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# Latest Quaternary Paleoseismology and Slip Rates of the Longriba Fault Zone, Eastern Tibet: Implications for Fault Behavior and Strain Partitioning

REN Junjie[1,2,*], XU Xiwei[2], Robert S. YEATS[3], ZHANG Shimin[1],DING Rui[1], GONG Zheng[1], LIU Shao[1] and KANG Wenjun[2]

1 *Key Laboratory of Crustal Dynamics, Institute of Crustal Dynamics, China Earthquake Administration (CEA), Beijing 100085, China*
2 *Key Laboratory of Active Tectonics & Volcano, Institute of Geology, CEA, Beijing 100029, China*
3 *College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331, USA*

Although much work has been done on active tectonics of eastern Tibet, little is known about the Longriba fault zone and its role in strain partitioning. Whether its two sub-parallel strands (Longriqu and Maoergai faults) can rupture simultaneously in a large earthquake remains unknown. We conducted trenching combined with the interpretation of satellite imagery, field investigations, topographic surveys and radiocarbon and Optically Stimulated Luminescence (OSL) dating, to reconstruct paleoseismic history, and we used displaced terrace risers to estimate geological slip rates. Our results demonstrate that the Longriba fault zone is predominantly right-lateral with a small southeast-verging thrust component. Four surface-rupturing events occurred on the Longriqu fault at 5080±90, 11100±380, 13000±260, and 17830±530 cal yr BP. Our previous trenches on the Maoergai fault reveal three Holocene events that occurred at ~5170±80, ~7100±70, and ~8510±420 cal yr BP. Based on the above paleoseismic history on the Longriqu and Maoergai faults, we suggest that the last event probably ruptured the two faults. Prior to the last event, the two strands of the Longriba fault zone experienced alternating earthquakes. The fault zone has a high potential for an earthquake larger than Mw 7. The slip rate of the Longriba fault zone decreases from ~7.5 mm/yr in latest Pleistocene to ~2.1 mm/yr in the Holocene, probably related to a slowing down of the eastern motion of the Tibetan Plateau. The comparison with slip rates at the Longmen Shan fault zone suggest that the Longriba fault zone has an equally important role in strain partitioning in eastern Tibet. This study is helpful to seismic hazard assessment and an understanding of deformation mechanism in eastern Tibet.

* Corresponding author. E-mail: renjunjie@gmail.com

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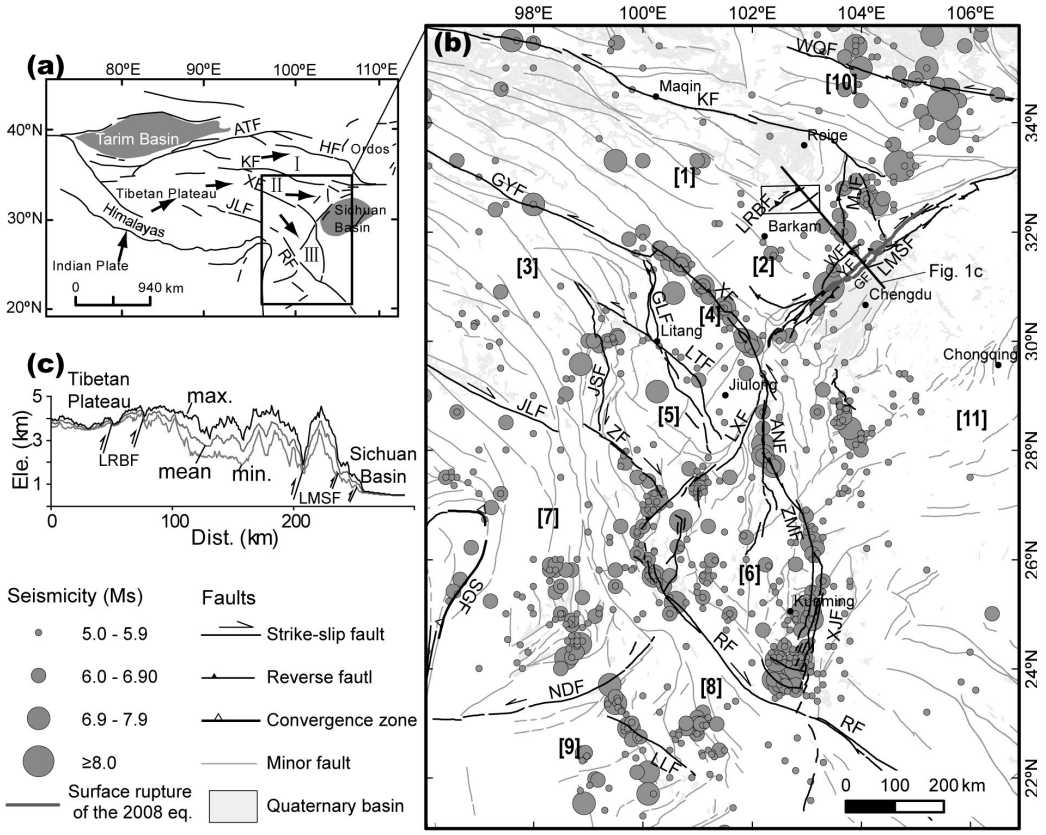


