Geophysical Research Abstracts
Vol. 20, EGU2018-9960, 2018
EGU General Assembly 2018

The Plumbing System Feeding the Lusi Eruption Revealed by Ambient Noise Tomography

Mohammad Fallahi (1), Anne Obermann (2), Matteo Lupi (3), Karyono Karyono (1), and Adriano Mazzini (1)

(1) Centre for Earth Evolution and Dynamics (CEED), University of Oslo, Oslo, Norway, (2) ETH, SED, Zürich, Switzerland (anne.obermann@sed.ethz.ch), (3) Department of Earth Sciences, University of Geneva, Geneva, Switzerland

Lusi is a sediment-hosted hydrothermal system featuring clastic-dominated geyser-like eruption behavior in East Java, Indonesia. We use 10 months of ambient seismic noise cross correlations from 30 temporary seismic stations to obtain a 3-D model of shear wave velocity anomalies beneath Lusi, the neighboring Arjuno-Welirang volcanic complex, and the Watukosek fault system connecting the two. Our work reveals a hydrothermal plume, rooted at a minimum 6 kmdepth that reaches the surface at the Lusi site. Furthermore, the inversion shows that this vertical anomaly is connected to the adjacent volcanic complex through a narrow (∼3 km wide) low velocity corridor slicing the survey area at a depth of ∼4–6 km. The NE-SW direction of this elongated zone matches the strike of the Watukosek fault system. Distinct magmatic chambers are also inferred below the active volcanoes. The large-scale tomography features an exceptional example of a subsurface connection between a volcanic complex and a solitary erupting hydrothermal system hosted in a hydrocarbon-rich back-arc sedimentary basin. These results are consistent with a scenario where deep-seated fluids (e.g., magmas and released hydrothermal fluids) flow along a region of enhanced transmissivity (i.e. the Watukosek fault system damage zone) from the volcanic arc toward the back arc basin where Lusi resides. The triggered metamorphic reactions occurring at depth in the organic-rich sediments generated significant overpressure and fluid upwelling that is today released at the spectacular Lusi eruption site.

Fallahi, M., Obermann, A., Lupi, M., Karyono, K., Mazzini, A. (2017) The plumbing system feeding the Lusi eruption revealed by ambient noise tomography, JGR, 122 (10), 8200-8213, doi: 10.1002/2017JB014592