A Historical Earthquake-Induced Landslide Damming Event at the Qiaojia Reach of the Jinsha River, SE Tibetan Plateau: Implication for the Seismic Hazard of the Xiaojiang Fault

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Abstract

In bedrock mountainous areas where active faults and deep river valleys interact, earthquake-induced landslides can be used to explore local seismic hazards. The intersection of the highly active Xiaojiang Fault and the Jinsha River and its main tributaries in southwest China is a site of abundant earthquake-induced landslides. We found some boulders inappropriately scattered on the east bank of the Qiaojia reach of the Jinsha River, where the Qiaojia Segment of the Xiaojiang Fault passes through. We investigated the lithology and topography nearby and confirmed its source area, as well as the existence of a landslide damming event in the field. A high-resolution Digital Surface Model (DSM) generated from Unmanned Aerial Vehicle (UAV) images was used to analyze its characteristics and calculate its parameters. Optically Stimulated Luminescence (OSL) and 14C dating methods on the related dammed lake sand shows the age of the landslide, which is not later than 878 AD. The characteristics of large size with limited depositional extent, spatial relevance between the landslide and Xiaojiang Fault, and temporal-coincidence of the landslide with 624 AD earthquake support the seismic origin of this landslide. Moreover, the 624 AD earthquake was reanalyzed for its magnitude and macro-epicenter based on the coseismic displacement of the Heishui River floodplain. It was calculated to be Mw7.7 or Ms7.9 and relocated to the Qiaojia area. No $M \geq 7$ earthquakes have occurred on the Qiaojia Segment for nearly 1,400 years since 624 AD. The elapsed time is close to the average recurrence interval of large earthquakes on the Qiaojia Segment. Therefore, the seismic hazard of the Qiaojia area should be considered in the future.

Keyword: Qiaojia, Jinsha River, earthquake-induced landslide, seismic hazard assessment, Xiaojiang Fault

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