Depositional processes and formation of the Sanbongi Fan along the Oirase River: Implications for a volcanic catastrophic flood

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Volcanic eruptions supply a large volume of volcanic debris to surrounding basins by various eruptive and fluvial processes and modify the landform and river morphology drastically (e.g., Smith, 1991; Newhall and Punongbayan, 1996). Japanese archipelago is located in an active arc setting, wherein, active volcanism has a stupendous impact on sedimentary environments and geomorphology. However, most of previous researches have considered the primary eruption processes in the subject fields of volcanology and igneous petrology, whereas only small numbers of studies have addressed the sedimentology, geomorphology, and paleohydrology in relation with sudden and voluminous input of volcanic debris to sedimentary basins in Japan (Nakayama and Yoshikawa, 1997; Kataoka and Nakajo, 2002; Kataoka, 2005). Also, there are very limited numbers of studies discussing the formation processes of terraces and fans influenced by volcanism (Fujiwara, 1960; Fujiwara and Takahashi, 1960; Yokoyama, 1999; Yoshida et al,, 2005; Kataoka et al., 2008) in contrast to the voluminous literature focusing on the relationship with local tectonics, global eustatic sea-level changes, and climate changes during Quaternary. Therefore, this study focus on the geomorphologic and sedimentologic features in the Oirase River catchment implying a volcanogenic catastrophic flood after the 15 ka Towada-Hachinohe ignimbrite eruption.

The Sanbongi Fan (Towada Terrace) is distributed in the downstream area of the Oirase River, consists of 7-8 m thick, lithic rich hyperconcentrated flow deposits including pumice clasts derived from the ignimbrite and well-round boulders up to 3 m derived from bedrock of welded ignimbrite as outsized clasts. The deposits are totally aggradational with no channels and scours, indicating no major hiatus during sedimentation. The depositional facies also indicates that the flood event was almost single and no braided streams but sheet-like flood formed the Sanbongi Fan. The most probable water source for the flood is the Towada caldera lake, as geomorphology and sediments left along the outlet (the upstream of the Oirase river gorge) suggests to a breakout flood rather than a meteorological phenomenon.