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3.4 ka tsunami deposit in the Rokken-gawa lowland near Lake Hamana, Pacific coast of central Japan

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Tsunami deposit found in the Rokken-gawa lowland, near Lake Hamana central Japan, indicates occurrence of tsunamigenic earthquake ca. 3.4 ka. This is the first record of reliable prehistorical tsunami in this region. Seismic reflection profiling and piston coring in the central part of Lake Hamana by Okamura et al. (2009) revealed accumulation of tilting in the lake bottom deposits, which indicated the recurrence of the earthquakes. They also reported possible tsunami deposits accompanying the earthquakes from the cores and suggested that the last seismic tilting event occurred around 3500-4000 cal BP.

We carried out paleoseismological surveys in the Rokken-gawa lowland. A total of 33 continuous samples of sediments, up to 5-m-long, were taken by the array coring survey using handy geoslicer and hand corer. Surface geology of the lowland is composed of upper peat layers (1 to 1. 5-m thick in general) and lower estuary mud and sand layers. One bed of well sorted fine to very fine sand, including rip-up clasts, is identified at the base of peat layers. This sand bed, in which the cross-stratification and inverse grading are common, eroded the lower estuary deposits and is up to 20 cm thick. It can be traced over 500 m along the long axis (N-S in direction) of the lowland and shows a thinning- and fining-landward trend. At some coring sites, the sand bed is separated in two depositional units, upper and lower, by the inserted thin plant debris concentrated layer. The upper unit is much thinner, less than 0.5 cm thick in general, and finer than the lower unit. The horizontal distribution of grain sizes and thickness of the sand bed shows that the sand bed was deposited from landward current. Plant debris concentrated layer separating the two depositional units is fallout deposit from the slack water during the stagnation stage of the current. The layered structure in the sand bed indicates the reactivation of the current after the stagnant stage. Asymmetric thickness of the two units suggests that the upper unit was deposited from weaker current than that formed the lower unit. The asymmetric succession of sand layers was probably formed by a set of run-up and backwash flows as shown in the case of 2004 Indian Ocean tsunami deposits (Umitsu et al., 2007). Umitsu et al. (2007) reported that the distribution of backwash flow deposits is almost limited in the topographic lows on the coastal lowland where the backwash flow was concentrated. The depositional age of the tsunami sand bed in the Rokken-gawa lowland is restricted by four radiocarbon ages. Especially, the age of 3255-3365 calBP and 3 385-3465 cal BP (2 sigma age range) obtained just above the tsunami bed suggest that the tsunami occurred around 3400 cal BP. The Amagi-Kawagodaira tephra (3126-3145 calBP, Machida and Arai, 2003) identified about 20 cm above the tsunami bed supports the estimation of the depositional age.

Deposition of the tsunami sand was followed by an environmental change from estuary to peaty marsh around the study site. This environmental change suggests an abrupt change of the costal topography, such as closure of the tidal inlet. The tsunami bed can be correlated with the tsunami deposit and the last tilting event in Lake Hamana reported by Okamura et al. (2009).

Machida. H. and Arai, F., 2003. Atlas of tephra in and around Japan [Rivised edition]. University

of Tokyo Press, 336pp. (in Japanese).
Okamura, M. et al. (2009) Abstract of Japan Geoscience Union Meeting 2009, T225-P004
Umitsu, M. et al. (2007) Marine geology, 242, 141-153.

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