



Earthquakes of moderate magnitude recorded at the Salt Lake paleoseismic site on the Haiyuan Fault, China

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The active left-lateral Haiyuan fault is one of the major continental strike-slip faults in the Tibetan Plateau. The last large earthquake occurred on the fault is the great 1920 M~8 Haiyuan earthquake with a 230-km-long surface rupture and maximum surface slip of 11 m (Zhang et al., 1987). Much less known is its earthquake recurrence behavior. We present preliminary results on a paleoseismic study at the Salt Lake site, at a shortcut pull-apart basin, within the section that broke in 1920. 3D excavation at the site exposed 7 m of fine-grained and layered stratigraphy and ample evidence of 6-7 paleoseismic events. AMS dating of charcoal fragments constrains that the events occurred during the past 3600 years. Of these, the youngest 3-4 events are recorded in the top 2.5m section of distinctive thinly-layered stratigraphy of alternating reddish well-sorted granule sand and light gray silty fine sand. The section has been deposited since ~1550 A.D., suggesting 3-4 events occurred during the past 400 years, and an average recurrence interval of less than 150 years, surprisingly short for the Haiyuan fault, with a slip rate of arguably ~10 mm/yr or less. A comparison of paleoseismic with historical earthquake record is possible for the Haiyuan area, a region with written accounts of earthquake effects dated back to 1000 A.D.. Between 1600 A.D. and present, each of the four paleoseismic events can be correlated to one historically recorded event, within the uncertainties of paleoseismic age ranges. Nonetheless, these events are definitely not 1920-type large earthquakes, because their shaking effects were only recorded locally, rather than regionally. More and more studies show that M5 to 6 events are capable of causing ground deformation. Our results indicate that it can be misleading to simply use the time between consecutive events as the recurrence interval at a single paleoseismic site, without information of event size. Mixed events of different magnitudes in the record will give a false sense of short recurrence intervals for the implied large characteristic magnitude for recurring events.