for several density contrasts and basin configurations.

Combined gravitational effects of the models have been applied as corrections to the Bouguer anomaly map to obtain a gravity-anomaly profile that generally represents effects of changes in crustal thickness or density. The granitic crust is considerably thicker under the Llano uplift than under the Gulf Coast geosyncline.

At present, the region is at or near isostatic equilibrium, but near the end of the Paleozoic it was out of equilibrium, with an excess mass at the present site of the Gulf Coast geosyncline. The writers speculate that gulfward migration of depocenters during Mesozoic and Cenozoic has taken place in response to a mechanism for gradual restoration of regional isostatic equilibrium.

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GEOLOGICAL HISTORY AND OIL AND GAS POTENTIAL OF CENTRAL GULF COAST

The area described includes the coastal plain and continental shelf between Texas and peninsular Florida, and includes the Mississippi embayment. The stratigraphic section includes sediments of all ages from Triassic through Holocene. The maximum composite thickness probably exceeds 80,000 ft, but only about 50,000 ft of Mesozoic-Cenozoic sediments is present at any locality in the deepest part of the Gulf Coast geosyncline. Oil and gas currently are produced in numerous fields in this area from both silicate clastics and carbonate rocks of Jurassic, Cretaceous, Tertiary, and Quaternary ages. The sedimentation history clearly indicates that the potential for future discoveries is great.

The structure and stratigraphy of this richly petroliferous basin are described and the possibility of discovering more oil and gas than has been found is pointed out. Thickness, lithology, and depositional environments of each major division of the Mesozoic and Cenozoic are shown on maps and sections.

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BASIC DELTA SYSTEMS IN EOCENE OF GULF COAST BASIN

Studies of certain of the thick terrigenous clastic wedges that comprise most of the Eocene fill of the western Gulf Coast basin indicate that principal deposition of sediments occurred as parts of major delta and associated systems.

Two basic types of delta systems are recognized in the Gulf Coast Eocene. One type developed at the mouths of a few, very large, distant-source streams which resulted in extensive shoreline progradation of numerous, elongate to lobate, terrigenous, delta lobes. Streams supporting this type of delta system entered the basin at only a few places and deposited local fluvial facies along the updip basin margin. The second type developed at the mouths of several, relatively small, local streams, and consists of a series of nearly uniformly prograding arcuate to cuspate delta lobes. Streams supporting this type of delta system entered the basin at many places and deposited a more or less continuous fluvial facies along the basin margin.

In the first type of delta system sediment input was great and exceeded the energy of coastal processes so that, within the component facies of the system, the ratio of constructional or progradational facies to destructional facies is high. In the second type, sediment input was moderate and only slightly exceeded the energy of coastal processes so that ratio of constructional to destructional facies is relatively low.

Extensive delta systems of the lower Wilcox in the Gulf Coast basin (Rockdale system in Texas, Holly Springs system in Louisiana and western Mississippi) are of the first type; large delta and associated systems of the Jackson (Fayette) in Texas and the Cotton Valley in the northern Gulf Coast basin also are primarily of this type. The recent counterpart is the Mississippi delta system. Main component facies of this delta system include: (1) extensive delta-plain deposits with abundant lignite or peat (distributary-channel and interdistributary deposits); (2) well-developed delta-front sand deposits made up chiefly of distributary mouth bars; (3) very thick, dark prodelta mud; and (4) interdelta mud. Lobes are elongate perpendicular to the coast where associated with sequences containing large amounts of mud, or are rounded where associated with sequences which are relatively low in mud content. Destructional components include thin, locally persistent, marine units across distal parts of abandoned delta lobes and widespread lignite or peat on the landward or updip parts of abandoned lobes. Constructional and destructional units are vertically distinct. Associated depositional systems include well-developed delta-flank mud facies along margins of the delta-fluvial systems, and prominent strandplain and barrier-bar (with complementary lagoon) systems along strike and down longshore drift.

The large delta systems of the upper Wilcox in Texas and Louisiana, of parts of the Vicksburg, and probably of the Frio in Texas are chiefly of the second type. Recent analogues include the Appalachicola, Rhône, and certain of the U. S. Atlantic coast delta systems. Because of approximate balance of moderate sediment input and energy of coastal processes, much of this type of delta consists of locally redistributed marine sediments; construction and destruction were more or less contemporaneous and units of these phases are not vertically distinct. Principal facies consist of numerous coastal barrier-sand bodies. Constructional delta-plain facies (including distributary-channel and interdistributary deposits) are only partly preserved. Lignite or peat is not important. Frontal shoal-sand facies commonly mark the original progradation of individual deltas. Lagoon, marsh, and lacustrine deposits are minor components. Prodelta mud is not thick and generally is similar to open-shelf deposits. No extensive marginal delta-flank deposits nor prominent strandplain and barrier-bar systems developed along strike.

Significant, and commonly multipay, oil and gas reservoirs are present within both types of delta systems in the Gulf Coast basin. In the first type, main trends are chiefly coincident with marine delta-front sand; in the second type, marine coastal barrier- and frontal shoal-sand bodies are the principal reservoirs. Distribution of deltaic oil and gas trends depends on the type of delta system in which they are present. Reconstruction of the system from facies composition and three-dimensional facies geometry and facies relations provides a useful guide for exploration.

