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A New Stratigraphic System, Geological Evolution and Potential Economic Sand Resources in the Mississippi Sound Area, Mississippi-Alabama

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The Mississippi Mineral Resources Institute
University, Mississippi 38677

A NEW STRATIGRAPHIC SYSTEM,
GEOLOGIC EVOLUTION AND POTENTIAL ECONOMIC SAND RESOURCES
IN THE MISSISSIPPI SOUND AREA, MISSISSIPPI-ALABAMA

Final Report to Mississippi Mineral Resources Institute

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INTRODUCTION

The purpose of the report is to summarize available, detailed-geological information about the stratigraphy, sand resources, and geological history of units that underlie the entire Mississippi Sound and certain adjacent areas. These data until now were inaccessible to the interested public and the specialists. Information was obtained from 105 rotary and vibracorehol es, drilled during the past decade. Only part of the rotary drillholes were drilled during scientific investigations by the Gulf Coast Research Laboratory, the rest were obtained from the U.S. Corps of Engineers, an oil company and a foundation engineering firm. Through the efforts of Dr. James R. Woolsey, Director, The Mississippi Mineral Resources Institute and his staff, vibracore samples from recent MMRI and Mississippi-Alabama Sea Grant Consortium drilling projects also became available. Over one thousand granulometric and microfossil analyses have been performed on the samples and the results provide the hitherto most complete account of the geological evolution of the Sound area. Additional samples from Mississippi Sound area and the Gulf nearshore drill sites off the barrier island chain currently are in the process of being analyzed. A forthcoming report would detail this information, including the geology and sand resources of the barrier islands chain and the adjacent inner shelf.

Sediment analyses at GCRL were performed by Wade E. Howat and Howard Newby; microfossil studies by Wade E. Howat and Dr. Wayne D. Bock of Miami, Florida. The generosity of Exxon, Mobil Oil and Shell Oil Corporations in donating foundation core samples from offshore drill locations is deeply appreciated. These data helped to define the age of sedimentary units in Mississippi offshore areas.

STUDY METHODS

(1) Drilling Information

Drill samples were obtained from a variety of sources over a period of more than a decade, from the entire Mississippi Sound (including the Alabama segment) area. Both rotary and vibracore drilling methods were employed by various agencies. With the rotary method, individual core segments usually ranged up to 3^ ft length, with ft intervening, 1½ noncored intervals. However, occasionally longer continuous cores were also taken in stratigraphically important depth intervals. Core diameters ranged between 1^-3 inches. Most of the rotary drillholes were drilled for the Gulf Coast Research Laboratory and the U.S. Corps of Engineers Mobile District, with two additional holes drilled by foundation engineering firms (Map 1; Appendix). The four deepest drill-holes (Appendix) demonstrate the late Neogen-Quaternary stratigraphic sequence in the subject area, with associated lithosomes and microfossil assemblages that characterize paleosalinity conditions of deposition. The total depth of barge-based, offshore rotary drillholes often is limited by the inability to reenter a drillhole, a problem absent in oil industry-related core sampling for foundation studies. These core-holes can penetrate 500 ft below sea level, including more than 400 ft through subbottom sediments.

Vibracores were short (usually 12-25 ft) continuous cores, obtained by a vibrating drillpipe that penetrates the soft subbottom deposits. Incoherent sands provide much poorer core recovery than better consolidated muddy-clayey sediments do. Vibracores were obtained from Mississippi Mineral Resources Institute (MMRI-series) and Mississippi-Alabama Sea Grant Consortium (SG-series; Appendix) drilling projects through the help of Dr. J. R. Woolsey, MMRI.

(2) Macroscopic description

Before being processed, the cores were described in terms of color, apparent grain size composition, inclusions, and sedimentary structures (oxidized surfaces, layering, bioturbation, trace and body fossils, etc.). Unconsolidated sandy units usually did not provie any useful structural traits.

(3) Sample preparation and processing

Samples taken at close vertical intervals from cores were first used for granulometric studies, then for microfossil analysis. A 100 g (sandy sample) or 60-70 g (silty) or 30-40 g (clayey) air dried sample weighed and dispersed in 30 ml 0.5 n Calgon (Na-hydrophosphate; NaH_2P0_4) solution for several hours to 1-2 days, was used in preparation for granulometric analysis by sieving and the hydrometer method.

(i) After initial preparation, samples were blended for 5-10 minutes in an electric blender and washed with distilled water into a 1000 ml cylinder. Hand-agitated thoroughly, until dispersed in cylinder. Hydrometer readings were taken for up to 8 hours to measure density of slurry. After this, slurry was decanted from cylinder and wet-sieved. Wet-sieving by 230-mesh (62.5 micron diameter) sieve passes the silt (3.9-62.5 micron) and clay (less than 3.9 micron) fractions through the sieve. The retained sand fraction was oven-dried and sieved for 15 minutes by the Ro-Tap method in nested sieves of -phi mesh diameter intervals.

Sieving produced the following sand fractions:

1 .0-2.0 mm very coarse sand	0.125-0.25 mm fine sand
0.5-1.0 mm coarse	0.062-0.125 mm very fine
0.25-0.5 mm medi urn	

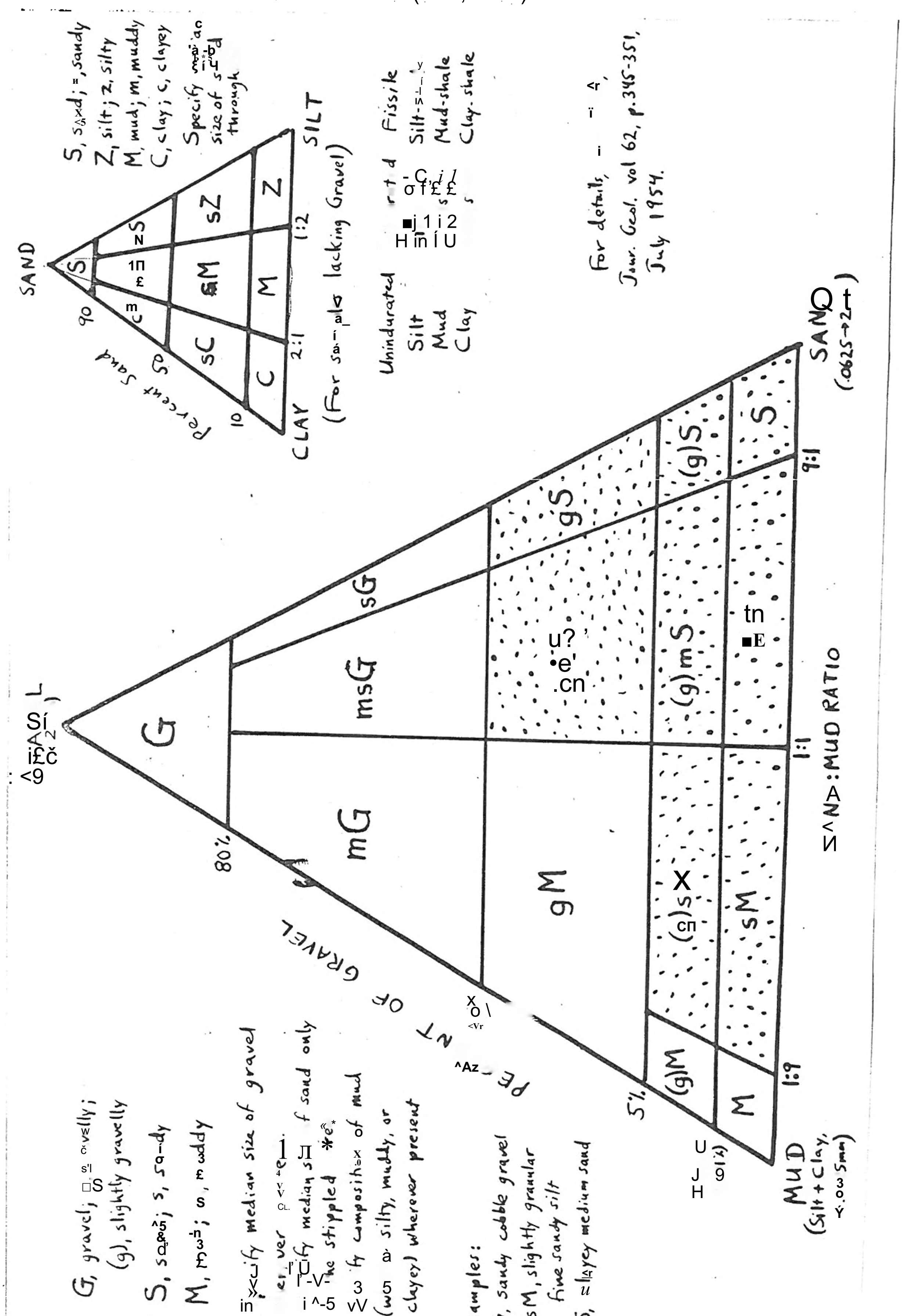
Results were computed to provide an integrated account on the grain size fractions and the statistical parameters of sorting, skewness and kurtosis. Folk's sand-silty-clay triangle (Fig. 1; Folk, 1961) was utilized in defining the granulometric sediment category. Skewness and kurtosis values were not employed in the sample descriptions but are still available on files. For sorting, Folk's inclusive graphic standard deviation (G_) was employed:

$$G_I = \frac{\phi 84 - \phi 16}{4} + \phi 95 - \phi 5$$

under .35 o very well sorted
θ'θ .35-. 50 d well sorted
.50-. 71 fi moderately well sorted
.71-1.00 fi moderately sorted
1.00-2.00 d poorly sorted
2.00-4.00 fi very poorly sorted

(iii) Microfossil analysis. Separate sample soaked in the dispersant solution were wet-sieved and air-dried. Carbon tetrachloride solution separated the light fraction that was decanted over filter paper and air-dried. In addition to marking presence of other microfossils (diatoms, ostracodes, sponge spicules, etc.), maximum 300-500 foraminifer specimens (depending on their abundance in given samples) were mounted on white-ruled paleontological slides under microscope. Tragacanth gum, treated with clove oil against bacterial growth was used for attachment. Identification to species rank was done at GCRL or by an outside specialist (Dr. W. Bock of Miami). The statistical composition data was evaluated in light of available salinity biotope information from various sources in the literature (see: Bandy, 1956; Otvos, 1981, 1985a; Phleger, 1954, 1955, 1960; Walton, 1960). Table 1 provides a listing of the main salinity biotope categories encountered, as interpreted from the foraminifer populations. All the available core

Figure 1. Sand-silt-clay composition diagram in siliciclastic sediment nomenclature (Folk, 1961).



information was integrated on "strip logs" that formed the basis for construction of geological cross sections.

TABLE 1. DESCRIPTIVE SALINITY BIOTOPES BASED ON FORAMINIFER ASSEMBLAGES.

(1) Very brackish

Domi nant

Ammoti urn sal sum (0-100%)
Ammoni a beccari i (0-100%)

Secondary (Usually less than 10-50% unless in a marsh.)

Ammobaculites exiguus
A. exi 1 i s
Trochammi na sp.
Mi 1 i ammi na fusca
Jadammi na polystoma
Arenoparella mexicana
thecamoebians
Haplophragmoides subinvolutum
H. canariense
Ammoastuta inepta

Very few (1-3) species dominate each sample.

(2) Moderately brackish

Domi nant

Ammonia beccarii (30-60%)
El phi di um galvestonense (10-50%)

Secondary

Ammoti um sal sum (0-20%)
Noni on depressulum matagordanum (0-15%)

Less than 5%

Cribroei phi di um pal meri nel la garden!si andensi s
El phi di um 1ati spati um ponti um
Bul imi nel 1 a elegantissima

15 or less species in this Biotope Group

(3) Brackish

Dominant (40-60%)

Ammonia beccari i tepi da (10-35%)
Noni on depressulum matagordanum (5-30%)
El phi di um galvestonense (10-30%)

Secondary (0-10%)

Hanzawaia strattoni (0-10%)

Secondary (30-40%)

(a) Relatively lower salinity within Biotope Type (3):

Cribroelphidiurn poeyanum (0-10%)
Ammonia beccar!i parkinsoniana (0-10%)
Bui imi nella eleganti ssima (0-10%) (significant organic content in sediments also favors this species)
Hanzawaia strattoni (0-5%)

(b) Relatively higher salinity within Biotope Type (3):

Hanzawaia strattoni (0-10%)
Nonionella opima (0-15%)
El phi di um i ncertum mexi canum (0-5%)

Following species together represent 5-10% of sample total. Each, less than 1%:

Fursenko!na sp.
El phi di urn 1 ati spat!urn ponti urn
E. advenum
E. sp.
Brizai i na lowmani
Quinqueloculina sp.
Tri locul ina sp.
Guttuli na sp.
Ci bi ci des sp.
Nonionella atlanti ca
Gl obi geri noi des sp.
Globi geri na sp.

Great species diversity in this Biotope Group.

(4) Marine

Domi nant

Hanzawaia strattoni (15.0-50.0%)

Secondary

El phi di urn galvestonense (5-20%)
Ammonia beccar!i (10-15%)
Nonion depressulurn matagordanum (10-15%)

5-10%

mi 1iolids
Quinqueloculina lamarckiana
Q. semi nul um
Bul imi nella sp.
Rosal i na columbiensis
Nonionella opima
Elphi di um incertum mexi canum
Cribroelphi di um poeyanum

0-5%

Bigeneri na irregularis
Textui ari a mayori
T. aggi uti nans
T. candeiana
Cibici des floridanus
Cassi dul i na subglobosa
C. crassa
Reussei 1 a atlantica
El phi di urn discoidale
Buccel1 a hannai
Tri fari na bella
Sagri na pulchella primitiva

Highest species diversity occurs in Biotope Group (4).

