Preliminary stratigraphy and depositional framework of Miocene in offshore Texas and Louisiana for CO2-EOR resource assessment

Mariana I. Olariu, Ramon H. Treviño and Timothy Meckel

Bureau of Economic Geology, The University of Texas at Austin

ABSTRACT

Siliciclastic Miocene strata are currently the most productive of all units in the northern Gulf of Mexico's outer continental shelf, accounting for 40% of all hydrocarbons produced and 40% of all remaining proved reserves. Good hydrocarbon reservoirs make great prospective CO2 storage targets. Numerous depleted oil and gas fields in the offshore Miocene may serve as initial storage or enhanced recovery targets.Prospective Miocene sand trends in the southeast Texas and southwest Louisiana offshore occur in narrow belts which are approximately parallel to the present coastline. There was a southward movement of the shoreline during the Miocene.

Offshore Texas growth fault system consists of major faults that tend to strike northeast-southwest and is characterized by downdip shortening into shale ridges that accommodate updip extension. The offshore of Louisiana is characterized by large-displacement, dominantly down-to-the-basin, listric growth faults that sole on a regional detachment zone above the Oligocene section. Regional deformation is a product of salt mobilization from the level of the autochthonous Jurassic Louann Salt.

The middle Miocene basin-margin sequence records a relatively brief (ca. 5.5 m.y.) depisode. The Texas/Louisiana shore-zone system connected two deltaic depocenters (wave dominated Corsair Delta to the west and Central Mississippi delta to the east) and was separated by a narrow shelf from the offlapping, muddy shelf-fed apron. Well-developed shorezone sand bodies and significant margin offlap demonstrate large-scale strike transport of sediment from the adjacent Mississippi delta system.

The upper Miocene depisode records extensive margin offlap, primarily centered on the Mississippi dispersal axes,that began immediately following the *Textularia Wareni* flooding and was terminated by a regional flooding event associated with the *Robulus E* biostratigraphic top. In the west-central Gulf, adjacent to the Mississippi delta system, abundant strike-reworked sediment locally prograded the strand plain to the shelf edge.

LOCATION AND GEOLOGIC SETTING

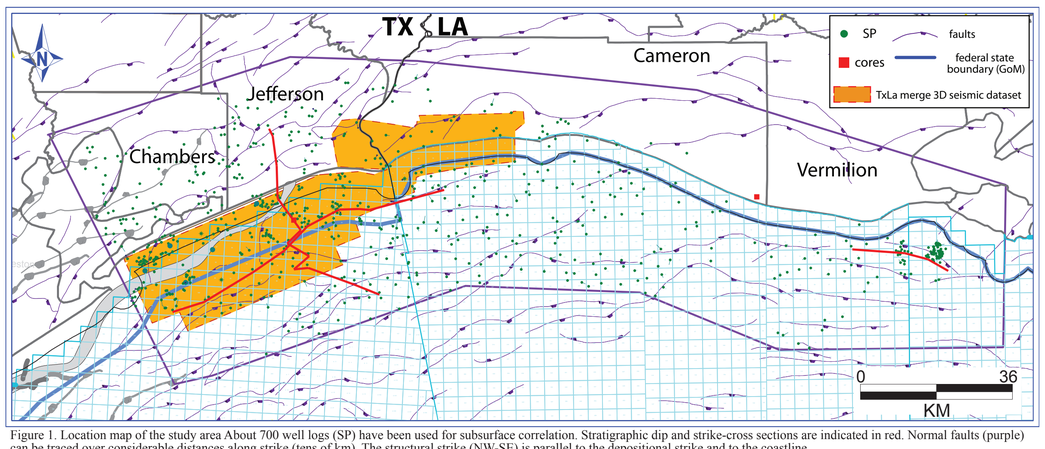


Figure 1. Location map of the study area About 700 well logs (SP) have been used for subsurface correlation. Stratigraphic dip and strike-cross sections are indicated in red. Normal faults (purple) can be traced over considerable distances along strike (tens of km). The structural strike (NW-SE) is parallel to the depositional strike and to the coastline.

