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Crustal Shortening in the Southern Zhangye Basin and Its Implications for the Deformation Distribution of the Qilian Shan, NE Tibetan Plateau

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The spatial pattern of crustal shortening along the eastern and western Qilian Shan, northeastern Tibetan Plateau is crucial for understanding the process and mechanism of growth and propagation of the plateau. Here we present a detailed record of seven strath terraces of the Tongziba River in the southern Zhangye Basin, which document the history of active deformation of the Minle-Damaying Fault (MDF) and Yonggu anticline, and six strath terraces of the Xie River, which document the history of active deformation of the MDF in the North Frontal Thrust (NFT) system at the eastern Qilian Shan mountain front. Based on the measured longitudinal profiles of terraces and the formation ages dated by AMS 14C and optically stimulated luminescence (OSL) dating methods, the total of shortening rates across the eastern Qilian Shan mountain front is estimated to be about 2.7 $\pm$ 0.8 mm/yr, much higher than the rate of $\sim$1 mm/yr across the western Qilian Shan mountain front. In contrast, no significant difference in the total shortening rate across the whole Qilian Shan Block is observed on GPS data. Thus we propose that the inner part of the western Qilian Shan could have absorbed more crustal shortening than the inner part of the eastern Qilian Shan. Such a spatial pattern of crustal shortening is consistent with the result form GPS data across the whole eastern and western Qilian Shan along N30°E. The different crust structure, especially the existence of a low-velocity layer in the mid-crust of the western Qilian Shan orogen, may account for the observed spatial pattern of crustal shortening in the Qili