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DEPOSITIONAL SYSTEMS OF LOWER WILCOX GROUP, NORTH-CENTRAL GULF COAST BASIN

The lower Wilcox Group (Eocene) of Louisiana, Mississippi, and Alabama consists of deposits of four principal depositional systems: (1) the Holly Springs delta system which is volumetrically the largest system; (2) the Pendleton bay–lagoon system which extends into eastern Texas; (3) a restricted shelf system east of the delta system; and (4) an unnamed fluvial system which crops out along the flanks of the northward-trending Mississippi trough. Sandstone isolith maps outline the geometry of the delta mass and show at least three lobe complexes separated by mud-rich interdeltaic subembayments.

Detailed facies maps, on which information derived primarily from electric logs is used, allows recognition of seven principal component facies of the delta system: (1) bar-finger sand facies; (2) interdistributary bay mud-salt facies; (3) distributary channel sand facies; (4) prodelta mud facies; (5) distributary mouth bar–delta front sand facies; (6) interdistributary deltaic plain sand-mud-lignite facies; and (7) destructional phase sand-mud-lignite facies. Two principal types of delta lobes differentiated by their areal geometry, internal facies relations, and distributary channel development, can be recognized in the Holly Springs delta system. Bird-foot lobes were constructed where distributaries prograded over thick prodelta mud sequences; thinner, more lobate shoal-water delta lobes formed on shallow, sandy shelves or on foundered plains of older deltas.

A distinct correlation between depositional environment and the production of oil exists in the Holly Springs and Rockdale delta systems, which comprise the lower Wilcox of southeast Texas. Sand units associated with facies of the distal margins of individual delta lobes or with the destructional units are the most prolific reservoirs, and production is therefore centered along the flanks of the major lobe complexes where maximum delta destruction and interfingering with marine mud occurred.

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WILCOX DIPMETER APPLICATIONS

Thick lenticular Wilcox sandstone bodies of fluvial channel, bar-finger, or marine-bar origin are favored objectives of drilling in the active Mississippi-Louisiana Wilcox (Eocene) play. Correct utilization of dipmeter surveys will facilitate development and exploration drilling for these thick sandstone bodies. Detailed computation with a maximum number of computation levels is necessary; also, detailed analysis by geologically oriented personnel is essential.

An approach to sandstone-trend determination is presented using sandstone cross-bedding and counter-regional dip due to differential compaction. Substantiation is provided by an example area, Milligan Bayou field, Avoyelles Parish, Louisiana.

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SEDIMENTATION IN BRETON SOUND AND EFFECTS OF MISSISSIPPI RIVER-GULF OUTLET

The Mississippi River-Gulf outlet is a channel 36 ft deep and 500 ft wide extending from a point south of Michoud, Louisiana, southeastward across the marshes and Breton Sound into the Gulf of Mexico. The outlet was constructed by the U.S. Army Corps of Engineers to provide additional access to the Port of New Orleans and thereby ease traffic on the Mississippi River. The channel crosses a delta lobe constructed when the Mississippi River flowed down a course east of its present course. The sedimentary environments and the features formed by the destruction of the now abandoned and subsiding lobe have a great influence on sedimentation in the outlet and, conversely, the outlet has had a profound effect on the environments on which it has been superimposed. The outlet has encountered an excessive amount of shoaling in its Breton Sound reach. In an effort to determine the cause(s) of the shoaling and the source(s) of the shoal material, a study was made of the factors influencing sediment distribution in the Breton Sound area (*e.g.*, tides, winds, spoil, and sediment distribution, salinity, current directions, and velocities). The principal source of the shoal material was determined to be the spoil dredged from the outlet itself which returns to the channel by density flow rather than by normal deposition of suspended material.

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DEPOSITIONAL ENVIRONMENTS OF SANDSTONES AS INTERPRETED FROM SUBSURFACE MEASUREMENTS —AN INTRODUCTION

A sedimentary rock is a product of its provenance and transportational mechanisms as well as of its environment of deposition. As such, a sedimentary rock reflects the physical and chemical conditions under which the sediment was transported, deposited, and buried. The combined factors of size, energy, and water depth give an indication of the environments of deposition and these factors are represented directly or indirectly on the IES log (in the Gulf Coast, the "base line" corresponding to impervious beds is commonly shale, and peaks on the left correspond to pervious beds, commonly sandstone). Therefore, it is necessary to know graphically the environmental transitions and configurations as shown on the log. These transitions are of three general types. *Type a* appears to be the most common transition in Gulf Coast stratigraphy and exemplifies an abrupt change from one size fraction to another; therefore this transition indicates an abrupt environmental change or a local unconformable surface. *Type b* is a gradual transition from sandstone to shale or *vice versa* through an interbedded sequence of sandstone and shale. On a local scale this transition could be attributed to a gradual regressive or transgressive oscillation. *Type c* is the least common and most difficult to recognize. This transition suggests a gradual size change (*i.e.*, graded bedding) and could appear at the top of a transgressive phase or the base of a regressive phase. Hence nine different combinations, with minor modifications, are possible in a sandstone-shale sequence and these are used to interpret the possible environments of deposition of the beds.

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BAR AND BARRIER-ISLAND SANDS

Elongate sand bodies may be classified as depositional dip sands (alluvial, channel, *etc.*) or depositional strike sands (bar, barrier, *etc.*). Bar and barrier sand bodies generally exhibit several characteristic properties. Among these are shape, relations with surrounding strata, mineral content, grain size and sorting, size and sorting trends, and carbonate and heavy-mineral content. These properties define the sand body and permit its identification. Depositional strike