Lithologic and petrologic analysis indicates that the Olmos was formed in two major sedimentary environments. Deltaic distributary channel, levee, marine bay, marsh, and crevasse splay sequences are recognizable in cores from updip wells. However, cores from downdip wells show open marine shelf sequences, occasionally interrupted by ordered, graded, and thin-bedded sandstones deposited by density flows.

Net sandstone isopach maps of the Olmos show that the Olmos was deposited updip as a series of overlapping, lobate sand bodies. Downdip sands have a sheetlike morphology and are much thinner. Structure maps of the top of the Cretaceous show gentle southeast dip in updip areas, indicating stratigraphic trapping of gas in those areas. However, downdip, gas is trapped against a series of down-to-the-coast normal faults.

Gas production trends closely parallel depositional trends. Updip wells produce an average of 52 mmcf/year/well, whereas downdip wells average only 33 mmcf/year/well. Depositional environment is the controlling factor on Olmos sand thickness and morphology, and thus, gas production.

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Ecostratigraphic Model for Shelf Platform Development of Middle Cretaceous (Stuart City) Limestones of South-Central Texas

A new shelf platform model has been developed for the middle Cretaceous strata of south central Texas based on an ecostratigraphic basin analysis. The concept of ecostratigraphy integrates the various ecologic parameters along time planes so that sequential distribution of magnafacies is observed.

Analyses of the Stuart City trend and associated facies suggest that the shelf platform is formed in a subsiding basin and is developed in two stages. The first involves a platform stage, the second a vertical stacking stage.

Shelf platform development is a continuous process beginning in the ramp limestones assigned to the lower Glen Rose Formation. These Trinitian carbonates develop barrier reefs and prograde across the shelf. The debris slope at the base of the barrier reefs forms an elevated platform that maintains the reef organisms within their preferred shallow-water habitat and above the relatively deeper waters of the shelf. When the debris slope reaches the early Fredericksburgian shelf edge, which is maintained by the continental slope, the material is carried beyond the point of stabilization of the debris slope and moves down the continental slope to the abyssal plain. Progradation ceases, but barrier-reef development continues and forms a nearly vertical zone of barrier reefs associated with the continental shelf edge.

The barrier trend, which is created at the close of the platform stage, forms the base upon which vertical barrier growth is initiated. In this region, the vertical stage formed during the Fredericksburgian, continued into the Washitan, and developed as a result of stretched, upward-shoaling cycles.

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Regional Jurassic Lithostratigraphy of Alabama

Jurassic units in the subsurface of Alabama include the Werner Formation, the Louann Salt, the Norphlet Formation, the Smackover Formation, the Haynesville Formation (including the Buckner Anhydrite Member), and the Cotton Valley Group. These units range in age from early Callovian to late Tithonian, (Middle to Late Jurassic) with the Jurassic-Cretaceous boundary possibly occurring in the upper part of the Cotton Valley Group. Deposition was controlled by pre-Jurassic paleohighs, diapiric salt structures, and the peripheral fault system that rims the Gulf Coast basin. Climates during the Jurassic ranged from hot and dry during Early Jurassic to hot and humid during Late Jurassic. The Werner Formation consists of a lower sandstone and shale sequence, overlain by an evaporitic unit, and lies disconformably either on the Paleozoic basement or the Eagle Mills Formation of Late Triassic age. Deposition of the Werner represents the initial transgression of marine waters into the Gulf Coast basin. The Louann Salt is a massive halite unit that formed a southward tilting ramp on which younger Jurassic strata were deposited. The Norphlet Formation is a sandstone sequence with thin interbedded shale that lies disconformably on the Louann. The Smackover Formation consists of two units, a lower laminated mudstone and brown dense limestone, and an upper dolomitic grain-supported limestone. The Smackover lies conformably on the Norphlet, and in places is gradational with it. The Haynesville is a sequence of calcareous, anhydritic sandstone and interbedded, anhydritic, micaceous shale. The Haynesville may consist of either a sequence of interbedded, calcareous mudstone, anhydritic shale and sandstone, limestone, dolostone, and salt stringers, or a massive anhydrite (Buckner) at the base. In places the Buckner is gradational with the upper Smackover. The Cotton Valley Group is a sequence of fine to very coarse-grained to conglomeratic sandstone, interlayered with silty micaceous shale, very thin limestone beds, and in the Mississippi Interior Salt basin, thin coal and lignite beds. The Cotton Valley was deposited in a terrestrial to littoral environment and the absence of fossils, to date, makes it difficult to distinguish from the sandstone units of the overlying Hosston of Early Cretaceous age.

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Use of High-Altitude Color Infrared Imagery in Structural Mapping of Monument Spring Area, West-Central Marathon Uplift, Brewster County, Texas

The Monument Spring area of the Marathon uplift, was analyzed using a Kelsh plotter and NASA high-altitude color infrared (CIR) imagery.

Structurally, the Marathon uplift is a broad dome from which the Cretaceous cover has been eroded, exposing the Paleozoic structures. These Paleozoic rocks, ranging in age from Late Cambrian to Pennsylvanian, are complexly deformed and exhibit a variety of structural attitudes.

The Marathon region was originally mapped extensively by P. B. King in 1937. The Monument Spring area contains two of the most prominent structural features described by King: the Marathon anticlinorium and the Pena Colorada synclinorium. These features are characterized by tight folds and thrust faults striking in a northeasterly direction. North-trending shears are also found within the area.

Although there is a general agreement between present maps and King's original interpretation, the use of high-altitude specialized photography and quantitative Kelsh data provides additional information on the structural complexities of the area. This information, derived from the high-resolution model (obtained with the Kelsh Plotter) is perhaps not readily apparent in the field. The interpretations derived from this information are outlined in the detailed mapping of the Rock House Gap, Sunshine Spring area, and one additional area southeast of Monument Creek.

