Raman spectroscopy applied to reveal the oxidation state of the “Red” obsidian from Shirataki, Hokkaido, Japan

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Silicic volcanism ranges from explosive to effusive. Understanding what controls in such activity is an important issue to explain the explosive-effusive transition. The recent observation on Cordon Caulle (Chile, 2011–12) revealed that explosive-effusive hybrid activity (Schipper et al., 2013) and the oxidation state in volcanic products have attracted attention to reveal the effusive-explosive transition during magma ascent, especially on viscous magma eruptions (e.g. Castro et al., 2014). The Laser Raman spectroscopy is expected to give information about micro-scale oxidation state based on the specification of oxide microlite and glass amorphous structure in volcanic rocks.
At the Akaishiyama obsidian lava on Shirataki, northern Hokkaido, Japan, we can observe the red-colored oxidized obsidian mingled with black-colored obsidian. The mingled shows various contrasts and distributions on the hand specimen, and we can consider that such a various oxidation texture reflect the different mechanisms of outgassing process during the eruption. In this study, we used the microRaman spectroscopy to characterize the oxidation state in the obsidian, using a JASCO NRS-7100 Laser Raman Spectrometer with 514 nm excitation at Kobe University Research Facility Center for Science and Technology, Japan. We obtained the 2 types of Raman spectra of oxide microlites in red and black obsidians, respectively. Compared with referential spectra, we identified captured spectrum as magnetite and hematite. Based on the analytical results of microRaman Spectrometer and distribution pattern of oxidation texture, we can discuss the formation process of heterogeneous oxidation textures during the eruption.

Keywords: obsidian, Raman spectroscopy, textural analysis, Shirataki

