IPOD Drilling on Convergent Ocean Margins

Active ocean margins have been drilled by the *Glomar Challenger* to test the conceptual subduction-accretion model of convergent-plate tectonism. In this model, subduction results in accretion of oceanic and trench sediment to the margin and a general buildup of the upper plate. The results of pre-IPOD drilling confirmed some general aspects of the model such as compressional strain, folding, deformation of young sediment, and periods of arc volcanism. However, the results of IPOD drilling along the Japan and Mariana Trench transects indicate that much of the oceanic sediment is subducted rather than accreted if the rates of convergence derived from global considerations are assumed. Off Japan, massive subsidence of the outer continental shelf during subduction suggests some erosion and disposal of the leading edge of the upper plate. Thus the conceptual subduction-accretion model cannot be applied in these two areas without major modification.

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Effects of Source Material and Thermal Maturation on Chemical Composition of Gulf Coast Crude Oils

Variations in the chemical composition of crude oils in the Gulf Coast of the United States are related to the depositional environments of the rock successions from which they are produced (a measure of source type), and to the temperature to which the oil has been subjected (a measure of maturation). The chemical composition of 2,105 Gulf Coast crude oils was calculated from physical properties determined by the U.S. Bureau of Mines. The relative proportions of paraffin, naphthene, and aromatic compounds in these oils revealed two clusters of crude oil composition. The first cluster contains an average of 70% paraffin, 20% naphthene, and 10% aromatic compounds and is the most common type of crude oil produced from Mesozoic reservoirs. The second cluster contains an average of 43% paraffin, 45% naphthene, and 12% aromatic compounds and is the most common type of crude oil produced from Cenozoic reservoirs.

The importance of source material in determining crude oil composition is demonstrated by (1) the close association of high-wax crude oils with Mesozoic and Cenozoic rocks formed in deltaic environments; (2) the association of crude oils rich in aromatic compounds with rocks formed in interdeltaic environments; and (3) the occurrence of high-sulfur oils in Mesozoic reservoirs which are not associated with delta systems. Deltaic environments provide greater sources of terrigenous organic material versus interdeltaic areas, which contain more marine organic material.

The effects of thermal maturation are shown by the relation between reservoir temperature and the relative proportion of naphthenes in the crude oil. Oils having greater than 55% naphthenic compounds are produced from Cenozoic reservoirs which have lower temperatures than those which produce paraffin-rich oils.

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Role of Physical Sedimentation in Carbonate-Bank Growth

Carbonate mud banks of central Florida Bay contain three types of sediment wedges which provide evidence that pulses of rapid physical sedimentation are a dominant cause for bank growth and migration.

Most dramatic are layered to laminated wedges of carbonate mudstone flanking eastern, southern, or western bank margins. Depositional units are 0.5 to 1.5 m thick and compose up to 70% of the existing bank. Units have erosional basal contacts; basal shelly sand grades upward to a layered to laminated mudstone containing no pellets, no burrowing, no seagrass rootlets, and few sand-size skeletal grains. Three features suggest rapid deposition: vertical escape burrows extending upward from the basal sand, vertical smooth-walled water-escape fractures in the lower part, and abundant seagrass blades incorporated into the layers.

The second type of wedge is a layered, pelleted mudstone to packstone otherwise similar to that described above.

The third type of wedge is a bioturbated, soft-pellet wackestone to packstone as much as 1 m thick and flanking only southern bank margins. It contains horizontal to inclined seagrass rhizomes throughout and has minor autochthonous mollusks.

The layered wedges are interpreted to record rapid subtidal sedimentation during rare superstorms (extreme hurricanes), the first type from storms of sufficient violence to destroy most pellets. The third wedge type records persistent lee-side accumulation from lesser hurricanes and winter storms. This deposition, although rapid, is slow enough to be in continuous association with a seagrass-community influence.

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Lower Cretaceous Carbonate Shelf in Southeastern Arizona and Northeastern Sonora, Mexico

The Mural Limestone (Bisbee Group, Lower Cretaceous) in southeast Arizona and northeastern Sonora exposes a broad carbonate shelf and an irregular, migrating shelf margin at the northwest end of the Chihuahua trough. The upper Mural represents the culmination and initial regressive phases of an Aptian-Albian transgression. It is underlain by nearshore clastic strata and limestones of the lower Mural and the Morita Formations, and overlain by clastic beds of the Cintura Formation. Study of the narrow outcrop belt from the Mule Mountains in Arizona to where the Mural disappears beneath Quaternary volcanics, 70 km to the south in Sonora, reveals an overall pattern of southward-deepening water. The upper Mural thickens from 50 to nearly 300 m over this distance. Facies present in Arizona are, from north to south: (a) shallow lagoonal packstones and wackestones; (b) a broad oolite and pelletoid-sand shoal; and (c) a muddy, open shelf with small, isolated reefs in waters at least 10 m deep. In Mexico,

larger isolated reefs give way southward to reef banks 5 to 8 km across, surrounded by mudstones and wackestones containing pelagic microfossils. Shallow-water deposits of the southernmost bank "step" progressively southeastward over deeper water limestones.

