pervasive secondary porosity as well as remobilization of material for localized late-stage cements.

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Facies Architecture and Production Characteristics of Wave-Dominated Deltaic Reservoir, Big Wells Field, Southern Texas

The Big Wells (San Miguel) oil field in Dimmit and Zavala Counties, southern Texas, produces from a broadly lenticular, wave-dominated deltaic sandstone encased in prodelta and shelf mudstones. An updip porosity pinch-out coincides with a gentle undulation on an otherwise smooth, gulfward-dipping monocline, resulting in a combination stratigraphic and structural trap. The reservoir is relatively tight with average porosity of 10% and permeability of 7 md; wells require fracing to stimulate production. Ultimate recovery is projected to be 30% of the 180 million bbl field.

The reservoir is subdivided into a nonproductive, transgressive upper sandstone and a productive but intensely bioturbated, predominantly deltaic lower sandstone. The tight upper sandstone provides the reservoir seal. Internal architecture of the reservoir is complex, consisting of strike-elongate beach-ridge deposits that merge north into a dip-elongate, digitate channel-sandstone system representing the deltaic entrant into the basin. SP-log facies display mostly strike-parallel orientations; however, resistivity-log facies are more complex and varied, reflecting a high degree of reservoir heterogeneity.

Early production is uninfluenced by the sedimentary fabric of the reservoir. Initial isoproductivity maps display peaks that correspond with faults, proximity to the gas cap, and to a lesser extent, local sandstone thicks. However, during subsequent production, internal architecture strongly influences reservoir yields as the depositionally complex northern half of the field displays lower recoveries than the beach-ridge deposits to the south.

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Textural Evidence for Origin of Salt Dome Anhydrite Cap Rocks, Winnfield Dome, Louisiana

Textures within anhydrite cap rock are products of repeated cycles of halite dissolution and residual anhydrite accretion at tops of salt stocks. Quarrying operations at Winnfield dome have exposed extensive portions of the anhydrite cap rock zone. This zone is composed primarily of unoriented, xenoblastic anhydrite crystals in laminae less than 1 mm to several centimeters thick. Laminations are defined by thin, dark sulfide accumulations and pressure solution of anhydrite. Deformed, banded anhydrite clasts are contained locally within laminae. Multiple-laminated, concave downward anhydrite mounds occur along some horizons. They may contain anhydrite breccia fragments or sulfides. Coarsely crystalline salt mounds, containing disseminated idioblastic anhydrite also occur along horizons. Mound morphologies vary from tall and thin to broad and squat; maximum dimensions range from less than 0.5 m to about 2.0 m. These moundlike structures are related spatially and genetically.

Moundlike structures are believed to form from salt spines along the salt-anhydrite contact. As the spine dissolves through several cycles of dissolution and accretion, a laminated anhydrite mound is preserved; if the spine becomes isolated from dissolution, then a salt inclusion is preserved. Anhydrite beds within the Louann Salt, deformed during diapirism, are preserved as deformed anhydrite clasts. Steeply dipping, bedded anhydrite zones within the salt stock may produce brecciated anhydrite mounds when incorporated into the cap rock. Sulfides record the movement of metalliferous fluids through the salt-anhydrite contact. Cores from other Gulf Coast domes indicate that these textures and interpreted processes are common.

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Reexamination of Bengal Fan Model for Turbidites of Frontal Ouachitas

The lower member of the Pennsylvanian Atoka Formation outcrops within the frontal Ouachitas of Arkansas. Strata are comprised of turbidites and related deep-marine deposits, which locally exceed 5.5 km (18,000 ft) in structural thickness. Several previous workers have drawn analogies between Ouachita turbidites (or flysch) and the present-day Bengal Fan, located in the eastern Indian Ocean. As a first-order approximation, this model is basically correct, especially in terms of overall tectonic setting. Yet, when examined in detail, there are striking dissimilarities between the frontal Ouachitas and the Bengal Fan.

The dimensions of the Bengal Fan are staggering, it measures roughly 1,000 km (620 mi) by 3,000 km (1,860 mi). The main feeder channel is 13 km (8 mi) across and 850 m (2,790 ft) deep. Channels within the mid-fan region are up to 2-3 km (1.2-1.9 mi) in width and 100 m (330 ft) in depth, and some channels maintain continuity for well over 2,000 km (1,240 mi). Rates of vertical sediment accumulation are no more than 75 m/m.y., with isopach data showing only 3.5 km (11,500 ft) of post-Eocene accumulation. Limited sampling also shows rather low sand-mud ratios over much of the fan.

Lithofacies data and depositional cycles within the lower Atoka Formation are suggestive of middle-fan, outer-fan, and basin-plain environments. If Atoka channels were as large as those of the Bengal Fan, they certainly remain unrecognized in the rock record. Instead, the entire length of the outcrop belt in Arkansas is less than 250 km (155 mi), and facies changes define a clear east-to-west transition from middle fan to basin plain. Significantly, Atoka sedimentation rates were approximately 10 times higher than Bengal rates. It is evident that the Atoka fan system was much more confined than the Bengal Fan; it probably formed within a narrow, rapidly filling, remnant ocean basin rather than on an unrestricted abyssal floor.

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Biostratigraphy and Paleoenvironment of Morrowan (Zone 2) Brachiopoda, Bird Spring Group, Arrow Canyon, Clark County, Nevada

Comprehensive study of the Morrowan brachiopod faunas of the Bird Spring Group at Arrow Canyon, Clark County, Nevada, is important because the section has been suggested as a stratotype for the base and top of the Pennsylvanian Subsystem and for the Atoka Series. Twenty-three species of brachiopods belonging to 17 genera occur in zone 20 at Arrow Canyon. Many of these also occur in described Morrowan faunas in Wyoming, Colorado, Utah, and New Mexico; but similarities with the Mid-Continent and Appalachian assemblages are less. However, no striking regional differences are evident, and it appears that the North American Morrowan fauna is more or less homogeneous. In contrast to the exotic South American and Arctic elements known from Atokan, Missourian, and Virgilian rocks at Arrow Canyon, no foreign taxa have been noted in zone 20. Microfacies and faunal associations indicate four distinct brachiopod-bearing environments: (1) relatively deep water below turbulence with few brachiopods on a soft substrate; (2) somewhat shallower, more turbulent water with many species, of which only a few are represented by large populations, living on a more firm substrate; (3) environments just below the zone of turbulence in which many species of brachiopods are represented by substantial populations on a calcarenitic substrate; and (4) crinoidal bars in the zone of turbulence with a few species represented by relatively few individuals.

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New Developments in Microphotometry of Kerogen and Bitumen at Various Stages of Thermal Maturity and Applications to Hydrocarbon Exploration

Microphotometry is the computerized microscopic measurement of reflectance, fluorescence, and transmittance of organic matter in sedimentary rocks. Microphotometric data are an indispensable tool in exploration of hydrocarbons.

The chromaticity of kerogen particles in fluorescence and transmitted light is derived from spectral analysis and provides new scales for thermal maturity: the Fluorescence Color Index and Transmittance Color Index. The TCI could substitute for the inaccurate TAI. Generation of crude oil within thermally mature kerogen particles shows characteristic fluorescence phenomena when microscopically observed and measured.

Spectral data and chromaticity values provide an improved method for determining the thermal maturity of petroleum source rocks, in particular when vitrinite reflectance data are unreliable or unavailable. The "oil floor" in a basin is marked by the disappearance of the fluorescence of fossil alginite, exinite, amorphous organic matter, and most bitumen. This method provides a better mapping of thermally mature petroleum source rocks.