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Diagenesis of Lower Tuscaloosa as Seen in du Pont de Nemours 1 Lester Earnest, Harrison County, Mississippi

The lower Tuscaloosa occurs at depths between 9,010 and 9,650 ft in the du Pont de Nemours 1 Lester Earnest well, Sec. 4, T8S, R13W, Harrison County, Mississippi. The diagenetic history of the section has been determined by means of thin-section, SEM, and XRD studies. The diagenetic sequence can be resolved into the following stages: (1) mechanical compaction; (2) early pyrite and nodular siderite development; (3) relatively early dissolution of feldspars and lithic fragments; (4) authigenic chlorite formation; (5) "wheat seed" and rhombic siderite formation, probably early; (6) syntaxial quartz cementation; (7) formation of authigenetic vermiform kaolinite, and precipitation of poikilotopic ferroan calcite and ankerite cement; and (8) carbonate cement dissolution, possibly accompanied by further silicate dissolution and minor amounts of additional mechanical compaction.

The ferroan calcite and ankerite cements are both characterized by sweeping extinction, more pronounced in the ankerite. The semiquantitatively analyzed calcites contain approximately 6% total iron plus manganese. "Minus cement porosity" values (sum of volume of open pore spaces plus volume of cement) suggest very early cementation at shallow burial depths. However, the cement composition indicates a much deeper site of origin, and close examination of cement-grain contacts suggests that much grain-surface etching and grain replacement have occurred. The general applicability of minus cement porosity curves for determining depth of cementation (as used by some authors) is therefore thrown into doubt, unless replacement carbonate can clearly be separated from true (pore-filling) cements.

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Submarine Fan Diversion by Tectonic Processes—Magdalena Fan and Slope, Southern Caribbean

The present site of deposition of deep-water sediments sourced by the Magdalena River is a series of slope valleys and the abyssal plain north and east of the present river mouth. During the Pliocene and early Pleistocene, sediments were actively fed to the Magdalena Fan southwest of the river mouth. Uplift of the Atlantico-Turbaco hills across the river's course caused the depositional site to shift east and northeast. Since then, the river has partially filled its estuary and has prograded three small, submerged delta lobes across a narrow shelf and has begun developing a new fan surface with leveed channels north-northeast of the river mouth, extending to water depths of about 1,100 m. This appears to be the site of the newly prograding, predominantly muddy fan system.

While fine sediment and some sand are being transported downslope by leveed channels originating near the crest of the river mouth bar, slumps of bed-load sediment are feeding the heads of submarine canyons northwest and west of the river mouth. Detailed bathymetric mapping of the continental slope reveals an integrated canyon system transecting northeast-southwest-trending valleys and ridges. Most of the river bed load appears to be transported down the submarine canyons, either to be deposited in the valleys or to be transported to the abyssal plain after several episodes of entrainment. The present distribution of sediments in the canyons and valleys reflects an ephemeral suite of turbidite facies with widely varying rates of accumulation.

Four lithofacies were recognized in piston cores from the continental slope. Sand occurs as massive beds from 20 cm to more than 3 m thick in upper slope canyons and in small channels within synclinal valleys. Interbedded sand and silty clay comprise a second facies consisting of 0.2 to 65-cm sand beds separated by thin clay and silty clay interbeds. This facies occurs mostly on the upper slope near the river mouth where the surface of the new submarine fan system is developing. The facies grades laterally and downslope into pelagic clay.

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Reconstructing Paleoenvironments of Jameson (Strawn) Reef Field, Coke County, Texas

The Jameson reef is an elongate, strike-trending mud buildup that occurs within the Middle Pennsylvanian (Desmoinesian) Strawn reef trend of west-central Texas. It consists primarily of carbonate wackestones, mudstones, and packstones with smaller units of *Chaetetes* framestones and grainstones.

Microfacies analyses indicate that the buildup was deposited on a warm, shallow-water carbonate platform characterized by downslope mud accumulations and upslope calcarenite beaches and islands. The shape of the buildup was controlled by ocean currents, which spread the sediments laterally and downdip.

The sediments were exposed to early marine and meteoric diagenesis as well as late subsurface diagenetic processes. Marine diagenesis includes primarily micritization of component grains. Leaching occurred in the meteoric phreatic environment following micritization. The leaching produced intergranular, intragranular, moldic, and vuggy porosity. A later transgression placed the buildup in the meteoric phreatic environment that induced cementation, partially filling pore spaces. The grainier rocks were cemented to a greater degree than the wackestones. Dolomitization occurred in the mixing zone where dolomite rhombs generally filled pores in the micrite matrix. Diagenesis culminated with stylolitization in the deep subsurface reducing porosity.

The middle zone of wackestone makes up the best reservoir rock mainly because selective cementation of the grainier rocks occurred in the meteoric phreatic environment.

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Seismic Stratigraphy of Winedale Prospect: Updip Wilcox Trend, Onshore Texas Gulf Coast

In the central Texas Gulf Coast, the late Paleocene–Eocene lower Wilcox Formation consists predominantly of massive sandstones updip of the Lower Cretaceous shelf margin. An exception is in northern Lavaca County where the lower Wilcox was incised by submarine canyons (e.g., the Yoakum shale channel) during middle Wilcox deposition. Productive sandstones in Valentine field and other nearby fields are remnants of the lower Wilcox between, and in places below, these shale-filled canyons.

Regional speculative seismic data were examined northeast of the anomalous Lavaca County area to find analogous geologic conditions in unleased acreage. In northeast Fayette County, near Winedale, terracing was found at the Lower Cretaceous Edwards and Sligo levels, with a corresponding wipeout of reflectors within the lower Wilcox above the terracing. Seismic data indicated that the terracing had localized lateral continuity. A flat spot, mapped at lower Wilcox, Edwards, and Sligo levels, was found to influence even the surface topography. When regional dip was removed, the present-day flat spot became a closed structure.

A well drilled to test the lower Wilcox reflection wipeout zone resulted in a discovery with an initial potential of 2.5 MMCFGD and 50 BCPD. Sidewall cores of the high-resistivity spikes bounding the producing sand encountered lignitic coals. A synthetic seismogram of the producing well showed that the top of the lower Wilcox, as picked on the regional seismic data, correlated to the uppermost coal. Because the discovery well had a water contact, two delineation wells were drilled updip. These wells were 5,000 ft apart, and each was about 3,000 ft from the discovery well. The producing sandstone pinched out, and both offset wells were dry holes.

The massive, lower Wilcox sandstones did not correlate well between the three wells, but individual coals and groups of coals made excellent correlations. Seismic data showed that the lower Wilcox was composed of a series of cycles, and cycle boundaries correlated with slightly thicker coals or groups of coals of widespread areal extent. Within the producing-sand seismic cycle, strong pinch-outs were seen on the strike and dip seismic lines near the producing well, as well as within other seismic cycles. However, a three-dimensional program is needed to trace the pinch-outs within various seismic cycles across the Winedale structure.