cones, spiracles, and lava pillars.

Lava-water explosive interaction have been well-known in basaltic volcanism, but previous studies showed it occurred in andesitic and rhyolitic [e.g. Hayakawa and Yui, 1989; Ito and Taniguchi, 1996]. Although their related-morphology has been studied, there remains problems to understand this phenomenon. Rootless cone (aka secondary crater and pseudocrater) is a typical morphology which is formed by lava-water interaction. They have a variety of shape; Hamilton et al., 2010 showed 3 archetypes of them which relates to flowing types of lava (tube-, channel-, and broad sheet lobe-fed). However, the relationship between their morphometry and formation conditions (e.g. explosivity, water/magma mass ratio, underlying sediments) has not been revealed. This is a problem for not only rootless cones but also other pyroclastic cones (e.g. scoria cone, maar, tuff cone). Rootless cones would be useful also in planetary science. Recent studies have found candidates of rootless cone on Mars [e.g. Greeley and Fagents, 2001]. These morphologies are expected to reveal recent 100Ma Martian magmatism. Thus this study could give great influence for planetary science. It is necessary to understand the variety of morphology and distribution of rootless cones to know the style of magmatism and environment.

Spiracles are found in bottom of lava flows as irregular shaped-vesicles which are formed by lava-water explosion. In Japan, cylindrical vesicles in Aokigahara lava flow was considered as typical spiracles for many years. Now its are considered as tree molds which were vertically-elongated by inflation of lava, and we lost an image of spiracle. Therefore we should reconstruct the image once again.

Lava pillars are considered as results of non-explosive lava-water interaction [e.g. Gregg et al., 2002]. They show chimney-like morphology, and has been found both in subaerial and submarine volcanism. Recently, Gregg et al., 2002; Gregg and Chirstle, 2013 showed that lava pillars were formed by water vaporization or hydrothermal activity at gaps of pahoehoe lava lobes. However, there exists lava pillars which were formed by a'a lava flow. Hence it remains problems for the lava pillar formation and non-explosive lava-water interaction.

In this presentation, we will review previous studies about morphologies which relate with lava-water interaction, and marshal problems to 1) understand volcanic explosion, 2) know its disaster risks, and 3) apply to planetary science. Especially focusing on rootless cone, we will discuss its variety of shapes based on our aerial photo analysis and field survey. Additionally, a new type of lava-water interaction-related morphology which we found both in Iceland (called as hraunbollar) and Hawaii will be introduced.

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