# Dyke intrusion between neighbouring arc-volcanoes responsible for 2017 unrest at Agung, Bali: insights from Sentinel-1 InSAR time series and 3D stress modelling

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**Abstract**

On November 21st, 2017, Agung volcano, located in Bali, erupted, ending more than 50 years of quiescence. The previous eruption in 1963 has a VEI of 5 and killed several thousand people, which underlines the potential large threat for the local population. The 2017 eruption was preceded by a strong seismic swarm from late August to mid-October, which led the Volcano Observatory (PVMBG) to increase the alert to its maximum level and to trigger the evacuation of over 150,000 people. Analysis of Sentinel-1 InSAR time series show a persistent 5 km radius uplift signal of 8-10 cm on the north flank of the edifice starting in late September 2017, in both ascending and descending tracks. Inversion of InSAR data using 3D Finite Element model shows that the ground deformation signal is consistent with a deep sub-vertical magma intrusion located between Agung and its neighbour Batur caldera. Using stress modelling, we also confirm that the N129° strike of the inferred dyke is not consistent with regional tectonic stresses but instead it can be explained by the topographic load induced by the volcanic centers. Our interpretation is that the transport of magma below Agung is controlled by the emplacement of large and deep mafic intrusions that likely propagate between Agung-Batur systems as tensile deviatoric stresses are highest. Later, the dyke stopped propagating vertically before intersecting and mixing with a shallow, long-lived andesitic storage zone, which is supported by petrological/geochemical evidence. Timescales of magma mixing usually range from days to few weeks, which explain the one-month delay between the end of the seismic swarm and the start of the 2017 eruption. For the first time, our geodetic observations revealed ongoing interactions between Agung and Batur, which have important implications for interpretation of distal seismicity, the links between magmatic systems of closely spaced arc volcanoes, and the potential for cascading hazards as the occurrence of simultaneous eruptions at neighbour volcanoes.

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