

Wednesday, February 29, 2012

Petroleum Club • 800 Bell (downtown)  
Social 11:15 AM, Luncheon 11:30 AM

Cost: \$30 pre-registered members; \$35 for non-members/walk-ups;  
Emeritus/Life/Honorary: \$15; Students: FREE

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.  
Pre-registration without payment will not be accepted.  
Walk ups may pay at the door if extra seats are available.

## HGS General Luncheon Meeting

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*Bryan P. Stephens*  
United States Department  
of the Interior - BOEM

# Basement Controls on Subsurface Geologic Patterns and Coastal Geomorphology Across the Northern Gulf of Mexico: Implications for Subsidence Studies and Coastal Restoration

Of all the processes that have contributed to the depositional architecture and ongoing subsidence of the Mississippi Delta, tectonic subsidence is probably the least understood. Localized vertical movements in southeast Louisiana are, in part, manifestations of ordered, basin-scale structural patterns that have exercised a profound level of control on all subsequent geological processes, including recent coastal environments and ongoing subsidence patterns.

The arrangement of structural elements across the northern Gulf of Mexico suggests the continental margin is segmented by northwest-southeast trending transfer fault zones related to Mesozoic rifting. Observations from a diverse collection of studies are used to document a framework of fourteen major transfer-fault delimited structural corridors, 25 to 40 miles in width, thought to be characterized by varying degrees of extension, crustal attenuation and tectonic subsidence. The corridors are more finely segmented by minor transfer fault trends which also exhibit regular and predictable lateral and vertical offsets that are reflected in the overlying Tertiary cover.

This study incorporates a seismic traverse from a recent proprietary offshore 3-D survey which images offsets in the basement surface corresponding to the transfer faults that trend into southeast Louisiana. Offshore examples illustrate the structural patterns resulting from the interaction of the basement structure, salt systems and Tertiary faults and can be used as analogs for the subsurface of South Louisiana.

Several examples along the northern Gulf Coast from Florida to southwest Louisiana are used to examine the apparent relationship between the transfer-fault delimited structural corridors and

coastal geomorphology. Vertical movements related to these subsurface geologic patterns appear to influence the spatial arrangement of Holocene coastal environments.

Recognition of the ordered arrangement of basement structures, faults and salt systems may provide new insights into the depositional architecture of the Mississippi Delta. Subsurface geologic templates can serve as useful analogs for understanding subsidence patterns in southeast Louisiana and the relative contributions of compaction, faulting, salt withdrawal, and isostatic adjustments. Identification of areas of relative geologic stability may influence the selection of coastal restoration projects and inform plans for a sustainable coast. ■

### Biographical Sketch

BRYAN STEPHENS is a native of the New Orleans area. He holds Bachelors and Masters degrees in geology from the University of New Orleans and the University of Kansas, respectively. From 1985 to 1988 Bryan worked in the Petroleum Research Section of the Kansas Geological Survey. From 1988 to 1999 he worked for Texaco in New Orleans on a variety of exploration and production assignments across the Gulf Coast and offshore Gulf of Mexico. He joined the Minerals Management Service, now the Bureau of Ocean Energy Management, in 1999, where his primary responsibilities include fair market value determination of lease sale tracts in the deepwater Gulf of Mexico. Bryan's geologic interests are centered on the interactions of basement tectonics, salt tectonics, and depositional systems. He is a member of AAPG and NOGS.

