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Seismic Stratigraphy of Barrier-Island Arc Retreat Paths in Mississippi River Delta

The stratigraphic record preserved in the retreat path of Mississippi delta barrier-island arcs is controlled by erosional shoreface retreat processes, relative sea level rise, and sediment supply. Marine reworking combined with subsidence of the abandoned delta generate a characteristic sequence of facies from flanking barrier islands, barrier-island arcs to inner-shelf shoals depending on age. The preservation of any part of these sequences is a function of the rate of relative sea level rise and the depth at which individual barrier environments accumulate below the base of the advancing shoreface. More than 500 km (300 mi) of high resolution shallow seismic profiles correlated with vibracores from retreat paths fronting the Isles Dernieres and Chandeleur barrier-island arcs, show contrasting stratigraphic sequences preserved on the inner continental shelf (Mississippi delta).

The Isles Dernieres barrier-island arc developed as a consequence of the Caillou Headland abandonment in the early Lafourche delta approximately 800 years B.P. The base of the advancing shoreface lies 3 to 4 m (10 to 13 ft) below sea level and truncates the entire Isles Denieres barrier-lagoonal sequence and the upper part of the Caillou delta plain. On the lower shoreface, channels can be seen projecting seaward under the central part of the island arc; associated with it is a beach-ridge plain extending eastward. On the inner shelf, a sand sheet up to 60 cm (2 ft) thick marks the retreat path of the Isles Dernieres.

The Chandeleur barrier-island arc was generated by abandonment of the St. Bernard delta complex 1,500 years ago. The base of shoreface erosion lies 6 to 8 m (20 to 26 ft) below sea level, and truncates the entire barrier-lagoonal sequence in the central part of the system. On the downdrift flanks only the upper portion of tidal inlet and recurved spit complexes are truncated. Scattered outcrops of shell reefs and lagoonal deposits occur on the lower shoreface. Beyond the shoreface, a 1 to 5 m (3 to 16 ft) thick sand sheet, with gently seaward dipping interval reflectors, caps tidal inlet scars up to 10 m (33 ft) thick, as well as the basal portions of migrating barrier-island sequences associated with earlier shoreline positions.

Differences seen in the two stratigraphic sequences are a function of distributary size and depositional history of each barrier-island arc. The Isles Dernieres developed from a series of small sand-deficient distributaries in the Lafourche delta complex, whereas the Chandeleur Islands developed from large sand-rich distributaries of the St. Bernard delta complex.

PFIESTER, SAM L., Midland, TX

Miocene Production in Southwest Alabama

The first commercial Miocene production in Alabama was discovered in early 1979 by Amoco Production Co.. The 2 Roy Amos 32-12 was completed through 13 3/8 in. casing at 1,664 ft (507 m) flowing 950 MCFGD on a 20/64-in. choke with 380 lb FTP. Since then 10 additional Miocene fields have been discovered from two different Miocene sands, the Amos and the Meyer. Completed well costs are approximately $150,000. Flow rates are usually in excess of 1 MMCFGD. Porosities range from 25 to 38%. Permeabilities range from a few millidarcys to > 2,500 md. Average reserves are in excess of 1 bcf/well. The depositional environment is postulated to be a flood-plain point-bar system. Shale compaction forms most of the structural relief. After perforating, the wells are gravel packed using 40/60 sand. Most wells exhibit natural flow rates in excess of 1 MMCFGD (28,000 m^3/day. The primary method of exploration is through stratigraphic interpretation of seismic. The productive gas sands appear on seismic data as an amplitude anomaly or "bright spot."

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Statistical Determination of Mean Strike and Dip: Example from Basal Tuscaloosa, Eastern Alabama

An unconformity may be a very complicated surface. A few strike and dip measurements are not adequate to define such a surface, and simple solution of the three-point problem commonly does not improve the definition. However, the use of trend surface analysis permits (a) determination of the "best fit" plane which represents the strike and dip for the region studied; and (b) evaluation of local departures from that plane, in terms of paleotopography.

This procedure has been demonstrated in a study of the basal contact of the Tuscaloosa Group with an underlying variably weathered "gneiss" complex, which was sampled at 17 localities in Macon and Tallapoosa Counties (Notasulga Quadrangle), Alabama. At each locality the elevation and nature of the basal Tuscaloosa contact was recorded along with lithologic observations. A trend surface analysis was used to generate a first order regression plane. This plane represents mean strike and dip of the unconformity; it strikes N81°W and dips 0.61°SW. This result is highly significant ($F_{2,14} = 190.5$; $N = 17$) and accounts for 96% of the variance in elevation ($R^2 = 0.965$).

