Reservoir Characterization of a Diatomite–Sandstone Reservoir Using Integrated Core and Log Analysis, Lost Hills Field, California

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Interbedded, low-permeability (<10 md) diatomites and sandstones of the Upper Miocene Belridge diatomite at Lost Hills field in the San Joaquin basin, California, have produced <6% of 2.6 billion bbl of original oil in place. Integrated log and core analysis enabled construction of a 1000-well 3-D geologic model that enables a better understanding of the flow units and facies architecture of this difficult-to-produce reservoir, which is a 670 to 1060-ft-thick (0.5 to 0.8-Maduration) package of stacked, <100-ft-thick, coarsening- and shallowing-upward cycles (parasequences) with diatomite bases, sandstone tops, and flooding surfaces between cycles. *Helminthopsis* burrows in diatomite half-cycles indicate slow pelagic sedimentation (possible deepening), whereas *Teichichnus* burrows in the sandstone tops indicate rapid, landderived sedimentation (possible shallowing).

Core-to-well-log-calibration enabled derivation of log algorithms to calculate reservoir properties that populate the geologic model. Integrated core, log, and model analysis reveals progradational parasequence stacking patterns within the Belridge that delineate three seismic-scale (150 to 500-ftthick) depositional sequences with hiatal and/or erosional surfaces between sequences. Basinward thickening of diatomite half-cycles contrasts basinward thinning of sandstones. Pliocene onlap, stratigraphic thinning, and modelderived lithologies indicate deposition on a faulted anticlinal high analogous to the modern Lost Hills structure. Also, stratal thickening on the downthrown sides of faults and thinning over flexures evidences deformation concurrent with diatomite deposition. Interestingly, concentration of diatomite on the crest of the Lost Hills paleohigh, with clastics on the flanks, indicates a paleotopographic depositional control.

A better understanding of this reservoir facilitates efficient reservoir management. Because core constrains an extensive log database, the Lost Hills model provides a valuable tool for characterizing this reservoir, predicting flow behavior, designing fracture stimulation programs, and maximizing recovery from what might otherwise be a marginal asset.