Oral | Symbol S (Solid Earth Sciences) | S-VC Volcanology

[S-VC55_1PM2]Active Volcanism

Convener:*Yosuke Aoki(Earthquake Research Institute, University of Tokyo), Mie Ichihara(Earthquake Research Institute, University of Tokyo), Chair:Mare Yamamoto(Department of Geophysics, Graduate School of Science, Tohoku University), Takahito Kazama(Graduate School of Science, Kyoto University)
Thu. May 1, 2014 4:15 PM - 5:30 PM 416 (4F)
This session discusses various phenomena associated with active volcanisms including, but not limited to, geophysical and geochemical observations, geology, historical eruptions, and development of modern instruments.

4:15 PM - 4:30 PM

[SVC55-P17_PG]Thermal activities of the Nakadake first crater at Aso volcano, Japan -Unusual heat discharge events in 2012-2014-

3-min talk in an oral session

*Akihiko TERADA[1] (1.Volcanic Fluid Research Center, Tokyo Institute of Technology)

Keywords:heat discharge rate, Aso volcano, hot crater lake, eruption

Aso volcano is one of the most active volcanoes in Japan in terms of the persistent release of volatiles and thermal energy from the Nakadake first crater. Throughout most of the calm period, the crater emits significant amounts of volcanic gas, including 200 - 400 tonne/day of SO_2. The first crater contains a hot crater lake, locally referred to as Yudamari with a diameter greater than 200 m. Applying the model of Ryan et al. (1974), which involves the effects of free and forced convection, Terada et al. (2012) estimated that during the calm period, the heat discharge through the lake surface is almost constant, with a value of approximately 220 MW.The water level falls rapidly preceding an active period. The disappearance of lake water is followed by the emergence of a red-hot crater bottom or wall and a phreatic-to-phreatomagmatic and strombolian eruption sequence that lasts several months. When the volcanic activity subsides to calm period levels, the lake reforms. These dramatic falls/rises in the lake water level are likely caused by increases/decreases in the input of high-temperature steam to the crater bottom (Terada et al., 2012).In spring of 2012, an unusual event involving the increase in water temperature and rapid decrease in water level occurred at the Yudamari crater lake. The heat discharge rates approached the figure of 600 MW which is three times higher than the representative figure in a calm period. The computational results based on energy and mass conservation indicate that the event is caused by an increase in temperature and flux of fluid inputs from the lake bottom. Preceding the event, silica content in lake water clearly increased, indicating a rise in temperature of hydrothermal system beneath the Yudamari crater lake. The event was accompanied by slight increase in SO_2 emission rate, but seismicity around the crater did not change significantly.After September 2013, the lake water of Yudamari almost disappeared. Consequently volcanic fluid emitting from the crater bottom ascended as a buoyant plume into the air without transportation of the heat to the lake water. To estimate the rate of heat discharge from the first crater, we applied the plume rise assumption (Briggs, 1969; Kagiyama, 1981). This assumption states that the height h of a given position in a fumarole increases proportionally with time t to the power of 2/3. Video records of surveillance camera operated by Japan Meteorological Agency are used to the analysis.In September, 2013 and December, 2013 - January, 2014, seismicity including earthquake swarms and volcanic tremors were enhanced, which were accompanied by an increase in SO_2 emission rates up to 2,000 tonne/day. During the periods, heat discharge rates are

estimated to be 800-1000 MW which is several times higher than the figure measured in a calm period. The ratio of H_2O/SO_2 has been roughly maintained whereas small amount of volcanic ash including juvenile materials were continuously emitted in January 2014. This may occur as a result of an increase in amount of degassing in the conduit beneath the first crater.Acknowledgments: I would like to thank Yoshihiro Ushiroshoji, Shinya Nagato and the Fukuoka District Meteorological Observatory, Japan Meteorological Agency for sharing their data and for providing permission for the data to be published.