depths near or above the temperature level required for thermal generation of hydrocarbons. This observation suggests faults of these types are minor factors in draining hydrocarbons from deep shales within basins where thick overpressured sedimentary sections are present at shallow depths and where shale tectonism is the primary mechanism for structural development.

Microfracturing resulting from increased fluid pressure is indicated to be a primary mechanism for flushing fluids from deep basins where thick abnormally pressured sedimentary sections are present. This flushing process would be enhanced by clay diagenesis since water supplied from smectite would cause the processes to continue for longer periods of time and to extend to greater depths than could be attained if only remnants of the original pore water were present in the section. Large volumes of diagenetic water present within the microfracturing interval could also act as a vehicle for primary hydrocarbon migration, provided hydrocarbons are present in sufficient quantities to be transported.

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Late Eocene to Early Oligocene Calcareous Nannofossils in Alabama and Mississippi

The Eocene-Oligocene boundary in the central Gulf coastal plain has been placed traditionally at the contact of the Shubuta Member of the Yazoo Formation and the Red Bluff Formation, or the contact of the Shubuta and the facies equivalents with the Bumpnose formation. Calcareous nannofossils were examined from six upper Eocene to lower Oligocene localities in Alabama and Mississippi. The Shubuta, Red Bluff, and equivalents have a very similar calcareous nannofossil flora, and both are in Martini's Zone NP21. However, from the base of the Shubuta up through the Red Bluff, 10 calcareous nannofossil extinction horizons can be used to subdivide the lower part of Zone NP21. *Discoaster saipanensis* Bramlette and Riedel, *D. barbadiensis* Tan Sin Hok, and *Reticulofenestra reticulata* (Gartner and Smith), which become extinct at or near the top of Zone NP20, are only rarely present in the 27 Shubuta samples examined, are poorly preserved, and are assumed to have been reworked. Below the Shubuta lies the Pachuta Marl Member of the Yazoo, which was examined at one locality in Mississippi and two in Alabama, and although the flora is poorly preserved, contains significant numbers of all three Eocene species.

If the Eocene-Oligocene boundary is assumed to correspond to the Shubuta–Red Bluff contact, this boundary, at least in the Gulf coastal plain, cannot be recognized using traditional calcareous nannofossil markers, because of its inclusion within Zone NP21. This contact, however, appears to coincide with the last occurrence of the planktonic foraminifer *Globorotalia cerroazulensis* s.l.; the extinction of *Hantkenina* spp. may occur slightly below the contact. The extinction of *Discoaster saipanensis* below that of the planktonic foraminifers has also been observed on several legs of the Deep Sea Drilling Project, where this offset is no more than a few meters. At the Red Bluff type locality, the separation approximates 65 ft (20 m). Clearly, in the study area, the extinctions of *G. cerroazulensis* and *D. saipanensis* do not define the same horizon.

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Hydrothermal Mineralization Within Balcones and Luling Fault Zones of Texas

Occurrences of precious and base metals, in anomalous concentrations, have been reported for more than 100 years from sites within the Balcones and Luling fault zones. Recent field investigations supported by geochemical studies have corroborated some of these reports while casting others in doubt. Whole-rock and groundwater analyses confirm claims of cobalt, zinc, and lead mineralization, but reputed gold, silver, and mercury concentrations have not been substantiated. Although some metals are present at high levels in selected samples, the mineralized fraction of the host rock is minute, and there is no evidence to encourage hopes for a viable resource.

The source of these metals is problematic. Throughout the region, Lower Cretaceous limestones serve as the hosts and mineralization is clearly secondary. Late Cretaceous igneous activity was extensive in this area, including the vicinity of most sites of mineralization. However, none of the sites are directly associated with volcanic or intrusive bodies, and the bulk composition of these igneous rocks suggests that they would have been unsuitable as a source for these metals. Current evidence favors mineralization from hydrothermal fluids expelled, by compaction, from sedimentary basins nearby. Metallogenesis has occurred along faults and joints which may have served as conduits for the mineralizing fluids. In addition, formation waters are actively mineralizing porous Cretaceous limestones at depth in major fault zones of south Texas; these limestones contain traces of secondary galena, sphalerite, fluorite, and strontianite, and the waters are high in the corresponding solutes. This modern analog is the most suitable model for the known occurrences of mineralization.

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Polycystine Radiolarian Distribution and Enhancements Related to Oceanographic Conditions in a Hypothetical Ocean

Radiolarian data from Holocene sediments of the world oceans were fitted to a hypothetical ocean exhibiting characteristics of all oceans. Warm-water sphere radiolarians exhibit major poleward boundaries to their distributions at subtropical and polar convergences. They exhibit poleward extensions in the westward boundary currents. Collosphaerids are enhanced in sediments under the anticyclonic gyres and eastern tropical regions. The *Dictyocoryne profunda-truncatum* group appears to be indicative of warm-water sphere mesotrophic conditions. Cold-water sphere radiolarians dominate sediments poleward of the polar convergences and occur in significant percentages under the eastern boundary currents and equatorial divergences. Intermediate and deep-water radiolarians appear to be enhanced under the polar cyclonic gyres, eastern boundary currents, and the oceanic divergences and convergences. These radiolarian indices of present oceanographic conditions (currents, divergences, convergences, and oligotrophic to eutrophic conditions) should aid in deciphering similar paleooceanographic conditions.

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Productive Lower Wilcox Stratigraphic Traps from Entrenched Valley in Kinkler Field, Lavaca County, Texas

Subsurface data around Kinkler field define a shale-filled valley (lower Wilcox A delta), which causes multiple stratigraphic traps in the incised strata, the fill, and the overlying beds.

The channel is 1.5 mi (2.8 km) wide, 4 mi (7.4 km) long, and