

tional environments interpreted as being fluvial-deltaic (Pleistocene), estuary and lagoon, and a barrier island complex (both Holocene). The clay-mineral assemblages of the Corpus Christi Bay cores were compared to those from similar environments in Aransas Bay, adjacent to the north, and were found to be different.

In the Corpus Christi Bay area, the uniform distribution of clay-mineral species in the cores studied strongly suggests a more or less constant detrital source from the Nueces River over a period of approximately the last 35,000 yr. Available data on the clay mineralogy of sediments in the Nueces River drainage system, which flows into Corpus Christi Bay, indicate that kaolinite is the dominant clay mineral of lower Eocene sediments, and that montmorillonite is found in upper Eocene through Pleistocene sediments. We conclude that the clay-mineral assemblage found in cores in the Corpus Christi Bay is detrital, and that diagenetic clays are of minor significance.

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Basement Structure of Gulf Coast: Interpretation of Gravity Anomalies Supported with Structural, Magnetic, and Seismic Data

The filtered gravity map of the 48 contiguous states by Hildenbrand et al illustrates the relationships of anomalies in the Gulf Coast more clearly than previous (unfiltered) presentations. Gravity anomalies are recognized, which lead to the following hypotheses. (1) The passive margin of a late Precambrian to early Paleozoic rift underlies the Ouachita foldbelt from the Marathons through the end of the exposed Ouachitas in Arkansas. (2) A late Precambrian to early Paleozoic transform passive margin underlies the buried Ouachita-Appalachian connection in Arkansas, Mississippi, and Alabama. (3) A continuation of the rift passive margin underlies the Appalachians. (4) An early Mesozoic rift passive margin underlies southern Mississippi, south Louisiana, and coastal Texas. (5) This Mesozoic margin has at least two transform offsets in southern Louisiana and southern Mississippi. (6) The Sabine uplift, the Monroe-Sharkey uplift, and other features along the Atlantic coastal plain are buried portions of a late Paleozoic island-arc complex. (7) The Florida platform is accreted Africa-South American continental material. These hypotheses are supported by structural, magnetic, and seismic data obtained over some of the features.

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Morphology and Dioptrics of Some Ostracod Eyespots

On the Gulf Coast, as in other areas, ostracods have been much used in interpreting paleoenvironments. Such use may be enhanced by study of the ocular structures, including eyespots. Eyespot morphology appears to relate to light levels, which in turn are related to water depths. Thus, a new means of reconstructing water depths may be available.

Eyespots from two species of *Echinocythereis* from modern sediments along the Gulf Coast were studied using polished sections and electron and light microscopy. The inner surface of an eyespot is undulating and has a central convex portion and posterior concavities, each with a small radius of curvature compared to the convex outer surface. Light is converged most strongly by the central area and is focused in the underlying eye space. Astigmatism occurs as light passes through the areas away from the center, in which case the focus is beyond the eye cavity in the absence of a tapetal layer. Comparison of a modern and an extinct (Eocene) species of *Echinocythereis* indicates similar morphology and presumably similar functioning. A potential exists for discerning modern morphology as related to water depth and applying such knowledge to fossil forms and their environments.

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New Reference Locality for Saratoga Chalk, Howard County, Arkansas

The Saratoga Chalk (Navarro Group, Gulf Series, Upper Cretaceous) crops out in a narrow band trending northeast-southwest through Howard, Hempstead, Pike, and Clark Counties, southwest Arkansas.

The Saratoga Chalk is a fossiliferous, hard, sandy chalk, somewhat glauconitic in composition, with thin beds of marly chinks and chalky sands scattered through the formation. Lying disconformably on the Marlbrook Marl, the basal contact is quite distinctive owing to a persistent break in lithology and faunal types. The overlying Nacatoch sandstone disconformably overlies the Saratoga Chalk.

The outcrop, located in Sec. 32, T11S, R27W, approximately 0.5 mi (800 m) west of the Saratoga townsite, provides a complete, easily accessible exposure of the Saratoga Chalk (here 24 ft or 7 m thick) within 1 mi (1.6 km) of the type locality. This new reference locality will complement the poor exposure of the formation at the type locality at Saratoga, Arkansas.

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Catahoula Formation as Uranium Source Rock in East Texas

The Oligocene-Miocene Catahoula Formation of the Texas Gulf coastal plain is a fluvial and lacustrine volcanoclastic unit composed of "normal" fluvial material mixed with distal rhyolitic air-fall ash. In the lower Texas Gulf coastal plain, it consists of stream-transported detritus from the volcanic source area in Trans-Pecos Texas and adjacent Mexico. This volcanoclastic component has altered to release uranium to mineralization processes in the lower Gulf Coast, but there has not been uranium production in the middle and upper Gulf Coast.

