Gological history of Sinabung volcano

Sinabung is a stratovolcano which has grown after the super eruption of 74 thousand years ago at the Toba Caldera. The volcano summit is about 2,460 m in altitude and stands about 1,200 m above the ignimbrite plateau formed by the Toba eruption. There is no record of historical eruptions, and the last magmatic eruption before 2010 occurred during 9 to 10^{th} century, whose products are mainly pyroclastic-flow deposits, distributed in the SE slope (Iguchi et al., 2012). The present eruption which began in September 2013 is close to the sequence of the 9 to 10^{th} Century eruption.

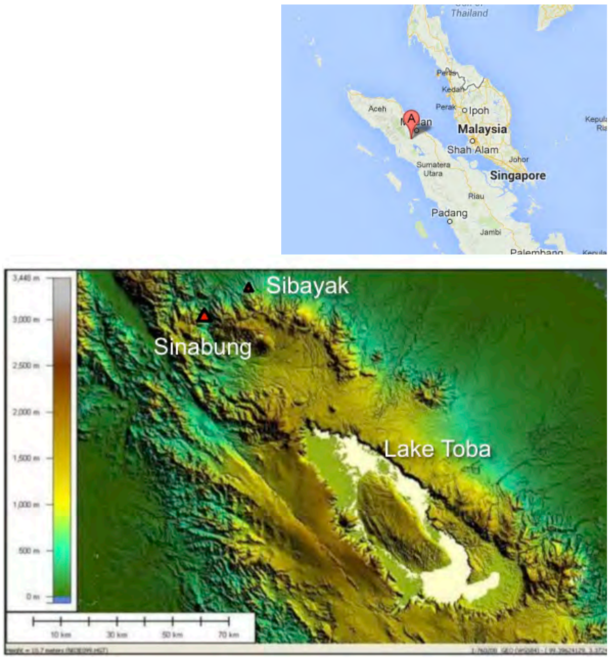

Fig. 1. Index map of Sinabung volcano, Northern Sumatra, Indonesia.

Basement rocks are exposed in the middle NW slope of the volcano. Older edifice is distributed in the western part, while young edifice occupies in the center and eastern parts (Iguchi et al., 2012). Those edifices consist mainly of lava flows/domes and pyroclastic-flow and debris-flow deposits. No pumice fall deposits were recognized in the edifices, suggesting that Sinabung had repeated less explosive eruptions through its history. Although several lava flows descended down to the lower slopes, relatively thick lava flows pile up on the upper slopes; where collapsed-type pyroclastic flow (block-and-ash flow) deposits are extensively distributed down to volcano foots below those lava flows. A small-scale debris avalanche deposit is distributed in the NE foot. The 9 to 10^{th} Century pyroclastic flow deposit is widely distributed in the SE slope below the lava flows extended about 1.5 km from the summit. The travel distance of the pyroclastic flows is about 4.5 km from the summit.

Rocks of Sinabung are basaltic andesite to andesite in composition (Fig. 2), and andesitic lavas contain hornblende phenocrysts. Old-stage lava is more enriched in K2O than the younger-stage lava (Iguchi et al., 2012).

Event-tree showing possible eruptive events in future for Sinabung volcano is shown in Fig. 4 (Yoshimoto et al., 2013). The present eruption that began in September 2013 follows the scenario of the highest probability.

This research began as a part of the SATREPS research project (Multi-disciplinary Hazard Reduction from Earthquakes and Volcanoes in Indonesia), and has continued presently in cooperation with Kyoto and Hokkaido Universities and the Indonesian Center for Volcanology and Geological Hazard Mitigation (CVGHM).

