Permeability Around the Nojima Fault Estimated Using Barometric Response of Pore Pressure

#Yasuyuki Kano (DPRI, Kyoto University), Yuichi Kitagawa (AIST)
Atsushi Mukai (Nara Sangyo University), and
Takashi Yanagidani (DPRI, Kyoto University)

Using an 800-m-deep borehole, which is one of the three boreholes drilled by the project, “Fault zone probe”, we have continued pore pressure monitoring. On August 2006, we installed a new pressure gauge and fixed the seal of the wellhead. We analyzed the data between August 2006 and March 2007 to estimate the poroelastic constants that characterize the rockmass around the borehole. The pressure inside the borehole fluctuates around 197 kPa. Barometric and tidal responses are clearly observed. From the barometric response, we can determine loading efficiency. We obtained a loading efficiency of 0.45 by fitting the barometric and pore pressure records which are low-pass-filtered at a period of 1.25 day for each month. Combining tidal response, and the loading efficiency, we can determine the shear modulus. The ratio of observed pore pressure to calculated tidal areal strain is 22 GPa, which yields an estimate for the shear modulus to be 24 GPa.

Hydraulic diffusivity can be estimated from the attenuation of the ratio of pore pressure change to barometric pressure change at lower frequency bands. The cutoff does not appear in the period range shorter than 11.5 days. Assuming the water table to be a surface of one-dimensional fluid flow, the upper bound of hydraulic diffusivity is estimated to be 1.5 m^2/s. We further examined barometric response (Figure 1) of pore pressure data recorded from August 2000 to April 2006. The cutoff appear above the period of 11.5 day (Figure 2), which shows that there are no significant change of hydraulic diffusivity, and thus permeability from 2001 to 2007. This result is consistent with the permeability estimation using the pore repssure response to repeated injection tests (Kitagawa et al, 2006, Tectonophys. and Mulai et al., 2006, Tectonophys.).