To evaluate the potential of the upper Texas Gulf coastal plain for uranium ore deposits, a geochemical study was undertaken. The Catahoula Formation was analyzed for U, Th, K, Rb, Sr, Zr, and Ti to estimate the nature of volcanic glass and its abundance and alteration. Concentrations from three key outcrops were compared. They were also compared to samples from a volcanic area in Trans-Pecos Texas, which is chemically appropriate as a source for the volcanic material in the Catahoula Formation.

In the lower Texas Gulf coastal plain, where uranium is produced, the glassy volcanic material has been pervasively altered, but in the upper coastal plain much glass remains. Because glass alteration is necessary for uranium release and concentration, the potential is low for large, shallow uranium ore bodies in the upper Texas Gulf coastal plain.

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Seismic Signature of Serpentine Plugs in Maverick Basin, Texas

Basalt necks occur on the surface of Uvalde and Kinney Counties in southwest Texas. These basalt necks are the "serpentine plugs" that produce from the Taylor section in the subsurface of Zavala County. Many plugs are present in both the surface and subsurface.

Geology of the serpentine plugs indicates that most of the volcanic activity occurred as post-Austin subaqueous extrusions. Formations below the volcanic material show no structural deformation. Formations above the Cretaceous show evidence of the pile of volcanic material in few places. The most significant evidence of structure and faulting is within the Taylor section.

Strategically placed seismic lines will give obvious evidence of the existence of a serpentine plug.

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Channels in Resedimented Chalks, Cretaceous Gulf Coastal Province of Texas and Mexico

Extensive roadcuts on U.S. Highway 90 in the vicinity of Langtry in west Texas display superb exposures of well-bedded chalky limestones comprising the lowest 27 m (89 ft) of the Austin Chalk equivalent. The limestone occurs as highly persistent beds averaging about 40 cm (15 in.) thick and separated by shale partings averaging 2-3 cm (about 1 in.). Limestone-shale contacts are very sharp. Nannoplankton indicate a Turonian to Santonian age and an outer shelf source; sedimentary features suggest redeposition by moderately low-density turbidity currents in a midfan setting characterized by distinctive distributary channels with channel-mouth bars and levees.

The informal term "Langtry formation" is applied to these strata, which flank shallower water platform facies to the east, north, and west (Austin Chalk and San Vicente Member of the Boquillas Formation), and pass into basinal limestones of the San Felipe Formation in the La Mula basin to the south.

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Sediment Distribution About Salt Domes and Ridges on Louisiana Slope

Salt ridges and domes underlie much of the present Louisiana slope. The bathymetric expression of underlying salt could be either a mound or a flattening of the normal rate of descent down the slope. The "mounded" salt features form barriers to the gravity-driven sediments from the shelf break. Much industrial research has been done in the search for reservoir sands about such an obstruction. Clues to depositional patterns about salt features may be obtained from studies in the deep ocean about seamounts located in pathways of ocean-bottom-following currents. Parallel-bedded sediments form foredrifts on the upcurrent side of a seamount. These foredrift sediments were deposited where the prevailing ocean bottom currents were locally decelerated by the obstructing seamount. In waters overlying the obstruction, a Taylor column of dead water or a slow cyclonic eddy provides tranquil oceanographic conditions, permitting a greater fallout of sediments. Moats are found on the sides of the obstruction and are the result of erosion or non-deposition owing to acceleration of deflected waters. Leedrifts are found on the downcurrent side of the obstruction. Current gyres result from deceleration of accelerated currents along the obstruction's flanks, and a complex sedimentation pattern results. Flow over the obstruction's top is determined by size and shape of the obstruction relative to size and velocity of the bottom-following current. A turbulent wave will be set up which may have sufficient amplitude to influence sedimentation on the downcurrent side. There are appreciable differences between the sedimentation patterns about a dome and a ridge.

If ocean bottom currents equal gravity-driven terrigenous sediment movement and seamounts equal salt domes and ridges, then the result of deep ocean surveys are directly applicable to sedimentation on slopes with underlying salt basement. The salt-related sedimentation pattern of the present slope should be applicable to similar paleoenvironments.

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Paleoenvironments and Hydrocarbon Potential of Upper Jurassic Norphlet Formation of Southwestern Alabama and Adjacent Coastal Water Area

Upper Jurassic Norphlet sediments in southwestern Alabama and the adjacent coastal water area accumulated under arid climatic conditions. The Appalachian Mountains of the eastern United States extended into southwestern Alabama, providing a barrier for air and water circulation during Norphlet deposition. These mountains not only contributed to the arid climate but also affected sedimentation. Norphlet paleogeography was dominated by a broad desert plain rimmed to the north and east by the Appalachians and to the south by a developing shallow sea. The desert plain extended westward into eastern and central Mississippi.

