

Spatial variations in fault zone structures along strike-slip faults: an example from active faults in southwest Japan

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Active faults and related fault-zone structures that form at shallow depths within the upper crust are closely related to the long-term seismic faulting history of seismogenic faults (e.g., Lin, 1999, 2008; Sibson, 2003; Lin et al., 2010). Accordingly, the analysis of deformation structures along active fault zones provides important information in reconstructing the long-term seismic faulting behavior of active faults and in understanding the tectonic environment and history of such faults.

This study presents a case study on the structures of strike-slip fault zones of the Arima-Takatsuki Tectonic Line (ATTL) and Rokko-Awaji Fault Zone (RAFZ), which consist of multiple right-lateral strike-slip active faults in southwest Japan. The formation mechanisms of damage zone and their tectonic implications are discussed.

Field investigations reveal spatial variations in fault zone structures along strike-slip active faults of the Arima-Takatsuki Tectonic Line (ATTL) and the Rokko-Awaji Fault Zone (RAFZ) of southwest Japan, which together form a left-stepping geometric pattern. The fault zones are composed of damage zones dominated by fractured host rocks, non-foliated and foliated cataclasites, and a fault core zone that consists of cataclastic rocks including fault gouge and fault breccia. The fault damage zones of the ATTL are characterized by subsidiary faults and fractures that are asymmetrically developed on each side of the main fault. The width of the damage zone varies along faults developed within granitic rocks of the ATTL and RAFZ, from ~50 to ~1000 m. In contrast, the width of the damage zone within rhyolitic tuff on the northwestern side of the ATTL varies from ~30 to ~100 m. The fault core zone is generally concentrated in a narrow zone of ~0.5 to ~5 m in width, consisting mainly of pulverized cataclastic rocks that lack the primary cohesion of the host rocks, including a narrow zone of fault gouge (<0.5 m) and fault-breccia zones either side of the fault. The present results indicate that spatial variations in the width of the damage zone and the asymmetric distribution of damage zones across the studied strike-slip faults are caused by local concentrations in compressive stress within an overstep area between left-stepping strike-slip faults of the ATTL and RAFZ. The findings demonstrate that fault zone structures and the spatial distribution of damage zone are strongly affected by the geometric patterns of strike-slip faults.

References:

Lin, A., Ren, Z., Kumahara, Y., 2010. Structural analysis of the coseismic shear zone of the 2008 Mw7.9 Wenchuan earthquake, China. *Journal of Structural Geology*, 32, 781-791, DOI:10.1016/j.jsg.2010.05.004

Lin, A., Yamashita, K., Tanaka, M., 2013a. Repeated seismic slips recorded in ultracataclastic veins along active faults of the Arima-Takatsuki Tectonic Line, southwestern Japan. *Journal of Structural Geology*, in press, <http://dx.doi.org/10.1016/j.jsg.2013.01.005>.

Lin, A., Yamashita, K., 2013b. Spatial variations in fault zone structures along strike-slip faults: an example from the active faults, southwest Japan. *Journal of Asian Earth Sciences*, submitted.

Lin, A., Toda, T., Rao, G., Tsuchihashi, S., Yan, B., 2013c. Structural analysis of coseismic normal fault zones of the Mw 6.6 Fukushima earthquake, northeast Japan. *Bulletin of Seismological Society of America*, 103, in press, doi:10.17850/0120120111.

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