Genetic Variations in a Growth-Fault System: Downdip Wilcox Trend of South Texas

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Extended Abstract

Analysis of a 180-mi (290-km) segment of the Wilcox growth-fault trend of South Texas (Fig. 1), based on data from more than 2,000 wells, 16 structural dip sections, and 300 mi (480 km) of seismic lines, has led to in-depth understanding of this complex structural system. Detailed structural mapping on two stratigraphic horizons (Fig. 2) has revealed an impressive array of genetic trap types arising from listric growth-fault tectonism.

Variations on the general tectonic theme are displayed along the trend as follows: (1) a relatively dip-restricted central segment spanning the South Texas Salt Basin (Fig. 3) and exhibiting a pronounced influence of salt tectonisms, (2) an eastern segment characterized by gulfward progradation of faults expanding into successively younger stratigraphic units and terminated downdip by "rollup" shale ridges, and (3) a southern segment similar to the eastern one but bearing a pronounced northeast-tilted overprint due to Laramide uplift in Mexico.

In map view, the trend is characterized by multiple sets of crescentic, nested faults with downdip-projecting horns intersecting those of adjoining sets (Fig. 3). Such sets probably resulted from sediment "piling up" in depocenters and failing due to gravitational instability along a prograding shelf edge; these sets are visualized as the result of giant, slowly creeping, submarine landslides occurring along the upper slope.

Common trap types among those universally recognized in growth-fault systems include "rollover" anticlines and associated upthrown antithetic and counter-regionally dipping fault blocks. Less conspicuous traps recognized in this analysis are those in the intersecting horns of crescentic fault sets, turbidite sandstone lenses deposited in bathymetric lows and converted to mounds by differential compaction, and early gas-filled paleostructural "sweet spot" reservoirs with pores largely unoccluded by cement. Evidence of tilting of paleostructural traps is common; an excellent example of post-gas-fill tilting is the giant Northeast Thompsonville field, which has a 250-ft (75-m) inclined gas column "locked in" by tightly cemented, water-bearing flank sandstones.

Future exploration will likely concentrate on more subtle traps, such as those of early growth, perhaps tilted paleostructures, basinal turbidite mounds, and undrilled blocks of intersecting fault horns. All are genetic traps in the downdip Wilcox trend of South Texas and should be present as well in other Cenozoic growth-fault systems of the Gulf Coast.

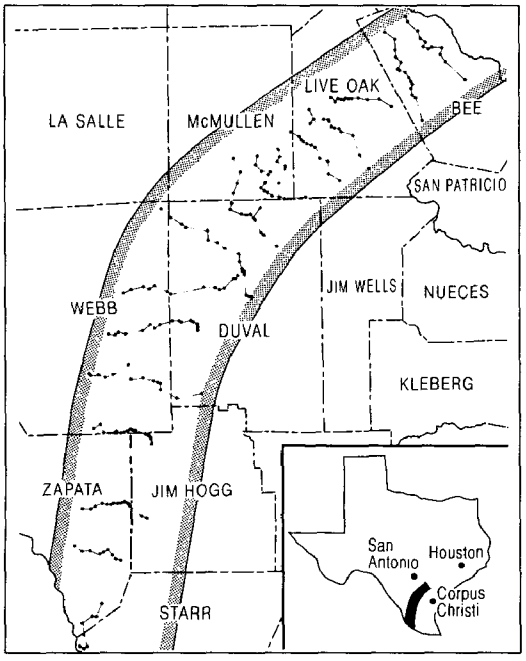

Figure 1. Map showing location of investigated trend and structural dip sections.

