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Subsurface Evaluation of Mississippi Coastal Sediment Units; Comparison with Apalachicola Area Quaternary Sequence

Ervin Otvos

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Dr. Ervin G. Otvos

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The Mississippi Mineral Resources Institute
University, Mississippi 38677

SUBSURFACE EVALUATION OF MISSISSIPPI COASTAL SEDIMENT UNITS; COMPARISON WITH APALACHICOLA AREA QUATERNARY SEQUENCE

The Mississippi Mineral Resources Institute

1987-1988 Yearly Report

Ervin G. Otvos, Ph.D.
Geology Section
Gulf Coast Research Laboratory
Ocean Springs, MS 39564

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INTRODUCTION

This report represents one segment in the continuing research effort for the better understanding of the formation, stratigraphy and associated mineral resources of the Mississippi coastal and nearshore areas by putting them in a regional framework and comparing them with adjacent areas of the northern Gulf Coast region. Understanding the Mississippi coastal Quaternary, in addition, will greatly help in defining it firmly, by delineating it from underlying Late Neogene units, with their own important ground water and potential hydrocarbon and heavy mineral resources.

The present study is a segment of an ongoing longer study. It compares the Mississippi Quaternary units with the Apalachicola sedimentary sequence; the best developed in the vicinity, east of the Mississippi-Alabama coastal segment.

The study results presented here will be supplemented by results of ongoing geological (sedimentary-stratigraphic) research, including additional maps and cross sections, to illustrate the detailed Late Neogene and Quaternary stratigraphy and mineral/sediment resources of the Mississippi-Alabama and the correlated Apalachicola area.

A final report, the next or the following year, depending on funding, will include all still outstanding data, including additional core descriptions, lithology and fossil information, cross sections and pertinent changes and conclusions.

METHODS

The work presented is based on detailed core sample investigations of about 46 Apalachicola area drillholes and several seasons of

TABLE 1. SALINITY RANGE CATEGORIES, BASED ON FORAMINIFER ASSEMBLAGES

(1) Oligohaline - lower mesohaline (c. 2-16 ppt)

Dominant

Ammotium salsum (0-100%)
Ammonia beccarii parkinsoniana (0-100%)

Secondary and minor (Each species usually less than 10-50%).
(Several are common in salt marshes).

Ammobaculites exiguus
A. exilis
Ammonia beccarii tepida
Trochammina sp.
Miliammina fusca
Jadammina polystoma
Arenoparella mexicana
Haplophragmoides subinvolutum
H. canariense
Ammoastuta inepta
thecamoebians

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

(2) Mesohaline — lower polyhaline (c. 10—26 ppt)

Dominant

Ammonia beccarii parkinsoniana (10-60%)
Ammonia beccarii tepida (10—80%)
Elphidium galvestonense (10—50%)

Secondary

Ammotium salsum (0-20%)
Nonion depressulum matagordanum (0-15%)

Minor (usually < 5% of total)

Cribroelphidium poeyanum
Palmerinella gardenislandensis
Elphidium latispatium pontium
E. incertum mexicanum

Altogether 15 or less species

(3) Polyhaline — lower euhaline (c. 20—30 ppt)

Dominant (40—60%)

Ammonia beccarii tepida (10—35%)
Nonion depressulum matagordanum (5-30%)
Elphidium galvestonense (10-30%)

Secondary (30-40%)

(a) Lower salinity subgroup
Cribroelphidium poeyanum (0-10%)
Ammonia beccarii parkinsoniana (0-10%)
Buliminella elegantissima (0-10%) (significant organic content in sediments also favors this species)
Hanzawaia strattoni (0-5%)

(b) Higher salinity subgroup
Hanzawaia strattoni (0-10%)
Nonionella opima (0—15%)
Elphidium incertum mexicanum (0-5%)

Minor

Sum: c. 5-10% of total. Each species less than 1 %.
Fursenkoina sp.
Elphidium latispatium pontium
E. advenum
E. sp.
Brizalina lowmani
Quinqueloculina sp.
Triloculina sp.
Guttulina sp.
Cibicides sp.
Nonionella atlantica
Globigerinoides sp.
Globigerina sp.

Great species diversity

(4) Euhaline (c. 25-32 ppt)

Dominant

Hanzawaia strattoni (15.0-50.0%)

Secondary

Elphidium galvestonense (5-20%)
Ammonia beccarii tepida (10—15%)
Nonion depressulum matagordanum (10-15%)

Minor

Each species c. 5—10%
Quinqueloculina lamarckiana
Q. seminulum
Buliminella sp.
Rosalina columbiensis
Nonionella opima
Elphidium incertum mexicanum
Cribroelphidium poeyanum
miliolids

Each species c. 0-5%
Bigenerina irregularis
Textularia mayori
T. agglutinans
T. candeiana
Cibicides floridanus
Cassidulina subglobosa
C. crassa
Reussella atlantica
Elphidium discoidale
Buccella hannai
Trifarina bella
Sagrino pulchella primitiva
Globigerina sp.
Globigerinoides sp.

Highest species diversity

geological field work. The cores were ■ obtained from various sources (Ardaman Engineering, Tallahassee, FL, Florida Geological Survey, Florida State University core collection, etc.) and drilled over the years through the GCRL. Macroscopic studies, granulometric analysis and microfossil evaluation of the sediment units, encountered in the drillholes have been performed at GCRL. Additional microfossil studies were performed by outside sources (e.g., W.D. Bock: foraminifer faunas; M. Sullivan: diatom algal studies). Depositional environment identification on the basis of foraminifer faunas in the core samples, was based on data developed by us, with the help of W.D. Bock (Table 1). Radiocarbon age dating results came from the University of Georgia, Center for Isotope Studies.

The study results were integrated in "strip logs" and foraminifer logs for each drillholes, combined in cross section profiles. This allowed regional evaluation of the major geological processes (e.g. transgressive/regressive events, fluvial deposition/erosion cycles,etc.) that effected the area during Late Neogene, Pleistocene and Holocene times. At the same time, they facilitated in establishing division and solving boundary problems between the major geological units encountered. The sequence of geological units and the processes that led to their formation then were compared with similar units and processes in the Mississippi-Alabama coastal zone.

MISSISSIPPI-ALABAMA COAST QUATERNARY SEQUENCE.

Underlying Units; The Neogene-Pleistocene Boundary Problem.

The problem of defining the lower boundary of Pleistocene deposits in the onshore and offshore subsurface in our area is related to the nature of the Late Neogene sedimentary units that underlie the Quaternary. The several hundred to several thousand feet thick (Late) Neogene here is composed of siliciclastic continental-to-brackish units that formed in lower fluvial floodplains, delta fringes, estuarine lagoonal-bay areas and in estuarine-influenced, brackish nearshore areas. Coarse and granular sands, often with gravels are quite common and indicate the presence of extensive, laterally shifting coastal river systems, associated with a variety of paralic environments. Occasionally, thin transgressive marine units (lenses), with datable fossils have been recognized and identified as of Middle Miocene, Late Miocene or Lower Pliocene age (Otvos, in press).

GENERAL STRATIGRAPHIC CHART, MIOCENE-HOLOCENE

MISSISSIPPI-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 - - -	
		Late Pleistocene (Mid-Wisconsinan?)		
			- - - unconformity - - -	
PLEISTOCENE		Late Pleistocene (Sangamonian and early Wisconsinan) transgressive-regressive sequence correlative units: Prairie Fm (alluvial) - Biloxi Fm (inner shelf-to~estuarine) - Gulfport Fm (barrier complex)		
			- - - unconformity - -	
		Earlier Pleistocene alluvial deposits (higher "terrace")		
			- - - unconformity - - -	
	Undifferentiated Miocene-Pliocene Coarse Clastics		Citronelle Fm - alluvial (in upland areas)	
			- - - unconformity - - -	
PLIOCENE			Jackson Bluff Fm (SE Alabama-W. Florida) Bluff Fm	Intracbas tal Limes tone-Jackson
		Es tua rine/alInviai 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	Choc tawha tehee Fm (=lower part Intracoastal Fm; Clark and Schmidt, 1982)
			- - - unconformity (?) - - -	
Middle		Hattiesburg Fm	Escambia Sequence Lower Pensacola Clay-Bruce Creek Limestone	Shoal River Fm Oak Grove-Bruce Creek Fms
			- - - unconformity * · -	
Lower		Catahoula Fm	Tampa-Chickasawhay undifferentiated	Tampa stage limestones (Chipóla, etc.)

Fig. 1 General Stratigraphic Chart, Miocene-Holocene,
' Mississippi-Alabama-Western Florida Panhandle Coast

Unconformity surfaces would be expected to be recognizable between the "undifferentiated" Neogene and the Pleistocene deposits but the presence of coarse-grained, sometimes oxidized units even within the continental Neogene sediments makes this recognition in the small-diameter drill cores more difficult, if not impossible. While it is clear that the continental Neogene deposits at several locations may be overlain by Pleistocene fluvial beds, these can not be dated as such at present and the Neogene-Pleistocene boundary is defined at the interface between nonfossiliferous siliciclastic deposits and overlying brackish or marine units that contain Quaternary fossils and/or can be correlated with Pleistocene deposits, encountered in drillholes toward or under the mainland.

PLEISTOCENE UNITS

SANGAMONIAN INTERGLACIAL

BILOXI FORMATION

Despite earlier suggestions in the literature that pre-Sangamonian Pleistocene coastal marine units and "terraces" have been preserved both in the Mississippi-Alabama and Apalachicola coastal zones, field studies (Otvos, 1985b) did not turn up any firm evidence for such assumptions. The only units that represent Pleistocene marine conditions along the NE Gulf are the Biloxi and the associated Gulfport Formation (Fig. 1).

The Biloxi is a sandy-silty, sandy-muddy, usually 15-40 ft thick transgressive-regressive unit that thins to a featheredge under the mainland. While offshore it is represented by open marine, shelf facies,with an abundance and great specific variety of microfossils, it ranges landward through a series of increasingly brackish environments, as defined by foraminifer spectra (Table 1) . The presence of the exclusively Quaternary nannoplankton species Gephyrocapsa oceanica and G. caribbeanica in the most marine Biloxi facies,helps to distinguish this unit from Neogene shelf deposits. In its most brackish facies,the formation contains a limited number of agglutinated foraminifer species, their pseudochitinuous, unidentifiable test residues, diatoms and oyster shells.

Landward the Biloxi interfingers with the alluvial Prairie Formation that may also under- and overlie it in mainland and nearshore areas. The Biloxi also grades upward into shoreface-subtidal subfacies of the Gulfport Formation.

GULFPORT FORMATION

This, usually 35-45 ft thick formation consists of shoreface-subtidal silty sands that grade upward into increasingly better sorted shallow subtidal-intertidal beach sands, capped (where preserved) by slightly oxidized, light grayish yellow and white dune sands. The pure white, clean beach and dune sand facies have been mined by the construction industry in sand pits. Downward percolating and precipitating organic (humic) acids often cement lower levels of the Gulfport sands, forming humate-cemented, semiconsolidated, dark brown-to-black "sandstone" ledges. The Gulfport developed as seaward prograding mainland barriers, occasionally possibly barrier islands, along the mainland shore during the stable Sangamonian high sea level stand (c, 25 ft above present sea level). Progradation of barrier involved construction of numerous subparallel beach ridges. While these ridges and intervening swales, despite their eroded state, are still relatively well preserved in the Mississippi area, they are hard- to-impossible to recognize in most of the Florida Panhandle Gulfport area. The various barrier segments, some stretching 10-20 miles parallel with and immediately adjacent to the present shoreline, at the time of their development were separated by inlets, formed by estuaries. The barrier segments exceed 1 mile in width and occasionally reach 30-40 ft peak elevations.

PRAIRIE FORMATION

The Prairie formed as a complex in continental fluvial-alluvial environments immediately before, during and after the Sangamonian transgressive-regressive cycle landward of the interglacial and post-interglacial seashore. Sandy-gravelly deposits are not rare, but silty sands, a muddy (silty-clayey) deposits are the predominant. Occasionally peat beds were preserved in backswamp/oxbow lake facies. The top portion of the sequence is typically oxidized and has yellowish-brown, yellowish gray colors. The formation, when not dissected by Late Quaternary land erosion, forms an even, slightly seaward- sloping land surface that locally attains a width of 20-30 miles. Along most of the northern Gulf the Prairie interfingers with the Biloxi brackish facies in the subsurface. The same relationship in Texas and SW Louisiana between the Prairie-equivalent Beaumont Formation and intercalated brackish deposits (Biloxi Formation correlatives) resulted in the incorporation of these Biloxi-correlatives into and as part of the Beaumont. The distinction between the Biloxi and the Prairie along the eastern Gulf, as two valid, separately mappable formations, despite their interfingering relationship is a practical fact. With a few exceptions, the Prairie does not interfinger with the Biloxi at near- and offshore locations, but overlies it in its regressive mode under the Mississippi Sound.

