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Do mesoscale faults near the tip of an active strike-slip fault indicate regional or local stress?

Atsushi Yamaji
Kyoto University, Division of Earth and Planetary Sciences, Kyoto, Japan (yamaji@kueps.kyoto-u.ac.jp)

Fault-slip analysis is used in Japan after the Great Tohoku Earthquake (2011) to judge the stability of fractures in the foundations of nuclear power plants. In case a fault-slip datum from a fracture surface is explained by the present stress condition, the fracture is thought to have a risk to be activated as a fault. So, it is important to understand the relative significance of regional and local stresses.

To answer the question whether mesoscale faults indicate regional or local stress, fault-slip data were collected from the walls of a trenching site of the Nojima Fault in central Japan—an active, dextral, strike-slip fault. The fault gave rise to the 1995 Kobe earthquake, which killed more than 6000 people. The trench was placed near the fault tip, which produced compressional and extensional local stress conditions on the sides of the fault near the tip. A segment of the fault, which ruptured the surface in 1995, bounded Cretaceous granite and latest Pliocene sediments in the trench.

As a result, the stress inversion of the data from the mesoscale faults observed in the trench showed both the local stresses. The present WNW-ESE regional compression was found from the compressive side, but was not in the extensional side, probably because local extension surpassed the regional compression. Instead, the regional N-S compression of the Early Pleistocene was found from the extensional side. From this project, we got the lesson that fault-slip analysis reveals regional and local stresses, and that local stress sometimes masks regional one.

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