First order residuals plotted against map location reveal little regional trend. However, mapping of basal Tuscaloosa grain-size data onto the residuals reveals a preponderance of coarse material at localities with negative residuals. This indicates the expected preferences for coarse (gravel) deposition in paleotopographic "lows." Mapping the weathered state of the underlying gneiss onto the residuals reveals no pattern, suggesting that much of the alteration of this unit postdated the unconformity. These results, although on a simple data set, illustrate the utility of the technique to stratigraphic problems involving mean strike and dip.

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Metallic Sulfide Deposits in Gulf Coast Salt Dome Cap Rocks

Sixty-five core tests at Hockley salt dome, Harris County, Texas, indicate an annular zone of iron, zinc, lead, and silver sulfides around the perimeter of the cap rock in cumulative concentrations from trace amounts to over 50% total sulfides. Barite has been identified in concentrations exceeding 60%. The textures within and the geometry of the mineralized zone suggest rapid precipitation in a highly reducing, tectonically active environment.

Petrographic, isotopic, trace element, hydrocarbon, and biological information supports origin of the deposit through a complex evolutionary system involving halokinesis; cap rock development and diagenesis; and the generation, migration, and accumulation of hydrocarbons and associated brines. Existing information indicates that at least 13 other Gulf Coast salt domes host metallic sulfide deposits containing zinc and/or lead as a result of similar processes.

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Characteristics of a Deep-Sea Channel on Middle Mississippi Fan as Revealed by a High-Resolution Survey

A high-resolution, deep-tow side-scan sonar and subbottom profiler survey has been completed across a section of the middle Mississippi fan in water depths of 2,470 to 2,600 m (8,100 to 8,500 ft). A traverse across the fan-axis channel revealed a variety of sediment types: a buried acoustically opaque unit, an extensive mantle of stratified, conformable sediments, and two channel infills. Sea-floor morphology displayed ridge systems, both marginal to the channel and elsewhere on the fan surface, and various channel bed forms, including mottling and ripple systems. Rills and bed truncations are indicative of erosion on the fan surface.

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Depositional Sequences in Pensacola Clay of Southwest Alabama and Their Significance in Petroleum Exploration

In southwest Alabama, the subsurface Pensacola Clay of Miocene age overlies Tampa Stage sediments of early Miocene and is overlain by Miocene coarse clastics. The Pensacola Clay consists of greenish-gray to light olive-gray, slightly calcareous, glauconitic, micaceous, fossiliferous, silty to sandy clay containing beds and lenses of sand, some of which produce

gas. Thickness of the Pensacola Clay increases southwestward. The Miocene coarse clastics are micaceous, locally carbonaceous and fossiliferous, and contain numerous beds of small mollusk shells.

Within the Pensacola Clay and the overlying Miocene coarse clastics, three separate progradational marine sequences may be recognized. Generally, sediments within each sequence coarsen upward. The lowermost sequence, the Amos, contains the gas-productive Amos sand. The middle sequence, the Escambia, has the Escambia Sand at its top. The uppermost sequence includes the upper member of the Pensacola Clay, which contains the gas-producing Meyer sand, and the interfingering Miocene coarse clastics.

Foraminifera found in the Pensacola Clay are indicative of outer to inner-neritic environments. Foraminiferal species number and diversity, as well as number of planktonic species, generally decrease upward within each depositional sequence, indicating an increasingly restrictive marine environment and shallowing of the seas.

The presence of *Globorotalia fohsi fohsi, G. fohsi robusta, G. fohsi lobata*, and *G. praemenardi* in the Amos depositional sequence indicates a middle Miocene age for the sequence. A late Miocene age is indicated for the Miocene coarse clastics by *Rangia (Miorangia) microjohnsoni*. The three depositional sequences appear to correlate with the TM 2.2, TM 2.3, and TM 3.1 third-order cycles of sea-level change as proposed by Vail et al in 1977.

Isopach and net sand maps of the different depositional sequences are useful for petroleum exploration. Comparison of such maps for the Amos depositional sequence indicates that in Baldwin County, Amos sands (the most productive of the Miocene sands) occur where the depositional sequence is locally thicker, probably as a result of postdepositional compaction of clays surrounding sand bodies. Sands found at the top of the Amos depositional sequence are often productive because these sands have been transgressively reworked and are overlain by marine source beds.

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Landform Dynamics of Bayou Lafourche Barrier Shoreline

A three-dimensional morphodynamic model depicting temporal and spatial changes in barrier morphology is presented for the Bayou Lafourche barrier shoreline. Variations in overwash intensity generate a predictable sequence of barrier morphologies, with overwash intensity defined as the frequency and magnitude at which overwash events impact the shoreline. This model depicts continuous change in barrier morphology, with decreasing overwash intensity leading to onshore sediment transport, barrier accretion, and dune development. Increasing overwash intensity leads to barrier erosion, offshore sediment transport, and washover sheet formation.

