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Partitioning of oblique convergence coupled to the fault locking behaviour of fold-and-thrust belts: evidence from the Qilian Shan, northeastern Tibetan Plateau

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Oblique plate convergence is common, but it is not clear how the obliquity is achieved by continental fold-and-thrust belts. We address this problem in the Qilian Shan, northeastern Tibetan Plateau, using new fieldwork observations, geomorphic analysis and elastic dislocation modeling of published geodetic data. A thrust dipping SSW from the northern range front underlies steeper, bivergent, thrusts in the interior ranges. Cenozoic thrust-related shortening is estimated to be ∼140-160 km, based on two transects. Elastic dislocation modeling indicates that strain in the interseismic period is consistent with a low angle detachment thrust locked at ∼20 km, dipping SSW at ∼13o. We suggest that this detachment is located above crust of the North China Block, which was originally underthrust during Paleozoic orogeny. Dislocation models place the strike-slip displacement at the down-dip limit of the locked portion of the detachment, along the left-lateral Haiyuan Fault. This configuration is consistent with the strain partitioning described for oceanic subduction zones, but not has previously been shown by dislocation models of continental interiors. The marginal, strike-slip, Altyn Tagh Fault influences thrusting within the Qilian Shan for 100-200 km from the fault, but, contrary to previous models, does not control the more regional structure of the range, where basement structures have been reactivated along an ∼800 km long Paleozoic orogenic belt. Overall, the Qilian Shan has elements of the main Tibetan Plateau in nascent form: active thrusts are marginal to an interior that is developing plateau characteristics, involving low relief, and low seismicity apart from along strike-slip faults.