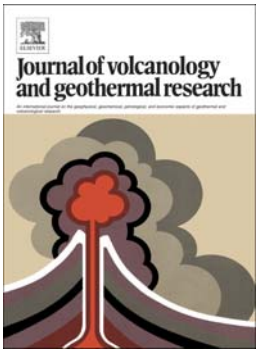

Geophysical image of the hydrothermal system of Merapi volcano

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PII: S0377-0273(16)30220-7
DOI: doi: 10.1016/j.jvolgeores.2016.11.011
Reference: VOLGEO 5964

To appear in: *Journal of Volcanology and Geothermal Research*

Received date: 24 July 2016
Revised date: 16 November 2016
Accepted date: 17 November 2016

Please cite this article as: Byrdina, S., Friedel, S., Vandemeulebrouck, J., Budi-Santoso, A., Suhari, Suryanto, W., Rizal, M.H., Winata, E., Kusdaryanto, Geophysical image of the hydrothermal system of Merapi volcano, *Journal of Volcanology and Geothermal Research* (2016), doi: 10.1016/j.jvolgeores.2016.11.011

Geophysical image of the hydrothermal system of Merapi volcano.

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Abstract

We present an image of the hydrothermal system of Merapi volcano based on results from electrical resistivity tomography (ERT), self-potential, and CO_2 flux mappings.

The ERT models identify two distinct low-resistivity bodies interpreted as two parts of a probably interconnected hydrothermal system: at the base of the south flank and in the summit area. In the summit area, a sharp resistivity contrast at ancient crater rim Pasar-Bubar separates a conductive hydrothermal system (20 - 50 Ωm) from the resistive andesite lava flows and pyroclastic deposits (2 000 - 50 000 Ωm). The existence of preferential fluid circulation along this ancient crater rim is also evidenced by self-potential data. The significative diffuse CO_2 degassing (with a median value of 400 g m^{-2}d^{-1}) is observed in a narrow vicinity of the active crater rim and close to the ancient rim of Pasar-Bubar. The total CO_2 degassing across the accessible summital area with a surface of $1.4 \cdot 10^5$ m^2 is around 20 t d^{-1}. Before the 2010 eruption, Toutain et al. (2009) estimated a higher value of the total diffuse degassing from the summit area (about 200 - 230 t d^{-1}). This drop in the diffuse degassing from the summit area can be related to the decrease in the magmatic activity, to the change of the summit morphology, to the approximations used by Toutain et al. (2009), or, more likely, to a combination of these factors.

On the south flank of Merapi, the resistivity model shows spectacular stratification. While surficial recent andesite lava flows are characterized by resistivity exceeding 100 000 Ωm, resistivity as low as 10 Ωm has been encountered at a depth of 200 m at the base of the south flank and was interpreted as a presence of the hydrothermal system. No evidence of the hydrothermal system