Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SSS035-22 Room:IC Time:May 24 12:00-12:15

Modeling of permeability structure using pore pressure and borehole strain monitoring

Yasuyuki Kano[1*], Hisao Ito[2]

[1]DPRI, Kyoto Univ., [2]JAMSTEC

The methods to determine permeability underground are hydraulic test utilizing borehole and packer or core measurement in laboratory. Another way to know the permeability around a borehole is to examine responses of pore pressure to natural loading such as barometric pressure change at surface or earth tides. Using response to natural deformation is conventional method for water resource research.

The size of measurement is different between in-situ hydraulic test, response method, and core measurement. It is not clear that the relationship between permeability values form each methods for an inhomogeneous medium such as a fault zone. Knowledge of inhomogeneity is essential to understand permeability structure around a fault zone.

Supposing the measurement of the response to natural loading, we made a model calculation of permeability structure around fault zone. The model is 2 dimension and constructed with vertical high-permeability layer in uniform low-permeability zone. The upper and lower boundaries are drained and no-flow condition. We calculated the flow and deformation of the model for step and cyclic loading by numerically solving a two-dimensional diffusion equation. The model calculation shows that the width of the high-permeability zone and contrast of the permeability between high- and low- permeability zone control the dominance of the low-permeability zone. We applied the the model calculation to the results of in-situ packer test, and natural response of water level and strain monitoring carried out in the Kamioka mine.

The model calculation shows that knowledge of permeability in host rock is also important to obtain permeability of fault zone itself. The model calculations help to design pore long-term pressure monitoring, in-situ hydraulic test, and core measurement using drill holes.

Keywords: fault zone, permeability structure, deep drill hole, pore pressure