(0.28-mm) quartzose sandstones; (2) a rippled facies is thinly interbedded shale and fine-grained (0.17-mm) sandstone; and (3) a bioturbated facies is highly churned, very fine-grained (0.12-mm) sandstone. These facies result in permeabilities decreasing from an average 47 md in the south to 0.1 md in the north.

The "C" sandstone was deposited in a middle to outer shelf location, and sands were supplied by storm-driven or tidal currents from the "Harris delta" to the east. The south limit of the reservoir is controlled by a deep northeast-trending salt dome or ridge, called Hill dome. The upper Woodbine-Eagle Ford section was truncated by erosion along this trend and unconformably overlain by carbonate muds of the Austin Chalk. Sandstone facies suggest that salt uplift during deposition created a high on the sea floor, which was scoured by currents. Successively finer grained sands were deposited to the north under conditions of decreasing current flow and increasing water depths.

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Variations in Gulf Coast Heat Flow Created by Ground-Water Flow

Two major regional trends in Gulf Coast heat flow have been noted: a decrease in temperature at given depths basinward and an increase in geothermal gradient with depth. These trends are complicated by local heat flow anomalies. Although basement heat input may have increased during a Mesozoic rifting episode, it has probably remained essentially constant since the Late Jurassic. Therefore, the regional differences in heat flow must be the result of intrinsic sediment properties, sediment deposition, and fluids moving through the sediments. Numerical modeling indicates that the major regional trends can be explained by a moving-boundary effect caused by continuous, long-term sediment deposition, coupled with forced convection caused by the compaction of the sediments. Deposition of cool sediments depresses the isotherms until the sediments can be heated to normal levels. Marginward heat advection due to lateral and upward movement of fluids through the more permeable sediments also contributes to the regional trend of higher temperatures in the older, inland sediments. Local perturbations (abnormally high temperatures) are caused by fluid movement focused along fault zones or flanks of salt domes. Observed thermal anomalies near salt domes may be caused primarily by fluid movement, not by the greater thermal conductivity of salt. Finally, theoretical and field evidence indicates the possible occurrence of free convection in the Gulf Coast basin, which may be an important factor in the heat flux on both a regional and a local scale.

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Seismic Stratigraphy and Sedimentology of Mississippi Fan

Eight seismic reflectors within the Pleistocene Mississippi fan, Gulf of Mexico, have sufficient areal extent to allow the construction of isopach and structure contour maps. These maps show that the fan was constructed by at least seven elongate fan lobes that moved slightly eastward and basinward with time. A fan lobe is basically a channel-overbank complex that can be divided into (1) an upslope erosional canyon formed by retrogressive slope failure; (2) an upper fan characterized by a major channel that acted as a conduit for sediment transport to deeper water; (3) an aggradational middle fan, convex in cross section, with a sinuous, migratory channel running along its apex; and (4) a lower fan where the channel frequently shifted position and often bifurcated prior to termination with the depositional mode changing from channelized to nonchannelized (sheet sands).

Drilling on the middle fan revealed that the channel fill contains a fining-upward series commencing with gravel, overlain by pebbly mud and sands, which gradually change into laminated silty muds and fine muds. The overbank deposits are very sand-poor and contain thin-bedded, fine-grained turbidites. Sedimentation rates inside and outside the channel range from 11 to 12 m/1,000 years. Fauna is sparse and indicates an upper and middle neritic origin.

The channel complex on the lower fan shows a decrease in size and sinuosity of the youngest channel. Drill holes reveal alternating "channel" and "overbank" deposits, supporting the concept of frequent shifting of the channel. At the distal end in the sheet-sand depositional area, sands are up to 9 m (30 ft) thick. Total net sand, based on gamma-ray logs, for the youngest fan lobe was calculated to be 47%; for the underlying one, 65%. Average sedimentation rates are 5-6 m/1,000 years.

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Distribution of Crust and Early History, Gulf of Mexico Basin

Studies of an extensive regional grid of multifold seismic data and refraction data in the deep central Gulf of Mexico combined with studies from surrounding regions provide a generalized picture of the geologic framework and tectonic setting of the basin. Various criteria—including seismic reflection data, seismic refraction data, depth to basement, gravity, magnetics, distribution of Jurassic salt and sediments, and total tectonic subsidence analysis—provide a basis for characterizing and mapping the distribution of oceanic crust, thin transitional crust, and thick transitional or continental crust. This distribution of crust provides constraints for reconstructing the gulf area, which involves closing up oceanic crust and then transitional crust.

This reconstruction provides room to accommodate any overlap of South America with Yucatan and supports a counterclockwise rotation of Yucatan out of the northern Gulf of Mexico. It is compatible with other published reconstructions that treat Yucatan as a separate block independent of South America, particularly ones that rotate Yucatan out of the gulf in a counterclockwise manner. The reconstruction also is compatible with a general model for the early evolution of the gulf basin that includes (1) a Late Triassic to Middle Jurassic rift stage and formation of transitional crust, culminating with the widespread deposition of evaporites; (2) a brief Late Jurassic period of oceanic crust formation in the deep central gulf; (3) a Late Jurassic through Early Cretaceous period of cooling and subsidence of the crust, and buildup of extensive carbonate platforms surrounding a deep basin; and (4) formation of a widespread middle Cretaceous unconformity.

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Reinterpretation of Early Cretaceous Carbonate Platform on Abaco Knoll, Northern Bahamas

Lower Cretaceous shallow-water limestones were dredged from between 2,300 and 3,000 m below sea level along the northeastern slope of Abaco Knoll in the northern Bahamas, and crystalline dolomites were dredged from between 3,600 and 4,000 m below sea level along the southwestern slope of the knoll. Among the shallow-water limestones is a coral-rudist boundstone, which represents one of the first pieces of an Early Cretaceous reef recovered in the northern Bahamas. The depositional setting of this reef could either have been a patch reef on an open platform or part of a platform margin complex.

The dredged intervals are below the top of a drowned shallow-water platform identified on a nearby multichannel seismic reflection line. The recovered carbonates confirm that the knoll is a drowned Early Cretaceous carbonate platform and suggest that the platform on Abaco Knoll was part of a broader Early Cretaceous megaplatform, which extended west beneath Northeast Providence Channel. Shallow-water limestones of Barremian to Aptian age from the northeastern slope of the knoll indicate that the platform was drowned sometime after the Aptian.

Early Cretaceous stratigraphic horizons at Abaco Knoll and nearby DSDP Site 98 are vertically offset. Depending on the depth of recovery for the dredged rocks, relief between the horizons is at least several hundred meters and might be as large as a kilometer. This relief can be explained by either (1) a fault or series of faults along the southwestern flank of Abaco Knoll, or (2) depositional relief between an Early Cretaceous platform (i.e., Abaco Knoll) and an adjacent deep-water basin (i.e., Northeast Providence Channel). The recovery of inferred shallow-water dolomites from the southwestern slope of Abaco Knoll, seismic stratigraphic reinterpretations, and previously published magnetic anomaly patterns suggest that faulting is the more likely explanation.