

## Formation history and magma evolution of Asahidake Volcano of Taisetsu volcanic field, central Hokkaido, Japan

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Taisetsu volcanic field, located in the northern part of Taisetsu-Tokachi volcanic chain, central Hokkaido, consists of Quaternary volcanoes. Its activity started at 1.0 Ma accompanied with voluminous lava flows and many lava domes and cones widely. The youngest activity has occurred in the center of the volcanic field as follows: Ohachidaira caldera-forming eruption occurred at 35 ka, and after that, the volcanic edifices, namely Ushiro-Asahidake, Kumagatake and Asahidake, have been formed at the southwestern rim of the caldera (Katsui *et al.* 1979). There are several previous studies about eruptive history and magma plumbing system of Asahidake, which is the youngest active cone (e.g. Sato & Wada 2007). However, the stratigraphic relationship between Asahidake and the other volcanoes (Kumagatake and Ushiro-Asahidake) is still unclear. In addition, the petrological study of these volcanoes has not been carried out sufficiently. Therefore, we performed geological and petrological study of Asahidake Volcano (Asahidake, Kumagatake, and Ushiro-Asahidake), in order to reconstruct the formation history and to reveal the magma evolution of Asahidake volcano.

Asahidake (2,291 m) consists of a pyroclastic cone formed above the 1600 m altitude and many lava flows on the west side. The horseshoe-shaped explosion crater called Jigokudani crater exists on the west side of the cone and the fumaroles still active. Ushiro-Asahidake lava dome (2,216 m) and Kumagatake pyroclastic cones (2,210 m) locate in the 1 km to the east from the summit of Asahidake and both are covered with the edifice of Asahidake. Based on the difference in volcanic edifice, the volcanic activity can be divided into 3 stages: Kumagatake, Ushiro-Asahidake, and Asahidake stages, in ascending order.

Kumagatake stage is characterized by the formation of pyroclastic cone with multiple craters. The eruptive materials are subdivided into 3 units by the difference in crater. The total eruptive volume of Kumagatake stage is 0.35 km<sup>3</sup> DRE.

In Ushiro-Asahidake stage, lava flowed down southward. After that, the lava dome was built on the summit. Total volume of this stage is 0.33km<sup>3</sup> DRE.

Asahidake stage is divided into two substage by the difference in eruption style. Early substage is mainly composed of magmatic eruptions. They are subdivided into lower and upper units on the basis of the stratigraphic relationship and magma type. The lower and upper units can be respectively subdivided into L1 - L3 and U1 - U5 subunits. The latest magmatic eruption of Asahidake is ca. 5 ka (Okuno 2005). The total volumes of lower and upper units are 4.50 and 0.99 km<sup>3</sup> DRE, respectively.

Asahidake late substage is characterized by phreatic explosions forming Jigokudani crater. The last small phreatic explosion might occur in 250 years ago (Wada *et al.* 2003).

The rocks of three stages are 2px basaltic andesite to dacite, often contain mafic inclusions. They sometimes include olivine and hornblende phenocrysts. On whole-rock chemistry, the SiO<sub>2</sub> contents of host rocks are 54.7-65.4 wt.% . Mafic inclusions show 54.0-59.0 wt.%. Dacitic rocks exhibits little variation in petrological features through all the stages. In contrast, mafic rocks are distinguishable according to stage and unit. Kumagatake stage can be clearly distinguished from the other stages by high Ni and low Cr contents. Ushiro-Asahidake stage and the lower unit of early Asahidake stage show similar, lower Ni and Cr contents. In contrast, the mafic rocks of upper unit of early Asahidake stage exhibit much wider variations

Heterogeneous textures suggest that magma mixing is the main magmatic process in the activities of Asahidake volcano, as mentioned by previous studies. This study revealed that magmatic compositions, especially mafic compositions, has changed in every stages, and units. That is, the mafic end-member magmas has replaced in each volcanic edifice and craters.

Keywords: Asahidake, Formation history, Transition magma, geology, petrology, Taisetsu volcanic field