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Deformation and kinematics of the central Kirthar Fold Belt, Pakistan

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The Kirthar Fold Belt is part of the lateral mountain belts in Pakistan linking the Himalaya orogeny with the Makran accretionary wedge. This region is deforming very oblique/nearly parallel to the regional plate motion vector. The study area is situated between the prominent Chaman strike-slip fault in the West and the un-deformed foreland (Kirthar Foredeep/Middle Indus Basin) in the East. The Kirthar Fold Belt is subdivided into several crustal blocks/units based on structural orientation and deformation style (e.g. Kallat, Khuzdar, frontal Kirthar). This study uses newly acquired and depth-migrated 2D seismic lines, surface geology observations and Google Earth assessments to construct three balanced cross sections for the frontal part of the fold belt. Further work was done in order to insure the coherency of the built cross-sections by taking a closer look at the regional context inferred from published data, simple analogue modelling, and constructed regional sketch sections.
The Khuzdar area and the frontal Kirthar Fold Belt are dominated by folding. Large thrusts with major stratigraphic repetitions are not observed. Furthermore, strike-slip faults in the Khuzdar area are scarce and not observed in the frontal Kirthar Fold Belt. The regional structural elevation rises from the foreland across the Kirthar Fold Belt towards the hinterland (Khuzdar area). These observations indicate that basement-involved deformation is present at depth. The domination of folding indicates a weak decollement below the folds (soft-linked deformation). The fold pattern in the Khuzdar area is complex, whereas the large folds of the central Kirthar Fold Belt trend SSW-NNE to N-S and are best described as large detachment folds that have been slightly uplifted by basement involved transpressive deformation underneath. Towards the foreland, the deformation is apparently more hard-linked and involves fault-propagation folding and a small triangle zone in Cretaceous sediments. Shortening is in the order of 21-24% for the frontal structures. The deformation above the weak Eocene Ghazij shales is partly decoupled from the layers underneath, especially where the Ghazij shales are thick. Thus, not all structures visible at surface level in the Kirthar Fold Belt are also present in the deeper section, and vice versa (disharmonic folding).
The structural architecture in the frontal central Kirthar Fold Belt shows only convergent structures nearly parallel to the regional plate motion vector of the Indian plate and thus represents an example of extreme strain partitioning.