Tectonic Evolution and Mechanism of Folding of Mississippi Fan-Fold Belt System, Eastern Gulf of Mexico

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Depth converted structural models constrained by 3-D seismic, gravity-magnetic and paleontological data over Atwater Valley and Mississippi Canyon protraction areas are used to address the tectonic evolution and mechanism of formation of the Eastern Mississippi Fan Fold Belt (EMFFB). The EMFFB is defined by a series of ENE-WSW trending salt cored detachment and break-thrust fold structures. The pronounced ENE-WSW linear strike orientation suggests interference with deeper basement fabric related to the rift stage opening of the Gulf of Mexico basin.

The structural evolution of the EMFFB involves a complex interplay of basement geometry, salt tectonism, gravity gliding and gravity spreading related to the following four-stage evolution of the eastern Gulf of Mexico. 1) late Triassic-early Cretaceous rift phase, 2) mid-late Jurassic salt deposition, 3) Cretaceous-Oligocene early salt tectonism and gravity gliding, 4) mid Miocene-Pliocene silici-clastic progradation, gravity spreading, and formation of the EMFFB.

Timing and mechanism of formation of the EMFFB has been addressed using palinspatically restored GeoSec depth sections, graphic correlation data, and growth strats relationships within and updip of the EMFFB. The EMFFB structures were triggered by gravity spreading, that resulted in adjustment of a 'super critical wedge' which slipped forward along a salt-basement decollement. This created the frontal EMFFB by basin inversion over pre-existing basement normal faults that acted as buttresses to the sliding wedge

3-D Synthetic Seismic Modeling of Turbidite Sandstones

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3-D synthetic seismic models were generated for a fine-grained, sand-rich turbidite system to illustrate lateral variability in acoustic impedance and seismic response as a function of turbidite facies architecture. The models represent a 250 meter exposed section containing 4 stacked turbidite fan complexes from the Karoo Basin, South Africa. The ultimate goal of this work is to aid in seismic interpretation of deep-water turbidite prospects and reservoirs.

Model generation consisted of: 1) construction of the 3-D lithostratigraphic framework from detailed outcrop descriptions and gamma ray measurements, 2) calculation and assignment of rock properties representative of consolidated subsurface reservoir sandstones and shales, and 3) generation of the 3-D synthetic seismic trace volume.

Acoustic impedance values were calculated using an empirical relationship to estimate P-wave velocity from porosity and clay volume. Synthetic seismic volumes were generated by convolving the reflectivity function derived from the acoustic impedance volume with Ricker wavelets having different peak-frequencies. These models illustrate: 1) the seismic response to changes in thickness and acoustic impedance of the turbidite channel, lobe and overbank facies without hydrocarbon effects, and 2) the ability to resolve the individual fan complexes using different model pulses