360 ft (110 m) thick, trending N30°E and curving to the north at its updip end. The erosional surface becomes more areally and vertically extensive in Halletsville field, 2 mi (3.7 km) south, and correlates with the Lavaca channel erosional surface in Valentine field 9 mi (17 km) to the southwest.

Kinkler field was drilled originally as a seismically defined anticlinal structure, and the discovery well was completed from a sand deposited within the shale-filled channel. Two additional producers and 5 dry or marginal wells from this zone delineate the sand. It is 2.5 mi (4.6 km) long, about 1,500 ft (457 m) wide, and reaches a net sand thickness of 39 ft (12 m). We call this a bay margin sand.

Another productive sand occurs directly below the erosional surface. This upward-fining sand is part of a lower Wilcox A delta and distributary- channel complex, which can be correlated across several square miles. Because individual reservoirs are discontinuous we think this is a point bar with clay drapes separating depositional lobes.

A compaction closure exists over the east margin of the channel. The structure is caused by counter-regional dip into the shale-filled channel on the west, in combination with regional dip to the southeast. Although the amount of closure, 25 ft (7.6 m), is small, the structure may have influenced overlying meander points and channel migration. Two overbank sands produce oil 700 ft (213 m) above the channel, and the compaction feature may have influenced the deposition of a gas-productive upper Wilcox sheet sand 3,000 ft (914 m) above.

The inferred geologic history suggests the lower Wilcox A section is an upward-coarsening progradational deltaic sequence ending in a delta- plain environment. Sea level lowering of several hundred feet caused the river to incise deeply into the flat-lying surface at about the end of lower Wilcox A deposition, resulting in an entrenched valley. Subsequent rapid marine transgression created a drowned valley that received fine clastics both from its marine and fluvial-deltaic ends. Sand spits developed along the valley margin as filling took place.

A present-day analog of the Kinkler field model is Lavaca Bay, a Pleistocene entrenched valley, with a documented record of erosion and sedimentation.

CLARK, H. C., Rice Univ., Houston, TX

Ouachita Orogenic Complex, Central Texas—Geophysical Measurements and Basement Offset

The outline of the buried Ouachita orogenic belt in Texas follows an ancient continental edge that has been involved in lithosphere plate interaction since late Precambrian time. Gravity and magnetic measurements along the central Texas part of the trend, combined with limited seismic and well information, indicate that the complex has been offset along a persistent zone of weakness during its history. The offset relationship of the gravity and magnetic anomaly patterns and their relationship, in turn, to the geology of this zone of weakness indicate a series of basement displacements through time. A broad negative gravity anomaly is related to the overthrust package developed during the collision phase. Broad magnetic anomalies are related to slivers of basement caught up in the collision. A belt of positive gravity anomalies is related to a concentration of dense rocks created during the collision phase, or to a mantle welt created during the pull-apart phase. Short-wavelength dipole magnetic anomalies are related to shallow volcanics extruded during this pull-apart phase. The detail in these patterns may provide a framework for interpretation of basement uplift and fracture patterns involved in the offset zone.

COLE, MARY LOU, and JOHN B. ANDERSON, Rice Univ., Houston, TX

Detailed Grain Size and Heavy Mineralogy of Sands of Northeastern Texas Gulf Coast—Implications with Regard to Coastal Barrier Development

The large volume of literature available on Gulf Coast sedimentology, along with recent advances in computerized analytical methods, now enables more detailed work to be accomplished. Numerous grain-size (automated settling tube) and heavy mineralogical analyses have been conducted on sand samples from the northeastern Texas Gulf Coast. Analyses of local point-bar samples result in the delineation of major river sand sources in the region. Kyanite/garnet/hornblende + pyroxene ratios seem to be the most useful criteria for distinguishing these sources. Grain-size data show combinations of discrete modes characteristic of each river system, whereas the subaerial delta lobes of these rivers consist of finer, better sorted sands, which are believed to represent the coarsest particles transported in suspension. Beach sands are slightly finer and much better sorted than wave-dominated delta sands.

