tems persisted. Strike-oriented shoreline sandstone bodies separated by finer grained shelf and back-barrier sediments are the dominant feature of the Lewisville Member. This marine-dominated succession reflects significant aggradation which kept pace with vertical rates of delta sand accumulation in adjacent areas along depositional strike.

Classical regressive beach sequences are rare in outcrops of the strike-oriented sandstones. Instead, there is evidence of substantial modification by tidal channel incision, or by partial reworking during episodes of low-energy marine inundation. External and internal geometry of these sandstones is thus highly complex. Trace fossils are abundant and indicate locally discontinuous sedimentation. *Thalassinoides* and *Ophiomorpha* are dominant, but escape burrows characterize some beds. Oyster reefs developed in tidal channels and interbar depressions, and along bay or lagoon margins. Clays and silts of coastal lake, bay, and lagoon origin reflect seasonal variation in sediment supply and water chemistry. Small flood-tidal deltas and washovers developed in places along the seaward margins.

Fluvial facies are prominent in outcrop but are not reflected in subsurface sandstone isoliths, presumably because of the volumetric dominance of the strike-oriented systems. Bed-load and mixed-load streams supplied fan deltas and small bayhead deltas, respectively. Fan-delta sandstones, with irregular Gilbertian foresets, but lacking the more typical upward-coarsening pattern, show a varied suite of trace fossils, including *Gyrochorte,* arthropod tracks, and delicate feeding traces.

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Depositional Environments of Some Naborton–Dolet Hills Sediments (Tertiary, Northwestern Louisiana) and Their Relation to Lignite

A preliminary study of the Naborton–Dolet Hills lignitiferous sediments from a single cored well suggests deposition in subenvironments of a deltaic system. The lithology, sedimentary structures, macerals, clay mineralogy, and facies relations are comparable to sequences found in the recent deposits of the Mississippi delta.

The upper Naborton Formation, including the Chemard Lake lignite lentil, consists of organic rich muds, carbonaceous clays, and lignite which probably formed as aggradational deposits on a deltaic plain during a constructional phase of deltaic development. The eroded top of the lignite seam in the study well indicates that a brief marine inundation, or destructional phase, followed deposition of Naborton sediments in the study area. Thinly laminated silty clays containing foraminifera overlie the lignite. The clays grade upward into the fine to medium-grained sand of the Dolet Hills Formation. This sand is massive to ripple laminated and most likely represents a crevasse, or bay-fill deposit.

Several well samples were tested for the presence of radioactive elements. No unusual concentrations of these elements were found associated with the Chemard Lake lignite.

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Foraminifers and Calcispheres from Cuesta del Cura and Lower Agua Nueva(?) Formations (Cretaceous), East-Central Mexico

This study is based on measured and sampled sections in Peregrina Canyon, Tamaulipas, Santa Rosa Canyon, Nuevo León, and at several localities in the Sierra de Catorce, San Luis Potosí. All sections included some covered intervals.

The Cuesta del Cura and the Agua Nueva(?) are composed of gray to black well indurated, laminated, microcrystalline, cherty limestones and dark fissile limestones and calcareous shales. The fissile limestones and shales are voluminous in the Agua Nueva(?), giving it a more clastic aspect which is the basis for its separation. Typically the Cuesta grades over a short interval into the underlying lighter gray, thicker bedded, unlaminated limestones of the Tamaulipas to form a distinct change in lithic properties, but the upper contact is obscure and necessarily arbitrary. The Cuesta del Cura averages 150 m in thickness; a maximum of 190 m of Agua Nueva(?) was measured and sampled.

Foraminifers and calcispheres are common to abundant in most samples. Along with radiolarians, they form the grains of wackestones and packstones. Planktonic forms dominate, giving faunules a strongly pelagic aspect. Induration allowed study by thin section only. Recrystallization and two dimensional specimens made identification difficult. However, many critical species of the middle Cretaceous fauna were recognized, including *Favusella washitensis, Ticinella roberti, Globigerinelloides breggiensis, Thalmanninella subticinensis, T. ticinensis, Planomalina buxtorfi, Rotalipora apenninica, Praeglobotruncana stephani, P. delrioensis, Globigerinelloides bentonensis, Rotalipora gandolfi, R. greenhornensis, R. cushmani,* and *Globotruncana helvetica.*

The distribution of the foregoing forms permitted division of the succession into eight informal biostratigraphic zones: *Globotruncana helvetica* zone (First occurrence); *Grandes globigerines* zone (Interval); *Rotalipora cushmani* zone (Total Range); *Rotalipora greenhornensis* zone (First occurrence); *Rotalipora gandolfi* zone (Partial Range); *Planomalina buxtorfi* zone (Total Range); *Thalmanninella ticinensis* zone (First occurrence); *Thalmanninella subticinensis* zone (First occurrence).

The foraminiferal distribution establishes a range of middle Albian to middle Cenomanian for the Cuesta del Cura and middle Cenomanian to middle Turonian for the lower Agua Nueva(?).

Calcispheres present include: *Calcisphaerula innominata, Pithonella ovalis, P. trejoi, Stomiosphaera conoidea,* and *S. sphaerica.* The ranges reported for these forms are long. Their distribution generally reinforced foraminiferal implications.

Microcalamoides diversus (forma C) of unknown affinity occurs in the basalmost few meters of the Cuesta del Cura, suggesting correlation with the middle Albian.

