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Shortening rates across the foothills of the Western Kunlun (Xinjiang, China) inferred from geomorphic measurements and cosmogenic 10Be dating.

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The Western Kunlun, which bounds north-western Tibetan Plateau, is one of the largest mountain range of Asia, with altitudes peaking at 6500-7500 m asl, and crustal thicknesses of up to ∼70 km. North of the plateau, in the foreland of the range, an active fold-and-thrust belt extends 200 km into the Tarim basin, but remains poorly documented regarding amounts of shortening or deformation rates. We discuss the distribution of deformation on the basis of a study of specific foreland folds and faults using high resolution satellite imagery, digital elevation models, seismic reflection data, on-site topographic measurements and cosmogenic isotope dating.
South of Hotan city, the 250 km-long Tekelike Fault – the mountain-front thrust that dips beneath the 45 km-wide, 5400m-high Tekelike Range, a basement ramp-anticline - cuts and offsets terraces abandoned by the Karakash River. 10Be concentrations of surface and sub-surface samples from these terraces upper-most deposits yield an exposure age of about 100 kyr for the upper terrace that lies 140 m above the present river bed, implying an incision rate of 1.4 mm/yr. Assuming a dip of 45 +/-15° and neglecting changes in river dynamics over this time period, this age would imply a minimum, average shortening rate of 1.4 +/- 0.7 mm/yr across the thrust.
Farther North, 100 to 200 km-long WNW-ESE trending anticlines deform the thick Tertiary and Quaternary sedimentary series lying in the foreland of the range. The 150 km-long, 35 km-wide Yecheng-Pishan anticline folds Plio-Quaternary molasses. Drainages crossing this growing anticline have abandoned flights of inset terraces on the sides of wind-gaps. The maximum elevation of the highest terrace above local drainage is about 350m. Near Pishan city, flat, well-preserved terrace surfaces are covered by thin loess, in turn capped by loose gravel pavement. On the uppermost two terraces of this valley, 70 and 120 meters-high, cosmogenic 10Be concentrations in surface and sub-surface samples are similarly high (> 8.106 at/g/yr), indicative of steady-state, with minimum ages of 500 kyr, and a maximum deflation rate of 0.001 mm/yr. Given these values, the maximum incision rate into the lower of these two terraces would have been 0.14 mm/yr.
These preliminary results imply minimum foreland shortening rates only on order or 1-2 mm/yr, far less than might be expected for a Cenozoic mountain range of such height and width. More dating and geomorphic measurements are presently in progress across other active structures.