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Paleo-sea depth changes and tsunami deposits due to the Kanto earthquakes in Ena Bay, south coast of Miura Peninsula

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Paleo-earthquake studies by geological and geomorphological surveys are important for earthquake forecast because they provide information not only of earthquake occurrence time and magnitude but also on environmental changes during co-seismic and inter-seismic intervals.

The recurrence interval of the great interplate earthquake along the Sagami Trough, Kanto earthquake, is estimated to be 200-400 years (Earthquake Research Committee, 2004). However, earthquake histories prior to the 1703 Genroku Kanto earthquake have not been revealed from historical literature. Miura Peninsula, which locates in northeastern part of the Sagami Trough, has been uplifted (Kanie et al., 1989) and tsunamis attacked along the coast of the Kanto region accompanied by the previous Kanto earthquakes (Hatori et al., 1973). Shimazaki et al. (2009) conducted Geo-slicer surveys in Koajiro Bay, Miura Peninsula and investigated histories of the previous Kanto earthquakes. As a result, they suggested that the 1293 earthquake causing destructive damage in and around Kamakura was the Kanto earthquake prior to the 1703 Genroku earthquake, as pointed out by Ishibashi (1991).

The purpose of this study is to reveal histories and identify tsunami deposits of previous Kanto earthquakes, and processes of uplift and subsidence from a reconstruction of paleo-sea depth using diatom and grain size analyses in Ena Bay, Miura Peninsula. In May and November, 2009, we conducted 3m length handy Geo-slicer surveys at Ena Bay, south coast of Miura peninsula. We have basically analyzed 3 cores (ENA-C, ENA-E and ENA-F).

As a result, three (ENA-E) or four (ENA-F) coarse layers including shell fragment and gravel are recognized. These event deposits erode a subsurface layer indicating that they accompanied with a strong current. Diatom analysis indicates an increase or a decrease of relative abundance of marine species, suggesting a change of sea depth. Namely, marine benthic species gradually decrease prior to the deposition of tsunami deposits indicating coastal uplift or sea level fall, and benthic species increase above tsunami deposits indicating coastal subsidence or sea level rise. It is revealed that Miura Peninsula uplifted about 1.5 m at the time of the 1923 Kanto earthquake and now subsides with a rate of about 3.7 mm/year from tide gauge record at Aburatsubo (Geospatial Information Authority of Japan, 2010). The characteristics of diatom analysis suggest that environmental changes corresponding to these co-seismic and inter-seismic crustal movements. This is consistent with the results in Koajiro Bay (Shimazaki et al., 2008). We concluded that these event layers are tsunami deposits accompanied with the previous Kanto earthquakes, named as T1, T2, T3, T4 and T5 unit from the top to the bottom, respectively.

The T1 unit is concluded as a tsunami deposit accompanied with the 1923 Taisho Kanto earthquake using Pb-210 dating. However, radiocarbon ages indicate that the T2, T3, T4 and T5 unit deposited about 2000 cal. yBP, 3000 cal. yBP, 3300 cal. yBP and 3700 cal. yBP, respectively. This is consistent with histories of previous Kanto earthquakes inferred from marine terraces in Boso Peninsula (Shishikura, 2003). Moreover, at least three coarse-grained layers are recognized between T1 and T2 at ENA-C. These layers are possibly identified as tsunami deposits from similar tendencies of grain size distribution and diatom species.

Keywords: Kanto earthquake, Tsunami deposit, Ena bay, Paleo-sea depth change, Diatom analysis