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Sequence Stratigraphy, Shale Characteristics, and Potential for Hydrocarbon Seal Development of the Middle Eocene Juncal Formation, Ventura Basin, Southern California

Shales that are effective seals may owe their sealing capacity to several characteristics, including fine grain size, low permeability, high clay content, high total organic carbon, high ductility, and high compressibility. Deep-water shales may make the best seals because they are typically fine-grained units deposited as laterally extensive and homogenous layers. The purpose of this study is to investigate which characteristics allow deep-water shales to act as hydrocarbon seals, and to determine where the most effective seals occur within a sequence stratigraphic framework.

The shales analyzed in this study are from the Middle Eocene Juncal Formation, which outcrops in the Topatopa Mountains of Southern California. The Juncal Formation consists of deep-marine shales with interbedded sandstones, which represent submarine slope and basinal plain deposits. Based on thin section petrography and TOC analyses, the Juncal formation has been divided into 5 microfacies. Each microfacies exhibits distinctive mineralogical and textural characteristics and occupies a distinct position within the stratigraphic sequence. MICP analyses were performed to determine which microfacies have the highest sealing capacity. The 5 microfacies, in order of decreasing seal capacity, are calcareous shale, phosphatic shale, pyritic fissile shale, micaceous siltstone, and bioturbated mudstone. Shales that are cemented with calcite have the highest sealing capacity. Shales with high TOC also have higher sealing capacities. Within the stratigraphic sequence, thick shales with their more uniform texture have significantly greater sealing capacity than thin shales interbedded with sandstones.