ganic matter, iron oxides, and colloidal silica and alumina.

Montmorillonite, illite, and chlorite were found to be the most abundant clay minerals. Kaolinite and vermiculite were present in some samples, usually in minor amounts.

The distribution patterns of clay minerals in the lower Gulf of California are determined by the source areas and strong diagenetic effects ensuing on contact with sea water.

The clay-mineral distribution shows a sharp contrast in clay-mineral assemblages between the marine and non-marine sediments. The montmorillonite, illite, and chlorite content of the normal marine samples is very uniform. In the warmer hypersaline environment of the swamps, formed in the depressions between cheniers, the clay-mineral assemblages have greater proportions of chlorite, indicating that intense chemical conditions behind cheniers are particularly effective in modifying the composition and structure of the clays entering the sea from rivers.

The clay mineralogy of the terrestrial samples is controlled by the source material and the weathering conditions of the area.

In both terrestrial and marine environments, anomalous clay-mineral assemblages reflect small-scale or local geographic conditions (provenance).

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Aspects of Wall Ultrastructure in Some Hyaline Foraminifera

Electron-microscopic examination of interior wall structure in some of the hyaline Foraminifera discloses that a variety of microcrystalline arrangements exists. In many instances the term "radial wall" is a misnomer. Some radial forms (*Ammonia beccarii*) are completely lacking in fibrous or prismatic crystals, displaying instead a very finely layered array composed of many plate-like crystals. In such cases, the appearance in polarized light is caused by the statistical, preferred orientation of *c*-axes giving rise to a more or less uniform extinction. The "prismatic" appearance is derived from the effect produced by the superimposition of "chitinous"-lined pore canals, even within the thickness of a thin section. An indistinctly radial form (*Cibicides refulgens*) has an identical microcrystalline arrangement except that the statistical *c*-axis uniformity is poorer, some areas being relatively well oriented with respect to the test surface and others not. True prismatic morphologic types do occur (*Lenticulina calcar*) as do walls composed of uniformly oriented microrhombs. The wall of the "granular" form *Nonion labradoricum* is constructed of lamellae, each lamella being composed of tabular granules sutured together. Each granule is a single crystal of calcite.

The lamellar character of the walls of many of the hyaline Foraminifera is not in agreement with the models suggested for this group. Indeed, some forms are non-lamellar. The concept that each chamber overlaps all previous chambers is not supported in every case by the data.

These observations clearly support earlier suggestions that any rational classification of the Foraminifera will have to consider the detailed structure and architecture of the walls. The fact that radial wall structure (in the petrographic sense) can be represented by several different microcrystalline morphologic types is as important as the difference recognized between radial and granular forms.

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Onlap, Key to Worldwide Unconformities and Depositional Cycles

Subsurface studies in many sedimentary basins around the world reveal that widespread onlap has occurred several times since the Precambrian. The existence of onlap indicates deposition on an unconformity surface that had topographic relief. There are several worldwide onlap unconformities. These began to form during (1) early Oligocene, (2) early Paleocene, (3) Late Jurassic (pre-Portlandian-Purbeckian), (4) latest Triassic (pre-Rhaetian), (5) Permian (pre-Leonardian), (6) latest Mississippian (post-type-Chesterian), (7) Early Devonian, and (8) Middle Ordovician times. In addition, several less important, but worldwide, periods of onlap, restricted largely to basin margins or actively rising areas, have been observed. These occurred during (1) late Miocene, (2) early Miocene, (3) early Eocene, (4) Early Cretaceous (pre-Cenomanian), (5) Middle Jurassic (pre-Dogger), (6) Early Triassic, (7) Pennsylvanian (pre-Desmoinesian), (8) Late Devonian, and (9) Early Silurian times.

Earlier workers recognized many of these unconformities in the United States and Canada on the bases of truncation (overstep) and onlap. In this paper onlap is emphasized as the better indicator of unconformities, because onlap is much more widely prevalent than truncation. Unconformities identified only by truncation usually occur in regions which have undergone a local period of uplift.

Several factors may obscure the presence of major unconformities. If the underlying sediments were relatively flat at the time of onlap or if the basin was subsiding differentially, yet rapidly, at the depositional site, detailed correlations across large areas usually are required to reveal the presence of an onlap unconformity. The unconformity may be missing in basin centers because of continuous deposition. In such a situation, the strata which were deposited while an unconformity developed toward the basin margin may be identifiable because of a change in depositional rate within the time-equivalent sediments of the basin center. Highly mobile belts commonly have many unconformities; only a few of these may be worldwide. In addition, continental sediments deposited above sea-level also may contain unconformities that formed entirely as a result of local factors.

Characteristically, the sediments of an onlap cycle are deposited relatively rapidly at the beginning of the cycle, and are deposited less rapidly later in the cycle. At the conclusion of the cycle, onlap at the basin margins is scarcely noticeable. During the next succeeding cycle, onlap commonly is relatively rapid again, but the area of onlap is nearer to the depositional basin center. This shift of onlap cycles through time from basin margin to basin center is believed to represent a fairly rapid drop in sea-level. The initiation of onlap is then interpreted to be the result of a gradual rise in sea-level, and local basin subsidence and sedimentation play the dominant roles in determining the positions and amounts of onlap and sedimentary thickening.

Although the basic causes of changes in sea-level are not well known, they may be related to changes in the configuration of ocean basins resulting from largescale mountain building. Some changes in sea-level may be related to the size of ice accumulations at the poles.