PROBABLE MID-WISCONSINAN COASTAL DEPOSITS

While the sea level never returned to its interglacial high during the late Pleistocene, possible seismic and drill data indications of a lower-than present sea level have been found in the Petit Bois Island area of Mississippi and off Gulf Shores, Alabama (Otvos, 1985a,p.32-33) . A sharply defined erosional surface, extending from 75 to 3 9 ft below present sea level at Petit Bois seems to cut into and forms the upper surface of Biloxi Formation deposits. It is overlain by prograding forest beds, interpreted as Mid-Wisconsinan barrier deposits. No core samples have yet been obtained from the assumed Mid Wisconsinan units.

HOLOCENE SEDIMENTS

The Holocene transgression reached the present mainland shore area about six thousand years ago and deposited a sequence, representing depositional facies of upward increasing salinity. Barrier island and spit growth (e.g., Morgan Peninsula) soon after the present shore area was occupied by the sea, restricted salinities and formed the present Mobile Bay and Mississippi Sound. A regressive sequence formed, with upward decreasing salinities imprinted in the sediments. Maximum sediment thicknesses occur under the islands and in certain estuarine zones with fills of pre-Holocene incised river channels.

APALACHICOLA AREA QUATERNARY

Area Geography

This area, in the eastern Florida Panhandle that serves as a comparison, forms a triangular-shaped bulge on the Gulf shore, approximately 45 mi wide. Its west-central portion is occupied by the extensive Apalachicola floodplain-estuary-delta system. The delta area offshore is flanked by the St. Joseph barrier spit and St. Vincent, St. George and Dog barrier islands. These enclose a series of bays and lagoons (St. Joseph, Apalachicola, St. Vincent and St. George Sounds).

Geological Setting

The Apalachicola Delta region was 'a low area throughout the Tertiary and is being called the Apalachicola Embayment for that reason (Schmidt, 1984, p.59-62). It has been receiving larger volumes of sediments than adjacent "highs" during the Miocene and this pattern continued since. The thickness of the Pleistocene sequence, resulting from this circumstance, renders this area a prime objective in comparison with the coastal Mississippi-Alabama Pleistocene sedimentary sequence.

Highest Late Neogene Units

Carbonate rocks (limestones, limey marls) and semiconsolidated-unconsolidated limey middle and inner shelf sediments (biocalcarenites, calcilutites,etc.) dominate the Late Neogene units that underlie the Quaternary in the area. Before recognition in the 1970's of their Pliocene age all near-surface Neogene rocks were considered as part of the Upper Miocene Choctawhatchee Formation (or Stage) here. Later Akers (1972) Huddlestun (1976, 1986) and Schmidt and Clark (1980) described a new Lower Pliocene Intracoastal Formation and dated the Jackson Bluff Formation in the eastern, east-central Florida Panhandle area as Lower-to-Middle Pliocene (Zones N 18-19). Huddlestun (p. 148) correlated the two units in the Apalachicola Embayment Pliocene with Zones N 19 and 20 on the basis of global planktonic foraminifer zones.

In the course of our own sample investigations of the topmost Apalachicola Neogene core intervals, only a very few planktonic foram specimens of exclusively Pliocene and younger age have been identified in calcareous sediments (Globigerina riveroae (Zone N 18-23; Globigerincides ruber (Zones N 18-23). The other age-diagnostic planktonics encountered (Globigerina nepenthes, Globorotalia acostaensis, G. menardi ,etc.) were usually of Miocene-Pliocene age. The presence of Upper Miocene units at quite shallow depths is indicated in Drillhole #16 (Lanark Village). The Miocene Globigerinoides praebulloides (N1-17) (8.5% of the sample at only 20 ft depth) strongly suggests that the Pliocene is either absent or represented only by a very thin unit here.

Although Schmidt (1984, p.54) assumed that downdip the Jackson Bluff extends into the Pleistocene, no Lower Pleistocene sediments,including correlatives of the Formation have yet been identified in the subject area. The 50-160 ft interval of Drillhole #21 labeled (Schmidt, p.126) as Pleistocene Jackson Bluff, actually consists of Holocene (to 62 ft below core top), Late Pleistocene marine-to-brackish (Biloxi Fm; 62-86 and 100-107 ft) and alluvial (Prairie Fm; 86-144 ft) deposits. The correlations were based on logs of adjacent drillholes. Calcarenite and interspersed muddy quartzarenite layers (Jackson Bluff Fm?) occured only below 144 ft) . A concentration of apparently reworked <u>Mercenaria</u>, <u>Chione</u> and <u>Cerithium</u> shells, radiocarbon dated very Late Pleistocene, occurred at 62 ft. It is assumed that during the Late Pleistocene-Holocene transgression the shells had been eroded and transported landward from their original deposition site to this location and deposited over the Pleistocene land surface. The absence of oxidation in the top of the Pleistocene units here may also be explained by wave erosion. Nannoplankton species at 55 and 70 ft included abundant <u>Gephyrocapsa oceanica</u>, the common <u>G</u>. <u>caribbeanica</u> and G. ("small")-nannofossils; exclusively Quaternary taxa. The dominance of the last taxon may indicate greater than 84 ka B.P. age (R.E. Constans, written comm., 1986), but this certainly does not apply to the 55 ft (Holocene) nannoplankton sample.

In the topmost units, the Neogene calcareous sediments include increasing amounts of siliciclastic (quartz-bearing) sands, silts, lime-cemented quartz sandstones and silty sandy calcareous deposits, signifying the last stage of Pliocene regression and the increasing significance of sediments, derived from fluvial and perhaps coastal barrier/eroded bluff sources. The siliciclastic component approached one-third, one-half of the total sediment/rock volume, especially in the higher calcarenitic zones. The highest units, here also assigned to the Pliocene, include 10-40 ft of medium gray (occasionally oxidized, with dark yellowish orange, yellowish brown colors) fine sandy medium silts, muddy fine sands, silty and medium silty granular fine and very fine sands as well as fine sands (e.g. Drillholes #3 and #33) . The gradation of typical fossiliferous Neogene rocks and sediments into fossil-free silts and quartz sands was best shown in Drillholes #6,12, 18, east of the Apalachicola River.

The top siliciclastic unit usually formed in brackish environments (chitinous foram test remnants, <u>Ammotium salsum</u>) , but occasionally

(Drillhole #3) open shelf depositional environments (Biotope Category 4) have also been identified in it. At certain locations (#4, Lukes Ford Ck) the nearshore Neogene foraminifer faunas were mixed with a large percentage of open marine planktonic species. The open marine species, as also in the case of some of the Biloxi biofacies, were probably transported to the shore, as they are at present, by eddies of the Loop Current (W.D. Bock, written com.).

QUATERNARY SEQUENCE

POST-NEOGENE LAND SURFACE MORPHOLOGY

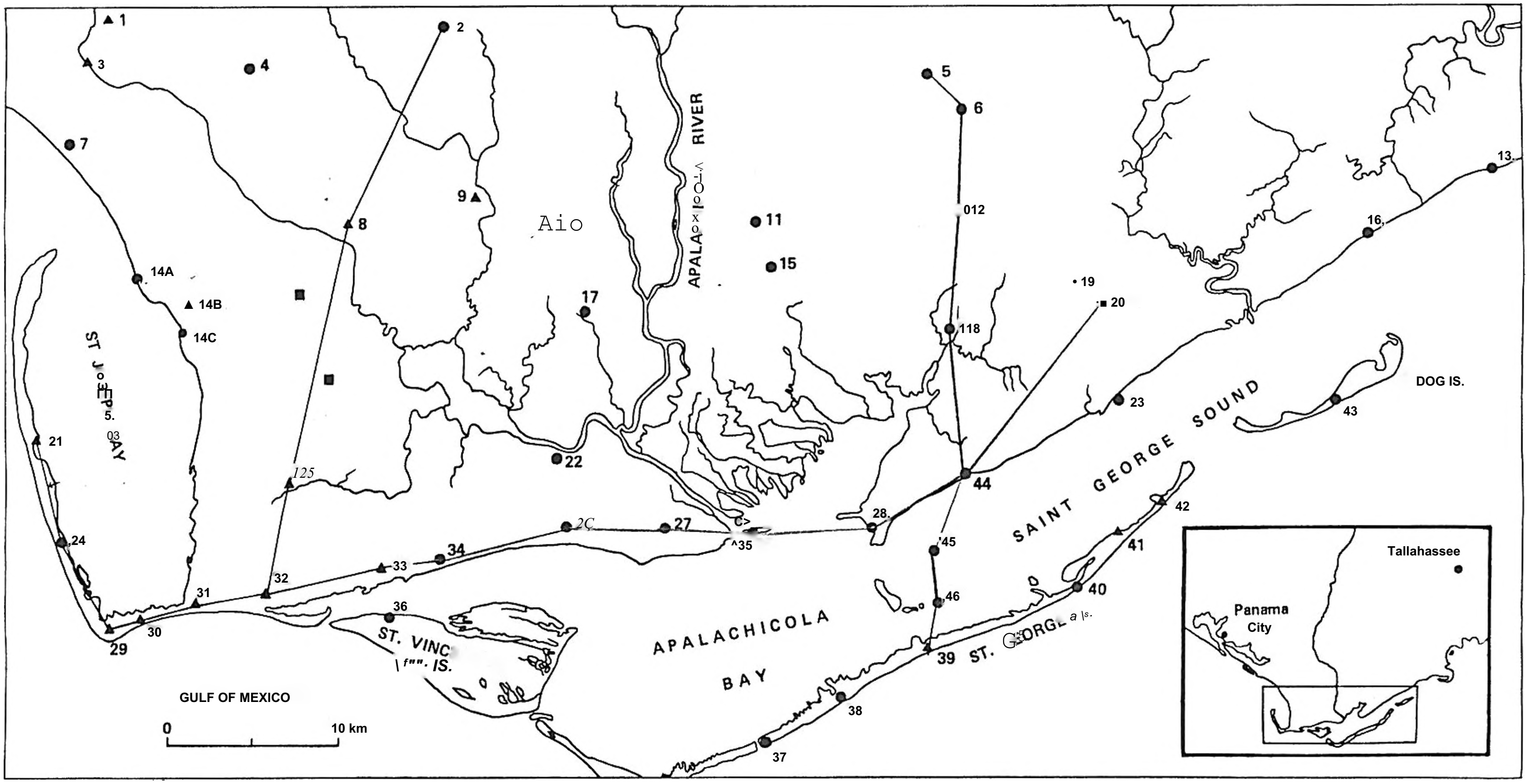
The earliest Pleistocene sediments were deposited on a SW-, S-ward sloping land surface, directly underlain by siliciclastic, to a lesser extent by calcareous Neogene units. In the NE part of the area the limestones, exposed in quarries, extend slightly above sea level, while in the SW the Neogene surface dips 160 ft below sea level. On the whole, it is gently sloping, incised heavily only in a few restricted areas. West of the town of Apalachicola, between Drillholes 22 and 26 the Neogene surface slope is 1:164. One incised branch of the Late Pleistocene Apalachicola River during a pre-Sangamonian low sea level stand followed this elongated low zone between Drillholes 15 and 26. Relatively steep slopes developed also in the SW corner of the area, near Drillholes #29-31, along another possible Pleistocene river channel trend (Fig. 1). The preliminary draft of the structural contour map, drawn on the Neogene surface (completed map to be included in final report) does not lend support to the suggestion that during "much of Pleistocene time" the Neogene rocks formed high bluffs on the eastern side of the Apalachicola River north of the present coast (Schnable and Goodell, 1968, p. 34).

LATE PLEISTOCENE TRANSGRESSIVE-REGRESSIVE COMPLEX

During the early phase of the Sangamonian transgression when sea level stood below c. 160 ft below present sea level, the deeply incised river channels became filled by slightly granular, moderately well-to

Fig. 2. Drillhole locations, Apalachicola Coast area.

