A detailed study of the upper Wilcox Group and lower Reklaw Formation, based on core, wireline-log, and 3-D seismic data in northern Bee County, Texas resolves this succession into 19 fourth-order sequences and demonstrates greater variability in depositional systems, facies, shoreline evolution, and reservoir sandstone-body geometry than previously documented. Earlier studies of the upper Wilcox Group in south Texas interpreted fluvial-dominated, wave-modified deltaic systems from thick (commonly > 400 ft [>122 m]), undivided stratigraphic intervals that encompass multiple depositional episodes. In contrast, mapping thinner, fourth-order sequences reveals a mosaic of wave-dominated shoreface, inner-shelf, lower-coastal-plain streamplain, and fluvial systems. A complex shoreline trajectory records numerous transgressive-regressive cycles representing multiple episodes of shoreline retreat and advance in south Texas.

The lower one-half of the upper Wilcox succession represents a major, 700 ft (213 m) retrogradational cycle capped by shelf deposits. It is overlain by a 300 ft (91.5 m) regressive cycle including a bedload fluvial system that truncates wave-dominated shoreline deposits. In turn, the overlying lower Reklaw stratigraphic succession represents a period of shoreline stabilization along the upper Wilcox/lower Reklaw shelf margin. Although upper Wilcox sedimentary delivery systems were continental in scale, most upper Wilcox sequences in northern Bee County are composed of small-scale depositional elements inferred to occur between regional, large-scale depocenters. Brazos Delta and other small-scale depositional features such as tidal inlets and lower-coastal-plain streamplain systems are appropriate analogs for upper Wilcox and Reklaw sequences at local scales in south Texas and should be considered in additional reservoir development.
Depositional History and Shoreline Evolution of the Upper Wilcox Group and Lower Reklaw Formation, Northern Bee County, Texas

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ABSTRACT
A detailed study of the upper Wilcox Group and lower Reklaw Formation—based on core, wireline-log, and 3D seismic data in northern Bee County, Texas—resolves this succession into 19 fourth-order sequences and demonstrates greater variability in depositional systems, facies, shoreline evolution, and reservoir sandstone-body geometry than previously documented. Previous studies interpreted deltaic systems from thick (commonly >400-ft [>122-m]), undivided stratigraphic intervals that encompass multiple depositional episodes. In contrast, mapping thinner, fourth-order sequences reveals a mosaic of wave-dominated shoreline, inner-shelf, lower-coastal-plain streamplain, and fluvial systems. A complex shoreline trajectory records numerous transgressive–regressive cycles representing episodes of shoreline retreat and advance in South Texas. The lower half of the upper Wilcox succession is a major, 700-ft (213-m) retrogradational cycle capped by shelf deposits. It is overlain by a 300-ft (91.5-m) regressive cycle including a fluvial system that truncates wave-dominated shoreline deposits. In turn, the overlying lower Reklaw Formation represents a period of shoreline stabilization along the upper Wilcox shelf margin. Although upper Wilcox sedimentary delivery systems were continental in scale, most upper Wilcox sequences in northern Bee County are composed of small-scale depositional elements inferred to occur between regional, large-scale depocenters. Brazos Delta and other small-scale depositional features such as tidal inlets and lower-coastal-plain streamplain systems are appropriate analogs for upper Wilcox and Reklaw sequences at local scales in South Texas and should be considered in additional reservoir development.

OBJECTIVES
- Display fourth-order stratigraphic succession and shoreline trajectory
- Delineate sandstone geometry and interpret depositional systems
- Document evolution of shoreline and lower-coastal-plain systems
- Relate depositional systems and facies to oil and gas productivity

Fig. 1. Thickness of the upper Wilcox Group in Texas with location of study area. Modified from Bebout et al. (1982).

Fig. 2. Upper Wilcox paleogeography. Modified from Sharman et al. (2016).

Fig. 3. Study area with well control. Also shown are location of type log (fig. 4), cored well (Carl No. 1 Gillette [description in fig. 13]), and wireline-log cross sections. Approximate location of upper Wilcox shelf edge is from Edwards (1981). Regional location of map area is shown in figs. 1 and 2.
Depositional History and Shoreline Evolution of the Upper Wilcox Group and Lower Reklaw Formation, Northern Bee County, Texas

INTRODUCTION

The Upper Wilcox Group comprises a series of sandstones laid out in the southwestern Gulf of Mexico, Texas shelf and slope (fig. 3.1). It has been interpreted as a succession of primarily shelf-edge deposits in a wave-dominated coastal setting (Fisher and Thomas, 1967). These deposits, based on trended net sandstone maps and observations from whole cores, were inferred as either tidal channel and Fluvial-dominated to origin (Fisher, 1967), based on data and interpreted primarily on carbonate and net of thick [300–800 ft] (915–2438 m) sections containing normal coherent sandstone sequences, resulting in mapping and interpreting composite depositional systems.