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GEOLOGY AND EXPLORATION OF THREE GREATER BASS STRAIT BASINS, AUSTRALIA

Three major Mesozoic-Tertiary basins lie in succession along the eastern one-third of the south coast of Australia within a distance of about 700 miles. The total area embraced is approximately 100,000 square miles, and it includes parts of three of Australia's six states. Fully three-fourths of the area is classified as an offshore shelf.

The general east-west alignment of the basins resulted from sharp taphrogenic breakdown across the generally north-south Paleozoic orogenic trend of eastern Australia and Tasmania. The main faults and many of the basin features have northeasterly or northwesterly trends, suggesting that rotational or transcurrent stresses and subsidence were involved in the breakup.

Sedimentation began at least as early as Late Jurassic. The succeeding Mesozoic development lacks uniformity over the area, but the Tertiary is more uniformly developed throughout. Several unconformities are recognized. Though not all sediments carry marine fossils, the contained waters are saline beyond the limits of the fresh water flushing onshore.

The Gippsland or eastern basin covers about 22,000 square miles. More than 12,000 feet of rapidly deposited Jurassic-Cretaceous clastic rocks fills a downfaulted central trough and overlaps the basin shelves on the north and south. About 10,000 feet of more widely extending Tertiary sandstone, shale, marl, limestone, and some coal, completes the basin fill.

The deeply silled Bass basin, which separates the island State of Tasmania from the mainland, covers about 35,000 square miles. The section is composed of 12,000 feet or more of sandstone, shale, marl, limestone, and some coal. Deposition began in the central part of the basin, probably as early as Late Cretaceous time, and continued through the Tertiary, progressively overlapping radially in all directions.

The western or Otway basin covers more than 40,000 square miles. The Mesozoic consists of sandstone, shale, siltstone, and mudstone. Deposition began during Late Jurassic time and continued, with laterally differing breaks in deposition, into the Paleocene; a maximum thickness of more than 15,000 feet was deposited. Approximately 8,000 feet of overlapping Tertiary sandstone, shale, marl, and limestone completes the basin fill.

Potential traps for petroleum accumulation of the following types occur: tectonic folds; fault or fault-block structures; massive, elongate sandstone bodies associated with pronounced transgressive overlap and compaction drape; porosity abutment both above and below extensive low-angle unconformities; unconformable overlap of basin-sink sediments over broad bottom highs and against and over major fault scarps; structural noses; extensive progressive flank overlap around a deeply silled basin by a section composed of sandstone, shale, marl, and carbonate rocks; and porosity pinchouts.

Approximately 30 exploratory wells drilled onshore in the extensively fresh-water-flushed basin flank, found numerous non-commercial oil and gas shows. The first offshore well drilled in the Gippsland basin 20 miles from the coast (the first offshore well in Australia) resulted, early in 1965, in a major wet gas discovery in thick, very porous Tertiary sandstone.

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PETROGRAPHIC AND CHEMICAL STUDY OF YUCATÁN CARBONATES

Carbonate rocks of Eocene(?) to Recent age crop out in northern Yucatán. Subsurface data from a few widely scattered wells indicate these Tertiary and Recent rocks range in thickness from 3,000 to 5,000 feet. Cretaceous (Comanchean and Gulfian) carbonates, evaporites, and volcanics underlie the Tertiary carbonate rocks.

Samples from all outcropping stratigraphic units in northern Yucatán have been collected. These samples have been studied in the following ways: (1) in hand specimen and by etching, (2) by preparation of acetate peels, (3) by staining (silver nitrate-potassium chromate) for calcite-dolomite content and by preparation of stained peels, (4) in thin section, and (5) by "wet" chemical analysis. Samples are presently being analyzed for $CaCO_3/MgCO_3$ content by EDTA (ethylenediaminetetraacetic acid) titration.

Virtually all carbonate rock types are present, but deposits of foraminiferal microcrystalline carbonates predominate. Reefoid carbonates are present in only minor quantities. Dolomitization and silicification are encountered in many samples. Silicification is most intense in reefoid deposits and negligible in all other rock types. Preliminary results of analyses for calcite-dolomite content in the rocks disclose no apparent correlation of dolomitization with individual rock types. There is, however, an apparent increase in dolomite content with the age of the rocks; this aspect is being investigated more thoroughly.

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STRATIGRAPHY AND STRUCTURE OF PARRAS BASIN AND ADJACENT AREAS OF NORTHEASTERN MEXICO

The Parras basin, in southern Coahuila and western Nuevo León, contains 15,000–20,000 feet of Upper Cretaceous and lower Tertiary terrigenous clastic sediments. From 5,000–7,000 feet of Lower Cretaceous carbonate rocks and 6,000–10,000 feet of Triassic and (or) Jurassic evaporites, carbonate, and terrigenous clastic rocks flank parts of the basin and underlie large areas within the basin. The Triassic and (or) Jurassic sedimentary rocks exhibit complex facies relations. Lower Cretaceous carbonate rocks are remarkably uniform over large areas of northeastern Mexico. Most of the Upper Cretaceous and lower Tertiary calcareous-arenaceous-argillaceous sediments were deposited in a boot-shaped, shallow, subsiding basin between the present-day Sierra Madre Oriental and the Coahuila Platform.

The Upper Cretaceous-lower Tertiary Difunta Group displays intertonguing relations between two distinct lithic types; red, non-marine, arenaceous-ar-