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Stratigraphy, Lithofacies, and Reservoir Distribution: Tengiz Field, Kazakhstan

A supersequence-scale stratigraphic framework is developed for the super-giant Tengiz field of western Kazakhstan through the integrated interpretation of seismic, core, log, and biostratigraphic data. Tengiz produces oil from an isolated carbonate platform (areal extent of 580 km²) of Devonian and Carboniferous age. An initial broad Late Devonian platform exhibits vertical growth and was followed by punctuated backsteps during the lower Carboniferous (Tournaisian and Viséan). The uppermost lower Carboniferous (Serpukhovian) is characterized by several kilometers of platform progradation seaward of the late Viséan platform break. The basal upper Carboniferous (Bashkirian) platform succession was aggradational. Drowning in the early Bashkirian halted carbonate platform growth. Paleotopographic relief on the top of the Bashkirian platform to the basin floor approaches 1,500 meters within several kilometers lateral distance.

The stratigraphic architecture defined in this study is used to subdivide the reservoir. The reservoir is also partitioned based on geographic position along a platform-to-basin profile. Time-slice mapping of synchronous depositional facies provides the basis for predicting reservoir distribution and continuity. On the platform, hydrocarbons are produced from Upper Viséan, Serpukhovian, and Bashkirian reservoirs in grainstone and mud-lean packstone lithofacies of the Shallow Platform and in packstone lithofacies of the Deeper Platform. Multiple pore types are recognized in Tengiz, but matrix permeability is controlled primarily by intergranular porosity. In-place, upper-slope microbial boundstone and transported lower-slope boundstone debris form thick and areally extensive mappable reservoirs (Late Viséan and Serpukhovian) that have distinctive seismic facies and production/performance characteristics. Fractures contribute to non-matrix permeability in these boundstones.