

Temporal changes of chemical composition of magmas in the last 10000 years at Mashu volcano, eastern Hokkaido, Japan

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Mashu volcano is situated at the east wall of Kutcharo caldera. Explosive eruptions were repeated between the past 10000 years, producing the caldera (7km in diameter) 7000 years ago, and magma compositions were changed with the time.

Based on Katsui et al. (1975) and Sumita (1993), we classified eruption history for the past 10000 years into four stages (late stage of stratovolcano, caldera-forming stage, post-caldera Kamuinupuri-forming stage, and the latest eruption stage of kamuinupuri).

In the late stage of stratovolcano, the pumice fall of Ma-l layer (about 10000 years ago:SiO₂=67.9-68.8%), and the ash of Ma-k layer (about 8500 years ago) were deposited, after that there was dormant period of about 1500 years.

The caldera-forming stage

The pumice falls by plinian eruptions were successively deposited (Ma-i:SiO₂=69.2-72.1%, Ma-h:SiO₂=68.1-70.5%, Ma-g:SiO₂=65.3-66.6%). The large-scale pyroclastic flows were continuously erupted (Ma-f:SiO₂=68.5-70.8%) and the Mashu caldera was formed. The bimodal distribution (An₆₈ and An₅₆) of the plagioclase core compositions shows that the dacite magmas were produced by the mixing of high-T and low-T magmas. The supply rate of high-T magmas was probably increased with progress of large-scale eruptions.

The post-caldera Kamuinupuri-forming stage

There was a dormant period of about 3000 years. About 3000 years ago, the pumice falls and pyroclastic flows were erupted (Ma-d:SiO₂=63.9-69.4%). Many plagioclase cores show more than An₈₀. The plagioclase phenocrysts from Kamuinupuri western lava (SiO₂=54.5-61.6%) show more than An₇₈, whereas in north side lava (SiO₂=68.4-70.6%), the plagioclase phenocrysts have a peak in An₅₆ and An₆₈. In addition, Kamuishu lava dome (SiO₂=73.9%) in the center of the caldera has plagioclase phenocrysts of a bimodal peak of An₅₆ and An₇₄. Except the western lava, it is thought that the eruptions were by magma mixing.

The latest eruption stage of Kamuinupuri

After a dormant period for about 1000 years, the latest eruptions (about 1000 years before) occurred. The pumice and ashes deposited (Ma-b:SiO₂=67.0-69.2%). The plagioclase phenocryst cores show a wide distribution range and have often more than An₉₀. Because the An-distribution is the same as that of Kamuinupuri north side lava, the high-T magma was injected into the remaining mixed magma chamber that had effused the north side lava.

In the eruption history for the past 10000 years, magma composition changes in each eruption stage and magma supply system would have been changed every the eruption stage.