bank deposits. Sediments near the channel terminus have upward-coarsening sequences (i.e. channel-mouth depositional lobes) and contain 47 to 65% sand.

Most of the sparse microfauna in both sands and muds are benthic species characteristic of inner and middle neritic origin. Traces of biogenic methane and other hydrocarbons were found in the underlying lobes but not in the youngest lobe. All sediments are underconsolidated, resulting from the extremely high accumulation rates of 6-12 m/1,000 yr (20-40 ft/1,000 yr).

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Lithologic Characteristics of Mississippi Fan

Deep Sea Drilling Project Leg 96 drilled eight sites on the youngest fan lobe of the Mississippi fan; well logs were run at six sites to complement core recovery. Four sites were drilled on the middle fan across the meandering channel: in a swale, on a point bar, in the channel thalweg, and in overbank deposits. The swale section consists of mud deposited mainly as fine-grained turbidites. The youngest fan lobe extends to 384 m (1,260 ft) subbottom at the overbank site and consists mainly of muds with clayey and silty zones. The gamma log indicates that most of the lithologic zones coarsen upward. Both channel sites have gravel overlain by pebbly muds, which corresponds to a zone of high-amplitude reflectors. The basal coarse unit is approximately 135 m (443 ft) thick. The channel fill shows a fining-upward sequence from gravel to interbedded sands and silts to sandy muds, and is capped by a 50-m (164-ft) thick homogeneous mud section. The sand section on the point bar side of the channel bend is 30 m (98 ft) thicker than on the thalweg site.

Four sites were drilled on the lower fan lobe, two adjacent to the channel and two near the channel terminus. Well logs indicate 47% net sand for the youngest lobe and 65% for the underlying lobe. The channel generally switches position, building an alternating section of channel fill and overbank deposits.

The channel-mouth depositional lobes coarsen upward, and individual sand layers range in thickness from 0.2 to 10 m (0.7 to 33 ft). They are deposited by turbidity currents.

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What is COMFAN?

COMFAN (Committee on Deep-Sea Fans) is an informal, international group of scientists that was hosted by Gulf Research & Development Co. in September 1982 to analyze the findings of deep-sea fan research accomplished during previous years. The group also reviewed the future plans for DSDP drilling on the Mississippi fan (Leg 96) and provided recommendations.

It was realized that tectonic setting and sea level variations have major influences on volumes of sediment supply, type of sediment, rates of accumulation, nature of fan growth, facies distribution, and stratigraphic sequences.

Deep-sea fans can be divided into three categories. Elongate fans develop in response to medium to high sediment input dominated by mud and fine sand. These fans have a major river as their primary source (e.g., Mississippi, Bengal, Indus, Amazon, and Rhone fans). Radial fans result from a lower sediment input with higher sand/clay ratios (e.g., La Jolla, Navy, San Lucas, Redondo fans). Slope aprons are a third category that, although not submarine fans, are closely related turbidite systems. Most fans are hybrids rather than true end members.

Three major conclusions were generated: (1) comparing modern fans with ancient turbidite systems is almost impossible because of scale differences and different study techniques; (2) slope failure may be a more direct source of fan deposits rather than deltaic systems; and (3) major fan accumulations most likely occur during the end of a sea level lowering or during the initial period of sea level rise, and sedimentation rates may be very high.

BOWLAND, CHRISTOPHER, Univ. Texas at Austin, Austin, TX

Seismic Stratigraphy of Western Colombian Basin, Caribbean Sea

Multichannel seismic reflection profiles disclose the regional stratigraphy of the western Colombian basin. The basement complex is the seismic unit below the deepest, continuous reflection horizon that can be traced throughout the basin. The basement complex reflection signature on the flanks of the Mono Rise and adjacent areas is smooth, continuous, and characterized by local occurrences of internal reflectors, and is equivalent to the Late Cretaceous Horizon B in the Venezuelan basin. In the central basin, the reflection signature is rough with abundant diffractions typical of normal oceanic crust.

The sediment overlying the basement complex is subdivided into five mapping units. Unit CB5, which directly overlies the basement complex, is thickest on the Mono Rise and thins down the flanks of the rise. This unit is equivalent to the Upper Cretaceous to Middle Eocene pelagic unit bounded by seismic horizons A″ and B″ in the Venezuelan basin. Unit CB4, characterized by pervasive, small offset faulting, is restricted to the crest of the Mono Rise. Units CB3 and CB2 contain subparallel, variable amplitude, continuous reflectors that fill the regional basement complex relief. They are Middle Tertiary terrigenous distal turbidites and hemipelagic deposits. Unit CB1 thickens toward southern Central America and shows complicated reflection patterns typical of a deep-sea fan complex. A jump correlation to Deep Sea Drilling Project Site 154 is used to assign a Late Miocene to Quaternary age to unit CB1. Development of unit CB1 was concurrent with the uplift of and magmatic activity in southern Central America.