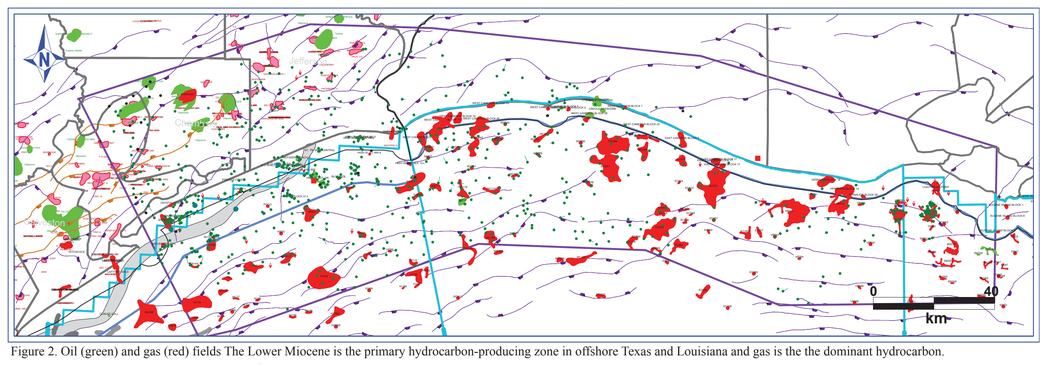


Figure 2. Oil (green) and gas (red) fields The Lower Miocene is the primary hydrocarbon-producing zone in offshore Texas and Louisiana and gas is the the dominant hydrocarbon.

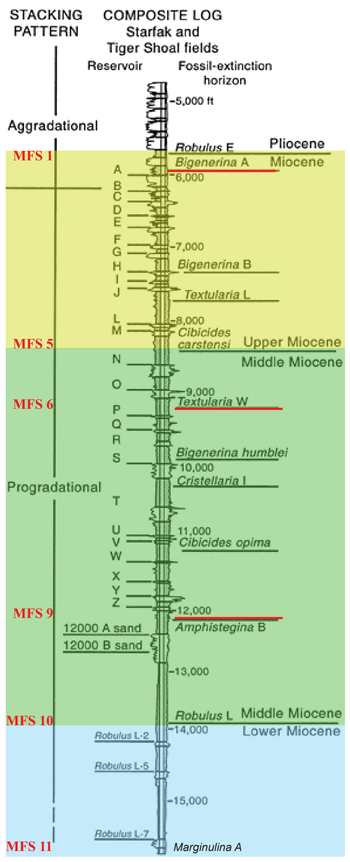
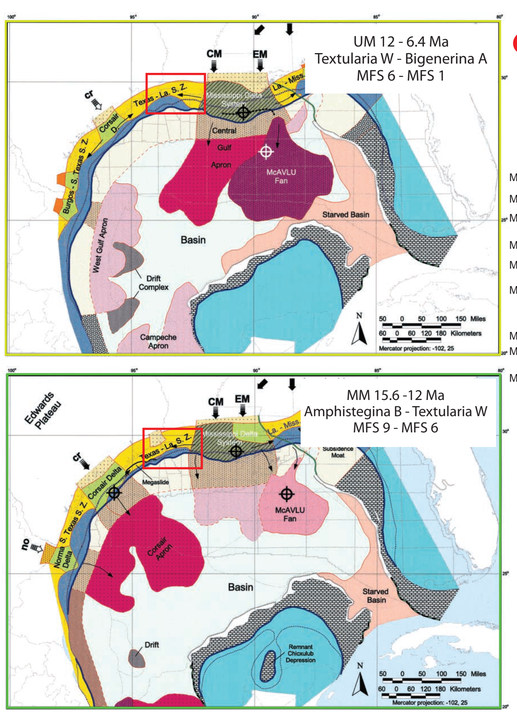


Figure 3. Correlation chart showing lithostratigraphic divisions (modified from Hentz and Zeng, 2003) and regional paleogeography of Miocene in the Gulf of Mexico Basin (from Galloway et al., 2000).



