

# Characteristics of Depositional Facies Identified in the Abo Fm., Kingdom North Field, Terry and Hockley Counties, Texas

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## ABSTRACT

Study of geologic data from wells in the Kingdom Field area and other parts of the Abo Shelf Complex trend in New Mexico and Texas has led to new concepts about the style of deposition of the Leonardian Abo Formation. The implications of paleogeographic restoration of the Abo shelf, combined with well logs and detailed description and interpretation of conventional cores petrographic samples from nine wells in Kingdom Field resulted in the definition of four important depositional facies that have significant control on reservoir character. The facies are; Supratidal/Terrestrial (updip and top seal), Intertidal (reservoir grainstones), Lagoonal (reservoir barrier), and Shelf-edge (secondary reservoir). A fifth facies, Karst Breccia, has also been defined.

Evaporites and variably anhydritic mudstones and wackestones that contain very fine peloids and skeletal debris, characterize the Supratidal/Terrestrial facies. Due to the high mud content and occlusion of most porosity by anhydrite, rocks of this facies are tight and form part of the updip seal of Abo reservoirs. Fenestrae, irregular laminae, normal grading, enterolithic beds, and desiccation cracks are some of the sedimentologic features observed in core that characterize this facies. Peloid grainstones and packstones that contain variable amounts of ooids and medium to coarse skeletal debris characterize the sediments of the Intertidal facies. These sediments were laid down in tidal delta complexes, tidal channels, and inner shelf shoals. This facies is identified in cores by common massive-appearing beds, cross-bedded grainstones, minor bioturbation and sharp bounding contacts. Rocks of this facies comprise the primary reservoir in the Abo. They generally possess fair to good porosity and permeability due to their clean, well-sorted texture and subsequent dolomitization. Bioturbated and stylolitic mudstones and wackestones that contain a wide range of skeletal debris characterize the Lagoonal/Subtidal facies. Peloids, crinoid fragments, brachiopods, fusulinids, gastropods, bryozoa, ostracods, calcareous algae, Tubiphytes, sponges, corals, and lithoclasts have all been recognized in sediments of this facies. The rocks are generally dark in color, display common moldic porosity that is typically plugged by anhydrite, and commonly have gradual or bioturbated contacts with over- or underlying beds. Due to their texture, low porosity, and distribution, strata of this facies generally produce a lateral reservoir barrier between the intertidal and shelf-edge grainstones. The Shelf-edge facies consists of two subfacies, build-ups and shelf-edge grainstone/packstone aprons. The aprons are composed of fine to coarse skeletal debris and lithoclasts. These sediments accumulate on the landward side of the shelf-edge buildups and are winnowed by wave and current action. They grade laterally into the sediments of the Lagoonal/Subtidal facies. Rocks of the

shelf-edge apron subfacies provide a secondary reservoir due to their winnowed, if poorly sorted, texture and dolomitization. The buildups comprise boundstones and packstones dominated by calcareous algae and Tubiphytes and less common sponges, corals, and crinoids. This subfacies represents only 6% of the 3177' of core examined. Although the carbonate factory at the shelf-edge generates a considerable volume of sediment, most accumulates in the shelf-edge aprons and lagoon. The buildups are regarded as a minor facies. Rocks of this facies can display good interparticle and framework porosity but typically are plugged with anhydrite and do not represent a major reservoir in the area.

The fifth facies defined by this study is a geologic "wild card". It is the karst breccia facies. Significant breccias comprising rocks of all the other described facies have been observed suggesting exposure of the entire Abo shelf on at least two occasions. Subsequent paleocave systems and breccia zones are typically plugged with cavern-filling anhydrite. These can easily be mistaken for thick depositional evaporite zones on density logs and care must be taken when correlating and mapping or confused interpretations may result.

## BIOGRAPHY

Anthony D'Agostino is currently Senior Stratigrapher/Biostratigrapher for PGS Reservoir (US) in Houston. Tony operated his own consulting company, TD Geoscience, from 1993-97. He was employed by ARCO Oil & Gas Co. from 1980 to 1993, with assignments in Houston, Plano, and Midland. He supported ARCO operations in the lower 48, Alaska, and overseas. Tony acquired his B.S. in geology from Illinois St. University in 1978, and his M.S. from Northern Illinois University in 1980. Since completing his graduate research in Antarctica his attention has been focused on operational problems in bio-, litho-, and sequence stratigraphy, clastic and carbonate sedimentology, and reservoir characterization. He has published (singly or with co-authors) research studies on foram biostratigraphy of the Miocene-Recent in the Ross Sea, Early Eocene sequence biostratigraphy of the Texas Gulf Coast, foram biostratigraphy of the Cretaceous and Cenozoic of the northwestern Pacific, fusulinid biostratigraphy in the Big Hatchet Mountains of New Mexico, and the cycle stratigraphy of the Abo Formation in West Texas and New Mexico. Tony has also published papers on the sedimentology, petrography, and ichnofossils of the Wilcox Fm. of Texas and the Jackfork Group in the Ouachita Mtns. of Arkansas. He served as technical program chairman for the West Texas Geological Society, secretary and 2nd Vice-President of the Permian Basin Section of the SEPM, program

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