

ervoir recovery efficiency, (4) entrapment history and area of accumulation, (5) functional reservoir thicknesses, and (6) the individual and group credibility of assigned values.

A precise combination of these parameters would establish an *in situ* reserve of hydrocarbons and its worth. Computers can minimize effectively the options for the involved disciplines excepting geology. The assignment of probabilities and values to multiple working geologic hypotheses continues to govern the assumed reserve and competitive bid. Expansion of measurement capability is probable, and its increased definition power will accentuate the role of conceptual geology.

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BLACK WARRIOR BASIN

The Black Warrior basin of Mississippi and Alabama is a potentially large oil and gas province with numerous possible reservoir units. This study excludes the rocks of the Ouachita folded belt in central Mississippi.

All the Paleozoic systems except the Permian are present in the study area and only the Cambrian does not crop out on the surface. There are at least 77,725 cu mi of sedimentary rocks, predominantly carbonates, in the basin.

Oil and gas have been, or presently are, produced from the Cambro-Ordovician, Ordovician, Mississippian, and Pennsylvanian in the Black Warrior basin. Analysis of the depositional and structural configuration of the area shows new trends that offer tremendous potential for a future major oil and gas province. The basin is considered a part of the Appalachian geosyncline. For each system present an attempt has been made to reproduce the tectonics affecting deposition and to depict the rocks as originally deposited. In this manner trends of high-energy deposition can be postulated, shorelines can be reconstructed and potential stratigraphic traps delineated. When these relations are analyzed, the known oil and gas shows in the Black Warrior basin become very significant.

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EAST BAY, MISSISSIPPI RIVER DELTA

Walsh discovered a quasi-permanent upwelling zone in East Bay, between South Pass and Southwest Pass of the Mississippi delta. He applied remote sensing to the study of physical characteristics of the sea surface around the delta. The purpose of cruise 68-A-14 of the R/V *Alaminos* was to verify Walsh's findings and to see if they were reflected in the bottom sediment.

In spite of a norther (cold front) coming over during the first days of the cruise and mixing the water body to a certain degree, the presence of cells with higher surface salinity and temperature than the surrounding water was substantiated. The bottom sediment distribution pattern shows an oval area underneath the salinity-temperature cells which is more silty than the surrounding sediments. Cores reveal that the cells were present during the accumulation of at least 7 m of sediment, indicating that the phenomenon is natu-

ral and not caused by warm brines released by the activities of the oil industry in this area.

Bathymetry analyses show a large variation in small topographic features and fewer gullies than indicated by Shepard a decade earlier. Comparing his and the present results, a trend of shallowing of East Bay seems to continue, but at a rather low rate.

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PRELIMINARY SCANNING ELECTRON MICROSCOPE OBSERVATIONS ON *Orbitolina* FROM LOWER CRETACEOUS GLEN ROSE FORMATION, TEXAS

The foram *Orbitolina* occurs profusely on the outcrop. The fossils vary in size and shape, probably depending on whether they are either microspheric or megalospheric in their initial stage. Their internal structure as well as external features are being studied. Heretofore, only the specimens with a megalospheric initial stage have been studied in detail. For this purpose, many specimens have been etched with dilute hydrochloric and acetic acids, and the results have been quite satisfactory except for the extreme outer marginal zone of the test.

Orbitolina, besides the embryonic apparatus, has a very complex and delicate internal structure. This structure is divided into 3 zones: the central complex, the radial, and the marginal. Preliminary observations were concentrated on the radial zone in general, and on the marginal zone in particular, as these are present in all specimens and play an important role in the test.

The radial and marginal zones consist of chambers, and the chamber passages with connecting tubes, called stolons, cover and encircle the entire test in successive offsetting layers. This pattern is striking and beautifully delicate. The chamber walls, as well as the chamber passages and their stolons, apparently have been strengthened by the cementation of calcite crystals, as evidenced by the holes left after etching. Between the chambers, chamber passages and stolons, the living *Orbitolina* may have filled the space with crystals and foreign material of different sizes. The finest crystals were observed in the outermost part of the marginal zone and the coarser seem to have been confined to the chambers and chamber passages.

Many specimens were etched to obtain the chamber, chamberlets, and cellules of the marginal zone. Only 1 specimen was successfully etched, yielding several chambers with chamberlets and cellules. After the crystals between the chamberlets and cellules were dissolved by acid, voids or empty spaces remained. These, when observed with transmitted light, appeared to be the features previously described as "partitions" and/or "plates" in axial and horizontal thin sections of *Orbitolina*.

Without the aid of the scanning microscope, some minute details within *Orbitolina* either would not have been known, at least to the writer, or would have been difficult to interpret using only the stereoscopic microscope. These observations, and others to be made in the near future, will contribute toward making the morphology of *Orbitolina* more readily understood.

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GRAND ISLE BARRIER ISLAND, LOUISIANA—HUMAN ACTIVITY IN NATURAL DYNAMIC SYSTEM

Grand Isle, Louisiana, is a recently formed barrier

island developed by the marine reworking of the seaward edge of the Lafourche delta, the last major deltaic deposit laid down by the Mississippi River prior to the development of its present delta. Marine reworking of the deltaic front provides sediment which is moved northeasterly and northwesterly away from the deltaic front by longshore currents to form barrier spits and chains of barrier islands, such as Isles Dernieres on the west and Grand Isle-Grand Terre Islands.