Fig. 1. Tectonic setting of the Longriba fault zone in eastern Tibet

(a) Major boundary faults and blocks of the Tibetan Plateau. Black arrows indicate block motion direction according to GPS data (*Gan et al.*, 2007). Ⅰ, Qaidam-Qilian block; Ⅱ, Bayan Har block; Ⅲ, Sichuan-Yunnan block. (b) Active faults and seismicity in eastern Tibet showing several rigid sub-blocks. Seismic data include instrumentally recorded earthquakes [China Earthquake Networks Center, http://www.csndmc.ac.cn/newweb/data.htm] and historical earthquakes. Fault data are modified after *Xu et al.* (2008). Surface ruptures of the 2008 Wenchuan earthquake are according to *Xu et al.* [2009]. Eastern Tibet and adjacent regions are divisible into 11 sub-blocks (*Cheng et al.*, 2012): 1, Aba; 2, Longmen Shan; 3, Zangdong; 4, Yajiang; 5, Shangri La; 6, Dianzhong; 7, Baoshan; 8, Jinggu; 9, Ximen; 10, Western Qinling; 11, South China. (c) Swath profile across the Longriba and Longmen Shan fault zones. See location in (b). Abbreviations for active faults: ANF, Anninghe fault; ATF, Altyn Tagh fault; GF, Guanxian-Jiangyou fault; GLF, Ganze-Litang fault; GYF, Ganze-Yushu fault; HF, Haiyuan fault; JLF, Jiali fault; JSF, Jinshajiang fault; KF, Kunlun fault; LLF, Longling-Lancang fault; LMSF, Longmen Shan fault; LRBF, Longriba fault; LTF, Litang fault; LXF, Lijiang-Xiaojin fault; MJF: Minjiang fault; NDF, Nandinghe fault; RF, Red River fault; SGF, Sagaing fault; WF, Wenchuan-Maoxian fault; WQF, Western Qinling fault; XF, Xianshuihe fault; XJF, Xiaojiang fault; YF, Yingxiu-Beichuan fault; ZF, Zhongdian fault; ZMF, Zemuhe fault.

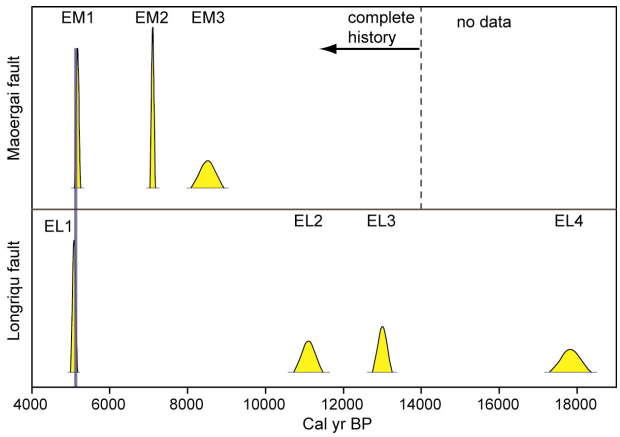


Fig. 2. Paleoseismic data of the Maoergai fault from Ren et al. (2013a,b).

Dashed line shows the upper limit of the complete history along the Maoergai fault. The age of the paleoearthquake is expressed by probability density function of normal distribution with 95% bounds, and the height of the distribution shows the probability of event age.

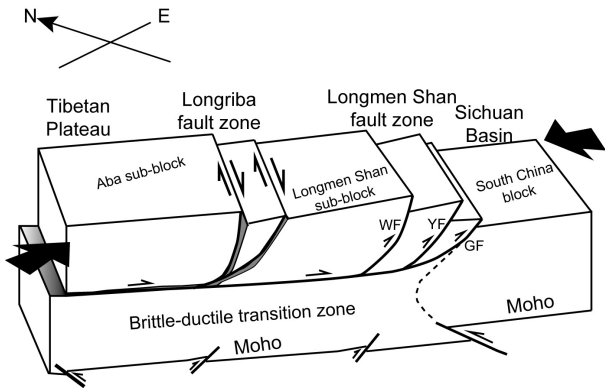


Fig. 3. Schematic block diagram showing the proposed kinematic mechanism along the Longriba and Longmen Shan fault zones.

The relationships of active faults and the Moho are according to the deep seismic results (e.g.,Hubbard and Shaw, 2009). Black arrows indicate directions of force acted on the Longmen Shan sub-block derived from GPS results (Gan et al., 2007). GF, Guanxian-Jiangyou fault; WF, Wenchuan-Maoxian fault; YF, Yingxiu-Beichuan fault.

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