molds of several gastropod genera of Eocene and Oligocene ages. Several specimens of a Paleocene pelecypod genus have been collected. Some small (10-25 mm in length), elliptical objects of uncertain paleontologic classification were found in Eocene, Oligocene, and lower Miocene.

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Geopressures and Secondary Porosity in Deep Jurassic of Mississippi

Deep drilling in the interior salt basin of Mississippi has revealed geopressured oil, gas, and water with high-pressure gradients. These geopressures are mainly in the Jurassic Smackover and Norphlet Formations, but also may be in overlying formations. The geopressures rise stratigraphically in a basinward direction and increase their gradients with depth. The highest documented Smackover pressure gradient in Mississippi is 1.06 psi/ft recorded in saltwater flows from a 23,455-ft wildcat. The highest Smackover gas gradient is 0.99 psi/ft at 22,250 ft. Pressure-gradient reversals are recorded in some parts of the basin.

Deep Smackover geopressures differ from relatively "leaky" geopressures in the Gulf Coast Tertiary in that they underlie nonshale crystalline seals with no transition zone. Deep Smackover geopressures cannot be predicted from compaction trends because cores reveal that geopressured Smackover sandstones are compacted severely, whereas their vuggy porosity is secondary in origin and is not a result of "undercompaction" related to geopressures as in the Gulf Coast Tertiary.

Geopressured gas mixes range up to 100 percent carbon dioxide and 78 percent hydrogen sulfide. The nature and distribution of these gases suggest they are late thermal migrants and late thermal metamorphic alterations of former oil reservoirs. The geopressures they have generated are young pressures in this "old" basin and are termed inflated and phase pressures, respectively. Associated geopressured acidic fluids appear to have dissolved available soluble minerals, thereby creating late secondary porosity in compacted sandstones which are now the deep gas reservoirs.

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Upper Depth Limits and Morphologic Variations of Foraminifera from Continental Slope and Abyss of Gulf of Mexico

Modern Foraminifera collected along three traverses across the Gulf of Mexico show that morphologic variations within species (clines) may serve as excellent indicators of bathymetry. Many species of Foraminifera are known to have restricted upper depth limits that can be used in making paleobathymetric interpretations. Penetration of Neogene offshore sediments of the Gulf of Mexico allows paleontologists to interpret paleobathymetry of sediment samples with a higher degree of accuracy through comparison of the ancient faunas with these modern counterparts.

Some depth-related morphologic variations of species, such as size, form, and ornamentation, are known to have importance in paleobathymetric interpretations and are useful in evaluation of an assemblage. The more obvious and important depth-related morphologic variations have been recorded for the genera *Uvigerina, Laticarinina, Gyroidina,* and *Hoglundina.* Genera which include especially significant depth-indicator species include *Gyroidina, Cibicides, Eponides, Oridorsalis, Cyclammina, Bulimina, Osangularia,* and *Alabamina.*

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Framework for Stratigraphic Interpretation of Dip Logs

Stratigraphic interpretations of dip logs have been attempted since the middle 1960s, with limited success. In many cases the dip-log information is not suitable for a stratigraphic interpretation. Deficient computation procedures for stratigraphic information and failure to remove postdepositional structural tilting are two common shortcomings.

Determination of the depositional environment of a sandstone requires consideration of (1) the paleocurrent dips within the sandstone, (2) dips in the units surrounding the sandstone, (3) and the depositional environment of the formation. Bar-type sandstones normally have internal paleocurrent dips in the same direction as the overlying shale dips. The paleocurrent dips in channel-type sandstones are perpendicular to the dips in the adjacent shales.

The sandstone interpretation generally should agree with a regional depositional model for sandstones. Marine-bar sands usually subparallel the regional depositional slope, whereas channel sands are perpendicular to the slope.

