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Internal Geometry and Reservoir Potential of Some Modern Crevasse Splay Sands

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 is demonstrated by the presence of several fine-grained (61-125μ) sand bodies (1-2 m or 3-6 ft thick) reflecting deposition in three 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 or 6 ft below mean sea level) are 50-60% fine-grained sand (88μ) and 40-50% interlaminated mud, with 5% crossbedding and a gradational base. The deeper (below 6 m or 18 ft) channel sands are 80-95% fine-grained (99-125μ) sand, with 20-75% crossbedding, 10% interlaminated muds, and an 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 homogeneous 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.

This study should complement the limited knowledge of modern crevasse splay systems as well as provide insight into the exploration or enhanced recovery of hydrocarbons in ancient equivalents, such as the Admire 650-ft sandstone of Kansas.

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Depositional and Structural Reconstruction of Southwestern Louisiana—a Temporal-Spatial Approach

Recognition of ancient depositional and structural environments within the Oligocene and lower Miocene hydrocarbon production trends of southwestern Louisiana was based on the interpretation of local lithologic and paleontologic variations within the spatial and temporal components of a regional framework. This trend-oriented technique is useful in predicting environmental origins and associated reservoir characteristics.

Spatial relationships were established by generation of lithofacies and structural contour maps produced from approximately 249 well logs. The massive sandstone facies (continental) and the downdip alternating sandstone and shale facies (deltaic) of the area were analyzed with a new coefficient, the facies index. This coefficient, defined as the average sandstone thickness divided by the total shale thickness, combines the effects of percentage of sandstone and amount of sandstone-shale interbeds. These maps were then superimposed on structure and isopach maps to derive simultaneous structural and depositional models.

Paleontologic studies were incorporated to decipher the Oligocene-Miocene depositional history of the area (temporal component), which is directly related to cyclic transgressive-regressive episodes of three orders of magntidue. The second- and third-order cycles probably represent depocenter shifts and glacial eustatic sea level fluctuations, whereas the first-order pattern reflects geotectonic and basin fill-compaction relationships.

With the integration of localized facies analyses, which were based on individual sandstone geometries, log profiles, lithologic relationships, and paleontologic data, an Oligocene-Miocene depositional and structural model was established. It is suggested that the *Heterostegina* and lower *Discorbis* zones of the Anahuac Formation (Oligocene) contain regressive east-west oriented (delta front) sands within an overall transgressive regime. The overlying upper *Discorbis* zone and lowermost Fleming Formation (Miocene) were probably formed by deposits of an extensive progradational delta system. This regressive sequence is overlain by a transgressive shale wedge containing *Siphonina davisi* (intermediate neritic), *Planulina palmerae*, and the upper bathyal Abbeville Assemblage which is found in the southern portion of the study area. After this transgression, a renewed regression and growth fault episode began in the north. This system prograded the shoreline to the southern extreme of the study area, where the unusually massive lower Miocene sandstones of eastern Cameron Parish (Rockefeller Refuge) originated from fluvial processes within a structural embayment.

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Ostracode Biostratigraphy and Paleoecology of Upper Taylor Group (Campian, Upper Cretaceous) in Central Texas

The upper Taylor Group in Travis and Williamson Counties, Texas, is lithologically monotonous, consisting of an argillaceous marl (Pecan Gap Formation) grading upward into a calcareous claystone (Bergstrom Formation), with no identifiable lithologic breaks in 142 m (466 ft). Outcrops more than 1-2 m (3.3-6.6 ft) thick are few, and existing biostratigraphic zonations for this interval are generalized.

To examine the potential of Ostracoda for biostratigraphic subdivision of this interval, six outcrops totaling 64 m (210 ft) of exposed section were sampled at 1.5-m (5-ft) intervals. Fifty-four species of Ostracoda were identified and their stratigraphic ranges plotted. Species diversity and equitability trend lines and triangular diagrams of proportional family composition provide a basis for paleoecologic interpretation.

Three distinct assemblages of ostracodas are found in these samples, and they can be assigned to interval zones proposed by E. M. Brouwers and J. E. Hazel in 1982, which had not previously been extended to central Texas. The Pecan Gap assemblage is characterized by "*Cythereis*" *caudata* and *Limburgina verricula* and belongs to the *Limburgina verricula* Zone. The lower to upper Bergstrom assemblage is characterized by *Cytheromorpha unifossula,* and it contains species common to both the *Limburgina verricula* and the *Escharacytheridea pinochii* Zones. *Cytherelloidea crafti* and *Xestoleberis ovata* characterize the uppermost Bergstrom assemblage, which falls within the *Escharacytheridea pinochii* Zone, although the nominal species is absent.

Depositionally, the upper Taylor is a single genetic unit. The gradational nature of faunal changes and a lack of nonrandom events in the diversity and equitability trends suggest that the first and last appearances of species should approximate evolutionary events, giving maximum chronostratigraphic significance to this biozonation scheme and offering hope for eventual refinement. The composition of these assemblages indicates deposition in a low-energy environment deeper than 75 m (246 ft).

The name "Neylandville," defined by paleontologic rather than by lithologic criteria, should not be used in central Texas and possibly elsewhere. Instead, the name "Bergstrom" should encompass the entire genetic package of claystones between the Pecan Gap Formation and the Navarro Group.

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Surface Formations of Trinity Group in Southwestern Arkansas, and Proposed Revision of Stratigraphic Rank for Three Lower Units

The surface units that comprise the Trinity Group of southwestern Arkansas have been given various levels of lithostratigraphic classification since H. D. Miser and A. H. Purdue conducted their surveys of the DeQueen and Caddo Gap quadrangles 66 years ago. Currently, the *Lexicon of Geologic Names of the United States* lists six formations in the area. From the base of the Trinity Group to the top, they are: (1) Pike Gravel, (2) Delight Sand, (3) Dierks Limestone, (4) Holly Creek Formation, (5) DeQueen Formation, and (6) Antlers Sand.

Our study of the Trinity Group in southwestern Arkansas supports the view that the three lower units should be regarded as members of one formation. This proposal was made initially in a 1956 doctoral dissertation by P. H. Nichols, who recommended that the name "Provo Formation" be adopted. The name "Provo," however, has been assigned to another formation of late Tertiary age in Utah. We suggest that the name "Cossatot Formation" be used for the strata described by Nichols. The name is taken from the Cossatot River, which flows west of the type locality in Sevier County, Arkansas.