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Sedimentologic and Stratigraphic Framework of Some Modern Crevasse Splay Sands

A series of cores taken along strike and dip transects through the Baptiste Collette crevasse splay, modern Mississippi River delta, have been analyzed to determine the sedimentologic nature and potential reservoir quality of modern crevasse splay sands. Internal geometry, lateral and vertical continuity, and sedimentary characteristics were determined to construct a model of crevasse splay depositional systems applicable to hydrocarbon exploration.

The stratigraphic framework is more complex than previously recognized. This complexity is demonstrated by the presence of several fine-grained (61-125μ) sand bodies (1-2 m, 3-6 ft thick), reflecting deposition in 3 distinct environments. Subaerial levee sands, which thicken toward the proximal end of the splay, contain 50-80% fine-grained (88μ) sand, 10% interlaminated muds, and 5-25% rooting. Distributary mouth-bar and point-bar deposits (-2 m, -6 ft, MSL) are 50-60% fine-grained sand (88μ), 40-50% interlaminated mud, with $<5\%$ cross-bedding and gradational base. The deeper (-6 m, -20 ft, MSL) channel sands are 80-95% fine-grained (88μ) sand, with 20-75% crossbedding, 10% interlaminated mud and erosional base. These correlatable sands are encased in thick, organic-rich, bioturbated, bay and abandoned-channel muds forming an impermeable seal.

Channel sands have the greatest reservoir potential, being more laterally continuous along dip, clean (5% silt and clay), well sorted, fine-grained and more homogenous, with few permeability barriers (i.e., mud layers and laminae). Conversely, the shallower bar and levee deposits have poorer reservoir quality, being less clean, less continuous laterally along dip, and with more permeability barriers.

It is felt that this study will complement the limited knowledge of modern crevasse splay systems as well as provide insights into the exploration or enhanced recovery of hydrocarbons in ancient equivalents, such as the Admire 650′ Sandstone of Kansas.

BRAUER, JULIE S., and PAUL A. BAKER, Duke Univ., Durham, NC

Experimental Hydrothermal Dedolomitization

Hydrothermal replacement of dolomite by calcite has been examined through experimental reactions carried out in teflon-lined stainless steel bombs, at temperatures ranging from 50° to 200°C (122° to 392°F), at

equilibrium vapor pressure, and for durations of days to months. Solution compositions were varied to examine the effects of ionic strength, Mg^{2+}/Ca^{2+} ratio, and SO_4^{2-} concentration on the direction and/or rate of reaction. The starting solid for these experiments was a stoichiometric and well-ordered synthetic dolomite; several experiments were also seeded with solid reagent-grade calcium carbonate (calcite).

In pure $CaCl_2$ solution (0.1 M) replacement was complete in less than one week at temperatures of 100° C (212° F) and greater. Replacement was minor after several weeks at 50° C (122° F). Longer term experiments at 50° are still underway. A series of experiments established that dedolomitization only occurs at Mg^{2+}/Ca^{2+} ratios of less than 1/10 (total ionic strength = 0.1) at all temperatures from 100° to 200° C (212° to 392° F). Because this reaction proceeds far faster than the reverse reaction (dolomitization), we believe this result establishes the most precise calcite/dolomite phase boundary to date. The presence of SO_4^{2-} was found to strongly inhibit the dedolomitization reaction, even at concentrations far less than in seawater. Seeding the reaction with a small amount of calcite had little effect on the rate of reaction, suggesting that nucleation is not rate-limiting in dedolomitization. Finally, increasing ionic strength from 0.01 up to 0.5 increased the rate of reaction.

BREINING, KATHY A., and KYGER C. LOHMANN, Univ. Michigan, Ann Arbor, MI

Diagenetic Evolution of a Silurian Limestone Reef: Geochemical Documentation of Mixed-Water Dolomitization

Examination of a partially dolomitized Silurian platform reef (Pipe Creek Jr.) indicates that the timing of dolomitization is tightly constrained within the calcite diagenetic sequence. Cathodoluminescence and isotopic analysis of calcite diagenetic components define the diagenetic environment and fluid chemistries at the time of dolomitization.

Abundant syntaxial and fibrous calcite marine cements suggest synsedimentary lithication of the reef complex. Multiple episodes of subaerial exposure are recorded both in the petrologic fabric as well as in the geochemical signatures of altered marine components and equant calcite cements. In the upper reef, marine components are corroded, and resulting porosity is partially infilled by red geopetal vadose silts. Resubmergence and continued marine cementation establishes a Silurian timing for this initial episode of exposure.

Evidence for subsequent exposure is contained in the isotopic and cathodoluminescent patterns of later marine cements and overlying equant calcite spars. Marine cement isotopic compositions deviate from an initial marine composition (-4.0 ‰ $\delta^{18}O$; + 2.0 ‰ $\delta^{13}C$ PDB) along covariant trends that reflect alteration by diagenetic pore waters. Equant calcite cements are restricted to the upper reef and partially occlude primary porosity. These cements exhibit invariant oxygen compositions between -7.0 to -8.0‰ and variable carbon which shows progressive depletion toward the upper reef. On this basis we interpret these cements as having formed within a shallow meteoric phreatic lens with light carbon derived from soil-gas CO_2 at the exposure surface. Cathodoluminescent patterns and sulfide mineralization indicate progressive reduction of pore waters in the meteoric lens. The latest stage of phreatic cementation records anaerobic fermentation during which the oxygen composition remains unchanged with carbon varying up to + 7.0 ‰ following precipitation of pyrite.

