nificantly than the compressional transit time—a fact which is consistent with the observations. We thus conclude that shear-to-compressional transit time ratio measurements provide a method for estimating variations in the sand-shale ratio of a formation.

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Depositional Environment of Eocene Queen City Formation in East Texas

Lithostratigraphic correlation of the Eocene Queen City Formation in Anderson, Cherokee, and Upshur Counties reveals three distinct facies indicative of a clastic shoreline environment: (1) flood-tidal delta, (2) lower shoreface and shelf, and (3) coastal barrier-island complex. These facies were identified on the basis of diagnostic physical structures.

The Eocene flood-tidal delta in Cherokee County is dominated by landward-dipping (northwest) foreset beds. This delta probably formed at the mouth of a microtidal estuary and was affected by storm processes and tidal currents. Lower Queen City shoreface and shelf structures are found in northern Cherokee County revealing the enigmatic feature of hummocky cross-stratification. These undulating sets of low-angle cross-beds are commonly affected by storm-wave processes and indicate a fairly shallow fairweather wave base during their Eocene deposition. Exposures of the Eocene coastal barrier-island complex in Upshur County reveal a regressive sequence with a back-barrier coastal marsh at the base. Successively overlying the coastal marsh are lagoon, coastal mud flat, tidal channel, and bayhead-delta facies. Preservation of the vertical succession of these facies beneath the transgressive Weches formation implies continued subsidence and sedimentation.

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Tectonic History and Influence on Sedimentation of Rhomb Horsts and Grabens Associated with Amarillo Uplift, Texas Panhandle

The Amarillo uplift consists of an en echelon series of fault blocks separating the Anadarko basin from the Palo Duro basin. The uplift is part of a northwest-southeast zone of basement weakness that extends from the Wichita Mountains in Oklahoma to southeastern Colorado.

Initial faulting, related to the opening of the southern Oklahoma aulacogen, took place from late Precambrian through Middle Cambrian time. Renewed movement in the Late Mississippian or Early Pennsylvanian, probably of a left-lateral transcurrent nature, broke the Amarillo uplift into a series of rhomb grabens and rhomb horsts. The Lefors basin, for example, in Gray County is a small rhomb graben 4 mi (6.4 km) by 8 mi (12.8 km) that contains in excess of 4,000 ft (1,200 m) of Pennsylvanian and Wolfcampian arkose ("granite wash"). The Amarillo uplift continued to subtly affect depositional patterns following its burial in Wolfcampian time.

Salt beds in the Clear Fork Formation (Leonardian) are purer and thicker in grabens where salt deposition proceeded at a faster rate relative to horsts. Recurrent motion on the Potter County fault in northern Potter and northeastern Oldham County produced cumulative displacements of 1,600 ft (488 m) on top of the Pennsylvanian, 800 ft (244 m) on Wolfcampian strata, 600 ft (183 m) on top of the Clear Fork Formation, and 450 ft (137 m) on the Dockum Group (Triassic). Post-Permian displacements are the result of both salt dissolution and minor structural movement. There is no direct evidence for Quaternary faulting, although the uplift is seismically active.

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Structural Evolution of the Guadalupe Mountains, South-Central New Mexico and West Texas

The Guadalupe Mountains of south-central New Mexico and west Texas occupy a unique physiographic and structural position. Physiographically, the mountains lie on the boundary between the block-faulted Basin and Range province to the west and the stable Great Plains province to the east. Structurally, the mountains form the northwestern margin of the Delaware basin, a prolific petroleum-producing region.

A combination of field observation, subsurface correlation, and map and photo interpretation has revealed four important phases in the complex structural evolution of the Guadalupe Mountains and adjacent Delaware basin.

Pennsylvanian to Early Permian (Wolfcampian) faulting and folding created the Huapache monocline and initially defined the limits of the Delaware basin.

Permian flexing and differential subsidence accentuated the shelf-to-basin transition and resulted in deposition of the prograding carbonate shelf sediments now exposed in the Guadalupe Mountains.

Late Cretaceous to early Tertiary (Laramide) deformation created the Carlsbad and Guadalupe Ridge folds, a series of anticlines and synclines in the eastern mountains.

Late Tertiary (post-Ogallala) to Pleistocene uplift and tilting brought the mountains to essentially their present configuration. The western border of the uplift is defined by Basin and Range-type normal faulting, whereas the eastern margin is both faulted and monoclinally folded. Minor faulting has been active into Holocene time.

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Fault Analysis in Wichita Mountains

Analysis of a large population, but small displacement, fault array in the Wichita Mountains of southern Oklahoma strongly supports the hypothesis of left-lateral wrench faulting as a major tectonic control for the region. Middle Cambrian granites make up most of the exposed core of the Wichita uplift. Because these granites were implaced prior to the development of the Anadarko basin structures, they should reflect Anadarko tectonics. In addition, the granites would have behaved in a brittle manner so that abundant faulting is practically the only mechanism of deformation within them; this permits uncomplicated structural analysis. Offset and trend measurements were made both in the field and from aerial photographs, and the collective data show statistically significant groupings with respect to trend and sense of shear. The fault fabric is consistent with a left-lateral wrench system that trends N70°-80°W, but also contains strong elements of the entire Riedel system (R, R′, and P shears). In addition to the wrench motions indicated by the analysis of small displacement faults, there is also a large component of vertical displacement in the region. A fault system known as the Wichita front, separates the Wichita uplift from the Anadarko basin and has 9 km (5.5 mi) of differential vertical relief across a zone 10 to 20 km (6 to 12 mi) wide. The relationship between the lateral and vertical motion is essential in understanding the types and distribution of structural traps in the Anadarko basin, and perhaps, even in neighboring basins.

