

Pulsating mud volcanism at LUSI, Indonesia

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Mud volcanoes are geologically important manifestations of vertical fluid flow and mud eruption in sedimentary basins worldwide. Their formation is predominantly ascribed to release of overpressure from clay- and organic-rich sediments, leading to impressive build-up of mud mountains in submarine and subaerial settings. Here we report on a newly born mud volcano appearing close to an active magmatic complex in a backarc sedimentary basin in Indonesia. This unusual setting results in a high temperature gradient that triggers mineralogical transformations and geochemical reactions at atypical shallow depth. The eruption of 100°C mud and gas that started the 29th of May 2006 flooded a large area within the Sidoarjo area in Northeast Java. Thousands of people have so far been evacuated due to the mud flood hazards from the eruption. Since the initial eruption, the flow rate escalated from 5000 to 120,000 m³/day during the first eleven weeks. Then the erupted volume started to pulsate between zero and 120,000 m³/day in the period August 14 to September 10, whereas it increased dramatically following swarms of earthquakes in September, before reaching 200,000 m³/day in December 2006. The eruption of boiling water is accompanied by mud, aqueous vapour, CO₂ and CH₄. We propose a mechanism where the eruptions started following the 27th of May earthquake due to fracturing and accompanied depressurization of >100°C pore fluids from > 5700 ft depth. This resulted in the formation of a quasi-hydrothermal system with a geyser-like surface expression, with an activity influenced by the regional seismicity.