line. Deviation from apparent equilibrium was most evident for samples from a few cold-water sites. Intraspecific isotopic variations in several warmer-water assemblages were up to 2 ‰, and isotopic variation within individual specimens as high as 1.5 ‰ were noted. Articulate brachiopods were not separable at any taxonomic level on the basis of ranges in isotopic values; the two extant orders of brachiopods, the Terebratulida and the Rhynchonellida, as well as the suborder Thecideidina, had essentially equivalent isotopic ranges at any given locality. Thus, there is no evidence for significant taxonomic control of oxygen isotope fractionation among articulate brachiopods. No correlation appears to exist between $\delta^{18}O$ and $\delta^{13}C$ values.

Our results suggest strongly that isotopic data from small populations or communities of well-preserved articulate brachiopods can be used in paleogeographic and paleo-oceanographic reconstructions.

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Controls on Carbonate Cementation and Solution

The diversity in cementation and solution of carbonate sediments occurs at deposition, with shallow burial and during deeper burial. Our inability to predict the evolution of porosity and permeability in carbonates often results in exploration failures in stratigraphic sequences that are otherwise well understood.

Current models of diagenesis are derived from specific, localized examples. We feel that carbonate diagenesis paths respond to geography, thus current studies may be too specific to reveal general themes. Cementation and solution need to be reconsidered in order to focus our perception of the important controls on these processes, such as mineralogy, depositional texture, burial depth, time, pressure, temperature, water chemistry, hydrocarbon migration, and micro-organisms. We relate all of the currently available analytical techniques into a self-consistent model and suggest new lines of analysis which may add to the general framework.

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Evolution of Tidal Inlets along a Transgressive Deltaic Shoreline

Stratigraphic sequences of deltaic and shallow marine origin commonly contain sand bodies transgressively overlying lower delta plain and delta-front deposits. Although generally ascribed to barriers formed during the destructive phase of the delta cycle, must of this sand is probably of tidal inlet origin because of the high preservation potential for sediment deposited below the base of the retreating shoreface in deep migratory tidal channels and their associated tidal deltas. To facilitate the identification of such units, this paper reviews the temporal evolution of the inlet sand bodies found along the rapidly transgressive shoreline of the abandoned Holocene Mississippi River deltas. This study also reveals that tide dominance or wave dominance of a coastline is not simply a function of tide range and wave height; it depends largely on the tidal prism, an inlet parameter which in Louisiana changes rapidly over time.

Three distinct stages can be identified in the evolutionary sequence for Louisiana tidal inlets: (1) wave-dominated inlets with flood-tidal deltas, (2) tide-dominated inlets with large ebb deltas, and (3) wide, "transitional" inlets with sand bodies confined to the throat section.

Stage 1.—Tidal inlets ranging in age from 50 to a few hundred years are associated with flanking barrier systems attached to erosional deltaic headlands. The barriers enclose restricted interdistributary bays. Small inlets also occur at the entrance to abandoned distributary channels within the headland section proper. The tidal prism being exchanged through either of these inlet types is small; the morphology of the inlets and adjacent coastline is wave dominated, and most of the inlet sand is associated with a flood-tidal delta. The inlets are generally shallow.

Stage 2.—The Holocene Mississippi River deltas are subject to rapid subsidence and consequent local sea level rise. One gage at Grand Isle indicates a sea level rise of 30 cm (12 in.) over the past 20 years; however, the longterm average is somewhat less. Subsidence leads to an expansion of back-barrier open water environments, an increase in tidal prism, and an evolution of the inlet into a tide-dominated morphology with a deep main channel and large ebb-tidal delta. The recent evolution of Pass Abel and Quatre Bayou Pass represents the transition from wave dominance to tide dominance. Sand bodies developed in stage 2 inlets have the greatest preservation potential because they generally lie below the base of the retreating shoreface.

