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Estimating the permeability-depth relation of sedimentary rocks based on the porosity-permeability relation and porosity well logging

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The spatial variation of permeability in sedimentary basin is essential for fluid flow modeling. This research demonstrates how to obtain the permeability-depth relation from the laboratory-based porosity-permeability relation and porosity well logging. The effect stress/stress history-dependent porosity/permeability models of sedimentary rock were proposed based on laboratory measurement. Accordingly, the effect of the maximum overburden on the porosity-permeability relation can be considered. Fourteen samples, including sandstones and mudstones collected from Taiwan Chelungpu-fault Drilling Project, were used to determine the parameters in the proposed porosity/permeability models. The porosity-depth relation, which derived from the sonic well logging, was used to obtain the permeability-depth relation together with the laboratory-based porosity-permeability relation. The results show that the lithology, in-situ effect stress, as well as the thrusting and erosion of strata, dominate the permeability-depth relation if the influence of fractures are neglected.