

Reexamination of late Pleistocene tephras of Shikotsu-Toya Volcanic Field

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Shikotsu-Toya volcanic field (STVF) in southwestern Hokkaido is located at an arc-arc junction of Kuril and NE Japan arcs, and composed of three caldera volcanoes (Shikotsu, Toya and Kuttara) and Yotei & Shiribetsu stratovolcanoes. Advanced tephrochronological studies have been undertaken to establish the sequence of the pyroclastic flow and pyroclastic fall deposits in STVF (Kasugai et al., 1980; Yamagata, 1994; Machida, 1999). Combined with precise AMS ¹⁴C dating and Marine Oxygen Isotope Stage (MIS) determinations, explosive eruptions have been repeated during 130-40 ka (Yamagata, 1994; Katoh et al., 1995; Machida and Arai, 2003; Sase et al., 2004). However, stratigraphy of these tephras has not been revised since 1990's and identification of tephra layers was mainly based on petrography and refractive index of glasses for the caldera volcanoes. Furthermore, it is suggested that Yotei and adjacent Shiribetsu volcanoes has erupted since ca. 50 ka (Nakagawa et al., 2011; Uesawa et al., 2016).

In this study, geological survey has been done mainly in southern and eastern part of lake Shikotsu (< 65 km). Pyroclastic flow deposits of Shikotsu caldera-forming eruption widely and thickly covered around the lake, we also carried out boring explorations in the proximal area (10 km and 25 km east from the lake center), and observed two cores of Japan Meteorological Agency (10 km south) and National Research Institute for Earth Science and Disaster Prevention (25 km SSE). We used four thick tephra layers as key beds in STVF; Spfa-1 & Spfl, Kt-1, Ssfa & Ssfl and Toya. To correlate tephra layers, we firstly investigate stratigraphic relationships with key tephra layers and then compare petrological characteristics with proximal samples. Then, we distinguished at least 27 tephra layers in STVF, and discovered six new tephra layers in this study. As a results, the beginning of eruptive activity dates back to 120 ka for Shiribetsu volcano and ca. 80 ka for Yotei and Shikotsu volcanoes.

Together with K-Ar ages of volcanic rocks around this area, eruptive history of STVF are summarized as follows. Andesite volcanism had occurred until middle Pleistocene and had terminated around 0.6-0.5 Ma. After a long dormancy (ca. 400 ky), STVF started its eruptive activity 130 ka at Toya, and 120 ka at Yotei volcanoes. A catastrophic caldera-forming eruption occurred ca. 110 ka at Toya volcano. Then, the activity has propagated toward the east. Kuttara and Shikotsu volcanoes started their activity almost simultaneously ca. 90 and 85 ka, respectively. Subsequently, a large stratovolcano; Yotei has been also constructed since ca. 75 ka at the back-arc side of the STVF. The explosive eruptions of VEI=5-6 had repeated at Kuttara and Shikotsu volcanoes, and VEI=6 eruption occurred at Kuttara, and the largest caldera-forming eruption in the STVF occurred at Shikotsu volcano (VEI=7) ca. 45 ka. Since then, Yotei and post-caldera volcanoes in STVF have continued their eruptive activity until now. It should be noted that there exist three active periods during 130-110 ka, 95-75 ka and 60-45 ka in STVF.

Keywords: tephras, late Pleistocene, Shikotsu-Toya Volcanic Field, glass composition