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Predicting Permeability from Well Logs in Carbonates with a Link to Geology for Interwell Permeability Mapping

A fundamental component in the construction of most reservoir performance models is an empirical relationship between permeability as measured in a limited number of cored wells and other petrophysical properties measured in well logs. This paper presents a permeability model specially designed for carbonates. The model relates permeability to interparticle porosity, makes special accommodation for separate-vug porosity, and includes a rock-fabric classification scheme with an important dual petrophysical-geological significance. Methods to estimate the separate-vug porosity from sonic logs and the rock-fabric from initial saturation are presented. The dual petrophysical-geological significance of the rock-fabric classification is important for providing a link to geological models for use in distributing permeabilities between wells. Porosity and permeability are highly variable and difficult to predict spatially in most carbonate reservoirs, but rock-fabric changes tend to be systematically organized in a predictable manner within a sequence stratigraphic framework.