Stratified and polygenetic en echelon detachment folds: Cases for Nankalayuergun fold zone, North Tarim Basin, NW China

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The Nankalayuergun fold zone in the North Tarim Basin, NW China, provides an exceptional opportunity for documenting the structural characteristics and evolution of en echelon folds along transpressional fault zone. However, the genetic mechanism of these en echelon detachment folds remains debatable due to poor understanding of the deep structure. Combined with seismic and borehole data, we characterized the geometries and kinematics of Nankalayuergun fold zone, revealed its Cenozoic evolution, and discussed the formation mechanism. The stratified fold zone was geometrically decoupled by salt structures, and the structural style of three salt-influenced folds had individual characteristics due to differences in salt thickness. The timing and strength of Cenozoic deformation of three en echelon detachment folds has a sequential evolution tendency from northwest to southeast. The structural relief of supra-salt fold is the sum of Cenozoic detachment and sub-salt Paleozoic-Mesozoic transpressional folds, indicating that sub- and supra-salt structures are kinematically coupled. Segmentation of Deep Nankayuergun Transpressional Fault (DNTF) can be observed by gravity and seismic data. The supra-salt detachment folds differ from classic echelon structures in that it is only located on the active side of the DNTF. Furthermore, the hinges of the supra-salt folds located right above the sub-salt transpressional fold scarps, corresponding to the reactivation of three DNTF segments. The transpressional regimes, sub-salt structures, and the heterogeneity of salt rock are major factors forming the polygenetic echelon detachment folds. The case presented in this study displayed a specific pattern of salt-influenced en echelon structures along transpressional faults and highlighted the influence of pre-existing structures on the geometry and kinematics of shallow folds, even though salt can decouple sub- and supra-salt deformation.