CROSS-SECTIONS

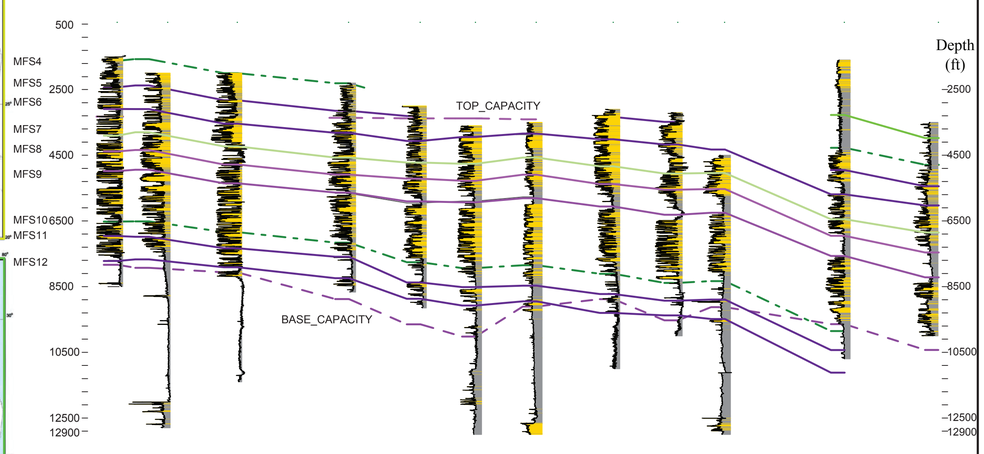


Figure 4. Dip cross-section in Texas The stratigraphy of the Miocene section in offshore Texas and Louisiana is complicated by structural deformation associated with growth faulting (see Fig. 1).

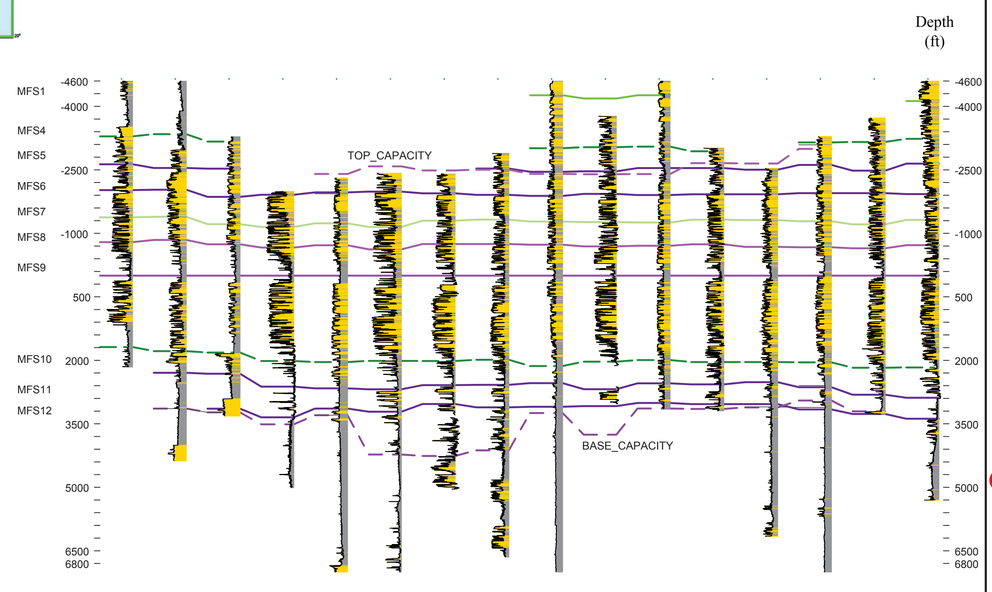


Figure 5. Strike cross-section offshore Texas Geologic sequestration of CO2 is more suitable in sandstone reservoirs between MFS 6 (*Textularia Wareni*) and MFS 10 (*Robulus L*)

