Regional Mapping of Confining Zones (Anahuac and *Amphistegina* B Shales)

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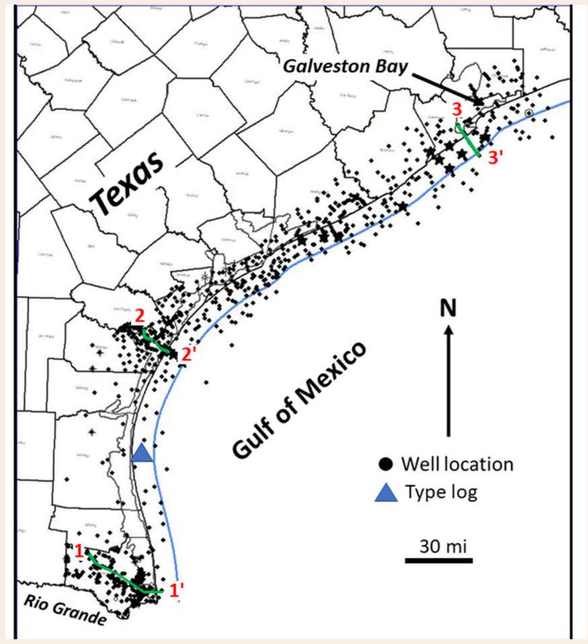
Abstract

The upper Oligocene Anahuac and lower Miocene *Amphistegina* B ("Amph. B") shales serve as regional confining zones in the offshore and near-onshore regions of the Texas Gulf coast. Both units occur within successions of interbedded abundant sandstone and shale and represent periods of relatively low sedimentation rates during widespread shoreline transgression. Many of the sandstones compose reservoirs for hydrocarbons and, when depleted, could serve as reservoirs for injected CO2. Analysis of wireline well-log signature, regional distribution, and thickness variation of the Anahuac and *Amphistegina* B shales as confining zones is essential for evaluating the potential for CO2 storage in the stratigraphically adjacent non-hydrocarbon-bearing sandstone reservoir facies. No regional-scale isopach map of the Anahuac or *Amphistegina* B shales was found in the scientific literature, perhaps because of uncertainty of stratigraphic boundaries. Therefore, GoMCarb has undertaken the regional isopach mapping of the two units in an area of the near-onshore and adjacent state offshore waters of coastal Texas that extend about 350 mi from the Rio Grande in the southwest to Galveston Bay in the northeast.

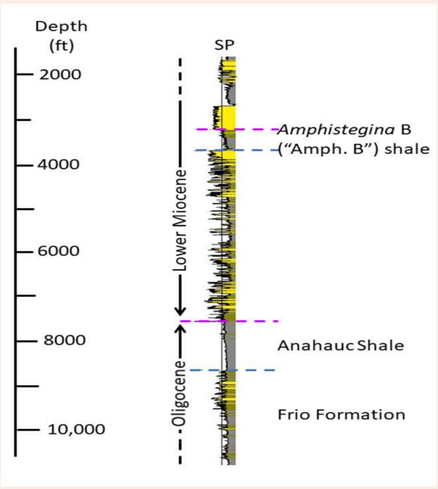
Methods

- Correlations are primarily based on well log correlations and did not benefit from biostratigraphic data.
- Correlation of the confining units was undertaken lithostratigraphically even though we recognize that such correlations cross time lines.
- The goal of the effort was to map the gross thickness of the two confining units under the assumption that they are a fine-grained lithology that impedes and/or retains fluid flow and increasing pressure resulting from CO2 injection.

Map Area

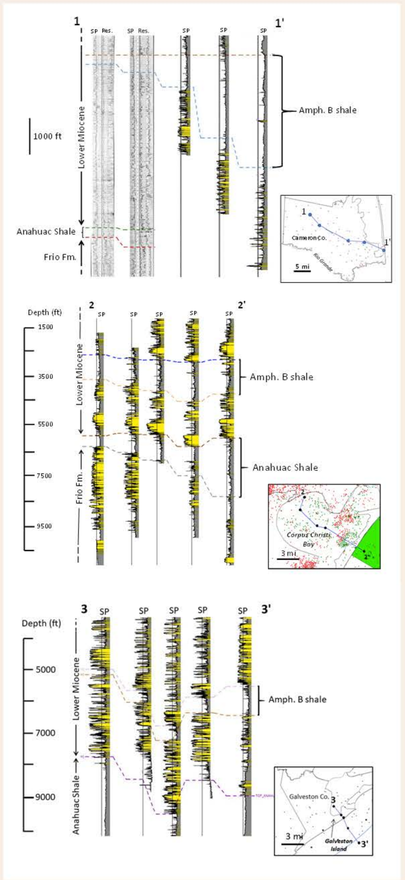


Type Log



- The dominant lithology of the upper Oligocene to lower Miocene section is interbedded sandstone and shale in successions of a few hundred feet to a few thousand feet thick.
- Thick (500-1000 ft) upward-coarsening and blocky to blocky-serrate sandstone wireline-log facies separated by thinner (100-500 ft) upward-fining intervals predominate throughout the successions.