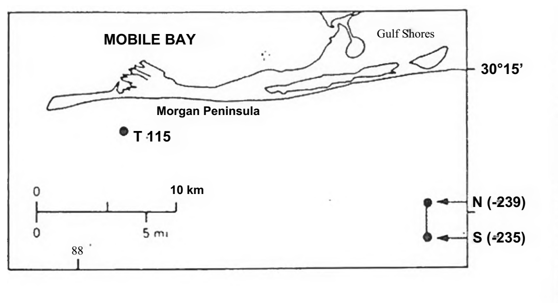
GEOLOGIC EVOLUTION AND STRATIGRAPHIC OUTLINE OF MISSISSIPPI COASTAL UNITS

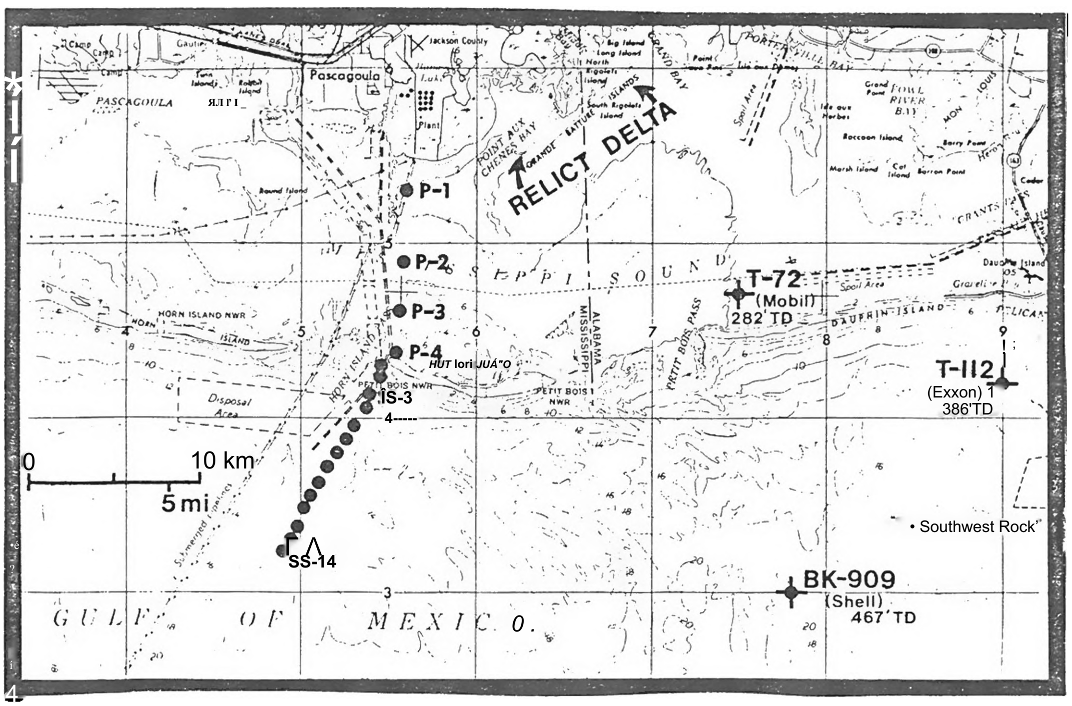
Late Neogene

The earliest sedimentary unit that outcrops in the area and occurs at shallow depths is a several hundred feet thick sequence of fresh water-brackish, semiconsolidated, bluish-green, bluish-gray silty clays, muddy deposits, with intercalated gray and greenish gray (fluvial) sand beds. The lower part of this continuous sequence, where it includes the brackish bivalve Rangi a Johnsoni (mi crojohnsoni), has been correlated with the Upper Miocene interval updip in south Louisiana (Ellisor, 1940) and designated as the Pascagoula Formation. It occurs in a belt of surface outcrops north of the coastal tier of counties and, based on the first appearance of the Rangia johnsoni range zone, at various depths, recorded as between -680 to-985 ft (Harvey and others, 1965; Otvos, 1985b) under the southwest Alabama-southeast Mississippi coastline. Discovery of Upper Miocene muddy fine sands with Gl obi geri na praebui 1 oi des planktonic foramini fers, at much shallower (340-360.5 ft) depth, downdip, off southeastern Alabama (Exxon T-115 drillhole; Fig. 2a) indicates that even under the Mississippi inshore-offshore coastal area the Miocene boundary probably occurs much higher than the known Rangi a occurrence levels would have us believe. As the Rangi a species is tied to erratic estuarine lenses and in the absence of lithologic indications or unconformities to delineate the upper boundary of the Pascagoula, the validity of the so-called Pliocene "Graham Ferry Formation" (Brown et al. , 1944) for units between the Pascagoula on one hand and the Citronelle Formation/or younger units, on the other is highly questionable.

Figure 2a, b. Drillholes locations, Block 72 (Mobil Oil), Block 909

(Shell Oil) and Block 115 (Exxon Oil) foundation coreholes.





The presence of Pliocene shelf units, overlying Upper Miocene units in central and western Northwest Florida (Huddlestun, 1984) indicates that Pliocene beds may also be present in the topmost part of the Neogene clastic sequence in coastal Mississippi and Alabama. A recently identified thin Pliocene marine lense in the Perdido Key area (Fig. 3; Otvos, 1985b) of Florida and Alabama could not be correlated westward into Mississippi. West of here, in the Dauphin Island area (Mobil Oil Corp.; Mississippi Sound Block 72; Fig. 2b) Neogene foraminifers have been encountered in greenish-gray marine muds, that underlie an oxidized unconformity surface beneath the Pleistocene Biloxi Formation at about 47 ft below sea level. Very few individuals of Globulina inaequalis, Globorotalia acostaensis, Guttulina postulata and Planulina depressa that represent the Upper Miocene-to-Upper Pliocene time interval, confirm the shallow depth of the Neogene in this area. While the presence of Pliocene units could not be proven by microfossils here or in Shell Oil corehole, BK 909, Chevron corehole, BK 861 (c. 9 km south of eastern Petit Bois Is.), these species can only suggest the possibility of correlation with the Perdido Key Pliocene marine lense.

Due to the barren nature of the late Neogene sequence in coastal Mississippi, for practical purposes it has been suggested (Otvos, 1985b) that in the absence of time-diagnostic fossils in a given drillhole or outcrop, the term "undifferentiated Miocene-Pliocene clastics" should be employed in the age designation and the concept of "Graham Ferry Formation" be dropped.

Citronelle Formation. A usually thin unit of fluvial clastics with occasional pebbly sand lenses, defined as the Late Pliocene (according to some, pre-glacial Pleistocene) Citronelle Formation blankets the uplands in south Mississippi and overlies the undifferentiated Miocene-Pliocene clastics with a sharp unconformity. Contrary to some (earlier) authors, e.g., Brown et al. (1944), this unit cannot be recognized beneath the Mississippi Sound and the barrier islands. Brackish and marine time-correlatives of the Citronelle may be preserved under the present inner-mid shelf areas of the Gulf of Mexico.

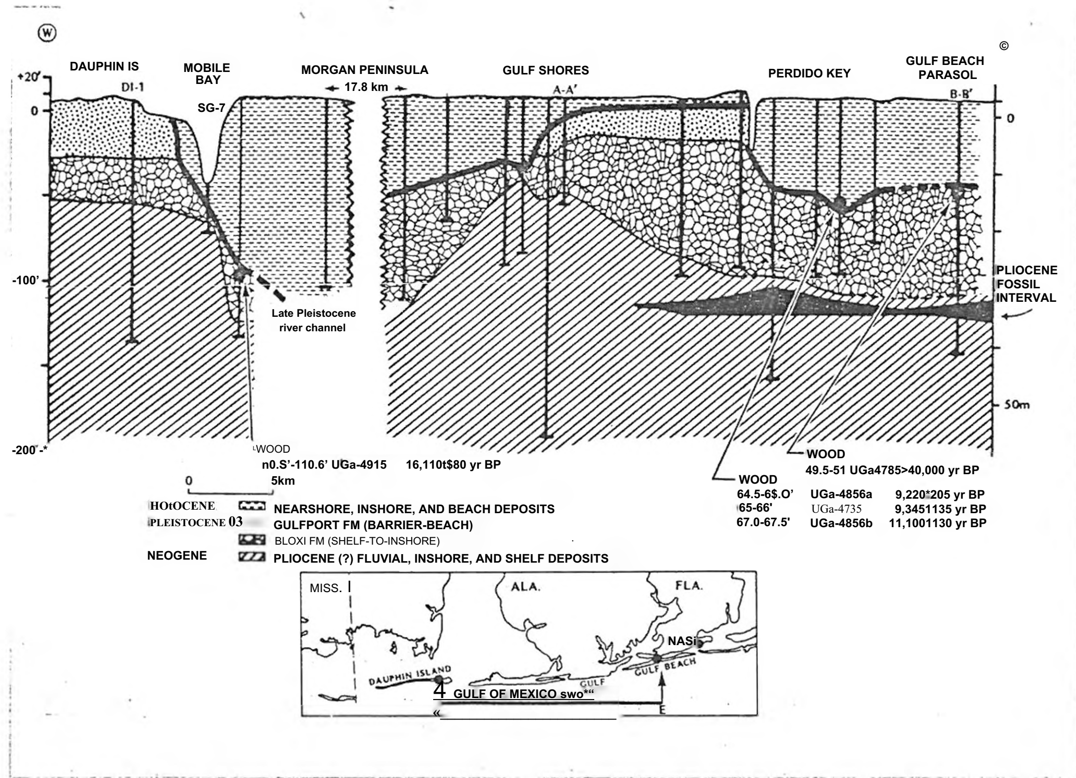
Plei stocene

An earlier Pleistocene unit of freshwater (river-floodplain) origin occurs a short distance north of the present Mississippi shoreline (Otvos, 1985, p. 12-16) but does not extend to or below the Mississippi Sound. However, three correlatable Late Pleistocene units (Sangamonian Inter-glacial) are well represented in the geological framework of the Sound.

(1) Biloxi Formation. This silty-sandy, sandy-muddy, often fossi iiferous unit, usually 15-40 ft thick, represents the basal unit of Sangamonian marine transgression. The Biloxi does not appear in natural outcrops. It usually overlies nonfossi 1iferous Neogene sandy, sandy muddy deposits and is overlain either by the Gulfport or the Prairie formation. Its landward feather-edge is traceable in the subsurface several miles north of the Sound shoreline. The Biloxi is composed of a whole range of depositional environments, from open marine, inner shelf facies to highly brackish estuarine-bay environments. These have been defined with the help of benthic forami nifer spectra that are very sensi-tive to differences in salinity conditions (Table 1). Occasionally the Biloxi is directly overlain by the Holocene Mississippi Sound deposits.

(2) Prairie Formation. The fluvial-floodplain deposits of this formation are also traceable along a level coastwise from Louisiana to northwest Florida. They occur landward and above the Biloxi and overlie, occasionally interfinger, with the Biloxi Formation.

Figure 3 . Morgan Península-Perdido Key (Ala . - Fla.) geologie cross secti on .



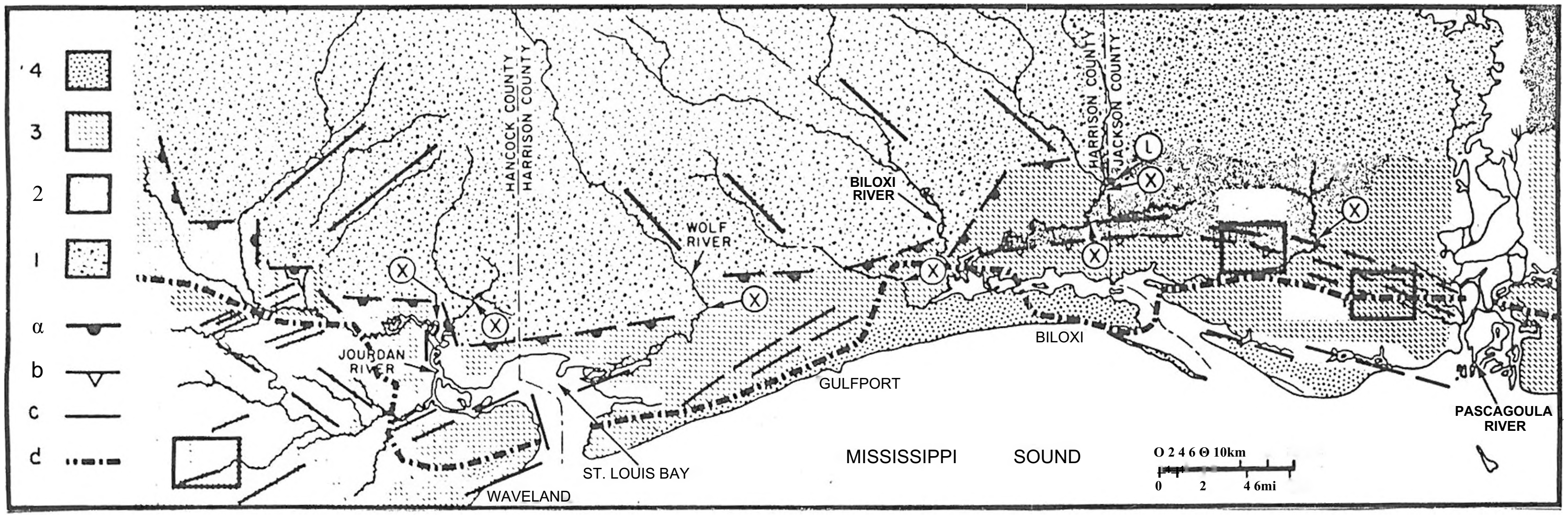
Yellowish-brown, oxidized and light gray bleached surface units, representing an unconformity surface often occur in the top part of the Formation, exposed in the pre-Holocene land surface. Channel and point bar sands are common in this unit. Under the Mississipi Sound, the Formation occasionally rests over the eroded Biloxi Formation surface, indicating that Prairie deposition continued seaward after the sea retreated from its high interglacial position at about 20-25 ft above present sea level.

(3) Gulfport Formation. Wei 1-to-moderately sorted, regressive barrier sands form this unit, that marked the edge of the mainland coast during the peak sea level stage of the Sangamonian Interglacial. This discontinuous trend that, along with the other two Late Pleistocene formations, can be traced along the length of the entire northern Gulf shore, in Mississippi as identified in the present mainland near Bay St. Louis, along the Harrison County shore and near Belle Fontaine Beach, Jackson County (Fig. 3). Maximum 1.5-2 km wide, parallel ridges characterize the unit in strandplain-like arrangements. It is absent under the Sound, but correlative deposits probably are present in the relatively high Pleistocene cores of Deer, Round, and eastern Dauphin Islands (Otvos, 1985b). Eroding Gulfport Formation sands were the chief sand source for the Mississippi mainland beaches prior to seawall construction (1925-28).

Holocene

The time interval between the very extensive Late Pleistocene (Wisconsinan glacial stage) regression and the return of the sea in the mid-late Holocene was represented by intensive erosion of all the above deposits, and the incision of river channel. The top Pleistocene

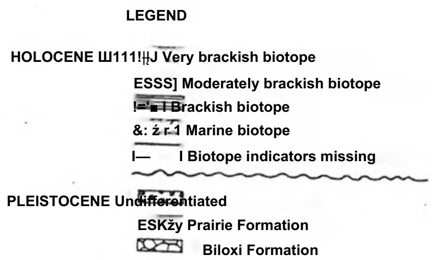
Figure 4. Geologic map of central-western Mississippi Coast.

