



## **The Post-seismic Slip of the 1973 M7.6 earthquake on the Luhuo Segment of the Xianshuihe Fault Zone, Sichuan, China**

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An M=7.6 earthquake ruptured the Luhuo segment of the Xianshuihe fault zone on Feb. 6, 1973. Since then, several across-fault (across the 1973 rupture) deformation observation systems have been set up one after another at the site of Xialatuo, Luhuo county, Sichuan province, China. Among them are a system of short baselines and short leveling, a set of creep-meters, an artificial construction, and some near-fault to far-fault GPS geodetic stations. By using data from the observation of these systems, this paper studies the characteristic of the post-seismic slip/deformation and their temporal-spatial variations for the Luhuo segment of the Xianshuihe fault zone, and builds a tectonic-dynamic model to explain the characteristic features. Our study mainly shows that, (1) in the first five years following the 1973 earthquake, the earthquake fault at Xialatuo behaved as an open one that the post-seismic slip showed mainly as aseismic left-lateral slip (creeping) at an average rate of 10.27mm/a along with slight tensional creeping. Since 1979, however, the rate of the post-seismic left-lateral creep has been slowing down gradually from 5.3mm/a to 2.27mm/a, and the process of the rate slowing down is the type of logarithmic function, suggesting that during the period since 1979 the fault plane, that ruptured in the 1973 earthquake, has been tending to re-couple and re-lock gradually with some strain having rebuilt-up. (2) Since 1999 the rate of relative left-lateral displacement/deformation at the fault far-fields on both sides of the fault segment is estimated to be 10mm/a, much greater than the near-fault (40m to 144m across the fault) left-lateral creep rates of 0.66 mm/a to 2.52mm/a in the same stage. Also, such significant differences of the near- to far-fault displacement/deformation rates occur along an about 2×30-km-wide zone centered along the fault segment of Luhuo, indicating the width of the seismogenic fault zone associated with the stress/strain build-up and release during major earthquake cycles here. (3) Combining with information of tectonic-dynamic background and deep crustal structure, the authors try to explain the mechanism of the post-seismic fault slip/deformation and its spatial-temporal variation for the studied fault segment. Key points of the explanation are as follows: Starting from the 5th year after the 1973 earthquake, the fault plane in the brittle upper crust, which was once used to be open in the earlier post-seismic stage, has been tending to re-couple and re-lock as a result of gradual increasing slip/friction resistance on the fault plane. In the deeper crust, however, the continuous ductile relative motion between the both sides of the fault keeps dragging the brittle upper crust to produce elastic displacement/deformation. (4) It can be estimated that the studied fault segment will entirely “re-lock”, enter the stage of inter-seismic locking, and re-build up stress/strain for the next major event in the next 15 to 25 years.