In-situ stress at the basement under Osaka plain (6) - In-situ crustal stress distribution in the surrounding Kinki distinct -

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In-situ crustal stress is an important factor to understand earthquake mechanism and tectonic activities. However, the reliable in-situ stress data seems to still be poor, because complicated procedures are necessary for measurement in a borehole. We have tried in-situ crustal stress measurements using rock core samples from deep boreholes. In previous studies, we report results of in-situ crustal stress measurements at deep seismic observation wells of NIED in Osaka plain, western Japan. Stress orientation was determined by observing borehole breakout (shear fractures due to stress concentration on the circular borehole wall) recognized by Borehole-televiewer (BHTV) logging. We applied DCDA (Diametrical Core Deformation Analysis) method to recovered rock cores to estimate differential stress values. DCDA method measures the circumferential diameter variation due to stress relief after the core recovery, and use elastic constants of the rock core. The circumferential core diameter variation was measured by an apparatus at NIED designed by Funato and Ito, 2017, IJRMMS. Those results suggest a pair of DCDA method by recovered rock core and borehole breakout observation by borehole wall image logging is recommended to measure both of value and orientation of in-situ crustal stress in the case of borehole breakout is produced.
In the first place, the in-situ crustal stress measurement suggests the following significance and possibilities.
・To capture the subsequent changes in the crustal stress state from the initial state (starting point) of in-situ crustal stress distribution and crustal deformation (strain distribution).
・To understand the relationship between changes in the in-situ crustal stress state and crustal movement, active fault activity, and earthquake occurrence.
・To promote modeling of crustal stress distribution and stress accumulation/release by combining in-situ crustal stress data, GNSS data, and seismic data.
In the Kinki region, where the Nankai Trough mega-earthquake is feared to occur, seismic activity is expected to increase in inland areas before the mega-earthquake. Those active earthquakes may be small in magnitude, but may occur just under residential areas and cause extensive human and property damage. Therefore, the relationship between increased seismic activity and crustal stress is an important issue. In the Kinki area around the Osaka Plain, in-situ crustal stress measurements in boreholes have been carried out in the past using the stress release method, hydraulic fracturing method, etc. Comparison of these results with in-situ crustal stress measurements under the Osaka Plain basement is important in considering the relationship between changes in in-situ crustal stress conditions and the occurrence of earthquakes.
The stress orientations obtained from the borehole breakout under the Osaka Plain basement are consistent with the regional stress orientations in the surrounding area, and the horizontal maximum compressive stress orientation is almost in the E-W direction. Looking at before and after the 1995 Hyogo-ken Nanbu Earthquake, the distance from the seismic fault is far here, and there seems to be no azimuth change due to the influence of the earthquake. The differential stress values are larger than those measured in the surrounding area, but they seem to be equivalent to the high differential stress values measured at domestic active earthquake swarm area in Japan. Regarding the large differential stress, it is necessary to consider what the factors are and whether or not they are related to the occurrence of

earthquakes, while comparing them with the surrounding stress values, seismic activity, crustal movement and tectonic background, etc.

Keywords: in-situ crustal stress, borehole, rock core, Osaka plain, Kinki distinct

