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 large-