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Progradational Sequences in Springer Formation, Ardmore Basin, Oklahoma

The transitional Mississippian-Pennsylvanian Springer Formation, exposed in the Ardmore basin of southern Oklahoma, consists of coarsening-upward progradational sequences that were deposited in the southern Oklahoma aulacogen. The unit is divided into three sandy members: the Rod Club, Overbrook and Lake Ardmore, which are separated by shale intervals. Each of the sandy members consists of one or more of the coarsening-upward sequences. A typical sequence includes from the base upward, dark gray shale with abundant siderite concretions, rhythmically interbedded siltstones and shales, interbedded burrowed sandstones and shales, and abundantly burrowed sandstones. The latter contain wood impressions, ripple cross-laminations, and occasional festoon cross-stratification. In addition, one of the sequences contains a thin, discontinuous marine limestone. These sequences represent the transition from an offshore/prodelta setting to a distributary mouth bar/lower shoreface setting.

One of the sequences in the Rod Club contains an additional lithofacies at its base which consists of interbedded shales and green-gray sandstones. Sedimentary features of the sandstones include: massive nongraded bedding, large lutite casts, ripple and dish laminations, flute casts, and numerous soft sediment microfaults. The general characteristics of the sandstones suggest deposition by sediment gravity flows. This lithofacies represents deposition in a slope setting, with the sandstones derived from the proximal delta/shoreface.

Offsets on microfaults in the lower Rod Club occur on two different scales. Small scale microfaults have displacements of a few millimeters. Offset on the larger microfaults (up to 5 cm, 2 in.) is expressed on both the upper and lower surfaces of a sandstone bed. There are no fault zones within the beds which suggest the faults are synsedimentary and represent deposition on an unstable slope. The microfaults are consistently oriented approximately 90° to the flute casts, and most are downthrown in the direction of transport. Paleoslope data from the flute casts and microfaults indicate the sandstones were transported southeastward along the axis of the Ardmore-Anadarko basin during deposition of the Springer.

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The Ubiquitous Overbid

The ever-present overbid on tracts in sales in the outer continental shelf and Alaska is an indigenous part of the process of the sealed bid. Although it has a universal definition within the petroleum industry, it has been frequently misused and misunderstood outside the petroleum industry.

Overbidding results from the process by which bids are compiled as well as the absence of knowledge of competitive bids. It results in the maximum amount of cash going to the seller, although on the average it tends to depress the rate of return to the buyer.

The final dollar amount for a given bid represents the results of a series of multiplications. For example, the ingredients in the multiplication can be formation thickness times recovery/acre-foot times area times (revenue minus cost) times risk. The distribution of any series of multiplications from randomly selected variables is always log-normal. Therefore, sealed bids on a given tract produce a log-normal distribution. One of the physical characteristics of a log-normal distribution involving about 10 points is a large percentage difference between the first and second point. This difference is the overbid.

Since the beginning of sealed bid sales in the OCS, the overbid has averaged between 40 and 50% of the winning bid. This consistency demonstrates the inevitability of the overbid.

The overbid provides the seller with the maximum values possible. Overbids could be reduced almost to zero by auction bids. In sales with limited acreage offered, the seller would receive substantially less money than from the sealed bid sale. However, in area-wide sales this may not be the case. The public and congressional cry for fair market value for the consumer might preclude auction sales.

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Neogene Fore-Arc Basin Development in Northern California: Eel River Basin

Strata representing the youngest phase of fore-arc basin development in northern California are exposed in an unusual cross-sectional view across the basin axis. The exposure of a large part of the stratigraphic section of the Neogene Eel River (Humboldt) basin can be attributed to uplift along the northern edge of the Mendocino triple junction. The fore-arc deposits overlie the Mesozoic and Cenozoic accretionary prism and slope deposits of the Franciscan Complex. Outcrop geology of the uplifted southern flank of the basin indicates that the facies and sediment distribution patterns agree with paleobathymetric studies; a complete deep to shallow marine transition is recorded in the basin sediments.

Facies studies demonstrate the time-transgressive nature of the sedimentary environments. Proximal facies are landward (east) of coeval deeper water deposits exposed along the coast. The basal contact is clearly depositional on this southern flank of the basin. Sandstones and pebbly conglomerates cut into coastal belt Franciscan accretionary prism sediments inland. A previously undescribed debris flow is conformable on similar Franciscan sediments along the coast. This debris flow is faulted against overlying faulted and fractured basin plain siltstones and fine sandstones (Miocene-Pliocene) which contain thin lenses of shell debris, pebbles, and glauconitic sand. A monotonous accumulation of organic-rich diatomaceous mudstones is capped by amalgamated channels continuing sequences of thin glauconitic sands with locally derived siltstone rip-ups, siltstone, and hemipelagic mudstones. The overlying sediments consist of fine-grained turbidites, thick bioturbated siltstones and fine sandstones, and coarser turbidites. A continental shelf sequence concludes this phase of Eel River basin development.

To the south of the main basin outcrop, progressive uplift and faulting related to the migration of the triple junction have left erosional remnants of sediments coeval with Eel River basin rocks. These rocks are found up to 50 km (31 mi) south of the upturned basin edge, suggesting that the basin was at one time more extensive to the south. Shallower depositional environments in some of these basin remnants may indicate the proximity of the original southern edge of the basin. Structural complexities to the south include strike-slip faulting and possible upper Miocene and younger trusting of Franciscan melange over Neogene marine sediments.