panies, pumping test data, water-well data furnished by the Texas Department of Water Resources, and geological and soils maps. This information was incorporated into the U.S. Geological Survey three-dimensional finite-difference computer model to predict ground-water behavior in a heterogeneous and anisotropic aquifer. Results indicate leakage through confining beds and communication across growth faults, suggesting that the Oakville is a complex aquifer system rather than a simple confined aquifer.

Understanding the development of intricate flow paths and controlled movement of fluids through designed and controlled systems may improve methods of shallow waterflooding of petroleum reservoirs as well as management of water resources.

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Ocular Sinuses in Genera of Ostracod Family Trachyleberididae

The ocular sinuses of seven genera of ostracods (Trachyleberididae) were studied through the use of internal molds and thin and polished sections. The three-dimensional aspects of the ocular sinus in the genera *Actinocythereis, Henryhowella, Malzella, Orionina, Puriana,* and *Radimella* have not been studied before. *Echinocythereis,* previously studied, was included for comparison.

Morphology of the sinuses varies from the low moundlike form in some specimens of *Henryhowella,* to the long structure in *Actinocythereis.* With the exception of *Henryhowella*, all other genera have ocular sinuses with many features in common. These properties include a stalk-like appearance marked by a distinct constriction someplace along the length of the stalk. Most of the sinus is circular in cross section except the distal portion, which is expanded and irregular in shape, presumably to accommodate the portion of the eye with the lens cell, retinal cells, and rhabdomes. The surface of the distal portion is dominated by a concavity that is the complement of the convexity of the adjoining eyespot. Adjacent to the convexity is an anterior lobe or rim and usually a higher posterior rim. Channels with diameters of 2 to 6 μm probably are passageways for axons. Ontogenetic development includes an early, low, cone-shaped sinus with a central concavity. Later juveniles in most taxa have a stalk, as do adults.

Despite overall similarities of the ocular sinuses, detailed examination indicates that genera and species can each be distinguished using this feature. Variations in size, shape, proportions, and secondary topography are diagnostic; thus, another character is available for taxonomic purposes.

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Deeply Buried Tertiary Sand Bodies in Northern Gulf of Mexico: Examples from Lower Hackberry (Oligocene) and Houma Embayments (Miocene)

Ninety-three electric logs were used to analyze deep-seated sand bodies in two fields in the Hackberry embayment of southeastern Texas and the Houma embayment of southern Louisiana. The geometry and occurrence of these sand bodies can be related to the regional structural and sea level history of the study areas. The Hackberry embayment originated by shelf-edge retreat after a major drop in sea level. Large amounts of sediment were then supplied by the Frio delta systems that built out to the shelf margin. The Houma embayment originated during a slight increase in the rate of sea level rise, while the Miocene deltaic systems built out over the continental shelf, triggering mass movement on the continental slope.

Both areas are characterized by large-scale synsedimentary faulting and salt tectonics. Large arcuate growth faults form the updip boundary of each embayment. Displacement across faults is from 900 to 2,000 ft (300 to 650 m). In both embayments, the sand bodies are overlain by thick shale masses that contain similar "flysch-type" faunas. The sands have a blocky appearance on the SP curves of electric logs, are slightly more than 100 ft (35 m) thick, and can be correlated for only a few miles. The structures show typical rollover, or reverse drag, into the main growth faults. In the Hackberry embayment, it can be shown that some intervals on the expanded downthrown side of the fault contain additional section, whereas marker beds below and above continue across the fault. These expansions developed during a time interval represented by 400 ft (130 m) of section and are interpreted as erosional and depositional events across the growth fault.

Comparison with present-day large-scale rotational slumps on the continental slope off the Mississippi delta shows that the overall characteristics of the Tertiary sands are similar to such modern slump masses; therefore, these sands are interpreted as having originated in a similar fashion. Thus, it appears that these analogous sand bodies accumulated as a result of comparable processes, even though the associated changes in sea level in the two areas differed considerably.

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Transgressive-Regressive Cycles and Environments of Coal Deposition in Upper Cretaceous Strata of Trans-Pecos Texas

Paralic deposits of Late Cretaceous age are represented in Trans-Pecos Texas by the Aguja Formation in the Big Bend region and the correlative San Carlos Formation in the Sierra Vieja region. Although both units are broadly progradational, each records a single widespread transgressive pulse. This transgressive event began in the early Campanian and reached a peak during the middle Campanian. Regressive (progradational) deposits consist of prodeltaic shale and delta-front siltstone and claystone, overlain by coalesced lenticular fluvial-dominated deltaic sand bodies. Transgressive deposits consist of local storm-dominated shoal sandstone, thin laterally extensive oyster-rich sublittoral sand sheets, and shelf mud. Transgression occurred relatively rapidly and was expressed differently depending on the distance traversed landward of the previous shoreline. Coal and lignite deposition occurred in restricted interdistributary areas during progradation, and in more widespread areas during peak transgression when the strandline was neither advancing nor retreating. No evidence is found for barrier island development during transgressive events; hence, the coal and lignite accumulated along a muddy nonbarred coast in marshes directly adjacent to the sea. The coal-bearing strata consist of an alternating series of dark-gray root-mottled carbonaceous claystone with sideritic "ironstone" concretions, coal or lignite, and well-laminated light-gray pyritic shale with calcareous concretions bearing marine invertebrates. The cyclic alternation of these facies suggests the repeated inundation of coastal marshes by marine waters, followed by mud accumulation, subsequent regrowth of the marsh, and the deposition of lignite or coal.

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Interdomal Sediment Ponding: A New Lower Hackberry Play?

Lower Hackberry (mid-Frio) reservoirs are highly unpredictable in the subsurface due primarily to variations in sand thickness and sand distribution. Most exploration for lower Hackberry reservoirs has been limited to turbidite sand-filled channels cut between sea-floor paleotopographic highs, and lower Hackberry sands on the northern flanks of salt domes, where excellent stratigraphic traps exhibit north dip—in places with significant closure. Two other existing types of reservoirs have received little attention, both in the literature and in exploration. The suprafan lobe in the midfan position lying at the base of the slope is a prime exploration target, where massive lower Hackberry sands should be found. Several wells in northwestern Cameron Parish, Louisiana, penetrated thick lower Hackberry sands in a downdip position from the channel plays, suggesting that a mechanism for large-scale downslope movement was present during Hackberry deposition.

Another potential reservoir that deserves more exploration is the interdomal sediment "ponding" of lower Hackberry sands into topographic lows created by the scouring of the sub-lower Hackberry surface. These sands generally are concentrated in the center of the pond and may not be present in either the traditional lateral or updip pinch-out positions. Many of the ponds occur independently from ideal structural location, commonly with a pinch-out of the sands serving as the trap. Ideal prospect locations are where the sub-lower Hackberry unconformity and top of the lower Hackberry marker diverge, indicating the presence of a sand-filled scour feature. Southwestern Calcasieu Parish provides excellent examples of this ponding feature in the subsurface. Successful exploration efforts depend on careful attention to paleontological information,