*Placenticeras* evolutionary sequence and time correlations are made.

The results of the biostratigraphic analysis suggest that the Senonian strandline in Presidio and Jeff Davis Counties, Texas, and northeastern Chihuahua shifted southeastward during an extensive marine regression.

L. GIFFORD KESSLER II, Univ. of Texas at Austin, Texas

PALYNOMORPH DISTRIBUTION AND DEPOSITIONAL ENVIRONMENTS IN GLEN ROSE FORMATION (LOWER CRETACEOUS), SOMERVELL COUNTY, TEXAS

The Glen Rose Formation (Lower Cretaceous) contains a microfossil flora which is useful as a paleoecologic tool. Examination of measured sections and three mapped terrigenous-clastic units shows that gymnosperm pollen and dinoflagellate hystrichospheres are useful in diagnosis of subtidal and supratidal conditions if coupled with lithologic evidence. Fern spores and angiosperm pollen were of limited use in paleoenvironmental interpretations.

Percentage-distribution maps of gymnosperm pollen and hystrichospheres for three units in a terrigenous clastic sequence in the Glen Rose of Somervell County show an increase of hystrichospheres and a decrease in gymnosperms toward probable open-water sediments. This suggests that palynomorph number is influenced by distance from source area.

Hystrichosphere morphologic types were found to change with depositional environment. Barb-spined forms commonly were associated with shallow-water open-marine sediments. Straight-spined forms commonly were associated with sediments deposited in shallow brackish-water.

Angiosperms, fern spores, and certain hystrichospheres were not related clearly to depositional environments inferred from lithologic evidence and other palynomorphs. Distribution of these microfossils may be explained by wind- and water-current fluctuations during deposition. Particle characteristics, such as settling velocity and size sorting, also may have influenced their distribution.

MURIEL E. HUNTER, Coastal Petroleum Co., Pinellas Park, Fla.

MOLLUSCAN GUIDE FOSSILS IN LATE MIOCENE SEDIMENTS OF SOUTHERN FLORIDA

Upper and lower members of the Tamiami Formation of late Miocene age are exposed at the surface in southern Florida. Fossiliferous members contain distinctive *Pecten* species, two varieties of *Ecphora*, and other mollusks. A study of the molluscan fauna of these members indicates the presence of at least three concurrent range zones. According to age, with the youngest at the top, these zones are: (1) *Pecten tamiamiensis* zone; (2) *Pecten jeffersonius* zone; and (3) *Pecten santamaria middlesexensis* zone.

This study suggests certain time correlations between formations of southern Florida, northern Florida, and the Atlantic coast.

WALTER H. TRENCHARD, Phillips Petroleum Co., Lafayette, La.

SEDIMENTATION AND DISTRIBUTION OF MARINE BIOFACIES

The rate of sedimentation is considered as a major factor in the distribution of faunal facies. The continental slope is believed to be the site of the greatest accumulation of sediment, but the rate of sedimentation on the slope commonly is low. Although it is nearly impossible to determine the rate of sedimentation in the geologic section, the relative rate of sedimentation generally is easy to establish. Five concepts are needed to interpret the relative rate of sedimentation in the geologic section: (1) Moore's concept (modified): the greater the relative abundance of Foraminifera in sediments, the slower the rate of sedimentation; (2) each facies has its own "normal" rate of sedimentation; (3) given uniform conditions, each facies should be present in belts approximately parallel with the coast; (4) each fossil species is present in a belt along the coast which overlaps or coincides with those of several other species; and (5) population peaks of many species tend to recur in the geologic section whenever and wherever conditions are favorable. The masking of fossil facies resulting from high rates of sedimentation is emphasized.

C. JOHN MANN, Univ. of Illinois, Urbana, Ill., AND WILLIAM A. THOMAS, Birmingham-Southern College, Birmingham, Ala

ANCIENT MISSISSIPPI RIVER

Stratigraphic evidence in the central Mississippi embayment indicates that apparently a stream of major size has occupied continuously the approximate same location as the existing Mississippi River—at least since Late Jurassic time. Significant quantities of deltaic sediments are present in the Smackover Limestone (Late Jurassic) and in most younger units. The stream which has persisted since Jurassic time is referred to here as the "Ancient Mississippi River."

C. JOHN MANN, Univ. of Illinois, Urbana, Ill.

ILLINOIS BASIN, MISSISSIPPI EMBAYMENT, AND OUACHITA OROGENIC BELT

Evidence that the Illinois basin was open toward the south during the Mississippian, the geographical coincidence of a unique Ouachita lithologic province with the Mississippi embayment, the distribution of late Paleozoic sediments, interpreted paleoslopes, and interpreted structural relations suggest that the embayment existed during late Paleozoic time. Further insight into the Ouachita orogenic belt and its relation to the Appalachian belt may be gained if the age of subsidence of the Mississippi embayment and its modification from or to the Ouachita belt can be determined.

JOHN H. BEARD AND JAMES L. LAMB, Esso Production Research Co., Houston, Tex.