The high-resolution, infrared imagery and analytical photogrammetric data in combination with more traditional geological information has proven to be a useful tool in this complex structural area.

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Monitoring Local Subsidence in Areas of Potential Geopressured Fluid Withdrawal, Southwestern Louisiana

Growth faulting, rapid deposition, and deep burial of sediments in south Louisiana have resulted in the abnormal pressurization of pore fluids within some sedimentary units. Fluid production from geopressured sandstones may result in porepressure reductions, clay compaction, and land-surface subsidence.

Subsidence is being monitored at the U.S. Department of Energy's Sweet Lake, Parcperdue, and Rockefeller Refuge geopressured-geothermal prospects in southwestern Louisiana. Reservoir-defining growth faults were extrapolated to the land surface. Surface lineations were mapped from aerial photographs, and historical elevator surveys were compared to obtain base-line subsidence rates.

Data from the Sweet Lake prospect indicate that no correlations exist between subsidence anomalies and lineations or fault projections. Subsidence here is probably a result of normal sediment compaction, salt dome-related land-surface adjustments, and/or historical subsurface fluid production. Conversely, a good correlation exists between the Parcperdue subsidence profile and the extrapolated updip extensions of mapped subsurface faults. Historical land-surface subsidence north of the Parcperdue prospect may have resulted from down-to-the-coast slumping along the growth faults that define the prospect. Subsidence at the Rockefeller Refuge prospect ranges from virtually zero on the eastern end of the prospect to 2 in. (50 mm) on its western end. The gradation may be due to oil- and gas-associated fluid withdrawals or land-management variations.

A subsidence analysis near Lake Charles, Louisiana, suggests that a more extensive historical record of leveling data could provide a more qualifying subsidence record. Repeated leveling surveys at the geopressured-geothermal prospects should aid in determining the causes of subsidence before and after depressurization of the geopressured aquifers.

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Elements of High-Constructive Deltaic Sedimentation, Lower Frio Formation, Brazoria County, Texas

The lower Frio Formation in eastern Brazoria County, upper Texas Gulf Coast, was deposited in a high-constructive deltaic environment in the Houston delta system. Constructive elements of the stacked, elongate to lobate deltas that were intersected in core are storm-induced delta-front splays, delta-front slump deposits, and distributary-mouth bar, distributary channel, and delta-plain assemblages. Reworked and winnowed abandonment facies are volumetrically insignificant relative to constructive elements and are subdivided into a cross-bedded shoreface-foreshore subfacies and a cyclic sequence of fine-grained storm deposits on the distal delta front. Micropaleontologic evidence indicates that deposition of constructive and abandonment facies took place in water depths of less than 120 ft (36 m).

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Paleoecology of Mississippi River Mudlumps—Statistical Analysis of a Foraminiferal Assemblage

The foraminiferal species in a mudlump from the Mississippi River were recorded and the number of individuals of each species was counted. This population was compared to living Foraminifera to determine the paleoenvironment in which the mud accumulated. A Chi-square test was performed to determine whether conclusions based only on the number of species present in a sample are similar to conclusions that take into account the number of individuals found for each species.

The Foraminifera in a sample of mudlump material were identified and used to determine the depth, salinity, and temperature of the paleoenvironment. Comparison with living species indicated that water conditions were middle-shelf, open-marine; the depth was between 165 and 410 ft (50 and 125 m); the salinity was between 35 and 38 parts per thousand; and the temperature ranged between 63 and 77°F (17 and 25°C).

Interpretations were based on the frequency distributions relative to each of the environmental parameters. The frequency distributions of the numbers of individuals compared favorably with those of the number of species. Chi-square analysis confirmed that no significant differences existed between the distributions. This result verifies that conclusions based on either of the frequency distributions are similar.

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Lithostratigraphy and Biostratigraphy of Upper Eocene and Lower Oligocene Strata in Southwest Alabama and Southeast Mississippi

Upper Eocene and Lower Oligocene strata in the eastern Gulf Coast region are represented by the western, clastic-dominated deposits of Mississippi, and the eastern, carbonate-dominated deposits of Georgia and northern Florida. These lithofacies intergrade and intertongue across Alabama. The complexity of the lithofacies changes in the region has caused problems in the recognition of geologic ages. The stratigraphic position of the Eocene-Oligocene boundary, as determined by macrofossils and benthic microfossils, is different from that position indicated by planktonic foraminifers. The four members of the Yazoo Clay (North Twistwood Creek Clay, Cocoa Sand, Pachuta Marl, and Shubuta Clay Members), the lateral equivalent of the Shubuta Clay Member (Crystal River Formation), and the overlying Red Bluff Clay–Bumpnose limestone and their associated foraminifers were studied from exposures at St. Stephens quarry in Washington County, Alabama, at Little Stave Creek in Clarke County, Alabama, and on the Chickasawhay River in Wayne County, Mississippi. Based on vertical distributions of planktonic foraminifers at these localities, the Eocene-Oligocene boundary occurs at the top of the Yazoo Clay. The lowermost two members of the Yazoo Clay were not placed in any specific foraminiferal biozones at this time owing to the paucity of planktonic foraminifers in these beds, but these units have been assigned to the *Globigerinatheka semiinvoluta* Interval zone by Barker. The distributions of planktonic foraminifers in the Pachuta Marl and Shubuta Clay Members at both localities allow assignment of these units to the *Globorotalia cerroazulensis* (s.l.) Interval zone, while the Red Bluff Clay–Bumpnose limestone is assigned to the *Pseudohastigerina micra* Interval zone.