the eroded Hercynian surface. This provided a seal for subsequent hydrocarbon migration from the underlying Silurian and Devonian source rocks. Important epeirogenic events and tensional faulting occurred during the Jurassic and Cretaceous.

Compressional forces in the Tertiary culminated in the Alpine orogeny. A broad zone of uplift and southward-directed imbricate thrusting formed along the northern margins of Algeria obscuring much of the sub-Tertiary depositional and structural features.

Hydrocarbon accumulation in Algeria has been predominantly controlled by the relationships among the Silurian-Devonian source rocks, the Hercynian unconformity, and the distribution of the overlying Triassic clastic and evaporite sequence. More than 65% of the recoverable oil reserves and 90% of the gas reserves are trapped immediately below or above the Hercynian unconformity, with the evaporites providing the seal.

Heretofore, the complex geology of the Tertiary overthrust zone has been a deterrent to exploration in both the autochthonous Miocene basins and the sub-Tertiary sequence. However, improved seismic techniques and renewed interest in the potential of overthrust provinces point to increased activity in this area.

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Downslope Transportation of Metalliferous Sediments Along East Pacific Rise During Messinian

The distribution of metalliferous sediments adjacent to active spreading centers is of both scientific and economic interest. Metal-rich waters emanating from active hydrothermal vents have been traced in intermediate level water masses far beyond the ridge crest, but the greatest concentrations of metal oxides in sediments occur near the vents. There, however, it is possible that the oxides may be redistributed and possibly further concentrated by redeposition. We document one such case of redeposition for Messinian sediments cored at Deep Sea Drilling Project Site 599, which, along with the other DSDP Leg 92 sites, was the first on the East Pacific Rise to be drilled using the hydraulic piston corer.

Site 599 (19°27.09′S, 119°52.88′W; water depth = 3,654 m), drilled in a small basin about 600 km from the present ridge crest, recovered 41 m of mostly Miocene calcareous oozes characterized by alternating light (mostly yellowish brown to dark yellowish brown) and dark (mostly dark reddish brown) zones from 10 to 100 cm thick and/or bands 2-5 cm thick. A sharp contact at sample point 599-3-3, 21 cm, separates fine-grained light-colored in-situ sediments of calcareous nannofossil Zone CN9b below from a coarser grained and darker metalliferous-rich unit above, which contains older nannofossils derived from Zone CN8b. Indicative of downslope transport of metalliferous materials during the Messininan, this example may explain much of the sediment banding seen throughout the section.

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Eolian Reservoir Characteristics Predicted from Dune Type

The nature of eolian-dune reservoirs is strongly influenced by stratification types (in decreasing order of quality: grain-flow, grain-fall, wind-ripple deposits) and their packaging by internal bounding surfaces. These are, in turn, a function of dune surface processes and migration behavior, allowing for predictive models of reservoir behavior. Migrating, simple crescentic dunes produce tabular bodies consisting mainly of grain-flow cross-strata, and form the best, most predictable reservoirs. Reservoir character improves as both original dune height and preserved set thickness increase, because fewer grain-fall deposits and a lower percentage of dune-apron deposits occur in the cross-strata, respectively. It is probable that many linear and star dunes migrate laterally, leaving a blanket of packages of wind ripple laminae reflecting deposition of broad, shifting aprons. This is distinct from models generated by "freezing" large portions of these dunes in place. Trailing margins of linear and star dunes are prone to reworking by sand-sheet processes that decrease potential reservoir quality. The occurrence of parabolic dunes isolated on vegetated sand sheets results in a core of grain-flow and grain-fall deposits surrounded by less permeable and porous deposits. Compound crescentic dunes, perhaps the most preservable dune type, may yield laterally (1) single sets of cross-strata, (2) compound sets derived from superimposed simple dunes, or (3) a complex of diverse sets derived from superimposed transverse and linear elements.

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Impact of Stylolites on Carbonate Reservoir Continuity: Example from Middle East

Growth of stylolites may adversely affect the continuity of carbonate reservoirs by producing barriers to fluid flow. The impact of stylolite development on reservoir performance, however, may differ from one part of a reservoir to another. Therefore, for effective reservoir management, the distribution and the permeability of stylolite-bearing beds should be known. In an example from the Lower Cretaceous of the Middle East, 3 zones of stylolites (D1, D2, and D3) are important to reservoir management. Only the uppermost zone (D1) is a significant barrier to fluid flow. Because the impermeable zone (D1) formed largely before oil entrapment, local precipitation of calcium carbonate occurred at abundant crystal-nucleation sites adjacent to the stylolite zone. The other stylolite zones (D2 and D3) were formed largely during or after oil entrapment. Oil inhibited carbonate precipitation by coating crystal nucleation sites. Calcium carbonate, dissolved at pressure-solution surfaces, was then transported away from stylolite zones prior to precipitation. Consequently, stylolites formed after oil entrapment do not constitute significant barriers to fluid flow.

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Controls on Porosity and Dolomite Distribution in Upper Smackover Formation (Upper Jurassic), Southwestern Alabama and Western Florida

Upper Smackover carbonates of southwestern Alabama and western Florida exhibit arcuate trends of porous dolomitized grainstones separated by areas of impermeable muddy limestones. The origin of these porous trends is related to the depositional and diagenetic history of upper Smackover carbonates and overlying Buckner evaporites. Shoal-water oolitic and peloidal grainstones of the upper Smackover were deposited across basement and salt-related topographic highs. Subsequent aggradation and stepwise progradation of oolitic shoals over low-energy packstones and wackestones produced a complex sea-floor topography of arcuate oolite ridges (highs) and elliptical muddy lagoons (lows). Marine regression during Buckner deposition led to the formation of saline ponds and sabkhas that were initially located over Smackover lagoonal lows and rimmed by Smackover oolite ridges. Precipitation of evaporites within these depressions created magnesium-rich brines that selectively dolomitized adjacent Smackover carbonates. Both the outflow of brine and the pattern of dolomitization were controlled by the fluid transmissibility of Smackover sediments. Consequently, permeable oolitic and peloidal grainstones were preferentially dolomitized over less-permeable muddy carbonates. A possible hydrologic analog for the study area exists within the MacLeod Evaporite basin, western Australia.

Following burial, dolomites maintained greater effective porosity on the flanks of basement and salt-related topographic highs than on the crests.

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Modern Analog for Deep-Water Deposition of Shallow-Water Pliocene Sands, Gulf of Mexico

Paleoenvironmental studies using benthic foraminifers and total fauna can be used to identify displaced shallow-water sands. A productive sand in Eugene Island field, which has a high resistivity but suppressed spontaneous-potential, was conventionally cored to determine reservoir characteristics and environment of deposition.

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-