APALACHICOLA DELTA REGION DRILLHOLES
TRIANGLES: WITH FOSSILIFEROUS BILOXI Fm INTERVALS
SQUARES: FOSSILIFEROUS EXCAVATIONS



very poorly sorted dense-to-very dense medium sand, slightly granular medium sand and coarse silty medium sand. With further rise of sea level, river floodplains spread over higher surfaces, depositing the Prairie Formation alluvium over the Neogene in the entire subject area. Distinction between nonfossiliferous, .siliciclastic sandy-silty Neogene top units and the overlying sandy-silty Pleistocene sediments is not always clear-cut and is helped when the top Neogene sediments are oxidized and/or are correlatable with fossiliferous Neogene sandy-silty deposits in other drillholes.

PRAIRIE FORMATION

The coarsest alluvial facies of this Formation, formed in the first stage of the Sangamonian transgression occur in the previously described river channel fills. The "massive clays and clayey sands" and quartz sands, described as individual Pleistocene units by Schmidt (1984) in the Apalachicola Embayment, represent Prairie, as well as Biloxi deposits (e.g. Depot Creek drillhole #25). As elsewhere in the northern Gulf coastal plain, the Formation is characterized by great vertical and horizontal variability. Common lithofacies include moderately sorted fine sands, slightly granular medium sands, coarse silty fine sands, muddy fine sands and muds. Due to the sandy nature of the Apalachicola source sediments, the Prairie sediments tend to be much more sandy, with less clay/mud content than in correlative units of the Alabama-Mississippi coastal area. Peaty matter (backswamp/oxbow swamp deposits) occurred in very few cores. The oxidized top portion of the Prairie is characterized by moderate yellowish brown, brownish gray and yellowish orange colors. Below it, light gray, light tan colors are predominant. A particular problem that involves the Formation and makes its thickness determination difficult is caused by the high permeability and sandy nature that the Biloxi Formation shares. This was instrumental in the total leaching of calcareous fossil tests and shells in certain Biloxi intervals. Unless nonleachable, siliceous diatoms or chitinous foram tests remain preserved in such units, it is often difficult to tell which of the two formations such unit belongs to. Leaching had been identified as a significant fossil-dissolving process by Schnable and Goodell (1968) and Otvos (1985b).

The Prairie forms a gently seaward-inclined, even, low land surface 10-30 ft above sea level, inland of the Gulfport belt. It has developed an erosional gully topography only locally, as in areas adjacent to the Apalachicola River. The Prairie land surface at several locations (e. g., Forbes Island Quadrangle, west of the Apalachicola River) carries incised traces of meander bends. The so-called "Old Delta" surface here (Schnable and Goodell, Fig.2) at the Howard Creek community is continuous with and part of the Prairie surface and apparently of the same age. .

BILOXI FORMATION

Biloxi deposits overlie the Prairie and due to fluctuations of the shoreline, display mutual interlayering with it. The earliest Biloxi sediments were deposited in low-lying areas, reached by the encroaching sea. In Drillholes #29 and #30 the first brackish deposits occur between 125 and 160 ft below present sea level. Following the drop of Sangamonian sea level, during regression Prairie deposits covered the Biloxi sediments. As noted, due to local leaching of the sandy Biloxi sediments that often resulted in the total dissolution of enclosed calcareous fossils and eliminated the crucial distinguish characteristic between the two formations, interlayering of the formation with the Prairie occasionally may be more apparent than real. Fossil-free sands that underlie the Gulfport barrier sands along the shoreline. Along the shore where the Gulfport deposits directly overlie fossil-free sands and silty sands (e.g., Drillholes #7, #14b), these sands and silts also appear to represent post-depositionally leached nearshore Biloxi deposits that grade upward into the Gulfport barrier sands. These large gaps in fossil content often hamper and occasionally even prevent landward correlation of the depositional facies. Biloxi depositional facies range from open marine, middle-inner shelf facies to highly brackish depositional environments. With one exception, the open marine (Category 4 and 5; Table 1) facies was restricted to the present St. Joseph Bay vicinity. Due to post-depositional leaching often only unsatisfactory subsurface information exists to provide a clue for river channel positions during Biloxi deposition. However,the distribution of shelf and brackish-highly brackish facies patterns strongly suggests that, as of today, the bulk of river discharge occurred at the southeastern coast.

Marine facies. Open shelf sediment beds were found only in certain depth intervals of Drillholes #14c, 21, 24, 30, 31, and #39 (St. George Is.) . These included highly varied, rich foram faunas. In addition to the dominant miliolids that in certain core intervals approached one-third of the foram populations (*Quinqueloculina* lamarckiana,, Q. tenaços r Q. s eminulum, Q. poeyana Q. bosciana, Q. subpoeyana, Q. compta, Triloculina brevidentata, T. trigonula, etc.), Rosalina columbiensis, R. fleridana, Brizalina striatula, Cribroelphidium poeyanum were predominant in Drillholes #14c, 21. In Drillhole #30 only a small percentage was represented by miliolids. In one interval of Drillhole #21, Asterigerina carinata was represented by 10% of the population, while in Drillhole #31 Textularia candeiana and T. mayori played a dominant role at 7 6-ft depth. Minor amounts of highly unusual species occurred in most intervals (e. g ♦, Milionella subrotunda, Patellina corrugata, Stetsonia minuta, Fissurina quadrata, Dyocinicides biserialis, etc.). Brackish water influence from the nearby river system, is suggested by the persistent Ammonia beccarii, Elphidium incertum me xicanum, E. galvestonense, Nonion depressuium matagordanum and other species throughout the mid-inner shelf facies. The closeness of fluvial sand sources is indicated by the slightly granular, moderately fine sand, moderately sorted medium sand lithology of the interval in Drillhole #3 0. Muddy fine sands and fine sands represented most of the open marine interval in Drillhole #24.

Brackish facies. The overwhelming majority of the fossiliferous Biloxi deposits contained foram taxa, that reflected shallow, brackish biotope conditions of Categories 2-3, occasionally of (Table 1). These deposits displayed the same range of lithologies, from granular medium sands to muddy sands and muds as did the Prairie sediments. Molluscan-bearing Biloxi deposits were also encountered in spoil heaps along shallow (5-8 ft) drainage ditches, (Sec. 3-T8S-R10W, sec. 21-T7S-R10W; Gulf County; sec. 21-T7S-R5W, Carbody Rd, Franklin County) . These molluscan species occur also in bays, estuaries and adjacent nearshore zone of the present-day delta area: Anadara transversa, Argopecten irradians, Busycon contrarium, Canditamera floridina, Crassostrea virginica, Chione cancellata, Dinocardium robustum, Mercenaria campechiensis, Noetia ponderosa, Oliva sayana, Polinices duplicatus, Terebra dislocata and the coral Astrangia sp.
The most brackish biotopes contain Ammotium salsum, chitinuous foraminifer tests and diatoms.

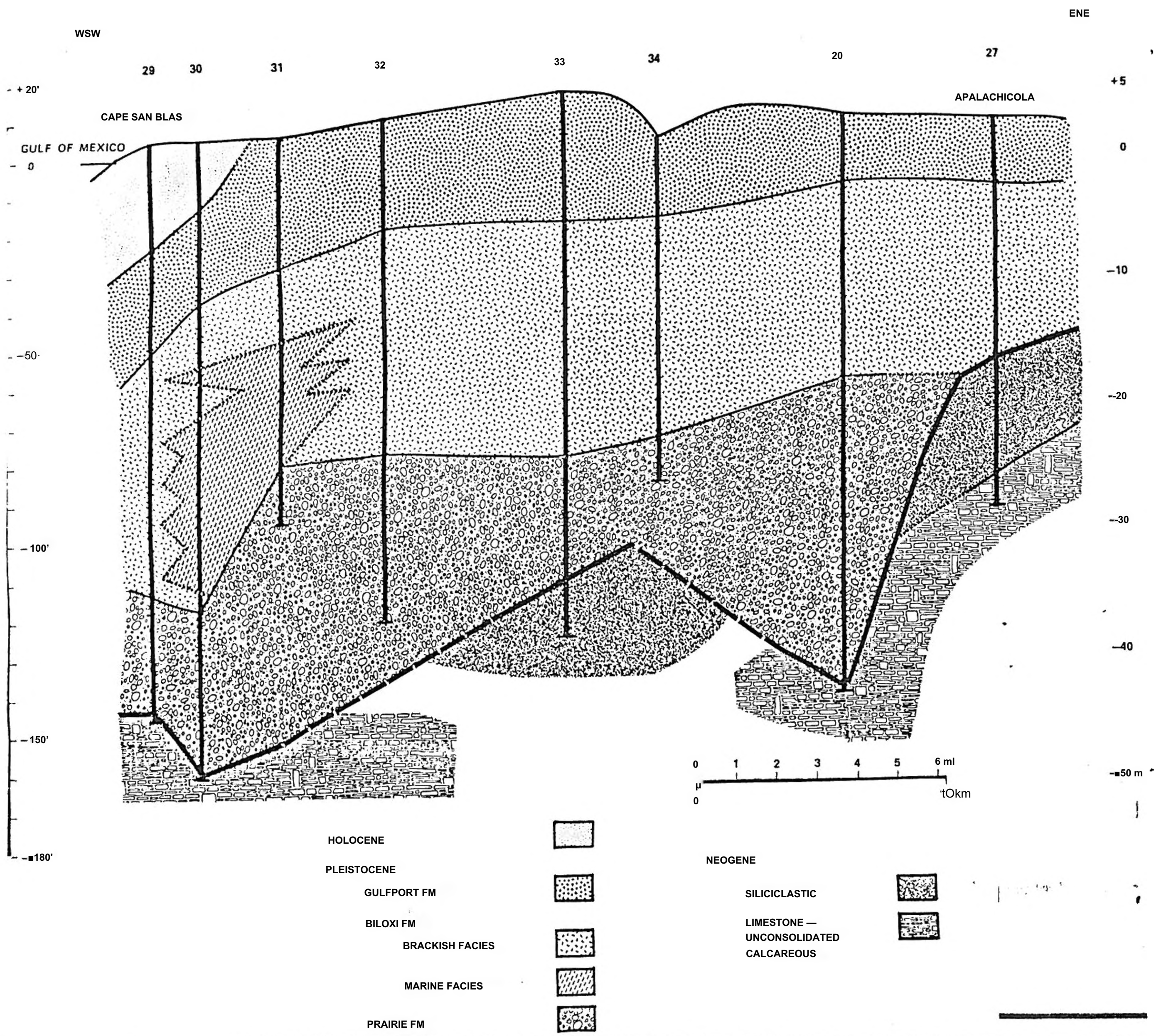
GULFPORT FORMATION

Doering (1956, p. 1857) correctly stated that the large sand ridges along the coast at Port St. Joe, Apalachciola, and Carrabelle are barrier chains similar to the Live Oak "bar" (Ingleside barrier complex) of the south Texas coast. The barrier plain on the

Apalachicola coast reaches 3.5 to -4 miles in width and is correlatable with other Gulfport/Ingleside barrier segments along the northern Gulf coastal plain. As many as 30 subparallel-parallel, gently arching ridges occur in certain strandplain areas. While the highest ridge tops usually reach 4-6 m, the beach ridge topography generally is much more subdued than in the Mississippi-Alabama area. The swales often are water-logged and filled by swamp vegetation. In certain areas, as west of the town of Apalachicola and east of Green Point, the strandplain topography does not exist. The Gulfport lies close to the surface and below the bay bottoms in the southern and eastern-southeastern parts of St. Joseph Bay, as indicated by Drillhole #30, by the trend of small, narrow, elongated marshy islands and of elliptical-shaped enclosed shallow bottom contours along the SE bay shores that run parallel with the barrier ridge trend on the mainland shore. The subsurface presence of the Pleistocene (Gulfport strandplain) is also indicated by the presently very shallow bottoms at the southern end of St. Joseph Bay. These topographic features developed over barrier ridge remnants, submerged during the Holocene transgression.

