Shoal development on the north and south sides of estuarine entrances gives rise to 2 structurally different types of barrier islands. South-side shoals are triangular sand bodies attached to the shoreline. Through time these shoals prograde seaward and form arcuate beach ridges. Shoal and beach ridges are partly eroded during periods of high wave energy. The development of barrier islands (Type I) results when renewed shoal and beach ridge formation occurs seaward from these terminated ridges. Shoals on the north sides of entrances are detached from the shoreline and are segmented as a result of longshore spillover of channel water. Longshore trending shoals form seaward of "spillover channels." These shoals are the forerunners of recurving beach ridges which form barrier islands (Type II) on the north side of the channel. At the present time Type I and Type II barrier islands are developing on the Georgia coast.

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GOVERNMENT'S EXPECTATIONS AS TO NATIONAL MINING AND MINERALS POLICY

There is a need for Congress to have a continuing evaluation of the nation's mineral and fuel position, as described in the Mining and Minerals Policy Act of 1970. Steps are being taken by the Department of the Interior and the Bureau of Mines to provide this evaluation.

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COMPUTER MAPPING IN LOWER FRIO FORMATION (OLIGO-MIOCENE), SOUTHWESTERN LOUISIANA

The usefulness of a computer in mapping the complex structure and stratigraphy of the Oligo-Miocene of the Gulf Coast has been questioned. During a regional study of the lower Frio by Paine, Meyerhoff, and Furrer, the writer had an opportunity to computerize the data used for the study (hand-contoured maps), and to produce a set of computerized maps from the same data. Four sandstone isolith maps, 1 isopach map, and 1 structure map of 1 zone were constructed, as well as 4 isopach maps and 4 structure maps of other zones.

The computer's sandstone isolith map of the *Nodosaria* "A" sandstone showed a marked difference from the hand-contoured map, because the writer had introduced a major distributary system into the eastern half of the area. The computer plotted this distributary system as a series of east-west, elongate, barlike bodies parallel with (1) thinner sandstone bodies in the western part of the area and (2) the shoreline of massive continental sandstone bodies on the north. In the growth-fault area of the *Nodosaria* embayment, computer maps and handmade maps are very similar.

The structure maps show less similarity. Only the large regional faults and the large domes appear on the computer maps. Smaller faults and closures do not appear on the computer maps. The differences between shallow and deep structure are evident on both the computer and hand-contoured maps.

This study revealed that computer maps are useful in stratigraphic work—both on regional and local scales. For structural work, the computer maps are less useful, but do reveal major features. The great number of maps which the computer can produce in a short time is an obvious advantage. Clearly, the geologist's prejudices are reflected in the computer output. The writer strongly recommends the use of computerized maps in studies of Gulf Coast geology.

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STRATIGRAPHY, SEDIMENTATION, AND PETROLOGY OF OLIGO-MIOCENE LOWER FRIO FORMATION, SOUTHWESTERN LOUISIANA

The Frio Formation, a major productive unit in South Louisiana, never has been described petrographically, although conventional cores and thousands of sidewall cores have been collected.

The lower Frio consists of about 1,000 ft of alternating sandstone and shale in the updip stable shelf area, but it thickens to an observed maximum of 7,000 ft in the downdip unstable shelf (*Nodosaria* embayment) area. The lower Frio is mainly a regressive sequence, and has been divided into 4 units (designated A, B, C, and D from top to bottom) on the basis of electric-log correlations and other characteristics.

Three lithologic sequences characterize each unit: a massive sandstone facies on the north (updip); an interbedded sandstone-shale (deltaic?) facies exhibiting considerable lateral variation; and a downdip sequence of alternating sandstone and shale in which the shale content increases markedly downdip. The sandstone bodies are thin and relatively persistent.

Unit D, at the base, marks the beginning of the regression, has the least amount of sandstone, and has smallest amount of production. Shoreline and deltaic sandstone bodies are poorly developed. Unit C shows an increase in sandstone content and production. The deltaic facies is well developed, and shows a marked increase in volume and areal extent. Most of the production is associated with this facies, although production does occur in marine sandstone facies. Unit B shows only limited southward regression, but exhibits considerable development of marine facies. Numerous fields produce from this unit. Significant production also comes from channel-like bodies with erosional lower contacts. These bodies may be bar fingers or distributary channel deposits. Unit A is the most regressive. It contains the largest amount of massive continental and deltaic plain sandstones, as well as a well-developed delta system. As a result, marine sandstones are limited in number and extent. The distributary sandstone bodies account for major production and several giant fields.

Independent stratigraphic, petrographic, and paleontologic studies demonstrate that the lower Frio contains strata deposited in continental, deltaic, and inner to middle neritic environments. Production, although primarily controlled by structure, is definitely affected by sedimentation and depositional patterns. Because structure in the Frio is now well known, future discoveries will be determined primarily by stratigraphic, petrographic, and paleontologic studies similar to this one.

