COLEMAN, J. M., Louisiana State Univ., Baton Rouge, LA, A. H. BOUMA and C. E. STELTING, Gulf Research and Development Co., Houston, TX, and D. B. PRIOR, Louisiana State Univ., Baton Rouge, LA

Framework of Mississippi Fan, Gulf of Mexico

The Mississippi fan is a broad, arcuate Pleistocene accumulation of displaced shallow-water sediments. The fan consists of elongate fan lobes that shift position at the onset of each active sedimentation event, probably related to the lowering of sea level and the outbuilding of the shelf. Isopach and structure maps, based on eight acoustical reflectors of regional extent, demonstrate this shifting as well as changes in the location of the source area, and a progradation basinward.

The youngest fan lobe is a suitable model for the underlying ones. It can be divided into four major morphologic units: (1) canyon—the Mississippi canyon resulted from retrogressive slumping during the late Wisconsin and was nearly filled thereafter; (2) upper fan lobe—a large, nearly filled erosional channel with low levees and a recent active central channel; (3) middle fan lobe—convex upward in cross section with a sinuous 3-km (2-mi) wide migratory and aggradational channel on its apex; (4) lower fan lobe—the central channel becomes smaller, less sinuous, shifts position periodically (as indicated by the indistinct abandoned channels), bifurcates, and terminates.

Fan lobes are primarily channel-levee-overbank complexes, erosional in the upper fan and aggradational basinward. The channel is an active conduit; deposition in the channel took place during and after an active transport period. Accumulation rates on the middle and lower fan are high, ranging from 6 to 12 m/1,000 yr (20 to 40 ft/1,000 yr). A major portion of the sand is transported to the lower fan area.

COLLINS, D. G., and J. M. PARKS,* Lehigh Univ., Bethlehem, PA

Variety of Geologic Silhouette Shapes Distinguishable by Multiple Rotations Method of Quantitative Shape Analysis Text

Silhouette shapes are two-dimensional projections of three-dimensional objects such as sand grains, gravel, and fossils. Within-the-margin markings such as chamber boundaries, sutures, or ribs are ignored. Comparisons between populations of objects from similar and different origins (i.e., environments, species or genera, growth series, etc) is aided by quantifying the shapes. The Multiple Rotations Method (MRM) uses a variation of "eigenshapes," which is capable of distinguishing most of the subtle variations that the "trained eye" can detect. With a video-digitizer and microcomputer, MRM is fast, more accurate, and more objective than the human eye. The resulting shape descriptors comprise 5 or 6 numbers per object that can be stored and retrieved to compare with similar descriptions of other objects. The original-shape outlines can be reconstituted sufficiently for gross recognition from these few numerical descriptors. Thus, a semi-automated data-retrieval system becomes feasible, with silhouette-shape descriptions as one of several recognition criteria.

MRM consists of four "rotations": (1) rotation about a center to a comparable orientation; (2) a principal-components rotation to reduce the many original shape descriptors to a few; (3) a VARIMAX orthogonal-factor rotation to achieve simple structure; and (4) a rotation to achieve factor scores on individual objects. A variety of subtly different shapes includes sand grains from several locations, ages, and environments, and fossils of several types. This variety illustrates the feasibility of quantitative comparisons by MRM.

COLLINSWORTH, BART D., Sul Ross State Univ., Alpine, TX

Depositional Setting and History of an Eocene Lacustrine Deposit, Brewster County, West Texas

Thick, massive beds of nonmarine limestone are exposed in the Elephant Mountain quadrangle, Brewster County, Texas. This Eocene carbonate ranges from 1 to 70 m (3 to 230 ft) in thickness, and is intercalated with the three lowermost formations of the Buck Hill volcanic group: the Pruett tuff, the Crossen Trachyte, and the Sheep Canyon Basalt. The Pruett Formation (Eocene), which is composed mainly of volcanic tuff and tuffaceous nonmarine limestone, unconformably overlies the Boquillas limestone (Cretaceous). These interbedded tuffs, and intercalating lavas of the lower Buck Hill group represent several interruptions during the formation of this lacustrine deposit.

