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.

FREED, ROBERT L., Trinity Univ., San Antonio, TX

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.

GIBSON, THOMAS G., U.S. Geol. Survey, Washington, D.C., ERNEST A. MANCINI, Univ. Alabama, University, AL, and LAUREL M. BYBELL, U.S. Geol. Survey, Reston, VA

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.

HAMAN, DREW, Chevron Oil Field Research Co., La Habra, CA

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, interdistributary bays, and subaqueous distributary-mouth bars. The living specimens exhibit a primary habitat preference for levee localities, with a subsidiary preference for interdistributary bay locations. This distribution pattern is reflected by the dead forms. Living representatives belong to three families, three genera, and 10 species out of a total of four families, four genera, and 15 species retrieved. *Mississippiella multiapertura,* n. gen., et n. sp., is described and assigned to the Family Paraquadrulidae. Interactions between measured environmental parameters most frequently involve dissolved oxygen in the four subenvironments. This observation suggests that this parameter is of prime importance in deltaic ecology. However, no single ecologic parameter could be identified as the causative control to thecamoebinid distribution. The living thecamoebinids appear to be tolerant of significant variation in turbidity, temperature, and alkalinity. The living forms indicate a preference for moderately oxidized to oxidized, low-saline to fresh waters associated with reducing to highly reducing bottom conditions. Taxa occurrences are plotted on probabilistic ternary diagrams in order to differentiate the microfaunas characteristic of the various subenvironment traverses, and on probabilistic target plots for microfaunal differentiation of the subenvironments.

HAN, JONG H., Bur. Econ. Geology, Univ. Texas at Austin, Austin, TX, and ALAN J. SCOTT, Univ. Texas at Austin, Austin, TX

Effects of Syndepositional Structures on Lower Vicksburg (Oligocene) Fluvial-Deltaic Sedimentation, McAllen Ranch Field Area, Hidalgo County, South Texas

The lower Vicksburg sandstones of the McAllen Ranch field area (including McAllen Ranch, Santa Anita, and Guadalupe fields) in south Texas have been significant gas producers for almost 4 decades. However, the relationship of syndepositional structures to the type and distribution of depositional systems is still not fully understood. The importance of growth faults, especially major regional faults, has long been recognized. Further detailed studies concentrating on deeper sandstones of the Vicksburg Formation indicate that these faults in the lower Vicksburg are characterized by low-angle fault-planes and greatly expanded stratigraphic intervals with plunging rollover structures on the downthrown fault blocks. Greatest stratigraphic expansion is associated with channel-mouth bar or delta-front facies.

Extensive drilling and acquisition of high-resolution seismic data in this area have provided the necessary stratigraphic control to determine the significance of more subtle structural effects on sedimentation. The present study is based on the analysis of 142 well logs, 10 cores, and several seismic lines.

The information from cores, characteristic log patterns, and net-sandstone maps of discrete genetic subunits strongly suggests a high-constructive deltaic origin for the reservoir facies. The maps show areas of rapid subsidence associated with large-scale mud movements. These movements result in the formation of sediment-withdrawal basins and fringing syndepositional anticlinal ridges. The localized basins have a profound effect on the style of deltaic sedimentation. Most significant is the exceptional thickening of the distal delta-plain facies characterized by interdistributary bay mud and crevasse splay sands. The splay sands contain abundant macerated plant material. Individual splays have a limited lateral extent, are stacked vertically, and form complex imbricated sand bodies which are gas-prone stratigraphic traps. Such an area presents an ideal target for explorationists and a complex set of problems for the production staffs comtemplating secondary recovery projects.

HANOR, JEFFREY S., Louisiana State Univ., Baton Rouge, LA

Reactivation of Fault Movement, Tepetate Fault Zone, South-Central Louisiana

The Tepetate fault zone consists of a series of faults trending east-west along the northern margin of the South Louisiana salt dome basin. The fault is known to be currently active in the Baton Rouge area, where it has fractured and displaced pavement and foundations. Detailed subsurface mapping of the fault zone in an area of Pointe Coupee Parish to the west reveals that there have been two distinct periods of growth faulting, separated by a long period of inactivity. The first period of fault activity occurred during the time from Wilcox (or earlier) to Frio deposition. There then followed a period of quiescence characterized by deposition of nearly 8,000 ft (2,400 m) of fluvial sands and shales, primarily of Miocene age. In more recent times, probably Pleistocene, the fault has been reactivated, and up to 40 ft (12 m) of additional displacement has occurred in the area studied. Of concern is the fact that a site near this fault has been proposed for the surface and subsurface disposal of hazardous wastes.

Recognition of the interruption and reactivation of growth faulting in south Louisiana is of considerable importance with regard to problems of regional structural evolution, fluid migration, and the siting of surface and subsurface waste-disposal facilities. Because of difficulties in subsurface correlation, faults of small displacement in fluvial sequences can easily be overlooked. Further detailed study, however, is warranted.

ISPHORDING, WAYNE C., Univ. South Alabama, Mobile, AL

Misinterpretation of Environmental Monitoring Data—a Plague on Mankind

All too often, data collected as part of environmental monitoring programs are subjected to interpretation by those unqualified to do so, frequently with results that require extensive litigation. A recent example involved a study carried out in Mobile Bay where geochemical data were used by certain individuals to "identify" bottom sediments contaminated by the drilling of an exploratory well. Elevated barium contents of up to several hundred ppm near the mouth of the bay were attributed to the spillage of drilling mud, although all drill cuttings, mud, and effluent from the rig had been pumped directly onto barges for disposal at sites onshore. Unfortunately, those making the allegations failed to carry out two analyses on the sediments that would have identified the true source of the barium. First, the sediments should have been X-rayed to determine if the barium was, in fact, the result of barite (subsequent diffractograms were all negative for barite). Second, the actual source of the barium could have been determined. Chemical "stripping" techniques now allow the elements in an analysis to be partitioned into: (1) a pore-water fraction, (2) an exchangeable ion phase, (3) ions associated with disseminated carbonate minerals, (4) ions associated with iron and manganese oxide phases, (5) ions attached to clays as organometallically chelated compounds, and (6) ions held in structural sites in the clay mineral lattices.

Partitioning of the barium in the Mobile Bay sediments disclosed that most was associated with the various clay-mineral phases and substitutional impurities in shell material. Thus, the barium observed was not the direct result of the drilling operation but rather reflected its common association with disseminated oxides in the bottom muds, as a chelated form adhering