Weiner information function, E = species equability] among the 14 doubly sampled stations indicate that the following ranges and averages (X) exist at high tide: S = 2 to 13, X = 7.5; H(S) = 0.311 to 2.046, X = 1.25; E = 0.306 to 0.720, X = 0.522. Low-tide samples have these ranges and averages: S = 2 to 12, X = 7.0; H(S) = 1.721 to 3.750, X = 1.08; E = 0.326 to 0.727, X = 0.488. In comparison to low-tide samples, high-tide samples have a higher species diversity, slightly lower dominance, and are more equable.

Three microbiotopes occur among the 14 stations: (1) beach at 3 stations, (2) lacustrine at 3 stations, and (3) bayou-fluvial at 8 stations. Among the microbiotopes, the beach marshes have the highest diversity (S = 10), the least dominance [H(S) = 1.36], and are least equable (E = 0.400). Lacustrine environments exhibit the greatest dominance [H(S) = 0.969] and equability (E = 0.635), although the diversity is midrange (S = 6.5). The bayou-fluvial marshes show a lower diversity (S = 6.12) and have midrange values for dominance and equability (S = 1.17; E = 0.510).

In the beach and bayou-fluvial marshes, arenaceous foraminifera dominate; however, a calcareous form, *Discorbis* sp., dominates the lacustrine marshes. Numerical abundance (number of individuals) and the diversity of the less common species appear to cause the greatest differences between microbiotopes.

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Isotopic Characteristics of Brines from Three Oil and Gas Fields, Southern Louisiana

Isotopic analyses of 20 brine samples from two diapir-related oil fields and one growth-fault-related gas field in southern Louisiana lend support to a model proposed by A. L. Workman and J. S. Hanor that brines from the geopressure zone are mixing with hydropressured formation waters along the flanks of the Iberia salt dome and, within the limits of the sampling, suggest that this hydrodynamic process may be characteristic of the region. The $\delta^{18}O$, δD and $^{87}Sr/^{86}Sr$ determinations suggest that formation fluids above 2,000 m depth have partly equilibrated with terrigenous clastic rocks. Fluids below 2,000 m appear to be mixed Oligocene and Miocene seawater and clay-mineral water or evolved hydrocarbon-bearing water. These fluid compositions vary with depth due to mixing and possibly to temperature variations. Some samples may contain constituents derived from salt dissolution.

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Subsurface Lignite Occurrence in Wilcox Group, Northeast Louisiana and Northwest Mississippi

An investigation of lignite occurrence in the Wilcox Group of northeast Louisiana and northwest Mississippi revealed high lignite concentrations associated with a highly constructive elongated delta in the lowermost Wilcox Group. Bar-finger sandstone and distributary channel sandstone facies of an elongated delta lobe were recognized trending north-south through the central portion of the study area by sandstone percent maps, net sandstone isopach maps, and characteristic SP curves on electric well logs. Lignite isopleth maps identified principal areas of lignite occurrence adjacent to the elongate delta. Fewer, but thicker seams were found in the northern regions, where a maximum of four seams ≥ 5 ft thick were identified. To the south, a greater concentration of thinner seams occur. The distribution is attributed to a change in the position on the deltaic plain. Numerous, thin lignite beds in the southern region are indicative of lower delta-plain environments, where bifurcating distributaries, crevasse splays, and marine inundation inhibited thicker peat development. The presence of thicker, but fewer lignites to the north supports a transitional to upper delta-plain environment.

Mapping of individual sandstone beds revealed dip-oriented, bifurcating, fanlike geometries indicative of a lower to transitional delta plain. Capping lignite seams are blanket type, having areal extents of up to several hundred square miles and thicknesses ranging from 2 to 20 ft. Thicker seam development occurs along the delta-lobe margins, extending landward into adjacent interdistributary basins. The large extent of the blanket seams is in part attributed to (1) lignite beds capping channel-fill deposits, and (2) distributary channel and point-bar sandstones directly overlying lignite beds, with no truncation evident. Cross sections illustrate subsidence of the lignite beneath the overlying channel deposits.

High-quality lignite originates in transitional to upper delta-plain environments. Optimal areas for high-quality lignites in the Wilcox Group should be the extreme northeastern and northwestern portions of the study area, and farther north into central Tensas and Franklin Parishes, where thicker, transitional to upper delta-plain paleoenvironments should exist. Minimum subsurface depth to the highly lignitic, lowermost Wilcox Group ranges from approximately 5,000 ft (1,510 m) in the northwestern region to 7,000 ft (2,114 m) along the extreme southern boundary.

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Correlation of Cenozoic Sediments on Gulf of Mexico Outer Continental Shelf: Galveston Area Offshore Texas to Vermilion Area Offshore Louisiana (Part 1)

Detailed stratigraphic correlations of the Texas and Louisiana outer continental shelf (OCS) of the Gulf of Mexico have been conducted for the past several years as part of the geological and geophysical effort included in the resource evaluation program.

