Grain-size analysis shows a composition of very fine sand with a large silt and clay component. Studies of sand-size distribution throughout the 53-ft core did not reveal graded bedding, thus excluding turbidity currents as a depositional mechanism. Analysis of the benthic fauna within the sand unit indicates that the sands and thin-bedded shales were originally deposited on the inner to middle shelf. The occurrence of bathyal shale above and below the productive unit suggests that the shallow-water sands were transported basinward into a slope environment.

Regional paleobathymetric maps indicate that there was a progradation of the shelf edge during deposition of the sand unit. This evidence, along with the fine-grained character of the sands, suggests that a deltaic complex was developing updip of the field.

The depositional environment is very similar to that described by J. M. Coleman and others near the modern Mississippi River Delta. The processes that are moving shallow-water sands across the shelf, stimulating mass movement and shelf-ridge slumping, were also active around ancient deltas.

Based on the modern analog, it is interpreted that the field sand is part of a debris flow initiated by shelf-edge failure. The geometry of the sand unit also supports this hypothesis.

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Texture and Reservoir Potential of Micritized Ooids

Micritized ancient ooids are important to hydrocarbon exploration because they may be reservoirs for gas or bound water. Porosity within micritized ooids may exceed 15%. Porosity and permeability in micritized ooids are greatest where micrite crystals are euhedral, relatively large, and uniform in size. A study of the massive Cotton Valley limestone in east Texas indicated that intra-ooid porosity, with permeabilities up to about 1 md, may constitute a significant reservoir for gas. Accordingly, a survey of ancient ooids was conducted to assess the nature and variability of their crystal fabric. Micritized ooids of Mesozoic and Paleozoic age were collected from outcrops and well cuttings. Most are composed of euhedral to subhedral 1-5 μm calcite rhombs. Crystal size and shape are most uniform within a single ooid and most variable between localities. Subsequent diagenesis (excluding leaching or replacement) produced either coarser anhedral crystals or cemented the rhombs with micropoikilotopic overgrowths. Micritized ooids from 13 samples exhibit a common fabric and may have been altered by a common process. Nearly all recent ooids are aragonitic, and most ancient ooids, including those examined in this study, were probably aragonitic as well. Mineralogical stabilization from aragonite to calcite is suggested as the micritizing process.

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Depositional Environments and Sedimentology of Vinita Beds, Richmond Basin, Virginia

The Carnian (middle to late Middle Triassic Age) Richmond basin of northeast Virginia is the oldest of the exposed Newark rift basins of the eastern seaboard. These basins formed during the Mesozoic divergence of the continents. As presently defined, the Richmond basin is a large synclinal feature measuring 32 mi (53 km) long by 8 mi (13 km) wide, and is located west of Richmond, Virginia, and east of Amelia, Virginia. Sediments of the Richmond basin have been assigned to the Richmond Group and have been stratigraphically subdivided into the following informal units, oldest to youngest: coarse boulder breccias, coal measures, Vinita Beds, and Otterdale Sandstone.

The Vinita Beds are composed of arkosic sandstones, shales, siltstones, and minor amounts of coal, and are mineralogically immature. They are composed of angular to subrounded rock fragments, quartz, and feldspars, and are highly micaceous and kaolinitic. In places, feldspars make up as much as 50% of the rock. Sandstones and conglomerates are cross-bedded and channeled, and shales and siltstones are thinly laminated. The Vinita Beds are rich in fossil fish, branchiopods, and plant fragments. These rocks were deposited in braided streams as well as in paludal and possible lacustrine environments in a humid and heavily vegetated setting.

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Depositional Environments and Hydrocarbon Occurrence of Upper Jurassic Cotton Valley Sandstones, Mississippi, Louisiana, and Texas

The sandstones of the Kimmeridgian (Jurassic) upper Cotton Valley Formation of Mississippi, northern Louisiana, and eastern Texas were deposited on a stable subsiding shelf. These sands are regressive and are part of a complex of deltaic and marine systems. They are quartz-rich and exhibit a variety of sedimentary structures. Cotton Valley fluvial-deltaic systems drained Paleozoic and younger highlands to the north and northwest, depositing sands on the shelf where they were subsequently reworked.

Three depositional environments have been interpreted for these sands in Mississippi: (1) a constructive delta in the west-central part of the state, (2) a destructive delta in the east-central part of the state, and (3) an interdeltaic system in central Mississippi between the other systems. In northern Louisiana and northeastern Texas, the following environments have been interpreted: a proximal destructive delta system in northwest Louisiana and northeast Texas and another delta system in northeastern Louisiana with an interdeltaic system consisting of barrier beaches and barrier bars located centrally between them.

Production is controlled by porosity and permeability barriers, fault traps, and salt- and basement-induced structures.

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Fine-Grained Sediments of an Interdistributary Basin, Mississippi Delta

A considerable portion of fine-grained sediments of the Mississippi Delta can be found in large-scale interdistributary basins that are located between distributary channels of different delta lobes of the same delta system. Because of their size, these basins are prone to filling with fine-grained material. Thus, the central basin is devoid of coarser influxes from the surrounding levees. Barataria basin (about 150 × 50 km in size) is such a basin bordered by the modern Mississippi River and the abandoned Bayou Lafourche. Ninety-five vibracores, 3-10 m deep, form the basis for this study. Correlation between cores along cross sections is based on lithology and organic matter content. X-ray radiographs show common occurrences of massive homogeneous and fine parallel-laminated sequences. Small-scale cross-lamination, lenticular bedding, and faunal bioturbation are rare, the latter most likely because of oxygen-starved conditions. Subtle facies differences can be detected between levees, basin drainage channels, lacustrine areas, submerged marsh bottoms, and various peats. Early diagenesis occurred throughout the basin in the form of heavy pyritized and/or calcite-rich zones. From examination of thin sections, both by light microscopy and SEM, it appears pyrite is most abundant in marsh sediments with intermediate (about 30-70%) organic matter content. These marshes contain sufficient iron (from clays) and sulfur (associated with decaying plant matter) to give rise to pyrite formation.

Detailed analyses of a basin of this kind are important in predicting and understanding geometry, continuity, and diagenetic features of deltaic shales. In addition, when reworked, these materials form possible source beds for hydrocarbons found in continental shelf and slope settings.

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Using Paleosols to Elucidate Episodic Sedimentation in Alluvial Rocks

Ancient alluvial deposits are believed to be incomplete because floodplains undergo relatively infrequent episodes of sedimentation for which the cumulation of time is geologically limited. However, many alluvial sequences contain superposed paleosols that preserve not only the record of deposition but also the geologically lengthier record of nondeposition and nonerosion. The only time that is not represented in an alluvial sequence with paleosols is that time represented by sediments and paleosols that have been eroded. Erosion can reflect channel migration, which produces coarse sediment filled scours and is a process common to both degrading and aggrading fluvial systems. In contrast, deep and laterally extensive scours, filled dominantly by fine sediments, are evidence for lengthy periods of degradation. This second type of scour, whose rec-