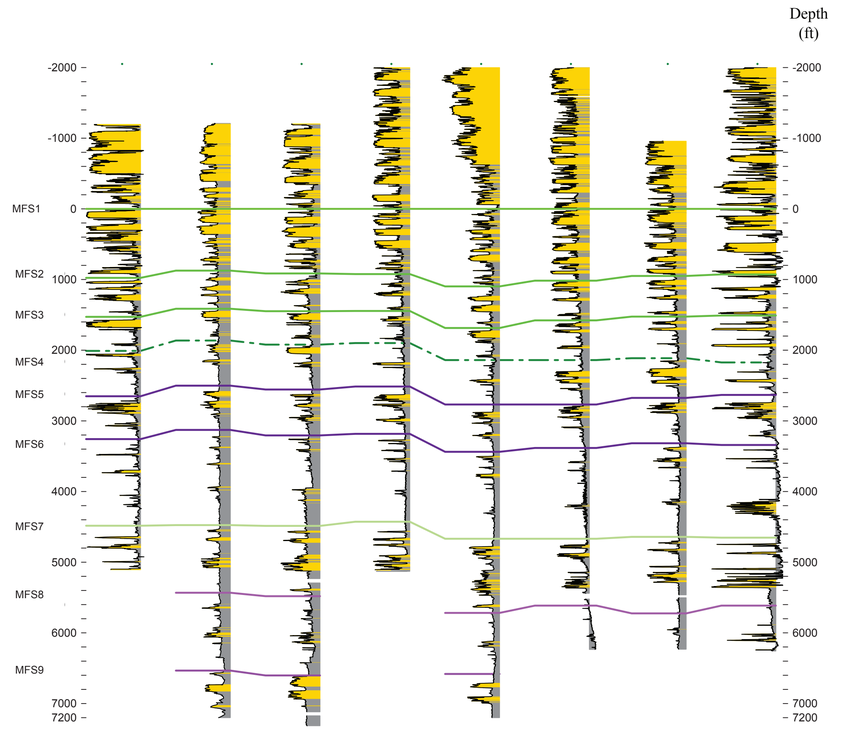


Figure 6. Strike cross-section offshore Louisiana CO2 sequestration most sitable in the Upper to Middle Miocene from MFS 1 (*Bigenerina A*) to MFS 8 (*Cibicides Optima*)

SANDSTONE MAPS

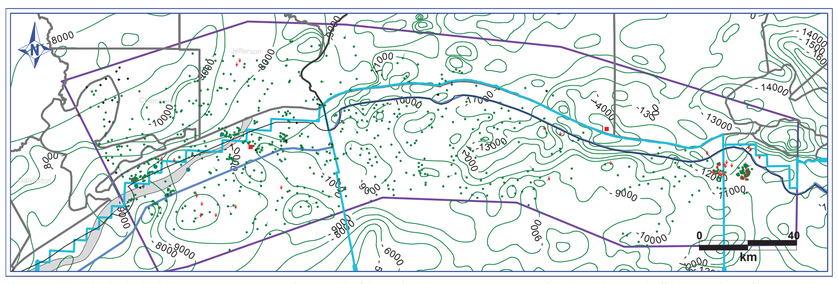


Figure 7. The U.S. Geological Survey geopressure-gradient model of the regional pressure system spanning the onshore and offshore portions of Texas and Louisiana Characterization of the regional pressure system is critical for assessing the occurrence of undiscovered petroleum resources, evaluating hydrocarbon reservoir-seal integrity, and determining the feasibility of geological sequestration and long-term containment of fluids.

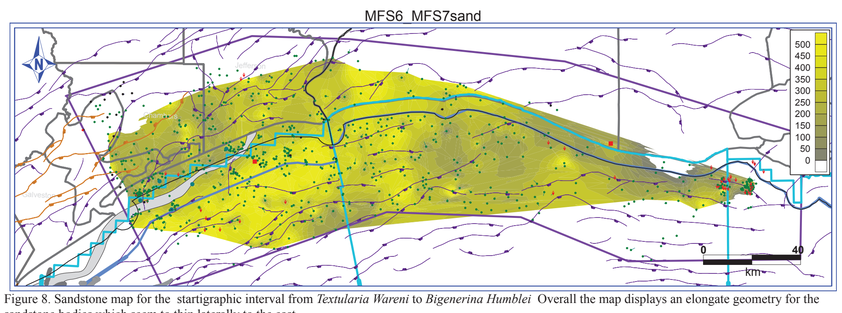


Figure 8. Sandstone map for the startigraphic interval from *Textularia Wareni* to *Bigenerina Humblei* Overall the map displays an elongate geometry for the sandstone bodies which seem to thin laterally to the east.

