or volume, and that variation in sediment porosity probably is the major factor responsible for differences between organism counts based on equal-weight samples and those based on equal-volume samples.

Consideration of the diagenetic processes of compaction and cementation that affect organism abundance shows that, for sediments which have not been materially changed by processes like interstratal solution, replacement, and recrystallization, abundance counts from recent and ancient sediments are more comparable if clays and shales are reported on the basis of equal-weight samples, and unlithified and lithified sands are reported on the basis of equal-volume samples.

16. Biostratigraphic and Paleologic Study of Midway Foraminifera along Tehuacana Creek, Limestone County, Texas, Gene Ross Kellough, University of Houston, Houston, Texas.

The Midway group of Texas, a predominantly shale, sandy shale, and sandy limestone section of Paleocene age, was deposited in an open sea whose depth fluctuated between very shallow and deep. This concept is based on a study of samples from Tehuacana Creek, Limestone County, in east-central Texas. The interval sampled extends upward for 278 feet from the Cretaceous-Paleocene contact. Lithologic examination revealed a complete cycle of deposition, with a basal glauconitic sand overlain successively by sandy shale, sandy limestone or calcareous sandstone, glauconitic sand, and shale.

The foraminiferal content indicates that the very lowest beds of the Midway (Littig member of Kincaid formation) are marine, not littoral, probably mid-neritic to outer neritic. Seemingly the unconformity between this section and the Cretaceous developed without the latter being exposed subaerially. Biostratigraphic and paleoecologic interpretation demonstrates that the shales and sandy shales of the lower part of the succeeding Pisgah member were deposited in water deeper than 200 meters. As the water became more shallow, sands and calcareous muds interbedded with sands of the upper Pisgah and Tehuacana member were deposited. This shallow-water environment favored an abundant growth of a few species of Foraminifera. The Mexia member (lower unit of Wills Point formation) represents a gradual return to a deeper-water environment characterized initially by a glauconitic sand followed by glauconitic muds and a rich fauna of both deep and shallow-water species. The dark pyritic muds of the upper part of the Mexia member were deposited in deep water (more than 200 meters). The fauna was rich in variety of genera and species of Foraminifera but poor in number of individuals.

The Midway group of Texas (Danian) has been included in the *Globigerina compressa-daubjergensis* zone by Loeblich and Tappan. An analysis of the distribution of Foraminifera showed that 4 zonules can be established at this locality. They are, from the base upward:

4. *Marginulina tuberculata* (Plummer) zonule
3. *Polymorphina cushmani* Plummer zonule
2. *Discorbis newmanae* Plummer zonule
1. *Alabamina midwayensis* Brotzen *limbata* (Plummer) zonule.

17. New Log Interpretation Techniques for Gulf Coast, R. P. Burton, Schlumberger Well Surveying Corporation, Houston, Texas.

The fact that porosity can be measured accurately with the sonic log has prompted new procedures for estimating saturation, wherein data concerning the various permeable beds in a given well are compared.

1. In one approach a comparison is made of the values of the formation water resistivity computed from the resistivity log and from the sonic log. Actually, apparent formation water resistivities are calculated in assuming that all sands are wet. With the concept of continuity, this procedure makes possible a quick determination of zones of saturation in shaly sand and in cases where there are appreciable variations in formation water salinity with depth.

2. It has been found also that comparison of the apparent formation factor obtained from the sonic log with that computed from a short investigation resistivity log may reveal in many cases the presence of residual oil or gas and thus detect potentially productive formations. This procedure is valuable when true formation resistivity and the resistivity of the formation water are in doubt.

Although these two procedures permit only a qualitative interpretation of the log, they have the advantage of speed and simplicity. The quantitative interpretation that remains to be done can be performed very quickly since all the non-productive formations have been eliminated by the foregoing procedures. The first procedure is best adapted to formations of high porosity and in fresh mud. The second procedure works best in formations of low porosity and with little contrast between the mud and formation water resistivities. Examples illustrate the application of these two techniques in the Miocene, Frio, and Wilcox sections of the Gulf Coast.

18. Geology and Petroleum Development of Continental Shelf of Gulf of Mexico, Gordon I. Atwater, Atwater, Cowan and Associates, New Orleans, Louisiana.

The stratigraphic and structural framework of the Gulf of Mexico is described, with particular 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