Disc Contents Contents Search

# MULTIPLE LATE CENOZOIC SHORE INDICATORS OR TECTONIC LINEAMENTS, NORTHEAST GULF OF MEXICO

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## ABSTRACT

Partly as reaction to correctly interpreted stair-steps of shore-parallel barrier-lagoonal complexes on our mid- and south Atlantic coastal plain that reflect various Late Cenozoic high sea level stands, repeated attempts had been made in the past half century on the Mississippi, Alabama and Florida Panhandle coasts to find correlatable shoreline indicators on the northern Gulf Coast. Cooke (1939, 1945), Brown *et al.* (1944), Doering (1956) and about a dozen authors in recent years employed overly generalized interpretations of the topography, explaining it in terms of coastal marine landforms, without the study of underlying sediments. On the basis of detailed core drilling and field surveys, only a single, Late Pleistocene coastal marine sequence can positively be identified on the Mississippi-Alabama coast (Otvos, 1972, 1975).

Found in the north-central coast, but also correlatable with Louisiana, Texas and Florida Panhandle coastal areas, this complex includes the Sangamon Interglacial, Biloxi, Gulfport and Prairie Formations.

The sandy-muddy, transgressive Biloxi Formation (Otvos, 1972, 1975), commonly rich both in microfossils and molluscans, includes various depositional facies, ranging from open-nearshore to brackish-estuarine deposits. Under the west Mississippi coast, it intercalates with the alluvial Prairie sediments and contains mostly *Ammotium salsum*, also few additional agglutinated foram species and *Ammonia beccarii. Campylodiscus echeneis, Eupodiscus radiatus* and *Cosmiodiscus beaufortianus* and other diatoms occur frequently. Seaward, thickening to 15.4 m and overlain by an unusually thick (13.8 to 20.1 m) Prairie sequence, the Biloxi sediment include varied, open-marine foram faunas, dominated usually by *Nonion depressulum matagordanum, Buliminella elegantissima, Nonionella atlantica, N. opima, Ammonia beccarii* and *Hanzawaia strattoni,* each with maximum values of 53 to 82 percent; commonly 5 to 30 percent of the total. *Elphidium incertum mexicanum* and *Brizalina lowmani* were also abundant. Spatial configuration of the facies indicated absence of barrier islands and lagoons offshore at this time. The presence of heavy mineral spectra and four Upper Cretaceous planktonic foram species of Texas-Oklahoma derivation in several drillholes proved the contribution of the Mississippi River to the formation in southwestern Mississippi. A post- and/or syndepositionally leached Biloxi facies, without calcareous shells of fossils is known from the Santa Rosa Island area, Florida Panhandle.

On the seaward side of the present mainland shore, the Biloxi is often overlain by the usually 3 to 8 m thick, regressive barrier sand sequence of the Gulfport Formation. It is correlative with the Texas Live Oak-Ingleside barrier trend. *Callianassa* burrow tubes in the dark, humate-impregnated lower section represent the only fossils known from the formation on at least the northeast Gulf. In most areas the Gulfport has the morphology of a prograded strandplain, but in the western Florida Panhandle it forms a featureless sand sheet, without the characteristic ridge-and-swale topography.

Attempts at identifying high Pleistocene shorelines on the Mississippi coast centered in Big Ridge Scarp, a c. 20 km-long, 4.5 to 6.0 m high escarpment in Harrison and Jackson Counties. Brown *et al.* (1944) were the first to call it "an old beach promontory." Theories of beach, barrier, spit, or wave-cut scarp origins have since been periodically revived. This scarp is cut in silty-sandy, sandy, occasionally gravelly, clayey and lignite-bearing alluvial beds, deposited after the Late Pliocene (?) Citronelle Formation and before the Sangamon transgressive-regressive sequence. The level surface at about 13.5 m elevation and the silty sands that immediately underlie it, bear no resemblance to beach and dune ridge morphology and associated sediment textures. A large borrow pit 4 km north of the Scarp (NW ¼ of sec. 34, R. 9 W., T. 6 S.) provides the best illustration for the variable lithofacies relationships.

Alluvial, cross-laminated silty sands predominate in this 6 m thick sequence. In the western part of the pit, a large body of maximum 2 to 3 m thick, finely laminated and bedded gray sandy muds with considerable clay content interfinger with the silty sands. Finely comminuted, dark organic material occurs in parts of the sandy muds, along with roots in growth position and lenses of carbonized woody detritus. In the southwestern pit wall the maximum 75 cm-thick lenses of concentrated, carbonized pine wood fragments include slash and loblolli pine (*Pinus elliottii* and *P. taeda*) cones. These still are the dominant species of the surrounding forests. These units represent floodplain lake deposits.

