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Emplacement processes inferred from micro-textures in Tokachi-ishizawa obsidian lava, Shirataki, northern Hokkaido

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Obsidian lava complex in Shirataki, Hokkaido, erupted at 2.2Ma and formed obsidian monogenetic volcanoes. A cross section of Tokachi-ishizawa obsidian lava (TI lava) in the complex is about 50 m in height and is stratigraphically observed from its flow bottom; pumice layer 1, obsidian layer, pumice layer 2, and rhyolite layer. The boundary between obsidian layer and pumice layer 1&2 is transitional. In this study, we precisely described the rock micro-textures of TI lava samples from obsidian layer to the rhyolite interior in order to understand the eruption processes of silicic obsidian lava.

TI lava samples are almost aphyric, composed of glasses (>98% in volume), rare plagioclase phenocryst (0.4-1.0 mm), plagioclase microlite (<0.2 mm), magnetite (<0.05 mm) and rare biotite (<0.01 mm). Magnetite can be classified into euhedral or subhedral group and acicular group, based on aspect ratio. We counted crystal number (N_v) of acicular magnetite by 3D counting method (Castro et al., 2003). The N_v value in all of the TI lava samples is high with 10^7-10^8 [number/cm^3]. On the other hand, euhedral magnetite (low aspect ratio) has obviously low crystallinity. Since N_v reflects the cooling history of crystallizing melt (Toramaru et al., 2008), this result indicates that acicular magnetite was probably crystallized by decompression like a degassing process, and thus magnetite in the groundmass was derived from two crystallization stages.

In the rhyolite layer, porosity is variable; bottom rhyolite layer sample (close to obsidian layer) has low porosity (2-3%), while interior rhyolite sample has high porosity (7-8%). Vesicles in rhyolite samples vary from spherical to high deformed shape. These porosity and vesicle shape variation imply difference in vesiculation processes in conduit and/or surface.

N_v and vesicle textures in TI lava indicate cooling history and vesiculation processes during conduit and surface flow. We intend to model the replacement processes that produced the obsidian-rhyolite internal structure of TI lava by viscous silicic magma.

Keywords: obsidian, rhyolite, Shirataki