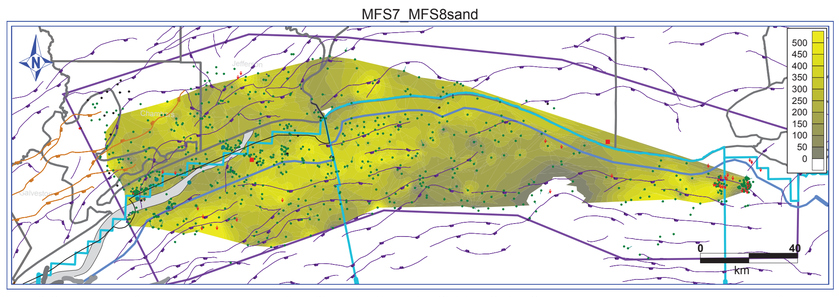


Figure 9. Sandstone map for the startigraphic interval from *Bigenerina Humblei* to *Cibicides Optima* Overall the map displays an elongate geometry for the sandstone bodies which seem to thin laterally to the east. The sandstone becomes thicker in the offshore area (Texas-Louisiana offshore zone).

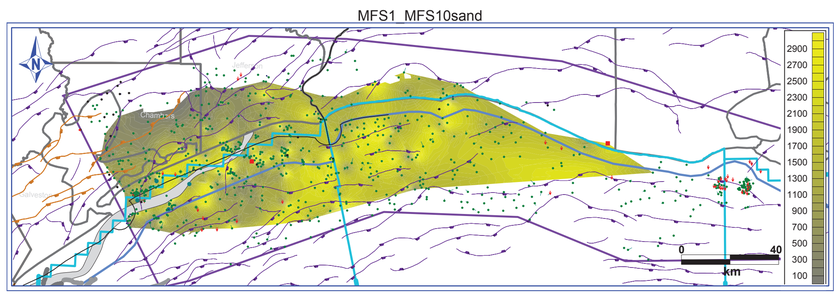
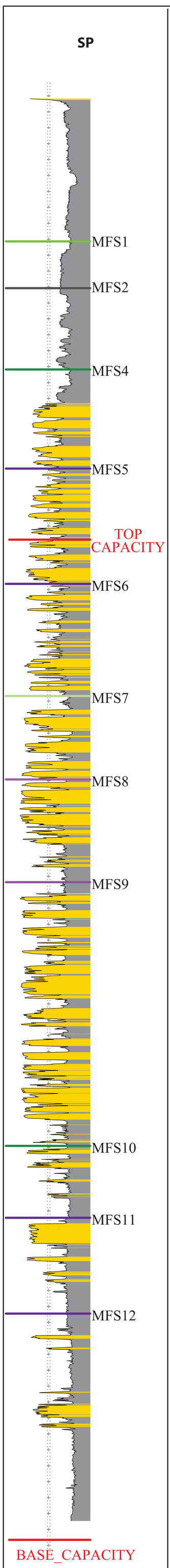
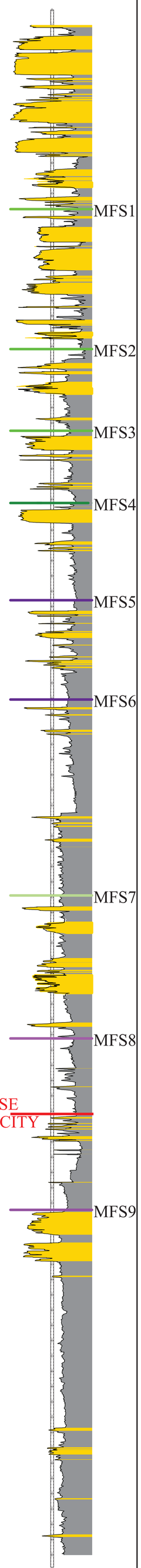


Figure 10. Sandstone map for the Upper and Middle Miocene from *Bigenerina A* to *Robulus L* Overall the map displays a strike-elongate (parallel to the present day costline) geometry for the sandstone bodies which seem to thin laterally to the east. The sandstone becomes thicker in the offshore area (Texas Louisiana offshore zone). Based on the sandstone thickness the capacity distribution is relatively low updip (northwestward), with an increasing storage potential in the basinward direction.



Type log offshore Texas



Type log offshore Louisiana