Reef cores in most of this belt consist of platy, branching megacolonies of the coral *Microsolena,* encrusted by thick, laminated stromatolites. In the north, rudists are abundant only on reef flanks and caps, and in shallow interreef and backreef areas. Rudists increase in abundance on reef banks to the south, as do various encrusting and head-forming algae. Thoroughly bound rudist-coral-algal frames dominate the southernmost reefs.

Lagoonal limestones of the early regressive phase overlie the reef interval, and are punctuated in the south by the thick sandstone and shale wedge. Nearshore and continental clastic units of the Cintura Formation ended carbonate deposition in this area.

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Deposition and Diagenesis of Mississippian Pinnacle Reefs of Chappel Limestone, Fort Worth Basin, Texas

The Mississippian Chappel Limestone constitutes an important oil-bearing unit that occurs along the western margin of the Fort Worth basin in north-central Texas. It has long been assumed that the Chappel is productive from pinnacle reefs. Stratigraphic relations of the "Chester," which in part overlies the Chappel, and the Chappel have remained enigmatic.

Study of cores reveals that the Chappel represents a mound-core facies consisting predominantly of fenestrate bryozoans which, soon after death, became rigidly stabilized by submarine aragonitic-fan druse cements; these provided sufficient wave resistance for the mounds to be termed "reefs." The "Chester" represents a flank facies, consisting predominantly of crinozoan components and siliceous sponge spicules, that is time-equivalent to Chappel core facies. Flank dips range up to 35°. Thus the term "pinnacle" is no longer applicable to these reef complexes.

The core facies consists predominantly of bryozoan boundstones and very coarse grainstones ("slabstones"); the flank facies contains grainstones, packstones, and wackestones. Slope instability precluded formation of submarine cements in grainstones of the flank facies.

The reef complex was subjected to complex, multicyclic diagenesis which records several episodes of subaerial exposure and freshwater diagenesis followed by submergence, recolonization, and renewed reef growth.

Nearly all preserved porosity is in the reef core and represents primary voids among erect and broken bryozoan "fronds"—voids which have been filled to varying degrees by submarine and vadose internal sediments, submarine cements, and meteoric vadose and phreatic cements. These materials were cyclically emplaced during submergent and emergent phases.

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Paleoecologic Implications of Foraminiferal Distributional Patterns Off Big Pine Key, Florida

Foraminifera are important both as biotic elements and as skeletal constituents of sediments in carbonate depositional provinces such as south Florida. A better understanding of distribution, habitats, and ecology of shallow-water Foraminifera can lead to more accurate paleoenvironmental interpretations based on the fossil record. In shallow-water carbonate environments plants are an important foraminiferal habitat, and the plant-dwelling biocoenosis in an area may not be reflected accurately by the thanatocoenosis among the associated bottom sediments.

Bottom sediments and vegetation were collected from lagoonal, tidal channel, patch reef, and outer reef environments in the vicinity of Big Pine Key. Living and dead individuals were distinguished for the 106 foram species identified. Sanders' similarity index indicated that the biocoenoses on different kinds of plants within any one environment were similar, whereas the biocoenosis from each major environment was unique. The Shannon-Wiener information function showed a correlation between species diversity and evenness as related to degree of environmental variability. Additionally, biocoenoses from vegetation were dissimilar to thanatocoenoses among sediments. Larger, more robust tests were predominant among sediments, particularly in less sheltered environments. Postmortem processes, such as sorting and differential destruction of tests, affect the character of species diversity and evenness indigenous to living populations. In making paleoecologic and paleoenvironmental analyses of fossil foraminiferal assemblages, it is necessary to discriminate between ecologic factors that influence the distribution of living populations and environmental factors that determine the final character of the dead assemblage.

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Mechanisms of Basin Subsidence

No abstract available.

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Entrapment Factors in California Turbidite and Canyon-Related Pools

California oil and gas pools in a variety of turbidite and other deep-water facies are classified according to their dominant or diagnostic causative geologic factors, some uniquely, others in more than one category. Canyon-dependent traps include sandstones in canyon walls and sandstones buttressed against canyon walls (Walnut Grove), sandstones draped by differential compaction over channel fill (Rosedale Ranch), and possibly other configurations. Fan-dependent stratigraphic traps are sand channels (and bar buildups?) without significant secondary structure (Strand). Anticline-depen-