The Gulfport sequence, as elsewhere, consists of subtidal-intertidal, and perhaps also some eolian supratidal sands that during the stable, high Sangamonian interglacial sea level stand aggraded above sea level and prograded seaward. It overlies shallow subtidal facies of the Biloxi Formation. The transition is not noticable where the Biloxi lost its fossil content through leaching. Well and moderately well sorted fine, occasionally very fine sands make up the here usually 15-30 ft thick Gulfport Formation. On the surface and immediately below oxidized pale yellowish brown-yellowish brown oxidized colors occur, along with (leached) white. As elsewhere on the northeastern Gulf coast, downward percolating, carbon-rich humic acids have weakly cemented the Gulfport sands at most observable locations. These precipitates reduce the commercial quality of Gulfport sands, if they are to be used as cement components or (as it has not yet been done) for glass manufacturing. Dark, dusky yellowish brown colors are typical of these humate-impregnated sand bodies. Excellent artificial cuts between c. 0-9 ft above mean sea level in the SE bank of the Gulf County Canal reveal parallel laminated, current-rippled and cross-stratified nearshore- subtidal, partly dark yellowish brown, humate-impregnated Gulfport facies, including also cut-and-fill structures. This elevation suggests that the sea level, responsible during Sangamonian times for the formation of the intertidal barrier ridge lithosomes, was higher at the time of barrier beach deposition;

Fig. 3. SWS-ENE Geological Cross Section (Two Segments) Cape St. Blas (Drillhole 29) - Apalachicola Airport (27) - Carbody Rd. (20)


WSW
ENE
29
30
31
32
33
34
20
27
+ 20'
CAPE SAN BLAS
GULF OF MEXICO
0
–50·
–100'
–150'
–180'
+5
APALACHICOLA
0
–10
–20
–30
–40
–50 m
0 1 2 3 4 5 6 ml
0
tOkm
HOLOCENE
PLEISTOCENE
GULFPORT FM
BILOXI FM
BRACKISH FACIES
MARINE FACIES
PRAIRIE FM
NEOGENE
SILICICLASTIC
LIMESTONE —
UNCONSOLIDATED
CALCAREOUS

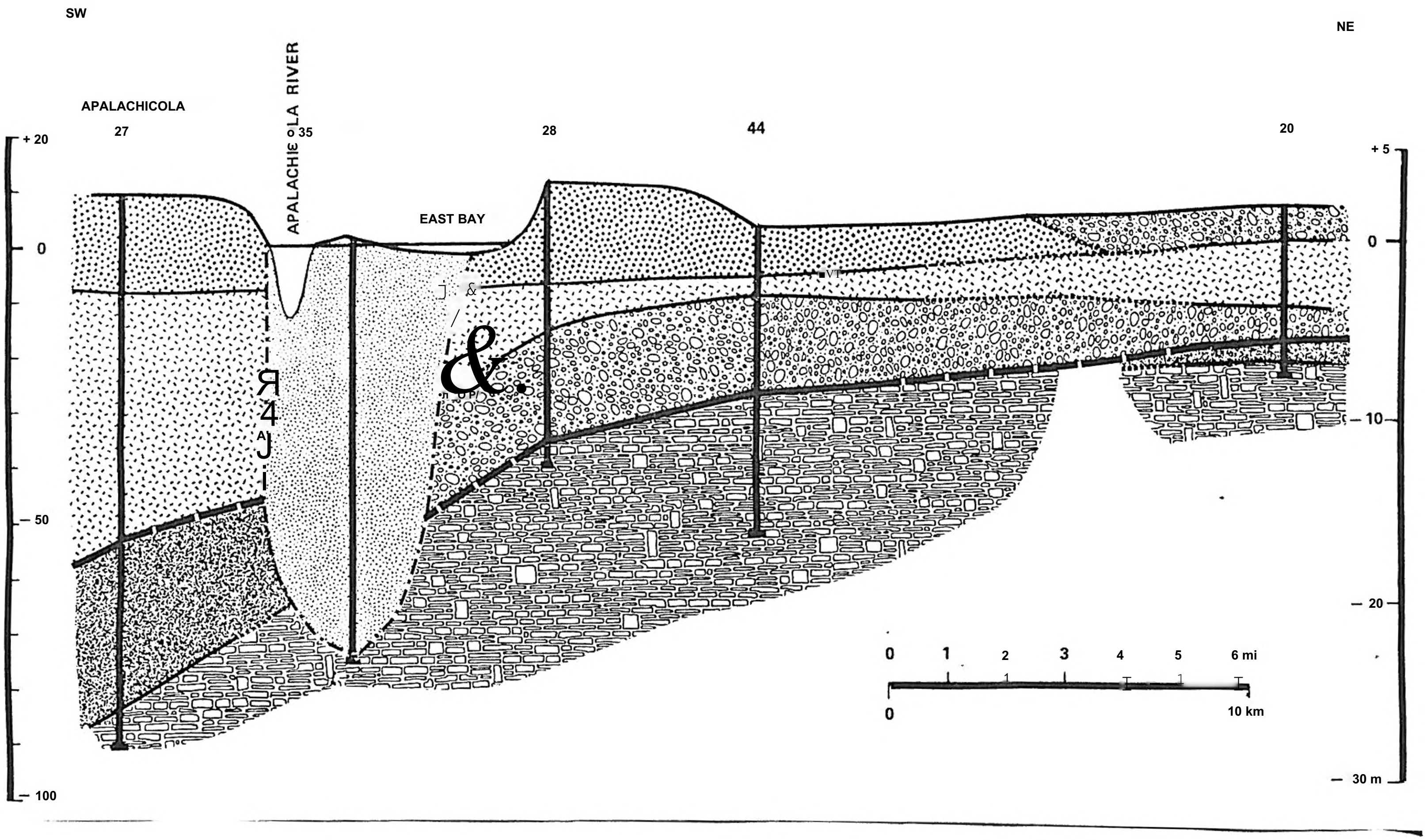

SW
NE
APALACHICOLA
APALACHICOLA RIVER
EAST BAY
27
35
28
44
20
+ 20
0
50
100
+ 5
0
10
20
30 m
0 1 2 3 4 5 6 mi
0 10 km

Fig. 4. Geological Cross Section
N - S Dalkeith (2) - McNeils (32)

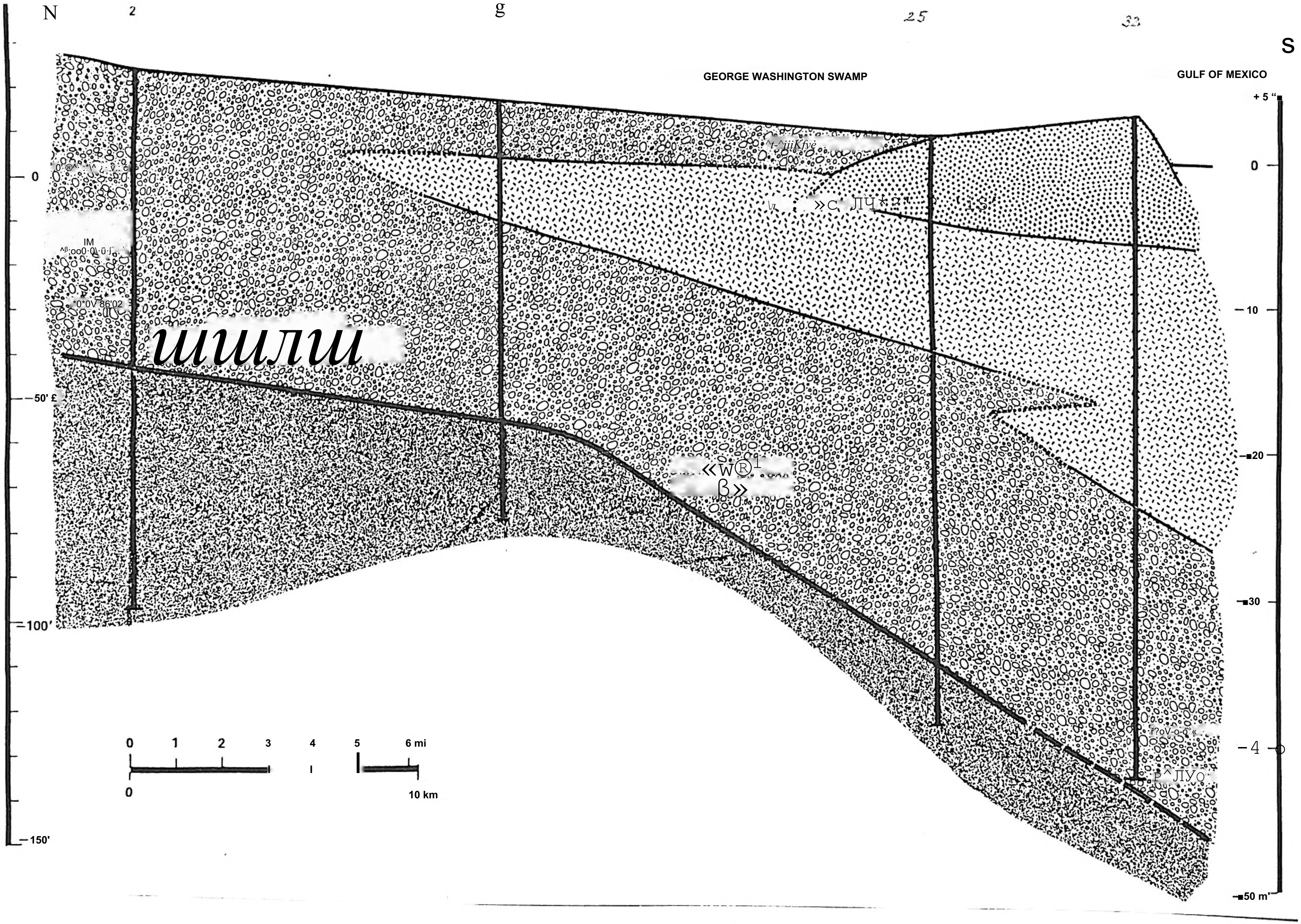
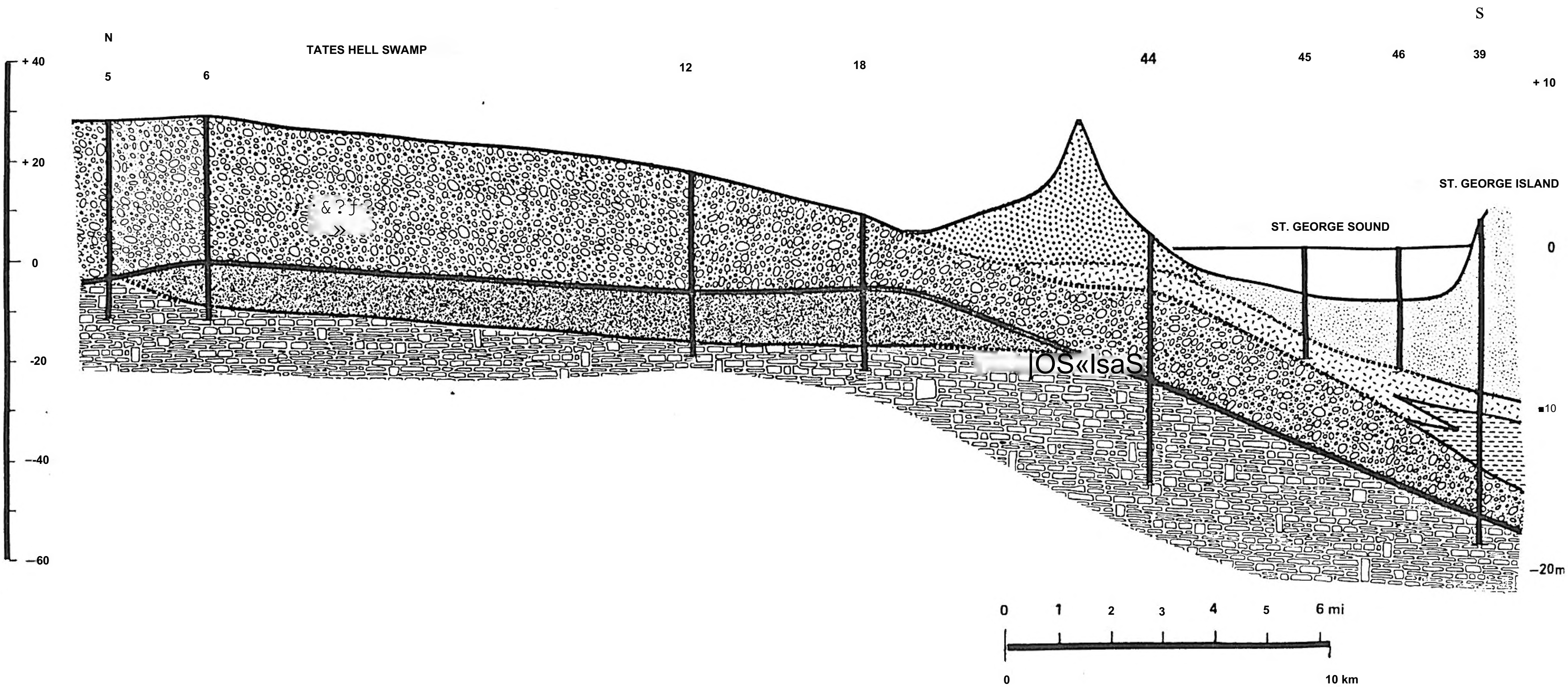

N
2
25
32
S
GEORGE WASHINGTON SWAMP
GULF OF MEXICO
0
-50'
-100'
-150'
+ 5
0
10
20
30
50 m
0 1 2 3 4 5 6 mi
0
10 km

Fig. 5. N-S Geological Cross Section
North Tate's Hell (5) - St. George Island (39)


N
S
TATES HELL SWAMP
5
6
12
18
44
45
46
39
+ 40
+ 20
0
-20
-40
-60
+ 10
0
10
-20m
ST. GEORGE ISLAND
ST. GEORGE SOUND
0 1 2 3 4 5 6 mi
0 10 km

compatible with the usually suggested +24-25 ft interglacial levels in tectonically stable regions.

