

# Gamo-touge Volcano: the oldest Pliocene monogenetic volcano in the eastern San'in region, SW Japan

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In the eastern San'in region, more than 40 basaltic volcanoes were formed from Pliocene to Pleistocene time (Furuyama et al., 1993). Pleistocene volcanoes such as the Kannabe Volcano Group have well preserved volcanic topography, indicating that they are monogenetic volcanoes (Furuyama, 1973). On the other hand, Pliocene volcanoes were dissected, and their original topography are not clear. However, these Pliocene volcanoes are considered to be monogenetic volcanoes without sufficient evidence (e.g., Furuyama et al., 1993). Pliocene basalt lava and pyroclastic rocks crop out in the northern part of the border between Tottori and Hyogo prefectures. Previous studies suggested that these volcanic rocks were formed by the activity of a monogenetic volcano called 'Hamasaka Volcano' (Mitsui and Nagao, 1990; Furuyama et al., 1993). However, its internal structure was not well understood.

In this study, we carried out geological mapping and radiometric dating to reveal the volcanic history and structure of this volcano. The volcanic rocks are composed of at least more than four basaltic lava sheets, pyroclastic deposits forming a scoria cone, and some intrusive rocks. The lava sheets, pyroclastic rocks, and intrusive rocks are composed of homogeneous aphyric basalt containing microphenocrysts of plagioclase, clinopyroxene, and olivine. Each lava sheets have a thickness of >10 m. This is recognized by clinker layers of ca. 2- to 5-m-thick intercalated between them. The basalt lava sheets are intercalated with 2- to 3-meter-thick felsic lapilli tuff at least two sites, which may have derived from other volcanoes. The pyroclastic deposits are found only in the southern part of the study area. The deposits mainly consist of basalt scoria lapillistone, tuff breccia and pyroclastic breccia including 10- to 300-cm-sized volcanic bombs. They dip from 6 to 23° from northeast to east, and their grain size tends to be coarser in the direction opposite to the dip. The attitude and the lithofacies imply the structure of a scoria cone. In addition, unconformity and sediments showing time interval (e.g., paleosol) are not recognized in the volcanic rocks. These lines of evidence indicate they are formed by monogenetic eruptions. We found a cylindrical basalt intrusive rock (150 m horizontal long axis) intruding Miocene basement and the pyroclastic deposits. This intrusive rock is homogeneous with the lava sheets and pyroclastic deposits, and the grain size of pyroclastic breccia is coarsest around it. Therefore, the intrusive rock is estimated to be their source vent. The vent was located about 2 km north of the Gamo-touge Pass, hence we rename this monogenetic volcano as 'Gamo-touge Volcano'.

Previous studies proposed this volcano as the oldest one of the monogenetic volcanoes in the eastern San'in region, and our zircon U-Pb dating results support their proposal. Although three whole K-Ar ages of ca. 3.4-3.8 Ma were obtained from the volcanic products of this volcano (Furuyama et al., 1993; Sakiyama et al., 1995), the radiometric ages reported from the other monogenetic volcanoes are ranging from 0.05 to 2.85 Ma (Furuyama et al., 1993; Sakiyama et al., 1995). Two felsic lapilli tuff samples intercalated with basalt lava sheets were measured by a zircon U-Pb dating method using laser ablation-ICP-mass spectrometry to determine the age of the Gamo-touge Volcano. As the result, both of two samples yielded the weighted mean  $^{206}\text{Pb}/^{238}\text{U}$  age of  $3.65 \pm 0.04$  Ma (95% confidence level). The obtained age in this study is consistent with the reported K-Ar ages. The zircon U-Pb dating method provides more reliable age data than the whole rock K-Ar dating method owing to the robustness of the U-Pb systems. Therefore, we conclude that the volcano was formed at ca. 3.65 Ma. The Gamo-touge Volcano is significantly older than the other monogenetic volcanoes.

Keywords: Gamo-toge Volcano, geological mapping, monogenetic volcano, Hamasaka Volcano, scoria cone, zircon U-Pb age