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# Radiocarbon Dating of the Minamidake Debris-Avalanche Deposit, Shiretoko-iozan Volcano, Eastern Hokkaido, Japan

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Mt. Shiretoko-iozan is a Quaternary andesitic composite volcano located on the Shiretoko Peninsula, eastern Hokkaido, Japan. An amphitheatre at the summit and a debris-avalanche deposit (Minamidake Debris-Avalanche Deposit) at the western foot of the volcano suggest that sector collapse occurred during its eruptive history. Three trenches (6.8, 7.3, and 4.2 m deep) were dug at the western terminus of the Minamidake Debris-Avalanche Deposit in order to date the sector collapse event. The stratigraphic section consists of (from lower to upper): the Sashiruidake Lower Lava, a debris-flow deposit, a buried soil, a debris-flow deposit, a buried soil, the Minamidake Debris-Avalanche Deposit, a buried soil, the Ta-c tephra, and the surface soil. Radiocarbon dating of a buried soil located immediately beneath the Minamidake Debris-Avalanche Deposit yields an age of 3740±40 years BP (4230–4190 and 4190–3980 years cal BP), suggesting that the sector collapse occurred at *ca.* 4 ka.

**Key words**: debris-avalanche deposit, radiocarbon age, sector collapse, Shiretoko-iozan Volcano, trench survey

## 1. Introduction

Mt. Shiretoko-iozan is a Quaternary andesitic composite volcano located on the Shiretoko Peninsula, eastern Hokkaido, Japan (Fig. 1). An amphitheatre at the summit (the Minamidake Crater; Katsui *et al*., 1982) and a debris-avalanche deposit at the western foot of the volcano (the Minamidake Debris-Avalanche Deposit; Katsui *et al*., 1982) suggest that sector collapse occurred during its eruptive history, although the timing of this event remains unknown. We conducted a trench survey and performed radiocarbon dating of a buried soil located immediately beneath the debris-avalanche deposit to clarify the timing of the sector collapse event.

## 2. Shiretoko-iozan Volcano

Shiretoko-iozan Volcano (elevation of 1563 m above sea level, base diameter 10 km) is the largest Quaternary stratovolcano on the Shiretoko Peninsula (Fig. 2). The volcanic edifice consists mainly of andesitic lavas (Katsui *et al*., 1982) that yield K–Ar ages of 0.24±0.03, 0.16±0.02, and 0.05±0.04 Ma, suggesting stratovolcano-building activity began at *ca.* 0.24 Ma and continued for more than 200,000 years (Goto *et al*., 2000).

An amphitheatre (2 km across) occurs just south of the summit and opens to the west (Fig. 2). The Minamidake Debris-Avalanche Deposit (Katsui *et al*., 1982) extends from the amphitheatre to the western foot of the volcano, and details of the deposit are described in section 3. Katsui *et al*. (1982) suggested that a violent explosion triggered collapse of the northwestern part of the volcano summit and that the subsequent debris avalanche cascaded down the northwest flank.

The base of the amphitheatre is partly filled with the Namakoyama Lava Dome and the Nanpo Lava. The Namakoyama Lava Dome, located in the middle part of the amphitheatre, is 1000 m across, 220 m thick, and grades to the west into a lava flow that extends for 4000 m (Namakoyama Lava, Fig. 2). The Nanpo Lava, located on the northern rim of the amphitheatre, comprises three lava lobes extending to the northeast, west, and south, respectively, over distances of 700–1500 m. No geochronological data have been reported for the Namakoyama Lava Dome or the Nanpo Lava.

The volcano is active, with recorded eruptions occurring in 1857, 1876, 1889, and 1935 (Katsui *et al*., 1982). These historic eruptions took place at a parasitic crater on the northwestern flank of the volcano (Fig. 2) and were characterized by phreatic explosions with extrusions of large amounts of sulphur (Watanabe, 1940).

## 3. Minamidake Debris-Avalanche Deposit

The Minamidake Debris-Avalanche Deposit is 6 km long (trending E–W), 3 km wide (N–S), up to 30 m

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