

Relation between long-period seismic signals and SO₂ emission at Asama volcano from October 2003 to January 2017

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Vulcanian eruptions had started on September 1st 2004, lasting until December 2004 at Mt. Asama. After that, several small and minor eruptions occurred in August 2008, from February to May 2009, and in June 2015. We compile long-period seismic data and SO₂ data from October 2003 to January 2017, and consider the relation between long-period seismic signals and volcanic gas emission. We categorize long-period seismic signals into three groups; the first category is a very long-period pulse (VLP) excited by a sudden gas emission from northern part of the conduit [Takeo et al., 2016]. The second category is a long-period rebound waveform (LP earthquake), and the third category is long-period tremor characterized by pointed tips and sawtooth waveform. We propose a mathematical model succeeding in simulating the oscillations resembling with these second and third categories signals. Before June 2004, VLP activity was synchronized with the seismicity, but it had gradually decreased toward the eruption in spite of increment of the seismicity. At this turning point, LP earthquakes and nonlinear tremors occurred in cluster. Based on the mathematical model, LP earthquake and the nonlinear tremor could be actualized by a blockage of the conduit, resulting the decline of VLP activity due to shielding of gas emission and the increment of seismicity due to stress accumulation in and around the conduit [Takeo et al., 2016]. The minor eruptions in 2008 and 2015 were preceded by rapid activation of VLP activity and/or increment of SO₂ emission, and large VLPs preceded these minor eruptions by two to four minutes. Based on the VLP activity and SO₂ emission data, the minor eruptions in 2008 and 2015 were interpreted as large-scale gas emission events. SO₂ emissions had been kept in high level from November 2008 to February 2009 in spite of low VLP activity, but this relation had turned over from April to August 2009. After the 2015 eruption, SO₂ emission level often had been kept more than 1000 ton/day by the end of November 2015. After that, low SO₂ emission had been continued until December 2016 in spite of relative high level of VLP activity compared with that before the 2015 minor eruption. In this period, VLP activity seems to increase gradually, followed by a rapid increment of SO₂ emission in January 2017. The variability of correlation between SO₂ emission and VLP activity suggests an existence of multi outgassing pathways in the shallow part of the conduit.

Keywords: Asama volcano, Long-period earthquake, Volcanic gas