# Role of the Longquan fault in the active deformation of the Longmen Shan fold-and-thrust belt, eastern Tibetan Plateau

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Present-day convergence within the Longmen Shan fold-and-thrust belt (LSFTB) was manifested by the 2008 Mw 7.9 Wenchuan and 2013 Mw 6.6 Lushan earthquakes, which ruptured multiple thrust ramps beneath the range front structures. However, it is still unclear whether fault slip has been propagated eastward into the foreland, closer to the Chengdu population center. In this study, we provide constraints on the 3D subsurface structure, fault activity and seismic hazards of the Longquan fault that is located in the central Sichuan basin, ~100 km east of the range front structures of the LSFTB. Our detailed 3D model of the Longquan fault reveals a segmented fault array involving an east-dipping back-thrust at the edge of the Quaternary basin between west-dipping fore-thrusts to the north and south. We evaluate the activity of the Longquan fault by interpretations of high-resolution satellite images, field mapping, paleoseismic logging of trench exposure walls and radiocarbon geochronology. Our results reveal that at least two surface rupturing events occurred on the Longquan fault in the Holocene, with the minimum of 3.2 m and 2.5-3.7 m slip for the most recent and penultimate events, respectively. The most recent event is inferred to be occurred in the period between 2060±30 yr BP and 580±30 yr BP, while the penultimate event occurred in the period before but around 3050±30 yr BP. These findings indicate a Holocene slip rate ranging from 0.95 to 1.65 mm/yr for the Longquan fault. The 3D structural model and the late Holocene faulting events occurred along the Longquan fault reveals that upper crustal shortening in the Sichuan basin is accommodated on a frontal thrust system that is linked to the recently active range front blind structures by a shallow detachment. We suggest that a dynamic weakening mechanism following fault activity closer to the Longmen Shan range front could help unlock the up-dip portion of this shallow detachment, sending slip eastward to the foreland and to the surface along the Longquan thrust ramps. These findings have important implications for seismic hazards of active frontal thrusts linked by upper crustal detachments in the Sichuan basin, as well as other active fold-and-thrust belts around the world.

Keywords: Active thrusting, paleoseismology, 3D structural modeling

 