Dolomitization occurs within this sequence of meteoric phreatic diagenesis. Early zoned meteoric spars, reflecting initial fluctuations in reducing conditions, are corrosively overlain by dolomite. The earliest formed dolomite is luminescent, signifying reduction of manganese, and is overlain by an outer ferroan dolomite. A progressive increase in reducing conditions is further indicated by the reduction of sulfate and concomitant precipitation of pyrite. The heavy carbon equant calcites, which postdate pyrite, suggest anaerobic fermentation during the final stages of phreatic cementation.

Because dolomitization is bracketed by events of meteoric phreatic cementation and diagenesis, and its chemical evolution mimics the progressive reduction of the pore-water system, we suggest a mechanism of meteoric-marine water mixing to account for partial dolomitization of the Pipe Creek Jr. reef. This does not, however, imply a similar mechanism for the pervasive dolomitization of adjacent shelf reefs. Rather, this study emphasizes the complex early diagenetic history of shelf sequences with implications for late Silurian sea level fluctuations.

BRETT, C. EVERETT, J. READ HOLLAND, and DAN THOMPSON, Univ. Alabama, University, AL

A Community Model for Coalbed Methane Utilization

The University of Alabama at Tuscaloosa provides a model for community utilization of coalbed methane and energy independence. A feasibility study for coalbed methane development has been completed through a grant from the U. S. Department of Energy. The total resource available beneath the 760-acre (310-ha.) campus is estimated to be nearly 10 bcf. The Mary Lee Coal Group alone contains more than 3.4 mcf of gas, assuming 75% recovery.

As a result of an economic analysis, two exploration/research wells have been completed to depths of 2,289 and 2,760 ft (698 and 841 m) respectively.

The university is currently in the process of unitizing with Bryce and Partlow Hospitals. The combined acreage is approximately 2,000 acres (800 ha.). It is anticipated that coalbed methane could meet the gas demands of all three facilities for many decades. The methane will be used for space heating, domestic hot water, and for compressed natural gas (CNG) to operate the university's vehicle fleet.

Recently the university, along with Southern Company Services, Kaneb Services, and the Gas Research Institute, has embarked on a demonstration project to evaluate the feasibility of using coalbed methane as a primary fuel source for a fuel-cell power plant. A 40-kW fuel cell will be utilized to provide both electricity and hot water for the student recreation building.

These coalbed methane utilization activities should provide planning information for communities located over coal lands to develop independent resources and provide long term energy alternatives.

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Tide-Dominated Delta Model for Coal-Bearing Wilcox Strata in South Texas

Coal-bearing Wilcox strata near Uvalde in south Texas are the deposits of a tide-dominated delta. The delta of the Klang and Langat Rivers, Malaysia, provides a modern analog for these strata. Five facies have been identified from a study of core and well logs: (1) lignite, (2) underclay, (3) interbedded sand and mud with lenticular, wavy, and flaser bedding, (4) ripple-laminated or cross-bedded sand, and (5) greenish, very strongly bioturbated sand. On the Klang-Langat delta, the modern equivalents of these facies are (1) peat formed in freshwater swamps, (2) root horizons developed beneath the peat (3) interbedded sand and mud deposited on tidal flats, (4) channel sands, and (5) shallow marine sand and mud.

Tidal flat deposits are the most abundant type of sediment on the Klang-Langat delta and in the coal-bearing Wilcox strata. The tidal flats of the modern delta are crossed by small tidal creeks and by larger tidal streams. The tidal channels are cut into tidal flat sediments and separate peat-forming areas. Channel sands in the Wilcox are cut into tidal flat deposits and form washouts in the lignite. Two types of channel-fill sand are present in the Wilcox, sands 5-15 ft (1.5-4.5 m) thick and sands more than 30 ft (9 m) thick. The thinner sands, deposits of small tidal creeks, have sharp, erosive bases, fine upward and pass into interbedded sand and mud. The thicker sands have sharp tops as well as sharp bases and show no grain-size trends; they are fills of larger tidal streams.

BRIMBERRY, DAVID LEE, Texas Tech Univ., Lubbock, TX

Depositional Environments, Conodont Biostratigraphy, and Porosity Diagenesis of Montoya Group (Upper Ordovician), Sacramento Mountains, South-Central Mexico

Intensely dolomitized and siliceous marine carbonates comprise Upper Ordovician strata in the Sacramento Mountains, New Mexico. Pray subdivided these units into lower Montoya, upper Montoya, and Valmont formations. These strata are more appropriately designated the Montoya Group which includes 3 formations: Second Value, Aleman, and Cutter.

The subrounded, medium to coarse-grained sandstone rests disconformably on the Lower Ordovician El Paso Formation. This thin sand (Cable Canyon Member of the Second Value Formation) represents a