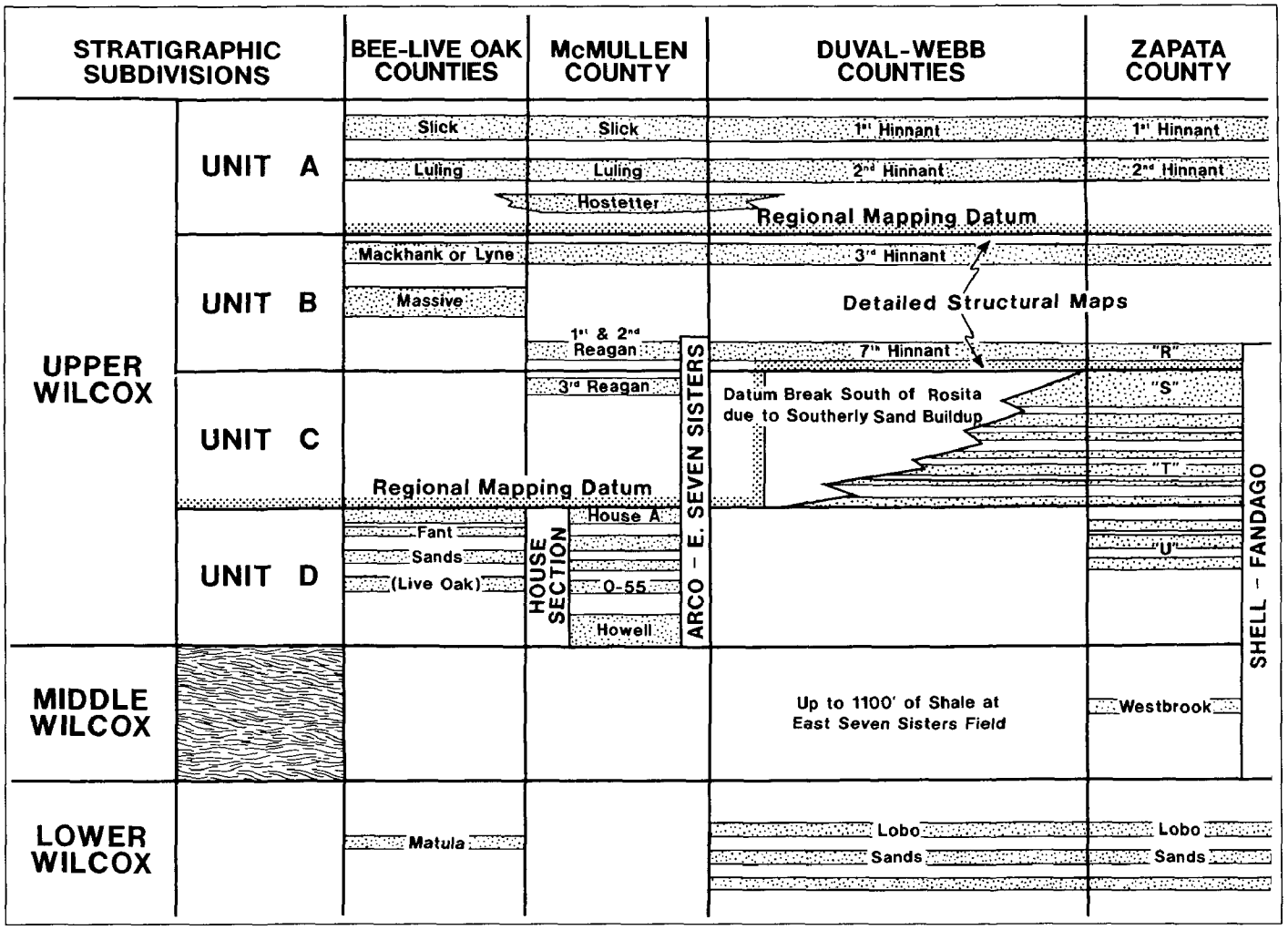

Figure 2. Diagram showing stratigraphic subdivisions of Wilcox system, local sandstone names, and regional mapping datums.

