

Combining experimental petrology with InSAR deformation constraints on the magmatic system prior to recent eruptions at Kelud volcano, Indonesia

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The parameters that govern the eruptive style at volcanoes are critical to understand, since the volcanic hazards posed to the nearby populations are directly related on whether an eruption is explosive or effusive. Eruptions from Kelud volcano located in East Java, Indonesia are difficult to forecast in that sense, because the eruptive style varies considerably, from effusive eruptions e.g. 1920 & 2007 to explosive eruptions in 1990 and 2014. Experiments were undertaken to constrain the magma storage conditions such as pressure, temperature and volatile contents prior to both explosive and effusive eruptions at Kelud. A gas-pressurized TZM cold-seal pressure vessel was used, whereby the sample (coarsely-crushed aliquots of the 2014 Kelud pumice contained in a AgPd capsule) were held at upper crustal conditions for several days to equilibrate, and then rapidly quenched using a water-cooled coupling system to prevent further crystallisation. The experiments were held near the NNO oxygen buffer using a double-capsule method. A range of pressures (25-200 MPa), temperatures (950-1100 °C), H₂O-saturated and mixed H₂O-CO₂ conditions were explored in this study. Experimental matrix glass and mineral rim compositions, as well as crystal contents were measured and compared to the natural mineral and groundmass characteristics erupted in explosive (1990, 2014) and effusive (2007) eruptions. The experiments were conducted on crystal-rich basaltic andesite pumice from the 2014 eruption, as this has a near identical bulk composition to the other effusively and explosively erupted products. The 2014 pumice therefore represents an ideal experimental starting material which can be applied to other Kelud eruption types investigated. This presentation will discuss the results from these experiments, which are the first to be conducted on Kelud volcanics, with the aim of elucidating magma storage conditions that precede Kelud's different eruption styles. These constraints will be compared to pre-eruptive deformation recorded with InSAR from COSMO-SkyMed satellite data. This rare coupling between pre-eruptive deformation monitoring data and experimental petrology will help to constrain the magmatic conditions that precede explosive eruptions at Kelud.