

Quaternary back-arc strain localization of Northeast Japan accommodated by fault-related folding

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Styles and mechanisms of permanent deformation of Northeast (NE) Japan has been widely discussed based on crustal structures, topography, seismicity, and other geophysical dataset and analyses in millennial timescale. To clarify its structural evolution, mountain building processes and possible mechanisms, here we show across-arc distribution of Quaternary deformation of NE Japan estimated by structural analysis on deformed middle to late Pleistocene fluvial and marine terraces combined with structural datasets mainly based on seismic reflection profiles and Plio-Pleistocene stratigraphy. Overall topographic characters of the NE Japan are mainly subdivided into three domains, including (a) back-arc sedimentary basins, (b) Ou Backbone Ranges, and (c) coastal mountain ranges facing the Pacific Ocean. Whereas the Backbone Ranges comprises the most prominent and highest topographic domains among them, our structural analyses clearly indicate that larger permanent strains have been accommodated by N to NNE trending active fault-related folds above blind thrusts beneath back-arc sedimentary basins, rather than those on either or both flanks of the Backbone Ranges with much slower fault slip rates. This view on strain localization is consistent with structural analyses on compiled Neogene outcrop data. Structural growth of most seismically active, offshore structures in back-arc are partly manifested by remnants of uplifted and/or folded marine and fluvial terraces. Interestingly, back-arc sedimentary basins located along the Sea of Japan coast simultaneously experienced rapid subsidence during Quaternary, so that near surface signals of structural growth of active structures are mostly concealed beneath alluvial plains. Such back-arc strain localization in NE Japan can be interpreted as combinations of localized post-rift positive inversion of normal faults within most prominent and mechanically and thermally weakest Miocene back-arc failed rifts within the overriding plate, and fast subsidence prompted by densification of the lower crust near rift axis intruded by substantial mafic rocks. Back-arc strain localization characterize structural evolution and mountain building processes in NE Japan and is considered as a primary response of the overriding plate to subduction which should be taken into account in understanding geodynamic processes of this subduction margin.

Keywords: Active fault , Northeast Japan, Fault-related fold, Quaternary deformation