Grand Isle became a subaerial deposit about 700 years ago and began to lengthen and grow southeasterly by ridge accretion. Its shape and location are controlled primarily by interaction of the longshore currents in the surf zone and the tidal-pass currents that interrupt them. Changes in the tidal channels, such as position or depth, drastically affect the action of the longshore currents. This has been dramatically shown at Grand Isle during 1970. High winds in the summer of 1970 and Hurricane Camille in 1969 deepened and changed the location of the tidal channels northeast and southwest of the island. As a result, accelerated erosion at the island's southwest end has removed several acres of a state park, moved the Gulf shoreline inland 300 ft, and caused the loss or removal of several beachfront homes. The causeway to the island and a large marina are threatened. Government money has been made available for jetty construction and for eventual sand-pumping operations to reduce erosion and restore the beach.

Destruction of the Lafourche delta and construction of the ephemeral and migrating barrier islands on its flanks provided sites attractive for development by man. The desire for permanency of the developed sites is in conflict with the natural dynamic shoreline processes.

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MAESTRICHTIAN (UPPER CRETACEOUS) BIOSTRATIGRAPHY, MAVERICK COUNTY, TEXAS, AND NORTHERN COAHUILA, MEXICO

Finely textured, calcitic, terrigenous clastic rocks of the type Escondido Formation (Río Grande section) afford perhaps the most complete sphenodiscid ammonite succession in North America. Documented superposition in the type section cannot be reconciled with the established Maestrichtian ammonite zonation for South Texas and northern Mexico. A new zonation is proposed that should provide a clearer basis for biostratigraphic correlation with sphenodiscid-bearing sections elsewhere.

Terrigenous clastic rocks previously referred to the Escondido Formation crop out in the eastern part of the Sabinas coal basin in northern Coahuila. In terms of facies and depositional style, these rocks bear more similarity to the Parras Shale-Difunta transition on the south than to the type Escondido. The lower part of the proposed zonal scheme can be recognized in the eastern Sabinas coal basin; the upper part is not expressed there because of facies change and missing section. If the ammonite zones have chronostratigraphic value then, during the Maestrichtian, the Sabinas coal basin was the site of far greater subsidence and sediment accumulation than the upper Río Grande embayment.

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CLAIBORNE GROUP OF CENTRAL TEXAS: RECORD OF MIDDLE EOCENE MARINE AND COASTAL PLAIN DEPOSITION

Sediments of the Claiborne Group in central Texas were deposited in a variety of nearshore-marine and coastal-plain environments. Fluctuations of the shoreline during middle Eocene time resulted in vertical stacking of 2,600 ft of sediments from contrasting depositional environments. Shoreline fluctuations probably did not result from simultaneous eustatic changes of sea level. They were caused by migrations of large fluvial, fluvio-deltaic, and interdeltaic complexes on the margins of a gently and perhaps uniformly subsiding basin. As a result of migrations of major sediment depocenters, the Claiborne rock record is characterized by high lateral and vertical variability.

Each formation of the Claiborne Group commonly is considered to be the product of a single depositional environment which extended laterally for hundreds of miles. For example, the basal formation of the Claiborne, the Carrizo Sandstone, is generally accepted as having been deposited under fluvial conditions close to the shoreline. This assumption is not borne out by detailed field work. An examination of the Carrizo Formation from Bastrop to Freestone Counties reveals that Carrizo sediments were deposited in fluvial, deltaic, and marine environments. In a single outcrop the Carrizo Sandstone may be shown as having been deposited in both barrier bars and delta distributary channels. Such variability also holds true for sediments from each formation comprising the Claiborne Group.

Petrographic analysis indicates that the sediment source remained constant during deposition of the Claiborne Group. The presence of phyllite and schist fragments together with the heavy minerals kyanite, staurolite, garnet, and zircon indicates that the source terrane was dominantly metamorphic. Evidence for volcanic activity is particularly strong in the Carrizo Formation and the uppermost Claiborne Yegua Formation. Volcanic minerals in these formations include bipyramidal quartz, euhedral apatite, and bentonite, indicating that the Claiborne coastline periodically was subjected to wind-transported detritus.

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DISTRIBUTARY-FRONT DEPOSITS INTERPRETED FROM DIPMETER PATTERNS

Continuing studies of high resolution dipmeter data suggest correlation between 3 types of dipmeter patterns and 3 different clastic depositional environments. The first environment lies between the beach and seaward edge of the continental shelf. The second environment lies between the seaward edge of the continental shelf and abyssal zone. The third environment is near active deltas where distributary-front sands tend to be deposited in one of three general shapes: elongate, crescent, or fan.

Distributary-front deposits in an active delta environment exhibit mainly "current patterns" on a high resolution dipmeter plot rather than structural dips. These "current patterns" result from the dip of foreset beds and make a characteristic dip pattern that can be identified readily. The direction of dip of these "current patterns" defines the direction of transport, and the magnitude of the dip patterns indicates the probable shape of the sand body.