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Role of detachments and thrust kinematics in Structural evolution of Kohat and Potwar fold thrust belt in Pakistan

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The Kohat and Potwar fold thrust belts in Pakistan represent the outermost external zone of the Himalayan fold and thrust system. The Main Boundary thrust marks their northern extent, showing that they are genetically linked; however, both exhibit a distinct contrast between the structural style at the surface and subsurface. This contrast becomes more conspicuous at the leading edge of the thrust belt where the Potwar allochothon extends further south, linked to Kohat in the north via an active strike-slip fault. Previous workers explained the structural evolution of the two belts separately, disregarding the influence of similar fold and thrusts developed in both belts. This research focuses on the preparation of a 3D structural model at the boundary of the two thrust belts to understand similarities and differences in their structural style and evolution. The model is constrained by integrating field, seismic and well data for better subsurface interpretation. Cross sections show that Potwar evolved on thrust faults originating from a basal detachment in Precambrian (pC) salt and terminating in Miocene Molasse forming duplexes of pre Himalayan strata. To the south, the Potwar allochothon is glided over a salt detachment with rare internal deformation toward its leading edge, forming fault bend fold thrust structure known as Salt range. The structural evolution towards the west in Kohat results from deformation on multiple detachment horizons at the pC salt, Eocene evaporites and Miocene Molasse. Disharmonic folding over Eocene evaporites is evident from their presence in the cores of outcropping folds. In the subsurface, closely spaced thrusts cut up section from basal detachment terminates in Eocene evaporites forming duplex in northern part of area. In south change of lithological facies from evaporites to limestone shift detachment level upward in to molasse strata which resemble structural style in northern Potwar. Thrusts at the surface evolved from the upper detachment while some out-of-sequence thrusts cut up section from breached duplexes. Differences between thrust spacing and variable displacement on thrusts significantly affected the propagation of deformation toward the foreland in both belts. This difference lead to the formation of the intervening Kalabagh strike-slip fault as a tear fault. Our model suggests that structural variation in both belts results from the nature, position and change of detachment levels on which deformation progressed toward foreland