Late Cretaceous to Tertiary subsidence and global eustasy are recorded in the sedimentary basins along the Gulf of Guinea in the eastern Equatorial Atlantic margin. The major marine transgressions occurred in the middle to late Albian, late Cenomanian to early Turonian, late Turonian to early Santonian, late Campanian to Maestrichtian, middle to late Paleocene, middle to late Eocene, late Oligocene, and early to middle Miocene. Foraminiferal and ostracod ages from the Benue Trough, the Niger Delta, and the Dahomey Embayment in Nigeria and Benin Republic allow a time framework whereby comparisons of the timing of marine events and faunal developments can be made across the Atlantic Ocean. Although the eastern margin of South America has been the traditional area in which similarities are sought with West Africa, comparisons with the eastern margin of North America are becoming feasible as more information accumulates from the latter region.

Foraminiferal paleo-ecologic data from the Nigerian basins allow the recognition of intervals of paleo-anoxicity, and the delineation of trends of ancient submarine canyons.

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Effect of Large-Scale Shifts of Gulf Stream on Miocene Sedimentation Patterns of Southeastern U.S. Continental Margin

A broad scour band bordered by zones of nondeposition is present today beneath the high-velocity core of the Gulf Stream; deposition takes place on either side of the scour band where bottom currents are weaker. Because the Gulf Stream serves as a barrier to the seaward dispersal of river-derived detritus, deposits are compositionally zoned; clastic sediment blankets the Florida-Hatteras shelf and slope and carbonate oozes, the Blake Plateau. Similar bands of erosion and nondeposition are observed in buried Cenozoic deposits across the Blake Plateau and under the shelf. The character and areal distribution of these bands suggest earlier Gulf Stream tracks. The vertical and horizontal distribution of these unconformities and their timing coincident with high and low stands of sea level as mapped by Vail suggest that they result from a dynamic response of the Gulf Stream to global sea-level oscillations and that the Gulf Stream axis shifts landward against the Florida-Hatteras slope during high stands of sea level and seaward across the central Blake Plateau during low stands of sea level. As a consequence, a complex sedimentary record is produced in which the scour band and sedimentary facies shift landward with deepening water and seaward with shoaling water.

This hypothesis was tested with a sedimentation model based on Vail's sea-level curve for the Miocene. The model successfully predicts the distribution of sedimentary facies, location of depocenters, and disposition of major unconformities within the Miocene section of the region as defined by seismic reflection profiles and drill-hole data from nine well sites. These results suggest that large-scale shifts in the position of the Gulf Stream have exerted the primary control on sedimentation patterns along this sector of the continental margin.

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Relation of Miocene Phosphorite Sedimentation to Structure in Atlantic Continental Margin, Southeastern United States

Regional sedimentologic and stratigraphic studies of Miocene phosphorites on the continental margin of the southeastern United States demonstrate a strong structural control over the formation and deposition of major concentrations of phosphorite in the Hawthorn and Pungo River Formations. The first-order structures controlled the regional limits of the phosphogenic system and provided the necessary depositional environments. Major phosphate sedimentation was concentrated along the nose and flanks of the Ocala arch and Carolina platform and decreased to a minimum into the intervening Southeast Georgia and Hatteras Embayments. Recent discoveries of Miocene phosphorite on the North Carolina continental shelf, in combination with the extensive lag deposits of phosphate on the Blake Plateau, represent a major phosphogenic system which occupies a position relative to the Carolina platform that is analogous to that of the major central and south Florida phosphogenic province relative to the Ocala arch.

Superimposed upon the regional structural framework is a series of second- and third-order structural highs and adjacent basins. Each structural high producing a platform or shoaling environment with the necessary associated accumulation basins, may contain one or more phosphate deposits. The specific location, size, and geometry of the resulting deposit is dictated by the folding or faulting, subaerial or submarine erosion, primary depositional processes, groundwater solution and collapse, etc. The location of the second- and third-order structures and the first-order structural highs dictates the subsequent depositional-erosional history. The latter determines the ultimate preservation and degree of secondary alteration of each phosphate deposit.

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Depositional Patterns of Neogene Sediments Around Carolina Platform on Mid-Atlantic Continental Shelf

An extensive network of high-resolution uniboom subbottom seismic profiles in combination with 9-m vibracores was obtained across the North Carolina continental shelf in Onslow Bay. Resulting data delineate an extremely complex depositional pattern of the Neogene sediments around the east and southeast flank of the Carolina platform. This major broad platform structure trends southeast across the Mid-Atlantic shelf and consists of Paleogene and Cretaceous sediments. The Neogene section, dominated by the Miocene Pungo River Formation, forms a complex clinoform sediment package which dips and thickens eastward and southeastward from the platform margin. This sediment package consists of numerous depositional sequences which are abruptly truncated by erosional surfaces and associated channels. Each channeling system was subsequently filled during the following depositional regime. The depositional sequences, which may reflect third- and fourth-order cyclical events, are characterized by interbedded lithologies consisting of phosphorite sands, phosphatic foraminiferal muds, dolosilts, and calcareous quartz sands. Deposition of the Pungo River Formation reflects deposition on a major second-order transgressive cycle. Thus, the upper part was deposited over the edge of the Carolina platform filling numerous erosional channels in the underlying sedimentary units. Postdepositional folding followed by subsequent erosional cycles severely truncated the sediments again. This resulted in a series of flexure basins and channels, filled with Pungo River sediments, lying on top of the Carolina platform as isolated outliers. The complex depositional erosional patterns of the Pungo River sediments reflect several orders of complex cyclical sedimentation taking place on the continental shelf during the Miocene.