fossil counts applied to subsurface deltaic interpretation. The major hydrocarbon reserves at the Hollywood and Houma fields are attributed to thick prodelta shale (low nannofossil counts) prior to sand deposition. This thick shale triggered faults and diapiric structures that were timed perfectly for receiving the early-migrating hydrocarbons.

The Hollywood and Krumbhaar deltas prograded over the thick shale depositing distributary-mouth bar sands. Accumulation in the Krumbhaar sand at the Hollywood and Houma fields was controlled by the lenticular nature of the distributary-mouth bar sand. Distributary-mouth bar sand "E" contains most of the reserves discovered to date in the Krumbhaar sand. Perfectly timed structure, faulting, and lenticular deltaic sand are responsible for this geographic concentration of hydrocarbons in a sand covering an area of 50 by 100 m (80 by 160 km).

The Krumbhaar sand was deposited by two distinct and separate deltas. The deltaic environmental setting for hydrocarbon accumulation in the Houma embayment area compares favorably with a similar Oligocene Vicksburg-Frio delta in Jefferson County, Texas. Deltaic information obtained from this study may serve as a subsurface model for discovering large reserves hidden by subtle deltaic traps.

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Late Cretaceous Volcanism in South and Central Texas—Stratigraphic, Structural, and Seismic Models

Since their discovery in 1915, hydrocarbon traps in and around "serpentine plugs" have produced about 47 million bbl of oil, and have significant potential for additional small discoveries. Production is from isolated reservoirs within mounds of altered volcanic tuff and associated shoal-water carbonates. A review of the more than 200 volcanic centers and intrusive bodies of south and central Texas has led to development of stratigraphic, structural, and seismic models useful in exploration and production.

The so-called serpentine plugs are largely tuff mounds formed by accumulation of volcanic ash (altered to palagonite) on the sea floor around a submarine volcanic vent. Volcanic activity peaked during deposition of the upper Austin Chalk and lower Taylor Marl (about 80 m.y. ago). After their eruption, the tuff mounds localized the deposition of shoal-water carbonates with good porosity and permeability. Low-permeability, organic-rich marine shale and marl of the Taylor Group capped the carbonates, serving as both a hydrocarbon source and a stratigraphic seal. Compactional draping of overlying San Miguel and Olmos sands, with minor offset faulting, created important additional traps in south Texas.

Central Texas volcanic centers are highly aligned along strike-oriented regional faults and fractures of the Balcones and Luling systems. The magmas in both central and south Texas were ultramafic and alkaline, suggesting that partial melting occurred at depths of about 37 mi (60 km). The magma rose rapidly to the surface, probably in an extensional stress regime controlled by pre-Tertiary Balcones-Luling faults.

The palagonite tuff of a typical, productive volcanic center has low seismic velocity and is encased in high-velocity carbonates. The strong velocity contrast, coupled with the distinctive shape of the tuff mass, yields a characteristic seismic pattern. Modern acoustical techniques, coupled with stratigraphic data, allow accurate delineation of buried tuff mounds and prediction of productive carbonate facies.

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Upper Jurassic–Lower Cretaceous Fan-Delta Complex—La Casita Formation of Saltillo Area, Coahuila, Mexico

The La Casita Formation represents a major influx of terrigenous sediment on the epicontinental shelf of northeastern Mexico during the Late Jurassic and earliest Cretaceous. Near Saltillo, the La Casita can be divided into three major units: (1) a basal unit of carbonaceous siltstone and mudstone, (2) a middle unit which is predominantly sandstone and pebble conglomerate, and (3) an upper unit of siltstone and fine-grained sandstone with thin limestone and dolomite layers becoming more abundant upward, and grading into the overlying Taraises Formation. The La Casita-Taraises terrigenous sequence is underlain and overlain by shallow-marine limestones.

In the Saltillo area, the La Casita crops out in narrow canyons in breached anticlines of the Sierra Madre Oriental. Consequently, interpretations concerning the depositional framework of the La Casita must be made from vertical sequences exposed in widely spaced canyons. A first-order, single-dependence Markov analysis aids in identifying preferred vertical transitions in lithologically variable parts of the section.

Important aspects of the La Casita in the Saltillo area include: (1) the large-scale depositional sequence of basal shallow-marine mudstones overlain by shallow-marine and alluvial sandstone, conglomerate, and mudstone, which are in turn, overlain by shallow-marine, fine-grained sandstone, mudstone, and carbonate rocks; (2) conglomeratic shallow-marine sediment; (3) textural and mineralogical immaturity; (4) the nonrandom nature of upward lithofacies transitions; and (5) a predominance of coarsening-upward sequences in the middle unit. These characteristics suggest that the La Casita in the Saltillo area records the progradation of a complex of fan deltas.

The lower, fine-grained unit represents Late Jurassic "prodelta" deposits that accumulated on the submarine shelf prior to the influx of coarse sediment. The middle, coarse-grained unit was deposited during the period of maximum seaward advance of the fan-delta complex during latest Jurassic time. This unit contains predominantly coastal and shallow-shelf conglomerate, sandstone, and mudstone, with some distal alluvial-fan conglomerate and sandstone. The upper La Casita records the waning input of coarse sediment as the fan-delta system retreated in earliest Cretaceous time.

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Paleocene-Eocene Boundary in Eastern Gulf Coast

The Paleocene-Eocene boundary in Alabama has been placed at various levels within the Tuscahoma Formation and the overlying Bashi Formation. The location of this boundary is important because both lignite- and petroleum-bearing deposits occur within this sequence in the Gulf Coast, and the region appears to be a good locality to test the local coastal-onlap models.

The middle beds of the Tuscahoma Formation are upper Paleocene (calcareous nannofossil Zone NP9 and *Morozovella*