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# Authigenic Muscovite and Stylolitization Timing, Jurassic Norphlet Formation, Offshore Alabama

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Stylolitization is common in some Norphlet Fm. areas, and is observed to vary in abundance from 0.4 to 1.1 stylolites/foot in the Mobile Area 872 #1 well. Stylolitization of quartz and k-spar, the two most common framework grain types, results in the precipitation of quartz and muscovite cement with the Norphlet Fm. Three authigenic muscovite morphologies are associated with Norphlet Fm. stylolitization: 1) large crystals of 1M muscovite found in vertical stylolite offsets; 2) fine-grained platy muscovite pore-fillings which only occur near stylolites; and 3) fine-grained platy pods of muscovite found in stylolite insoluble residue.

Thirty one $Ar^{40}/Ar^{39}$ analyses of groups of these mica morphologies indicate that the large 1M muscovite grew at 51 ±9 ma, pore fillings at 77 ±22 ma and pods at 86 ±16 ma. The large 1M muscovite is the most abundant of the three muscovite types.

Petrography illustrates that the muscovite paragenesis is related to Norphlet Fm. stylolitization. Early muscovite pore fillings grew near incipient stylolites due to k-spar dissolution. As stylolitization continued, the earliest pore fillings were conveyed back to the stylolite and currently are found within the seam of insoluble residue as mica pods. Large 1M muscovite growth is correlated to late, intense stylolitization.

Stylolitization is the subject of well and associated porosity reducing cementation is more intense that than observed in penetrations from higher pressured areas. In higher pressure regions of the Norphlet we interpret that high fluid pressure can minimize effective overburden pressure, retard stylolitization, and maintain high reservoir quality.

# Near-trace 3-D Seismic Cubes: A New Tool for Sequence Stratigraphic and Hazards Studies

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Two-millisecond sampled near-trace seismic traces extracted from 3-D seismic exploration data produce high resolution 3-D seismic cubes. Near-trace seismic reflection cubes contain frequencies of up to 120 Hz and allow detailed mapping of Late Pleistocene deep water seismic stratigraphic sequences on a computer workstation. High resolution 3-D data cubes are an ideal tool for the study of sequence stratigraphic systems tracts and geohazards from the shelf edge to the lower continental slope. Seafloor morphology, subsurface faults, amplitude anomalies indicative of shallow gas, and internal sequence facies can be mapped in three dimensions to two-way times of up to two seconds beneath the sea floor. A high-resolution 3-D data set is used to illustrate the application of such subsets for mapping systems tracts and drilling hazards of the lower continental slope offshore Louisiana.

# The Gulf of Mexico As Global Analogue: A Comparison of AVO and Energy Absorption With the South Caspian Basin

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Frequently cited as a global analogue for young Tertiary basins, results derived from the GOM are often (mis-)applied in relatively unexplored areas, world-wide. However, unsophisticated application of conventional AVO reconnaissance techniques will not work, for example, in the similar geological conditions prevalent in the South Caspian Basin.

Results of full waveform modeling of several SCB well reveal the inadequacies of traditional P-wave approximations. e.g. $\text{Impedance}_{sst} > \text{Impedance}_{shale}$ shallow, but $\text{Impedance}_{shale} > \text{Impedance}_{sst}$ deeper.

Also, the Class II-III AVO response shows a local relationship with porosity that is the inverse of the GOM. Three-point log analysis techniques point to a mineralogical influence as a contributing factor. Geophysical modeling shows noise induced by converted waves which can be minimized by radon transform filtering. Perturbation models are presented that show a change in AVO character at the crossover point(s). As these are not consistent basin-wide, conventional AVO modeling without nearby well control will

lead to false results. Preliminary results show some success in using energy absorption to detect hydrocarbons. Examples are shown from the GOM and SCB which show conflicting AVO responses but consistent energy absorption.

Conclusions derived from the SCB, and elsewhere, allow us to reconsider assumptions made about the application of the techniques closer to home and permit a greater understanding of the geological processes behind the geophysics.

# Guiding the Deviated Well Bore

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Cost-effective deviated drilling requires accurate determination of the drill bit in four-dimensional space, including its stratigraphic and structural position, as well as its trajectory orientation and rate. Failure to maintain the desired trajectory, for example by drilling out of the target horizon or below the oil/water contact, can cost millions. I introduce an analytical method for forward-modeling and actual drilling of deviated wells, that allows for rapid spatial locating of the bit, integrating data from measurement-while-drilling instruments. The method, based on a single parent equation with appropriate derivative formulas, predicts the bit's location and trajectory relative to stratigraphy, to fluid contacts, and to structure, including relations to fractures and fault displacements, thus providing feed-back information towards well-bore corrections and adjustments. Analysis of an offshore Gulf of Mexico deviated test well illustrates the effectiveness of the method, in which entry into the target zone, an undesirable exit into overlying nonproductive strata, and subsequent reentry into the target zone well accurately predicted tens to hundreds of feet in advance—real-time analysis, that is during actual drilling rather than my subsequent analysis, might have prevented the costly target exiting. As measurement-while-drilling technology advances, decreasing the spacing between the bit and measurement-while-drilling instruments, equating to decreasing the time lag between when the bit is at a specific position and when geologic data about that position is obtained, the locating, predictive and wellbore corrective capabilities of this method can only increase.

# Extensive Salt Sheet Provinces of the Louisiana Shelf, Gulf of Mexico

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The existence and importance of horizontal salt movement and structuring on the Louisiana shelf is well defined by drilling, improved seismic technology and new understanding of salt tectonics. In this paper, we describe the extensive salt sheet provinces of the Louisiana shelf, and discuss related salt emplacement destruction, timing, associated depositional environments, and their significance for subsalt exploration.

On the northwestern Louisiana inner shelf and onshore coastal area, extensive salt sheets were extruded periodically into overlying sediments and coalesced into extensive salt canopies on the sediment-starved slope from late Eocene to early Miocene. These salt canopies were destroyed by prograding Oligocene and Miocene deltaic sediments, leaving extensive salt welds linking isolated shale ridges and salt remnants, and a large family of faults developed above the detachment. In the South Addition of the Louisiana OCS, the structural framework of the Plio-Pleistocene section exhibits a similar but more complex style along the shelf. Zones with extensive salt welds and detached large basinward-dipping families of faults dominate most of the area. They are separated by zones with isolated salt sheets and related small randomly-orientated faults.This pattern suggests uneven slope environments or, alternatively, sediment starvation and feasting during the emplacement of salt sheets from late Miocene to early Pliocene.