reference to that part with water depths of less than 200 feet, which is considered the limit of economic accessibility for petroleum exploration. This limit encompasses 96,000 square miles bordering the coast of the United States and 56,000 square miles bordering Mexico. Of the total, only the 20,000 square-mile area off the coast of Louisiana has provided economic success.

A cross section from north of Baton Rouge, Louisiana, to Merida, Yucatan, shows the Tertiary Gulf Coast geosyncline. Maps of the Gulf of Mexico are presented showing the extent of the Mesozoic, Early Tertiary, Later Tertiary, and Quaternary sediments that are considered proved or prospective for petroleum within the 200-foot water depth.

The oil and gas development of the continental shelf bordering Louisiana and Texas is described, and a map is presented showing the distribution of the offshore structures that have been drilled or leased to date. As of July 1, 1958, 86 fields had been found by the testing of 123 prospects off Louisiana, and approximately 2.5 billion barrels of oil and 9 trillion cubic feet of gas had been outlined by the successful completion of 1,302 wells out of a total of 1,896 tests. The reserves established by a total of 133 wells drilled off the Texas coast are negligible. While 162 offshore prospects have been tested in the whole area, these represent only about 50 per cent of the structures indicated by geophysical data.

As examples of offshore deep-seated salt-dome fields, structure maps are presented for the Block 110 field, West Cameron area, and the Block 39 (Rollover) field, Vermilion area, Louisiana. A structure map and cross section of the Block 126 field, Eugene Island area, Louisiana, exemplify the shallow piercement salt-dome fields. The occurrence of sulphur on the Block 18 Dome, Grand Isle area, Louisiana, where operations for mining are now under way, is illustrated.

19. GRANDISON COMPLEX, LAFOURCHE AND JEFFERSON PARISHES, LOUISIANA, Ramsey L. Oakes, consulting geologist and geophysicist, New Orleans, Louisiana.

The Grandison area, centering in southeastern Lafourche Parish, on the Mississippi River delta in South Louisiana, is an interdomal basin surrounded by peripheral salt domes and anticlines. Hinge line flexures and normal faults help to make correlative zones 2,000 feet lower in the center of the basin than on the flanking anticlines. The main producing sands of the basin either grade into shale or are truncated onto the flexures and against the faults. One gas sand produces over a distance of more than 12 miles along its pinch-out on the flanks of four major anticlines. Isopach maps were valuable in predicting where the pinchout would occur.

The foraminiferal assemblages in the marine zones reflect ecological changes that occur across the faults and flexures and on the flanks of the anticlines and domes. The most extensive producing sand contains gas wherever the ecological conditions under which it was deposited are constant; but where these conditions change across the closely controlled Coffee Bay fault and onto the anticlines, no accumulation occurs.

Although the central part of the Grandison complex is a structural basin at depth, above 7,000 feet it is a broad, very gentle dome that makes a prominent photogeologic anomaly that has aided exploration.

20. SEDIMENTATION AND STRUCTURE OF *Planulina*-ABBEVILLE TREND, SOUTH LOUISIANA, Hunter C. Goheen, Atlantic Refining Company, Lafayette, Louisiana.

The term Erath member is proposed for the so-called deep-water facies of the downdip Anahuac formation, which is regarded as upper Oligocene or lower Miocene. The middle neritic *Planulina* and outer neritic to bathyal Abbeville are considered here as biostratigraphic zones within the Erath member. The Erath member consists mostly of shale, but the erratic sands occasionally found in it form a productive trend across South Louisiana from the Cameron Parish coastal area due east to St. James Parish. The particular economic significance of the Erath sands results from their having been deposited in deeper water than the sands of most other South Louisiana productive trends. A study of the depositional types of sand and their distribution, in relation to the tectonic history, aids in locating areas that are prospective for hydrocarbon accumulation.

21. THORNWELL FIELD, JEFFERSON DAVIS AND CAMERON PARISHES, LOUISIANA, Frank R. Hardin, petroleum geologist, Houston, Texas.

Thornwell field is located in the lower Miocene producing trend of southwestern Louisiana, in Jefferson Davis and Cameron parishes. It was discovered by Cities Service Oil Company in 1942 and developed into a four-well field, producing gas and condensate from a *Planulina palmerae* sand occurring between 9,600 and 9,700 feet. After depletion and abandonment of these four wells, Austral Oil Company and Pan American Production Company drilled several deep tests and discovered gas condensate in the *Marginulina*, *Camerina*, and *Miogypsinoides* sand sections.

The Thornwell field is a domal structure with an exceedingly complex fault pattern. This pattern consists of a large northeast-striking fault that enters the field from the southwest and breaks into a system of smaller radial faults as it crosses the dome. The most northwesterly fault block (on the upthrown side of the large fault) is the highest structurally, and each block becomes successively lower

around the structure in a clockwise direction. The sediments are considerably thicker on the downthrown side of each fault than on the upthrown side, demonstrating that fault movement was contemporaneous with sediment deposition.

