

EGU2020-18993, updated on 07 Jul 2022

<https://doi.org/10.5194/egusphere-egu2020-18993>

EGU General Assembly 2020

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Structural relief across the NW segment of the Zagros Mountain Front Flexure in the Kurdistan Region of Iraq: implications for basement thrusting

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Within the NW segment of the Zagros belt in the Kurdistan Region of Iraq, the Zagros Mountain Front Flexure separates the High Folded Zone from the Foothill Zone and forms a pronounced topographic and structural step. Due to the lack of outcrops and subsurface data, balanced and kinematic valid geometrical interpretations for the subsurface deformation associated with this step are not well constrained yet. To solve this, we estimated the structural relief across seven regional transects crossing the Mountain Front Flexure and we constrained the geometry of deformation from deformed-state and forward-modeled balanced cross-sections. The calculated structural relief for six out of seven transects ranges from 2 to 3 km. By using forward modeling, we show that predominantly thick-skinned deformation is needed to explain this amount of relief across the Mountain Front Flexure. Our best-fitting result suggests c. 6.5 km of displacement along a basement thrust fault that dips c. 25° at the top of the basement and that is shallowing downwards. About 4.2 km of this displacement on the basement fault were accommodated up-section by thrust-related and detachment folding of the Triassic and younger units within two prominent anticlines. About 2.3 km of displacement was transferred to the Foothill Zone, forming detachment folds above the Triassic detachment level. Inclined river terraces on the flank of anticlines within the Foothill Zone indicate ongoing displacement on this basement fault. The amount of shortening within the low topographic part of the belt from the deformation front to the limit of seismogenic thrusting within the Imbricated Zone, implies that the Late Miocene to Quaternary shortening rates there were much lower than the present-day geodetically derived convergence rates for this part of belt. These results shed new light on the geometry of the Zagros and its structural evolution.