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Zircon Fission-track Dating of the Hiyoriyama Cryptodome at Kuttara Volcano, Southwestern Hokkaido, Japan

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Zircon fission-track dating was applied to determine the age of the Hiyoriyama Cryptodome in the Noboribetsu Geothermal Field, Kuttara Volcano, southwestern Hokkaido, Japan. We dated two rock samples (HY-10 and HY-11) collected from the wall of an explosion crater at the summit of the cryptodome. A total of 20.5 kg of dacite (HY-10) and 25.5 kg of dacite (HY-11) was crushed, and 1004 (HY-10) and 1008 (HY-11) zircon grains were used to determine the relatively young fission-track ages. Dating was performed using the external detector method, and the ages were calculated from the densities of spontaneous and induced tracks in the whole zircon grains. The obtained ages are 15±4 ka (HY-10) and 14±4 ka (HY-11), which are the same within error. The dating results suggest that the cryptodome formed at *ca.* 15 ka.

Key words: Fission-track dating, zircon, Hiyoriyama Cryptodome, Noboribetsu Geothermal Field, Kuttara Volcano

1. Introduction

Fission-track dating is a radiometric dating method based on counting the number of damage trails left by fission fragments in uranium-bearing minerals, such as zircon and apatite, and in glasses (Fleischer *et al.,* 1975; Hurford, 1990; Wagner and Van den haute, 1992). This method is commonly used for samples in the age range of 10^5 to 10^8 years, but may be applied to younger samples in the range of 10^3 to 10^4 years by measuring a large number of mineral grains (Danhara, 1995; Wagner, 1998; Kameyama *et al.,* 2005; Takagi *et al.,* 2007).

In the present study, we applied fission-track zircon dating to a Quaternary subaerial dacite cryptodome at Hiyoriyama (the Hiyoriyama Cryptodome) in the Noboribetsu Geothermal Field, Kuttara Volcano, southwestern Hokkaido, Japan. No previous study has reported geochronological data for the cryptodome, and fission-track dating of zircon from the cryptodome provides an insight into the history of dome formation and the evolution of the Kuttara Volcano.

2. Hiyoriyama Cryptodome

The Hiyoriyama Cryptodome is located in the northern part of the Noboribetsu Geothermal Field, in the western part of Kuttara Volcano (Fig. 1). The Kuttara Volcano consists mainly of an andesitic stratovolcano that reaches an elevation of 549 m above sea level, with a small caldera (Lake Kuttara) on the summit. The volcano evolved over the period 80–45 ka, involving early silicic explosive activity and subsequent stratovolcano building associated with caldera collapse at 40 ka (Katsui *et al.,* 1988; Yamagata, 1994; Moriizumi, 1998; Moriya, 2003). The Noboribetsu Geothermal Field is inferred to have formed after the collapse of the caldera (Katsui *et al.,* 1988). The geothermal field is approximately 1 km wide (northeast-southwest) and 1.5 km long (northwest-southeast).

The Hiyoriyama Cryptodome (Fig. 2) is elliptical in plan view, ranging in diameter from 350 m (northeast-southwest) to 550 m (northwest-southeast). It rises 130 m above the surrounding area, with the highest point being 377 m above sea level. The surface of the cryptodome is covered with sediments up to 15 m thick (Katsui *et al.,* 1988). An explosion crater occurs at the summit (Fig. 3). The crater is 55×95 m in size (elongate northwest-southeast) and 20 m deep, and contains active fumaroles.

The Hiyoriyama Cryptodome consists of coherent dacite that is well exposed on the wall of the summit explosion crater, where it appears massive with columnar joints spaced at intervals of 100–150 cm. The dacite is grey and porphyritic, containing phenocrysts of plagioclase (<4 mm long, 21–25 vol.%), quartz (<5 mm, 6–8 vol.%), hypersthene (<2 mm, 4–6 vol.%), trace

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