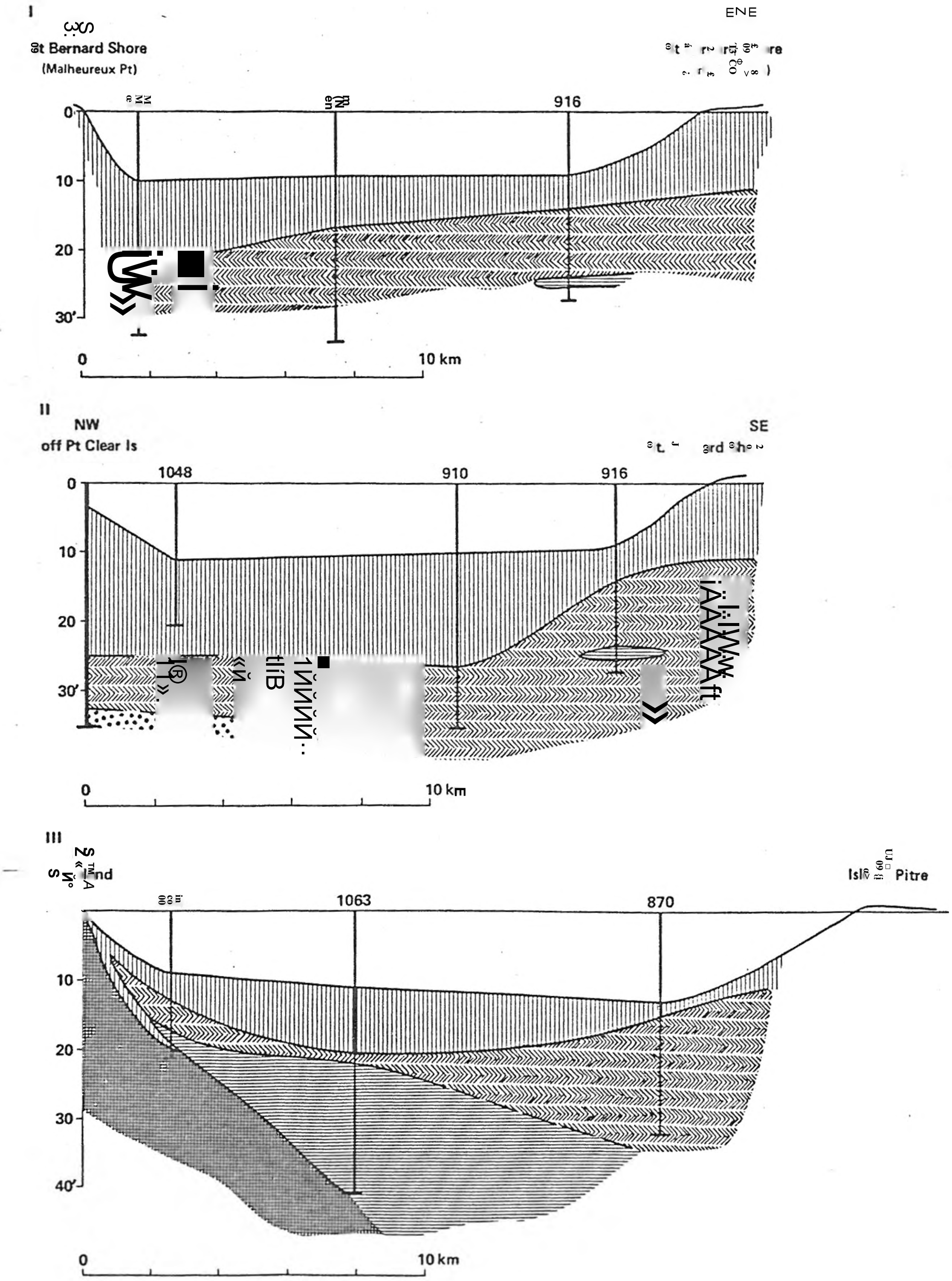


Geologic map of central-western. Mississippi Coast. (1) Citronelle Formation. (2) Pre-Sangamon Pleistocene unit. (3) Prairie Formation. (4) Gulfport Formation. (a) Citronelle Scarps. (b) Big Ridge Scarp. (c) Drainage and shoreline lineaments. (d) Landward limit of Biloxi Formation in subsurface. Circled X indicates location of abrupt stream course change. (L) Lamey borrow pit.

Figure 5. Twelve geologic cross sections through Mississippi Sound (Locations: Map 1, Appendix). Holocene depositional environments and Late Pleistocene geologic formations.

Note: Late Holocene transgressive-regressive cycle best expressed in biotope sequences in Sections IV, V, VII, VIII, XI, XII (see also: Otvos, 1981). Influence of St. Bernard subdelta on Mississippi Sound biotope sequences: in Sections I, II, and III.

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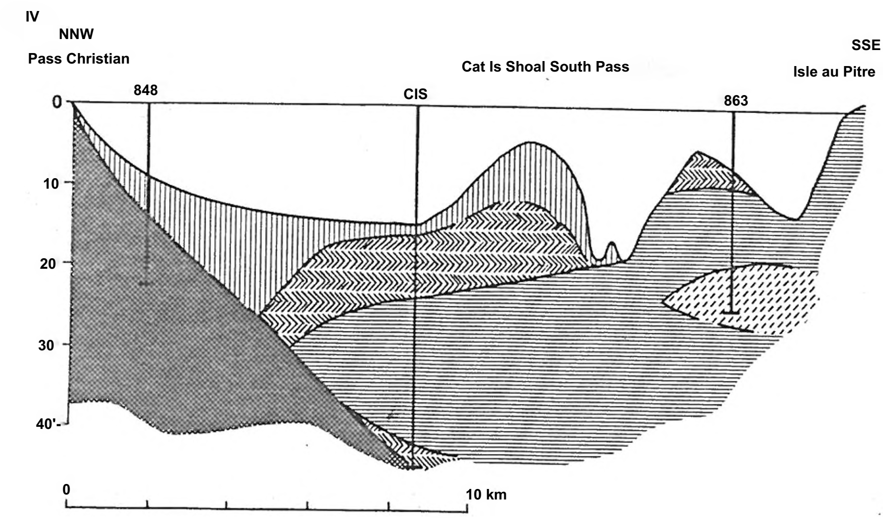
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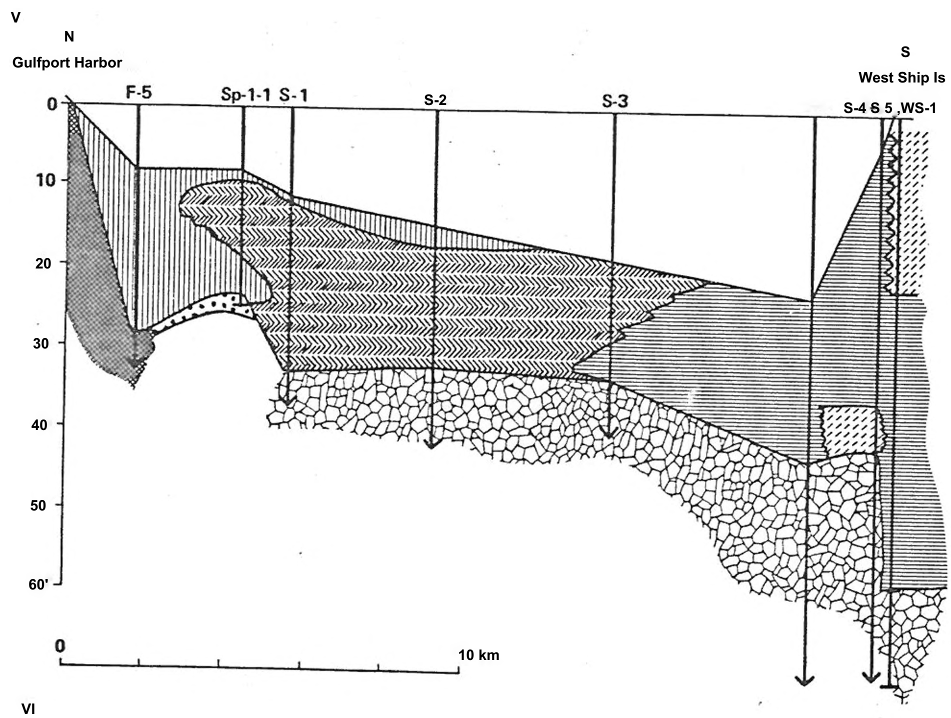
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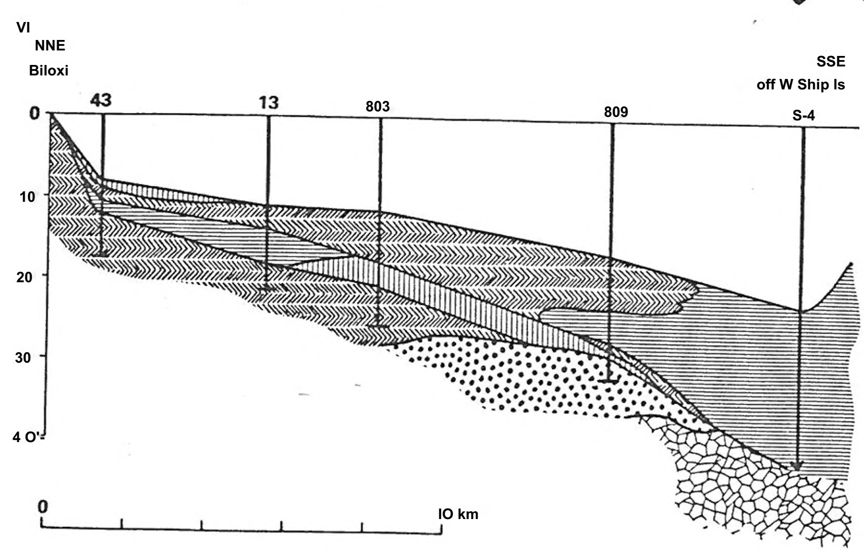
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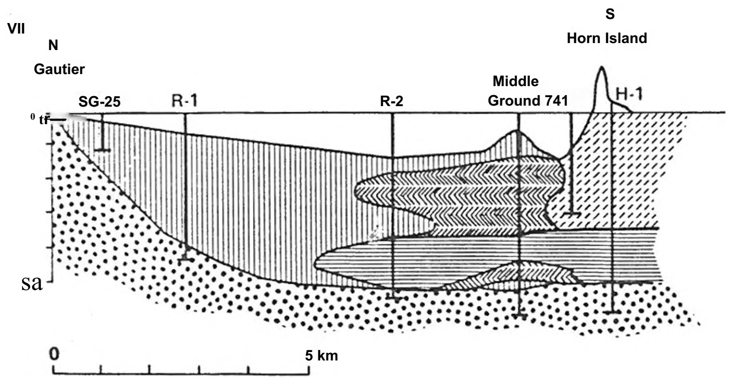
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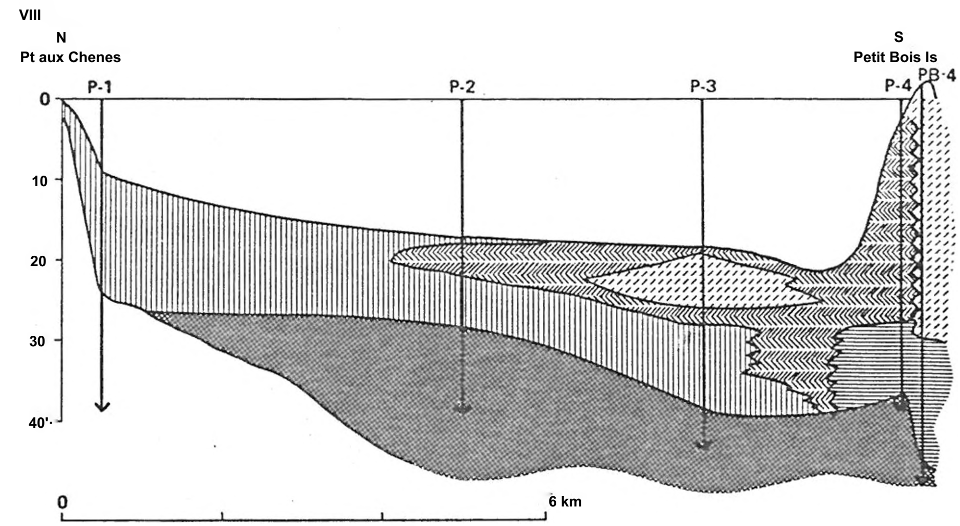
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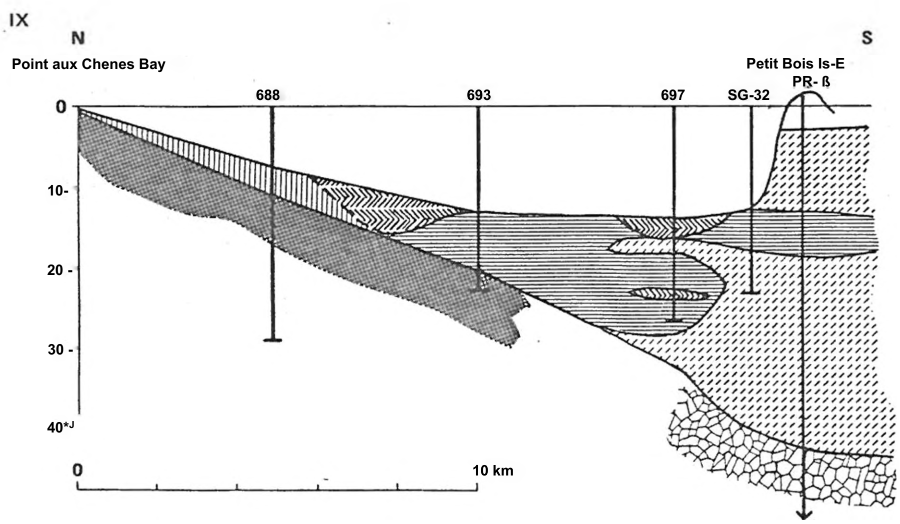
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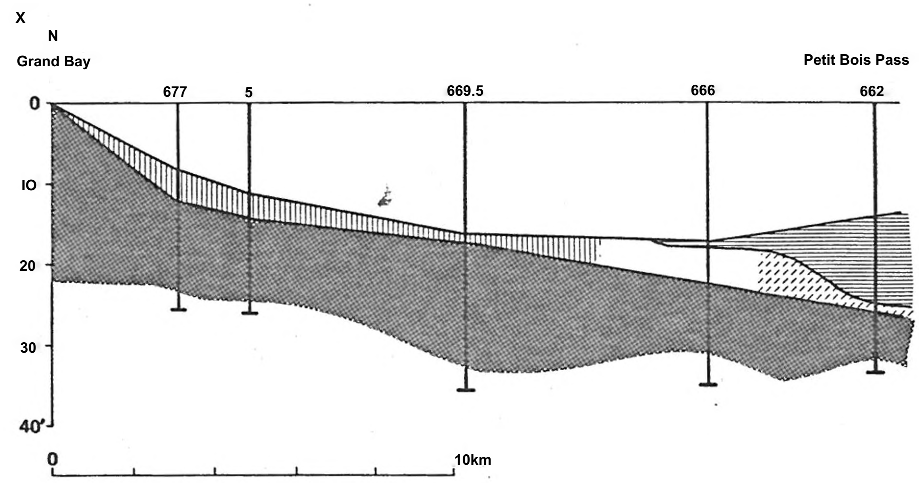
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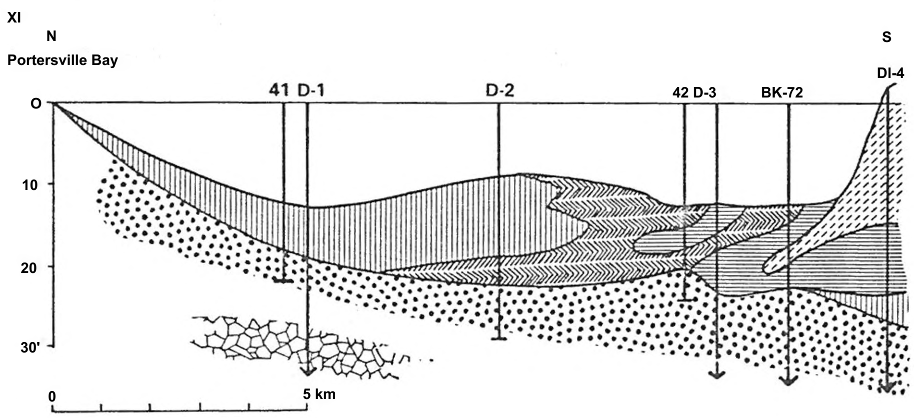
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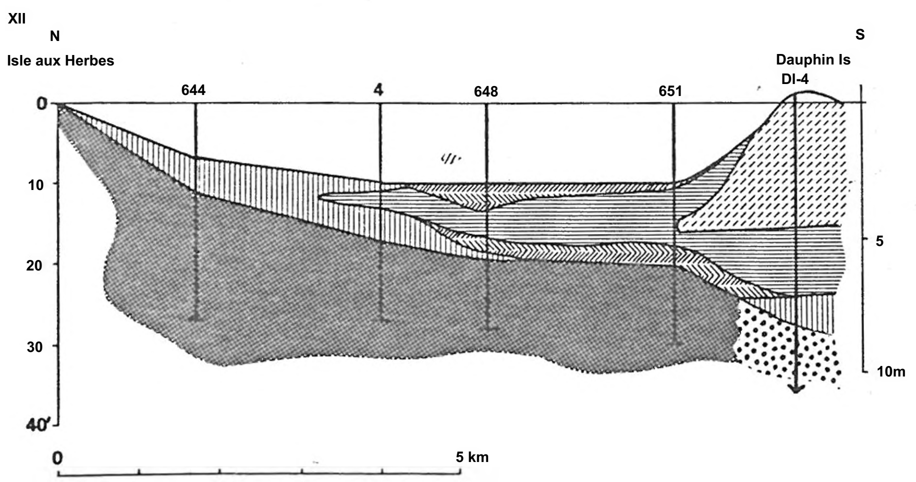
5 km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10m
0
5 km

deposits, exposed on the land surface, became oxidized and subjected to soil development. Erosion and bioturbation after the return of the Holocene sea often removed these features, associated with the major unconformity surface. When the Gulf returned to the area of the Sound c. seven-to-six thousand years ago, the river channels (e.g., Biloxi Back Bay, St. Louis Bay, Pascagoula estuary) gradually became estuaries and eventually the present area of the Sound became part of the Gulf. Development of the barrier islands did not commence until littoral drift, primarily from the Alabama mainland, has constructed a zone of shoals from which the chain of barrier islands emerged. This resulted in the formation of the Mississippi Sound with a sharp reduction in water salinity. Sandy bottom deposits formed along the shoal-island chain that extended through the present south Hancock marsh area into Orleans Parish, Louisiana and along the mainland shore, while the central parts of the Sound received mostly clayey, muddy sediments (Otvos, 1976, Map #3). The southwestern corner of the Sound was added to the Sound through growth of the Mississippi River St. Bernard subdelta that isolated another part of the Gulf of Mexico c. 3,000 years ago. These muddy subaqueous deposits locally can be recognized by the presence of reworked Cretaceous forami ni fers, transported from Texas-Oki ahorna source areas (Otvos, 1985b) by the river. The Holocene sequence of Mississippi Sound thus represents a transgressive-regressive cycle (Fig. 5).

