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Seismicity at Lusi and the adjacent volcanic complex, Java, Indonesia

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We study the local seismicity around the spectacular Lusi eruption site, a sedimentary-hosted hydrothermal system in East Java. Lusi is located 10 km NE of the Arjuno-Welirang volcanic complex and is fed by both mantle and hydrothermal fluids rising and mixing with those present in the sedimentary formations. During a period of 17 months, we observed 289 micro-seismic earthquakes with local magnitudes ranging from ML0.5 to ML1.7. The events predominantly nucleate at depths of 8-13 km below the Arjuno-Welirang volcanic complex. Despite the geological evidence of active tectonic deformation and faulting observed at the surface, little to no seismicity is observed in the sedimentary basin hosting Lusi. Although we cannot entirely rule out artifacts due to a significantly increased detection threshold in the sedimentary basin, the deficit in seismicity suggests aseismic deformation beneath Lusi due to the large amount of fluids that may lubricate the fault system. An analysis of focal mechanisms of seven selected events around the Arjuno-Welirang volcanic complex indicate predominantly strike-slip faulting activity in the region SW of Lusi. This type of activity is consistent with the orientation and the movements observed for the Watukosek fault system that extends from the volcanic complex towards the NE of Java. Our results suggest that the tectonic deformation of the region is characterized by scattered faulting, rather than localized along a distinct fault plane.