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CHARACTERIZATION OF THE MONTEREY FORMATION AT ELK HILLS

The Monterey Formation at Elk Hills consists of both sandstone and fine-grained siliceous reservoir units. The fine-grained siliceous units comprise fractured, thinly-bedded heterogeneous strata that are difficult to characterize using standard petrophysical tools and conventional reservoir evaluation techniques. We supplement "conventional" analyses with additional logs and core measurements to improve our understanding of these reservoirs. For example, the opal CT to quartz transition occurs within the reservoir interval and has a significant impact on matrix pore sizes of porcelanite, the primary reservoir rock. We recognize and map this transition using neutron and density porosity logs, and can quantify the impact on pore throat diameter using mercury intrusion techniques (MICP). Increased clay volume also degrades pore geometry, and is quantified using similar techniques. Clay volume varies with bedding cycles that are delineated using porosity logs and spectral gamma-ray data. These basic rock properties control hydrocarbon saturation and the mechanical behavior of the rock packages.

The permeability measured in the laboratory for porcelanites typically ranges from 0.3 to 3 millidarcies (air). Therefore, fractures are required to move significant volumes of fluid to the wellbore, and in some cases may provide additional storage capacity. We integrate data from cores, borehole image logs, and outcrop analogs to characterize the fracture networks. These data enable us to define mechanical units and quantify ranges of fracturing associated with specific lithologies. Image logs enable us to map fracture orientation relative to regional stresses and local features such as faults.