TABLE 2

GENERAL STRATIGRAPHIC CHART, MIOCENE-HOLOCENE
MJSSISSIPPI-ALABAMA-FLORIDA PANHANDLE COAST

			MISSISSIPPI	ALABAMA - W. FLORIDA PANHANDLE	CENTRAL FLORIDA PANHANDLE
HOLOCENE			Alluvial, estuarine, lagoonal-bay and inner shelf deposits; transgressive-regressive sequence in Mississippi Sound and Mobile Bay		
			- - - unconformity - - -		
PLEISTOCENE			Late Pleistocene (Mid-Wisconsinan?)		
			- - - unconformity - - -		
			Late Pleistocene (Sangamonian and early Wisconsinan) transgressive-regressive sequence correlative units: Prairie Fm (alluvial) - Biloxi Fm (inner shelf-to-estuarine) - Gulfport Fill (barrier complex)		
			- - - unconformity - - -		
			Earlier Pleistocene alluvial deposits (higher "terrace")		
			- - - unconformity - - -		
		Undifferentiated Miocene-Pliocene clastics		Citronelle Fm - alluvial (in upland areas)	
				- - - unconformity - - -	
PLIOCENE				Jackson Bluff Fm (SE Alabama-W. Florida)	Intracbastal Limestone-Jackson Bluff Fm
			Estuarine/alluvial Pliocene deposits; correlative with central Florida Panhandle Pliocene units		Phosphoritic Sand (Four-Mile Village Member)
				- - - unconformity - - -	
MIOCENE	Upper		Pascagoula Fm	Miocene Coarse Clastics Upper Pensacola Clay	Choctawhatehee Fm (=lower part Intracoastal Fm; Clark and Schmidt, 1982)
				- - - unconformity (?) - - -	
	Middle		Hattiesburg Fin	Escambia Sequence Lower Pensacola Clay-Bruce Creek Limestone	Shoal River Fin Oak Grove-Bruce Creek Fms
				- - - unconformity - - -	
	Lower		Catahoula Fm	Tampa-Chickasawhay undifferentiated	Tampa stage limestones (Chipóla, etc.)

ECONOMIC MINERAL RESOURCES

One purpose of the study was identification of potential economic resources beneath the seafloor, encountered by drillholes. Pure clay and sand boides, as well as shell layers were the subject of such a search. Careful review of the drillhole information eliminated clay and shell resources from consideration. Clay layers, enriched in the pelitic size fraction (finer than 3.9 microns) are thin and occur only sporadically. Even if they would contain exploitable concentration of trace elements and clay minerals, due to their small volume and under-water locations, economic use would be out of question in the foreseeable future. Only on a few occasions did we encounter thin shell lenses; partially due to problems in penetrating shell reefs by the rotary or vibracore drilling methods and recovering repre-sentative shell samples from such reefs. Buried oyster reefs are known from several Mississippi Sound locations (Otvos, 1976; Demoran, 1981) and further exploration should be done by seismic methods.

Sand resources of sufficient purity and sorting values in appropriate depositional settings (e.g., surf and beach zones) may contain heavy ore mineral concentrations (placer deposits). A more immediate use of sand was for beach nourishment in remedying erosional losses on a large scale on the Mississippi mainland shore (1951, 1967, 1972-73) and on certain islands (e.g., West Ship Island). Drilling provides the granulometric definitions, locations and dimensions of such subsurface sand resources, available for beach nourishment. Due to shallow penetration of the vibracores and the LC-line of rotary drillcores (Maps 1, 2), drilled in front of the Harrison County beach, the total thickness and volume figures of all shallow sand resources are not yet known from the mainland beach area. Drillholes in the closely drilled LC-line (Capozzoli et al., 1972), c. 2100 ft offshore from the beach, generally penetrated only 10 ft below the mudline, occasionally to 11-15 ft, with few exceptions encountering sediments with a sand content of over 80%. Due to the presence of rotary drillholes, sand units with the greatest cumulative thickness values (20-40 ft; Map 2) occurred along the barrier islands. Vibracores rarely penetrated Pleistocene sand units.

No indications of heavy mineral layers have been noted in macroscopic examination of core samples with high sand content. Relatively few of these samples (Appendix) had high sorting values, suggestive of depositional environments where placer concentration could take place.

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APPENDIX

DRILLHOLE STRATIGRAPHY

In the following, the sedimentary sequences of the Mississippi Sound area drillholes are presented in a summarized fashion. Salinities (Biotopes 1 through 4) are based on foraminifer analyses (Table 1). Depth are below sea level and in feet. Certain Holocene and Pleistocene units contain no fossils; only the presence of fossils has been marked here, their absence not. Nonfossi i iferous intervals either indicate non-marine (non-estuarine) units (e.g. , fluvial Holocene, Prairie Formation, Neogene intervals) or their absence due to postdepositional leaching as occurred occasionally in the top part of the Biloxi Formation. When the Pleistocene formations could not be defined, the term "Pleistocene" was used without differentiating specific stratigraphic units. "Sand unit" depth interval, at the end of each drillhole description, refers to intervals with a sand content (grain size: 62.5 microns or greater) of at least 80%.

(1) MMRI VIBRADORES

Drillhole 2

Holocene	9.0-14.0	Fine sandy muds, very brackish (1).
Plei stocene		
Prairie Fm	14.0-17.5	Muddy fine sands with bioturbated Pleistocene top.
	17.5-23.1	Muddy fine sands, poorly sorted.
	23.1-26.1	Very fine sandy mud.
Biloxi Fm	26.1-27.6	Very fine sandy mud, brackish (3) bi otope.

Sand units: none

Drillhole 3

Holocene	16.0-16.3	Muddy fine sand, brackish (3).
	16.3-23.5	Muddy, unfossi 1 iferous fine sands, poorly sorted.

Pl ei stocene Gulfport Fm (?)	23.5-34.1	Moderately well sorted medium sand, humate impregnation.
	34.1-35.2	Moderately well sorted fine sand, humate impregnation.

Sand units: 19.2-35.2 (muddy fine-fine-medium sands; poorly-moderately well sorted)

Drillhole 4

Holocene	10.0-11.5	Very brackish (1) mud.
	11.5-12.0	Brackish (3) clay.
	12.0-15.3	Very brackish (1) very fine sandy muds, fecal pellets.
	15.3-19.3	As last, but nonfossi 1iferous.
Pleistocene	19.3-19.7	Bioturbated muds.
	19.7-27.1	Very fine sandy mud.

Sand units: none

Drillhole 5

Holocene	11.0-13.6	Very brackish (1), clayey very fine sand to very fine sandy muds.
Pleistocene	13.6-26.0	Very fine sandy muds, muds and muddy very fine sands.

Sand units: none

Drillhole 644

Holocene	7.0-10.7	Very brackish (1), clayey fine sand, muddy very fine sand, very fine sandy mud.
P1eistocene	10.7-27.0	Very fine sandy muds, muddy fine sands, muds.

Sand units: 15.2-17.6 (muddy fine sands, poorly sorted)
23.9-27.0 (muddy fine sands, poorly sorted)

Drillhole 648

Holocene	10.0-13.3	Moderately brackish (2) with muddy fine sand, poorly sorted.
	13.3-16.6	Brackish (3), fine sandy mud.
	16.6-18.2	Moderately brackish (2), fine sandy clay and clays.

	18.2-19.2	Very brackish (1), moderately brackish (2), mud.
Piei stocene	19.2-20.2	Muddy very fine sand.
	20.2-28.4	Very fine sandy mud.
	28.4-29.3	Fine sandy clay.

Sand units: none

<u>Drillhole 651</u>

Holocene	10.0-10.7	Moderately brackish (2), mud.
	10.7-15.2	Brackish (3), muddy fine sand, fi ne-very fine sandy muds.
	15.7-17.7	Brackish (3) clayey fine sand.
	17.7-20.5	Moderately (2)-to-very brackish (1), muddy fine sand.
P1 e istocene	20.5-29.7	Very fine sandy mud.

Sand unit: 16.3-19.1 (muddy fine sand, poorly sorted)

<u>Drillhole 662</u>

Holocene	14.0-23.0	Brackish (3), muddy very fine sand, muddy fine sand, clayey fine sand, very fine sandy muds, very fine sandy clays.
	23.0-25.6	Marine (4) sediments of above categories.
Plei stocene	25.6-33.4	Unfossi i i ferous mud.

Sand units: 14-14.6 (muddy fine sand, clayey fine sand, poorly sorted)
17-17.6 (as above)

<u>Drillhole 666</u>

Holocene	16.0-16.5	Brackish (3), very fine sandy muds.
	16.5-22.5	Nonfossi 1iferous very fine sandy mud.
Pl ei stocene	22.5-35.0	Muds, very fine sandy medium silts, silty fine sands, well sorted fine sands.

Sand unit: 32.1-35.0 (fine sand, medium silty very fine sand, poorly-to-well sorted)

Drillhole 669.5

Holocene	16.0-17.6	Very brackish (1), very fine sandy mud, diatoms.
Pleistocene	17.6-27.4	Very fine sandy medium silt, very coarse sandy coarse silt.
	27.4-28.9	Coarse silty fine sand.
	38.9-35.5	Fine sand.

Sand unit: 28.3-35.5 (fine sand, wel1-moderately wel1 sorted)

Drillhole 677

Holocene	8.0-12.9	Very brackish (1), fine sand, muddy fi ne sand, poorly sorted.
Pleistocene	12.9-25.8	Fi ne sand, moderate to well sorted.

Sand units: 8.0-13.0 (fine sand, muddy fine sands, poorly sorted)
13.0-25.8 (fine sand to medium sands, moderately to well sorted)

Drillhole 688

Holocene	7.0-11.6	Very brackish (1), muddy fine sand
	11.6-14.3	Same, but nonfossi 1 iferous.
Plei stocene	14.3-23.7	Very fine sandy mud.
	23.7-26.8	Very fine sandy coarse silt.
-	26.8-29.2	Mud

Sand units: none

Drillhole 693

Holocene	13.0-20.0	Brackish (3), very fine sandy mud.
Plei stocene	20.0-22.8	Mud.

Sand units: none

Drillhole 697

Holocene	14.0-17.2	Too few for determination: fine sandy clay.
	17.2-18.4	Marine (4), fine sandy clay, clayey fine sand.
	18.4-23.0	Brackish (3), clayey medium sand, medium sandy clay.

	23.0-24.0	Moderately brackish (2), very fine sandy clay.
	24.0-28.6	Brackish (3) mud.
	28.6-38.9	Marine (4) mud.

Sand units: none

Drillhole 741

Holocene	12.0-30.0	Marine (4), medium and fine sands, very well to moderately well sorted

Sand unit: 12.0-30.4

Drillhole 746.5

Holocene	15.0-17.8	Very brackish (1) fine sandy mud.
	17.8-20.7	Moderately brackish (2) fine sandy mud.
	20.7	Very brackish (1), fine sandy mud.
	33.4	Very brackish (1) muds.

Sand units: none

Drillhole 753

Holocene	8.0-8.8	Very brackish (1) fine sandy mud.
	8.8-13.3	Fine sandy mud.
	13.3-21.6	Muddy fine sands, clayey fine sands, fine sandy muds.
Pleistocene	21.6-27.6	Clayey medium sands, clayey fine sands.

Sand unit: 23.8-26. 8

Drillhole 761.5

Holocene	5.0-9.9	Very brackish (1), clays.
	9.9-19.5	Quite brackish (2), muds and very fine sandy muds.

Sand units: none

Drillhole 775.5

Holocene	18.0-18.5	Brackish (3) muddy fine sand.
	18.5-20.1	Moderately brackish (2), very fine sandy mud.
	20.1-24.7	Very brackish (1), diatoms.
	24.7-26.0	Moderately brackish (2), fine sandy mud.

Pleistocene Prairie Fm	26.0-34.7	Very fine sandy coarse silts, muddy fine sands, muds.

Sand units: none
Shell concentrate: 26.0-27.3

Drillhole 778.5

Holocene	15.8	Moderately brackish (2) clayey fine sand.
	15.8-17.6	Very brackish (1), fine sandy mud.
	17.6-21.2	Muddy fine sand.
Pleistocene	21.2-23.7	Poorly sorted, fine sand.

Sand unit: 19.4-23.7

Drillhole 781

Holocene	12.0-12.8	Moderately brackish (2), muddy very fine sand.
	12.8-26.1	Muds and very fine sandy muds with diatoms.

Sand units: none

Drillhole 785

Holocene	9.0-13.3	Very brackish (1), muddy medium sands, poorly sorted.
	13.3-15.6	Moderately brackish (2), medium sand.
	15.6-16.7	Medium sand, moderately sorted.
	16.7-27.1	Fine sand, very- to weli-moderately sorted.

Sand unit: 11.5-27.1

Drillhole 803

Holocene	11.5-18.0	Moderately brackish (2), very fine sandy mud, clays.
	18.0-21.6	Very brackish (1), clays, very fine sandy muds.
	21.6-26.5	Moderately brackish (2), very fine sandy mud, muds.

Sand units: none

<u>Drillhole 805</u>

Holocene	13.0-14.6	Very brackish (1) mud.
	14.6-26.3	Very brackish (1)-to-fresh water (diatoms, fecal pellets), very fine sandy mud/clay
Piei stocene	26.3-29.9	Clayey fine sand, very poorly sorted.

