

**AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003**

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Reservoir-Scale Porosity Trends in a Sequence Stratigraphic Framework, Tilston Field, Williston Basin, Canada

The Tilston Field is located in the northeastern part of the Williston Basin and is the fifth largest oil field in Manitoba. In each of the three Tilston Field oil pools, the Mississippian Mission Canyon-1 Member (Tilston Beds) is subdivided into five or six parasequences that are 4 to 10 meters thick. Flooding surfaces are highlighted by 0.3 to 2.0 meter thick zones of argillaceous-rich wackestones and mudstones. The parasequences show an upward increase in porosity and are interpreted as shallowing-upward subtidal carbonate cycles. These parasequences stack to form a highstand systems tract (HST).

Parasequences TB4 and TB5 of the late HST have the lowest percentage of argillaceous material, the highest porosity, and are the main oil producing units in the Tilston Field. The lack of argillaceous material and the good to excellent porosity, suggests that reservoir compartmentalization is unlikely across the TB4 to TB5 boundary. In contrast, the early HST parasequences (TB3 to TB1) are demarcated by argillaceous-rich flooding surfaces characterized by fair porosity and low vertical permeability, which compartmentalizes the aquifer. Therefore, in the absence of vertical fractures, the edge-water aquifer should be stronger than the bottom-water aquifer.

Progressive erosional truncation of the parasequences to the north, combined with the presence of two structural saddles, effectively reduces the areal support of the edge-water aquifer from south to north. The most southerly oil pool has the strongest edge-water aquifer support. Significant differences in horizontal well productivity are directly related to the reservoir geology of the three Tilston Field oil pools.