MIDDLE WISCONSINAN EVENTS

Marine Episode During a Wisconsinan Interstade?

Schnable and Goodell (1968), based largely on a set of finite radiocarbon dates from plant matter, obtained from their core samples claimed the presence of two upward fining sequences in a number of drillholes. They suggested that, following the Sangamonian marine transgressive episode, recorded in a Pleistocene "Lower Sequence" of the Apalachicola area; an "Upper (mid-Wisconsinan)" marine sequence has been preserved at Cape San Blas (Drillhole #2 9), St. Vincent Island and elsewhere. The dates ranged between 23-34 ka B.P., partly coeval with the Farmdalian Mid-Wisconsinan interstadial; a time of relatively high, but lower-than-present sea levels. Schnable's assumed Mid-Wisconsinan regional sea level, based on his cross sections, facies and age interpretations, would have been much too high according to our present state of knowledge.

According to our studies, the Cape San Blas core includes only a single Biloxi sequence between 55-121 ft. Biloxi lenses occur below this depth within interlayered Prairie alluvial deposits. The Biloxi interval, despite leaching, the enclosed fossils had apparently been subjected to, correlates well with the Biloxi sequence found in adjacent drillholes. Therefore, no proof yet exists in the area for Wisconsinan coastal and/or marine deposits, associated with a relatively high sea level.

The "mythical" Pleistocene six- and nine-meter shorelines Schnable and Goodell (1968; Fig.2), following Brenneman and Tanner (1958) and Tanner (1966) showed two "Pleistocene barrier island and sand ridge" trends in the north-central part of the Apalachicola coastal area (Tate's Hell Swamp; Fort Gadsden and Tate's Hell USGS Quadrangles), 10-12 miles inland Tanner described the ridges as "immature barrier islands"; c. 10 km long, 100-400 m wide, 1-4 m above the adjacent sand plain and located 5 km apart. Actually, no such, naturally formed and distinct topographic ridges exist here.

The two suggested ridge trends were said to occur at c. 3 0 ft, respectively 20 ft elevations. The area in question is underlain by the gently southward-sloping, even Prairie land surface. Except for man-made embankments (”grades”) of now-abandoned logging railroad spurs that run parallel with these contour lines, no enclosed contours occur here to indicate elongated, distinct ridges of any kind. Drillhole #6 (corner of Rake Creek Rd. and embankment of the northern logging railroad spur) encountered poorly and moderately poorly sorted, slightly granular fine sand, muddy, coarse silty and clayey fine sand layers in the top 13 ft, underlain by poorly and very poorly sorted slightly granular medium sand and muddy medium sand layers. Apart from the absence of naturally formed topographic ridges, no marine or even brackish deposits, -that would have lent support to a barrier island origin, had been encountered in the Tate's Hell subsurface elsewhere either; all the near-surface sediments belong to the Prairie alluvium.

WISCONSINAN STREAM INCISION AND DUNE FORMATION

The Prairie surface west of the Apalachicola River has been extensively dissected during post-Sangamonian sea level drop. Fair-sized meandering river channels, today filled by marshy-swampy vegetation and small, intermittently active, underfit creeks (Cypress Creek, Indian Bayou, Depot Creek), mark this period. These channels, minor distributaries of the Apalachicola formed an integrated system after they entered the area from the east at different locations. The incised, meandering channel floors lie 4-8 ft below the dissected Prairie ”upland" surface and c. 6-20 ft above the adjacent broad Apalachicola River floodplain. Presently only extreme floods may top these topographic thresholds to enter from the valley. Such diverted Apalachicola River flow seem to have been responsible for excavation of the Lake Wimico basin and the Jackson River channel between the present Lake and the lower Apalachicola. Depot Creek occupies a wide, locally braided, partly meandering channel with remnants of mid-channel bar-islands, that was excavated with the rest of the incised channel system probably during Apalachicola floods downstream from Lake Wimico. The southernmost, widest meander segment of this channel ends abruptly in a narrow swale between two Gulfport beach ridges, close to the southern end of the present George Washington Swamp (also located in a broad interridge swale), north of McNeils. The accumulated waters probably found seaward outlet through short channels west of McNeils and by seeping through the Gulfport sand ridges as shallow ground water.

Three widely isolated sand hill ridges, with axes perpendicular to the shore or at oblique angle with it and with the Gulfport barrier trend, overlie the Gulfport Formation at Carrabelle, Lake Morality (NE of Carrabelle) and Royal Bluff, on the SE shore of the Apalachicola Coast. Axes of the maximum 0.7 mile long ridges are concave (slightly parabolic) toward the SW and the steep slopes rise an impressive 30-40 ft above their base. Grayish-orange (Royal Bluff) and light gray (Carrabelle), moderately well sorted, medium and fine sand (.22 and 0.29 mm medians) forms the ridges, indicators of dry conditions during a relatively lowers sealevel, cooler time period at some distance inland. Similar post-Sangamonian Pleistocene eolian dunes have been noted elsewhere in the Florida Panhandle area and also in Louisiana (Otvos, 1985a).

HOLOCENE

Transgressive Phase.

Deep Apalachciola River channel incision marked the Late Wisconsinan-Early Holocene during the sea level lowstand. The returning sea level caused alluviation and subsequently estuarine sedimentation in the river valley. A Rangia date at -72.5 ft (9950 yr BP; Drillhole #35) marks the beginning of brackish sedimentation (Schnable and Goodell, 1968, p.54) in the channel. The present mainland shore near McNeils has but cut back by wave erosion and a 0.4-0.6 mile wide Holocene strandplain prograded seaward and westward from this eroded shore in the Indian Peninsula-Cape San Blas area. Sharply defined, semiparallel dune ridges consist of well-to-very well sorted slightly oxidized (pale grayish orange and very pale orange) sands. Such oxidation, while fully expected in Pleistocene deposits, seemed highly unusual in the subrecent Late Holocene dune sands.

Another mainland strandplain developed along the Gulfport strandplain between Beacon Hill and Highland View, on the western mainland shore. It is maximum 0.7 mile wide, with highest ridge tops barely above 10 ft above sea level. The white, well-to-very well sorted sands lacked oxidized hues. Drillhole #14a, on the seaward margin of the strandplain yielded a datable (composite) shell sample between 30-41.5 ft (UGa-5820; 3570 ± 60 yrs BP) indicated that a transgressive, marine clayey fine sand, fine sand sequence, grades upward into brackish clayey fine sandy and fine sand deposits under the 2 0 ft thick strandplain sand unit between 20-51 ft. No oxidized colors marked the Pleistocene top in the cores. The Holocene mainland strandplains resemble those of the Mississippi mainland shore at Bellefontaine Point and in SW Hancock County (Otvos, 1988) .

An extension of the mainland strandplain in the west, St. Joseph Peninsula started its growth from the E-W-oriented older beach ridge complex at Cape San Blas . With the help of NNW-directed littoral drift, first it incorporated "Richardson Hammock" island, due north of Cape San Blas and the adjacent submarine shoals (shoal- retreat massif). Its gradual northward growth gradually enclosed St. Joseph Bay as an estuarine embayment and, by reducing wave energies on the opposite mainland shore, probably put an end to the progradation of Palm Point strandplain. Migrating sand covered the regular beach ridges along the Gulf shores, creating steep-faced dunes of over 30 ft elevation. Growth of the large barrier spit was accompanied by erosion along its Gulf shore, as indicated by the abrupt, truncated SSW-ends of the recurved beach ridges that form the barrier spit. A small spit, Indian Peninsula, grew southeastward from E-W-trending mainland south shore strandplain, composed of slightly oxidized sands and channeling littoral drift southeastward, toward St. Vincent Island.

Three major islands

St. Vincent, St. George and Dog Islands formed during the Late Holocene stable sea level stage through aggradation of offshore shoals and subsequent progradation (Otvos,1985). The SW end of St. George evolved originally as a separate island, "Little St. George" that was partly incorporated during the southwest growth of St. George, partly lost to erosion, while St. Vincent, Dog and originally northeastern St. George grew from small shoal core areas through strandplain progradation. Due to wave erosion along its Gulf shore, St. George retained only small part of the original strandplain morphology. Growth of the islands isolated a line of bays landward of them, turning them into estuaries. The lower salinity depositional facies thus created is reflected in cores that coverlie higher salinity, earlier Holocene, nearshore sediments in the area. In this way, although not to the same extent, the Holocene depositional (transgressive-regressive) sequences under the lagoons resemble those, beneath Mississippi Sound and Mobile Bay (Otvos, 1985) .

POTENTIAL MINERAL RESOURCES

Gulfport Formation

The higher (dune, intertidal) barrier sands of this formation commonly are free of iron and silt/clay contamination and have been used for construction purposes in a number of sand pits in Bay St. Louis-Waveland and E. Gulfport, MS and along Highway 98, in the Florida Panhandle (Sandestin-Panama City Beach area) . Humate-impregnated Gulfport sands, due to their carbon-content, could only be used as fill. The purest barrier sands may qualify in concrete and glass manufacturing.

Holocene Shallow Nearshore (Shoal) Sands

Nearshore heavy mineral deposits in the vicinity of the Mississippi and Apalachicola barrier islands and south of St. Joseph Spit may occur in economically exploitable quantities. A study of cores in the Apalachicola region Holocene strandplain areas may reveal the occurrence of such placer deposits that formed in high energy shallow subtidal-intertidal conditions.

REFERENCES

Akers, W. H., 1972, Planktonie foraminifera and biostratigraphy of some Neogene formations, northern Florida and Atlantic coastal plain: Tulane Studies in Geol, and Paleont., v.9, 140 p.

Brenneman, L. and Tanner, W.F., 1958, Possible abandoned barrier islands in panhandle Florida: Jour. Sed. Petrology, vol. 28, p. 342-344.

Doering, J.A., 1956, Review of Quaternary surface formations of Gulf Coast regions: Amer. Assoc. Petroleum Geol. Bull., v. 40, p. 1816-1862.

Huddlestun, P. F., 1984 (same text, 1976), The Neogene stratigraphy of the central Florida Panhandle: Ph.D. Dissertation, Florida State University, Tallahassee.

Otvos, E. G., 1985a, Coastal evolution, Louisiana to Northwest Florida, The New Orleans Geol. Society, 91 p.

_____, 1985b, Barrier island genesis - question of alternatives for the Apalachicola Coast, northeastern Mexico. Jour. Coastal Research, v. 1, p. 267-278.

_____, 1988, Pliocene age of coastal units, northeastern Gulf of Mexico. Trans. Gulf Coast Assoc. Geol. Societies. In press.

Schmidt, W., 1984, Neogene stratigraphy and geologic history of the Apalachicola Embayment, Florida. Fla. Geol. Survey Bull. No. 58, 146 p.

Schmidt, W. and Clark, M. W., 1980, Geology of Bay County, Florida: Fla. Bureau of Geology Bulletin, No. 57, 96 p.

Tanner, W. F., 1966, Late Cenozoic history and coastal morphology of the Apalachicola River Region, western Florida, p. 83-97; In: Deltas in Their Geologic Framework (M.L. Shirley and J. A. Ragsdale, Eds.), Houston Geological Society.

Schnable, J. E. and Goodell, H. G., 1968, Pleistocene-Recent stratigraphy, evolution, and development of the Apalachicola Coast, Florida. Geol. Soc. America Special Paper No. 112, 72 p.

APALACHICOLA COAST DRILLHOLE LOGS

In describing the depositional salinity environments of brackish and marine units, the foraminifer biotope classification (Table 2) has been used. Color designations follow standard USGS-GSA rock-color chart. Folk's granulometric criteria were utilized in defining sediment lithologies. The index numbers by which the holes are located on the map are shown on Fig. 1. Elevations are in feet related to sea level. Final report will reproduce all logs in full. At present some of the cores are still under analysis. The full report will also include all the cross sections from the entire investigated area.

