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Applying Sequence Stratigraphic Methods to Constructing Petrophysical Models

The advent of sequence stratigraphic methods to construct chronostratigraphic reservoir models has provided the platform necessary to accurately distribute petrophysical properties in 3D using the rock-fabric method. Rock-fabric descriptions offer a fundamental basis for relating geologic descriptions to petrophysical properties because rock-fabric facies tend to be systematically distributed within geologic frameworks. Indeed, the vertical succession of rock fabrics, which is basic to sequence stratigraphy, is one observation used to determine changes in accommodation. The three basic rock fabrics are grainstone, grain-dominated packstone, and mud-dominated fabrics, which include mud-dominated packstone, wackestone, and mudstone. These basic fabrics vary at the high-frequency cycle scale, which is the basic stratigraphic scale for model construction.

The size of interparticle pore space is described by the amount of interparticle porosity and the basic rock fabrics. The volume of separate vugs, such as grain molds and intragrain pore space, is an additional descriptor. Grain type is very useful for determining changes in accommodation but does not impact interparticle pore size. However, the volume of separate vugs may be related to grain type. Dolomitization modifies the pore size principally in the mud-dominated fabrics because the dolomite crystals may be larger than the precursor lime-mud particles.

Geologic core descriptions usually need to be modified for petrophysical quantification because facies descriptions are often too detailed and textural descriptions too generalized. The rock fabrics are calibrated to wireline logs, distributed within the sequence stratigraphic framework, converted to permeability and initial water saturation using appropriate transforms, and distributed using geostatistical methods.