

Tephrochronology in the southwest part of basaltic Izu-oshima volcanic island during last 20,000 years, off Tokyo, Pacific Ocean

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The Izu-oshima volcano (110 km SSW of Tokyo) in northern Izu-Bonin Arc, is one of the most active Quaternary volcanoes in Japan. This volcano originating from basaltic magma has frequently erupted; that is, 12 times of major eruptions occurred after 2 ka. Studies of its eruption history have been carried out by Nakamura (1964), Kawanabe (2012) and so on. However, precise ages of eruption preceding the caldera formation occurred at 1.8 ka have not been determined. Here, we re-examine the chronological framework of eruption history of the Younger Edifice of pre-caldera.

Fall-out tephtras are typically exposed along so-called Great Cut of Beds in SW part of the island. Previous studies by Tazawa (1990) and Uesugi et al. (1994) have described this outcrop, numbering each tephtra layer using serial numbers (O1–95 and Osb96–127). All tephtras except O55 and O58 are proximal fall-out tephtras composed of scoriaceous lapilli and/or scoriaceous ash. Due to the large number of tephtras and lithological similarity, it is difficult to confirm each tephtra defined by previous studies except several characteristic ones such as O95, O58, and O55. O55 and O58 are rhyolitic tephtras from Nijima island and Omuro-dashi submarine depression, respectively (Saito et al., 2007).

Uesugi et al. (1994) estimated the age of the lowest tephtra to be 25 ka or older by using 15 radiocarbon ages. However, this estimation is not reliable because it was determined using two oldest conventional radiocarbon ages (non-calibration) of 14–13 ka for the same horizon (just above O64) and under the assumption that the frequency of the tephtra occurrence (154 years interval) is constant.

In this study, radiocarbon dating was performed for organic tephtric loess collected from 9 horizons above O55 and 16 under O55. The oldest radiocarbon age is 18,598–18,287 cal BP, determined at the horizon 4 m below O95. The age of O95, the most prominent scoria fall deposit, is most likely to be 16–17 ka judging from several radiocarbon ages. It is 2400–3700 years younger than the estimated age (19.4–19.7 ka) by Uesugi et al. (1994). We also recognized widespread K-Ah tephtra using volcanic glass geochemistry. Two radiocarbon ages determined at 45 cm above and 55 cm below K-Ah are 6,882–6,747 cal BP and 8167–8021 cal BP, respectively. These ages are concordant with revised age of K-Ah (7,307–7,196 cal yrs BP; McLean et al., 2018), indicating the age of horizon detected K-Ah is older than estimated age of 6,330±85 yBP by Uesugi et al. (1994). These results indicate that the interval between O95 and K-Ah is shorter (67–75%) than previous estimation, suggesting higher frequent occurrence of the eruptions in this period.

Keywords: Izu-oshima, eruption history, carbon dating