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Active Fault Drilling in Central Japan - Stress, Strength and Structure in the Fault -

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The drilling method is of great advantage to study on the mechanics and structure of fault because we can access the materials and internal structure of the fault directly. We did integrated investigations on active faults in central Japan, i.e., Nojima fault which appeared on the surface by the 1995 Great Kobe earthquake (M=7.2), the Neodani fault which appeared by the 1891 Nobi earthquake (M=8.0), Atotsugawa fault, that was considered to have activated at 1858 Hida earthquake (M=7.0), the Atera fault, of which some parts seemed to be dislocated by the 1586 Tensho earthquake (M=7.9), and Gofukuji Fault that was considered to have activated about 1200 years ago. Using the boreholes with down-hole measurements and surface geophysical survey, physical properties and structures of fault were observed. Additionally, the stress states in and around the faults were obtained from in-situ stress measurements by hydraulic fracturing method. Each of faults showed characteristic features according to their geological and geophysical situations.

An important phenomenon was decrease of differential stress magnitude in the area closer to the center of the fault that was observed in the Neodani fault and the Nojima fault. The orientations of the maximum horizontal compressive stress were nearly perpendicular to the fault and reverse of the fault moving direction for Nojima fault and Atera fault, respectively. These results support an idea that the fault becomes to be "weak" after the earthquake and the differential stress is small at narrow zone adjoining the center of the fault.

Geophysical surveys, down-hole well loggings, macro- and micro-scopic observations of cores showed complicated internal structure in the fault. As a schematic view, there were narrow hardly fractured zones with fault gouge and broad weakly fractured zones were distributed adjacent to the hardly fractured zones. One of the hardly fractured zones might have slipped when the last earthquake.

The depth and the number of drillings were limited and it was significant to study comprehensively with several research methods, such as geophysical survey and geophysical observations, e.t.c..