ends of alternating left and right segments. The segments curve toward one end of the organism, terminating distally in spines. Individual segments exhibit longitudinal ornamentation, and grooves separating adjacent segments indicate articulation.

Data from the USSR, Africa, and South Australia suggest that *Pteridinium* lived in a shallow water, near-shore, high-energy environment. However, the CSB examples are preserved in an essentially bedding-parallel position in deep-water flysch, suggesting transportation from nearshore into deep water.

GIBSON, THOMAS G., U. S. Geol. Survey, Washington, D.C., and LAUREL M. BYBELL, U. S. Geol. Survey, Reston, VA

Multiple Depositional Cycles in Bashi and Hatchetigbee Formations (Lower Eocene), Alabama

The marine Bashi Formation and its updip facies equivalent, the Hatchetigbee Formation, may represent the most complete earliest Eocene shallow-marine section in the world. These two coeval formations contain as many as 4 transgressive-regressive cycles, probably reflecting several significant sea level changes during the first 2 million yr of the Eocene. The most transgressive, deepest water marine deposits, which suggest inner to middle neritic depths, are at or very near the base of each cycle, and consist of abundantly fossiliferous glauconitic sand, silt, and clay. The uppermost sediments in each cycle usually consist of clay containing brackish to freshwater palynomorph assemblages. This upward transition in each cycle from neritic to freshwater environments within less than 6 m (20 ft) of section can most reasonably be explained by rapid changes in relative sea level rather than by progradation.

Discoaster diastypus, Tribrachiatus bramlettei, or *Tribrachiatus contortus* occur in the lower 3 cycles. First occurrence of these 3 species has been used to define the base of calcareous nannofossil Zone NP10 of Martini or the *Discoaster diastypus* Zone of Bukry, both considered to mark the base of the Eocene. In central Alabama, strata above a scour surface at the top of the third cycle do not contain *T. bramlettei* or *T. contortus*, which become extinct at or near the top of Zone NP10, or *Discoaster lodoensis*, which first occurs in Zone NP12; they do have *Tribrachiatus orthostylus*, which first occurs in upper Zone NP10. We tentatively have placed within Zone NP11 these sediments which probably represent a fourth cycle.

GIES, ROBERT M., Canadian Hunter Exploration, Calgary, Alberta, Canada

Hydrocarbon Entrapment in Alberta Deep Basin

Entrapment of hydrocarbon accumulations in the deepest region of the Alberta sedimentary basin is linked to certain principles of subsurface fluid flow behavior in generally tight sandstones, and to active hydrocarbon generation in adjacent source beds. Similar geologic conditions and associated deep-basin-type hydrocarbon accumulations no doubt exist in the deeper portions of other sedimentary basins.

Conventional concepts of subsurface hydrocarbon accumulation do not apply to the deep basin form of entrapment, yet both mechanisms conform to certain important physical principles of fluid flow behavior. The conventional entrapment idea, based on many case histories and sound physical principles, entails downdip hydrocarbon-over-water contacts, initial reservoir pressures greater than formation water pressures at the same position (the so-called "capillary displacement pressures"), updip reservoir seals, and accumulations that are essentially in static equilibrium.

Deep-basin concepts of hydrocarbon entrapment, on the other hand, are opposed to conventional ideas. Hydrocarbon-bearing sands in deep basin regions grade laterally updip into permeable water-bearing sands without reservoir barriers to segregate the fluids. Water-over-hydrocarbon contacts appear at the updip limits of the accumulations and generally are absent downdip. Original hydrocarbon accumulation pressures are usually less than projected formation-water pressures at common depth points. Deep-basin accumulations fed by active downdip source rocks may be in a dynamic state of slow, updip hydrocarbon migration. Hydrocarbons lost across the updip water/gas contact are replaced by new hydrocarbon influx from downdip source rocks. Prolonged hydrocarbon flux through deep-basin reservoirs may result in exceptionally low residual water saturations and favorable hydrocarbon relative permeabilities in tight sandstones.

These unusual physical principles of the Alberta deep-basin hydrocarbon accumulations are illustrated by Elmworth field examples and by physical fluid flow models.

GILREATH, J. A., Schlumberger Offshore, New Orleans, LA, R. L. LANGLEY, Etudes & Production Schlumberger, Paris, France, and P. PRUCHNIK, Schlumberger-Doll Research, Ridgefield, CT

Dipmeter Advisor—An Artificial Intelligence Interpretation Program

The Dipmeter Advisor program is an application of Artificial Intelligence and Expert System techniques to the problem of dipmeter interpretation. Development of the rule-based program, which attempts to emulate human dipmeter analysis performance, began in 1978 and has now progressed to the field-test stage.

The program currently contains 90 rules which were obtained from a knowledge engineer's observation of one expert over a period of eighteen months. The program, which is designed to interact with the user and the geologist, divides the process of dipmeter interpretation into 11 successive phases. The sequence progresses from initial examination through validity checks, structural dip determination, structural dip deletion, missing-section analysis, depositional environment analysis, and stratigraphic analysis.

During the interpretation process the program asks the user for information about missing sections and depositional environments. If requested inputs are not available, the program then utilizes structural dip changes as missing-section indicators, and dip scatter plus shale resistivity (in some areas) as environmental indicators. After locating any structural dip changes, the program searches above the point of change for a mega-red dip pattern. If such a pattern is found, the vertical extent and azimuth of the pattern are used to determine the type of fault (growth, late) and the fault-plane orientation.

Stratigraphic interpretations are performed by comparing, with the rule base, the lithology, dip patterns, and menu of depositional features found within any given environment.

GINSBURG, ROBERT N., and DONG RYONG CHOI, Univ. Miami, Miami Beach, FL

Coral Content of Quaternary Reef Limestones

The coral content of Quaternary reef limestones provides a useful calibration of the preserved record of modern reefs. Estimates of the percentage of corals in outcrops range from 32 to 46% for the Key Largo limestones of south Florida; 18 to 46% for Pleistocene limestones of the Kenya coast; and up to 60% for Pleistocene reef limestones of Barbados. Core borings from the Great Barrier Reef have an even wider range in the percentage of coral, with only localized areas of more than one-third massive or branched coral.

Simulated core borings made on photographs of outcrops call attention to the wide range of variations to be expected. The average standard deviation of coral percentages in simulated core borings is ± 13% as compared with percentages of their respective outcrops.

These results further support the view that percentage of coral in Quaternary reef limestones is highly variable and is often less than one-third of the total biomass. Furthermore, they give a useful baseline for comparing Quaternary and more ancient reef limestones.

GJOLBERG, J., K. KLEINSPEHN, A. NØTTVEDT, Univ. Bergen, Bergen, Norway, M. RYE-LARSEN, Esso Norway, Stavanger, Norway, and RON STEEL,* Norsk Hydro, Bergen, Norway

Paleogene Sedimentation and Deformation Along Svalbard's Sheared Margin

The northern part of the Svalbard-Barents margin was a shear margin from 58 Ma to 36 Ma. The strike-slip effects on Spitsbergen are evident in (a) the Central Basin, (b) the fold-and-thrust belt of western Spitsbergen, and (c) Forlandsundet Graben.

An early mid-Paleocene transtensional regime is suggested by about