Occurrence of spherulite concentration zone and internal structure of the Shirataki obsidian lava, northern Hokkaido, Japan

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Obsidian and rhyolite formation process during emplacement of silicic magmas was studied through the observation of internal structure of obsidian-rhyolite lava from Shirataki, northern Hokkaido, Japan. The Shirataki monogenetic volcano field (2.2 Ma) contains many outcrops of densely compact obsidian layers (SiO_2=76.7-77.4 wt.%). Akaishiyama lava in the field shows good exposures of internal sections from the top to the bottom with thickness of about 250 m, and it comprises an upper dense obsidian zone (10m thick), an upper banded obsidian zone (100m), a central rhyolite zone (100m), a lower banded obsidian zone (5m), a lower dense obsidian zone (7m), and a lower clastic zone (3m).

The upper banded obsidian zone includes many concentration layers of spherulites (<12cm in diameter). This zone also contains rhyolite blocks comprising innumerable spherulites and tuffisite short channels. The variety of spherulite morphology is probably due to difference in the number density and the connectivity of vesicles, and subsequent outgassing. The lower-banded obsidian zone is characterized by alternating thin layers of vesicular rhyolite and obsidian. The dense obsidian is composed of >98 % glass with H_2O (<0.1wt.%) and magnetite microlite (<1.5%). The obsidian glass from the upper dense obsidian zone is lower in FeO content than that from lower dense obsidian zone, which is correlated with the number density of magnetite. These geological and petrological features indicate that the formation of obsidian and rhyolite was mainly controlled by the timing of vesiculation and outgassing of silicic magmas, in addition to the cooling effect.