Temporal variation in the depth of magma surface inside the vent of Aso volcano during the 2014–2015 eruptive activity

*Kyoka Ishii[1], Akihiko Yokoo[1], Takahiro Ohkura[1]

1. Graduate School of Science, Kyoto University

The continuous eruptive activity depends on the temporal change of the magma supply and/or gas flux from a depth. Monitoring the depth of magma surface in the shallow conduit system, which reflects the magma supply rate, can help to elucidate the relation between eruptive activity and magma supply. In November 2014, a magmatic eruption started at Aso volcano and lasted five months until May 2015. Strombolian explosions frequently occurred during this period, and seismo-acoustic signals were observed at stations near the active vent. Infrasound signals show several distinct peak frequencies derived from acoustic resonance in the space above the magma surface (Yokoo et al., 2019, EPS). The crater floor collapsed on May 3, 2015, which consequently stopped the magmatic eruption. The depth of the magma surface in late April 2015 was estimated as 40–200 m from the time delay of seismo-acoustic signals and the peak frequency of infrasound signals (Ishii & Yokoo, 2021, EPS). However, the temporal variation in the depth throughout the eruptive activity has not been revealed. Therefore, we estimate the temporal variation in the depth of the magma surface in 2014–2015 at Aso volcano. We used a combined method modified from Ishii & Yokoo (2021, EPS) to estimate the depth. This method uses both the time delay of seismo-acoustic signals and the peak frequency of infrasound signals to constrain the depth of the magma surface and the sound velocity inside the vent. The seismo-acoustic events are detected by STA/LTA algorithm during November 28, 2014–May 31, 2015. The total number of events is over 100,000. The subjected period is divided into six periods depending on the waveforms of infrasound signals. The temporal variation of the conduit shape is considered to estimate the depth. Assuming that the conduit is a conical frustum pipe, its radii of open-end and closed-end are constrained by the frequency ratio between fundamental resonant frequency and its overtone frequency. In the early eruptive episode (November–December 2014), the magma surface was at a depth of around 200 m, then rose to 120 m until late January 2015. Prior to this rise of the surface, ground deformation was recorded by tilt and strain measurements on January 5–9, 2015, and an expansion source at a depth of 1–2 km under the active crater can reproduce the observed deformation records (JMA, 2015; Kyoto Univ., 2015). Therefore, it is suggested that magma intrusion into the shallow plumbing system caused the magma surface to rise. The shape of the space above the magma surface changed from a cylinder to a conical frustum when the magma surface rose. The space can be formed beneath the crater floor due to the disintegration of the heated conduit wall near the magma surface. A few days before the end of the eruptive activity, the magma surface dropped about 50 m. This magma drainage and the instability of the conduit shape caused the crater floor to collapse on May 3, 2015, leading to the end of the magmatic eruption.

Keywords: Aso volcano, Strombolian explosion, Infrasound

