velascoensis Interval zone). The entire overlying Bashi Formation is lower Eocene (Zone NP10 and lower part of the *Morozovella subbotinae* Interval zone). No calcareous fossils are known from the upper part of the Tuscahoma. Therefore, the boundary problem was investigated, using abundant sporomorphs in cores of the Tuscahoma and the Bashi at Ozark, Alabama, and other cores and outcrops in Alabama and western Georgia.

The sporomorph assemblages of the Tuscahoma and the Bashi differ considerably, but the assemblages within each formation are generally quite uniform from base to top. According to sporomorph data, a small hiatus appears to exist between the Tuscahoma and the Bashi.

In the Oak Grove core hole in Virginia, the shallow-marine Aquia Formation contains Tuscahoma-like sporomorphs in beds within Zone NP9. The overlying lagoonal Marlboro Clay is either entirely upper Paleocene or may span the Paleocene-Eocene boundary. Above the Marlboro is the marine-transgressive Nanjemoy Formation (Zone NP10), containing Bashi-like sporomorphs. Thus, sporomorphs from the top of the Tuscahoma in Alabama are most probably of late Paleocene age, as are the similar sporomorphs from the upper Paleocene middle part of the Tuscahoma and upper Paleocene Aquia Formations.

The uppermost beds of the Tuscahoma in eastern Alabama and western Georgia are marginal-marine to nonmarine deposits. The overlying Bashi Formation is of inner neritic origin. Therefore, in the Atlantic and Gulf coastal plains, a regression marked the end of the Paleocene, and a fairly rapid, sea-level rise occurred at or just after the beginning of the Eocene; this agrees with published global sea-level curves.

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Clay Mineralogy and Depositional History of Frio Formation in Two Geopressured Wells, Brazoria County, Texas

Twenty-three shale samples, ranging in depth from 5,194 to 13,246 ft (1,583 to 4,037 m), from Gulf Oil Corp. 2 Texas State Lease 53034 well, and 33 shale samples, ranging in depth from 2,185 to 15,592 ft (666 to 4,752 m), from General Crude Oil Co./Department of Energy 1 Pleasant Bayou well were examined by X-ray techniques to determine the mineralogy of the geopressured zone in the Brazoria fairway. Both wells have similar weight-percent trends with depth for a portion of the mineralogy. Calcite decreases, whereas plagioclase, quartz, and total clay increase slightly. Within the clays, illite in mixed-layer illite-smectite increases and smectite in mixed-layer illite-smectite decreases.

Four minerals have distinctly different trends with depth for each well. In the 2 Texas State Lease 53034 well, potassium feldspar and mixed-layer illite-smectite decrease, kaolinite increases, and discrete illite is constant. In the 1 Pleasant Bayou well, potassium feldspar and kaolinite are constant, mixed-layer illite-smectite increases, and discrete illite decreases.

The most important diagenetic change in each well is the transformation of smectite to illite within the mixed-layer phase which occurs according to the reaction suggested by J. R. Boles and S. G. Franks with Al^{3+} acting as an immobile component. This change begins at calculated equilibrium temperatures of 89 to 92°C. The decrease in calcite and the lack of chlorite in the shales suggest that carbonate, iron, and magnesium migrate out of the shale in each well.

In the 2 Texas State Lease 53034 well, the Boles and Franks reaction is consistent with a steady supply of original mixed-layer illite-smectite during deposition. Potassium feldspar provides K^+ for the smectite to illite transformation. The breakdown of potassium feldspar also results in the formation of kaolinite and the increase of plagioclase feldspar, which is due to the reaction with Na^+ and Ca^{2+}, provided by the smectite to illite change.

In the 1 Pleasant Bayou well, the Boles and Franks reaction is consistent with an unusually high mixed-layer illite-smectite content in the early depositional stages. The source of K^+ for the smectite to illite reaction is discrete illite. The breakdown of discrete illite results in both the formation of kaolinite and the increase in plagioclase feldspar.

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Paleocene to Middle Eocene Stratigraphy of Alabama

Each of the eight Paleocene to middle Eocene formations that crop out across Alabama contains similar lithofacies. Each of the formations is characterized by east to west thickening, representing one or more transgressive cycles. An integrated biostratigraphic framework of calcareous nannofossils and planktonic foraminifers demonstrates that individual formations are generally the same age throughout Alabama, although the base of some cycles may be older in southwestern Alabama. The lower Eocene strata were deposited in a more open-marine environment in eastern Alabama than the rapidly prograding sequence in western Alabama.

The early Paleocene Clayton Formation contains calcareous nannofossils characteristic of Martini's Zones NP1, NP2, and NP3, and planktonic foraminifers typical of Stainforth's *Subbotina pseudobulloides* and *S. trinidadensis* Interval zones. The lower and middle parts of the Porters Creek Formation are of late early Paleocene age (Zone NP3 and *S. trinidadensis* and *Morozovella uncinata* Interval zones); the upper Matthews Landing Marl Member of the Porters Creek is of early late Paleocene age (Zone NP4 and *M. angulata* Interval zone). The Coal Bluff Marl Member of the Naheola Formation is also of early late Paleocene age (Zone NP5). The lower Gravel Creek Sand Member of the Nanafalia Formation is assigned to Zone NP5 and is separated by a significant unconformity from the middle and upper members of the Nanafalia; the middle "*Ustrea thirsae* beds" and the upper Grampian Hills Member are late Paleocene in age (Zone NP7 and NP8 and *Planorotalites pseudomenardii* Range Zone). The lowermost marl beds of the Tuscahoma Sand in western Alabama are assignable to Zone NP9 and the *P. pseudomenardii* Range Zone, and the remainder of the Tuscahoma is assigned to Zone NP9 and the *Morozovella velascoensis* Interval zone (late Paleocene). The Hatchetigbee and Bashi Formations are of earliest Eocene age (Zone NP10 and lower part of *Morozovella subbotinae* Interval zone). A major unconformity separates these formations from the overlying Tallahatta Formation, which is assignable to Zones NP12, NP13, and NP14, resulting in a late early Eocene age for the lowermost part of the Claiborne Group.

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Modern Thecamoebinids (Arcellinida) from Balize Delta, Louisiana

Distribution patterns exhibited by both living and dead thecamoebinids are discussed in relation to four physiographic subenvironments to the Balize delta, Louisiana. The subenvironments are the channels, submerged levees, interdistribu-