Initiation of Norphlet sedimentation was a result of erosion of the southern Appalachians. Norphlet conglomerates were deposited in coalescing alluvial fans in proximity to an Appalachian source. The conglomeratic sandstones grade downdip into red-bed lithofacies that accumulated in distal portions of alluvial fan and wadi systems. Quartzose sandstones (Denkman Member) were deposited as dune and interdune sediments on a broad desert plain. The source of the sand was the updip and adjacent alluvial fan, plain, and wadi deposits. Wadi and playa lake sediments probably also accumulated in the interdune areas. A marine transgression was initiated late in Denkman deposition, resulting in the reworking of previously deposited Norphlet sediments.

Norphlet hydrocarbon potential in southwestern and offshore Alabama is excellent with four oil and gas fields already established. Petroleum traps discovered to date are primarily structural traps involving salt anticlines, faulted salt anticlines, and extensional fault traps associated with salt movement. Reservoir rocks consist of quartzose sandstones,

which are principally eolian in origin. Porosity types include both intergranular and secondary dissolution. Smackover algal carbonate mudstones were probably the source for the Norphlet hydrocarbons.

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Sources and Distribution of Silt, South Texas Shelf

Fourier grain shape and mineralogic analyses were conducted on the coarse silt fraction of the surficial sediments on the south Texas continental shelf to determine the sources and distribution of the silt. The distribution patterns were evaluated in light of the late Pleistocene paleogeography and modern hydrodynamic conditions prevailing on the shelf to determine whether the coarse silt fraction was relict, palimpsest, or modern in origin.

Two coarse silt-grain shape types are present in varying proportions in the samples from the south Texas shelf. One is associated with quartzose coarse silt and is considered to represent multicyclic coarse silt-size detritus derived from the Texas coastal plain and high plains. The second type is associated with more feldspathic coarse silt and is considered to represent first-cycle, coarse, silt-size detritus derived from igneous and metamorphic rocks of Texas, New Mexico, and Mexico.

Each of the major river systems that supplied sediment to the south Texas shelf during the late Pleistocene and Holocene is characterized by distinctive proportions of first- and multicyclic coarse silt. The Brazos-Colorado and Rio Grande systems, which drain igneous, sedimentary, and metamorphic rock terranes, deposited sediment enriched in first-cycle coarse silt on the shelf during the late Pleistocene low sea level stand. At the same time, the Guadalupe and the Copano-Nueces-Baffin coastal plain river systems, which drain sedimentary rock terranes only, deposited sediment enriched in multicyclic coarse silt on the shelf.

In the southern part of the other south Texas shelf, the distribution patterns of first-cycle and multicyclic coarse silt define the late Pleistocene alluvial plains of the Rio Grande and the south Texas coastal plain rivers. The locations of the alluvial valleys, as defined by grain shape analysis, coincide precisely with the locations of these valleys as defined by shallow seismic studies; therefore, the coarse silts in this area are considered to be relict in origin, unmodified by the weak (0-10 cm/sec) semipermanent bottom currents that prevail in the southern part of the outer south Texas shelf. The preservation of paleogeographic features in the surficial sediments of this area of the shelf indicates that no modern coarse silt, which might bury this relict surface, has been deposited here during modern times.

In the northern part of the south Texas outer shelf, first-cycle coarse silt originally deposited on the ancestral Brazos-Colorado delta is found not only in the delta area, but also overlying most of the alluvial valley of the Guadalupe system lying west of the delta. Therefore, the coarse silt on the northern outer shelf in the vicinity of the Brazos-Colorado delta and the ancestral Guadalupe valley is palimpsest in origin and apparently is being reworked by the strong semipermanent bottom currents that prevail in this region.

In the southern part of the south Texas inner shelf, the patterns of distribution of first-cycle and multicyclic coarse silt indicate that the inner shelf coarse silt is also relict in origin. The apparent absence of modern coarse silt on this part of the inner shelf is thought to reflect the paucity of this size fraction in the major sediment sources of the southern inner shelf—the Rio Grande and Padre Island. In the northern part of the south Texas inner shelf, evidence indicates that the inner shelf coarse silt is a mixture of palimpsest silt reworked from the late Pleistocene substrate and modern silt provided by the Colorado River.

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Rules of Sandstone Diagenesis Related to Reservoir Quality

The reservoir quality of sandstone is almost entirely controlled by diagenetic events. The chemical and physical processes responsible for diagenesis are complex and they influence sand during all stages of burial and, in some basins, during subsequent uplift. Petrographic studies by many workers in the past 10 years provide the basis for formulating rules of sandstone diagenesis that help in predicting reservoir quality in differ-