

## Coseismic surface rupture length produced by the 2008 Mw 7.9 Wenchuan earthquake, the Longmen Shan Thrust Belt, China

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The magnitude (Mw) 7.9 (Ms 8.1) Wenchuan earthquake occurred on 12 May 2008 and ruptured active faults of the Longmen Shan Thrust Belt (LSTB), which marks the boundary between the eastern margin of the Tibetan Plateau and the Sichuan Basin. Although many studies of the 2008 Mw 7.9 Wenchuan earthquake have described the ground deformation features, rupture mechanism, and structural features of the seismogenic fault zone associated with this event, debate remains concerning the total length of the co-seismic surface rupture zone and whether the earthquake ruptured the Qingchuan Fault in the northeastern segment of the Longmen Shan Thrust Belt (LSTB), China. Based on our initial fieldwork carried out 2 days after the 2008 Wenchuan earthquake, we reported that the earthquake produced a ~285-km-long surface rupture zone along the LSTB, at the eastern margin of the Tibetan Plateau, dominated by thrust slip and right-lateral displacement along the central and northeastern segments of the zone, and by left-lateral displacement along the southeastern segment (Lin et al., 2009, 2010). However, other field-based studies have reported that the total length of the co-seismic surface rupture zone is 200~240 km and that the Qingchuan Fault was not ruptured by the Wenchuan earthquake (e.g., Liu-Zeng et al., 2009; Xu et al., 2009; Yin, 2010; Zhang et al., 2010). The length of surface rupture produced by large, individual earthquakes is a key parameter in assessing the seismic moment, the rupture mechanism, the degree of seismic hazard, and the activity of a seismogenic fault, including the recurrence interval of large earthquakes and the long-term slip rate. Therefore, additional work is needed to constrain the length of the co-seismic surface rupture and the location of rupture termination at the northeastern segment of the LSTB, in order to accurately assess the nature of the seismic hazard in the densely populated Sichuan region of China.

In this study, we present new field evidence that the Qingchuan Fault was ruptured by the 2008 Wenchuan earthquake and that the total length of the co-seismic surface rupture zone is up to 285~300 km. Field investigations reveal that the earthquake produced a ~60-km-long surface rupture zone along the pre-existing Qingchuan Fault, with the offset being mainly right-lateral strike-slip and a distinct component of vertical slip. Co-seismic surface ruptures are characterized by faults and extensional cracks. Field measurements indicate co-seismic right-lateral strike-slip displacements along the Qingchuan Fault of 0.3~0.6 m and vertical offsets of 0.2~0.5 m, which differs to the displacements observed along the central and southwestern segments of the Wenchuan surface rupture zone in the displacement amount and sense. The change in slip sense from thrust-dominated slip in the central and southwestern segments of the LSTB to right-lateral strike-slip-dominated displacement along the Qingchuan Fault (northeastern segment of the LSTB) reflects a change in the orientation of compressive stress along the LSTB, associated with eastward extrusion of the Tibetan Plateau as it accommodates the ongoing penetration of the Indian Plate into the Eurasian Plate.

### Reference:

Lin, A., Rao, G., and Yan, B., 2012. Field evidence of rupture of the Qingchuan Fault during the 2008 Mw7.9 Wenchuan earthquake, northeastern segment of the Longmen Shan Thrust Belt, China. *Tectonophysics*, DOI: 10.1016/j.tecto.2011.12.012 (in press).

Keywords: 2008 Wenchuan Earthquake, coseismic surface rupture, Qingchuan Fault, Longmen Shan Thrust Belt, active fault, Tibetan Plateau