Stage 3.—Further subsidence generally leads to the development of an open sound permitting efficient tidal exchange with the gulf along the sound margin (Chandeleur Sound). As a consequence, the inlets play only a minor role in the tidal exchange pattern. At this stage, the inlet sand bodies evolve along two distinctly different paths, apparently controlled by sediment supply. Barriers with adequate coarse sediment produce many small well-defined inlets with large flood-tidal deltas (washover fans) and only transient, post-storm ebb deltas. The island shore is distinctly wave dominated. Along coastal segments where coarse sediment is scarce, one finds rapid island deterioration, shoaling of the inlet channel, and reworking of the ebb-tidal deltas into a "transitional" configuration with the sand tied up in throat section shoals.

As the inlets migrate during the transgression, they will leave behind on the continental shelf tidal sand bodies with a landward succession of facies changing from those characteristic of wave dominance, into tide dominance, and back again to "transitional" or wave-dominated inlets.

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Geological Evolution History of Petroliferous Basins on Continental Shelf of China

Coastlines of China are about 18,000 km (11,118 mi) in length, and their aggregate continental shelf area within 200 m (656 ft) seawater depth is more than one million km^2 (386,102 mi^2). Recent geophysical exploration work and numerous petroleum drilling records are available and give a general understanding of the geological evolution history of these petroliferous basins. There are two tectonic types of basins distributed on the continental shelf areas: the tectonic types of Bohai Gulf, South Yellow Sea, and Beibu Gulf basins are the intraplate polyphase rifting-depression basins; the East China Sea, Pearl River mouth, and Yingge Sea basin are the epicontinental rifting-depression basins. They are believed to be extensional in origin. Because of the severe convergence of Indian plate with Eurasia plate, there has been produced NNE-spreading movement of the South China Sea basin, which permits two triple junctions on its northern margins. The extension mechanism could be derived from the rising of an upper mantle plume to produce two NNE weak fracturing zones, resulting in a series of intraplate and epicontinental rifting-depression basins.

The depositional models and sea-level variations of these basins are interpreted from the drilling records and seismic profiles. They can be explained by the tectono-eustatic changes in sea level and Cenozoic climate changes of China.

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Seismic Stratigraphy and Sea Level Changes in Active Margin Settings: An Example from Luzon, Philippines

Controversy arises when attempting to relate unconformities on a tectonically active margin to global changes in sea level. Seismic stratigraphy studies on active margins generally concentrate on defining large seismic packets and do not directly relate unconformities and their correlative conformities to global sea level changes. In the Central Valley of Luzon, we determined sequence boundaries in the basin and developed an age model that strongly suggests that sea level change is the major factor affecting shorter term (less than 5 m.y.) changes in sedimentation on this active margin.

The Central Valley is a Cenozoic fore-arc basin bounded by an arc complex and the left-lateral strike-slip Philippine fault on the east and by an east-dipping subduction zone adjacent to the Manila Trench on the west. Multichannel seismic reflection, well, and outcrop data were used to determine the depositional history of the basin. Because much of the 13 km (8 mi) thick basin fill consists of deep-water marine sediments, conventional criteria such as coastal onlap and erosional truncation could not always be used. Instead, evidence for pulses of submarine fan deposition during lowstands of sea level (suggested by Vail and Hardenbol in 1979, and by Shanmugan and Moiola in 1982) was used to identify some of the sequence boundaries. The ages of the major boundaries, predicted from comparisons with Cenozoic Sea level curves, agreed very well with established ages from well and outcrop data.

The supposed difficulty in determining sea level changes in active margins is that tectonic effects override and cloud the effects of global sea level changes. We agree that major regional tectonic events such as the initiation of subduction or strike-slip movement that creates or destroys basin morphologies clearly are the dominant factors in the overall stratigraphy of the basin. However, episodic tectonic events during continued basin evolution result in discrete changes in local basin morphology and sediment source areas which may lead to local unconformities or local increase or decrease in sediment influx. These effects are probably small compared to the basin-wide effects of global sea level changes. Such is the case in the Luzon Central Valley where the effects of global sea level changes can be seen throughout the basin.