LOWER LIMIT OF PLIOCENE AND PLEISTOCENE IN CARIBBEAN AND GULF OF MEXICO

A comparison is made between the late Neogene planktonic foraminiferal biostratigraphy of Italy and the Caribbean and Gulf of Mexico. In both regions the order of stratigraphic appearance of the species *Globorotalia margaritae* (= *G. hirsuta* auct.), *G. aemiliana*, *G. crassacrotonensis*, *G. crassaformis*, *G. tosaensis*, and *G. truncatulinoides* is closely comparable and provides a basis for interregional correlation of the Pliocene and early Pleistocene. The occurrence of *G. margaritae* defines the early Pliocene; the globorotaliid lineage of *G. aemiliana* → *G. crassacrotonensis* → *G. crassaformis* defines the middle Pliocene; and the appearance of *G. tosaensis*, *G. truncatulinoides*,

and *Sphaeroidinella dehiscens* defines the very late Pliocene and early Pleistocene. Onset of climatic deterioration in both regions defines the base of the Pleistocene. In Italy the base of the Pleistocene corresponds to the arrival of the cold-water immigrant species *Arctica islandica* and *Hyalinea balthica*, whereas in the Caribbean and Gulf of Mexico climatic cooling was accompanied by either extinction or withdrawal of the warm-water Pliocene species *Globoquadrina altispira*, *G. venezuelana*, and *Globorotalia menardii* and the appearance of the cool-water immigrant species *G. inflata*. Paleobathymetric and physical evidence shows upward shallowing of facies in the very late Pliocene and early Pleistocene, which seemingly is indicative of and related to glacio-eustatic phenomena

## DISTINGUISHED LECTURE TOUR ABSTRACTS, 1968-1969

RAMON E. BISQUE, Colorado School of Mines, Golden, Colorado

### Explosion in Geological Education and Its Future Effects on the Profession

This fall (1968) several hundred thousand high school students across the nation are studying their environment through a series of laboratory and field investigations. These investigations are designed to permit the students to discover principles of science for themselves and understand earth processes. Stream tables, rock and soil samples, fossil models, field trips, and stereoscopes are now commonplace in thousands of high schools.

The earth and space orientation of this new science course will influence the perspective of millions of youngsters during the next few years. Geoscientists and their efforts will be viewed within the framework of science and the geodisciplines will benefit from an understanding and appreciation in the younger generation that they have never before experienced.

Geology in particular stands to benefit from the new surge of interest that these youngsters will carry with them. A widespread realization of the essential and basic contribution of geology to the progress of mankind is but a part of the dividend. New areas of research will be opened and advanced as greater numbers of young scientists, teachers, and technicians apply their intellect to the study of our planet.

Geologists in our universities and industries should be aware of this new facet of secondary school science education and be prepared to reap the benefits for the geologic profession.

ROBERT F. DILL, U. S. Navy Electronics Laboratory, San Diego, California

### Pleistocene Sea Levels and Continental Margin Sedimentation

Continental margin sedimentation has been controlled greatly by large fluctuations of Pleistocene sea level and differential channeling of sediment down submarine canyons. Relatively recent stillstands of the strandline have cut terraces and sea cliffs into the continental slope to 700 ft below present sea level. Shallow-water fossils of late Pleistocene age have been collected from these terraces during deep-submersible dives with the *Deepstar*. During the lowered stand most submarine canyons actively diverted shallow-water sediments into the deep sea and marginal basins. Deep dives and extensive sampling of the large sediment fans formed during this period have shown a predictable sediment-distribution pattern that can be related to ancient deposits of similar origin.

Colored motion pictures, taken during scuba dives and from deep submersibles, show presently active processes of sedimentation and erosion in submarine canyons and associated deep-sea fans. Similar pictures, taken during dive traverses off Southern California, and Baja California, Mexico, show the relations of prograding slope sediments to the deeply submerged terraces, associated sea cliffs, and shallow-water sediments.

JOHN JAMES PRUCHA, Syracuse University, Syracuse, New York

### Sedimentary Rock Deformation Related to Structure in Basement

Petroleum exploration and development in areas of deformed sedimentary rocks commonly must be concerned with the interrelations between sedimentary rock deformation and the structure of the basement. Concern with the changes in the nature and attitudes of structures with increasing depth, and increased emphasis on understanding regional structural styles, necessitate an understanding of expected basement behavior during deformation of the overlying sedimentary rocks.

The *basement* comprises those igneous and metamorphic rocks of the earth's crust which unconformably underlie the unmetamorphosed, dominantly sedimentary rocks of a particular region. As defined here the term bears no connotation of specific age. Although for most of North America the basement is Precambrian, it is Mesozoic in parts of California and Paleozoic in parts of the New England Upland the Appalachian Piedmont.

The widespread occurrence in the basement of severely deformed metasedimentary rocks in association with igneous intrusives typically reveals a long and complex history of deformation under confining pressures ranging up to 5,000–8,000 bars and at temperatures commonly in the order of 300°–800°C. Thus the environment which originally produced the basement rocks was much different from that of the relatively low energy levels in which the overlying sedimentary rocks were deposited and subsequently deformed, and the resulting mechanical properties of basement-type rocks are very different from those of most sedimentary rocks.

It is clear that the interface between the basement and the overlying sedimentary rocks is a mechanical discontinuity as well as a stratigraphic and structural one. Especially in those regions where the basement was closely involved in the deformation of the superjacent sedimentary rocks is a knowledge of the expected mechanical behavior of the basement essen-