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Louisiana Chenier System—Some Preliminary Reinterpretations and Refinements

The Louisiana chenier system is the product of a complex interaction of coastal, riverine, biologic, and storm processes. An important component of the chenier system, the chenier ridge, has been described as an accumulation of sand and/or shell material winnowed from existing marsh and tidal flat deposits. According to most interpretations, these ridges are correlative with changes in the flow direction of the Mississippi River from west to east. Most workers believe that the extensive mudflat and marsh sediments that separate the chenier ridges represent periods of progradation, influenced by a high sediment load from the Mississippi during periods of westerly discharge. These alternating periods of easterly and westerly flows represent the classical model that has been presented for genesis of the chenier plain during the past 3,000 years.

While it is generally agreed that Mississippi River sedimentation has been a major factor in the development of coastal geomorphology of southwestern Louisiana, the "flip/flop" model presented above is oversimplified. Furthermore, the term, chenier ridge, has been indiscriminately applied to almost any morphologic unit within the system that shows noticeable relief as reflected in vegetative development. Therefore, little genetic significance should be ascribed to the term. Multiple beach ridges, recurved spits, overwash deposits, storm berms, strandline ridges, perched beaches, and ancient oyster reefs all quality as chenier ridges under previous guidelines.

A more serious problem that appears with the Mississippi River flip/flop model is that relict shoreline dates are not directly correlative with the Mississippi delta–lobe dates, and a growth rate curve of the chenier plain does not support this model.

If the modern southwestern Louisiana coastal zone is examined, several distinctly different environments are encountered: shelly sand beaches, exposed tidal mudflats, and eroding marsh deposits. The conceptual model that has been implied in previous studies of a strandline consisting either of chenier ridges or a marsh/tidal flat environment, depending on the Mississippi River discharge direction, appears to be unjustified on the basis of modern day conditions and C^{14} dating. Refinements in the model based on current field work and further dating should yield a more detailed and integrated picture of the development of the chenier system through time.

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Jurassic Geology and Hydrocarbon Potential of Southwestern Alabama

The Jurassic Haynesville-Buckner-Smackover-Norphlet sequence in southwestern Alabama includes excellent deep reservoirs and laterally equivalent source rocks. The complex interaction of stratigraphy, syndepositional salt tectonics and faulting, and draping due to differential compaction over basement structures provides mechanisms for early entrapment of potentially significant hydrocarbon reserves in this area. Major Smackover-Norphlet production to the northwest and northeast, at Hatters Pond, Chunchula, and Jay fields, is from facies similar to those found in southwestern Baldwin County, Alabama. Detailed petrographic analyses of cores, chips, and cuttings samples from seven wells in southern Alabama and western Florida provide data for conceptualizing Upper Jurassic stratigraphy (Norphlet–Lower Haynesville) and paleofacies relations in this area.

The development of a regional Triassic Eagle Mills paleotopography in this area, including the interior salt basin, was influenced by existing Paleozoic basement structural trends and tensional tectonism related to incipient opening of the ancestral Gulf of Mexico. In the easternmost part of the salt basin, deposition of the Werner Anhydrite and Louann Salt was succeeded by the southward progradation of fluvial lower Norphlet facies. Upper Norphlet facies include littoral and possibly eolian sandstones, which are among the oldest Jurassic hydrocarbon reservoirs in the region. Rapid inundation of the Norphlet surface in lower Smackover time resulted in the deposition of "basinal" argillaceous carbonates (brown dense facies) in the area. This event was followed by the establishment and progressive southward progradation of a shoal-water limestone facies mosaic, including high-energy grainstones. Many of these subsequently dolomitized grainstones have porosities of as much as 24% and good permeabilities despite their burial below 19,000 ft (5,791 m) in southern Baldwin County. However, commercial hydrocarbon production from such reservoirs has not yet been extended south into this area.

Evaporitic sabkha facies of the uppermost Smackover and Buckner–Lower Haynesville subsequently prograded over shelf carbonates throughout most of the study area. Whereas the area south of the Baldwin County graben generally appears to have remained basinal in character throughout all of Smackover time, Buckner–Lower Haynesville deposits in the Amoco 2 Amos well in Sec. 32, T7S, R4E, include thick grainstone shoal deposits which indicate the local existence of an emerging positive area south of the graben. This facies could provide for a significant stratigraphic-structural hydrocarbon accumulations in this heretofore unexplored region.

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Early Cementation and Mineral Stability of Chipola Formation, Calhoun County, Florida

The Chipola Formation crops out along the Chipola River, Ten Mile Creek, and Farley Creek in Calhoun County, Florida. The formation, dated at 16.1 m.y.B.P., is predominantly an unconsolidated, bioclastic wackestone. These carbonate rocks have undergone very little diagenetic alteration and as a result, fossil preservation is excellent. Original mineralogy is unchanged. X-ray analysis of unlithified sediment indicates an average composition of approximately 70% carbonate (45% aragonite and 25% low-magnesium calcite) and 30% noncarbonate (15% quartz, 6% clay, and 9% other). Most shell material is preserved as aragonite and a few sediment samples are still composed of high-magnesium calcite. Disregarding the age of the formation, the unit is considered to be in a very early diagenetic stage.

Cementation occurs in the unit by the formation of low-magnesium calcite in the form of microspar. The