

Transition magma and formation history of Asahidake volcano of Taisetsu volcanic field, central Hokkaido, Japan

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Taisetsu volcanic field consists of quaternary volcanoes located in the northern part of Taisetsu-Tokachi volcanic chain, central Hokkaido. In the youngest activity, the large eruption forming Ohachidaira caldera occurred in the center of Taisetsu volcanic field in c.a. 30 ka, and after that stratovolcanoes namely Pon-Asahidake, Ushiro-Asahidake, Kumagatake and Asahidake have been formed at the southwestern rim of the caldera. Although the studies of eruptive history and magma plumbing system of Asahidake which is only an active volcano within these volcanoes have been carried out (e.g. Sato and Wada, 2007), stratigraphic relationships and petrological studies of Asahidake volcanoes including Kumagatake and Usiroasahidake has not been done sufficiently. Thus, we performed geological and petrological study of Asahidake, Kumagatake, Ushiroasahidake in order to reconstruct spatiotemporal evolution of magma and history of these volcanoes.

Asahidake (2,291m) consists of a pyroclastic cone formed above the 1600m 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. Older pyroclastic cones, Ushiro-Asahidake (2216m) and Kumagatake (2210m) are located in the eastern side of Asahidake.

Based on the stratigraphic relations, degree of preserved land forms, field occurrences and petrological characteristics, Asahidake volcanic activities are distinguished into 3 stages: Ushiro-Asahidake, Kumagatake and Asahidake stage, in ascending order. Ushiro-Asahidake stage edifices are composed of a pyroclastic cone and lava flows which was considered as Asahidake volcanic edifice. Kumagatake stage edifices consist of a pyroclastic cone and lava flows which flowed down to the northwest from the cone. Asahidake stage can be divided into three stages: Stage 1~3, in ascending order. Stage1 volcanic edifices are composed of large amount of lava flows at the southwest-western foot of Asahidake, and are subdivided into Stage1-2 (Late) and Stage1-1 (Early). Stage1-1 lava flows are distributed in the south western foot of Asahidake. Stage1-2 lava flows are distributed in the western foot of Asahidake and its runout distance from Asahidake is more than 8 km. Stage2 edifices consist of Asahidake pyroclastic cone and the lava flows effused from the cone. These Asahidake stage deposits are often recognized heterogeneous structure such as mafic inclusions over the period of time. In addition, the formation age of the cone is estimated to be c.a. 6,700 years ago on the basis of radiocarbon dating. Stage3 is characterized by phreatic explosion which formed Jigokudani crater. The last small phreatic explosion might occur in 250 years ago.

Eruptive deposits of Asahidake, Kumagatake and Usiroasahidake comprise andesite and dacite. Phenocrysts contents range from 10 to 35%. Phenocryst minerals are Pl + Cpx + Opx + Mt (+Ol) in andesite, and Pl + Cpx + Opx + Mt (+Ho) in dacite, respectively. Whole-rock composition shows different features for each stage in the Harker diagrams, especially in SiO₂-MgO.

It is newly revealed that Ushiro-Asahidake and Kumagatake activity may be able to be recognized as adjacent activity of Asahidake volcano in this study. The eruptive history and spatiotemporal magma changing of these volcanoes is as follows: After the Ohachidaira eruption (30 ka), Ushiro-Asahidake and Kumagatake activity had occurred. Between these activities, magmas were similar in each other. Thereafter these activities, Asahidake had effused a large amount of magmas which is different from Ushiroasahidake and Kumagatake (Stage1), and erupted magmas forming a large stratocone which might be occurred by different several magmas during the following stage (Stage 2).

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