

sediments followed as a second lobe formed on the east flank.

3. Development of southeast lobe began in 1933 at the mouth of an artificially leveed channel that extended 1/2 mile beyond the southern edge of the existing delta plain. After a period of adjustment to this unnatural channel, a normal sequence of prodelta and delta-front environments and associated subenvironments developed and prograded east-southeastward.

4. In 1936 the discharge channel was extended through Matadorda Peninsula, and the Colorado River began discharging directly into the Gulf of Mexico. Distributaries into the southeast lobe remained open but could divert only a fraction of the total discharge. This decrease in volume of discharge was accompanied by lower flow velocities, a slower progradation rate, and the deposition of generally finer sediments.

5. The lobe entered its destructional phase in 1941, when all distributaries were closed. Wave action has removed most of the subaqueous delta front, beaches and interdistributary bays have formed, and a flourishing marsh has developed.

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ORIGIN AND CHRONOLOGY OF ALABAMA RIVER TERRACES

Investigation of high fluvial terraces along the Alabama River indicates that the highest terraces (115+ m above the floodplain) may predate the Citronelle Formation. Preliminary radiometric age determinations suggest that all of Quaternary history may be represented by those terraces less than 50 m above the present floodplain. The Citronelle surface in southwestern Alabama shows differential warping caused by subsidence of the Gulf Coast geosyncline and uplift of the adjacent upland. Rates of uplift were roughly 1.2 cm/10³ years.

The average rate of river entrenchment prior to North American Pleistocene glaciation was about 2.5 cm/10³ years. During glacial Pleistocene time, the maximum net rate of river entrenchment may have been as great as 7 cm/10³ years. Observation of fluvial features, such as meander scrolls, shows that, in terraces more than 60 m above the floodplain (*i.e.*, more than 1.1 × 10⁶ years old), meander scrolls have been obliterated. Likewise, terrace surfaces are mostly destroyed where more than 1.6 × 10⁶ years old. In deposits more than 3.5 × 10⁶ years old, primary structures have been obliterated and the only evidence of these oldest terrace deposits is chaotic blankets of alluvium.

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LOGARITHMIC SPIRE IN PLANKTONIC FORAMINIFERIDA: ITS USE IN TAXONOMY, EVOLUTION, AND PALEOECOLOGICAL

Studies of several species of planktonic Foraminifera indicate that the spire of the generated coil is an important measure of species. The spire is easily measured and is logarithmic. Test and chamber growth dimensions measured in relation to the spire show that all species thus far studied exhibit nearly perfect geometric growth. Growth measurements taken in this manner allow the growth plan of individuals or assemblages of species to be compared statistically.

Such studies lead to a better understanding of variation within species and of the distinguishing morphologic characteristics of a species. Evolutionary change is better understood by investigating changes in growth

dimensions with respect to the logarithmic spire. In paleoecologic studies of species populations, geographic variation can be quantified to yield a more precise analysis of paleoenvironmental parameters.

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GEOLOGY AND GEOPHYSICS OF EAST NANCY FIELD, CLARKE COUNTY, MISSISSIPPI

East Nancy field, discovered in April 1968, produces from 2 zones. The upper Smackover reservoir is oolitic limestone. The lower reservoir is a sandstone generally called Norphlet by the industry, but included in the Smackover in this paper.

Accumulation is the result of closure on a low-relief salt anticline. The structure is "buried," exhibiting no reversal on beds above the Cotton Valley. Consequently, shallow subsurface and gravity interpretations offer little aid in delineating the anomaly. East Nancy was first drilled, and apparently condemned, by Southwest Gas Producing Company in 1959, following an extensive conventional seismic program. The discovery well was located on the basis of CDP data, which defined the structure.

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PETROLOGY AND SEDIMENTATION OF HACKBERRY SEQUENCE OF SOUTHWEST LOUISIANA

Recent discoveries in the Hackberry of southwest Louisiana have created new interest in the high-risk, deep Hackberry section. Petrographic examination of 3 conventional cores and hundreds of sidewall cores, together with previously completed isopach studies, has established that the lower Hackberry sandstones are turbidites. Within the area, the lower Hackberry sandstone interval shows two depositional patterns: an updip north-south channel pattern, and a downdip blanket-type sandstone pattern. Cores in the lower Hackberry show the following graded sequence from bottom to top: (1) a coarse-grained conglomeratic sandstone which grades upward into finer laminated sandstones; (2) crossbedded and convoluted sandstone; (3) siltstone; and (4) finely laminated shale. The sandstone is bimodal and trimodal, commonly containing 30-50% clay matrix. The microfaunal assemblage within the lower Hackberry cyclic sequence indicates depth ranges of 300-3,000 ft (Zones 5, 6).

Because of the turbidite nature of the sediments, production within the channels has been small, except where the channels have encountered salt domes and have been deflected around them. In such channels, the turbidity currents lost velocity, and important sandstone bodies were deposited, reworked, and locally winnowed. In the downdip area where the channels spread out into a blanket pattern, production is controlled by the topographic and structural configuration of the unconformity surface on and around which the turbidity currents deposited sediments.

