

# Mechanism of Eruptions Accompanied with pyroclastic flow at Sakurajima Volcano

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Sakurajima is a post-caldera cone situated on the southern rim of Aira caldera, south Kyushu, Japan. Vulcanian eruptions have occurred at the Minamidake crater at the summit since 1955. However, principal eruptive activity shifted to the Showa crater at the eastern flank of the summit in 2006. The eruptions at the Showa crater were phreatic in 2006-2007 and vulcanian eruptions started from 2008. Minor vulcanian eruptions occurred about 1,000 times per year in 2010-2013. Ash plume height of the eruptions sometimes reached to 3000-5000m from the crater after 2013. The eruptive activities at the Showa crater become active and are sometimes accompanied with small pyroclastic flows after 2008. The pyroclastic flow is dangerous volcanic phenomenon, it is important to understand the mechanism of generation of the pyroclastic flow for volcanic disaster prevention. In this study, we research air-shock on eruptions, ground deformation and precursory earthquakes patterns before eruptions, and eruption earthquakes accompanied with the pyroclastic flow.

Inflationary strain changes are observed by extensometers a few tens of minutes to several hours prior to the eruptions and are caused by pressure sources located at depths of 0-1.5 km. The inflation rates decrease or sometimes suspend about 30 minutes before the eruptions. Small earthquakes dominated by high frequency components (5-6 Hz) swarm when duration of inflation is longer than 1 hour. The hypocenters of the small earthquakes are located at a depth of 0.5 km beneath the crater and are close to depth of the pressure source. The earthquakes begin to occur a half hour to 1 hour after the start of the inflation. The amplitudes and number of the earthquakes further increase when the inflation rates decrease or suspend. Then, the occurrences of the earthquakes suddenly stop at the start of the eruptions. Inflation duration of the eruptions accompanied with pyroclastic flow is longer (more than 1.5 hours). Seismic energy releases of the precursory earthquakes accelerate before the eruptions, although there are all kinds of large and small seismic energy releases. The precursory earthquake may be generated by release of excess pressure accumulated by inflation of the pressure source. The accelerations of the seismic energy releases before eruptions with the pyroclastic flow tend to be larger than those with normal events. We could be possible to predict generation of the pyroclastic flow from monitoring of the inflation duration and the seismic energy release of precursory earthquakes. The decrease of the inflation rate and the precursory earthquakes may be generated by degassing from magma in the conduit. The pyroclastic flow may be caused by fall down of high density eruption products because of the degassing.

Keywords: Sakurajima volcano, pyroclastic flow, eruption