This study and companion studies by Zhang et al. (2005) and Zhang et al. (2006) isolate the Upper Wilcox Group and Middle Wilcox deposits into high-resolution, high-resolution stratigraphic sequences. These cross-equivalents are interpreted as the Middle Wilcox and Reklaw shelf margin submarine fans in southern Texas. This study completes and refines stratigraphic studies by Zhang et al. (2005) and Zhang et al. (2006) by focusing on a part of the northern part of the County, located on the southern margin by the upper Wilcox shelf edge (fig. 3.1). It provides detailed net sandstone maps of 18 depositional sequences, based on high-resolution stratigraphic successions, and documents its stratigraphic evolution. It also demonstrates variability of depositional styles and helps to interpret distinct stratigraphic onshore-offshore transition in the middle marine.

STRA VIG R A T Y AND SHORELINE TRAJECTORY

DELTAIC SYSTEMS

WAVE-DOMINATED SHORELINE SYSTEMS

SHELF SYSTEMS

STRATIGRAPHY AND SHORELINE TRAJECTORY

Fig. 8. Stratigraphic section A-A. Section is located in figure 3. It has been used with stratigraphic data shown in figure 6.

Fig. 9. Stratigraphic section B-B. Section is the top of the Upper Wilcox Group. The In-situ core section with detailed section is shown in figure 5. The baseline
for this section has been interpreted to show upward coarsening.

Fig. 10. Source data is shown in figure 5. The Lower Wilcox Group is shown in blue.

Fig. 11. Source data is shown in figure 5. The Upper Wilcox Group is shown in red.

Fig. 12. Wave-dominated shoreline systems in the upper Wilcox 12 sequence. Core description is shown in figure 13.

Fig. 13. Wave-dominated shoreline systems in the upper Wilcox 14 sequence. Core description is shown in figure 14.

Fig. 14. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 15.

Fig. 15. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 16.

Fig. 16. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 17.

Fig. 17. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 18.

Fig. 18. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 19.

Fig. 19. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 20.

Fig. 20. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 21.

Fig. 21. Upper Wilcox Group in the upper Wilcox 14 sequence. Core description is shown in figure 22.
PRODUCTIVITY AND DEPOSITIONAL SYSTEMS

The upper Wilcox/Reklaw succession in northern Bee County produces oil and gas from a wide variety of depositional systems types. The greatest number of wells with production data are in wave-dominated shoreline systems (Fig. 22). Most production data in fluvial-dominated deltaic reservoirs in the study area are from distributary-channel facies (Fig. 23). However, production data exist for other deltaic facies, including delta-front, channel-mouth-bar, crevasse-splay, and interdistributary-bay. Both oil and gas productivity are greatest in sandy channel-axis deposits in fluvial systems (Fig. 24). However, channel-margin and less-sandy interchannel facies are also productive. These facies are more heterogeneous than sandstone-rich, axial-fluvial-channel facies and are composed of overbank and crevasse-splay sandstones that pinch out into muddy floodplain deposits where potential stratigraphic traps may occur. Shelf and transgressive depositional systems in the upper Wilcox Group in northern Bee County display great variability, with some wells having limited volumes of oil (Fig. 25).

CONCLUSIONS

Sediment-delivery systems in the upper Wilcox Group in the Texas Gulf Coast were associated with continental-scale drainage patterns. However, net-sandstone maps of many upper Wilcox and Reklaw sequences in South Texas suggest small-scale depositional elements.

Structural controls on deposition for upper Wilcox and Reklaw sequences in northern Bee County are inferred from abrupt increases in isopach and net-sandstone values across faults, coinciding with facies changes. Reklaw sequences C to E are preferentially developed on the downthrown side of upper Wilcox shelf-edge faults, suggesting shoreline still stands and increased accommodation.

Trap styles for hydrocarbons include structural, stratigraphic, and combination structural/stratigraphic types. The most productive facies in wave-dominated shoreline and deltaic systems in the upper Wilcox and Reklaw Formations occur in shoreface/beach deposits, whereas distributary-channel facies are predominant in fluvial-dominated deltaic systems.

REFERENCES


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