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Causes of along-strike structural segmentation in the Southwest Tien Shan foreland, NW China

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Structural inheritance and variations in the thickness of the pre-existing sediment pile commonly act to segment and compartmentalise deformation in foreland settings. These controls have important implications regarding the style and organisation of structures (folds and thrusts) and hence the distribution of hydrocarbons in compressional settings. The fold-thrust belts of the Southwest Tien Shan foreland (NW Tarim Basin), NW China, show dramatic along-strike variations in deformation style and geometry which allow the foreland to be divided into a series of distinct structural segments. A combination of field investigation and satellite image interpretation have been used to examine the relationships between pre-existing structures, variations in the thickness and rheology of the sediment pile, and subsequent segmentation of the foreland. In the far west, the Kashgar Fold Belt is dominated by E-W trending detachment folds which deform a thick (up to 10 km) Cenozoic sediment pile. As the Cenozoic sediments thin onto an intrabasinal high to the east, there is a transition from detachment folding to imbricate thrusting. The imbricate thrusts define the Keping Shan Thrust Belt, a 250-300 km wide arcuate salient. The sediment pile of the Keping Shan is dominated by Paleozoic strata, with only a very thin Cenozoic succession and a complete absence of Mesozoic sediments. Internally, the geometry of the Keping Shan is complex and a series of major strike-slip faults, which are oblique to the general trend of the belt, further compartmentalise the thrust system. These faults correspond to abrupt lateral variations in the thickness of the Paleozoic stratigraphy, related to an important phase of extension during the Early Permian. To the west, the Keping Shan tapers into a major recess in which there is very little surface deformation. This transition may relate to a substantial thickening of the syn-compressional Late Cenozoic sediment pile, which may have acted to suppress the structural evolution of folds and thrusts altogether. Understanding the fundamental controls on the along-strike segmentation of the Southwest Tien Shan foreland provides not only an insight into the active deformation of the hydrocarbon-rich Tarim Basin, but can be applied as an analogue for similar fold-thrust belts worldwide.