Sand units: none

<u>Drillhole 809</u>

Holocene	17.0-21.8	Very brackish (1), fine sandy mud, clayey fine sand.
	21.8-24.0	Quite brackish (2), muddy fine sand
	24.0-27.8	Brackish (3), very fine sandy mud and muddy very fine sand.
	27.8-28.8	Moderately brackish (2), muddy fine sand.
	28.8-29.2	Very brackish (1), muddy fine sand.
Pl eistocene	29.2-32.5	Clayey fine sand.

Sand units: none

<u>Drillhole 839</u>

Holocene	9.0-14.7	Very brackish (1), muds.
	14.7-16.4	Quite brackish (2), very fine sandy clay, clay.
	16.4-29.6	Very brackish (1), mud.
Plei stocene Biloxi Fm	29.6-37.2	*Very* brackish, fine sandy muds, muds.

Sand units: none

<u>Drillhole 848</u>

Hol ocene	9.0-14.7	Very brackish (1), fine sandy muds.
Plei stocene	14.7-22.3	Muddy fine sand.
	19.6-22.3	Moderately brackish (2), fine sand, very fine sand.

Sand unit: 16.9-22.3 (muddy fine sand, very fine sands, poorly to well sorted)

Drillhole 863

Holocene	7.0-9.4	Moderately brackish (2), muddy fine sand, muds.
	9.4-19.1	Brackish (3) clayey fine sand.
	19.1-24.7	Brackish (3) muds and very fine sandy muds.

Sand units: none

Drillhole 870

Holocene	13.0-15.4	Very brackish (1), muddy medium sands, muddy fine sands.
	15.4-32.3	Moderately brackish (3) muds, cl ays.

Sand units: none

Drillhole 885

Holocene	9.0-9.5	Moderately brackish (2) fine sandy mud.
	9.5-20.1	Very brackish (1) fine sandy clay.
Plei stocene	20.1-29.9	Coarse silty, very fine sand, poorly sorted.

Sand unit: 17.2-21.8 (muddy fine sand, poorly sorted, fine sand, moderately well sorted)

Drillhole 910

Holocene	10.0-12.5	Very brackish (1) very fine sandy medium silts.
	12.5-26.4	Very brackish (I) muds and clays.
	26.4-35.5	Moderately brackish (2) muds and clays.

Sand units: none

Drillhole 916

Holocene	9.0-13.8	Very brackish (1), very fine sandy medium silt.
	13.8-23.8	Moderately brackish (2), mud.
	23.8-25.4	Brackish (3), mud.
	25.4-27.2	Moderately brackish (2) clay.

St. Bernard delta deposits: below 13 ft. (Cretaceous forams 333-337, 483-487 cm below mudline)

Sand units: none

Drillhole 925

Holocene 9.0-16.5 Very brackish (3), very fine sandy medium silts.
16.5-33.1 Moderately brackish (2), very fine sandy muds, medium silts.

St. Bernard delta deposits: below 19 ft. (Cretaceous forams: 295-407 cm below mudi ine)

Sand units: none

Drillhole 932

Holocene 10.0-22.5 Very brackish (1), very fine sandy medium silts, medium and fine silts and muds.
22.5-32.2 Moderately brackish (2), clays.

St. Bernard delta deposits: below 19 ft.

Sand units: none

Drillhole 1037

Holocene 10.0-19.8 Very brackish (1), fine sandy medi um-to-coarse silts, very fine sandy muds.
19.8-34.2 Moderately brackish (2), muds.

St. Bernard delta deposits: below 20 ft. (Cretaceous forams: 326.5-332.5 cm below mudline)

Sand units: none

Drillhole 1048

Holocene 11.0-15.9 Very brackish (1), very fine sandy coarse silt, very fine sandy mud.
15.9-20.8 Muds with diatoms, organic matter, very fine sandy muds, muddy very fine sands and fine sands.

Sand units: none

Drillhole 1063

Holocene 11.0-20.8 Very brackish (1), fine sandy muds and muds.

	20.8-40.5	Brackish (3), clays and muds, very fine sandy muds, muddy very fine sands.

Sand units: none

Drillhole 1077

Holocene	10.0-19.8	Brackish (3) muddy fine sands, silty very fine sand.
	19.8-26.4	Marine (4) fine sandy mud, mud.
	26.4-32.8	Brackish (3) muddy and silty very fine sand.
	32.8-33.8	Moderately brackish (2) muddy and silty very fine sand.

Sand units: 10.0-11.6 (muddy fine sand, poorly sorted)
18.2-21.4 (coarse silty very fine sand, moderately well sorted)
23.5-29.6 (muddy very fine sand, poorly sorted)

Drillhole 1090.5

Holocene	14.0-20.6	Very brackish (1), very fine sandy clay. Clays.
	20.6-24.9	Nonfossi 1 i ferous muddy fine sand.
	24.9-29.1	Moderately brackish (2), muddy fine sand.
Pleistocene	29.1-33.2	Moderately brackish (2), very fine sandy coarse silt, muddy fine sand.
	33.2-39.5	Marine (4) muddy, very fine and fine sands; fine sands.

(2) SEA GRANT VIBRACORES (SG SERIES)

Drillhole SG-2

Holocene	8.0-11.6	Very brackish (1) fine sandy mud.
	11.6-14.3	Moderately brackish (2) clayey fine sand.
	14.3-18.4	Very brackish (1) muddy fine sand.

Sand units: none

Drillhole SG~4

Holocene	4.0-10.1	Very brackish (1) muddy fine sand
Plei stocene	10.1-13.6	Muddy fine sand, silty fine sand.

Sand units: none.

Drillhole SG-13

Holocene	0.0-13.3	Very brackish (1) muds, fine sandy muds.
	13.3-13.9	Moderately brackish (2) clays.
	13.9-18.2	Brackish (3) clays.
	18.2-21.1	Moderately brackish (2) (very few) clays.

Sand units: none

Drillhole SG-14

Holocene	5.0-10.2	Very brackish (1) muddy fine sand.
Plei stocene	10.2-12.2	Fine sandy mud.

Sand unit: 5.0-6.2 (poorly sorted, muddy fine sand)

Drillhole SG-16

Holocene	7.0-10.6	Very brackish (1) fine sandy clay.
Pleistocene	10.6-15.0	Fine sandy muds, fine sandy clays. Clay.

Sand units: none

Drillhole SG-25

Holocene	3.0-6.8	Very brackish (1) very fine sandy mud.
	6.8-8.6	Very brackish (1) muddy very fine sand.
	8.6-11.9	Very brackish (1) very fine sandy muds and medium silty very fine sands.

Sand units: none

Drillhole SG-26

Holocene	9.0-11.9	Brackish (3) with marine indicator, clayey-muddy fine sand.
	11.9-15.5	Moderately brackish (2) clayey-muddy fine sand.
Pleistocene	15.5-25.6	Very fine sandy mud.

Sand unit: 9.0-10.9 (clayey fine sand)

Drillhole SG-27

Holocene	12.0-22.0	Very brackish (1) muddy fine sands, muddy fine sands, fine and very fine sandy muds. Muds.

Sand units : none

Drillhole SG-28

Holocene	8.0-15.5	Very brackish (1) muddy fine sand.

Sand unit: none

Drillhole SG-29

Holocene	6.0-10.3	Very brackish (1) mud and very fine sandy muds.
	10.3-10.9	Moderately brackish (2) fine sandy mud.
	10.9-12.8	Very brackish (1) fine sandy mud.
	12.8-15.8	Moderately brackish (2) coarse silty very fine sand.

Sand units: none

Drillhole SG-31

Holocene	5.0-6.0	Mud.
	6.0-12.5	Fine sandy mud.
	12.5-14.8	Mud.

Sand units: none

(Note: near-absence of microfossils in samples very uncharacteristic)

Dri11 hole SG-32

Holocene	13.0-14.3	Moderately brackish (2) clay.
	14.3-18.2	Brackish (3) fine sandy clay, muddy fine sand.
	18.2-23.5	Marine (4) fine sand.

Sand unit: 18.2-23.5 (moderately well sorted fine sand)

Drillhole SG-33

Holocene	18.0-20.3	Moderately brackish (2) fine sandy mud and mud.

20.3-23.6 — Brackish (3) fine sandy muds, muddy fine sands, fine sand.

Sand unit: 24.0-25.0 (fine sand)

<u>Drillhole SG-34</u>

Holocene — 16.0-24.5 — Very brackish (1) fine sandy muds, muds, muddy fine sand.

Sand units: none

<u>Drillhole SG-35</u>

Holocene — 18.0-27.2 — Brackish (3) clay.

Sand units: none

<u>Drillhole SG-36</u>

Holocene — 8.0-10.3 — Very brackish (1) fine sandy muds and muds.
10.3-17.2 — Moderately brackish (2) clay.

Sand units: none

<u>Drillhole SG-41</u>

Holocene — 12.0-18.5 — Very brackish (1) muddy fine sand.

Pleistocene — 18.5-22.0 — Fine sandy muds and clays, mud and clays.

Sand units: none

<u>Drillhole SG-42</u>

Holocene — 13.0-15.3 — Moderately brackish (2) clays.
15.3-17.9 — Brackish (3) very fine sandy mud.
17.9-20.5 — Moderately brackish (2), very fine sandy clay.

Pleistocene — 20.5-24.5 — Very fine sandy mud (20.0-22.0 bioturbated).

Sand units: none

Drillhole SG-43

Holocene	8.0-10.3	Very brackish (1) fine and very fine sandy muds.
	10.3-12.2	Brackish (3) clays.
	12.2-17.2	Moderately brackish (2) clay, fine sandy muds, muds.

Sand units: none

Drillhole CIS (Cat Island Shoal)

Holocene	15.0-16.0	Very brackish (1) fine sandy muds.
	16.0-24.0	Moderately brackish (2) fine sandy muds.
	24.0-30.7	Brackish (3) muddy fine sands, clayey fine sands, medium and fine sands.
	30.7-41.0	Brackish (3) muddy and coarse silty very fine sand.
	41.0-43.3	Moderately brackish (2) muddy, coarse silty very fine sand.
Pieistocene	43.3-45.0	Bioturbated, very brackish muddy fine sand.

(3) ROTARY DRILLCORES

Drillhole VC-1

Holocene	6.0-20.0	Very brackish (l) clayey and muddy fine sand, fine sand, pebbly fine sand, muddy medium sand.
Sand unit: 7.0-14.0	(poorly sorted,	fine sand, pebbly fine sand)

Drillhole VC-4

Holocene	9.0-19.5	Very brackish (1) muddy and clayey fine sand, fine sandy clays and muds.
Plei stocene	19.5-25.0	Muddy fine sands, muds, clays, medium silts.
Sand unit: 20.0-21.5	(poorly sorted	muddy fine sand)

Drillhole VC-6

Holocene	9.5-22.0	Very brackish (1) clayey fine sands, fine sandy clays.

22.0-24.0 Moderately brackish (2) muddy very sandy.
24.0-25.0 Very brackish (1) coarse silt; very fine sand, muddy very fine sand.

Pleistocene	25.0-30.2	Muddy fine sand.

Sand units: 14.0-22.0 (clayey fine sands, muddy fine sands, very fine sands)
25.0-26.0 (moderately well-poorly sorted, muddy fine sand, poorly sorted)

Drillhole VC-8

Hol ocene	11.0-27.0	Very brackish (I) clays and very fine sandy clays, muds, very fine sandy muds.

Sand unit: none

Drillhole LBH (Long Beach Harbor)

Holocene	6.0-16.0	Very brackish (1) very fine sandy mud.
Pleistocene	16.0-24.0	Slightly granular fine sand.
	24.0-48.0	Muddy fine sand, very fine sandy muds.
Neogene	48.0-50.0	Clay.

Sand unit: 13.0-24.0 (slightly granular fine sand, poorly sorted)

Drillhole Sp-1-1

Holocene	8.0-9.0	Very brackish (1) mud.
	9.0-18.0	Moderately brackish (2) clay.
	18.0-23.5	Very brackish (1) muddy fine sand
Plei stocene	23.5-25.0	Muddy very fine sand.

Sand unit: none

Drillhole Sp-2-l

Holocene	12.0-17.0	Very brackish (1) clays, muds.
	17.0-20.6	Moderately brackish (2) clays.
	20.6-23.5	Moderately brackish (2) muddy fine sands.

Pl ei stocene	23.5-27.5	Very brackish (1) bioturbated clayey fine sand.
	27.5-30.0	Fine sand.

Sand unit: 27.0-30.0 (poorly sorted clayey fine sand, fine sand)

Drillhole Sp-2-2

Holocene	14.0-20.0	Clay.
	20.0-23.0	Fine sandy clay and mud .
	23.0-26.0	Muddy fi ne sand.
Pleistocene	26.0-33.0	Muddy fi ne sand.

Sand unit: 30.0-33.0 (poorly sorted muddy fine sand)

Drillhole Sp-3-1

Holocene	8.0-11.5	Moderately brackish (2) fine sands, muddy fine sands.
	11.5-12.0	Brackish (3) muddy fine sand
	12.0-20.0	Moderately brackish (2) muddy fine sand.
	20.0-21.5	Brackish (3) marine indicators, clayey fine sand.
	21.5-24.0	Marine (4) fine sand.

Sand units: 8.0-10.0 (well sorted fine sand)
10.0-11.0 (muddy fine sand)
16.0-20.5 (clayey fine sand)
20.5-24.0 (fine sand)

Drillhole Gulfport Harbor F-5

Holocene	8.0-28.0	Very brackish (1) very fine sandy muds and muds.
Plei stocene	28.0-55.0	Coarse silts, silty fine sands, muddy fine sands.
	55.0-88.0	Gravel, medium sands.
Neogene	88.0-100.0	Muds.

Sand unit: 55.0-88.0 (poorly sorted medium sand)

Drillhole SS-1

Holocene	48.0-56.0	Marine (4) medium sand.

Pl ei stocene		
Biloxi Fm	56.0-66.0	Marine (4) muddy very fine sand, very fine sandy mud.

Sand unit: 48-56.0 (wel 1-moderately well sorted medium sand)

<u>Drillhole 1-110, Biloxi</u>

Holocene	2.0-15.0	Clayey fine sand.
Pl ei stocene		
Biloxi Fm	15.0-28.0	Brackish (3) slightly granular muddy fine sand.
	28.0-45.0	Muddy fine sand, gravelly medium sands.

Sand units: 2.0-15.0 (clayey fine sand)
35.0-40.0 (poorly sorted gravelly medium sand)

<u>Drillhole Bk 72</u>

Holocene	12.5-15.0	Moderately brackish (2) puzzling high percentage of <u>Nonionella,</u> muddy very fine sand.
	15.0-23.0	Brackish (3) very fine sandy coarse silt, muddy very fine sand, fine sandy muds.
Plei stocene		
Biloxi Fm	23.0-35.0	Moderately brackish (2) (bioturbation) fine sandy mud.
—	35.0-45.0	Very brackish (I) muds, clays, fine sandy clay, muddy fine sand.
	45.0-46.0	Moderately brackish (2) fine sandy muds.
	46.0-47.0	Brackish (3) fine sandy mud, fine sandy clay.
Neogene	47.0-90.0	Marine (4) mud, clays.
	90.0-300.0	Fine sand, medium sand, granular coarse sand, muddy fine sand, fine sandy coarse silts.

Sand units: none (above -100 ft. level)

<u>Drillhole S-1</u>

Holocene	11 .0-12.0	Very brackish (1) mud, sands, muds, cl ays.
	12 .0-33.0	Moderately brackish (2) muds, very fine sandy muds, clays, very fine sandy clays.