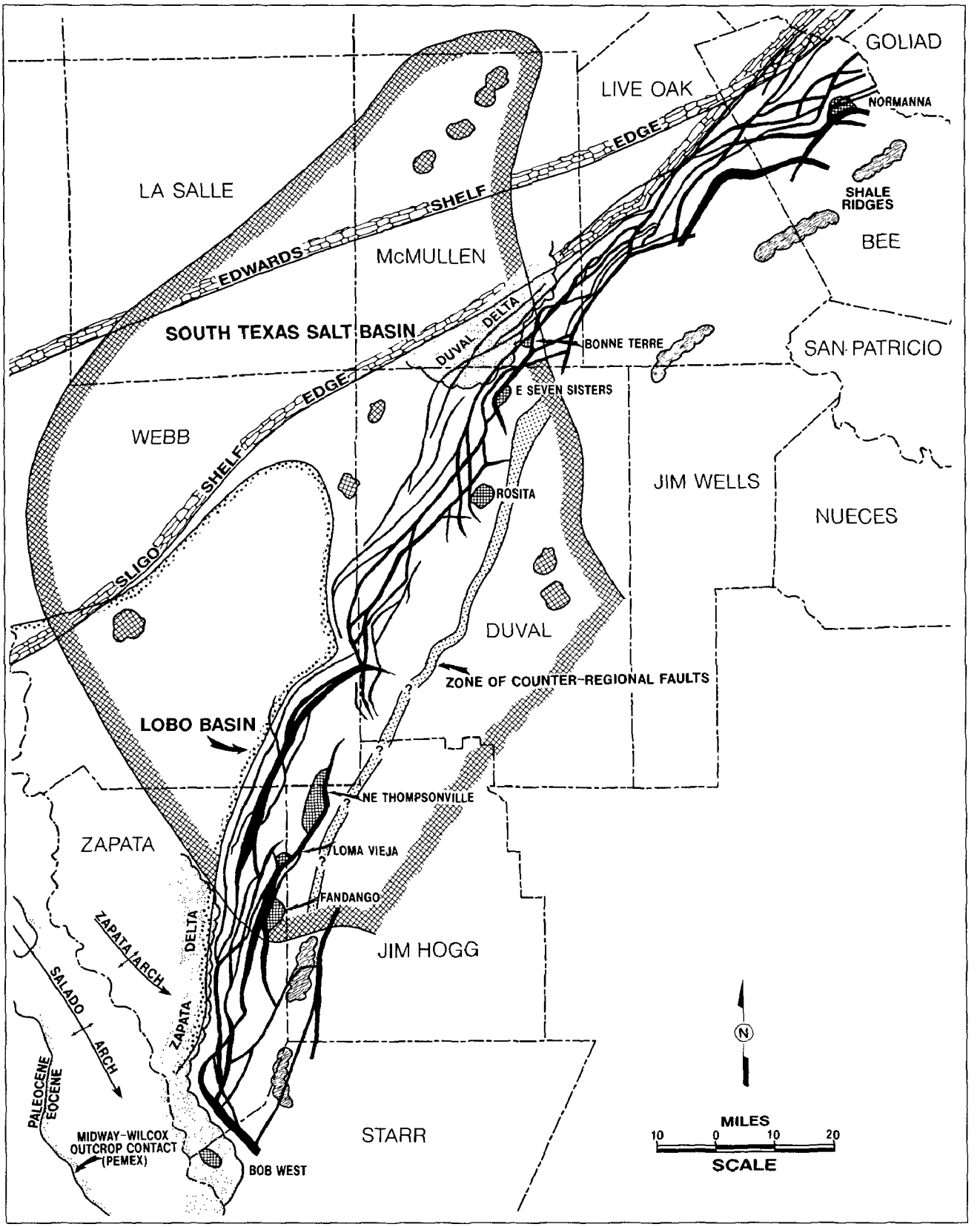

Figure 3. Map showing primary geologic features of trend, major gas fields, and crescentic fault system traces present at the deepest mapping datum as shown in Figure 2. Traces of antithetic faults not shown.