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NEW PLEISTOCENE MARINE FOSSIL LOCALITY IN CHAMBERS COUNTY, TEXAS

A well-preserved marine invertebrate fauna of late Pleistocene age represented by 48 species has been found in Ingleside barrier island, southeastern Texas.

The fauna is similar to the Holocene fauna of the Texas Gulf Coast. Most of the species suggest deposition in a rather low salinity bay or inlet environment, but the entire fauna indicates changing environmental conditions.

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REEVALUATION OF GULF COAST PLIOCENE-PLEISTOCENE BOUNDARY

A reexamination of the sequences of planktonic foramin and calcareous nannoplankton in the Plio-Pleistocene sediments beneath the Louisiana continental shelf has been undertaken to modernize correlation schemes that were established 10-20 years ago. As a consequence it can be shown that (1) a new correlation of marine micropaleontological and continental glacial events is necessary; (2) the Gulf Coast faunal events can be correlated reliably with those in the type Italian Pleistocene section and in the deep sea cores; (3) some species, the limits of whose ranges have been relied upon for isochronous boundaries (e.g., *Globobulimina altispira*) appear to have persisted in some areas for a considerably longer time than in other areas; and (4) it is increasingly evident that it is invalid to correlate the Plio-Pleistocene boundary, as defined by paleontology, with a climatically defined boundary.

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PETROGRAPHY OF SELECTED TERTIARY LIMESTONE TYPE SECTIONS IN FLORIDA

The Tertiary limestones of Florida provide sedimentologic information for environmental analysis. The type sections of the Eocene Ocala Group (Crystal River, Williston, Inglis Formations), and the Oligocene Suwannee and Marianna Limestones were studied petrographically. These formations represent several different microfacies that can be recognized in other areas. Rock types present include biosparites and biomicrites, many of which are pelletoidal and intraclast bearing.

The various facies reflect the presence of topographic highs, numerous marine transgressions and regressions, and a complex diagenetic history involving periods of organism boring, solution, spar infilling, recrystallization, dolomitization, and silicification. Petrographic information about the various type sections provides standards of reference which can be related to other exposures of these formations.

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POTENTIALLY PETROLIFEROUS TRENDS IN FLORIDA AS DEFINED BY GEOTHERMAL GRADIENTS

A newly constructed geothermal gradient map of Florida suggests both the presence of areas with high petroleum potential and the thickness of the potentially petroliferous section. The base of the "potential section" is defined by the depth of the basement, and the top is defined by the depth at which the minimum temperature exists for petroleum maturation. From previous studies this upper limit is assumed to coincide with the 221°-isotherm depth. A "potential section" map has been prepared which includes all of the presently productive fields and new discoveries within favorable areas. Locations of thick sediment sections of proper

temperature for oil occurrence are: the Western Panhandle, a small area of the central Panhandle, and the extreme southwestern part of the peninsula. Over most of central and north Florida and in the southern Keys the basement may be penetrated before encountering the requisite minimum temperature for petroleum maturation. Tests in these areas run a higher probability of being barren.

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APPLICATION OF ISF/SONIC COMBINATION TOOL TO GULF COAST FORMATIONS

The Spherically Focused Log is a new resistivity log developed to replace the short-normal in the Induction-Electrical sonde (IES). It uses an electrode array and includes a current focusing system. Bucking currents, flowing mainly in the borehole, cause the measuring current to enter the formation and then diverge spherically.

The Spherically Focused Log (SFL, trademark of Schlumberger) has much better bed definition and considerably less borehole effect than the short normal. It has a shallower investigation, hence it gives more accurate invaded-zone resistivity.

The Induction-SFL can be run in combination with a borehole-compensated Sonic, thus providing a simultaneous recording of deep resistivity, shallow resistivity, SP, Sonic transit time (porosity information), a caliper or Gamma Ray, and computed R_{wa} . This combination makes possible a more immediately available evaluation of zones of interest with less expenditure of rig time.

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DIAGENETIC ASPECTS OF SUBMARINE CEMENTATION IN BERMUDA "BOILER" REEFS

Holocene reefs in Bermuda, called "boilers," are presently being cemented by fibrous and fine-grained "mud textured" magnesium calcite to produce a rock with low porosity and permeability. As much as 50% of the resulting rock consists of cement and internal sediment. Internal composition varies from pelleted ostracod- and foram-rich sediment to oolites and pisolites. Such sediments occur in vugs measuring from a few millimeters to caves up to more than 1 m across. These submarine caves are formed by overgrowth and sheet-like layers of coralline algae and the hydrozoan *Millepora* sp. (constructional formation), and by organic enlargement of cave walls by boring organisms (destructional formation). Such caves could be mistaken easily for subaerially formed caves, and the internal oolites and pisolites might be mistaken for freshwater cave pearls.

Syncementation fractures up to 1.5 m in width cross-cut one of the "boiler" reefs. Fractures are believed to result from instability due to organic growth which commonly produces overhanging ledges along the margins of these reefs.

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RECENT DEVELOPMENTS IN MIOCENE *Planulina* GAS TREND OF SOUTH LOUISIANA

The lower Miocene (Oligocene?) *Planulina* interval of South Louisiana is a sequence of interbedded sandstones and deep water shales beneath the *Siphonina*