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Mesozoic-Cenozoic Deposition Along Atlantic Continental Shelf From Scotian Shelf, Canada, To Baltimore Canyon Trough, United States

In 1982, geologic data from 17 wells in the Baltimore Canyon Trough were released to the public. These wells provide sufficient data for definition of regional stratigraphic units in the Baltimore Canyon Trough. Prior to 1982, the only publicly available data from deep wells on the northern United States outer continental shelf were from two COST wells in the Georges Bank basin and two COST and three exploratory wells in the Baltimore Canyon Trough. Lithologic similarities between the Scotian Shelf formations and the rock units penetrated by these COST wells have been observed in the past. In this study, the stratigraphic terminology developed for the Scotian Shelf is extended through the Georges Bank basin and is informally applied to the Baltimore Canyon Trough strata as homotaxial equivalents.

The Late Triassic(?) to Jurassic salt, carbonate, clastic, and carbonate sequence penetrated in the Georges Bank basin is correlative with the Argo, Iroquois, Mohican, and Abenaki Formations on the Scotian Shelf. Exploratory wells in the Baltimore Canyon Trough were not deep enough to penetrate equivalent rocks. However, previous seismic studies of the trough suggest that a carbonate complex equivalent to the Abenaki Formation may exist beneath the present-day slope. Upper Jurassic to Lower Cretaceous strata in the Georges Bank basin and Baltimore Canyon Trough are equivalent to the Scotian Shelf deltaic sandstones and shales of the Mohawk, Mic Mac, Missisauga, Naskapi, and Logan Canyon Formations. These deltaic deposits are overlain by upper Lower Cretaceous to Upper Cretaceous marine mudstones and shales that are equivalent to the Scotian Shelf Dawson Canyon Formation. The Cenozoic strata in the Georges Bank basin and Baltimore Canyon Trough consist of shale, mudstone, chalk, and unconsolidated sand. On the Scotian Shelf, the Cenozoic section is generally sandier and consists of the Banquereau Formation, an interbedded mudstone and sandstone sequence, and the Laurentian Formation, which consists of glacial and proglacial sediments.

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Submarine Cementation Patterns of Holocene Reefs Provide Models for Porosity Development in Ancient Reef Reservoirs

An understanding of processes of formation and postdepositional alteration of Holocene carbonate buildups can aid the explorationist in locating and predicting reservoir facies in subsurface analogs. In the subsurface, ancient shelf-edge reefs may contain primary porosity that has escaped shallow subsurface cementation. This preserved primary porosity is commonly enhanced later by carbonate dissolution associated with widespread subsurface fluid migration and/or dissolution fronts along permeable stylolite zones. Therefore, given a burial history of continued subsidence, knowledge of early submarine cementation patterns is important for understanding reef facies distribution of late subsurface diagenesis.

In reef systems, submarine cementation is controlled by size of sedimentary components, facies energy setting, and reef growth history. Cements are acicular aragonite and dentate Mg-calcite rims, and more commonly thin crusts and geopetal skeletal infills of Mg-calcite peloids. Rapid facies accumulation during reef growth limits submarine cementation to thin rims and incomplete skeletal infilling. Extensive back-reef sediment apron deposits are generally mud free and composed of well-sorted skeletal fragments, that undergo only minor submarine cementation. Reef core (framework) facies contain large amount of in-situ skeletons and increasing mud and peloidal submarine cements within the core matrix. High energy fore-reef facies are extensively cemented by fibrous aragonite druses and dense peloidal Mg-calcite infill. The best potential reservoir facies are usually back-reef packstone-grainstones, which have greater porosity and permeability because high accumulation rates and moderate energy conditions limited submarine cementation.

Following a reef's demise and submergence, submarine cementation of the upper reef surface may form an effective diagenetic