Eruptive stratigraphy and magma compositions of the Tsubota stage (4.0-2.5 ka) in the southern part of the Miyakejima Volcano, Japan

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Miyakejima Volcano, located on the Izu-Mariana Arc, is one of the most active volcanoes in Japan. Based on the eruption frequency, styles and magma compositions, the development history during the last 10,000 years of the volcano is divided into five stages: the Ofunato stage (10-4 ka: including a dormant period from 7 to 4 ka), the Tsubota stage (4-2.5 ka), the Oyama stage I (2.5-1.3 ka), the Oyama stage II (1.3 ka-AD 1469), the Shinmio stage (AD 1469-1983) (Niihori et al., 2003). Clarifying the stratigraphy and petrologic feature of The Tsubota stage is important for understanding long-term eruption history and magmatism of Miyakejima Volcano, because it is the initial stage after the long dormancy (7-4 ka) and is characterized by relatively differentiated andesite magmas. The Tsubota stage products are distributed in Northwestern and Southern parts of Miyakejima island, and the former (TbN) has been investigated by Tsukui et al. (2005). In this study, we focused on the southern part of ejecta of the Tsubota stage (TbS). Geological survey, radiocarbon dating and petrological analysis of juvenile materials were performed to reveal the eruption stratigraphy and magma compositions of the stage.

TbS can be divided into at least 5 units as TbS-1 to 5 (bottom to top), separated by weathered volcanic ash and/or erosional surfaces that represent significant time intervals between eruptions. TbS-1 consists of a scoria fall and pyroclastic surge deposits. The thickness of the scoria fall is > 200 cm at Tsurune-misaki cape, the western coast of the study area. The ^{14}C dating of charcoal in this layer indicates approximately 3,200 yBP. Although pyroclastic surge deposit comprises of > 10 m thick tuff breccia in Tsurune-misaki cape, the thickness and grain size (lapilli tuff) decrease towards Chotaro-ike, the eastern coast of the study area, suggesting that TbS-1 was derived from the source near Tsurune maar (Tsukui and Suzuki, 1998). Source directions interpreted by the impact sag structures and dune migrations are also consistent. TbS-2 is a lava flow showing different groundmass colors (light to dark gray) in the same rock. The ^{14}C age of charcoal in debris flow deposits just beneath the TbS-2 is approximately 2,600 yBP. TbS-3 (light gray-colored) and 4, 5 (dark gray) are also lava flow units.

Phenocryst contents of juvenile materials are generally up to 6 vol. %, and the assemblages are mainly plagioclase, clinopyroxene, orthopyroxene, and opaque mineral. However, TbS-5 rarely contains olivine phenocrysts. TbS-2 and TbS-3 are andesite (SiO_2 = 58.0-59.0 wt. %), whereas other units are basaltic andesite (SiO_2 = 52.9-54.8 wt. %). Whole-rock Mg#s (= 100×Mg / (Mg + Fe)) of andesite and basaltic andesite samples are 31.2-32.9 and 36.8-43.2, respectively.

TbS 1 to 5 cannot be correlated with TbN (composed of 6 units) described by Tsukui and Suzuki (1998) with respect to lithofacies, stratigraphy and petrological characteristics. Thus, it seems to be at least 11 eruptions occurred at the Tsubota stage during 4,000 to 2,500 yBP. The eruption frequency in this stage can be estimated to be 0.73 times or more per 100 years. This value is significantly lower than other stages of the Miyakejima Volcano (e.g., the Shinmio stage: about 2.53 times).

Niihori et al. (2003) reported the systematic cycles for whole-rock Mg# is the highest during the first eruption and it decreases with time in each stage (except for the Ofunato stage). In this cycle, the Tsubota

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stage has been characterized by andesitic (SiO_2 = 55.9-63.2 wt. %) and relatively low Mg# (28.9-38.8) compositions lacking in high Mg# basaltic andesite. However, our data suggest that undifferentiated (high Mg# and basaltic andesite) magmas were ejected around 2,600 yBP and 3,200 yBP in the late Tsubota stage. The banded structure of light and dark gray-colored in TbS-2 lava flow implies the mixing processes of andesite and basaltic andesite magmas in this stage.

References:

Niihori et al. (2003) *Bull.Volcanol.Soc.Japan* **48**, 387-405.

Tsukui and Suzuki (1998) *Bull.Volcanol.Soc.Japan* **43**, 149-166.

Tsukui et al. (2001) *J.Geogr* **110**, 156-167.

Tsukui et al. (2005) *Geological map of volcanoes 12. Geological Survey of Japan, AIST.*

Keywords: Miyakejima Volcano, eruptive stratigraphy, magma composition

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