The oldest sands of Galveston Island were derived from the Trinity River, implying a possible deltaic origin for the island. However. most of the island is comprised of Mississippi River, Brazos River, and Trinity-Sabine River sands, mixed in approximately equal proportions, suggesting an offshore Pleistocene source for these features. These sands were deposited on an irregular Pleistocene erosional surface, resulting in dramatic thickness variations. Modern offshore sands and those currently being accreted to barriers, contain a high proportion of Mississippi River sand. This change results from the depletion of offshore mixed sands and marks the onset of barrier retreat.

COLEMAN, J. M., and D. B. PRIOR, Coastal Studies Inst., Louisiana State Univ., Baton Rouge, LA, and JOHN F. LINDSAY, Exxon Production Research, Houston, TX

Formation of Mississippi Canyon

The most prominent submarine physiographic trough in the northern Gulf of Mexico is the Mississippi Canyon. This submarine trough has an average width of 5 mi (8 km), length of 75 mi (120 km), and bathymetric relief of 985 ft (300 m). Its origin has generally been attributed to channel entrenchment of the Mississippi River during lowstands of sea level and erosion of the more distal parts by turbidity currents or submarine gravity flows. In the last 2 years, a dense, high-resolution seismic and side-scan sonar grid 1,000 ft (305 m), together with deep borings utilized to obtain samples for carbon-14 dating, has been used to establish a time-stratigraphic framework and origin for this feature. Nine horizons, chosen from borings and dated by carbon-14 and paleontologic methods, have been traced laterally on the seismic lines. These horizons range in age from Illinoian (~400,000 years B.P.) to late Holocene (3,500 years B.P.). During the interval from Illinoian to late Pleistocene (25,000 to 27,000 years B.P.), the Mississippi River deposited a series of fluvial and deltaic deposits of approximately 3,300 ft (1,000 m). There is no evidence that a submarine canyon existed in the vicinity of the present feature during this time interval. Approximately 25,000 years ago, a carbon-14-dated horizon was truncated by the initial formation of the submarine canyon. Samples dated by carbon-14, obtained near the base of the canyon fill, show that by 20,000 years B.P., canyon fill had commenced. Thus, this major submarine trough had, at most, 7,000 years in which to remove 1,500 to 2,000 km^3 of material. It is highly probable, therefore, that the canyon originated from massive shelf-edge slope failure on an unstable continental margin. A series of successive failures, each one creating an upslope instability that triggered the next failure, caused an elongate trough to form that excavated the canyon to a depth of 4,000 ft (1,220 m) below present sea level. Once the canyon had formed, its steep side walls continued to be unstable, and sediments slumped into the canyon axis, forming the initial canyon fill. This phase is well documented: the lowermost sediment fill is composed of displaced material similar to that now found on the canyon rim.

Large scars from sidewall failures can also be easily mapped on the seismic data. From 20,000 years to approximately 5,000 years B.P., a series of late Wisconsin and Holocene delta lobes formed, which were responsible for the remainder of the fill of the canyon. During the past 5,000 years only a thin deep-water pelagic drape has been deposited within the canyon. Maps have been constructed that depict the various horizons, and the geometry of these horizons verify this mode of formation.

COLEMAN, NEIL M. , Somerset, PA, and MARK T. STEWART, Univ. South Florida, Tampa, FL

Basement Structure in Northwest Peninsular Florida

Results of a recently completed gravity investigation suggest that basement offsets produced by normal faulting are the sources of observed gravity and magnetic anomalies in northwest peninsular Florida (Lafayette, Dixie, Gilchrist, and Levy Counties). A series of parallel fault-block basins and uplifts is proposed as the dominant basement structure. These basins and uplifts and the Southwest Georgia Embayment developed in response to the same regional stress field in early Mesozoic time.

Two-hundred sixteen gravity stations have been established and correlated with the International Gravity Standardization Net. Bouguer anomaly values have been derived for each station and regional gravity components analyzed, using trend-surface analyses. Geologic cross sections have been made on the basis of available stratigraphic information. The gravity effect for each section was calculated, using the method of polygons. Basement structural interpretations were iteratively adjusted within geologic constraints until close agreement was achieved between calculated and observed gravity profiles.

