Northwest Borneo orogene. The shelf widens to more than 300 km toward the south in Sarawak and measures about 100 km in the north in Sabah. Structural deformation is most severe onshore and decreases toward the offshore, where all the currently producing East Malaysian fields are located.

The two largest offshore oil fields, the Baronia field in northern Sarawak and the Samarang field in southern Sabah, are both situated in areas characterized by synsedimentary tectonics. Production is from upper Miocene coastal-plain and coastal sands, which have been charged with hydrocarbons from land-plant-derived source rocks.

The large gas fields are located offshore central Sarawak, and the gas is trapped in upper Miocene carbonate reefs.

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Recent Advances in Passive-Margin Research

Recently available multichannel-seismic data have provided a detailed look at many Atlantic passive margins. DSDP holes and COST wells have provided geologic calibration. Reefal–carbonate-bank underpinnings provided a mechanism for slope migration seaward of the original continental edge, especially in the Jurassic–Early Cretaceous. Tertiary defacement by erosion and mass-wasting has caused large landward retreats of the slope. These events are nearly coeval on both sides of the Atlantic Ocean, indicating their significance.

Deeper crustal layers are identified on the modern reflection and refraction data. Intermediate seismic-velocity layers, 7.1 km/sec, near the continental edge on both sides of the Atlantic might be characteristic of transitional-type crusts, or merely continuations of layer 3b under the slope and shelf.

Deep-cutting, listric normal faults are observed where the soles of the faults merge into a lower crustal layer (6.3 km/sec velocity). Thinning with listric faulting of apparent continental crust has brought the mantle (8.2 km/sec) to within 14 km depths. Viscous creep in the lower continental crust appears necessary to account for the measured thinning.

Detailed analysis of the multichannel data permits sequence identification within the thick margin sediments. Sea-level cycles can be identified, and correlations reveal the configuration of genetically related stratigraphic units. Such analyses define the subsidence history and paleobathymetry of the margins. Some passive margins start with an uplift and rifting phase, whereas others are rifted through previous deep basins without uplift or volcanism. Other margins are dominated by volcanism in the early stages, and outer-ridge structures have formed.

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Depth Migration of Seismic Data

Conventional time migration of seismic data results in the incorrect positioning of reflectors where there are significant lateral variations in the velocity of the overburden. In such situations the basic migration procedure should use the provided velocity information and obey the wave equation with adequate accuracy to produce a cross-sectional representation of the reflectors in true depth.

A method involving finite-difference approximations to the wave equation has been implemented for obtaining migrated depth sections. The initial seismic data have the properties of an upcoming wavefield recorded at the earth's surface. This is projected downward in small increments of depth, making appropriate corrections for the transmission of the seismic waves through the assumed velocity variations within the layer. Thus, at an intermediate stage of processing, the data consist of an imaged depth section above the depth Z, followed by "conventional" unmigrated seismic data associated with shooting and recording at depth Z.

This depth-migration procedure applies to both two- and three-dimensional common depth point stacked data, where it is expected to be particularly important for oil field development projects. The method has also been developed for application to conventional unstacked two-dimensional data which have been recorded on a uniform grid with a shot at each receiving group. Although this latter mode becomes relatively expensive, it does offer the possibility of improved detailing of zones of exploration interest overlain by complex geology with rapid lateral velocity variations. The method also can be reversed to yield synthetic seismic data consistent with a given geologic model.

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Surface Turbidity and Hydrographic Variability on South Texas Continental Shelf, Gulf of Mexico—Time-Sequence Study

Regional surface-water turbidity patterns and associated hydrography were monitored on the south Texas continental shelf over an 18-month period (fall 1975 to spring 1977). During six monitoring cruises, quasi-synoptic surface measurements were made of water transmissivity, suspended-sediment concentrations, temperature, salinity, and drifter trajectories. Time-sequence patterns of these parameters illustrate substantial temporal and spatial variability; temporal variations occur at both the seasonal and annual time scales.

Turbidity and hydrographic patterns indicate a surface-sediment dispersal system regulated by a shelf-water exchange process consisting of opposing lateral movements of inner-shelf and outer-shelf water masses. Relatively turbid inner-shelf waters reflect the offshore and alongshore transport of coastal-derived sediment. The inner shelf has a regional gradient of shoreward-increasing turbidity; superimposed local gradients are established at major tidal inlets that serve as prominent sediment point sources and dispersal centers. Turbidity variability along the inner shelf is jointly attributed to variations in coastal runoff, relative tidal sediment flux from individual inlets, and ambient wind-induced hydrographic conditions. The outer-shelf patterns suggest the shelfward incursion of open-ocean waters, the extent of which varies spatially and temporally. Regional turbidity patterns appear to reflect the degree of interchange between the gulfward movement of turbid inner-shelf waters and the shelfward incursion of clear open-ocean waters. The observed variability is compatible with a conceptual model of the regional dispersal system based on seafloor sediment distribution, which suggests both net offshore and net southward alongshore transport on a wind-dominated shelf.