Sand development is much poorer in the higher (northwesterly) fault block than in the lower (southerly) segments. The *Camerina* sand may be an exception to this generalization since it is known to be well developed in only one fault block. No wells in the lowest fault blocks have penetrated beds older than *Marginulina howei*.

22. ORIGIN AND DEVELOPMENT OF TEXAS SHORELINE, Rufus J. LeBlanc and W. D. Hodgson, Shell Development Company, Exploration and Production Research Division, Houston, Texas.

Geological events associated with the late Quaternary have controlled the origin and development of the Texas shoreline. Some features of the shoreline are of late Pleistocene age while others are definitely related to the Recent epoch. During the last Pleistocene glacial stage when sea-level was lowered approximately 450 feet, the coastal Texas streams deeply entrenched their valleys and the Gulf shoreline was probably 50–140 miles seaward of the present shoreline. With melting of the late Pleistocene glaciers and the accompanying rise in sea-level, Texas streams alluviated their entrenched valleys. Sedimentation in these valleys did not keep pace with rising sea-level and consequently the lower parts of the entrenched valleys were drowned to form a series of estuaries. The bay shoreline of Texas originated during this stage. During the standing sea-level stage, which began about 5,000 years ago, the large Texas rivers, such as the Rio Grande, Brazos, and Colorado, filled their former estuaries and constructed broad deltaic plains which protrude into the Gulf. The other smaller Texas rivers which carry smaller quantities of sediments are still in the process of filling their drowned valleys or estuaries. A series of barrier islands were formed along the coast between the Rio Grande and the Colorado-Brazos deltaic plain and east of the Colorado-Brazos deltaic plain, giving rise to the Gulf shoreline along these segments of the coast. The abandoned beach ridges and intervening low swales and mud flats, which are well preserved on these barrier islands, clearly demonstrate the seaward growth of the islands during the standing sea-level stage.

23. GALVESTON BARRIER ISLAND AND ENVIRONS: MODEL FOR PREDICTING RESERVOIR OCCURRENCE AND TREND, H. A. Bernard, C. F. Major, Jr., and B. S. Parrott, Shell Development Company, Exploration and Production Research Division, Houston, Texas.

Galveston Island, Bolivar Peninsula (a land-tied island) and associated tidal deltas together comprise a sand-barrier feature separating the Gulf of Mexico from Galveston Bay, East Bay, and West Bay, Texas. This composite sand mass extends parallel with the shoreline from Caplan on the east to San Luis Pass on the west, a distance of 50 miles. The barrier feature is the easternmost part of a line of barriers, which is interrupted at only a few places by river deltas and extends a distance of more than 600 miles along the Texas and Mexican coasts.

The sand body below Galveston Island is approximately 30 miles long, 30 feet thick, and averages about 1½ miles wide. It thins to zero near the 30-foot contour, 2 miles seaward of the gulf shore and a few hundred feet landward of the bay shore. Eolian processes increase the thickness of barrier island sand masses along the south Texas coast by as much as 40 feet.

Geological processes producing barrier island and other shoreline sand bodies throughout the world during the Recent standing sea-level stage have produced similar sand bodies in standing sea-level stages of the geologic past. It seems logical that lenticular barrier island sands probably form reservoir rocks containing large quantities of hydrocarbons in both structural and stratigraphic traps in many sedimentary basins. Several examples have been described in the literature. Many accumulations of the stratigraphic type remain to be found and there is a real need for criteria for their recognition and for the prediction of their location. The paper summarizes the geologic processes, setting (framework), history, genesis, lithologic character and sequence, directional features, shape, and trend of the Galveston barrier island sand mass and related facies. The model should be of value to a geologist in the exploration for and exploitation of reservoirs of this type.

24. LATE QUATERNARY GEOLOGY OF SABINE LAKE AND VICINITY, TEXAS AND LOUISIANA, Henry E. Kane, assistant professor of geology, Lamar State College of Technology, Beaumont, Texas.

The late Pleistocene and Recent sediments, faunas, and geomorphology were mapped in the vicinity of Sabine Lake, in an area that straddles the Texas-Louisiana state line and extends into the Gulf of Mexico. The former valley of the Neches and Sabine rivers is entrenched into oxidized Pleistocene deposits to a minimum depth of 120 feet at the Gulf of Mexico shoreline. This valley has been filled in by the streams and closed off at its southern end, except for Sabine Pass, by prograding of the Gulf shoreline to form the present lake estuary, Sabine Lake. The erosion and subsequent alluviation were caused by a fall and rise in sea-level due to waxing and waning of continental glaciers late in Quaternary time.

Lithology and fauna, especially the Foraminifera, were determined from cores and clam-shell samples taken in the Sabine Lake estuary and Gulf of Mexico nearshore neritic environments. No