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Mechanisms of active folding of the landscape (Southern Tianshan, China)

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We explore the kinematic mechanisms of active large-scale folding, based on analysis of a major anticline of the Kuche thrust belt of the southern Tianshan, taking advantage of a combination of excellent surface exposures, limited erosion and good subsurface imaging.

The Quilitak anticline is a complex fault-bend fold having a subsurface width of 10-20 km that contrasts with its surface expression as a 5-7 km wide mountainous ridge. The abrupt edge of mountainous relief forms a continuous linear front characterized by steep triangular facets that we quantitatively show to be formed by active folding of a pediment across an axial surface along which bedding dips change abruptly. The Quilitak topographic front is a giant $\sim$600 m high cumulative fold scarp. The fold scarp forms where an active axial surface, which is a discontinuity in instantaneous uplift rate, moves with respect to the land surface. The Quilitak triangular facets thus directly reflect active underlying kink-band migration and non-collocated uplift. The topographic relief and morphology of Quilitak anticline reflects incremental fault-bend folding that has accumulated since an acceleration in deformation rate of about an order of magnitude from $\sim$0.6 mm/y to $\sim$4-5 mm/y.

Balanced cross-sections logged across the Quilitak active axial surfaces at the topographic front show that recent sediments record bed-by-bed growth of the fold scarp. Analysis of layer shapes shows that the active hinge zone has a finite width ($\sim$115m) across which progressive folding occurs. The dip of bedding strongly depends on erosion/sedimentation processes, but can be successfully approximated using a self-similar curved-hinge kink-band migration model. Fitting this model to horizon shapes

yields robust estimates of the horizontal displacement of the axial-surface for each mapped bed with an estimated displacement rate on an *en echelon* fold-scarp segment near Kuche of $\sim$1-2 mm/yr, which is the horizontal component of fault slip at depth.