# Segmentation of crustal deformation area within the Sanriku coast, northeast Japan, on the basis of spatial distribution of millennial-scale crustal movements

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Along the Sanriku coast, northeast Japan, discrepancies in crustal movement have been reported between uplift on a timescale of $10^5$ years (Koike and Machida, 2001) and subsidence on a timescale of $10^1$ –$10^2$ years (Kato, 1983; Ozawa et al., 2011). Some hypothetical models, which explain these discrepancies, are proposed in relation to megathrust earthquake cycle (e.g., Ikeda et al., 2012; Nishimura, 2014). These models assume that crustal movement style is same within whole part of the Sanriku coast, and show that amount of accumulation of uplift exceeds that of subsidence during one earthquake cycle. However, because of lack of age data of marine terrace except for Hachinohe to Kuji (Miyazaki and Ishimura, 2018) and of putative marine terrace along the southern part of the Sanriku coast (Koike and Machida, 2001), spatial distribution of crustal movement cannot be estimated on the basis of only feature of Pleistocene marine terrace. On the other hand, sedimentary successions in alluvial plains distributed along the Sanriku coast may offer records of millennial-scale crustal movements during the Holocene.

Recent sediment core analyses and radiocarbon dating shows sedimentary succession influenced by sea-level changes during the past 10,000 years. In the Rikuzen-takata plain, Kesennuma Okawa plain, and Onuma, on the southern Sanriku coast, a millennial-scale subsidence is inferred on the basis of height distribution of intertidal sediments which is lower than non-tectonic relative sea-level (Niwa et al., 2014, 2015; Ishimura and Miyauchi, 2017). Depositional environment estimated from a sediment core of the Tsuya plain, between Kesennuma plain and Onuma, also support a millennial-scale subsidence (Niwa et al., 2016). In the Tsugaruishi plain, on the central coast, height distribution of intertidal sediments and aggradation of delta sediments since ca. 7500 cal BP indicates subsidence on a millennial-scale (Niwa et al., 2017). On the other hand, sedimentary feature typical of subsidence area is not identified in sediment cores obtained from Omoto plain, northern Sanriku coast, suggesting no noticeable subsidence on a millennial-scale (Niwa et al., in press).

Inferred millennial-scale crustal movements shows subsidence trend on central to southern Sanriku coast and relatively uplifting trend on northern part of the coast. This spatial distribution of millennial-scale crustal movements is consistent with geodetically estimated subsidence rate on a timescale of $10^1$ –$10^2$ years (Kato, 1983) and the amount of subsidence at 2011 Tohoku-oki earthquake (Ozawa et al., 2011), indicating that the Sanriku coast presents a variety of crustal movement styles. These results suggest that the northern and the central to southern parts of the Sanriku coast should be considered separately when assessing crustal deformation related to subduction.

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