

The study on the secondary phreatic eruptions in the pyroclastic deposits of Mt. St. Helens 1980 eruption

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Purpose

It is not rare that lava, pyroclastic flow, etc. produced by volcanic activity contact with surface water, and cause secondary explosion. Japan has many volcanic islands and some volcano also has a lake in near like Usu volcano. These have high possibility that the ejecta will contact surface water and tends to be accompanied by the disaster. Therefore, it is useful to study the explosion phenomenon by contact of this high temperature fluid and surface water because of disaster mitigation. However, there are little studies that are touching even the mechanism of explosion. Therefore, this study focuses on the explosion phenomenon after debris avalanche and pyroclastic flow generated in the 1980 eruption of Mt. St. Helens volcano, and aims at construction of the model of explosion.

Mt. St. Helens 1980 eruption

The eruption of Mt. St. Helens volcano on May 18, 1980 started first in jet of the blast accompanying collapse of a volcanic edifice and shifted to the eruption of plinian eruption and also generated the pyroclastic flow. The debris avalanche produced by collapse of a volcanic edifice flew into the North fork Turtle river and Spirit lake in the north of Mt. St. Helens and the pyroclastic flow covered and deposited (Shimozuru 1981 etc.). After deposition, phreatic explosions occurred on the debris avalanche and the pyroclastic flow deposit and left many craters. These phenomena were reported to Shimozuru (1981), Rowley et. al. (1981), and Moyer & Swanson (1987). Especially, Moyer & Swanson summarized the feature about deposits produced by the explosion on the pyroclastic flow deposit. As for the mechanism of explosion, since crater density was large around a lake, or the old river valley, they guessed that the debris avalanche and the pyroclastic flow contacted surface water such as a lake and a river and it was the generation source of the steam for explosion. And also guessed that the scale of explosion changed by the permeable difference in a pyroclastic flow deposit. However, the facts from observation or field investigation indicating them are not shown except for the position of a crater. Moreover, the explosion produced on the debris avalanche is not considered.

Field investigation

Therefore, in this study, field investigation was conducted in the deposit of secondary explosion on the debris avalanche and pyroclastic flow deposits in Mt. St. Helens volcano to confirm the idea of Moyer & Swanson and presume the more clear mechanism of explosion.

By analyzing the aerial photograph, at least nine craters produced by secondary explosion have been checked on the debris avalanche deposit. They are almost circular, and the diameter is from about 10 m to about 100 m and some craters are overlapped. As a result of investigating, it turned out that in common there is a characteristic layer that consists of the rock whose surface colored the orange. This layer can be recognized in craters which diameter is more than 30m. Since discoloration of an orange is only the surface, it is considered that alteration by hot water etc. was received comparatively for a short time. Therefore, after the eruption, surface discoloration may have been formed by the contact between hot debris avalanche and river water and this contact may cause the secondary explosion. However, it's not sure because it cannot be denied that the discoloration may have been made inside the volcanic body before May 18 eruption.

About the crater formed on the pyroclastic flow deposit, although the many craters were collapsed and buried by erosion of a river, there are some craters that remained their shape. And some were destroyed partially and the inside of a crater has exposed. Thanks to the observation inside the crater destroyed partially, it seemed that volcanic vent made by secondary eruption narrowed thinly in the shallow place. Therefore, it is considered that explosion would occur in the comparatively shallow place.