Part 1 of this study includes the area from Galveston, offshore Texas, to Vermilion, offshore Louisiana. Part 2 will extend down the Texas coast to Port Isabel. Part 3 will extend eastward beyond the Main Pass area. Other parts in the series are contemplated for the eastern gulf and the deep-water areas.

The study area for part 1, Galveston through Vermilion, was selected because it is centrally located and includes portions of most of the productive trends on the federal OCS, and it includes a stratigraphically complex region characterized by the transition from the deltaic sedimentary sequences of the central Gulf of Mexico OCS to the offshore bar facies of the western Gulf of Mexico.

The primary objective of this investigation is to establish a regional stratigraphic correlation grid including all major productive intervals based on electric-log, seismic, and paleontological data. Twenty-five stratigraphic horizons have been identified and regionally correlated.

The correlations of regional markers are presented on both electric-log (geologic) cross sections and on seismic sections that closely parallel the geologic cross sections. The regional markers correlated on the E-logs were projected onto nearby seismic sections and correlated from well to well to verify the accuracy of the electric-log correlations. Time-depth values were calculated from borehole velocity surveys and integrated sonic logs. Approximately 30 electric log and 40 seismic sections have been constructed. Work on part 1 included the detailed analyses of more than 1,500 wells, three-quarters of which had paleontological data, and the interpretation of 12,000 line-mi of seismic data.

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Local Carbonate Production on a Terrigenous Shelf

During the past 10 years, the Department of Oceanography at Texas A&M University has been involved in investigating reefs and banks on the Texas-Louisiana outer continental shelf. Studies were conducted on the geologic structure, sediment distribution, biology, and water and sediment dynamics at over 30 reefs and banks. Because of the influence of the Mississippi River and other streams, the dominant sediments in this part of the Gulf of Mexico are terrigenous sands and muds. Uplift of the sea floor caused by salt diapirism exposes bed rock that serves as a substrate for colonization by calcareous organisms.

Sediment facies and biologic zones at the Flower Garden Banks are closely related. The presence of a bathymetric high influences the direction and velocity of bottom currents. Factors that control sediment facies are biologic components and depth of the nepheloid layer (turbid water). Factors that control biologic zonation are the nature of the substrate, the water depth, and the depth of the nepheloid layer.

No land-derived sediment (silt and clay) are present above a depth of 75 m. Studies of the physical characteristics of the water column indicate

that the nepheloid layer rarely rises to depths of 75 m. The 80-m depth contour marks a major boundary between biologic communities. That depth separates the turbid water fauna below from the clear water fauna and flora above.

The east and west Flower Garden Banks serve as modern analogs of Tertiary reefs, such as the Oligocene reef at Damon Mound, Brazoria County, Texas. The sediment facies are similar, even to the muddy *Porites* gravels and *Heterostegina* sands that were deposited under an Oligocene nepheloid layer.

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Foraminiferal Stratigraphy and Paleoecology of Blufftown Formation (Santonian-Campanian) of Georgia and Eastern Alabama

Fifty-two species of Foraminifera belonging to 35 genera are recorded from Georgia and Alabama. Of these, one species and one genus are new. Two distinctive foraminiferal assemblages are recognized: one consists mostly of benthic species (upper and lowermost middle Blufftown); the other contains associated benthic and common planktonic Foraminifera (middle and upper part of middle Blufftown). Some benthic individuals represent the arenaceous families Lituolidae and Ataxophragmoidae, but most belong to the calcareous families Anomalinidae, Cibicididae, and Nodosariidae.

Absence of foraminiferal assemblages in the lower Blufftown sands indicate a marginal marine environment of deposition. The fossiliferous clayey middle Blufftown represents deposition in a middle neritic environment of a transgressive sea. The silty upper Blufftown member represents a regressive marine deposit. Because of the fluctuating marine conditions, only the more tolerant species could survive so foraminiferal distribution is not uniform throughout the section. The presence of few species but abundant individuals supports this interpretation.

On the basis of the planktonic Foraminifera and diagnostic megafossils, the Blufftown Formation is Santonian to early Campanian in age.

