micrites studied thus far is low and suggestive of high-Mg calcite mud precursors for those micrites.

Oxygen isotopic composition of both CDP and ADP samples are rather broad ranges suggesting varying contributions of original mineralogies for both groups. There is, however, an overall negative trend toward lighter $\delta^{18}O$ isotopic values with increasing age, indicative of either progressively higher temperatures with age or lower $^{18}O/^{16}O$ ratios in ocean water.

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Geologic Implications of Dewatering of Coal and Other Carbonaceous Lithologies—A Hypothesis

A large amount of water is released from coal and other noncoal carbonaceous lithologies during the coalification process. Calculations of the amount of water released from coal and carbonaceous lithologies in low-permeability Upper Cretaceous rocks in the Green River basin of Wyoming reveal that this source of water is as important as any other sediment-derived water. Based on water resistivity (R_w) calculations and coal compositional changes during coalification, we suggest that this organically derived water is fresh relative to most formation waters. The addition of this water to the pore fluids is of sufficient quantity to create a chemical disequilibrium between the pore fluid and rock constituents, thereby producing a potential for precipitation or dissolution of cements. The addition of fresh water in conjunction with the variable stratigraphic distribution of coal beds and a restricted hydrologic communication between lithologic units implies that variable water resistivities (R_w) could occur that might adversely affect geophysical well-log responses and water-saturation (S_w) calculations. In coal-bearing rocks, the addition of organically derived water into the pore system may, in part, contribute to the development of abnormally high pressures.

The effectiveness of this dewatering process depends on the amount and stratigraphic distribution of coal, stage of coalification, and degree of hydrologic isolation or impermeability of the coal-bearing sequence.

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Catahoula Formation as a Source of Sedimentary Uranium Deposits in East Texas

Volcanic glass-rich mudstone and siltstone samples from the Oligocene/Miocene Catahoula formation of Jasper County, Texas, and coeval volcaniclastic rock samples from Trans-Pecos, Texas, have been compared as to U, Th, Zr, Ti, K, Rb, and Sr contents. Results are consistent with the 1977 eruption model of Sparks and Walker, in which the east Texas Catahoula samples are their "distal air-fall ash," and the Trans-Pecos samples their near-source units. Uranium is slightly greater in the distal ash (5.85 ppm U) compared to the Trans-Pecos samples (average 5.41 ppm U). Elements which are preferentially incorporated in crystallizing phases are more abundant in the crystal-rich near-source units (310 ppm Sr, 2,163 ppm Ti, 461 ppm Zr, and 22.7 ppm Th) than in the distal ash (48 ppm Sr, 1,050 ppm Ti, 88 ppm Zr, and 18.1 ppm Th). Elements which tend to become enriched in the residual magma are less abundant in the near-source units (206 ppm Rb and 3.09% K) than in the distal ash (291 ppm Rb and 4.94% K). These results emphasize the close chemical affinities of Catahoula and Trans-Pecos volcanic material.

Diagenetic and pedogenetic alteration of Catahoula volcanic glass releases uranium to solution and, under favorable conditions, this uranium may accumulate to form ore bodies. Uranium has been produced from such ore bodies in south Texas, but economic deposits are not known in east Texas. Significant differences between south and east Texas include: (1) a greater amount of volcanic debris delivered to south Texas, both as air-fall ash and stream-transported material, (2) delivery of only air-fill ash to east Texas, (3) the possibility of more petroleum-related reductants such as H_2S in south Texas, and (4) pervasive glass alteration with subsequent uranium release in south Texas due to late calichification. These differences argue against economic deposits of the south Texas type being found in east Texas. If economic deposits occur they are likely to be far downdip making exploration difficult and expensive.

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Geology and Hydrocarbon Accumulations, Columbus Basin, Offshore Trinidad

The Columbus basin, on the eastern shelf of Trinidad, lies at the eastern extremity of a belt of severe deformation along the northern boundary of South America that has been affected by compressional and wrench tectonics in the Pliocene-Pleistocene. Two major structural trends are present in the Columbus basin: a series of ENE-trending anticlines and NNW-oriented normal faults. The basin was filled during the late Miocene to Holocene with sediments deposited by an ancestral Orinoco River draining a hinterland to the southwest. The Pliocene-Pleistocene section, which contains the hydrocarbon accumulations in the Columbus basin, was laid down in three coarsening-upward sedimentary sequences followed by a late Pleistocene transgressive sequence.

Traps for hydrocarbon accumulation were formed by an easterly trending Pliocene-Pleistocene wrench system with associated ENE-oriented anticlines combined with NNW-oriented normal faults. Oil was sourced in the late Miocene lower Cruse Formation, whereas gas was derived both from Pliocene-Pleistocene pro-delta shales and as a late high temperature phase of lower Cruse hydrocarbon generation. The NNW faults formed migration conduits from the oil source rock to Pliocene-Pleistocene reservoirs. The temporal relationship of faulting to oil generation is a major factor affecting the distribution of oil and gas. The size of hydrocarbon accumulations is limited to some extent by a lack of an effective hydrocarbon seal, particularly in the western half of the basin.

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Stable Isotope Variations in Modern Articulate Brachiopods

Carbon and oxygen isotopic analyses were performed on several species of Holocene articulate brachiopods from various locations in the Carribbean Sea and in the Atlantic and Pacific Oceans, from salinities ranging between 30 and 38 ‰ and over a temperature range from 4 to 28°C (39 to 82°F). The $\delta^{18}O$ of articulate brachiopods are systematically related to the $\delta^{18}O$ and temperatures of the ambient waters. Lowenstam in 1961 concluded that articulate brachiopods secrete calcium carbonate (low magnesium calcite) in isotopic equilibrium with the surrounding waters. The data compiled in this study, along with that of Lowenstam, closely approximate the equilibrium calcite-water 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 ris-