#2
Dalkeith, Gulf Cty No. 6
Sec. 5-T6S-R9W, White City Quad.
Long. 85°9.56' Lat. 29°59.4'
GCRL

<u>Pleistocene</u>

Prairie Fm.

+24.0- +19.0' Muddy, very fine sand, poorly sorted, very loose, medium light gray (N 6). Oxidized between +19-20' with dark yellowish orange hues (10 YR 6/6).
+19.0- -14.0' Fine sand, medium sand, slightly granular medium sand; moderately sorted, medium dense-to-dense. Very light gray(N8)- to-white (N9), with plant fragments at -8.0'. Medium coarse-grained alluvial facies.
- 14.0- -19.0' Fine sandy mud, soft, medium gray (N5), with plant fragments. Fine-grained alluvium.
- 19.0- -43.0' Medium sand, slightly granular medium sands. Granular coarse sands. Poorly sorted to very poorly sorted, dense-to-medium dense, very light gray (N8) to medium light gray (N6). Oxidized to yellowish orange (10 YR 6/6) at -25'; to pale yellowish gray (5Y 9/1) at -37', Coarse-grained alluvial facies.

<u>Neogene</u>

- 43.0- -58.5' Coarse silty very fine sand, poorly sorted, medium dense, micaceous, medium gray (N5) . Molluscan fragments. Forams include <u>Ammonia beccarii tepida</u>, <u>parkinsoniana</u>, <u>Elphidium galvestonense</u>; very

brackish (1) biotope.
- 58.5- -89.0' Very fine sandy coarse to medium silts, calcilutitic. Poorly sorted, medium to very dense, medium gray (N5) to medium light gray (N6) . Scaphopods, gastropods, bivalve molluscs. Rangia cuneata at -86'. Ostracods, echinoid spines. Forams include Rosalina columbiensis, Nonion depr. matagord., Hanzawaia strattoni, Triloculina quadrilateralis, Quinqueloculina seminulum, Globigerina bulloides♦ Marine (4) biotope.-
- 89.0- -97.0' Shell hash, light gray, worm tubes, molluscans, miliolide forams, Hanzawaia strattoni, Globigerinoides immaturus

#9
Gulf County No.5
Sec. 3, T7S, R9W
Cypress Creek, White City Quadrangle
Long. 85 °0 8.2', Lat. 2 9° 54.5' GCRL

Pleistocene

Prairie Fm.	+ 10.5 - -1.5 ft Slightly granular, muddy fine sand and muddy fine sand, poorly sorted, medium dense, very light brownish gray (5YR 7/1) and pale yellow (5Y 8/6) to very light gray (N8), with dark yellowish orange (10YR 6/6) and moderate red (5R/6) streaks. Oxidized. Alluvial.
Biloxi Fm.	-1.5 - -16.0 Slightly granular, very fine sandy mud, soft to medium, very light (gray N8), very light greenish gray (5G 9/1) with light olive brown (5Y 5/6), dark yellowish orange (10R6/6) and moderate red streaks. Ostracods. Elphidium galvestonense foram. Very brackish (1) biotope.
Prairie Fm.	- 16.0- -39.0' Granular medium sands, slightly granular medium sand and medium sands, poorly sorted. Very dense, white (N9). Coarse-grained alluvial facies. - 39.0- -40.0' Fine sand, pale yellowish orange (10 YR 8/6) . - 40.0- -42.0' Mud, stiff, medium light gray (N6) . Fine grained alluvium.

- 42.0- -57.0' Slightly granular medium sand, poorly sorted, dense, white (N 9). Coarse-grained alluvium.

Neogene * - 57.0 -86.5' Fine sand, coarse silty fine sand, moderately sorted, very dense, medium light gray (N 6) to dark gray (N 3)
Mica flakes. Leached brackish-to-marine forams. Chitinous lining of Ammonia beccarii and unidentified tests at -80.4'. Very brackish (1) biotope: -83.5-86.5': brackish «(3+) biotope; 86.5-88.0': marine biotope with Rosalina columbiensis, Reussella atlantica, etc.
86.5-94.5' Coarse, silty fine calcarenite, muddy medium calcarenite with quartz grains, medium dense-to-partially indurated at -94.5'. Medium light gray (N6) . Ostracods, molluscans, bryozoans. Forams: Globigerinoides trilobus, G. bulloides, Asterigerina miocenica, Amphistegina gibbosa. Open marine (5) shelf biotope.

#14a
Gulf County No.12,
Sec. 21,T7S, R11W
Palm Point, Port St. Joe Quad.
Long. 85°20.35', Lat. 29°51.25'
GCRL, Ardaman Engineering

Holocene +6.5-- 39.5 ft
+ 6.5- 0.0 Medium sand, very well sorted, loose, white (N9 molluscan fragments. Dune environment.
0.0- -13.5 Medium sand, very well, to moderately sorted, loose, pale yellowish-orange (10YR8/6) and very pale yellowish brown (10YR7/2). Molluscan fragments. Shoal environment.
13.5- -40.0 Fine sands and clayey fine sands, poorly sorted-to well sorted. White (N9), medium light gray (N6), moderate greenish gray (5G 5/1). Diatoms, echinoid spines, ostracods, foraminifera. Abundant (20%) molluscan shells between -23.5-35.0'. Composite shell radiocarbon date (Chione cancellata and other shell fragments; 30.0-41.5': 3570 ± 60 yr BP, UGA-5820). 13.5-34.0': moderately brackish (Biotpe 2),

Ammonia beccarii tepida and *parkinsoniana*, *Cribroelphidium poeyanum*, *Elphidium galvestonense*. -34.0-40.0': Brackish (Biotope 3), previous four taxa, plus *Quinqueloculina tenagos*, *Q. lamarckiana*, *Rosalina floridana*.

Pleistocene

Biloxi Fm.	40.0-59.5' Muddy fine and very fine sands, very fine sandy coarse silt·, fine sandy muds, very poorly sorted, dark olive (55Y 3/1) with very light olive gray (5Y 6/1) sand lenses, micaceous, plant fragment, *Ammotium*? fragments at 44.5'; collapsed chitinuous lining of *Ammonia beccarii*? at -55.0. Very brackish (Biotope 1).
Prairie Fm.	59.5-71.5' (TD) . Medium sand, muddy medium sand and medium sandy mud. Slightly granular coarse sand, moderately sorted sand, olive black (5YR 2/1) to white, coarse-grained alluvial environment.

#17
Saul Creek Landing
Sec.5, T8S, R8W
Jackson River Quadrangle
Long. 85°3.8' Lat.29° 48.85'
GCRL

Pleistocene

Prairie Fm.	+5.0- -48.0' Slightly granular muddy medium sand, clayey and silty medium sand and slightly granular coarse silty coarse sand. Moderately sorted-to-poorly sorted, loose-to-medium dense. Abundant plant fragment and diatoms at -44.0-48.0'. No brackish or marine fossils. Coarse-grained alluvial environments.
Neogene	-48.0- -54.0' Medium silt, calcareous, soft-to-stiff. Olive gray (5 Y4/1), micaceous. Forams: *Ammotium salsum*. Very brackish (1) biotope.

#2 0
Carbody Rd., Franklin County No.5

Sec. 21, T7S, R 5W, Green Point Quadrangle
Long. 84° 45.1' Lat.29° 50.45'
GCRL

Pleistocene

Prairie Fm. +6.5- 0.0' Slightly granular fine sand, poorly sorted, medium, dense. Black (N1) , medium light gray (N6) . Yellowish gray (5-Y 8/1) . Medium-grained alluvial facies.

Biloxi Fm. 0.0- -11.5' Muddy fine sand, clayey fine sand and fine sandy clays, softy-to-very loose. Light olive gray (5Y 6/1) becoming greenish gray (5G 6/1) with depth. Molluscans, forams, chitinous foram linings. Heavy leaching obvious. In adjacent shallow (4-6') drainage trench: rich Chione cancellata, etc. shell fauna (brackish indicator).

Prairie Fm. -11.5- 17.5' Slightly granular medium sand, poorly sorted, medium dense, pale yellowish brown (10 YR 6/2) .

Neogene -17.5- -21.5' Mud, olive gray (5Y 4/1), molluscans, crab claw. Unidentified glauconitic casts of foram fragments.
-21.5- -25.0' Granular muddy medium calcarenite, white (N9), poorly indurated, ostracods, forams. Neogene foraminifers : Guttulina postulata, G. caudata, G. irregularis, Hanzawaia concentrica, Nonionella pizzarense. Marine biotope (4).

#21
St. Joseph Peninsula State Park
Sec. 14,T8S, R12W; W-12051
Long. 85°24.45' Lat.29°47.3'
Fla. Geol. Survey (Schmidt, 1984,p.126)

Holocene +10.0-0.0' Fine sand, very well-to-moderately well sorted. White (N9).
0.0- -52.0' Fine sand, well sorted, grayish orange (10YR 7/4) at 0.0. White (N9), molluscans and

fc oraminifera : 0.0-16.0': Ammonia beccarii tepida, Elphidium incertum mexicanum, Quinqueloculina-fragments. Brackish (3) biotope; 16.0-22.0: Cribroelphidum poeyanum, Elphidium incertum mexicanum, Hanzawaia strattoni. Marine .(4) biotope.
-22.0-38.0': Elphidium incertum mexicanum. Ammonia beccarii tepida and parkinsoniana Rosalina columbiensis, Cribroelphidium poeyanum. Brackish (Biotope 3-3+).
38.0-48.0' Muddy -fine sand, poorly sorted, medium light gray (N6), abundant molluscan fragments. Gephyrocapsa spp., G. oceanica and caribbeanica dominate the nannoplankton assemblage at -25 and -45' . Brackish (3-3+) biotope with Nonion depressulum matagordanum, Cribroelphidium poeyanum, Elphidum incertum mexicanum, Ammonia beccarii tepida, Ammonia beccarii parkinsoniana, Elphidium galvestonense, Hanzawaia strattoni
-48.0-52.0' Medium silty fine sand, extremely poorly sorted, light gray (N7), abundant molluscan shells. 52': composite shell data, UGa 5604: 18,774 ± 99 yr. B.P.(Mercenaria merc., Cerithium, Chione cancellata). Petrified wood fragment, ostracods, forams: Elphidium incert. mexicanum, Ammonia beccarii tepida, Elphidium galvestonense. Brackish (3) biotope.

Pleistocene

Biloxi Em.

-52.0'-62.0' Granular muddy fine-to-fine sand, extremely poorly to poorly sorted, light gray (N7), ostracods, molluscans. Foraminifera : Quinqueloculina lamarckiana, Asterigerina carinata, Nonion depressulum matagordanum, Cribroelphidium poeyanum, Elphidium incertum mexicanum, Quinqueloculina tenagos, Hanzawaia strattoni. Biotope: 4-5 (marine, inner shelf).
-62.0-72.0' Medium sand and muddy medium sand, medium light gray (N6) . Ostracods, echinoid spines, molluscans. Foraminifera: Elphidium incertum mexicanum, Rosalina columbiensis, Nonion depressulum matagordanum, Cribroelphidium poeyanum, Ammonia beccarii tepida♦ Marine (4-4+) biotope, inner shelf.
-72.0-77.0' Muddy fine sand, poorly sorted medium light gray (N6), ostracods. Foraminifera: Nonion depressulum mat agordanum, Ammonia beccarii tepida,

Elphidium incertum mexicanum, Rosalina columbiensis, Nonion depressulum mat agordanum, Cribroelphidium poeyanum, Ammonia beccarii tepida Marine (4-4+) biotope, inner shelf.

Prairie Fm. -77.0-92.0' Fine sand, muddy fine sands, moderately sorted, pale yellowish brown (10 YR 6/2) and medium light gray (N6), carbonized wood fragments, limonite-cemented concretions. Fine-grained alluvial environment.

Biloxi Fm. -92.0-98.0' Very fine sandy mud, dark gray (N3). Bioturbation. Pale yellowish brown (10YR 6/2) sand lenses and burrow-fills. Ostracods, molluscans. Foraminifera : Elphidium incertum mexicanum, Ammonia beccarii tepida, Nonion depressulum mat agordanum, Cribroelphidium poeyanum, Nonion atlantica. Brackish (3?) biotope, few specimens.

Prairie Fm -98.0-108.0'Silty fine sands and muds; fine-grained alluvial environment.
-108.0-134.0' Slightly granular fine and medium sands. Coarse-grained alluvial facies.

