Geophysical Research Abstracts, Vol. 9, 01457, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01457

Effective confining pressure dependency for fluid flow properties of young sedimentary rocks from TCDP Hole-A

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Accurate measuring of the permeability and porosity, as well as the specific storage, from core samples is essentially important to explore the fluid percolation process in crust. An integrated permeability/porosity measurement system-YOYK2 (confining pressure up to 200 *MPa*) was utilized to measure the pressure-dependency of permeability and porosity of core samples from Taiwan Chelungpu fault Drilling Project, Hole-A. The measured permeability/porosity of core samples under effective confining pressure (up to 120 *MPa*) are $10^{-13} \sim 10^{-14} m^2$/ 15%∼19% for sandstones and $10^{-16} \sim 10^{-19} m^2$/ 8%∼11% for siltstones. The permeability of shale under pressure is near the lower bound of measured permeability of siltstone ($10^{-18} \sim 10^{-19} m^2$). The porosity of shale (13%∼14%) is lower than that of sandstone and higher than that of siltstone. The permeability of siltstone and shale is more sensitive to effective confining pressure than that of sandstone. On the other hand, the pressure-sensitivity of porosity is almost identical for different rock types. Generally speaking, the porosity about decreases 15% when the effective confining pressure increased from 3 *MPa* to 120 *MPa* for tested rock samples. After testifying existing equations for describing the pressure-dependency of permeability/porosity, a power law seems to be superior to an exponential relation for young sedimentary rocks in Taiwan Western Foothills. The calibrated porosity sensitivity exponent α is estimated to range form 3.26 to 5.47 (loading) and range form 2.34 to 3.08 (unloading) for tested sandstones by using a

power law to describe the pressure-dependency of permeability/porosity. The porosity sensitivity exponent α is estimated range from 25.98 to 47.50 (loading) and from 6.91 to 46.43 (unloading) for tested siltstone and shale which is much higher than that of sandstone. It is expected that overpressure will easily develop during the compaction of fine sediments for their extremely high value of α. The specific storage (related to the pressure-dependent permeability/porosity) demonstrates more pressure sensitivity for adopting a power law than using an exponential relation. The calculated specific storage is ranged from $2\times10^{-3}MPa^{-1}$ to $0.2\times10^{-3}MPa^{-1}$ for sandstone and from $0.7\times10^{-3}MPa^{-1}$ to $0.07\times10^{-3}MPa^{-1}$ for siltstone and shale when the effective pressure increasing from 3 *MPa* to 120 *MPa*. Based on the laboratory works, a power law to describe the pressure-dependent specific storage is suggested for young sedimentary rocks in Taiwan Western Foothills. The suggested pressure-dependent specific storage, as well as the permeability/porosity, can be incorporated into required analysis when fluid flow in the crust of Taiwan Western Foothills is evaluated.