



Estimation on in situ transport properties of sedimentary formation using a stress-history-dependent model

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The relationship among porosity, permeability and depth is crucial for sedimentary basin analysis, including compaction, decompaction and anomaly pressure distribution of geological unit. Conventionally, porosity-depth relation can be derived from well logging which is expensive, whereas permeability-depth relation is difficult to be estimated. In this study, a novel method is proposed to estimate the in situ transport properties of sedimentary formation based on laboratory core measurement of porosity and permeability. A stress-history-dependent model of transport properties, which can be used efficiently to evaluate the porosity/permeability-depth relation, is accordingly obtained. The Estimation of porosity-depth relation of sedimentary formation near a thrusting faulting is validated using well logging data. Further more, we demonstrated that this method can be applied to estimate the porosity-depth relation of the sedimentary formation which is deeply buried in the footwall of a thrusting fault using the cores from the uplifted hanging wall. Finally, the permeability-depth relation of rock matrix can be estimated easily with the laboratory-derived porosity-permeability relation if the porosity logging is available. Utilizing a pseudo-continuum fracture model (Oda's model), the permeability contributed from the fracture network can also be estimated. The permeability-depth relation of the sedimentary formation can be evaluated accordingly.