Piei stocene Biloxi Fm	33.0-38.0	Muddy fine sand.
	38.0-43.0	Very fine sandy mud.
	43.0-50.0	Brackish (3) very fine sand, clayey very fine sand, clayey medium sand.
	50.0-54.0	Fine sandy mud.
	62.5-86.0	Well sorted-poorly sorted fine sand, granular medium sand.

Sand unit: 59.0-75.0 (wel 1+moderately well sorted fine-medium sands)

<u>Drillhole S-2</u>

Holocene	14.5-17.0	Very brackish (1) muds, clays and fine sandy muds.
	17.0-32.0	Moderately brackish (2) very fine sandy muds, muddy fine sand.
Pl ei stocene Biloxi Fm	32.0-43.0	Muddy fine sand.
	43.0-47.0	Marine (4) very fine sandy clays.
	47.0-52.0	Marine (4) clayey fine sands, muddy fine sands.
	52.0-57.5	Marine (4) very fine sandy clays.
	57.5-60.0	Marine (4) clay.

Sand unit: 71.0-85.0 (medium sand, pebbly coarse sand)

<u>Drillhole S-3</u>

Holocene	18.0-26.0	Moderately brackish (2) clay.
	26.0-30.0	Moderately brackish (2) very fine sandy mud.
-	30.0-33.6	Brackish (3) muddy fine sands.
Plei stocene Biloxi Fm	33.0-42.0	Muddy fine sands.
	42.0-50.0	Brackish (3) very fine sandy medium silt, muddy fine sand.
	50.0-60.0	Muds, very fine sandy coarse silt.
	60.0-121.0	Muddy fine sands, muds, very fine sandy muds, slightly granular muddy medium sands.
Neogene	121.0-123.0	Clay.

Sand unit: 62. 0-66.0 (well sorted slightly granular medium sand)

<u>Drillhole $-4</u>

Holocene	23.0-30.0	Brackish (3) medium sand.
	30.0-43.0	Brackish (3) medium and fine sand.

Pl ei stocene Biloxi Fm	43.0-48.6	Muddy fine sand.
	48.6-63.0	Moderately brackish (2), very brackish (1) fine sandy mud.
	63.0-65.0	Medium sand.
	65.0-85.0	No sediment record exists.
Neogene	85.0-90.0	Mud.

Sand units: 23.0-37.0 (moderately well sorted medium sands)
37.0-43.0 (very well sorted fine sand)
63.0-65.0 (well sorted medium sand)

Drillhole S-5

Holocene	4.0-36.0	Brackish (3) medium-muddy fine sands.
	36.0-42.0	Marine (4) medium-muddy fine sands.
Plei stocene	42.0-43.7	Clay.
	43.7-48.0	Muddy fine sand.
	48.0-60.0	Moderately brackish (2) fine sandy mud, fine sand.
	60.0-75.0	Clays and fine sandy muds.
	75.0-77.0	Slightly granular muddy fine sands.
Neogene	77.0-84.5	Fine sandy clays.

Sand units: 4.0-38.0 (moderately well-well sorted medium sand/fine sand)
43.8-50.0 (poorly sorted muddy fine sand)
52.0-56.0 (moderately well sorted fine sand)

Drillhole S-6

Holocene	6.0-17.0	Marine (4) medium sand.
	17.0-30.0	Brackish (3) fine sand, muddy fine sand.
	30.0-32.5	Brackish (3)-to-moderately brackish (2) muddy fine sand (deterrite decrease of salinity from 17.0-30.0 interval).
Plei stocene Prairie Fm	32.5-53.5	Fine sandy muds, fine sandy coarse silts, very fine sandy coarse silts.
Biloxi Fm	53.5-63.0	Brackish (3) - Marine (4) muddy very fine sand, very fine sandy mud.
	63.0-95.0	Coarse silty very fine sand, fine sands, medium sands.

Sand units: 6.0-17.0 (wel1-to-moderately well sorted medium sand)
17.0-25.0 (poorly sorted muddy fine sand, fine sand)
66.0-95.0 (well sorted fine sand)

Drillhole EBC

Holocene	13.0-14.5	Very brackish (1) mud.
	14.5-15.5	Moderately brackish (2) clay.
	15.5-31.5	Very brackish (1) fine sandy muds.
Pleistocene	31.5-45.0	Muds.
	45.0-60.0	Coarse silty very fine sand.

Sand units: none

Drillhole Ship Island-1

Holocene	6.0-8.0	Moderately brackish (2) very fine sandy mud.
	8.0-34.0	Marine (4) medium sand, muddy medium sands, muddy fine sand.
	34.0-56.0	Brackish (3) muddy fine sand, fine sandy mud, fine sand.

Sand unit: 7.0-25.0 (medium sand, muddy medium sand)

Drillhole Ship Island-II

Holocene	5.5-29.5	Brackish (3) fine sand, muddy fine sand.
	29.5-44.5	Marine (4) muddy and clayey medium sand, fine sandy mud.
Pleistocene	44.5-50.0	Very fine sandy mud.

Sand unit: 5.5-36.0 (wel 1-to-moderately sorted fine sand, poorly sorted muddy medium-fine sand)

Drillhole Ship Island-III

Holocene	8.0-10.0	Brackish (3) fine sand.
	10.0-22.0	Moderately brackish (2) clayey fine sand.
	22.0-41.5	Marine (4) medium sand, muddy fine sand.
Pleistocene	44.5-45.5	Very fine sandy mud.

Sand unit: 8.0-39.5 (wel1-to-moderately sorted medium sand, fine sand, clayey fine sand)

Drillhole Ship Island-IV

Holocene	5.5-20.0	Moderately brackish (2) medium sand.
	20.0-28.0	Brackish (3) medium and fine sand.

	28.0-36.0	No sample.
	36.0-44.0	Marine (4) muddy very fine sand.
Pleistocene	44.0-53.0	Brackish (3) very fine sandy mud.

Sand unit: 5.5-32.8 (moderately-to-wel 1 sorted medium sand, fine sand)

Drillhole Ship Island-V

Holocene	8.5-16.0	Marine (4) very fine sandy mud, fine sand.
	16.0-20.5	Brackish (3) muddy fine sand.
	20.5-36.5	Moderately brackish (2) clay, medium sandy clay, medium sand.
	36.5-48.0	Very brackish (1) medium sand, fine sandy mud.
Pleistocene	48.0-54.0	Moderately brackish (2)-brackish (3) fine sandy mud.

Sand units: 10.0-20.0 (fine sand and muddy fine sand)
25.0-48.0 (medium sand, muddy medium sand)

Drillhole Ship Island-VI

Holocene	4.5-33.0	Brackish (3) medium-fine sand.
	33.0-41.0	Marine (4) fine-muddy fine sand.

Sand units: 4.5-11.0 (medium sand)
11.0-41.0 (wel1-to-moderately well sorted fine sand, muddy fine sand)

Drillhole Ship Island-VII

Holocene	3.5-41.5	Marine (4) fine-to-mediurn sand.
	41.5-45.0	Very fine sandy mud.

Sand unit: 3.5-41.5 (fine and medium sand)

Drillhole CE (off E. Cat Island)

Holocene	4.5-6.0	Very brackish (1) fine sand.
	6.0-19.5	Moderately brackish (2) fine sand.
	19.5-46.0	Marine (4) medium sand, silty and muddy very fine sand.
Plei stocene Biloxi Fm	46.0-52.0	Very brackish (1) very fine sandy mud, muddy fine sand.

Sand units: 4.5-36.0 (wel1-to-moderately well sorted fine sand, medium sand)
46.0-49.0 (poorly sorted muddy very fine sand) ·

Drillhole Cat Island West (PC)

Holocene	4.5-6.0	Very brackish (1) fine sand.
	6.0-17.0	Brackish (2) fine sand.
	17.0-42.0	Marine (4) fine sand.
	42.0-45.0	Very brackish (1) muddy and silty fine sand.
Pl eistocene		
Biloxi Fm	45.0-58.0	Very brackish (1) muddy fine sand.
	58.0-65.0	Brackish (3) clayey fine sand.
	65.0-75.0	Marine (4) silty fine sand.
Neogene	76.0-86.0	Very fine sandy medium silt, clay.

Sand units: 4.5-41.0 (well-to-moderately well sorted fine sand)
56.0-76.0 (poorly sorted clayey, muddy silty fine sand)

Drillhole Point Clear (Pt. C)

Holocene	3.0-13.0	Very brackish (1) muddy and clayey fine sand.
	13.0-25.0	Fine sand, moderately-to-wel i sorted.
	25.0-32.5	Moderately brackish (2) muddy very fine sand.
Pleistocene	32.5-35.5	Muddy fine sand.

Sand unit: 3.0-25.0 (moderately well sorted fine sands, moderately sorted clayey and muddy fine sands)

Drillhole SJ

Holocene	4.5-25.0	Very brackish (I) mud and clays.
	25.0-35.0	Moderately brackish (2) clays.
	35.0-46.0	Brackish (3) clays, fine sandy clays, fine sand, clayey fine sand.
Pleistocene		
Biloxi Fm	46.0-57.0	Very brackish (1) very fine sandy mud.

Sand unit: 43.0-46.0 (poorly sorted fine sand)

Drillhole SHS (Square Handkerchief Shoal)

Holocene	6.0-14.0	Very brackish (1) fine sand.
	14.0-24.0	Marine (4) fine sand.
Pleistocene	24.0-52.0	Muds, sandy coarse silt, slightly granular medium sands.

Sand unit: 6.0-24.0 (very wel1-to-moderately well sorted fine sand)

Drillhole R-1

Holocene	8.5-19.0	Very brackish (1) muds and very fine sandy muds.
	19.0-22.0	Very brackish (1) muddy fine sands.
	22.0-32.0	Very brackish (1) very fine sandy mud.
	32.0-39.0	Very brackish (1) muddy medium and fine sands.
Pleistocene	39.0-44.0	Very fine sandy muds.

Sand unit: 37.0-38.5 (poorly sorted muddy medium sand)

Drillhole R-2

Holocene	13.5-18.8	Very brackish (1) muddy fine sand.
	18.8-23.0	Moderately brackish (2) to brackish (3) muddy fine sand.
	23.0-29.3	Silty fine sand and fine sand.
	29.3-36.5	Very brackish (1) fine sand muds and muddy fine sands.
	36.5-52.0	Brackish (3) fine sandy muds and clays, muddy fine sands, muds.
Pleistocene	52.0-54.0	Muddy fine sand.

Sand unit: 18.5-29.0 (wel1-to-moderately sorted fine sands and poorly sorted muddy fine sands)

Drillhole R-3

Holocene	14.0-15.0	Very brackish (1) clayey and muddy medium sand.
	15.0-19.0	Moderately brackish (2) medium sand.
	19.0-23.0	Marine (4) medium and fine sand.
	23.0-24.0	Very brackish (1) clay.
	24.0-28.5	Marine (4) mud and clayey fine sand.
	28.5-33.0	Brackish with marine indicators (3) fine sandy mud.
	33.0-40.5	Very brackish (1) clays, muds and very fine sandy muds.

	40.5-50.0	Moderately brackish (2) muds, clays.
	50.0-53.8	Very brackish (1) fine sandy muds.
Pleistocene	53.8-54.0	Very fine sandy mud.

Sand unit: 14.0-22.0 (poorly sorted clayey and muddy medium sands, moderately wel 1-to-poorly sorted fine and medium sands)

Dri11 hoi e MG (Middle Ground)

Holocene	5.0-11.0	Very brackish (1) medium sand.
	11.0-19.5	Moderately brackish (2) fine sand.
	19.5-48.0	Moderately brackish (2) silty and clayey fine sand, fine and medium sand, very fine sandy muds.
	48.0-50.5	Very brackish (1) medium silty fine sand.
Pleistocene	50.5-58.5	(Bioturbated in top) mud.

Sand unit: 5.0-35.5 (wel1-to-moderately well sorted fine to medium sand, moderately-to-poorly sorted clayey fine sand, silty fine sand)

Drillhole P- 5

Holocene	13.5-20.0	Medium sand.
	20.0-32.5	Marine (4) medium sands.
	32.5-37.5	Brackish (3) medium sands.
	37.5-42.5	Marine (4) medium sands.
Plei stocene	46.0-70.0	Siighlty granular medium sand, fi ne sand, muddy fine sand.

Sand unit: 13.5-65.0 (wel1-to-poorly sorted medium sands, muddy medium sands, fine sand, muddy fine sands)

Drillhole OPB

Holocene	3.0-44.0	Brackish (3) fine-to-medium sands.
Pleistocene	44.0-50.0	Very brackish (1) clay.
	50.0-65.0	Muddy medium sands and fine sandy muds.

Sand unit: 3.0-44.0 (wel 1-to-poorly sorted fine-medium sands)

Drillhole P-1

Holocene	19.0-24.5	Very brackish (1) muddy fine sand, muds.
Plei stocene	24.5-31.5	Brackish (3) clay.
	31.5-38.5	Very brackish (1) fine sandy muds, fine sandy clays.
	38.5-46.0	Brackish (3) with marine indicators clayey fine sand, medium sands, mud, very fine sandy coarse silt.
	46.0-49.5	Very brackish (1) clay.
	49.5-67.0	Silts, silty fine sands, fine and medium sands.
	67.0-77.0	Moderately brackish (2) clay.
	77.0-97.0	Marine (3) clay.

Sand unit: 62.0-67.0 (well sorted fine to medium sand)

Drillhole P-2

Holocene	17.0-17.5	Very brackish (1) very fine sandy clay.
	17.5-22.5	Moderately brackish (2) very fine sandy mud.
	22.5-28.5	Very brackish (1) very fine sandy mud.
Plei stocene		
Prairie Fm	28.5-34.0	Very fine sandy coarse silt.
	34.0-40.0	Fine sand.
	40.0-46.0	Coarse silty very fine sand.
—	46.0-56.0	Fine sand.
	56.0-67.0	Medium sand.
Biloxi Fm	67.0-84.5	Marine (4) silts, muds and clays.

Sand units: 34.0-40.0 (moderately well-to-moderately sorted fine sand)
46.0-67.0 (moderately well-to-well sorted fine-medium sand)

Drillhole P-3

Holocene	18.5-19.0	Moderately brackish (2) muddy medium sand.
	19.0-26.0	Marine (4) mud.
	26.0-28.5	Moderately brackish (2) fine sandy mud.
	28.5-38.5	Very brackish (1) fine sandy mud.
Plei stocene		
Prairie Fm	38.5-72.0	Fine and medium sands, muddy medium and fine sands.
	72.0-92.0	Muds and clays.

Neogene	92.0-94.5 Clay.	

San units: 18.5-24.5 (muddy medium sand)
38.5-45.0 (moderately well sorted fine sand)
50.0-71.5 (muddy fine sands, fine sand, medium sand)

Drillhole P-4

Holocene	3.5-28.0	Moderately brackish (2) medium sands
	28.0-37.0	Brackish (3) clayey fine and medium sands.
Plei stocene Biloxi Fm	37.0-53.0	Fine sand and very fine sandy mud.
	53.0-66.0	Marine (4) muddy very fine sand.
	66.0-88.5	Marine (4) mud.

Sand units: 3.5-27.0 (well to very well sorted medium sand)
27.5-28.0 (fine sands, medium sands, clayey fine and medium
35.0-36.5 sands)
38.5-42.0

Drillhole D-1

Holocene	13.0-19.5	Very brackish (1) fine sandy muds.
Plei stocene Biloxi Fm	19.5-66.5	Very brackish (1) fine sandy muds, muddy medium fine sands, medium sands.

Sand unit: 50.5-66.5 (poorly sorted medium sand)

Drillhole D-2

Holocene	9.0-19.0	Very brackish (l) clayey and muddy fine sands.
	19.0-22.5	Moderately brackish (2) muddy very fine sands.
Plei stocene	22.5-29.5	Fine sandy clay , clayey and muddy fine sands.

