Measurements of organic carbon from the Lower Cretaceous Mowry Shale in Wyoming provide an illustration of the effects that can be obtained using different linear models in the regression. Relations between the distribution patterns and location of Lower Cretaceous hydrocarbon fields in this region can be shown graphically on the models.

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EXPLORATION AND PRODUCTION RESULTS OF OFFSHORE EXTENSION OF MEXICAN CRETACEOUS GOLDEN LANE

The Cretaceous Golden Lane reef fields are in northeastern Veracruz state, east-central Mexico. They partly underlie the coastal plain and partly the adjacent submerged continental shelf of the Gulf of Mexico. This paper is concerned mainly with the offshore fields and, more specifically, with a 45-mi-long belt of the Golden Lane reef south of Arrecife Medio field.

For many years several geologists postulated that the spectacular Golden Lane fields are only one segment of an atoll whose eastern part is beneath the continental shelf of the Gulf of Mexico. This working hypothesis led to an extensive and detailed seismic exploration program which, complemented and integrated with the discovery of the fields herein described, confirmed the presence of the postulated atoll. In essence, the atoll is a Middle to Late Cretaceous feature with a maximum north-south diameter of about 85 mi and a minimum east-west diameter of about 40 mi.

The earliest seismic survey was begun in 1957, and the first discovery, Isla de Lobos No. 1-B, was completed on June 28, 1963. Several discoveries have been made since Isla de Lobos; all are on topographic and/or structural highs of middle Cretaceous reef or reef-associated limestone, which generally is overlain unconformably by strata that range in age from Late Cretaceous to Oligocene.

The various offshore fields are discussed from north to south. The Arrecife Medio field, drilled from August 1963 to November 1966, has 3 producers and 5 dry holes. Approximately 1,450 b/d of oil and 444 Mcf/d of gas are produced from the field. Isla de Lobos field —the first offshore discovery—drilled from May 1963 to July 1964, has eight producers. Approximately 7,300 b/d of oil and 1,200 Mcf/d of gas are produced. Tiburón field has been drilled since July 1964, and has 5 producers, 2 dry holes, and 1 well abandoned because of mechanical difficulties. Approximately 2,635 b/d of oil and about 470 Mcf/d of gas are produced. Atún field was discovered in 1967 and is being developed. Of the completed wells, 2 produce only gas, 2 produce oil and gas, and 1 was plugged because it reached the reef below the oil-water contact. This field presently can produce 6,856 b/d of oil and approximately 5,100 Mcf/d of gas.

The following wells are considered as discoveries of fields similar to some of those described. Esturión No. 1 produces 623 b/d of oil and 188 Mcf/d of gas; Bagre No. 1-A produces 950 b/d of oil and 614 Mcf/d of gas; Pez Vela No. 1 found a gas reservoir whose potential was not determined.

The following discoveries were considered noncommercial. Robalo No. 1 produced approximately 180 b/d of oil and 46 Mcf/d of gas; and Tintorera No. 1 produced approximately 55 b/d of oil and an insignificant amount of gas. Three wells found salt water, probably because of a low structural and/or paleotopographical position. These are Pulpo Nos. 1-A and 2 and Pargo 1.

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REGIONAL DISTRIBUTION OF LATE JURASSIC DEPOSITIONAL WEDGE, UPPER GULF COASTAL PLAIN OF NORTHEAST MEXICO AND SOUTHERN UNITED STATES

The writer reviews and compares Jurassic stratigraphy and sedimentation within the various Jurassic sedimentation provinces of northeast Mexico and the southern United States. Many of these provinces are being explored actively. Of great importance is the presence or absence of adequate reservoir rock, particularly within the Late Jurassic Smackover-Zuloaga equivalents. Before active exploration can begin, regional studies must be made to determine where porous facies are most likely to be present. Stratigraphic dip sections of the Jurassic section must be made, and the various units correlated. Dip sections cannot be made at random but must be located strategically. Lithofacies maps must be made to show in detail the lateral lithologic changes in the various units. Several producing fields in Texas, Arkansas, and Mississippi are good examples of the types of producing structures which may be expected. Economics and reservoir characteristics of the producing fields must be understood thoroughly before a particular structure or other type of trap is drillled. The understanding of economics and reservoir characteristics can be gained through detailed study of existing Jurassic fields.

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COMPARISON OF MODERN ISLAND AND MAINLAND SUPRATIDAL-FLAT CARBONATE DEPOSITS, BRITISH HONDURAS

The usefulness of supratidal-flat sediments in paleogeographic reconstructions is decreased by the difficulty in distinguishing between island and mainland deposits. Holocene carbonate sediments in British Honduras form supratidal-flat deposits on shelf-margin islands and on the mainland. The vertical sequence and sedimentary structures of deposits in both areas are similar, reflecting similar modes of formation and physical settings, respectively.

Constituent compositions and the nature of nearby deposits differentiate these island and mainland supratidal carbonates. Shelf-margin islands are associated with backreef coralgal sand; fragments of corals and coralline algae are included in some island deposits. Mainland deposits lack these indicators of a shelf-edge environment but contain brackish-water organisms and terrigenous material, such as quartz and clay minerals. Furthermore early diagenetic dolomite occurs only in island sediments. These distinguishing compositional differences, though diagnostic for northern British Honduras, are not absolute. Rather, they illustrate types of characteristics which may be useful environmental indicators in other areas.

