New insights into the middle and late Holocene coastal movements and tsunamis in the Shizuoka Prefecture

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Geological evidences of coastal movements and paleotsunamis relating to the Nankai Trough earthquakes are gradually increasing in Shizuoka region. I summarize the latest achievements in this study field based on the results of sediment core analyses obtained from the coastal lowlands along the western Suruga Bay and Enshu-nada. Comparing these data with the predicted coastal movements by the "Tokai earthquake model", I make reference to the variety of occurrence mode of the Nankai Trough earthquakes.
Historical documents reported the coastal uplift and subsidence during the 1854 Ansei-Tokai earthquake in the Shizuoka region; eastern Shizuoka region close to the Suruga Trough axis (e.g., around the Cape Omaezaki and western Suruga Bay coast) was remarkably uplifted (1.0-1.5 m), and the western region distance from the trough axis such as around Lake Hamana was subsided at tens of centimeters. Opposite phase of coastal deformation, subsidence in eastern region and uplift in the western region has been shown by the leveling during this interseismic period. This reversal of coastal deformation trend has been interpreted as the deformation of upper plate in response to the subduction of the Philippine Sea Plate; plate coupling and release of accumulated strain along the plate boundary. To explain this phenomenon, current fault model for the Tokai earthquake is approximated by single large slip surface on the plate boundary.
However, centennial-scale coastal deformation predicted by the Tokai earthquake model does not always correspond to the millennium-scale coastal movements suggested by the geological evidences. Southern coast of the Omaezaki area (Shirowa area) solely shows remarkable uplift rate; up to 1.5 m/1000 y. Along the Suruga Trough axis, uplift rate rapidly decreases in short distance from the Shirowa area. Average uplift rates are ~0.7 m/ 1000 y. and ~0 m/ 1000 y. at the sites of ca. 2 km and ca. 10 km north of Shirowa area, respectively.
Coastal uplift rate also decreasing in the trench-normal direction (westward from the Shirowa area) changes to subsidence after that. At the Kikukawa lowland, about 10 km west of the Shirowa area, average uplift rate in the last 7000 years is estimated to be ~0.4 m/1000 y (Kashima et al. 1985). The Otagawa lowland, about 15 km west from the Kikukawa lowland shows a rapid subsidence rate of ~1.0 m/ 1000 y (Fujiwara et al., 2015). About the same subsidence rate is estimated in the western Hamamatsu Plain, about 20 km west from the The Otagawa lowland (Fujiwara et al., 2014).
It is unreasonable to explain the local uplift around the Shirowa area by the Tokai earthquake model with a large single fault plain, which produces coastal deformation having a long wavelength with 100 km-order. Possible cause of the local uplift around the Shirowa area is a subsidiary fault in the upper plate. Large subsidence rate in western Shizuoka region is also difficult to explain by using the Tokai earthquake model.
While the number of reported tsunami deposits and possible tsunami deposits has been increasing in the Shizuoka region, quality and quantity of these data are not adequate to reconstruct the wave height and inundation area of each paleotsunami. Fujiwara et al. (2013) traced the landward extent of some tsunami deposits from the contemporary shoreline in the western Hamamatsu Plain. The result suggests that unusually large tsunamis, so called "the maximum possible tsunami" supposed by the Cabinet Office, Government of Japan has not occurred in the last 4000 year.
As mentioned above, results of recent paleoearthquake researches in the Shizuoka region make us to change our understanding about the Tokai earthquake. These data would help to explain the

variability of the occurrence mode of the Nankai Trough earthquakes.

Keywords: Nankai Trough, Paleoearthquake, Shizuoka, Paleotsunami