Sand unit: 9.0-15.0 (clayey fine sand)

Drillhole D-3

Holocene	12.5-16.0	Marine (3) very fine sandy muds.
	16.0-18.0	Moderately brackish (2) very fine sandy muds.
	18.0-23.5	Brackish (3) very fine sandy muds.

Piei stocene Biloxi Fm	23.5-58.0	Very brackish (1) clays, very fine sandy clays and muds.

Sand units: none

DEEP STRATIGRAPHIC DRILLHOLES
(Reference Sections)

(1) GULFPORT PORT AND HARBOR

Location: Harrison County, Mississippi
Latitude 30°21.8'
Longitude 89°5.9'

Elevation: 9.0' (above sea level)

age	depth (in feet below surface)		sediment description
Recent	0	3.5	fill (spoil)
Plei stocene Biloxi Fm	3.5	5.5	Very fine sandy medium silt. Medium gray, soft, mollusca fragments, ostracods, diatoms, echi noid spines, Noni on depressulurn matagordanum, Bui imi nel 1 a eleganti ssima, El phi di urn galvestonense, Rosalina columbiensis. Brackish (3) biotope.
	5.5	7.0	Slightly granular fine sand. White to medium gray, poorly sorted, mol Tuscan fragments, diatoms, Nonion depressulum matagordanum, BuT imineITa elegantissima, Rosal i na columbi ensis. Brackish (3) biotope, high species diversity with inner shelf species, i.e. , Bi generi na irregularis and Textul ari a sp.
	7.0	12.5	Very fine sandy mud. Medium light gray, very soft with mollusca fragments, 7.0-9.6: Nonion depressulum matagordanum, El phi di um galvestonense, Ammonia beccar!i tepi da, brackish 3 biotope. 9.6-10.6: Ammotium salsum, El phi di um galvestonense, Ammoni a beccar!i tepida, quite brackish 2 biotope. 10.6-12.5: El phi dium galvestonense, Ammonia beccar!i tepida, Nonion depressulum matagordanum. Brackish (3) biotope.
	12.5	17.0	Slightly granular medium sand. Medium light gray, very loose, poorly sorted, moll usean fragments, Ammonia beccar!i parkinsoniana,

			Noni on depresso]um matagordanum Bul imi nel 1 a elegantissima , Rosal i na columbiensis, admixture of very brackish and inner shelf species with Mi 1 iammina fusca, Aminoti um sal sum Bi generi na irregui aris. Brackish (3a) biotope.
	17.0	22.0	Pebbly muddy fine sand. Medium light gray, very poorly sorted, mollusca fragments, El phi di urn galvestonense, Quinqueloculina lamarckiana, Ammoni a beccari i parki nsoniana, Tri loculi na brevi dentata. Marine (4) biotope.
	22.0	27.5	Fine sandy mud. Moderate greenish gray, mol Tuscan fragments, soft. El phi di urn galvestonense, Nonion depressulum matagordanum, Rosal ina columbiensis. Marine (4) biotope.
	27.5	32.5	Muddy fine sand. Moderate to greenish gray, soft. Mol Tuscan fragments. ETphidium gaTvestonense. Nonion depressulum matag. , Bui imi nei Ta elegantissima, Noni onella opima, Quinqueloculina lamarckiana [30.5-30.6: Geophyrocapsa oceanica, G. caribbeanica (late Pleistocene nannoplankters)]. Marine (4) biotope.
	32.5	38.0	Fine sand. White-light gray with moderate greenish gray Crassostrea virginica, moderately sorted, very few individuals.
	38.0	41.0	Very fine sandy mud. Light olive gray, light greenish gray with plant root fragments. Ammonia beccari i tepida, Ammoti um sal sum. Moderately brackish (2) biotope. Very few individuals.
Neogene (Pl iocene?)	41.o	57.0	Mud. 41'-55' Pale olive gray to light greenish gray with yellowish brown, limonitic inclusions, fading to yellowish gray to moderate greenish gray with traces of dark yellowish orange inclusions. Dark greenish gray with yellowish gray inclusions, stiff.

57.0	68.0	Clay. Dark greenish gray, stiff.
68.0	72.5	Very fine sandy mud.
72.5	78.0	Clay
78.0	93.0	Mud
93.0	98	Very fine sandy mud.
98.0	110	Mud
110	118	Muddy very fine sand. Dark greenish gray.
118	125	Mud
125.0	135	Very fine sandy medium silt. Dark greenish gray.
135	145	Medium silt. Dark greenish gray.
145	165	Medium silty very fine sand. Dark greenish gray.
165	195	Very fine sandy medium silt. Greenish gray.
195	221	Mud. Moderate greenish gray.
221	222	Very fine sandy mud. Moderate greenish gray.

(2) POINT AUX CHENES

Location: Jackson County, Mississippi
Latitude 30°19.34'
Longitude 88°28.78'

Elevation: 2.0[1]

age	depth (in feet below surface)		sediment description
Hol ocene	0.0	4.0	Muddy fine sand. Very poorly sorted, very loose, black to medium light gray, medium gray with plant fragments and limoni tic incl. Haplophragmoides subinvolutum, Trochammi na i nfi ata, few mol Tuscan fragments. Marshy, very brackish (1) biotope.

Piei stocene Prairie Fm	4.0	10.0	Muddy fine sand and fine sand. Very poorly sorted, very loose, oxidized (4.0-8.0[1]). Light gray, with dark yellowish gray inclusions.
	10.0	12.0	Muddy, medium sand. Poorly sorted, medium dense, medium light gray.
	12.0	13.0	Very fine sandy coarse silt. Light gray with black organic inclusions.
Biloxi Fm	13.0	30.5	Clay. Very soft, medium gray, 13.4-14.4: El phi di um galvestonense, Nonionella opima, Bul imi nel la sp., Hanzawaia strattoni. Brackish (3) biotope. 14.4-16.4: unidentified species. 16.4-27.0: Ammotium salsum, Ammonia beccarii tepida, El phi di urn galvestonense, Nonion depressulurn matagordanum. Very brackish (I) biotope to Moderately brackish (2) biotope. 27.0-30.5: Brizaiina 1owmani i, Nonionella opima, Rosal i na columbi ensis. Marine (4) biotope.
	30.5	34.0	Fine sandy clay. Very soft, moderate greenish gray with moll usean fragments. El phi di urn galvestonense, mi 1 i o 1i dae, Ammonia beccari i, Hanzawaia strattoni, Rosal i na columbienses. Marine (4) biotope.
	34.0	42.0	Very fine sandy coarse silt. Soft, moderate greenish gray. Rangia sp., plant fragments, Ammonia beccarii tepida, chitinous linings, El phi di um galvestonense, Ammotium sal sum, Rosal i na columbiensis. Brackish (3) bi otope.
	42.0	45.5	Mud. Dark greenish gray, very soft. Rosal i na columbiensi s, Nonion depressul um matagordanum Ammoni a beccari i tepida and parki nson., El phi dium galvestonense. Marine (4) biotope.
	45.5	52.5	Fine sandy mud. Moderate greenish gray and light brownish gray, mollusk and plant fragments. Rosalina columbi ensi s, mi1 i o1i dae, Hanzawaia strattoni, Ammonia beccarii. Marine (4) biotope.

52.5	57.5	Very fine sandy medium silt. Light to moderate olive gray, soft, with plant fragments. Ammotiurn salsum. Very brackish (1) biotope.
57.5	67.5	Mud. Moderate greenish gray, soft, with plant fragments. 57.5-62.5: Ammoni a beccari i, chiti nous lini ngs, Ammotiurn salsum. Very brackish (1) biotope. 62.5-67.5: El phi di urn galvestonense, Ammonia beccari i tepida, Nonion depressulum matagordanum. Brackish (3) biotope.
67.5	82.5	Clay. Moderate greenish gray with plant fragments, soft mol luck. 67.5-77.5: El phi dium galvestonense (40%), Bri zali na lowmani , Ammonia beccarii, Nonionella galvestonense, N. opima. Brackish (3b) biotope. 77.5-82.5: Hanzawaia strattoni, El phi di um galvestonense, Nonionella opima, Bigeneri na irregularis, Textul ari a mayori. Marine (4) biotope.
82.5	85.5	Very fine sandy mud. Dark greenish gray, medium, abundant sand lenses. Nonionel1 a opima, Bul imi nella cf B. bassendorfensi s, E1 p h i d i um galvestonense. Marine (4) biotope.
85.5	89.5	Fine sandy mud. Moderate greenish gray, mol lusek fragments. Ammonia beccarii, chitinous lining. Very brackish (1) biotope.
89.5	97.5	Muddy fine sand. Moderate greenish gray to light greenish gray with mollusk fragments, white, very poorly sorted, very dense. 89.5-94.0: forams absent. 94-94.5: Nonionella opima, El phi di um galvestonense, Hanzawaia strattoni, Buliminella cf B. bassendorfensis, Bri zal i na 1 owmani. Marine (4) biotope.
97.5	105.0	Fine sandy mud. Light olive gray, with plant fragments, stiff. Ammotium salsum, unidentified collapsed chitinous linings. Very brackish (1) biotope.

Neogene	105.0	114.0	Medium silt. Medium-stiff, light greenish gray with plant root fragments.
	114.0	120.0	Very fine sandy medium silt. Medium pale greenish gray. El phi dium galvestonense, Ammonia beccari i sp., Hanzawai a strattoni, Bri zal i na lowmani. Brackish (3) biotope.
	120.0	125.0	Medium silty, fine sand. Poorly sorted, light gray, with ferruginous nodules. El phi di um gal vestonense, Ammonia beccarii, Hanzawaia strattoni, very few individuals. Brackish (3) biotope.
	125.0	155.0	Pebbly to slightly granular, fine sand. Poorly sorted, very dense, light greenish gray to light gray.
	155.0	173.0	Muddy to coarse silty fine sand. Poorly sorted, very dense, light greenish gray to white-light gray.
	178.0	195.0	Very fine sandy medium silt. Dark yellowish orange to light olive gray with dark yellowish-orange inclusions, to very dark olive gray to very light gray.
	195.0	255.0	Fine sand. Moderately-poorly sorted. Medium light gray to light gray.
	255.0	260.0	Very fine sandy, medium silt. Dark greenish gray, hard.

(3) MOBIL OIL CORP, Block 72

Location: Mississippi Sound, Alabama
Latitude 30°15.0'
Longitude 88°16.3'

Water Depth: 12.5'

age	depth (in feet below sea level)		sediment description
Hol ocene	12.5	15.0	Muddy very fine sand. Very poorly sorted, moderate greenish gray, mollusk fragments. Ammonia beccarii, Nonionella opima, Bul imi nella

			eleganti ssma, Noni on depressulum matagordanum. Brackish (2) biotope.
	15.0	18.0	Muddy fine sandy. Very poorly sorted, moderate greenish gray, mollusk fragments. 17.0-20.0: El phi dium galvestonense, Nonionella opima, Hanzawaia strattoni, Buliminella eleganti ssima, Noni on depressulum matagordanum. Brackish (3) and Marine (4) biotopes.
	18.0	23.0	Fine sandy muds. Moderate greenish gray, mollusk fragments. El phi di um galvestonense, Ammonia beccarii tepida, Noni on depressulum matagordanum, Cribroei phi dium poeyanum. Marine (4) and Brackish (3) biotopes.
Pleistocene Prairie Fm	23.0	29.5	Mud. Stiff, oxidized, light olive gray with dark yellowish orange streaks, bioturbated muds with admixture of Holocene microfauna and mol Tuscan fragments.
	29.5	35.0	Clay. Stiff, slightly oxidized, pale yellowish streaks, root-like plant fragments.
Biloxi Fm	35.0	43.5	Mud. Stiff, moderately light gray with moderate red and pale yellow streaks, root-like fragments. Ammotium sal sum (few pyri tized), Ammonia beccarii tepida (mostly pyri tized), Brizai ina sp. (pyri ti zed).
	43.5	45.0	Clay. Nonionel1 a atlantica (pyritized), Ammobaculites exiguus, El phi di um sp. (pyri ti zed). Very brackish (1) biotope.
	45.0	46.0	Fine sandy mud. Moderate greenish gray. El phi dium gal vestonense, Ammonia beccari i tepida, Ammonia beccarii parksoniana, Guttulina laevis. Moderately brackish (2) biotope.
	46.0	47.0	Fine sandy clay. Moderate greenish gray. Mol Tuscan fragments. Ammonia beccari i tepida, Hanzawaia strattoni, Cri broei phi di um poeyanum, El phi di um galvestonense, Rosalina columbiensis.

age	depth from	depth to	sediment description
			Brackish (3) biotope, indicators with equal amount of marine fauna.
Neogene (Pl ločene)	47.O	50.0	Mud. Oxidized, light greenish gray, limoni tic stains, glauconitic.
	50.0	90.0	Muds, clays. Dark greenish gray, very stiff. Hanzawaia strattoni, Ammonia beccar!i tepida, Cri broei phi di urn poeyanum, Nonionella opima, Nonionella atlantica, Bui imi nel la elegantissima, Rosal i na columbiensi s, Noni on depressulum matagord., Globul i na i naequali s, Gl obi geri na praebui 1 oides , Globorotalia acostaensis , G. praemenardi i. Planui i na depressa, Guttuli na costul ata. Marine (4) biotope.
	90.0	135.0	Fine sand and silty fine sand. Very light greenish gray, poorly sorted.
	135.0	155.0	Slightly granular, medium and coarse sands. Poorly sorted, very light gray.
	155.0	175.0	Fine sandy coarse silt. Poorly sorted, white, micaceous.
	175.0	185.0	Fine sand. Moderately sorted.
	185.0	195.0	Mud.
	195.0	300.0	Fine sand. Moderately well sorted.

(4) LIGHTHOUSE MOTEL

Location: Gulf Shores, Alabama
Latitude 30°14.94'
Longitude 87°40.7'

Elevation: 6'

age	depth (in feet below surface)		sediment description
Holocene	0	10.0	Medium sand. Moderately well to well sorted, white, slightly granular, dune environment.

PI ei stocene Gulfport Fm (?)	10.0	18.0	Medium sand. Poorly sorted, light brown to tan humate stain, plant fragments, dune (?) environment.
Biloxi Fm	18.0	33.0	Fine Sand. Moderately well sorted, light gray with brownish gray, humate inclusions, humate concentration increased with depth to moderate brown. Small mol Tuscan fragments. Remaneica sp. Marine (4) biotope.
	33.0	37.0	Fine sandy mud. Greenish gray with mollusk fragments. Nonion depressulum matagordanum, mi1 io1idae, Rosal i na columbiensis. Marine (4) bi otope.
	37.0	44.0	Fine sand. Moderately well sorted, light gray with dark greenish gray mud lenses, mollusk fragments. Remaneica sp. and pyri tized Ammoti um sal sum? Marine (4) biotope.
	44.0	54.0	Slight granular medium sand. Moderately to poorly sorted, dusky yellowish brown to moderate grayish green with plant fragments and mol Tuscan fragments, very few individuaTs of ET phi di um galvestonense, Bui imi nei Ta elegantissima, Ammonia beccar!i tepida and Hanzawaia strattoni. Brackish (3) biotope.
	54.0	56.0	Medium sandy olay. Very soft, moderate greenish gray to moderate light gray. El phi di urn galvestonense, Cribroei phi di um poeyanum, Ammonia beccari i tepi da, Bui imi nel la elegantissima. Brackish (3) biotope.
Neogene	56.0	58.0	Slightly granular medium sand. Poorly sorted, very dense, medium light gray, bioturbated fluvial (?) sand with Nonion depressulurn matagordanum, Ammonia beccar!i tepida, Cribroelphidi um poeyanum, and moll usean fragments admixed.
	58.0	84.0	Slightly granular medium sand. Poorly sorted, very dense, strongly oxidized, dark yellowish orange to dark yellowish orange and pale yellowish gray. Fluvial environment.

