Evaluation of temporal changes in volcanic fluid emitted from the bottom of active hot crater lakes

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Hot crater lakes on active volcanoes generally overlie magma-hydrothermal systems. Water level and temperature of such hot crater lakes sometimes show interesting changes with time in response to volcanic activity. In many cases such variations of hot crater lakes are caused by changes in volcanic fluid supplied from lake bottom. Therefore, monitoring of hot crater lakes are useful to detect even slight changes in hydrothermal activity. In contrast, measurements of thermal energy emitted as subaerial fumaroles show larger uncertainties, particularly when performed with a remote sensing apparatus. To evaluate changes in mass flux and the specific enthalpy of the volcanic fluid supplied through the lake bottom, we developed a generic numerical model of a hot crater lake and applied it to the level and temperature data monitoried at Yudamari crater lake of Aso volcano (Terada et al., 2012) and Yugama crater lake of Kusatsu-Shirane volcano in Japan. At Aso volcano, we found that the fluid from the bottom was a mixture of ground water and high-temperature steam. The ground water flux showed a seasonal increase lagging behind the rainy season. The flux of the high-temperature volcanic gas was in a close relation to the amplitude of volcanic tremors. We considered that heating of the hydrothermal system drove such tremors. At Kusatsu-Shirane volcano, we detected an increase in specific enthalpy of input fluid in coincidence with intense earthquake swarm that was accompanied by ground inflation at a shallow part beneath Yugama crater lake.

Terada et al., (2012), *Bull. Volcanol.*, doi: 10.1007/s00445-011-0550-4