

New Constraints on Recent Large Earthquakes along the Xidatan-Dongdatan Segment of the Kunlun Fault, Western China

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The Kunlun fault is considered as one of the major left lateral strike-slip faults to accommodate the eastward extrusion of Tibet. Some studies have been focused on the late Quaternary activity of the 600-km-long central Kunlun fault including the Xidatan-Dongdatan and the Tuosuo lake segments. Characteristic offset of 9-12 m on Xidatan-Dongdatan segment are generally accepted. However three large historical earthquakes along other segments of Kunlun fault indicate that the average offset produced by these earthquakes is much smaller than that published for the Xidatan-Dongdatan segment. Recent well-recorded large earthquakes on other strike-slip faults also show similar offset. Because the offset is a vital parameter for understanding the activity of the fault and assessing the seismic hazards, further work is needed to clarify whether the seismic behavior of Xidatan-Dongdatan segment is an exception.

In this study, displaced terrace risers and gullies preserved on the lowest and youngest terrace in central part of the Xidatan-Dongdatan valley indicate that the offset produced by the most recent earthquake is 3-6 m, which is much smaller than what has been previously estimated, however, which is consistent with the slip of historical earthquakes along the Kunlun fault and recent well-recorded large earthquakes on other strike-slip faults. Accumulated offsets on higher terraces indicate repeated seismic activity of the Kunlun fault. We assume a 150-km-long surface rupture for the most recent event based on roughly continuous linear features on remote sensing images and distinct mole tracks in the field.

The lack of seismicity records in the region earlier than 100 years ago led us to carry out paleoseismic investigation. Samples collected from the faulted upper layer show that the most recent large event on Xidatan-Dongdatan segment is not older than 663 yr BP. At least 3 prehistoric events are identified on the trench wall.

Due to a lower constraint on the offset produced by the most recent earthquake, it would be necessary to reevaluate the seismic behavior of the Xidatan-Dongdatan segment.