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Fault & Fracture Development in Foreland Fold and Thrust Belts - Insight from the Lurestan Province, Zagros Mountains, Iran

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SUMMARY

The Simply Folded Belt of the Zagros Mountains, Iran, represents one of the best examples of foreland fold and thrust belt. A regional fault and fracture analysis of the Cenomanian – Coniacian Ilam and Sarvak formations, exposed in southern Lurestan Province, is presented as a case study for fault and fracture development in folded belts. The area is characterised by the occurrence of gentle to tight anticlines and synclines whose NW-SE axial traces are parallel to the general trend of the belt. Fold style is intimately related to both vertical and lateral facies distribution. The two formations belong to the Bangestan Group and, in this area, they represent the oldest strata exposed in the core of most anticlines outcropping at surface.

Distribution, kinematics and timing of faults and fractures have been characterised through extensive fieldwork and interpretation of orthorectified QuickBird imagery and 3-D virtual outcrop models based on LiDAR technology. Data have been collected from 10 anticlines covering an area of approximately 150 x 150 km. Key outcrops for fracture and fault kinematics interpretations are presented.

Field observations and interpretation of QuickBird and 3-D photorealistic models suggest a complex fault and fracture geometry and timing relationship. Both fractures and faults record pre-folding to uplift-related deformations. Pre-folding structures are typically represented by small-scale, flat-ramp-flat geometry thrusts, systematic veins and stylolites, which are superimposed on inherited syn-sedimentary normal faults. Folding-related structures generally reactivated pre-existing fracture and fault planes. Strike-slip faulting is typically recorded as the last faulting event and is probably related to late stage of fold tightening. All structures are geometrically and kinematically consistent with the trend of the Arabian passive margin and its subsequent tectonic inversion. Uplift and stress release induced opening and propagation of through-going fractures.

Faults and fracture orientations generally change accordingly with local fold trend. Symmetry between fracture and fold orientation, although commonly interpreted as evidence for folding-related fracture development, is here interpreted as evidence of syn- to post-folding local vertical axis passive rotation.