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The Cenzonic tail derived structures of transtensional faults in Bohai Sea, East China

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Two pre-exsiting giant strike-slip fault zones, Tanlu Fault Zone and Zhangpeng Fault Zone, comprise a conjugate strike-slip fualt system in Bohai Sea. They reactivated and developped into many branches under the extensional and shear stresses indued by the combined action of plate collision and deep mantle upwelling in Cenzonic. In response to the stress concentration at the tails of those branches, various kinds of tail derived structures develop. To systematically describe and distinguish above tail derived structures, we reviewed numerous high-resolution seismic sections and plandimetric maps of Bohai Sea, such as deteiled fault system diagroms, coherence slices and 3D visualization structural diagrams, and distinguished three types of tail derived structures at the tails of the transtensional branches of Tanlu Fault Zone and Zhangpeng Fault Zone, based on their geometric characteristics, namely, extensional horsetail/imbricate fan, wedge-shaped tail, and mixed tail of extensional horsetail fan and wedge-shaped tail (the tail derived structures develops in stepovers of transtensioanl branches are not discussed in this paper).

Extensional horsetail fan mainly develops at fault tails with releasing single bend and the horsetail splay faults are T faults (about 45° to main strike-slip fault), while the wedge-shaped tail mainly develops at fault tails unfavorable for strike slip, they could be straight or with gentle restaining single bend and the derived faults are mainly antithetic faults (R’ shears, normally above 70° to main strike-slip fault). If the fault tail developing a wedge-shaped tail has a small releasing single bend at its tip, a extensional horsetail fan would occur at the tip of the wedge-shaped tail, viz., mixed tail derived structure. All above tail derived faults show normal throws in profile and develop in extensional quadrant of the hanging wall of those branches. And with the shear of above main strike-slip faults, the angles bewteen the main faults and their derived faults become larger, block rotation and compressional faulted anticline are commonly observed in wedge-shaped tail in this process, but no reverse faults are observed.

Overall, the geometries and structures of tail derived stuctures are strongly controlled by the tail shape of a fault, and by the evolutionary stage of the fault. The tensile stress derived by releasing single bend induces the deveopment of T fault, while the weak compressive stress derived by the tail unfavorable for strike-slip leads to the initiation of antithetic faults. And the extensional geodynamic background induced by deep mantle upwelling contributes to the absence of reverse faults.