Pumice-Bearing Pyroclastic Density Current Deposits in the Southeastern Flank of Merapi Volcano: An Evidence for Past Violent Eruption

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Abstract

Merapi is an active volcano in the most populous island of Java, Indonesia. The volcano is the closest to the trench in the middle of a long subduction system called Sunda arc. We report stratigraphy of 6.5 m thick pyroclastic dense current (PDC) deposits outcropped in the south-south east flank of the volcano, nearly 8 km away from the summit. The area where the PDC is outcropped is along the pathway of pumice-rich PDC produced by the November 2010 eruption. Despite the shorter reach, this outcrop indicates that this populated area is still under the constant risk of direct volcanic eruption hazard in the future.

Field observation reveals at least four distinct units of PDC in the study area. The uppermost of these PDC layers is overlain and scoured in some parts by a ~3 m thick lahar deposit. The four PDC layers are further named as layer A, B, C, and D in ascending order. At the bottom, layer A is at least 2.5 m thick and contains oxidized scoriaceous lithic and pumice clasts. Layer B is 1.3 m thick and has abundant pumice clasts with size up to 10 cm. Accumulation of lapilli size clast dominated by dense lithic is observed at the base of layer B. This layer is underlain by a 3 cm thick of fall deposit containing coarse ash to lapilli size clasts. Layer C is ~1 m thick and has abundant pumice clasts (up to 15 cm in diam.). The top of this layer is a 3-5 cm thick of thinly laminated ash layer. Both B and C layers have charred log with diameter up to 20-35 cm. Pumice accumulation is observed at the top of both layers, beneath the thin ash layer. Layer D which is directly overlain by lahar deposit is 1.7 m thick and contains denser lithic (~60 cm) than pumice clasts (~2 cm). Plagioclase, clinopyroxene, and hornblende phenocrysts are present in all samples. Qualitative analysis of the vesicles in the juvenile clast suggests that from bottom to top the bulk vesicularity and bubbles interconnectivity vary. The non-deformed bubble shape suggests a rapid bubble nucleation process in all layers. Furthermore, bubble interconnectivity suggests that bubble-bubble coalescence occurs in all layers but is most intensive in layer C and D. This outcrop displays an evidence that the explosive eruptive event in Merapi is not uncommon and may reoccur in the near future.