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Diagenesis by Kohout Convection in Carbonate Platform Margins

Kohout convection is a large-scale, long-lived ground-water flow system in the margins of steep-sided active carbonate platforms. It was first postulated to occur in the subsurface of Florida by Francis Kohout in the 1960s. The flow is driven by buoyancy arising from subsurface differences in salinity, temperature, or both. Temperature differences alone drive Kohout convection in isolated platforms. Cold, dense seawater surrounding a platform at depth migrates inward, displacing warmer pore waters at the same elevation. This inflowing density current is, in turn, warmed within the platform and is buoyed upward to discharge on the platform shelf or margin. The result is a giant convective "half-cell" of circulating seawater occupying the platform margin. In carbonate shelves, where regional meteoric ground-water flow may be present, the meteoric water mixes by dispersion with the convecting seawater, resulting in an increase of buoyancy enhancing the flow rate. Kohout convection may be modeled by systems of differential equations governing the fluid flow, heat transfer, and dispersive mass transfer. Approximate analytical and numerical solutions of these equations in the isolated platform setting show the effects of platform margin geometry and subsurface permeability on flow rates and flow patterns of Kohout convection.

Kohout convection may be an important agent of mesogenetic diagenesis because it affects rocks deeply buried in a stratigraphic sense. Porosity may be developed and modified by dissolution by inflowing seawater undersaturated with respect to calcium carbonate phases, by cementation as the seawater warms and rises, and by dolomitization (if possible in these waters), leading to reservoir conditions in platform margins.

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Environments of Sand Deposition, Southwest Louisiana Continental Shelf

A synthesis of approximately 20,000 km of high-resolution seismic profiles, coupled with vibracores and industrial platform borings, shows that various large sand bodies are present in the late Pleistocene and Holocene sediments of the southwest Louisiana continental shelf. Sand-deposition patterns have been largely controlled by glacio-eustatic sea level fluctuations, paleogeomorphology, subsidence, and salt tectonism.

Sand deposits of the area fall into two categories: (1) those associated with sea level lowstands, or regressive deposits, and (2) those associated with rising sea levels, or transgressive deposits. Regressive facies include fluvial and deltaic sands, whereas transgressive sands are largely formed by the reworking of regressive deposits.

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Petrology and Sedimentology of Mississippi Fan Cores, DSDP Leg 96

Pleistocene sediments were cored at nine middle and lower Mississippi fan sites, in water depths from 2,500 to 3,300 m (8,200 to 10,825 ft). Radiography, thin-section, SEM, and XRD studies provided data from which the fan's major depositional environments can be described.

Sands and minor gravels are concentrated in middle and lower fan channel fills, and in lower fan channel-mouth deposits. Silts and clays occur in overbank deposits, passive channel fills, and interbeds associated with coarser facies. Graded bedding of varying thickness is the dominant sedimentary structure in all environments.

Granule and pebble gravels are composed of well-rounded chert and polycrystalline quartz, with minor metamorphic and igneous rock fragments. Moderately to well-sorted sands are mainly fine and very fine feldspathic litharenite, sublitharenite, and subarkose. Sands commonly have thin-section porosities between 20 and 35%; woody organic contents range from 0.7 to 7.9 total organic carbon.

Authigenic minerals occur in sands and muds, but are most abundant in silts and clays. Smectite, illite, dolomite, calcite, pyrite, and gypsum are the main authigenic phases.

At this stage in their depositional history, the sands are clean, have high porosities and permeabilities, show only minor pore-reducing diagenetic effects, and thus have excellent hydrocarbon reservoir potential.

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Effects of Diagenesis on Reservoir Properties and Log Response, Upper Jurassic Taylor Sandstone, Cotton Valley Group

The Taylor Sandstone in Terryville field, Lincoln Parish, Louisiana, is one of many tight gas-bearing sandstones of the Upper Jurassic Schuler Formation, Cotton Valley Group. This coastal strand-plain sandstone is fine to very fine grained, well sorted, with grains that are subrounded to well rounded. It is highly quartzose with an abundance of carbonate cement and lesser concentrations of quartz cement, clay precipitates, and pyrite.

Mechanical compaction has caused a 10% reduction in primary porosity with increasing overburden. Chemical diagenesis has altered the texture and composition of the sandstone and has affected porosity and permeability through cementation, dissolution, and authigenic clay precipitation. Early stages of diagenesis included pyritization, mechanical compaction, and hinderance of compaction by precipitation of quartz cement at grain contacts. The middle stages were dominated by carbonate cementation, which replaced large amounts of detritus and quartz cement and reduced primary porosity to irreducible limits. Finally, the latest stages of diagenesis included development of secondary porosity by localized dissolution of replacive and interstitial carbonate and reduction of porosity by precipitation of pore-lining and pore-filling illite and illite/smectite clays. Poor permeabilities in the sandstone are a direct consequence of incomplete dissolution of carbonate in pore throats and the obstruction of voids by the late clay precipitates.

The conductive property of authigenic pyrite has affected the response of the deep induction resistivity log, consequently causing abnormally high calculated water-saturation values in the Taylor Sandstone. The effect pyrite has on formation resistivity can be clearly seen on R_t-ϕ plots (Pickett method). Formation resistivity is affected even at low percentages of pyrite, and shows an exponential decrease with increasing pyrite concentration. A correction of resistivity was made possible by determin-