Regional Stratigraphy



Three regional, depositional-dip-oriented cross sections extending from the Rio Grande valley to Galveston Bay illustrate regional variation in the stratigraphic expression of the Anahuac and Amph. B shales.

Anahuac Shale

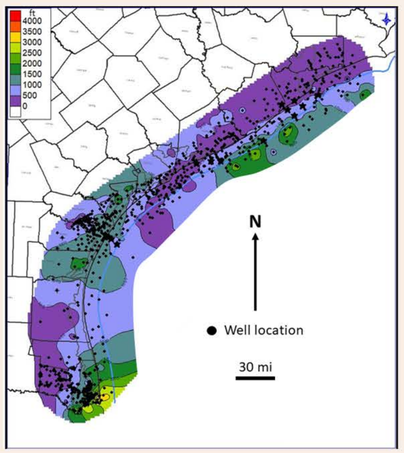
In the updip, western part of the study area, litho-stratigraphic boundaries of the Anahuac Shale are generally sharp. In the down-dip, eastern half of the study area, stratigraphic boundaries of the Anahuac Shale are generally gradational, occurring as retrogradational, upward-thinning and upward-fining thin (<20 ft) sandstone beds at the basal boundary and as progradational, upward-thickening and upward-fining sandstone beds at the upper boundary.

Amphistegina B Shale

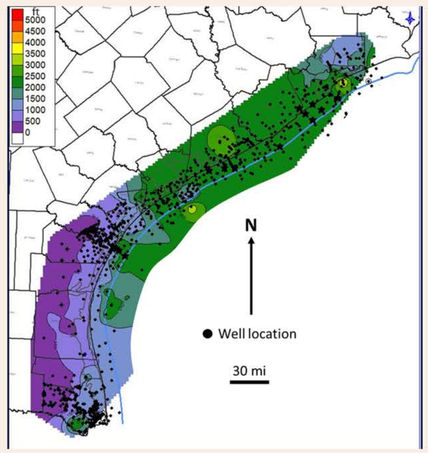
As with the Anahuac successions, lithostratigraphic boundaries of the *Amphistegina* B shale are generally sharp in the updip, western part of the study area and gradational in the downdip, eastern part of the area.

Regional Thickness

Amphistegina "B" Shale



Anahauc Shale



- The **Anahuac Shale** markedly thickens basinward. It ranges from about 250 ft in the western, onshore areas to greater than 3500 ft in the eastern extent of correlations.
- Structurally, the Anahuac Shale is generally gently eastward-dipping, except across major growth faults that are salient features of the eastern half of the study area.
- The unit seems to thicken more abruptly in the southern and northern thirds of the study area, although this observation may be influenced by the lower degree of well control in the central portion of the study area.
- Local, abrupt thickening of the section in the far southern and northern parts of the map record the presence of basinward-dipping growth faults that cannot be precisely defined using only well-log data.

- The ***Amphistegina* B shale** also thickens basinward in the map area.
- Thickness of the unit varies from a minimum of about 170 ft in western Kenedy County to greater than 3100 ft in easternmost Cameron County across an inferred growth-fault zone.

Potential for CO2 Storage

- The **Anahuac** and ***Amphistegina* B** shales are continuous and widespread across the coastal areas of Texas and maintain thicknesses greater than 200 ft (regionally much thicker) over the same region.
- These shales are commonly faulted in the eastern part of the coastal plain and offshore, but they occur in fault blocks that are aerially large enough to effectively form confining zones for hydrocarbon traps, as evidenced by the large number of oil and gas fields in the region.
- In the western part of the study area, the shales are relatively unfaulted and form extensive possible confining zones for injected CO2.
- Therefore, the potential for the Anahuac and *Amphistegina* B shales to act as confining zones for sandstone reservoir compartments of the Frio and lower Miocene successions for CO2 storage is high.