Degree of Risk of the Occurrence of Debris Flow Resulting from Phreatic or Phreatomagmatic Eruption

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1. Introduction

In the event of a volcanic eruption, the national government shall carry out an urgent survey based on the law concerning the promotion of countermeasures for preventing sediment disasters in sediment disaster caution zones to notify local governments and citizens of when and where a sediment disaster may possibly occur as emergency sediment disaster information and disseminate it in advance. In order to release emergency sediment disaster information with any accuracy, it is necessary to appropriately determine whether an environmental field where debris flow due to volcanic eruption tends to occur is formed or not. Therefore, the Sabo Risk Management Division focused on phreatic and phreatomagmatic eruptions that occur more frequently than magma eruptions, systematically investigated the processes that led to the occurrence of debris flow due to volcanic eruption in the past, and verified in comparison with the progress of the eruption of Mt. Naka of Mt. Aso, which occurred recently, and the property of volcanic ash.

2. Findings from Literature Research

As a result of re-examining previous literature about phreatic and phreatomagmatic eruptions in Japan since the dawn of history, 49 volcanos out of 110 active volcanos had records of phreatic or phreatomagmatic eruptions, and there were 60 records of debris flows. The cause of debris flows could be identified for 36 out of 60 cases, the most common cause was rainfall, followed by eructation from volcanic vents. As a result of investigating the conditions where debris flows occurred, it was found that a debris flow tends to occur (1) if the eruption style made a transition to a phreatic or phreatomagmatic eruption, (2) if the number of craters increased, (3) after the occurrence of a pyroclastic flow, and (4) if the ash fall area changed because a large amount of fine-grained volcanic ash deposits at the headwaters of the basin. In addition, there is a risk of the occurrence of debris flows (5) if there is a crater lake in the cone and (6) if sediment fills the valley at the headwaters to cause a dam-up (obstruction of flow passage). Therefore, these cases also need to be considered as the time to release emergency sediment disaster information.

3. Findings from a Field Investigation (example of Mt. Naka of Mt. Aso)

At Mt. Naka of Mt. Aso, a magma eruption started to occur in 2014, its eruption style made a transition to phreatomagmatic or phreatic eruption in September 2015, small eruptions occurred continuously from September to October 2015, and fine-grained volcanic ash deposited at the headwaters.

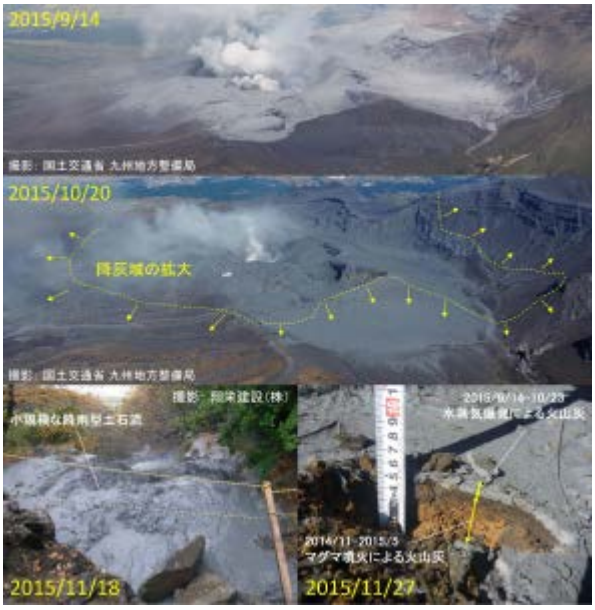

Figure Situation around the volcanic vent of Mt. Naka of Mt. Aso from September to November 2015

In November 2015, a small-scale rainfall-type debris flow occurred in a mountain stream flowing near the volcanic vent due to rainfall of up to approximately 20 mm/h. As a result of analyzing the volcanic ash collected during the field investigation carried out after the eruption, it was found that this ash was characterized by a high clay content of approximately 20% to 40% and the risk of the occurrence of liquid mud increased when fine-grained volcanic ash with a high clay content deposited intensively around the volcanic vent.

4. Conclusion

We are planning to perform closer investigations into the respective eruptions to study the indicators to measure the tendency of the occurrence of debris flows when releasing emergency sediment disaster information.

☞For details refer to the following:

1) Masayuki Sakagami, Yu Kunitomo (At press) Volcanic mud flow related to phreatic or phreatomagmatic eruption occurred since the dawn of history. *Journal of the Geological Society of Japan*