Neogene -134.0-144.0 Medium quartzarenite with calcareous cement, somewhat porous. Light gray (N6). Ostracods, molluscans. Foraminifera : Amphistegina gibbosa, Textularia mayori, T. candeiana, Hanzawaia strattoni, Asterigerina miocenica, A. carinata, Globulina gibba, Reussia spinulosa. Mid-shelf (Biotope 5). Several taxa are typical Miocene-Pliocene forms.

#22
Box R Ranch
Sec.19, T8S, R8W, Franklin County No.9
Jackson River Quadrangle
Long. 85°05.25' Lat. 29°45.8'
GCRL

Pleistocene

Prairie Fm. +7.5- 16.5' Fine sand and clayey fine sand, moderately to moderately well sorted, loose, very light gray (N

8) to white (N9) . Plant fragments at -16.5' . Fine-grained alluvial facies.

- 16.5- 31.5'Medium sand, well-to-moderately sorted, medium dense, white (N9), pale grayish orange (10 YR 8/4), and pale grayish brown(5YR 4/2),Coarse-grained alluvial facies.

- 31.5-46.0' Muddy very fine sand, fine sands. Very poorly -to moderately sorted. Very loose-to-medium dense. Very light olive (5Y 7/1) to dark olive gray (5Y 3/1) . Very abundant plant fragments at -4 6' - 46.0-50.0'. Clay, soft, light bluish gray (5B 7/1), light bluish gray (5B 7/1) .

- 50.0- -60.0' Very fine sand, fine sand, very poorly to moderately sorted, dense, medium light gray (N6), very light gray (5G 6/1), micaceous. Fine grained alluvial facies.

- 60.0- -65.5' Granular medium sand, poorly sorted, dense, brownish gray (5 YR 4/1) .

Neogene

-65.5- -68.5' Fine sandy mud, stiff, light greenish gray (5G 8/1), with dark greenish gray (5G 4/1) hues. Abundant :molluscan fragments. Ostracods. Brackish (3) foram biotope.

-68.5- 84.0' Fossiliferous calcarenite, loose, with limestone fragments to well indurated, grayish green (10 GY 5/2) . Abundant molluscan fragments (c. 61% of sample weight), ostracods, echinoid fragments. Neogene Triloculina quadrilateralis longicost ata. Marine (4) biotope.

#2 4
William Rish State Park
Sec. 1, T9S, R 12 W
St. Joseph Peninsula Quad.
Long. 85°23.4' Lat. 29°43.8'
GCRL

Holocene

+7.0- -11.0' Fine sand, very well-to-well sorted, loose-to-medium dense. White (N9) to 4' ; very pale yellowish brown (10YR 7/2) to moderate yellowish brown (10 YR 5/4). Dune and intertidal-shoal environments.

-11.0- -31.0' Slightly granular fine sand and medium sands, moderately sorted, very dense, light gray (N7). Molluscan fragments. Remaneica sp. (typical of sandy, shallow bottoms). Rosalina columbiensis. Marine (4) biotope.

-31.0- -40.0' Muddy fine sand, very loose. Moderate greenish gray (5G 5/1) to dark greenish gray (5G 4/1). Ostracods, bryozoans, echinoid spines, molluscan fragments. Abundant plant fragments. At -39': radiocarbon date from wood fragment: UGa-5604:11,210 ± 221 yr. B.P. Agé indicates that wood may have come from vegetation growing on the Pleistocene land surface well prior to Holocene transgression, carried landward by transgression and buried with Holocene marine sediments. Foraminifera : Ammonia beccarii tepida, parkinsoniana, CribroeIphidium poeyanum, Elphidium galvestonene, E. incertum mexicanum, Nonion depressulum matagordanum. Brackish (3) biotope.

Pleistocene

Biloxi Fm.

-40.0- -57.0f Fine sands, moderately sorted. Olive gray (5Y4/2) to light gray (N7) sands with olive gray (5Y 4/2) mud lenses. Molluscan fragments. Foraminif era : 51. 57.0': Quinqueloculina lamarckiana, Q. tenagos, Triloculina trigonula, Q. seminulum, Elphidium galvestonense. Marine biotope; (Numerous miliolids may be partly shelf-current derived.)

-57.0-74.0' Muddy fine sand, poorly sorted soft-to-medium, moderate greenish gray (5G 5/1) . Molluscan fragments, echinoid spines, bryozoans, ostracods. Foraminifers : Rosalina columbiensis, Elphidium incertum mexicanum, Ammonia beccarii tepida, Nonion depressulum mat agordanum, Hanzawaia strattoni, Textularia mayori. Between -57.0-60.0': Neogene species Guttulina costulata, G. irregularis and Cibicides floridanus. Marine biotope (4+).

Prairie Fm.

-74.0- -86.0' (TD) Fine sandy muds and clays, stiff, grayish olive green (5G 3/2) with medium gray (N5) fine sand lenses. Bioturbation, mica flakes, plant fragments. Very fine-grained alluvial facies.

#25

Depot Creek, Gulf County No. 14746
Sec. 28, T8S, R10W, Lake Wimico Quadrangle
Long. 85° 14.8' Lat. 29° 45.8'
Florida Geol. Survey (Bur.Geol.)
Schmidt, 1984, p.136.

Pleistocene

Gulfport Fm.	+6.56- -11.5' Fine sand, well to moderately sorted. Pale yellowish brown (10 YR 6/2) to very pale yellowish brown (10YR9/2); humate impregnated darkish colors. Dune-intertidal facies.
Biloxi Fm.	-11.5- -20.5' Mud and fine sandy mud. Very light gray (N8) to medium light gray (N6) . Ammonia beccarii tepida♦ Very brackish (1) biotope. -20.5- -31.5' Clayey fine sand and muddy fine sand, moderately sorted, medium light gray (N6). Ostracods, molluscan fragments. Brackish taxa with Rosalina columbiensis. Brackish (3) biotope. -31.5- -41.5' Muds and fine sandy muds, medium gray (N5) . Brackish forams inel. Buliminella elegantissima. Brackish (3) biotope.
Prairie Fm.	-41.5- -66.5' Muds and fine sandy muds, micaceous, light gray (N7), light olive gray (5Y 6/1) and yellowish gray (5Y 8/1). Very fine-grained alluvial facies. -66.5- -81.5' Slightly granular medium sands and granular coarse sand, poorly sorted, very light gray (N8) and white (N9) . Coarse-grained alluvial facies. -81.5- -93.5' Medium silt, medium light gray (N6). Very fine grained alluvium. Reworked Neogene planktonic foram (Globigerinoides sp.) -93.5- -112.5' Slightly granular medium sand, poorly sorted, white (N9). Coarse-grained alluvial facies.
Neogene	-112.5- -125.5' (TD) Fossiliferous siliciclastic muddy fine and muddy medium (quartz) sand, poorly sorted. Abundant shell fragments (20%), ostracods, echinoid spines. Many Neogene benthic forams, including age-diagnostic Globigerina riveroae (N 18-19) and

Globorotalia obesa (N5-23). Also: Guttulina caudata, G. postulata, Reussia spinulosa, Hanzawaia concentrica, Elphidium incertum, Amm. becc. tepida. Shelf environment.

#2 6
Highway 385; Franklin County No.10
Sec. 6, T9S, R8W, West Pass Quadrangle
Long. 85° 4.95' Lat. 29° 43.75' »
GCRL

Pleistocene

Gulfport Fm. +11.0- -7.0' Fine sand, well-to-moderately sorted, medium dense, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 3/2).

Biloxi Fm -7.0- -17.0' Fine sand, poorly sorted, very loose, medium light gray (N6) , Ammotium salsum. Very brackish (1) biotope. —17.0 -33.0' Muddy fine sand, very poorly sorted, very loose, greenish gray (5G 4/1) to dark greenish gray (5G 4/1) . Ostracods, echinoid spines, molluscans. Moderately brackish (2) biotope.

- 33.0- -37.0' Very fine sandy mud and very fine sandy coarse silt, greenish gray (5G 6/1) to olive gray (5 Y 4/1). Abundant plant fragments.
- 37.0- -43.0' Muddy very fine sand, coarse silty very fine sand, very poorly sorted, dark olive gray (5Y 4/1), micaceous. Ostracods, foraminifers, molluscans, echinoid spines. Moderately brackish (2) biotope.
- 43.0- -57.0' Mud, soft, dark olive gray (5Y 4/1). Diatoms, ostracods, molluscans, forams. Very brackish (1) biotope.

Prairie Fm. - 57.0- -81.0' Slightly granular, coarse silty fine sand, slightly granular muddy fine sand, poorly sorted, white (N9) to moderate brown (5 YR 3/4) . Coarse-grained alluvial facies.
- 81.0- -100.0' Very fine sandy mud, stiff, olive green (5Y 4/1) to medium light gray (N6) , micaceous. Fine grained alluvial facies.

-100.0- -140.0' Slightly granular medium sand, poorly sorted, medium dense, white (N9), bluish gray (5 B 6/1) and dark gray (N 3) . Coarse grained alluvial facies.

Neogene

-140.0- -141.0' (TD) Medium calcilutite, light gray (N 7), echinoid spines, ostracods, forams. Globorotalia dutertrei (N 17-23), Globulina gibba, Guttulina costulata, Reussia spinulosa, Guttulina irregularis, etc.

#27
Apalachicola Airport-E, Franklin County No. 8
West Pass Quadrangle
Sec. 2/3, T9S, R8W
Long. 85°01.2' Lat. 29°43.2'

Pleistocene

Gulfport Fm.

+10.0- -8.0' Fine sand, very fine sand, well-to-moderately well sorted, loose-to-medium dense, pale yellowish brown (10YR 6/2)-to-dusky (humate) yellowish brown (10 YR 3/2) .

Biloxi Fm.

-8.0- -41.0' Muddy fine sand and fine sands, very loose-to-medium dense, medium light gray (N6)-to-yellowish gray (5Y 8/1), plant fragments. Foraminifers assumed to have been totally leached out; position below Gulfport Fm suggests that this interval belongs to Biloxi Fm.
-41.0- -53.0' Clayey fine sand, clayey medium sand, very poorly sorted, light greenish gray (5G 8/1), medium dense.

Neogene

-53.0- -74.0' Fine sandy silt, fine sandy muds and muds, very poorly sorted, medium stiff, dark olive gray (5Y 3/1), diatoms, forams. Ammotium salsum; Very brackish (1) biotope. Siliciclastic unit.

-74.0-83.0' Muddy fine (quartz) sand, fine sand and medium sand, poorly to moderately sorted, very dense, brownish gray (5YR 4/1) and white (N9) . Ammoti um salsum. Very brackish (l) biotope.

-83.0-91.5' Sandy medium fine calcilutite, poorly indurated, light greenish gray (5G 8/1) . Foraminifer identification in progress.

#28
Eastpoint, Franklin County No.6
Sec. 36, T8S, R7W, Apalachicola Quadrangle
Long. 84°53.95' Lat. 29°43.9'
GCRL

Pleistocene

Gulfport Fm. +11.0- -7.0' Fine to coarse sand, poorly-to-well sorted (10YR 7/4), dusky yellowish brown (10 YR 2/2). Humate impregnation; may decrease quality of grain size sorting. Barrier (dune/intertidal) facies.

Biloxi Fm. -7.0- -15.0' Coarse, silty fine sand, poorly-to-moderately sorted, dusky yellowish brown (10 YR 2/2) . Diatoms, forams probably leached out. Very brackish (1) biotope assumed.

Prairie Fm. -15.0- -35.5' Slightly granular muddy fine sand, poorly sorted, moderate light gray (N6) to grayish blue green (5BG 5/2). Medium-grained alluvial.

Neogene -35.0- -41.0' Fine sandy, coarse (?) calcilutitic? poorly indurated, very light gray (N8) . Ostracods, foraminifera : Discorbis consorbina, Elphidum discoidale, Nonion depressulum, Valvulineria fleridana. Few well preserved specimens. Grain size study in progress for this interval.

29
Cape San Blas
Sec.28-T9S-R 11W(MR)
Cape San Blas Quadrangle
Long. 85°21.3″ Lat. 29.40.1'
Florida Geol. Survey/Schnable (Schnäble and Goodell, 1968)

Holocene +5.5- -3.0' Fine sand, well sorted, loose white (N 9) to light grayr abundant shell hash. Dune and intertidal facies.