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Collapse-Fault Systems of Louisiana Gulf Coast

Collapse faulting is found circumscribing salt-withdrawal basins in the south Louisiana salt-dome province. The salt-withdrawal basins are the result of unusually large volumes of salt vacating a restricted area of the source salt bed to form peripheral salt intrusions. Such localized salt-withdrawal basins are not known in the upper Gulf Coast or interior salt basin because the salt intrusions in those areas are of smaller volume and more widely dispersed. In the lower Gulf Coast, areas are found where large intrusions of salt have occurred, salt domes are found clustered, or a salt ridge of extraordinarily large mass has risen. An abnormally steep-sided basin is associated with the unusually large intrusions of salt.

The sedimentary rocks overlying the salt-withdrawal area have collapsed periodically as salt was withdrawn and moved toward the surface at the periphery of the withdrawal area. The sedimentary collapse caused normal faulting parallel with, and on, the flanks of the newly initiated basin structure. The faulting, when viewed in cross section, tends to assume a conical configuration nearly conforming to the cross-sectional outline of the basin. These faults are referred to as collapse faults.

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Analysis of Energy Crunch

The peaking of domestic oil production in 1970 coincided with the first increase in the GNP unit cost of energy. Thus began the energy crunch that was well documented but unrecognized until the moratorium of Arab oil imports in 1973. Domestic drilling activity declined by more than 50 percent from 1956 to 1971. Corresponding average annual reserve additions declined by more than 30 percent. Restrictions on development of large reserves such as Prudhoe Bay resulted in loss of almost 2.5 million BOPD in 1974.

Industry is charged with irresponsibility but the record shows tremendous response to the crisis. Is there monopoly when the 30 largest companies account for less than 20 percent of U.S. drilling? About 600 operators drilled in the Rockies during 1973. Industry responded to increased prices with 30 percent more gas completions in 1973. In two provinces, first quarter 1974 stripper well recompletions increased by 100 percent. A study of Wind River basin indicates that even more incentives may be required to increase gas development in similar provinces.

It is uncertain that adequate incentives will be provided to meet the goal of energy self-sufficiency. Analysis of a recent U.S. energy model requires annual drilling of 53,000 wells to meet 1985 forecasts without depleting reserve/production ratios. Computer well-data files are available to assist the massive information analysis required for this task. Computer maps such as trend residuals assist in focusing exploration on the most favor-

able targets. If governmental restraints are minimized the widespread use of computerized industry data can assist attainment of adequate energy supply.

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Mexican "Island" Arc

The idealized island-arc system includes a deep-sea trench on the ocean side, a chain of islands (at least partly volcanic) landward of the trench, and a wide saltwater basin between the islands and the continental mainland. There may be a large negative gravity anomaly along either the trench or the chain of islands, and there is typically an active seismic zone which dips landward from a line beneath the trench. The Japanese Islands and the Marianna Islands have been cited as good examples of island-arc systems.

The southern half of Mexico exhibits the characteristics of an island-arc system except for the fact that it is composed of no islands: neither large like Japan nor small like the Mariannas. The Mexican trench, the volcanic chain, and the northward-dipping active seismic zone are present; furthermore, the Gulf of Mexico has the same approximate size and characteristics as the middle-sized basins along the eastern edge of Asia.

In general, the trench-volcano-basin transect looks very much like cross sections taken through recognized mature island-arc systems. The gravity anomaly, although present, is small, but this is not unusual along other trenches and island arcs.

The entire system is associated with well-developed north-south tension; that is, the Mexican "island" arc lies along the narrow trailing tensional edge of a roughly triangular continent. The absence of islands is the result of two facts: (1) the Mexican system is mature in the sense that the Japanese system is mature, rather than immature like the system in the Mariannas; and (2) the development near the tip of a roughly triangular continent makes fragmentation into islands unlikely. The Mexican system is approximately the length of the main Japanese island (Honshu) which likewise is not cut by straits, and is smaller than the main Indonesian island.

Knowledge of the other island-arc systems of the world can be applied in a useful way to the Mexican system; knowledge of the petroleum production continentward from the Mexican arc (on both Mexican and U.S. sides of the Gulf of Mexico) can be extrapolated to the middle-sized basins in other parts of the world.