84.0	124.0	Granular medium sand. Very poorly sorted, very dense, slightly oxidized, white with dark yellowish orange inclusions. Fluvial.
124.0	138.0	Slightly granular fine sand. Poorly sorted, very dense, very pale pink with few reddish orange inclusions. Fl uvi al.
138.0	155.0	Slightly granular, medium sand. Poorly sorted, very dense, very pale tan with pale yellowish inclusions. Fluvial.
155.0	200.0	Slightly granular, coarse silt, fine sand. Very poorly sorted, very dense, dark yellowish orange, pale orange, and purplish red. Micaceous. Fluvial depositional envi ronment.

DRILLHOLE COORDINATES, MISSISSIPPI SOUND AREA

DRILL HOLE	WATER DEPTH (FT)	LONGITUDE	LATITUDE	USGC TOPOGRAPHIC QUADRANGE MAP OF AREA
(1) Mississippi Mineral Resources		Institute	(MMRI) Vibracores	
2	9	88°52.l'	30°21.7'	Deer Island
3	16	32.8'	15.5'	Pascagoula
4	10	15.1'	17.1'	Dauphin Island
5	11	21.6[1]	20.6'	Isle aux Herbes
644	7	15.1'	18.4'	dto
648	10	15.1'	16.4'	dto
651	10	15.1'	16.2'	dto
662	14	21.5'	13.7'	Petit Bois Pass
666	16	21.6'	16.0'	Isle aux Herbes
669.5	16	21.5'	17.6'	dto
677	8	21.6'	21.6'	dto
688	7	26.6'	18.1'	Grand Bay S.W., MS-AL
693	13	26.6'	15.2'	dto
697	14	26.6'	13.5'	Petit Bois Island
741	12+	39.3'	14.4'	Horn Island W.
746.5	15	40.6'	16.4'	Pascagoula
753	8	40.6'	19.8[1]	dto
761.5	14	43.6'	17.2'	dto
775.5	18	51. 2'	16.4'	Deer Island
778.5	15	51.2'	17.5'	dto
781	12	51.6'	18.8'	dto
785	9	51.9[1]	20.6'	dto
803	11.5	59.0'	19.2'	Biloxi (15-min)
805	13	59.1'	18.0'	dto
809	17	59.1'	16.0'	dto
839	9	89°08.0'	19.5'	Pass Christian
848	9	12.9'	18.3'	dto
863	7	11.2'	11.2'	Isle aux Pitre, LA-MS
870	13	14.4'	11.0'	dto
885	9	21.2'	15.7'	Bay St. Louis
910	10	22.4[1]	07.0'	Three Mile Bay, LA
916	9	20.1'	05.4'	dto
925	9	24.3'	04.6'	Malhereaux Pt.
932	10	28.0'	04.6'	dto
1037	10	31.4'	06.6'	False Mouth Bayou, LA
1048	11	25.8'	10.0'	Grand Island Pass, MS-AL
1063	11	18.8'	13.7'	No topographic quadrangle
1077	10	12.2'	15.5'	Pass Christian
1090.5	14	04.8'	16.7'	Gulfport South

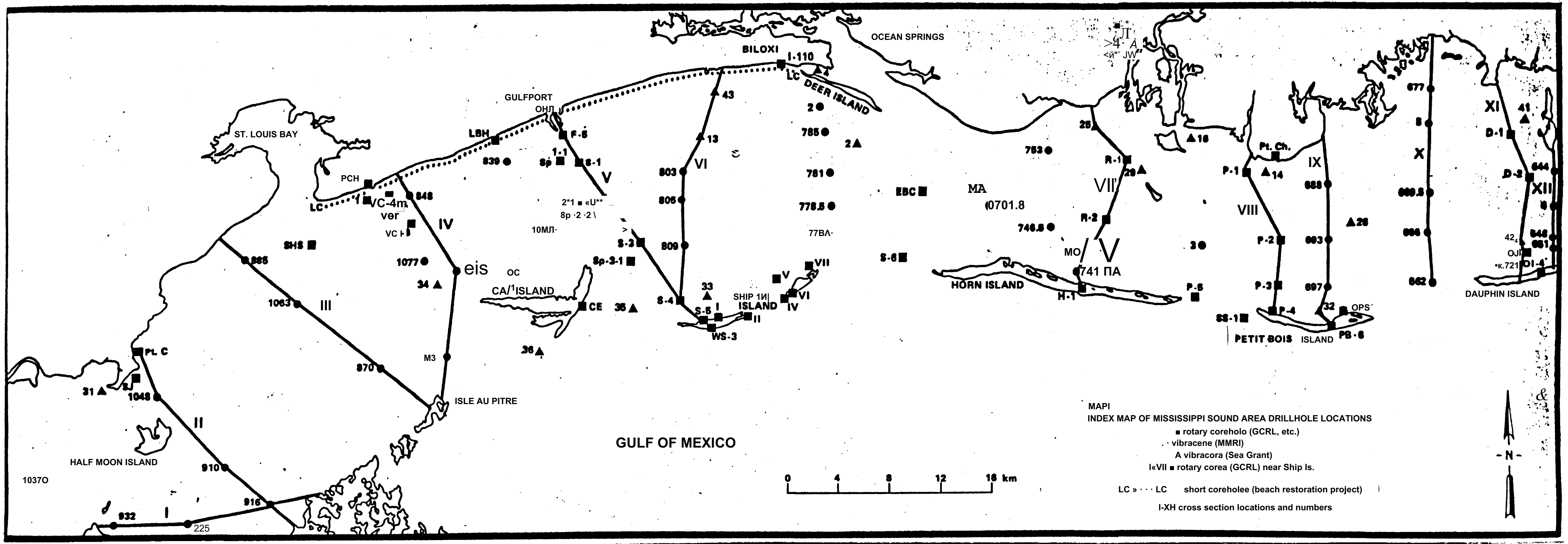
(2) Sea Grant	Vibracores (SG Series)			
2	8	88°50.0'	30°20.3'	Deer Island
4	4	53.0'	22.9'	Ocean Springs
13	11	58.2'	20.4'	Biloxi (15 min)

DRILL HOLE	WATER DEPTH (FT)	LONGITUDE	LATITUDE	USGS TOPOGRAPHIC QUADRANGE MAP OF AREA
(2) Sea Grant	Vibracores (Continued)			
14	5	29.2'	18.7'	Grand Bay, S.W.
16	n. a.	33.5'	20.2[1]	Pascagoula (15 min)
25	3	88°38.4'	30°21.0'	dto
26	9	25.8'	15.9'	Grand Bay S.W.
27	n. a.	35.4'	14.7'	Horn Island E.
28	n. a.	43.8'	18.5'	Pascagoula (15 min)
29	n. a.	36.2'	19.l'	dto
31	5	89°28.4'	10.4'	Grand Island Pass
32	13	27.0'	12.4'	Petit Bois Island
33	18	88°57.5'	13.6'	Ship Island
34	16	89°11.5'	14.3'	Gulfport South
35	18	02.8'	12.9'	Cat Island
36	8	07.0'	11.6'	dto
41	c.12	88°17.1'	20.1'	Isle aux Herbes, AL
42	n. a.	16.0'	16.l'	dto
43	8	57.3'	22.4'	Biloxi (15 min)
CIS	15	89°10.8'	15.2'	Pass Christian
(3) Rotary Drillcores				
(a) US Corps of Engineers, Pass Christian-Long Beach Area				
VC-1		89°14.8'	30°18.6'	Pass Christian
-4		13.9[1]	18.4'	dto
-6		13.3[1]	18.1'	dto
-8		13.O[1]	17.5'	dto
PCH (harbor)		14.9'	18.8'	dto
LBH (harbor)		22.7'	20.6'	dto
Gulfport Ship Channel				
Sp-1-1		89°04.7'	19.6'	Gulfport S.
2-1		03.0'	17.7'	dto
2-2		03.1'	17.4'	dto
3-1		16.1'	15.7'	dto
F-5		05.4'	20.9'	Gulfport South
SS-1		88°30.6'	13.0'	Horn Island E.
(b)	Foundation Engineering			
1-110, Biloxi	just off beach under new Interstate Highway interchange loop			
Bk.72, Mobil Oil Corp.		88°16.3'	30°15.0'	Petit Bois Pass
(c)	Gulf Coast Research Laboratory			
West				
S-1		89°03.5'	30°19.4'	Gulfport S
S-2		02. 2[1]	17.8[1]	dto
S-3		05.l'	15.9'	dto

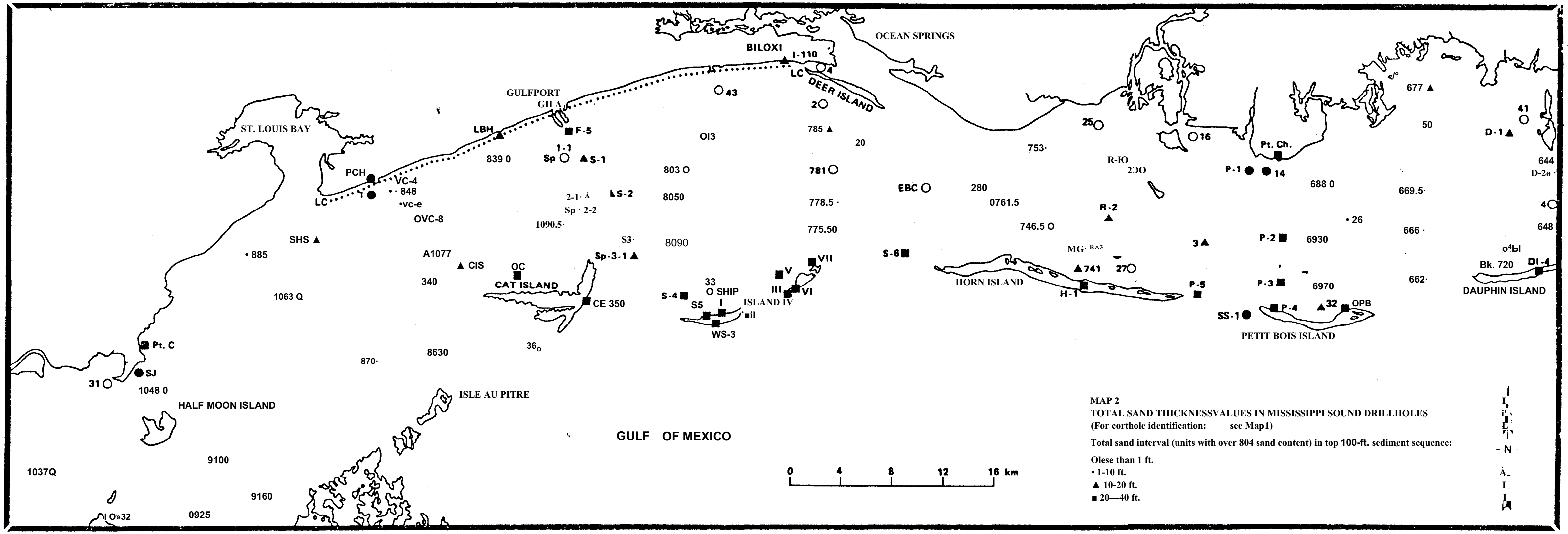
(3) Rotary Drillcores (Continued)

(c) Gulf Coast Research Laboratory (Continued)

DRILL HOLE	WATER DEPTH (FT)	LONGITUDE	LATITUDE	USGS TOPOGRAPHIC QUADRANGE MAP OF AREA
S-4		88°59.0'	13.5'	Ship Island
S-5		59.l'	12.7'	dto
S-6		47.3'	15.2'	Deer Island
EBC		46.5'	18.0'	dto
Ship Is.-I		88°58.0'	30°12.9'	dto
II		54.5'	13.0'	dto
III		54.3'	13.5'	dto
IV		54.2'	13.4'	dto
V		54.4'	13.7'	dto
VI		53.6[1]	13.9'	dto
VII		52.7'	14.6'	dto
Cat Is.-(CE)		89°04.4'	13.4'	Cat Island
(OC)		08.1'	14.2'	Isle aux Pitre
Point Clear (Pt. C)		25.1'	14.1	Grand Island Pass
St. Joseph Pt. (SJ)		26.9'	11.1'	dto
SHS		17.8'	16.2'	Bay St. Louis
<u>Central</u>				
R-1		88°36.6'	19.4'	Pascagoula (15 min)
R-2		38.0[1]	16.5'	dto
R-3		37.0'	15.1'	dto
MG		39.3'	15.4'	dto
P-5		32.0'	13.5'	Horn Island E.
<u>East</u>				
OPB		25.6'	12.6'	Petit Bois Island
P-1		30.8'	18.8'	Pascagoula (15 min)
P-2		30.6'	16.4'	dto
P-3		30.3'	14.3'	Horn Island E.
P-4		30.2'	13.O[1]	dto
D-I		17.5'	19.8'	Isle aux Herbes, AL
D-2		16.0'	18.2'	dto
D-3		16.0'	15.8'	dto



MAP I
INDEX MAP OF MISSISSIPPI SOUND AREA DRILLHOLE LOCATIONS
rotary corehole (GCRL, etc.)
vibracore (MMRI)
vibracore (Sea Grant)
rotary cores (GCRL) near Ship Is.
LC · · · LC short coreholes (beach restoration project)
I-XII cross section locations and numbers
0 4 8 12 16 km
N
GULF OF MEXICO
ST. LOUIS BAY
GULFPORT
BILOXI
OCEAN SPRINGS
DEER ISLAND
HORN ISLAND
PETIT BOIS ISLAND
DAUPHIN ISLAND
SHIP ISLAND
ISLE AU PITRE
HALF MOON ISLAND


MAP 2
TOTAL SAND THICKNESSVALUES IN MISSISSIPPI SOUND DRILLHOLES
(For corthole identification: see Map1)
Total sand interval (units with over 804 sand content) in top 100-ft. sediment sequence:
Olese than 1 ft.
• 1-10 ft.
▲ 10-20 ft.
■ 20—40 ft.
0 4 8 12 16 km
N
ST. LOUIS BAY
GULFPORT
BILOXI
OCEAN SPRINGS
DEER ISLAND
CAT ISLAND
SHIP
ISLAND IV
HORN ISLAND
PETIT BOIS ISLAND
DAUPHIN ISLAND
HALF MOON ISLAND
ISLE AU PITRE
GULF OF MEXICO
Pt. Ch.
Pt. C
SJ
PCH
LC
LBH
GH
I-110
SHS
CIS
OC
CE 350
EBC
S-6
H-1
P-1
P-2
P-3
P-4
P-5
SS-1
OPB
D-1
DI-4
Bk. 720
R-2
WS-3
S-4
S5
VII
V
VI
III
F-5
S-1
S-2
Sp-3-1
VC-4
OVC-8
A1077
1063 Q
1048 0
1037Q
9100
9160
0925
8630
870·
340
839 0
803 O
8050
8090
781
778.5 ·
775.50
785 ▲
753·
280
0761.5
746.5 O
688 0
6930
6970
669.5·
666 ·
662·
677 ▲
644
648
885
848
43
16
14
25
27
41
31
32
33
36
50
20
26