CONTI, ROB, Bur. Econ. Geology, Univ. Texas at Austin, Austin, TX

Stratigraphic Distribution of Hydrocarbons with Differing API Gravities in East Texas Basin

In studying the stratigraphic and geographic distributions of oils initially produced from seven East Texas Cretaceous formations, the effects of depth, temperature, and rate of burial on increasing hydrocarbon maturation, expressed as increasing API gravity, can be determined statistically. Analysis of both linear-regression and data-density trends indicates that API gravity increases as the oil matures during burial. Linear-regression analyses yield positive API-gravity gradients and low correlation coefficients for the data populations. Data-density trends show well-delineated and differing API-gravity gradients with ordinal and abscissal limits.

From younger to older formations, there are two main trends of increasing API gravity. The oil from sub-Clarksville reservoirs, showing the best-delineated high API-gravity gradient, represents one main trend. The oils from Woodbine and Paluxy reservoirs show both main trends; API gravity increases rapidly, then slowly, as burial continues. The oils from Glen Rose, Rodessa, Pettet, and Travis Peak reservoirs show the second main trend, that is, a low API-gravity gradient. A composite plot for the seven formations, showing one curvilinear trend, with both high and low API-gravity gradients, implies different radiocarbon maturation rates tor the East Texas oils. Almost all maturation trends are within a temperature range of 110 to 250°F (43 to 121°C), which falls below the theoretical temperature window of 250 to 350°F (121 to 177°C) for maximum hydrocarbon generation.

For each formation, the geographic distributions of API gravity, depth of burial, and formation temperature establish a stratigraphic, geographic, and tectonic framework for studying the statistical distributions. Generally, high API gravity oils have been produced from the deep southern and shallow eastern parts of the basin. Lower API gravity oils are produced from the northern and western shallow parts of the basin.

DOKKA, ROY K., Louisiana State Univ., Baton Rouge, LA

Implications of Fission-Track Ages from Kaplan Geothermal-Geopressure Zone, Vermilion Parish, Louisiana

Apatite and zircon mineral separates were extracted from cores from near the bottom of two geopressured-geothermal wells in Vermilion Parish, southern Louisiana, and dated by the fission-track method. Samples were taken in the sandstone units of the Oligocene age Frio Formation. The purpose of the study was to determine if fission-track clocks had been affected by long-term heating within the zone. Downhole temperature measurements indicate that the samples are currently at ~277°F (136°C) and ~338°F (169°C). Fission-track clocks, such as apatite and zircon, lose their tracks when subjected to temperatures of ~212°F (100°C) and ~ 347°F (175°C), respectively, for geologically significant periods of time (1 m.y.).

Results show that apatite clocks were reset to 0 m.y. whereas zircon yielded ages of 82 and 88 m.y. (Cretaceous). If bottom-hole temperatures are reliable, then the data suggest the following. (1) Zircon ages are relict, reflecting times of cooling of the volcanic, plutonic, or metamorphic source. The Frio Formation in southern Louisiana was at least in part derived from a Cretaceous or older source. Such cooling ages are common in the Ouachitas, southern Appalachians, and the Gulf coast plain. (2) Reset apatite and relict zircon ages suggest that temperatures within the geopressured zone have probably not been any higher than the 347°F (175°C) they are today.

EVERETT, ROBERT W., JR., Texaco Inc., New Orleans, LA

Using Nannofossil Counts in Interpretation of Subsurface Deltas

The Balize delta in Plaquemines Parish, Louisiana, and the six preceding Holocene deltas offer models for subsurface interpretation. Nannoplankton counts were made from 65 bottom samples from the shelf area of the Gulf of Mexico off Louisiana. This work indicated a correlation between surface salinity and nannoplankton counts. In the subsurface, an ecology of outer middle neritic (water depth approximately 120 ft; 37 m) or deeper, accompanied by low (less than 5,000 per slide) nannofossil counts, indicates a deltaic environment. The Miocene *Cristellaria* "I" Hollywood and Krumbhaar sands, which were deposited by prograding deltas, are examples of nanno-