Holocene depositional environment and crustal movement trend at the Omoto Plain, northern Sanriku coast, northeast Japan

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Along the Sanriku coastal area, discrepancies in crustal movement trend have been suggested between uplift on a timescale of 10^5 years and subsidence on a timescale of 10^1 –10^2 years. And, the cause of the discrepancies has been discussed in relation to megathrust earthquake cycle (e.g., Ikeda et al., 2012). After the 2011 Tohoku-oki earthquake, Holocene subsidence trend has been suggested along the central to southern Sanriku coast (south from Miyako) on the basis of well-dated sedimentary successions in the alluvial plains (e.g., Niwa et al. 2017). However, such crustal movement data on a timescale of 10^3 –10^4 years has not been obtained along the northern Sanriku coast (north from Miyako) yet. Therefore, whether subsidence trend on a timescale of 10^3 –10^4 years have applicable to earthquake cycle model along the whole Sanriku coast or style of crustal movement can be variable within the Sanriku coast is still open to question. In this study, we investigate Holocene sedimentary succession and crustal movement trend of the Omoto plain, located at northern Sanriku coast, on the basis of two sediment cores.

Well-dated Holocene sediment showed environmental changes influenced by sea-level changes; upward growth and landward progradation of barrier/flood tidal delta from 10 to 9.0 ka BP, estuarine environment after decay of barrier/flood tidal delta from 9.0 to 8.0 ka BP, and regressive prodelta ~ delta front and subsequent fluvial environment after 8.0 ka BP. In the upstream site, delta plain sand and silt with upward-finning successions, at uppermost of which abundant tidal flat diatom species is identified, covers prodelta ~ delta front sediments and is dated to 7.4 to 7.2 ka BP.

Uppermost part of delta plain sediments is considered to be deposited under intertidal environment on the basis of abundance of tidal flat diatom species. Thus, height of this horizon (-7.6 m relative to the present sea-level) approximates paleo sea-level at 7.4 to 7.2 ka BP. This level is higher than paleo sea-level in the Tsugaruishi plain at the same timing (-11.5 m relative to the present sea-level; Niwa et al., 2017). In the Tsugaruishi plain, ca. 6 m thick of marsh sediments which covers mid-Holocene intertidal sediments, and aggradational sediment stack of middle to late Holocene delta system are interpreted to reflect millennium-scale relative sea-level rise induced by subsidence trend (Niwa et al., 2017). On the other hand, in the Omoto plain such sedimentary property shown in the Tsugaruishi plain is not observed. This suggests that little upward addition of accommodation space has been produced in the Omoto plain during middle to late Holocene. These features indicate that subsidence trend (, if it exists at all,) is not noticeable in the Omoto plain in contrast with the Tsugaruishi plain.

This difference corresponds to contrast between central to southern Sanriku with large coseisimic subsidence during the 2011 earthquake and northern Sanriku with small coseismic subsidence. Results of this study suggest that style of crustal movement is different within the Sanriku coast across vicinity of Miyako.

Reference

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Niwa et al. (2017) Quaternary international, 456, 1 –16.

Keywords: northern Sanriku coast, Holocene, vertical deformation trend, 2011 Tohoku-oki earthquake

