AOGS 2005

Experimental determination of transport properties and overpressure prediction in the thick sediment layer

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Overburden loading due to sediment accumulation is one of the most common mechanisms of generation and maintenance of excess fluid pressure in sedimentary basin. Aquathermal expansion of water, dehydration reaction and ground water flow from the depth are also possible mechanisms for the fluid pressure generation. Even though numerical modeling for overpressure generation in the sedimentary basins has been developed in recent years, transport properties, such as permeability, specific storage and Skempton's coefficient at the depths which are important properties for this model are still ambiguous. Therefore we tried to evaluate transport properties at the depth condition by laboratory measurements using surface samples. Sedimentary basin in Taiwan was selected in our research because detail overpressure data has been reported.
Our laboratory result showed, permeability of each sample ranged widely from 10^{-13} m^2 to 10^{-19} m^2, and permeabilities of Miocene sedimentary rocks were lower than those of younger (Pleistocene) sediments. These trends are also recognized in specific storage (ranging from 10^{-8} Pa^{-1} to10^{-11} Pa^{-1}) and Skempton's coefficient (from 1 to 0.7). Modeling of the overpressure generation was referred to the studies of Xiaorong and Vasseur [1] and Wangen [2]. The dehydration model of smectite to illite change was referred to Pytte and Reynolds [3]. In our analysis, transport properties were assumed to be as a function of effective pressure which are estimated from laboratory results, the sedimentation rate was changed from age to age and geothermal gradient was assumed to be a constant of 30 ^{0}C/km. The result showed that aquathermal and dehydrated factors were small significance in overpressure generation compared to gravitational sediment loading. The analytical result only considering three factors (sedimentation, aquathermal effect and dehydration) showed that overpressures were not larger than those observed in borehole measurements. If we considered a constant fluid flux from the bottom of the basin, predicted fluid pressure was good agreement with borehole observations. Therefore the sediment loading and fluid flux from the depth might be most significant factors controlling fluid pressure evolution.

Keywords: overpressure; permeability; storage capacity; basin analysis; Taiwan.

References

[1] X. Luo and G. Vasseur, *AAPG Bulletin.* **80**, 1550 (1992).
[2] M. Wangen, *Tectonophysics.* **334**, 221 (2001).
[3] A. M. Pytte and R. C. Reynolds, *Thermal histories of sedimentary basins.* 133 (1988).