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In-situ stress measurement by Deformation Rate Analysis-Fukuoka and Hatajiri drilling sites close to Atera fault-

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Drillings were performed near the Atera fault in southeastern Gifu Prefecture by the National Research Institute for Earth Science and Disaster Prevention (NIED) to understand the fault structure, material properties and stress state in and around an active fault zone. We have measured in-situ stresses by Deformation Rate Analysis (DRA) using the core samples obtained from those drilling sites. We already reported about the stress state at Ueno site, located 1.5km southwest from the Atera fault. In this study, we describe the in-situ stresses at Fukuoka site and Hatajiri site at distances about 4km southwest from the Atera fault and about 3km further southwest, respectively.

The measurements have been performed for 296 and 379 m depths at Fukuoka site (FKO296 and FKO379, respectively) and 400m depth at Hatajiri site (HTJ400). Rock type of FKO296 and FKO379 is granite and that of HTJ400 is granodiorite porphyry [Ikeda et al. (2001)]. Specimens used for the stress estimation are of rectangular prism in shape of about 14.5 mm x 14.5 mm x 34.0 mm. They are sawed from boring cores in the vertical and the four horizontal directions. The static Young's moduli of core specimens for FKO296, FKO379 and HTJ400 estimated from stress-strain curves are 29.6+-2.4GPa, 27.0+-2.2GPa, 56.2+-7.1GPa, respectively. The cores of both sites are not oriented. For Fukuoka site, however, the core orientation was determined by comparing fracture traces on the core surface with those on borehole televiewer image.

The estimated maximum and minimum horizontal stresses and the vertical horizontal stress (SH, Sh, Sv) for FKO296 and FKO379 are (12.7, 9.3, 7.3MPa) and (16.0, 11.5, 8.9MPa), respectively. Average density of over burden rock calculated from Sv is somewhat smaller than the one from logging data. For both depths, the minimum horizontal stress is larger than the vertical stress, and the difference between the maximum horizontal stress and the minimum horizontal stress is small. The stress field is in the so-called reverse fault regime. The maximum horizontal stress lies in about N-S to NNW-SSE direction at two depths. A parameter r is defined as follows; r = (S1-S3)/(S1+S3), where S1 and S3 are the maximum and minimum principal stresses of compression, respectively. Assuming that one of the principal directions is in the vertical, the r-values of FKO296 and FKO379 are 0.27 and 0.29, respectively. For HTJ400, SH=18.7MPa, Sh=9.1MPa and Sv=9.7MPa. Average density calculated from Sv is equal to logging data. This site is in the strike-slip regime. The r-value is 0.35.

An important result in this study is that the maximum horizontal stress direction is about N-S which is the reverse of inferred direction from the motion direction of the Atera fault. Another important result is that the r-values of FKO296 and FKO379 are smaller than that of HTJ400.

For FKO296 and FKO379, the estimated stress magnitudes, the directions of maximum horizontal stress and the stress regimes are almost consistent with the stress state estimated from hydraulic fracturing method [Ikeda et al. (1999), Ikeda et al. (2001)]. For HTJ400, the maximum and minimum horizontal stresses by DRA are smaller than those by the hydraulic fracturing method. Although the reason for this discrepancy is unknown, the stress regime is consistently determined.

Sato et al. (2001) determined the maximum horizontal stress direction to be E-W and the r-value to be 0.17 for 340 m depth at Ueno site. Taking account of this result together, the present study suggests that the r-value gradually decreases toward the fault. However, in order to conclude this, more investigations are needed, especially on the stress field near this fault.

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