The carbonate rocks consist primarily of pure to impure silty limestones with no appreciable dolomite or evaporite content. The unit contains charophytes, ostracodes, algal stromatolites, oncolites, possibly *Equisetum*, silicified wood, stromatolific tufa, and fresh-water gastropods. These features probably represent a shallow, low energy, sublittoral to littoral marginal facies which were deposited in a relatively humid environment. The thick lower beds of this nonmarine limestone were most likely deposited in a drainage basin formed by block faulting in the Late Cretaceous to early Tertiary. In contrast, the thinner beds in the upper portion of this deposit may have accumulated in local depressions formed in the surrounding volcanic flows.

The true size of the lake basin is unknown due to the lack of exposure, but the Pruett tuff interbedded with limestone has been found in the subsurface approximately 90 km (56 mi) northwest of the study area.

COLTEN, VIRGINIA A., Univ. Illinois, Urbana, IL

Experimental Determination of Smectite Hydration States Under Diagenetic Conditions

Knowledge of the hydration state of smectite under burial diagenetic conditions is necessary for the interpretation of the smectite to illite transformation, abnormal fluid pressure development, and reservoir properties. Simple changes in fluid composition, pressure, or temperature have been thought to affect the number of layers of water associated with smectite at depth.

The hydration state of smectite while in contact with brine, at pressures and temperatures that simulate burial diagenetic conditions, has been determined by X-ray diffraction analysis. A heated high-pressure X-ray cell was used to determine the basal spacing from oriented mounts. The hydration state of the smectite was monitored by determining the $2\theta$ positions of the 003 and 005 reflections.

Two layers of water ($d_{001}$ = 15.8A) are retained by Cheto montmorillonite in 1 molal NaCl solution under 15.1 MPa (2,200 psi) pressure, to at least 175°C, and in the same solution under 3.4 MPa (500 psi) to 125°C. Two layers of water are also retained by Cheto montmorillonite in 5 molal NaCl solution to 200°C under pressures of 4.83 MPa (700 psi) and 46.2 MPa (6,700 psi).

This experimental evidence contradicts the previously suggested mechanism for generating fluid overpressuring in shales by simple thermal dehydration of smectite under burial conditions.

Experiments done with dilute NaCl solutions demonstrate the effect of concentration on the swelling of smectite at depth, while experiments with KCl solutions illustrate the effect of the interlayer cation on the hydration state of the clay.

CONIGLIO, M., and N. P. JAMES, Memorial Univ., St. John's, Newfoundland, Canada

Algal Origin of Peloids, Peloidal Intraclasts, and Structure Grumeleuse in Paleozoic Limestones: Evidence from Cow Head Group, Western Newfoundland

Deep-water carbonate strata of Cambro-Ordovician age in western Newfoundland are composed of interstratified conglomerates and thinly bedded calcarenites, lime mudstones, and shales. Early lithification has preserved an abundant but simple algal flora in shallow-water clasts within both conglomerates and deep-water slope sediments. Large boulders contain sheets of *Girvanella* and arborescent clusters of *Epiphyton*, but only *Girvanella* as intraclasts, rafts of intertwined tubules, single tubules, and oncolites can be distinguished in calcarenites.

Preservation of *Girvanella* in boulders varies from distinct tubules to "structure grumeleuse" (clotted fabric) in which patches of micrite mask any evidence of former algal structure. Comparison of *Girvanella* in boulders and calcarenite grains indicates that much carbonate sand consists of broken and abraded *Girvanella* sheets. In contrast, *Epiphyton* thalli appear to be comminuted to form silt- and sand-size micrite peloids.

An extension of these findings is that many peloids, peloidal intraclasts, and much structure grumeleuse in early Paleozoic carbonates, both shallow and deep water, are derived from calcareous algae. These