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,