

**AAPG Annual Meeting
March 10-13, 2002
Houston, Texas**

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Sedimentology and Depositional History of a Major Shelf Sand Sheet in the Northeast Gulf of Mexico: Modern Analog for Ancient Shallow-Marine Sandstones

Shelf deposition following lowstand delta-building at the shelf edge was documented for the northeast Gulf of Mexico, between the Mississippi and Apalachicola River deltas. Vibracores (52), bathymetry data, and foraminiferal data were used to detail the quartz-rich terrigenous clastic sediments that dominate the entire coastal/shelf depositional system. Owing to low subsidence rates that characterize most of the study area, reworking and hydrodynamic winnowing occurred during repeated cycles of sea level rise and fall in response to Pleistocene glaciation and de-glaciation to produce a sandy coastal plain and continental shelf. Moreover, during the post-glacial rise and present highstand in sea level, the eastern two thirds of the shelf has been sediment starved enabling additional reworking of the shelf sands during the passage of strong cold fronts and hurricanes, thus concentrating a nearly uniform thickness of clean, multi-cyclic, quartz sand, known as the Mississippi-Alabama-Florida (MAFLA) shelf sand sheet.

In terms of areal extent and geometry, the MAFLA sand sheet is an extensive sand body that dominates the shelf. Although relatively thin (3.5 to 5.5 m thick), the sand sheet extends at least 400 km along strike and is 25 to 100 km wide in the dip direction. Consequently, the total volume of the clean, fine-to-medium quartz sand is about 72 billion m³, which would represent a significant oil and gas reservoir sand in ancient transgressive shelf settings. The MAFLA sand sheet provides an actualistic modern-day analog for shallow marine sandstones deposited under regional transgression in the ancient sedimentary record. Since these sandstones, commonly referred to as 'transgressive lags' or 'sheet sands,' are poorly documented with respect to sedimentary characteristics of recognition, stratigraphic framework, and reservoir architecture, this study provides additional insight to their geologic characterization. Transgressive shelf sandstones can be significant hydrocarbon reservoirs in certain sedimentary basins of North America and elsewhere.