the basin it overprints, the Northern New Guinea basin. Consideration of plate kinematics suggests convergence became increasingly oblique during the Cenozoic. We have calculated an average convergence of N6°E at 11.9 cm/year (4.7 in./year) during the Paleocene to Eocene, N60°E at 6.8 cm/year (2.7 in./year) during the Eocene to Miocene, and N60°E at 9.3 cm/year (3.7 in./year) during the Miocene to Holocene. Present-day Australian and Pacific plate vectors indicate predominantly left-lateral strike-slip motion in northern New Guinea.

The sinistral Northern New Guinea fault system defines this zone of plate interaction and represents a suture between continental crust to the south and intermediate crust to the north. The fault system extends more than 3,000 km (1,900 mi) from the Huon Gulf of Papua westward into eastern Indonesia, and is comprised of the Ramu-Markham (Papua) and Sorong (Indonesia) faults. This system is particularly well defined along the Ramu-Markham valley by recent earthquakes of focal depths between 41 and 300 km (25 and 186 mi). First motion studies of these earthquakes indicate both compressional and strike-slip events. Maximum compressive stresses delineated from conjugate shear fractures studied in the field closely agree with the first motion solutions. When combined with the trend analyses of surface fold axes and reflective seismic structural information, these data are consistent with the regional left-lateral deformation of this Tertiary basin.

Hydrocarbon exploration strategies within the Northern New Guinea basin must address not only sedimentation, but also must deal with the basin's complex structural and tectonic evolution. A static tectonic classification will not adequately define the Northern New Guinea basin. It is better described as an evolving basin being overprinted by wrenching.

TURLEY, ROBERT D., GEOWARE, Littleton, CO

Microcomputer Geoscience Software

As an increasing number of geoscientists acquire microcomputers, it becomes evident that most geoscientists do not have time to learn to program or to write programs specific to their professional tasks.

Acting as a worldwide clearing house, GEOWARE solicits descriptions of geoscience software and will publish catalogs of private, commercial, and public domain software descriptions. The catalogs will include the name, address, and phone number of the owner of the software so he may be contacted directly to discuss the software, negotiate for purchase, or arrange for custom programming.

Geoprogrammers are encouraged to contact GEOWARE to receive forms for describing their software.

TYLER, NOEL, Bur. Economic Geology, Univ. Texas, Austin, TX

Architecture and Production Characteristics of Strand-Plain Reservoir Facies, Matagorda County, Texas

The North Markham–North Bay City field, Matagorda County, Texas, is one of the major multiple-reservoir oil fields of the central Texas Coastal Plain that produce from stacked Frio barrier/strand-plain sandstones. The three principal oil reservoirs in the field are interpreted to be transgressed strand-plain (Carlson), progradational strand-plain (Cornelius), and composite progradational strand-plain/wave-dominated delta (Cayce) systems. Production characteristics of strand-plain facies are modeled using these reservoirs as examples.

Reservoir continuity is greatest in transgressed and progradational strand-plain sandstones where crosscutting channel facies are of minor importance. Hydrocarbon distribution is laterally continuous in both reservoir types. Broad edgewater incursion indicates an absence of internal facies barriers. Progradation of the Cornelius strand plain resulted in a composite reservoir in which the older sands and contained hydrocarbons pinch out against the overlying offlapping sequence.

In contrast, reservoir continuity in the Cayce is poor. Crosscutting fluvial sands produce oil at lower rates, act as conduits for early water influx, and provide facies boundaries against which hydrocarbons in adjacent progradational facies are pooled. Facies changes and pinchouts in heterogeneous reservoirs such as the Cayce are in part responsible for limiting ultimate recovery from major clastic reservoirs along the Texas Gulf Coast to approximately 50 % of the original oil in place.

