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Kink-style detachment folding in Bachu fold belt of central Tarim Basin, China: geometry and seismic interpretation

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The phenomenon of Kink banding is well known throughout the engineering and geophysical sciences. Associated with layered structures compressed in a layer-parallel direction, it arises for example in stratified geological systems under tectonic compression. Our work documented it is also possible to develop super large-scale kink-bands in sedimentary sequences. We interpret the Bachu fold uplift belt of the central Tarim basin in western China to be composed of detachment folds flanked by megascopic-scale kink-bands. Those previous principal fold models for the Bachu uplift belt incorporated components of large-scale thrust faulting, such as the imbricate fault-related fold model and the high-angle, reverse-faulted detachment fold model. Based on our observations in the outcrops and on the two-dimension seismic profiles, we interpret that first-order structures in the region are kink-band style detachment folds to accommodate regional shortening, and thrust faulting can be a second-order deformation style occurring on the limb of the detachment folds or at the cores of some folds to accommodate the further strain of these folds. The belt mainly consists of detachment folds overlying a ductile decollement layer. The crests of the detachment folds are bounded by large-scale kink-bands, which are zones of angularly folded strata. These low–signal-tonoise, low-reflectivity zones observed on seismic profiles across the Bachu belt are poorly imaged sections, which resulted from steeply dipping bedding in the kink-bands. The substantial width (beyond 200m) of these low-reflectivity zones, their sub-parallel edges in cross section, and their orientations at a high angle to layering between 50 and 60 degrees, as well as their conjugate geometry, support a kink-band interpretation. The kink-band interpretation model is based on the Maximum Effective Moment Criteria for continuous deformation, rather than Mohr-Column Criteria for brittle fracture. Seismic modeling is done to identify the characteristics and natures of seismic waves within the kink-band and its fold structure, which supplies the further evidences for the kink-band interpretation in the region.