

Geological evaluation of frequency and process of caldera-forming eruptions in Sunda arc, Indonesia.

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Two caldera-forming eruptions have occurred in Indonesia in the past 200 years, causing as much as 130 thousand casualties. There are additional three large-scale eruptions in the past 1000 years. Our study aims to determine the temporal and spatial frequency of these large eruptions, and the processes leading to these eruptions.

There are several caldera-forming events in the Sunda arc region between east Java, Bali, and Lombok, within the past 30ky. The post-caldera activities continue as active volcanoes. The young deposits make the region suitable for comparative study of the long-term changes in activities of caldera-forming volcanoes. The knowledge gained from the region would contribute greatly to the long-term hazard assessment of less frequent volcanic activities around the globe. Eruption of this magnitude has not occurred in Japanese arcs in the past 7ky.

However, the volcanic history of this region is not adequately constrained in order to conduct the comparative study. (a) The ages of pre-caldera activities are mostly unknown. (b) The description and stratigraphy of caldera-forming eruptions have not been made except for select events. (c) Pre-historic eruptions of the post-caldera activities have not been described. We have started to survey the deposits and determine their ages. The challenges and the tentative results of our study in Bali and Batur caldera volcano are listed as an example.

(a) Pre-caldera activities.

Volcanic rocks are extensively distributed in Bali, but ages of these activities are mostly unknown. The ages of pre-caldera activities have not been determined as well. The older volcanoes having dissected edifice are found at Batur caldera volcano, Bratan caldera volcano, and Agung volcano. The ages of these activities need to be determined.

(b) Caldera-forming eruptions.

Previous studies have shown that Batur caldera was formed by two large-scale eruptions at 28ka and 20ka. Our study have shown that the development of the caldera is much more complicated. PDC deposits younger than 20ka are distributed extensively and are found at the northern caldera wall and at the plateau to the south of the caldera. There are at least seven plinian tephra deposits in the western part of caldera. The active history of caldera volcanoes in Bali for the past 30ky needs to be clarified through the study of stratigraphical relations between these deposits and the deposits of Bratan caldera as well as Agung volcano.

(c) Post-caldera eruptions.

For the post-caldera cones of Batur volcano, only the ages of lava flow eruptions since 19th century has been known. We have found the older phreato-magmatic deposits containing large amount of charcoal and wood. It is estimated the post-caldera activity has started much older than

historic records, and phreato-magmatic eruptions have occurred repeatedly at the shore of the caldera lake. The long-term history and its variation of the post-caldera activity are important to the hazard assessment of the volcano, and are needed to be determined.

We plan to conduct similar surveys in East Java (Bromo-Tengger caldera volcano) and Lombok (Rinjani caldera volcano). The study on these caldera volcanoes will enable us to compare between caldera-forming eruptions, or between caldera volcano and the region without caldera volcano.

Keywords: Indonesia, Bali, volcano, caldera, stratigraphy, long-term hazard assessment