ULMER, DANA S., Southern Methodist Univ., Dallas, TX

Dedolomitization and Calcitization of Gypsum in Mississippian Arroyo Penasco Group, North-Central New Mexico

The Espiritu Santo Formation of the Mississippian Arroyo Penasco Group represents the oldest Paleozoic stratigraphic unit preserved in north-central New Mexico. The Espiritu Santo Formation is a diagenetically complex carbonate unit that exhibits a well-developed cement stratigraphy reflecting changes from meteoric fresh to marine-phreatic environments. Recrystallization of the algal-laminated sediments occurred during subaerial exposure of the overlying Macho Member of the Tererro Formation, a collapse breccia produced by the dissolution and removal of gypsum. The breccia and recrystallized limestone are indicative of broad, low-relief topography and shallow water table.

Cathodoluminescent petrography reveals the presence of pseudomorphs of dolomite and gypsum throughout the Espiritu Santo carbonates. Typical dedolomite morphologies are: inclusion-rich cores surrounded by limpid rims; corroded Mn-rich rhombs within calcite pseudospar; highly zoned rhombs; and uniformly luminescent rhombs enclosed in gypsum pseudomorphs. Calcitized gypsum, occurring as bladed to hexagonal crystals and nodules, varies from highly zoned to uniformly luminescent crystals. The varying luminosity is a possible relict of the original trace-element distribution and/or the diagenetic environment.

Meteoric waters migrating from the Macho Member were enriched, but undersaturated, in dissolved $CaSO_4$ and have low Mg/Ca ratio. Thus these pore fluids within the Espiritu Santo carbonates dissolved gypsum and dolomite. The solution, supersaturated with respect to $CaCO_3$, precipitated calcite. Therefore, the dissolution of gypsum and dolomite and the precipitation of calcite occurred simultaneously during diagenesis. The reaction terminated once the supply of gypsum was exhausted.

URIEN, CARLOS M., Urien & Associates, Buenos Aires, Argentina

South American Sedimentary Basins

More than 64 sedimentary basins have been identified on the South American continent. According to their regional structural character and tectonic setting, they are classified in 4 super groups.

(1) About 20 interior or intracratonic basins occur on South American cratons (Guayanas, Brazilian, and Patagonian). In most cases, their sedimentary fill is Paleozoic or early Mesozoic. Rift or transverse grabens resulting from incipient sea floor spreading extend towards the continental margin.

(2) 17 basins are located along the Atlantic stable margin, and consist primarily of half grabens with downfaulted seaward blocks. These rifts (or pull-apart basins) were separated as results of the migration of the African and American continental blocks. Therefore the sedimentation is chiefly Cretaceous and Tertiary.

(3) On the western edge of South American cratons, almost 20 basins of downwarped blocks extend from Orinoco down to the Malvinas plateau in a relatively uninterrupted chain of retroarc basins, bordered by the Andean orogen. They lie on a flexured Precambrian and Paleozoic basement, and are highly deformed in the west (Subandean belt) due to the action of compressional forces caused by the tectonic influence of the Mesozoic Andean batholith.

(4) Westward, the Pacific margin is bordered by 27 foreland and forearc basins, which alternate from north to south on an unstable or quasi-stable margin, fringed by a trench and slope complex where the ocean crust is subducted beneath the continental plate.

VAIL, PETER R., Esso Production Research Co., Houston, TX

Episodic and Cyclic Sedimentation

At the 1982 meeting of the SEPM in Calgary, Robert H. Dott, Jr., of the University of Wisconsin gave a very thought-provoking presidential address on episodic sedimentation. He defined episodic sedimentation as punctuated or discontinuous deposition. He concluded that sediments are deposited episodically and are controlled by such factors as the local storms, floods, and tides. Considered by itself, the concept implies that one basin has no predictable relation to another. Thus, when applying the

episodic concept it follows that the best way to determine the distribution of sedimentary rocks within a basin is to understand facies relationships and the tectonic setting of the basin. This concept makes good sense and obviously applies to the vast majority of sediments. The weakness of the concept is its inability to explain the "rare event." For these rare events, the episodic-oriented geologist commonly calls on the 1,000 yr storm, the 500-ft (150-m) waves from meteorites, the blanket of dust that extinguishes life.