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Relict Lacustrine Sediments on Inner Continental Shelf, Southeast Texas

Using scuba, 27 rock samples were collected from a small northwest-trending ridge with 5.5 m of relief located 74 km south of the northern entrance to Padre Island National Seashore and 3.2 km offshore from Padre Island (26°51′N, 97°18′W) in 14 m of water. All are massively bedded subarkoses and sublitharenites cemented by low-Mg micritic calcite. The acid-insoluble residue, which averages 73 percent, is a subrounded muddy, fine sand ($M_z = 3.06\Phi$) that is poorly sorted ($\sigma_1 = 1.74\Phi$), extremely leptokurtic ($K_G = 4.32$), and strongly fine skewed ($Sk_1 = +0.65$). Most contain mesovugs and channels that are lined with sparry calcite, clay, or fibrous chalcedony. Irregular shaped lumps and clots of iron and manganese oxides are common. Land snails (*Helicina orbiculata tropica, Polygyra septemvolva febigeri*) and freshwater snails (*Helisoma trivolvis, Physa* sp.) have been extracted from the rock. Teeth and bones of Pleistocene mammals (*Mammuthus columbi, Mammut americanum, Bison* sp.) also have been found in crevices in the ridge.

The ridge is interpreted as an intermittent lake deposit that formed on a late Pleistocene extension of the South Texas eolian sand sheet. Mud and fine sand were blown into the lake from surrounding dune fields and mixed with accumulating carbonate deposits. During dry periods, the sediments developed soils that were vegetated and later calichified. Because of their superior hardness, the lake sediments survived the Holocene transgression and have become a submarine prominence.

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Origin of Bahama Platform

The origin of the Bahama platform and its continued subsidence to permit the accumulation of a thick carbonate cap have been a problem of Middle American geology. The relation of this feature to previously published reconstructions of the late Paleozoic–early Mesozoic "fit" of North America, Africa, and South America also has posed a problem. A new model incorporating the volcano-tectonic rift and ignimbrite-sheet association is proposed to explain the origin of the Bahama platform as an integral part of Caribbean plate tectonics. A new North America–South America join is utilized to account for the major geologic and tectonic continuities of Paleozoic age throughout Mexico and Central America.

The clockwise rotation of North America as it separated from South America and Africa caused the counterclockwise bending of the entire peninsula of Mexico and Central America, with the newly accreted Caribbean plate into a subduction zone that was to evolve into the arc-trench system of the Greater Antilles. The rotation and beginning of subduction of this Caribbean plate into the Cuban trench, in Jurassic time, triggered volcanic eruptions that provided the foundations for the Cuban volcanic arc. Additionally the eruptions provide the usual thick and widespread ignimbrite sheet behind the arc in the area now occupied by peninsular Florida and the Bahama Banks.

Not only is evidence for this feature found in wells drilled in Florida, but it also provides the foundation on which was deposited the thick sequence of carbonate strata that form the Bahama Banks. This interpretation eliminates the overlap of the Bahama salient onto Africa, explains the origin of the Old Bahama Channel, serves the same purpose as the sedimentary prism proposed by Dietz and others, and has the volcanic character to meet the geophysical requirements indicated by Uchupi *et al.*

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Arctic Gas—New Natural Gas for United States

After over six years and $50 million worth of environmental and engineering studies, officials from Alaskan Arctic Gas Pipeline Co. and Canadian Arctic Gas Pipeline Ltd. submitted simultaneous applications to the United States and Canadian federal governments last March, for permission to build a 2,600-mi pipeline from the Arctic to the United States.

The 100 pounds of filing materials represent the most thorough environmental study ever undertaken for a project such as this—in addition to engineering studies which have been massive.

The 48-in. Arctic Gas pipeline will transport to U.S. markets all of the Alaskan gas from Prudhoe Bay as well as that Canadian gas from the Mackenzie delta which is surplus to Canada's needs.

Although the Arctic Gas pipeline will end at the northern U.S. border, three companion pipeline facilities will be constructed to transport the gas directly to markets throughout the country in what will be the most economical way of distributing Arctic gas directly to U.S. consumers.

Northern Border Pipeline, a consortium of six Arctic Gas members, will construct a 1,600-mi, 48-in. telescoping line from