

Tectonics or magma intrusion? – New results from the analyses of seismic swarms at Gede Volcano and Salak Volcano, West Java, Indonesia

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Gede and Salak Volcanoes are representative of plugged arc volcanoes. Gede exhibits a seismic swarm every few years, but only minor visible degassing. Salak exhibits minor degassing from its crater. The latest eruptions at Gede and Salak were in 1957 and 1930, respectively. Due to large populations nearby, the Center for Volcanology and Geological Hazard Mitigation (CVGHM) has monitored these volcanoes since 1985. In collaboration between the Earth Observatory of Singapore and CVGHM, we are upgrading geophysical, geochemical and hydrological monitoring on both volcanoes. Recent swarms occurred beneath both volcanoes and, in each case, we asked if the swarm was of magmatic or tectonic origin. If there was magma intrusion, will it lead to any eruption?

A relatively short swarm occurred at Gede in late February through early March 2012. The preliminary hypocenter determination reveals locations <1 km NE of the active crater with depths concentrated at 1-4 km. In comparison, hypocenters prior to that most recent swarm lie along a diffuse NE-SW trending line that passes between Gede and Pangrango volcanoes. Tilt data at Gede suggest that deformation was controlled by local tectonics until early Nov 2011. Then, a change in tilt vector suggested inflation due to magma intrusion, followed by swarm of earthquakes at the end of Feb 2012. Several months later tilt returned to a NE, tectonic direction. CO₂ flux measurements around Gede are high and also consistent with recent magma intrusion.

Following a M=4.8 tectonic earthquake just west of Salak on 9/9/2012, small earthquakes occurred in the nearby Awibengkok geothermal field. Further analysis of the selected earthquake mechanisms and b-values may further differentiate the origin of that swarm. Tentatively, we conclude that this seismicity was induced by the tectonic quake. We have just started deformation monitoring at Salak and, as at Gede, this will be an important constraint for interpretation of future swarms.