The erosional sequence begins with stage 1, when a continuous foredune barrier is formed under low intensity overwash and fair weather conditions. Increasing overwash intensity erodes the stage 1 foredune and creates an offshore movement of sand. Increasing overwash intensity leads to foredune breaching, overwash, and the development of an eolian terrace, stage 2. During stage 3, the foredune is eventually destroyed, forming a washover terrace. Continued intense overwash activity finally results in the destruction of stage 3, and the formation of a washover sheet, stage 4.

The accretionary sequence begins with a stage 4 washover sheet generated by intense high-energy overwash conditions. With decreasing overwash intensity, an onshore movement of sediment is produced and the barrier begins to accrete, leading to stage 3. Continuing low overwash intensities lead to discontinuous foredune development and the formation of an eolian terrace, stage 2. Stage 1 is reached when the discontinuous foredunes coalesce to form a linear continuous foredune.

Spatially, longshore variation in sediment availability results in different barrier-beach stages occurring simultaneously along the Bayou Lafourche barrier shoreline. Position within the barrier island system determines sediment supply. Coastal tracts on the central headland and updrift, and of flanking barrier islands, are characterized by a negative sediment budget and the persistence of barrier stages 3 and 4. The downdrift flanks of the erosional headland and flanking barrier islands and spits have abundant sediment, with barrier stages 1 and 2 persisting. An intense overwash event associated with a major tropical cyclone impact would transform the entire Bayou Lafourche barrier shoreline into a stage 4 barrier and initiate a new accretionary sequence.

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Recurrent Species Associations and Species Diversity of Cytheracean Ostracodes in Upper Austin and Lower Taylor Groups (Campanian, Upper Cretaceous), Travis County, Texas

Assemblages of cytheracean ostracodes from the Dessau, Burditt, and Sprinkle formations of the upper Austin and lower Taylor Groups of Travis County, Texas, were examined in order to identify recurring species associations and the paleoenvironmental factors that control their stratigraphic distribution. From Q-mode cluster analysis, six sample groups were identified, all of which correspond closely to observable lithofacies. Four recurrent species associations were identified from the R-mode cluster analysis and were found to correspond to four of the six sample groups. Indices of species diversity and of its components, species richness and species equitability, show noticeable changes from one lithofacies to another, with the greatest changes occurring at the disconformable Dessau-Burditt and Burditt-Sprinkle (Austin-Taylor) contacts.

The stratigraphic distributions of cytheracean ostracode faunas in the upper Austin and lower Taylor appear to be controlled by the distribution of lithofacies. Some of the faunas, however, differ primarily in abundances of species, as opposed to containing different species. Such faunas can be differentiated by comparing values of species diversity and its components. Plotted trend-curves of the indices provide visual aids for this purpose. The parallel shapes of the trend-curves for two outcrops suggest potential use of diversity trend-curves for stratigraphic correlation, and major breaks in these curves at known disconformities show potential for detecting previously unrecognized disconformities. Appearances and disappearances of a few species, including *Alatacythere cheethami, "Hazelina" austinensis, Schuleridea travisensis,* and *Loxoconcha retiolata,* may be temporally significant.

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Petrologic Variation in Pliocene to Quaternary Gravels of Southeastern Louisiana

Grain-size analyses and chert-to-quartz ratios were studied on Pliocene and Quaternary gravel fractions from the Florida parishes of southeastern Louisiana to differentiate between gravels of different ages. Gravels are found in the following units: (1) Pliocene-Pleistocene Citronelle Formation; (2) Prairie Formation (< 35,000 y.B.P.); (3) Deweyville terrace deposits (30,000 to 17,000 y.B.P.); and (4) Holocene channel and bar deposits.

Petrologic studies show that the Citronelle gravels are easily distinguished from the younger terrace gravels by their coarser grain size, low granule content and high chert-to-quartz ratios. Prairie and Recent gravels have similar textures and composition indicating they were deposited under similar conditions. Both Prairie and Recent gravels were derived directly from the Citronelle (Bogue Chitto valley), whereas in others (Tangipahoa valley) they were cycled through the Prairie Formation.

In the Pearl River valley, Prairie and Deweyville gravels are significantly finer and contain higher granule content and lower chert-to-quartz ratios than other gravels in the Florida parishes; this suggests that the late Pleistocene Pearl River was mature and had high discharges, possibly due to an enlarged drainage basin that contained quartz-rich sources which are not available to the modern Pearl River. Post-Deweyville climatic and hydrologic changes have resulted in a smaller drainage basin and less discharge for the modern Pearl River.

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Paleogene Calcareous Nannoplankton Biostratigraphy: Mississippi, Alabama, and Tennessee

Distribution and abundance of calcareous nannoplankton in the Paleogene formations of Mississippi (MS), Alabama (AL), and Tennes-