

Paleostress Magnitudes an Active Foreland Fold-Thrust Belts from Tectonic Analysis of Calcite Twins. Examples from Taiwan and the Zagros

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Computerized inversion of calcite twin data provides 5 parameters among the 6 of the complete stress tensor: it is to date the only technique which allows simultaneous calculation of principal stress orientations and differential stress magnitudes from a twin set.

In the western Taiwan Foothills, twins collected within Pliocene reef limestones on top of outer anticlines reveal large pre-folding and smaller post-folding differential stresses related to the Plio-Quaternary WNW compression: folding presumably caused rapid uplift and erosion, leading to both decreasing lithostatic load and differential stresses. Stress estimates at the scale of individual folds as well as entire orogens support a first-order control on differential stress levels by the depth of overburden, and therefore a frictional strength of the upper crust as revealed by contemporary stress measurements.

In the Zagros, twins from veins and host rocks of late Cretaceous to Miocene age reveal a late folding NNE compression related to Arabia-Eurasia collision. Differential stresses are unexpectedly low and roughly constant across the Simply Folded Belt (SFB) : they disagree with previously reported stress values which are much higher and show a strong decay across both the belts and their undeformed forelands. The relative homogeneity of differential stresses agrees with the homogeneously distributed shortening across the SFB, in contrast to classical fold-thrust wedges. This supports buckling of the cover sequence over the weak Hormuz salt as the dominant mechanism of deformation. Internal viscous-plastic processes help to keep stress level in this detached cover beyond the frictional yield, thus lowering its seismogenic potential.

These studies underline the potential of calcite twins analyses in constraining both deformation mechanisms in foreland fold belts and upper crust mechanics.

Key words: Calcite twins, differential stresses, foreland fold-thrust belts.