-3.0- -5.5' Fine sand. Occasional dark gray very fine sandy coarse silt lenses. Loose dark gray-to-light gray silt. Diatoms, molluscans, ostracods, forams. Brackish (3) biotope.

- 5.5- -11.0' Same lithology, with miliolid forams and brackish types. Marine (4) biotope.

- 11.0- -23.7 Very fine sandy coarse silt and muddy fine sands. Very poorly sorted, dark gray, bioturbation. Echinoid spines, diatoms, molluscs (scaphopods). Mulinia lateralis. Ostracods. Forams include Buliminella elegantissima, Nonion depr ♦ matag., Elph. galv., Amm. becc. tepida. Brackish (3) biotope.

Pleistocene

Gulfport Fm.

- 23.7- -49.5' Fine sand, very well sorted, dusky yellowish (humate) brown. Top 6 in. mottled with sand from above; fill burrows. Bioturbation throughout section. Plant fragments at -49.5'. Single limonitic miliolid test. Nearshore-shoreface facies (dune, beach facies may have been eroded).

Biloxi Fm.

- 49.5- 67.0' Fine sand and slightly granular fine sand, moderately well sorted, bioturbated. Pale yellowish brown to light gray. Mica flakes, diatoms. Forams include Ammonia beccarii, Elph. galvestonense. Very brackish (1) biotope.

- 67.0- -86.0' Slightly granular, coarse sand, moderately sorted, light olive gray. Silt-filled burrows, micaceous. Diatoms.

- 86.0- -96.5' Muddy fine sand and very fine sand, light gray-to-dark gray. Bioturbation at -86-86.5'. Sharp contact with interval above. Foraminifers relatively rare in the Biloxi area of this drillhole; intensive postdepositional leaching is suspected also in this core.

- 96.5- -113.5' Fine sand, very well sorted, white, silt-lined burrows, very small clay balls. Foram absence due to leaching (?) .

Prairie Fm. -113.5- -146.5' Slightly granular muddy medium sand, mud, medium sandy granule gravel and granular coarse sand, poorly sorted, dark gray-to-light gray. In -113.5-115.5' interval includes (reworked?) weathered, chalky molluscan fragments, and Chione cancellata shells. Alternative interpretation (at least locally, in fine-grained sediments and with presence of shells): foram-leached Biloxi Formation lense. If Prairie: coarse alluvial facies.

Neogene -146.5- -148.5' Sandy calcarenite, indurated, light gray, molluscan fragment. Bryozoa. Foraminifers presently under study.

#3 0
Eglin AFB Radar Station
Sec.22-T9S-R11W
Cape San Blas Quad.
Long.85 °20.35' Lat.29° 40.75'
GCRL

Holocene +5.6- -12.0' Fine sand, moderately well sorted-to-poorly sorted, loose-to-very loose, light gray (N7), very light olive gray (5Y 7/1)-to-dark olive gray (5Y 3/1). Molluscan fragments, echinoid spines. Forams: Elphidium galvestonense, Ammonia beccarii tepida, A.b. parkinsoniana, Quinqueloculina seminulum. Biotope: to 0.0' : probably dune and intertidal? facies; below: 2 (moder, brackish; nearshore influence).

Pleistocene

Gulfport Fm. -12.0- -37.0' Fine sand, well-to-moderately well sorted, very loose-to-medium dense. Dusky yellowish brown (10 YR 2/2) to pale yellowish brown (10 YR 6/2; humate impregnated). Barrier (dune/intertidal) facies.

Biloxi Fm. -37.0- -58.0' Muddy fine sand and fine sand, poorly sorted medium dense, light olive gray (5Y 6/1) . Ostracods. Crassostrea virginica-fragments at -45.0' Forams: -44.4-53.0: Ammonia beccarii tepida, Elphidium *galvestonense*. *Ammonia beccarii parkinsoniana*, *Elphidium incertum mexicanum*. *Moderately brackish* (2) biotope; 53.0-58.0[f]: *Nonion depressulum mat agordanum*, *Elphidium incertum mexicanum*, *Rosalina columbiensis*, *E. galkvestonense*, *Cribroelphidium poeyanum*. Marine (4) biotope.

58.0-113.0 Muddy very fine sand, very poorly sorted, loose, dark olive gray (5Y 3/1), echinoid spines, molluscan fragments. Moderately brackish (2) foram biotope, with reworked Neogene *Guttulina costulata* and *G. irregularis*.

Praire Fm.

-117.6 -133.0' Mud, fine sandy mud, slightly granular clay, very soft, olive gray (5 Y 4/1) and dark olive gray (5Y 3/1). Abundant plant fragments at -119-121'. Fine-grained alluvial environment.

-133.0- -147.0' Slightly granular medium sand, poorly sorted, very dense, white (N9) to medium light gray (N6) . Reworked *Globigerina praebuiloides* (Zones N 1-17),poorly preserved. Coarse-grained alluvial facies.

Biloxi Fm.

-147- -160.8' Slightly granular, muddy, medium-to-coarse sand, very poorly sorted, medium gray (N5) . Echinide fragments. *Crassostrea*. *Ammonia becc*♦ *tep*. and *park*. Very brackish (1) biotope.

Neogene

160.8- 160.9 (TD) Slightly granular, muddy coarse calcarenite with calcareous cement. Very poorly sorted, white (N9). Molluscan fragments. Forams include *Asterigerina miocenica, Globulina gibba*, *Guttulina costulata* and *G. irregularis* (Neogene taxa). Marine (4) biotope.

#32
McNeil; Gulf County No.1
Sec. 17, T9S, R10W
Long.85°15.88' Lat.29° 41.54'
GCRL

Pleistocene

+11.5- -17.5' Fine, well sorted sand. Humitic; dusky yellowish brown (10 YR 2/2), Gulfport Fm. moderate yellowish brown (10 YR 5/4), light brown (5 YR 6/4). Dune/intertidal facies.

Biloxi Fm -17.5" "36.5' Very fine sand, fine sand, medium silty fine sand, muddy fine sand, poorly sorted, occasional molluscan fragments and diatoms from -27.0- -36.5; Very brackish (1) biotope with Ammonia beccarii tepida, Elphidium galvestonense

- 36.5- -62.0' Muddy fine sand, poorly sorted light greenish gray (5GY 8/1). Forams: Ammon. becc. tepid. , Cribroelphidium poeyanum, Quinqueloculina tenagos, Nonion depr. mataq., Textularia mayori. Brackish (3) biotope.

-62.0- -7 6.5' Very fine sandy mud, dark greenish gray (5G 4/1), light bluish gray (5B 7/1). Molluscan fragments, forams include brackish types and Rosalina columbiensis, Cribroelph poeyanum, brackish (3) biotope.

Prairie Fm -76.5- 111.0' Slightly granular medium silty medium sand, very poorly sorted, light gray (N6) . Coarse-grained alluvial facies. -111.0-124.5' Medium silt with very fine sand lenses. Fine- grained alluvium.

-124.5-13 8.5' (TD) Slightly granular medium sand, poorly sorted. Coarse-grained alluvium.

#33
St. Joseph Paper Co., Franklin County No.1
Sec. 12, T9S, R 10 W, Indian Pass Quadrangle
Long. 85°11.6″ Lat. 29° 42.55'
GCRL

Pleistocene

Gulfport Fm. +18.0 - -16.5' Fine sand, moderately well sorted. Yellowish gray (5Y 8/1), dusky yellowish brown (10 YR 2/2) , pale yellowish brown (10 YR 6/2) . Dune/intertidal facies.

Biloxi Fm. -16.5- -46.0' Muddy fine sand, poorly sorted medium light gray (N6), plant seeds. Ammonia beccarii, chitinous foram linings. Very brackish (1) biotope.

-46.0- -57.5' Coarse silty fine sand, fine sands,

poorly-to-moderately- well sorted, light brownish gray (5 YR 6/1), light gray (N7-to-light greenish gray (5G 8/1). Chitinous foram linings.
-57.5- -62.0' Fine sandy mud, light greenish gray (5G 8/1), plant fragments. Chitinous foram linings.
-62.0- -78.0' Coarse silty-very fine and fine sands, poorly sorted, medium light gray (N6) . Chitinous foram linings, *Ammotium salsum*. Very brackish (1) biotope.

Prairie Fm.

-78.0- -110.0' Coarse silty medium sand, fine sand, very fine sandy coarse silt and very fine sandy mud, light gray (N7), poorly sorted. Fine-grained alluvial facies.

Neogene

Fossiliferous siliciclastic (non-calcareous) facies to -125' .
-110.0- -122.6' Muddy medium-fine sand, greenish gray (5G 6/1), molluscans, echinoid spines, ostracods, diatoms, foraminifera: *Rosalina columbiensis*, *R. concinna*, *Hanzawaia strattoni*, *Nonion depressulum matag*. , *Quinqueloculina lamarckiana*, *Textularia mayori*, *Globigerinoides ruber*. Marine (4-5) biotope.
-122.6- -125.0' (TD) Muddy medium-fine sandstone, calcarenitic, calcareous cement. Poorly indurated, molluscs, ostracods. Forams: *Textularia mayori*, *Hanzawaia strattoni*, *Dis corbis valvulat a*, *Quinqueloculina lamarckiana*. Marine (5) biotope. Inner-mid shelf.

#34
Eleven Mile Oyster Camp, MK
Sec. 8, T9S, R9W, Franklin County
Long. 85°9.25'W Lat. 29°42.5'N
Florida Bur. Geology/Schnäble
Schnäble and Goodell, 1968

Holocene

+5.5- -3.5' Clayey fine sand, very poorly sorted, dark gray. *Crassostrea* shell fragment. Forams: *Ammonia beccarii tepida* and *Haplophragmoides subinvolutum*. Very brackish (1) .

Pleistocene

Gulfport Fm. -3.5- -15.5' Fine sand, moderately well sorted-to-moderately solrted. Dusky yellowish brown (1) YR 2/2 to pale yellowish brown . (1) YR 6/2) ; humate impregnated. Dune/intertidal facies (barrier deposits).

Biloxi Fm. -15.5- -46.5' Muddy fine sand, fine sand and fine sandy clay, poorly 'sorted, dark greenish gray and dark gray. Trace of molluscan fragments at -15.5', -29.5', and -37.5'.
-46.5- -72.5' Coarse silty fine sands, fine sandy muds, poorly sorted, dark gray, abundant wood, especially at -47.5- -48.5'. Diagenetic gypsum crystals: -55.0- -72.5'. This brackish/marine unit subjected to leaching.

Prairie Fm. -72.5- -84.5' (TD) Granular silty medium sand and slightly granular medium sands, very poorly-to-moderately sorted, gray, coarse grained. Coarse-grained alluvial facies.

#35
Apalachicola Bay, A.Quadrangle
T9S-R7W (On Delta island; Causeway)
Drillhole MQ, Franklin County
Florida Bur.Geology;
Long. 84° 57.4'W Lat. 29° 43.7' N
Schnäble and Goodell (1968)

Holocene +1.5- -11.5' Fine sand, well-to-moderately well sorted, light gray-to-dark brown, plant fragments. Ammotium salsum. Very brackish (1) biotope.
-11.5- -17.5' Muddy fine sands, fine sands, poorly sorted, tan-to-gray. Burrows (bioturbation), diatoms, Ammotium salsum, Miliamina fusca, Ammonia beccarii parkinsoniana♦ Very brackish (1) biotope.
-17.5- -23.0' Muddy very fine sands, poorly sorted, micaceous, tan-to-gray, with molluscans. Mulinia lateralis and Nuculana concentrica (bivalves).
Ammonia beccarii parkinsoniana. Very brackish (1) biotope.

-23.0- -40.5' Very fine sandy medium silt, very fine sandy mud, muds and clays. Dark gray colors. Diatoms, ostracods, moluscans. Nuculana concentrica bivalve. Ammonia beccarii tepida, parkinsoniana, Elphidium galvestonense, * Nonion depres sulum matagordanum. Moderately brackish (2) biotope, maximum extent of Late Holocene transgression (Otvos, 1985) in this estuary.

-40.5- -65.5' Muddy fine sand, muddy medium sand, gray. Diatoms, molluscans. Ammotium salsum. Very brackish (l) biotope.

-65.5- -73.3' Muds, very fine sandy muds, gray, micaceous. Diatoms, plant fragments, molluscans. Rangia cuneata. Very brackish (1) biotope.

Neogene

-73.8- -75.5' Biogenic limestone. Muddy, medium fine calcarenire, with quartz sand. Very light gray (N8) , poorly indurated. Molluscs, foraminifera. (Analysis in progress at present.)