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EXPANDING HUMAN HORIZONS IN GEOSCIENCES

Several earth-science societies—the Society of Exploration Geophysicists, Geological Society of America, Seismological Society of America, American Geophysical Union, and American Geological Institute, for example—have adopted programs designed to increase the number of black, Spanish-surname, Indian-American, and other minority groups in the geosciences. These programs include (1) special efforts to motivate minority youths of precollege age to study geology and related sciences when they leave high school; (2) providing summer and part-time jobs in industrial, governmental, and academic geoscience programs for high school and college minority students; (3) encouraging undergraduate and graduate scholarships for minority geoscience students in colleges and universities; (4) giving grants to colleges and universities that make special efforts to train minority geoscientists; and (5) eventually finding professional jobs in the geosciences in oil and mining companies, state and federal geological surveys, universities, and other institutions for qualified graduates. The aim of these programs, as for all programs of geoscience education, is to provide a continuous flow of talented young people from all racial, ethnic, and economic backgrounds into geology, geophysics, and related geosciences.

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SEDIMENTARY AND STRUCTURAL CHARACTERISTICS OF LOWER PALEOZOIC STRATA ADJACENT TO BURIED PRECAMBRIAN TOPOGRAPHY IN SOUTHEASTERN MISSOURI

A mature Precambrian igneous topography in southeastern Missouri having a maximum relief of more than 2,000 ft was buried by Late Cambrian and Ordovician sediments, but is now extensively resurrected by stream erosion. Peripheral dips in sedimentary strata adjacent to the buried topography of as much as 34° are shown to be limited in lateral extent, and are interpreted as due mainly to the compaction of carbonate muds by as much as 25%.

Detrital igneous material ranging in size from fine sand to large boulders is locally abundant in some sedimentary units. Sedimentary breccias are common at the margins of depositional basins bordered by Precambrian ridges. These breccias are attributed by Snyder and Odell to submarine sliding on slopes of as little as 4°. Algal and stromatolite reef facies are developed at the margins of the depositional basins, and appear closely related to the Precambrian topography which apparently existed as islands or shoal areas in early Paleozoic seas.

Joints and fractures developed in sedimentary strata exhibit both radial and tangential orientation with respect to the configuration of the buried hills. Comparison with results of model experiments by Cloos and Beloussov, and theoretical analysis support a concept of origin in which tensional stresses developed in the sediments during compaction.

The area of these stratigraphic and structural features constitutes a unique "laboratory of exposures" which provides opportunities for comparison with facies encountered in deep drilling elsewhere in the Mid-Continent.

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FUTURE PLANS FOR DEEP SEA DRILLING PROJECT

The Deep Sea Drilling Project, funded by the National Science Foundation, guided by JOIDES, managed by Scripps Institution of Oceanography, and subcontracted for drilling by Global Marine, Inc., of Los Angeles, has been extended for 3 years of drilling. The 7-year period of drilling began August 11, 1968, and will extend until August 11, 1975. The present total estimated cost is approximately $70 million.

Drilling in the past has carried D/V *Glomar Challenger* into the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Caribbean and Mediterranean Seas. She is presently in the Indian Ocean and will proceed, by present plans, back into the Pacific Ocean in early 1973; in early 1974 her track will go into the Atlantic Ocean, to terminate at the end of contract in the Gulf Coast port. It is hoped that a program of drilling in Antarctic waters can be mounted satisfactorily from the *Challenger*. Such a program would involve either 2 or 3 austral summers. Additional drilling in the far North Atlantic would be visualized as part of the high-latitude work. It is hoped that penetration into 500-1,000 m of rock beneath the sediment cores can be achieved several times during this period.

Emphasis in the extension program, as assembled by the JOIDES panel structure, includes investigation of (1) chemical history of the oceans, (2) diagenesis, (3) basement rocks, (4) interaction between basement rocks and sediments, (5) history of ocean current systems, (6) organic evolution and productivity, (7) global tectonics, (8) trenches, (9) high-latitude oceans, (10) continental margins, and (11) remanent magnetism.

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SOME CASE HISTORIES IN PROJECTIVE WELL-LOG INTERPRETATION

A decade has passed since the introduction of projective well-log interpretation, *i.e.*, of a system of quantitative geologic well-log analysis and interpretation for the purpose of exploration for oil and gas.

Such projective techniques use well logs to investigate and map physicochemical rock modifications that may have taken place in the sedimentary geologic column as a result of the migration and accumulation of oil and gas in structural as well as in stratigraphic traps. The principles on which the individual techniques of this system rest have been reviewed in scientific and trade magazines. Many example surveys and discovery data have been published, but most survey results have remained confidential. With passing years some operators have drilled and discovered oil not knowing that such surveys have been made on their prospect areas. Some example surveys made in Florida, in the Permian basin, in the Denver-Julesburg basin, and in the Williston basin are presented in which a number of producing oil and gas wells, and fields, have now been developed in areas mapped and indicated as petroliferous long before discoveries.

One feature common to all petroliferous trends delineated by projective well-log interpretation is that the exact limits of expected production are not pinpointed nor is any claim made that the indicated petroliferous trends will be economically productive. To define economically productive limits, a much greater well density is needed. With such density all the oil fields within the explored depth would have been found, but deeper production possibilities would be indicated by projective techniques.