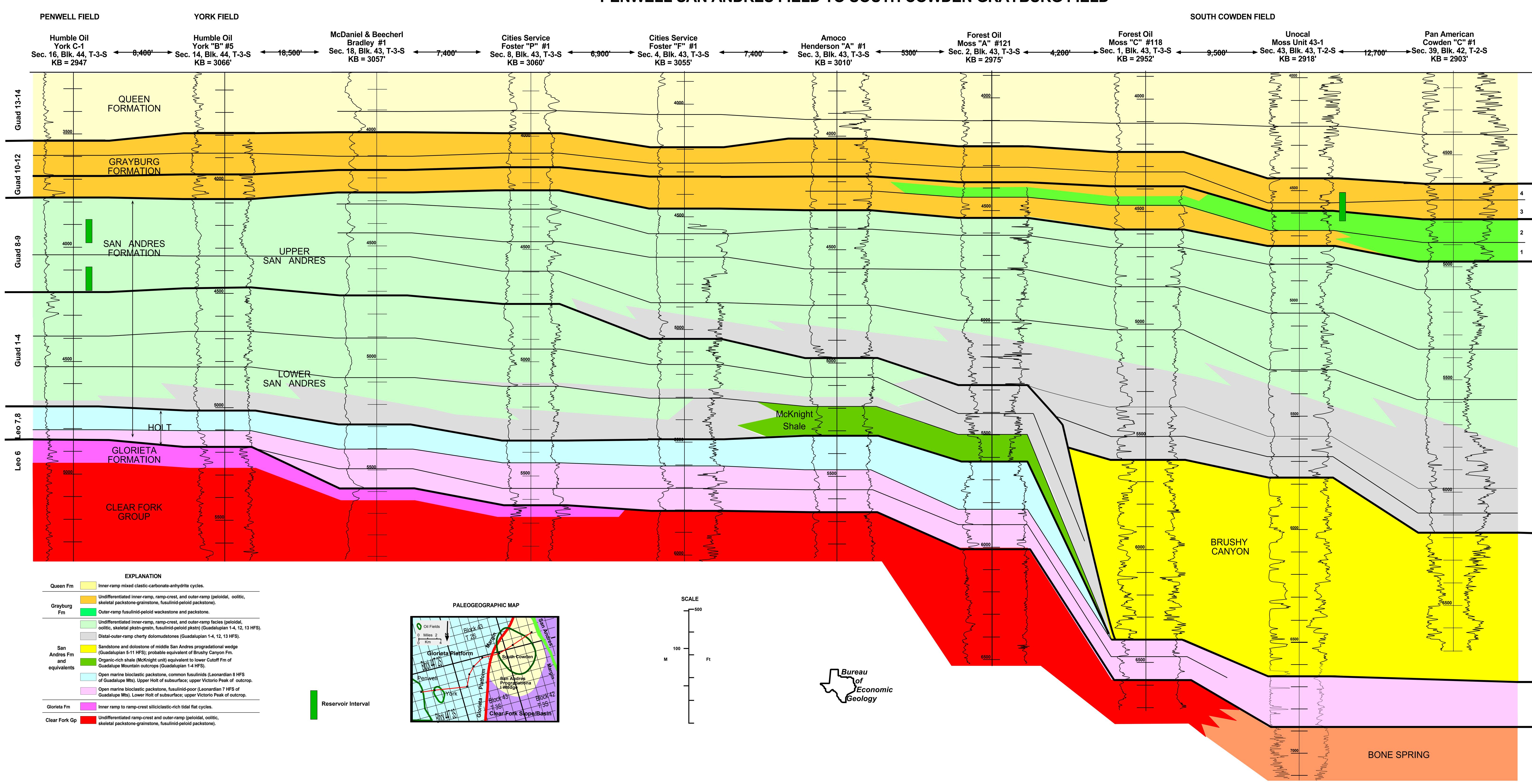
REGIONAL CROSS-SECTION OF MIDDLE PERMIAN STRATIGRAPHY

PENWELL SAN ANDRES FIELD TO SOUTH COWDEN GRAYBURG FIELD



Penwell San Andres Field, South Cowden Grayburg Field, West

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Overview: This simplified, 1Ó=100Õ scale, cross-section extends 14 miles from the interior of late Leonardian-early Guadalupian carbonate platform in Penwell field to South Cowden field, located basinward of the terminal Glorieta platform margin and just inboard of the terminal San Andres margin. The datum for the section is a persistent siliciclastic unit in the middle Queen Formation. Notable features are (1) the terminal Glorieta platform margin, (2) a basin-restricted, progradational wedge immediately basinward of this margin, (3) restriction of the McKnight facies along the Glorieta margin, (4) localization of major productive Grayburg facies to the structural high developed over the progradation wedge, and (5) noncorrelation of productive facies in Penwell field (San Andres) with

Stratigraphic Ur

<u>Leonardian 6 HFS/Glorieta-Clear Fork:</u> The Glorieta Formation in Penwell field consists of a multi-frequency cyclic succession of tidal flat and tidal flat-capped subtidal dolostones that are clearly defined by the high gamma ray signature caused by siliciclastics associated with the tidal flat deposits. Downsection and basinward (eastward), these rocks grade into cyclic, subtidal dolostones of the Clear Fork Group which usually do not exhibit high gamma ray signatures.

predominantly open marine dolostones and limestones that were deposited during major sea le rise and flooding of the platform. This transgression is characterized in outcrop and subsurface sections by retrogradational high-frequency sequences and cycles above the Glorieta-Clear Fork a equivalent succession (Leonardian 6 HFS). The Holt is an important lower San Andres productional horizon along the eastern margin of the Central Basin Platform where sealed by the overly

Guadalupian 1-13 HFS: Incomplete core coverage and lack of biostratigraphic data preclude delineation of Guadalupian HFS on most of this section. In outcrop, Guadalupian 1-4 HFS comprise progradational, basinward-stepping high-frequency sequences composed of, from platform to basin, grain-rich ramp crest facies, outer ramp fusulinid-bearing rocks, and distal ramp, organic rich silty mudstones and shales. The McKnight shale, recognizable on this section by its log signature, is the surface equivalent of the distal ramp Cutoff Formation in outcrop.

As is the case in outcrop, Guadalupian 5-7 HFS are not developed on the carbonate platform but are present basinward of the lower San Andres platform margin as a basin-restricted progradational wedge made up clinoformal sandstone and carbonate beds. This wedge, the probable equivalent of the Brushy Canyon Formation in the Guadalupe Mountains, is restricted to the South Cowden field area. This section runs perpendicular to the axis of the southeast-trending wedge.

Guadalupian 9-10 HFS are represented on the eastern end of the section by largely aggradational, fusulinid-dominated outer ramp San Andres lithofacies.

Guadalupian 10-12 HFS: Four high-frequency sequences can be recognized in Grayburg Formation cores from South Cowden field although only three are apparent regionally. The lower two are dominantly transgressive and composed of outer ramp silt-based, backstepping high-frequency cycles of fusulinid wackestone sand ramp crest pelloidal grainstones and grain-dominated packstones. Most of the production from the Grayburg comes from the upper two sequences (Grayburg 12 HFS) which consist of aggradational, high-frequency cycles of pelloidal wackestone and packstone with grain-dominated caps.

Guadalupian 13-14 HFS: The Queen Formation displays a major basinward facies offset and consists of multiple inner ramp high-frequency cycles composed of basal sandstones and capping, amalgamated tidal flat facies. Basinward, these cycles are capped with pelloidal wackestones and packstones that are locally productive.

