

Outgassing and Oxidation processes of viscous magmas inferred from micro-Raman and IR spectroscopy

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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) reported the explosive-effusive hybrid activity (Schipper et al., 2013), and we can consider that this eruption style reflects heterogeneous processes such as vesiculation and outgassing in volcanic conduit. Obsidian can be observed as pyroclastic and effusive-lava products of such a silicic and viscous magma eruption, and we can consider that obsidian contains the heterogeneities in rock textures such as crystallinity, water concentration oxidation state, and structure of glass networks. Thus, we performed the micro-Raman and IR spectroscopy on obsidian in order to discuss the heterogeneous processes recorded in rock texture.

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 obsidian shows various contrasts and distributions on the hand specimen, and we can consider that such various oxidation texture reflects the different mechanisms of outgassing and oxidation during the eruption. In this study, we used the microRaman and IR spectroscopy to characterize the oxidation state in the obsidian. We obtained the 2 types of Raman spectra of oxide microlites in red and black obsidians, respectively. Compared with referential spectra, we identified the captured spectrum as magnetite and hematite. Furthermore, the height of 470 cm^{-1} on the glassy part shows the degrees of oxidation. The IR spectroscopy shows the different water concentration between red-colored and black-colored obsidian glasses. The red-colored oxidized glass shows lower water concentration than black-colored obsidian glasses. Based on the analytical results of microRaman and IR spectroscopy and, we discuss the formation process of heterogeneous oxidation textures during the eruption.

Keywords: Oxidation texture, Raman spectroscopy, IR spectroscopy, obsidian