Our experience, based on seismic stratigraphic studies tied to well and outcrop sections, indicates that yes, sediments are deposited episodically, but they are packaged in genetically related depositional packages or sequences that are shifted back and forth in a predictable global cyclic pattern. We believe this global cyclic pattern is caused by rapidly fluctuating eustatic changes of sea level superimposed on more slowly changing tectonics. Each sequence is composed of all the rocks deposited during a complete cycle of sea level starting with the fall and progressing through the succeeding low, rise, and high before the next fall. We believe orderly cyclic sedimentation caused by eustatic sea level changes is a better explanation for many of the rare events. Deep-marine massive sand fans and debris flows commonly ascribed to 1,000 yr storms or 500-ft (150-m) tidal waves may be explained better by rapidly falling sea level or sea level lows. Rapid rises of sea level and their associated condensed stratigraphic sections offer an alternative explanation for the massive faunal extinction and rare deposits associated with the Cretaceous-Tertiary or Eocene-Oligocene boundaries.

WANLESS, HAROLD R., Univ. Miami, RSMAS, Virginia Key, FL and JEFFREY J. DRAVIS, Exxon Production Research Co., Houston, TX

Comparison of Two Holocene Tidal Flats—Andros Island, Bahamas, and Caicos, British West Indies

Minor climatic and physiographic differences have caused dramatic differences in sedimentation between the tidal flats of Andros, northwestern Bahamas, and Caicos in the southeastern Bahama chain.

Both tidal flats are leeward of large islands and adjacent to broad, shallow platforms that provide carbonate mud to the flats. Each flat forms a sediment wedge 4 m (13 ft) thick (Andros flats are 200 × 30 km, 125 × 19 mi; Caicos, 60 × 10 km, 37 × 6 mi), and each contains an outer channeled flat and an inner algal marsh. Both flats have cementation and protodolomite forming on channel-margin levees and the inner algal marsh.

Differences in rainfall, wind regime and orientation promote important sedimentological differences. Andros receives nearly twice as much rainfall as Caicos; gypsum forms in cemented crusts in Caicos, but not on Andros. Andros receives brief strong pulses of northwest wind following passage of 40 to 60 winter cold fronts per year. The northwest exposure of the margin of the Andros flat thus is flooded several times each year by sediment-laden waters. This flooding focuses on the shore and channel margins, building broad, strongly laminated levees. Caicos flats, in contrast, face south, and neither winter cold fronts nor summer trade winds blow onshore. Levees are poorly developed. Caicos is dominated by brisk easterly trade winds, causing persistent turbidity in nearshore waters. This is dispersed through tidal channels, largely filling interdistributary ponds to a level at which organic-rich intertidal algal mats can flourish. Lower energy conditions on Andros provide insufficient sediment to fill ponds.

WARESBACK, DAMON B., JOHN G. MCPHERSON, and STEPHEN SELF, Univ. Texas, Arlington, TX

Volcanogenic Alluvial Fan Sedimentation, Puye Formation, New Mexico

The Pliocene Puye Formation of north-central New Mexico represents a rift-filling volcaniclastic alluvial fan sequence developed on the east flank of the Jemez Mountain volcanic pile. This coarse-grained sequence can be separated into two compositionally distinct members that are genetically unrelated. The basal Puye (here referred to as the Totavi Member) consists of a 25-m (82-ft) thick, clast-supported conglomerate with interbedded sandstone lenses. The Totavi is a coarse-grained braided stream deposit composed of reworked Precambrian terrane of the Sangre de Cristo Mountains and mafic lavas of the Taos basin. The sequence displays cross-bedded sandstones and conglomerates, and well-developed clast imbrication and long-axis orientation, which indicate a paleoflow direction to the southwest. The Totavi member is an axial-stream gravel deposit of the Rio Grande rift.

