

Geomorphological and petrological studies on the development of landform and source of the Otsukigawa debris avalanche deposits in the Otsukigawa basin on the Yatsugatake Volcano in central Japan

*Michito Koshiba¹, Mamoru Koarai¹

1. Graduate School of Science and Engineering, Ibaraki University

In the Otsukigawa basin at the eastern foot of Yatsugatake volcano, Higashi-Tengudake, there are debris avalanche deposits with numerous hummock landforms. This is called Otsukigawa debris avalanche (hereinafter ODA) and Otsukigawa debris avalanche deposits (hereinafter ODAD) (Kawachi, 1983a), which are presumably fed by a series of massive collapses extending from Nyuu at the northern end to Iouake flowed about 10 km from the presumed source, formed a mountain range around Matsubara Lake, and blocked Chikumagawa River, creating a natural dam (Inoue et al., 2010). However, the classification of the debris avalanche deposits of Otsukigawa River and the morphology of the hummocks remain to be examined. The triggering event of ODA has been considered to be the AD887 Ninna Gokishichido Earthquake, based on historical data and chronological samples in the sediments (Ishibashi, 1999; Inoue et al., 2010). However, Yamada et al. (2021) pointed out that the ages of wood fossils near Matsubarako Lake obtained in existing studies are dispersed between BC350 and AD1460. Kariya and Kurimoto (2021) confirmed that the age of collapsed sediments near Midori-ike Lake, Inagoyu spa and Honzawa spa is different from that of ODAD by C14 dating of wood fossils. The collapse of AD 887 from a geomorphic perspective suggests that the amount of collapse estimated from the sediments is less than the scale of collapse (Inoue et al., 2010) and that at least four mass movements occurred instead of a single collapse (Machida and Tamura, 2010). In this study, we combined geomorphological and petrographic of ODAD, mainly in the Hummocks area, and the main scarps near the source of the avalanches to clarify the detailed source of the avalanches and to discuss the geomorphological development history of the Otsukigawa basin.

In the area around Matsubarako Lake, there are 54 hummocks and three relatively flat areas separated by hummocks. These flat surfaces have different elevations across the hummocks and can be classified as three lobe-shaped landforms. In addition, there are several lobe-shaped landforms in the upper reaches of Otsukigawa River.

The shape analysis of hummocks shows that most of the hummocks are parallel to the flow direction of debris avalanches, and the flatter the hill, the more pronounced the trend. In addition, hummocks orthogonal to the flow direction are clustered in the center of the channel, which may have been subjected to compressive stress when it stopped.

Rock samples were collected from sampling spot of hummocks distributed around Matsubara Lake, where rocks exposed on the ground surface were observed. Most of the flowstones are composed of red-oxidized amphibole hornblende dacite rubble with well-developed flow channels. This is consistent with the characteristics of the Inagodake lava that constitutes Inagodake. The Tengudake lava exposed on the slide cliff just below Tengudake is hornblende amphibole andesite. However, hornblende amphibole andesite is rarely found in Hummocks.

Therefore, it is considered that the collapse that formed ODAD such as Hummocks originated from Inagodake. The fact that andesites that make up the main scarps near the source are not found in Hummocks suggests that the collapse that formed the huge main scarps on the main ridge is older than

the collapse that formed ODAD. However, the collapse deposits fed by the Tengudake lava, which account for most of the existing main scarps, have not been found. Further geological investigations are needed to understand the relationship of sediment cover in the Otsukigawa basin, where multiple mountain collapses are thought to have occurred.

Keywords: Yatsugatake Volcano, Otsukigawa debris avalanche, Hummocks, Geomorphic analysis, Petrography, Longitudinal of hummock

