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Late Quaternary activity of the Zemuhe Fault, southeastern margin of the Tibetan Plateau

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The eastward extrusion of the Tibetan Plateau has been recognized to be related to the collision between the Indian-Eurasian plates. Late Quaternary activity of active faults developed along the boundary of the Tibetan Plateau, therefore, is vital to understand current crustal deformation of the Tibetan Plateau in response to the collision. This study focuses on the late Quaternary activity of the Zemuhe Fault, the central segment of the N-S-trending fault zone developed along the southeastern margin of the Tibetan Plateau, and documents its tectonic implications to the southeastward motion of the plateau caused by the collision between the Indian and Eurasian plates.

The N-S-trending active fault zone, mainly composed of the Anninghe, Zemuhe and Xiaojiang faults, is a tectonic boundary on the southeastern margin of the Tibetan Plateau. We constrain the late Quaternary activity of the central segment of this fault zone, the Zemuhe Fault, including the slip rate as well as the average recurrence interval of strong earthquakes. On the basis of interpretations of aerial photographs, field investigations, trench excavations and radiocarbon dates, the horizontal slip rate is estimated to be 10-11 mm/yr with a vertical slip component of 0.4-0.5 mm/yr. Trench investigations and ¹⁴C ages reveal that at least four seismic faulting events occurred in the past 1600 years, which suggest an average recurrence interval of 400 years for M 7.0-7.5 earthquakes, coinciding with the historical records. Coupling the slip rate of 10-11 mm/yr and the average displacement of 3-5 m caused by an individual event, the long-term recurrence interval of M 7.0-7.5 earthquakes is estimated to be 300-500 years during the late Quaternary on the Zemuhe Fault, which is also consistent with that inferred from trench investigations. Our results show that the N-S-trending fault zone plays an important role as a tectonic boundary releasing strain energy produced by southeastward motion of the Tibetan Plateau with repeated strong earthquakes occurred in a recurrence interval of 300-500 years.

Keywords: Tibetan Plateau, strike-slip rate, recurrence interval, Zemuhe Fault, paleoseismology