In the absence of compositional differences, lateral facies relations may distinguish island and mainland deposits if sufficient stratigraphic control is available. An island interpretation is favored where submarine shelf-lagoon deposits occur between discontinuous supratidal deposits which are separated by several miles, especially within a marine-to-terrestrial facies transition. Otherwise, an interpretation of frequently shifting sites of supratidal sedimentation along a mainland is favored.

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FORAMINIFERAL TRENDS WITHIN INNER SUBLITTORAL ZONE OFF COAST OF WASHINGTON

Foraminiferal and diatom distributional trends within the inner sublittoral zone have been studied along 170 km of the coast of Washington from Grays Harbor to Cape Flattery. The samples are from water depths of 7–59 m.

Trends in the concentration of foraminiferal tests and diatom frustules in bottom sediments appear to be closely related to wave-induced turbulence at the sediment surface. Concentrations of tests markedly increase seaward at 20-m water depth, apparently the deepest limit of intense turbulence. Frustules, because of their very slow settling velocity, are prevented from settling at depths less than about 50 m except in certain microenvironments. These trends are not correlated with trends in sediment grain size, a fact which suggests that little modern sediment is accumulating in this area.

One trend is related to increasing depth and distance from shore; *Elphidium* spp. decrease markedly seaward of 30 m as *Eggerella advena* increases. Comparison with other studies in nearby areas indicates that this trend is heterobathyal. Off Oregon it occurs at about 100 m and off Washington south of Grays Harbor, if the *Elphidium* fauna is present at all, it occurs at depths less than 20 m.

Other foraminiferal trends are related primarily to substrate. Rocky substrates near the coastline have a characteristic *Cibicides lobatulus-Glabratella ornatissima* fauna. Relict coarse sand substrates offshore have faunas with abundant *Trochammina charlottensis, Cribrostomoides jeffreysii,* and *Elphidiella hannai.*

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HOLOCENE OCEANOGRAPHY OF CHUKCHI SEA

Piston cores from the southeastern Chukchi Sea have permitted differentiation of modern from Holocene sediments deposited when sea level stood about 20 m lower. Because microfossil distributions in modern sediments are associated closely with ice-free oceanographic conditions, the following trends appear to be related to Holocene oceanographic conditions. *Eggerella advena,* indicative of warm, dilute Alaskan coastal water, is as abundant in Holocene as in modern sediments, but *Reophax arctica,* indicative of central shelf water, and *Spiroplectammina biformis,* indicative of cold bottom water in the northern Chukchi Sea, are much less abundant in Holocene sediments. Frustules of the planktonic diatom *Coscinodiscus,* presently displaced northward by the Bering Strait current from regions of maximum phytoplankton concentrations in the overlying water, are more abundant in Holocene than in modern sediments in cores directly north of Bering Strait.

The northward-flowing Bering Strait current controls conditions in the southeastern Chukchi Sea. This flow was reduced during the Holocene because the cross-section area of the strait was smaller; apparently, however, the flow was reduced at the expense of central shelf water as Alaskan coastal water filled the southeastern Chukchi Sea. Although currents were slight in the central part of the southeastern Chukchi Sea, waters still piled up against the coast near the present settlement of Kivalina and produced a high-velocity northwest current. As evidence of this, Holocene sediments northwest of Point Hope contain more plant fragments and sand than nearby areas, and these presumably were deposited from the current.

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FRINGING REEF OR ALLOCHTHONOUS BLOCKS?

Many Permo-Pennsylvanian reef complexes of the Permian basin, Texas, have flanking carbonate mounds or "reefs." Faunal evidence indicates that these are topographically low relative to equivalent-age sediments in the reef proper. The shallow-water carbonate rocks were deposited either at times of lowered sea level, or they flowed or slid down the slope *en masse.* It is a real challenge to the subsurface geologist to identify their mode of deposition, particularly in the absence of cores.

Lloyd C. Pray and colleagues, using geopetal fabrics, showed that the so-called Bone Spring "patch reefs" in the Guadalupe Mountains were emplaced by gravity. In Howard and Glasscock Counties, Texas, large reef-dolomite blocks are embedded in a cherty forereef limestone facies of the Wolfcampian Wichita-Albany, and there is no question that they are allochthonous.

On the flanks of the Pennsylvanian and Wolfcampian "Horseshoe atoll" in Howard, Scurry, and Kent Counties, Texas, the problem is less simple. The greatly leached and porous atoll was raised intermittently above sea level, and fringing reefs should have formed on the flanks of islands. However, this does not preclude the other methods of emplacement of shallow-water limestone. Very careful study is required to differentiate the various types of deposits. Differentiation of each type is critical to the exploration geologist because the fringing reefs appear to make prolific petroleum reservoirs whereas the allochthonous or turbidite carbonates commonly host noncommercial accumulations.

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VIBRO-BOX SAMPLER: NEW TOOL FOR STUDY OF SEDIMENTARY STRUCTURES IN NEARSHORE SANDS

Increased exploration for stratigraphic traps in ancient shallow-marine sandstone and the resulting problems in environmental reconstruction have emphasized once again the lack of information on the characteristics of modern counterparts. The vibro-box sampler is designed to provide data on sedimentary structures of sand from the important zone between low tide and the 10-fm line. The sampler is a combination of the box sampler of Klovan, as modified by Imbrie, and the vibro-corer of Sanders.

The sampler is made of stainless steel (to resist corrosion) and can recover a 20 by 19 in., vertical, undisturbed "slice" from the bottom. A compressed-air vibrator is used, first, to drive the sampler into the bottom and, second, to activate a diagonal plate which seals in the sample. Additional vibration is necessary to free the sampler from the bottom. Surprisingly, the