While conclusive subsurface evidence is not yet available, the probability that the escarpment is a fault scarp is strongly suggested by numerous, parallel drainage lineaments north of and parallel with the scarp, and by elongated, sag pond-like features along its toe. The rectangular pattern of lineaments continues from the earlier Pleistocene land surface, north of the Scarp, in an easterly and southerly direction over the adjacent younger Prairie land surface (T. 7 S., R. 7 and 8 W.).

Similar shore-parallel escarpments, cut in alluvial Citronelle and Prairie deposits have also been mistaken for beach ridges, bars and spits in coastal Alabama and the Pensacola area of the western Florida Panhandle (Carlston, 1950; Marsh, 1966). In the Coden Quadrangle, Alabama such a scarp, in Prairie alluvial deposits, is in lateral continuity with a Citronelle scarp segment to the west and suggests renewed structural movements. Sag pond-like features along Citronelle scarp toes occur in south Hancock County, Mississippi and may indicate tectonic origins. A wide belt of parallel, arcuate interfluve ridges, cut in Citronelle (?) and underlying deposits in the central Florida Panhandle was named part of an early "Gadsden" shoreline sequence by Winker and Howard (1977). In the absence of sediment, fossil and geomorphic evidence, instead of shoreline features, the interfluves also appear to result from tectonic causes that influenced the regional drainage pattern. Clear-cut examples of pre-Sangamon marine littoral and associated brackish inshore deposits and landforms are yet to be demonstrated on the northeast Gulf.

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Coastal plain lineaments with suspected tectonic origin and expressed in scarps, rectangular drainage patterns, including abrupt river course changes apparently also influenced the outline of certain Late Pleistocene and recent shoreline segments.

The contrast between numerous pre-Sangamon Atlantic coastal plain barrier-lagoon complexes and their absence on the Gulf Coast may have regional tectonic explanation. No pre-Sangamon Pleistocene marine and brackish inshore units were found in drillholes in the Mississippi-Alabama and Apalachicola Bay areas. The Biloxi Formation often rests on late Miocene deposits. Coastal progradation apparently was minimal between Citronelle and Sangamon times.

Repeated vertical movements in the narrow (0 to 17 km) Pleistocene coastal plain on the NE Gulf may have been instrumental in the wholesale erosion of the earlier littoral units. The relatively high (20 to 40 m) summit elevations of the Citronelle Formation along the present shore imply significant Pleistocene uplift. During glacial stages, the surface relief and erosion intensity increased further.

# BED FORMS ON WEST FLORIDA SHELF AS DETECTED WITH SIDE-SCAN SONAR

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## ABSTRACT

A Side-Scan Sonar investigation on the West Florida shelf reveals a multitude of bed form types. A nongenetic classification was devised based on apparent wavelength and ripple index (R. I. = Wavelength/wave height). This system divides the observed features into four groups: *Giant* - wavelength greater than 30 meters, R. I. 30 to 100; *Large* - wavelength less than 30 meters but greater than 1 meter, R. I. 15-30; *Small* - wavelength less than 1 meter, R. I. 5 - 15; and *low-relief swells* - wavelength greater than 300 meters and relief only a few meters.

Five major zones roughly parallel to the coast are delineated according to the distribution of bed form types.

Zone A, parallels the coast line out to approximately 20 meters depth and is characterized by giant to large scale bed forms. These features are observed on the sonographs as long, sinuous, and sometimes bifurcating, troughs of high reflectivity (coarse-grained?) sediment, interspaced with mounds of presumably finer grained material. Similar bed forms described in the literature have been labeled "current lineations."

Zone B extends out to mid-shelf depth (40 to 100 m) and is characterized by "low-relief swells" and a few patches of giant to large-scale features. The low relief swells at times correlate with large elliptical patches of apparently fine sand on a relatively coarser grained, flat, seafloor.

Zone C is centered around the Florida Middle Gounds region and is characterized by small-scale bed forms and low-relief swells. These small scale bed forms observed on the sonographs resemble current ripples. The orientation of these ripples varies from predominantly N-S across the Florida Middle Grounds to an E-W orientation in areas farther south.

Zone D is situated offshore Cape San Blas along the Florida panhandle. The bed forms in this zone are characterized by high relief (2.0 to 8.0 m) giant scale features. Superimposed on the giant-scale bedforms and on the seafloor fringing this zone are small-scale bedforms resembling current ripples.

Zone E encompasses the outer shelf and is generally void of bed forms. However, a few unusual giant to large scale features are observed.

Most of the giant, giant to large and large-scale bed forms on the west Florida shelf are considered to be storm related features. In some cases the giant scale features and the low-relief swells may be relict structures left over from times of lowered sea level. The small-scale bed forms within Zone C are possibly the results of either internal waves or tides set up on the summer thermocline and/or currents created by Loop Current intrusion on the shelf. The latter event may also generate strong shelf edge currents creating the bed forms in Zone E.

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