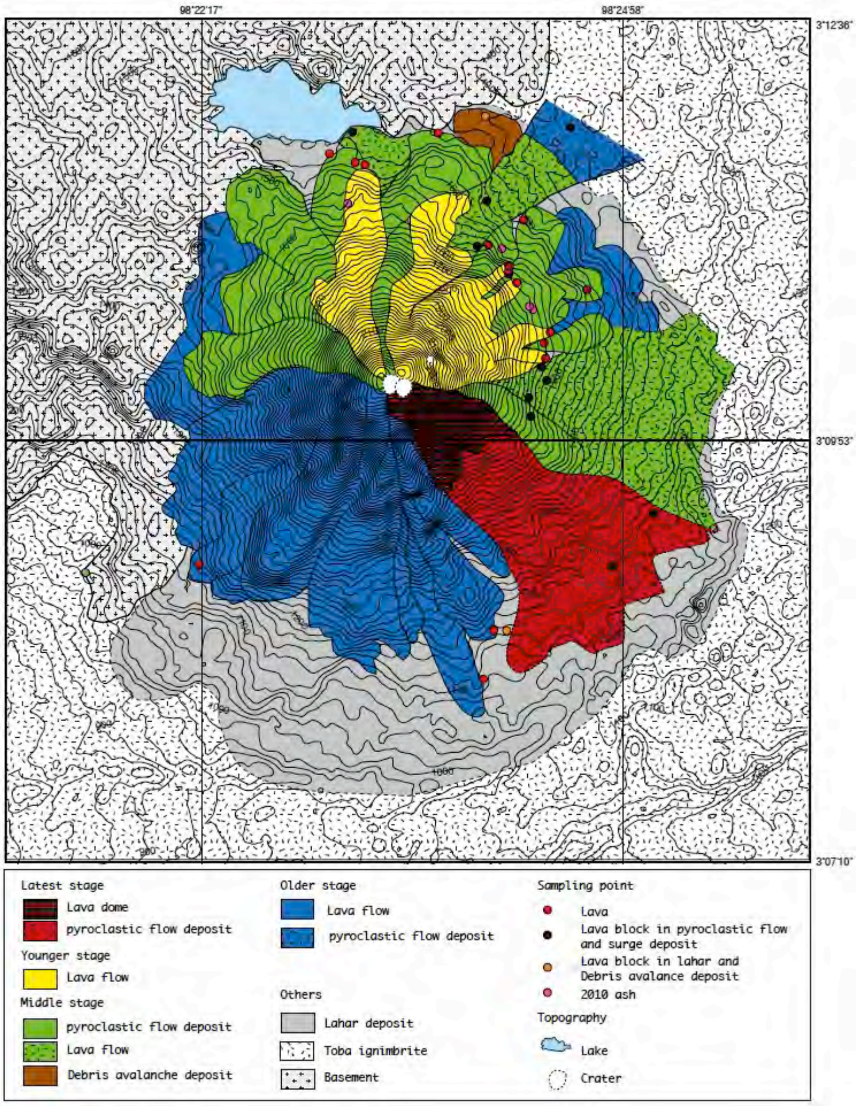

Fig. 2. Geologic map of Sinabung volcano (Iguchi et al., 2012).

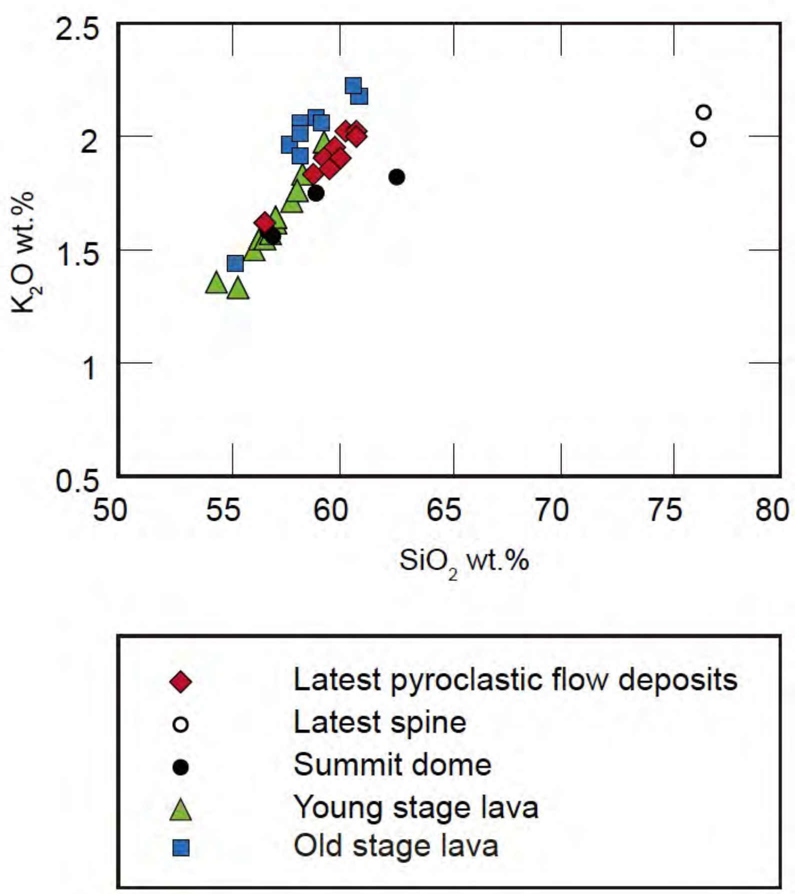

Fig. 3. SiO2-K2O variation diagram for Sinabung volcano (Iguchi et al., 2012). Latest pyroclastic flow deposits = 9~10th Century eruption. Summit dome and latest spine are strongly altered hydrothermally, such that they potted away from the main chemical trend.

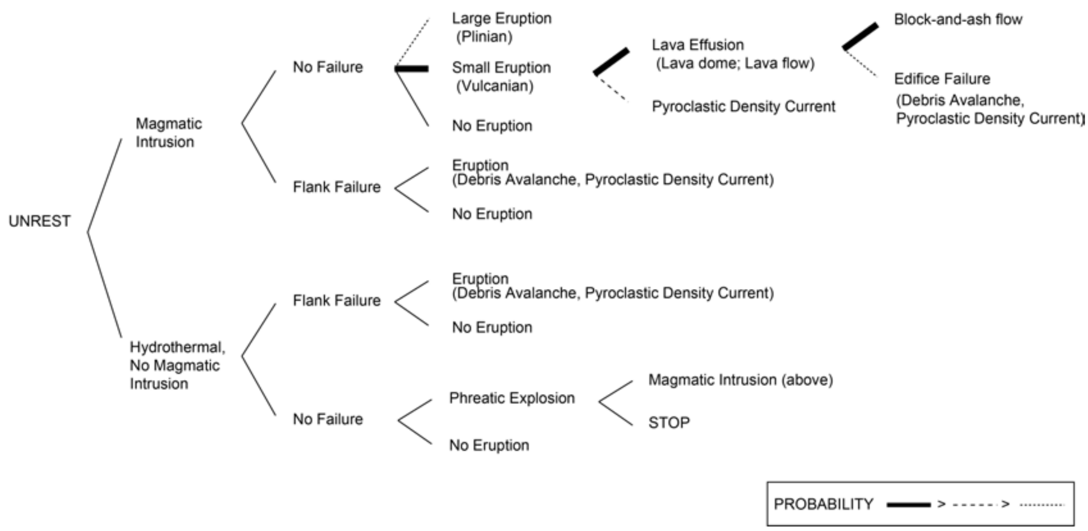

Fig. 4. Event tree of Sinabung volcano prepared in July 2013. The 2013 and 2014 eruption follows the high probability scenario in this diagram. From Yoshimoto et al. (2013).

References

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