The Totavi member is conformably overlain by a 100+ m (330+ ft) thick volcanogenic alluvial fan deposit here referred to as the San Ildefonso Member. This member represents the eroded and reworked detritus of the growing silicic volcanic complex of the Jemez Mountains. The San Ildefonso Member consists of four major interstratified lithofacies associations. These include: (1) clast-supported, massive and horizontally stratified conglomerates, with interbedded sandstones; (2) matrix-supported conglomerates; (3) laminated claystones and mudstones; and (4) primary pyroclastic deposits of both silicic and mafic composition. The clast-supported conglomerates and interbedded sandstones are typical coarse-grained, braided-stream deposits representing longitudinal bar and minor transverse bar accumulations. Internal stratification and clast imbrication points to an easterly flow direction.

The matrix-supported units display a complete spectrum of types from clast-rich (debris flows) to clast-poor (mudflow) varieties. These deposits are sediment gravity flows developed in response to steep slopes, abundant unconsolidated volcanic detritus, and excessive loading by water uptake. A number of debris flows and mudflows are underlain by primary volcanic airfall material and were undoubtedly initiated by volcanism.

The laminated claystones and mudstones are lacustrine deposits that resulted from temporary damming of the alluvial fan and ancestral Rio Grande drainage systems. The San Ildelfonso Member contains at least 7 primary silicic air fall ash beds and 3 basaltic ash beds. These not only provide a time framework for sedimentation but can be used to delineate lateral facies changes.

WARREN, JOHN, Univ. Texas, Austin, TX, DAVID LOCK, CRA Exploration, Pty. Ltd., Research Corp., Canberra, Australia, and PATTI GRANGER, Univ. Texas, Austin, TX

Coorong Dolomites (South Australia) and Models of Ancient Coorong-Style Dolomites

The Coorong Dolomites and associated magnesian and calcian carbonate muds form sporadic deposits over a 90 × 200 km (56 × 125 mi) area of coastal dune strand plain in southeastern South Australia. They are deposited wherever the Pleistocene dune surface intersects the water table. A reconstruction based on the hydrological setting of the Coorong is a facies mosaic model. It includes the ideas that: (a) dolomite and magnesian carbonate deposition was widespread and associated with resurging continental groundwater; and (b) although widespread, the actual volume of "primary" dolomite is insignificant compared to the total volume of lacustrine and other carbonate sediment.

The lacustrine sediment in the interdunal depressions builds up to the highest level attained by the water surface, equivalent to the outcropping water table. The upper portion of these carbonate muds often contains one, sometimes two, indurated crusts. Such crusts contain subtle, small-scale structures called extrusion tepees. These tepees form as layers of mud are injected from below into megapolygonal cracks in the crust. Successive layers of mud are cemented to the sides of the crack as the lake desiccates each summer. Ongoing episodes of injection and cementation expand the crust volume until it overthrusts into large-scale tepee structures.

An ancient "Coorong-type" dolomite is a shallowing upward mudstone sequence which shows increasing evidence of subaerial exposure in the upper levels of the cycle. The lower portion of the cycle is a relatively thick, organic rich, laminated, calcitic mudstone (2–3 m, 7–10 ft, thick). This passes up into a lighter, highly bioturbated and pelleted dolomudstone (1–2 m, 3–7 ft, thick). The upper zone is characterized by crusts containing extrusion tepees, intraclast breccias, and siliceous cements. The succession is capped by a well-developed palaeosol with portions of the uppermost zones sometimes showing evidence of dedolomitization.

One should be wary of the idea that ancient Coorong-type dolomites are never associated with evaporites. In the modern Coorong lakes, gypsum and halite grow as an ephemeral phase in the near surface and surface muds during late summer. The same crystals are dissolved out by winter rains, and their molds destroyed by bioturbation and the thixotropic nature of fresh dolomite mud. In Precambrian analogs, the lack of bioturbation could lead to the retention of some evaporite pseudomorphs. Also the modern hydrology of the Coorong is highly compartmentalized. A laminated gypsarenite sequence at least 2 m (7 ft) thick is