

Process Hierarchies Along the Northern Gulf of Mexico

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A host of synergistic geologic processes exist on and shape a passive continental margin. These include tectonics (basement, salt, sediment, and interactions between), sea-level oscillations, sediment deposition, diagenesis, and changes in fluid-migration routes. Each process appears to be divisible into hierarchies, as exemplified by the Exxon/Vail sequence-stratigraphy model. This hierarchy is based on what is decipherable from industry (10 to 100 Hz) seismic and well log data. Third and fourth order cycles are documented worldwide. These sequences can be correlated with Milankovich cycles and are common in Quaternary/Neogene sequences.

A similar approach might be used to rank other geologic processes. Tectonic processes might be divided into the following hierarchy: (1) order tectonics is the basin; (2) order tectonics is salt/shale diapirism and lateral wedge migration; (3) order features are supra-salt growth faults

that span the continental margin and sole out in shales/salt tongues and possible inter-subsalt-basement shear zones; (4) order units can include discrete, secondary antithetic faults, and primary and secondary fractures associated with advancing salt and/or shale; (5) order and finer tectonic features descend into shattered sediments where local heterogeneity results from original deposition irregularities and subsequent differential compaction, hydrocarbon pockets, local migration, and diagenetic routes.

During preliminary regional exploration, with specific geology yet unmapped, it is prudent to sketch what processes, including their dimensions, periodicities, and vectors, may be operating in a reconnaissance area. This knowledge would be invaluable for deriving an evolutionary history in the area of interest.