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Three-Dimensional Aspects of Belize Patch Reefs

Rotary-drill rock cores and vibrocores of sediments were used to investigate the origin and sedimentary history of patch reefs and a "rhomboid" shoal in offshore Belize (Central America). All lagoonal patch reefs and shoals examined are localized on preexisting Pleistocene topography. The buried topographic highs are composed of Pleistocene coralline limestone, suggesting a constructional patch-reef origin rather than an erosional or karst origin. The principal Holocene sediment- and framework-builder is the branching coral *Acropora cervicornis*, but *A. palmata*, various massive corals, and the lettuce coral *Agaricia* sp. are also contributors. These accumulations, up to 27 m thick, amplify Pleistocene topography. The accumulations are totally uncemented, and metal probes can easily be inserted more than 5 m into the living reef slope. Steep dips, commonly greater than 45° and extending from the surface to a least 30 m in depth, provide a sedimentary paradox. Even though these reefs are uncemented and periodically subjected to hurricanes, reef debris has not been found in the surrounding lagoonal muds more than a few meters away from the reef "toe." The surrounding coral-free lagoonal sediments, consisting both of clays and carbonate materials, are more than 6 m thick.

Understanding the mechanics of patch-reef formation may provide clues important to oil exploration: (1) many of the rhomboid shoal reefs are of reservoir size even though they are less than 9,000 years old; (2) their position adjacent to a humid mountainous hinterland makes them susceptible to burial by terrigenous clays as the coastal plain progrades; (3) both the clays and carbonate muds are in a favorable stratigraphic position to serve as source beds.

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Dolomitization of Pliocene-Pleistocene Carbonate Sediments, Bonaire, Netherlands Antilles

Dolomitization of sediments may be controlled, in part, by their predolomitization diagenetic history. The Pliocene-Pleistocene dolomites on Bonaire underwent a period of minor freshwater diagenesis prior to dolomitization. During this initial stage of diagenesis, some low-magnesian calcite cement formed. Unaltered high-magnesian calcite skeletal fragments were replaced during dolomitization, aragonite was dissolved, and low-magnesian calcite was at first inert and later locally dissolved. The inclusion crystals and crystal molds of calcite cement in dolomite rhombs, the presence of calcite zones in dolomite rhombs, and the preservation of limestone fragments in dolomitized breccias demonstrate that low-magnesian calcite was not replaced during the initial dolomitization. Cloudy centers and clear rims formed when the dolomitizing fluid changed from near saturation with respect to calcite (cloudy centers owing to inclusions and molds) to undersaturation with respect to calcite (inclusion and mold-free rims).

The concentration of Na^+ in these dolomites is approximately 350 ppm, and the $\delta^{18}O$ values range from +1.97 to +4.1. These data indicate that the dolomitizing fluid was low in Na^+ (relative to seawater) but isotopically heavier than most groundwater and, therefore, probably an evaporation-concentrated fresh water.

The data suggest that dolomitization may be climatically controlled. In humid climates, a sediment in the freshwater-seawater mixing zone may undergo rapid calcification owing to the high PCO_2 in the groundwater. In arid climates, the water will have a lower PCO_2 as a result of limited soil development; therefore, calcification will be slower and chances for dolomitization will be increased.

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Description and Sedimentology of Submarine-Fan Gas Reservoir in Woodbine–Eagle Ford Interval (Upper Cretaceous), Sugar Creek Field, Tyler County, Texas

Abundant gas and some condensate are being produced from fractured sandstones of the Upper Cretaceous Woodbine–Eagle Ford interval at depths of 10,800 to 11,350 ft (3,240 to 3,405 m) in the Sugar Creek field area of Tyler County, Texas. The reservoir sandstone units are complex, single to multiple bodies 15 to 40 ft (4.5 to 12 m) thick and less than a few thousand feet wide within a mud-dominated clastic wedge. The wedge thickens from about 50 ft (15 m) near the Lower Cretaceous shelf edge to more than 1,500 ft (450 m) within 15 mi (24 km) downdip to the south. Subsurface correlation and mapping of the discontinuous, lenticular sandstone bodies indicate that they are best delineated as a series of coalescing, dip-oriented lobes. Deposition appears most likely to have been as prograding submarine-fan lobes, with sediment being channeled from updip delta and nearshore deposits across a narrow shelf and through shelf-edge breaks and then dumped downslope.

Within the major sandstone units, individual beds commonly are 1 to 3 ft (0.3 to 1 m) thick and display sharp contacts with interbedded, thin (1 to 2 in.; 2.5 to 5 cm) shale layers. As viewed in polished core slabs, the sandstones are mostly massive; however, radiography reveals abundant lamination and cross-stratification and some ripple-bedding and soft-sediment-deformation structures. A detailed analysis of sedimentary features and sandstone fabric suggests periodic rapid