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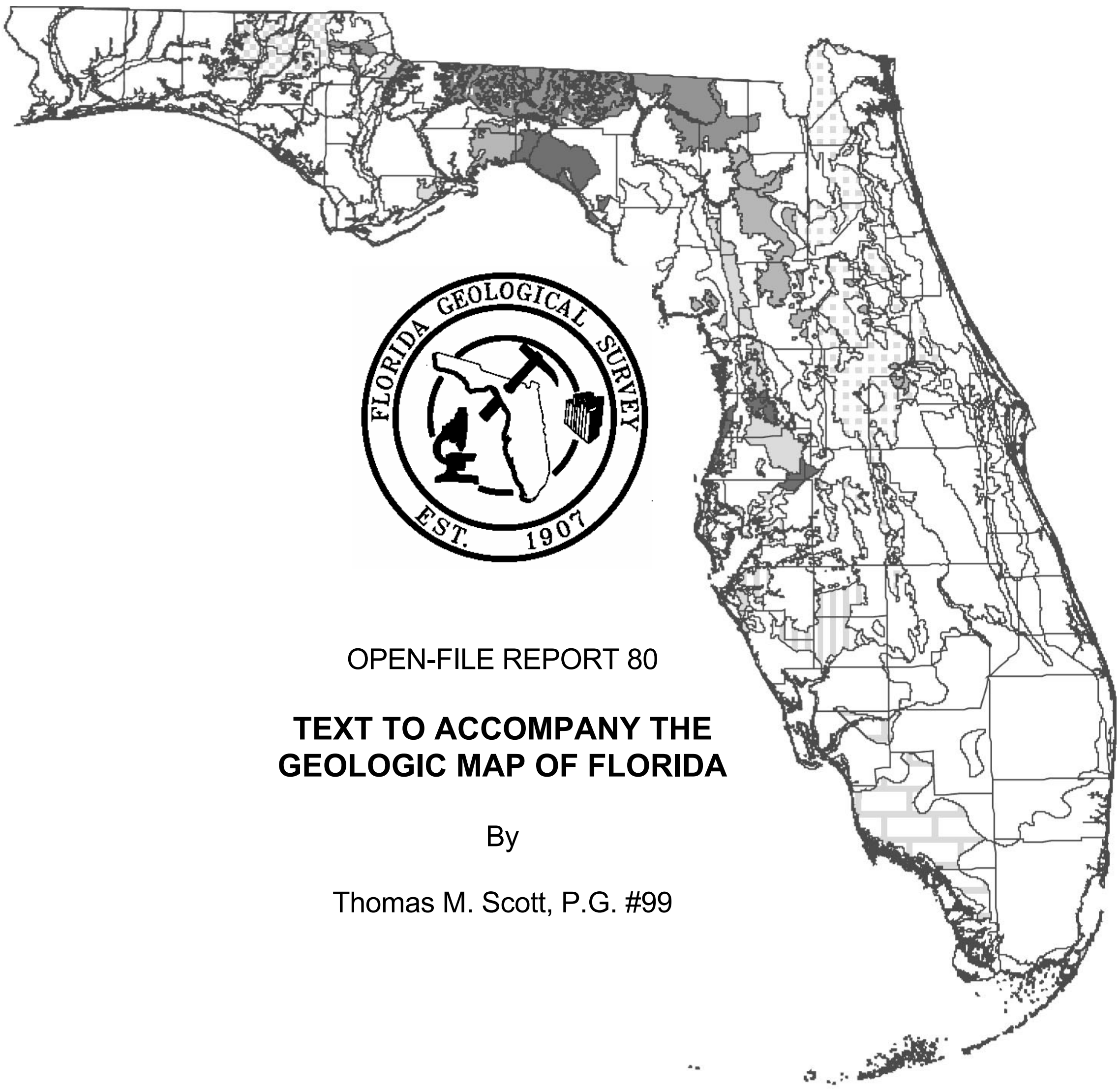

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TEXT TO ACCOMPANY THE GEOLOGIC MAP OF FLORIDA

By

Thomas M. Scott, P.G. #99

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INTRODUCTION

The Florida Platform lies on the south-central part of the North American Plate, extending to the southeast from the North American continent separating the Gulf of Mexico from the Atlantic Ocean. The Florida Platform, as measured above the 300 foot (91 meter) isobath, spans more than 350 miles (565 kilometers) at its greatest width and extends southward more than 450 miles (725 kilometers) at its greatest length. The modern Florida peninsula is the exposed part of the platform and lies predominantly east of the axis of the platform. Most of the State of Florida lies on the Florida Platform; the western panhandle is part of the Gulf Coastal Plain.

The basement rocks of the Florida Platform include Precambrian-Cambrian igneous rocks, Ordovician-Devonian sedimentary rocks, and Triassic-Jurassic volcanic rocks (Arthur, 1988). Florida's igneous and sedimentary foundation separated from what is now the African Plate when the super-continent Pangea rifted apart in the Triassic (pre-Middle Jurassic?) and sutured to the North American craton (Smith, 1982).

A thick sequence of mid-Jurassic to Holocene sediments (unlithified to well lithified) lies unconformably upon the eroded surface of the basement rocks. Carbonate sedimentation predominated from mid-Jurassic until at least mid-Oligocene on most of the Florida Platform. In response to renewed uplift and erosion in the Appalachian highlands to the north and sea-level fluctuations, siliciclastic sediments began to encroach upon the carbonate-depositing environments of the Florida Platform. Deposition of siliciclastic-bearing carbonates and siliciclastic sediments predominated from mid-Oligocene to the Holocene over much of the platform. Numerous disconformities that formed in response to nondeposition and erosion resulting from sea-level fluctuations occur within the stratigraphic section.

The oldest sediments exposed at the modern land surface are Middle Eocene carbonates of the Avon Park Formation which crop out on the crest of the Ocala Platform in west-central Florida. The pattern of exposures of younger sediments is obvious on the geologic map. Much of the state is blanketed by Pliocene to Holocene siliciclastic and siliciclastic-bearing sediments that were deposited in response to late Tertiary and Quaternary sea-level fluctuations.

The characteristic landscape of Florida is relatively to extremely flat. There are few large, natural exposures and limited smaller exposures that geologists can investigate. The result is that geologists must rely primarily on de-watered or dry pits and quarries for exposures and must make use of subsurface data in studying the geology of Florida. Subsurface data, in the form of well cuttings and cores, were utilized extensively in the development of this map. Formational tops recognized in the subsurface have been extrapolated to the surface where exposures are limited.

PREVIOUS INVESTIGATIONS

Previously published geological maps of Florida include Smith (1881), Dall and Harris (1892), Matson et al. (1909), Sellards, Gunter and Cooke (1922), Cooke and Mossom (1929), Cooke (1945), Vernon (1951), Vernon and Puri (1964) and Brooks (1982).

Groundwork for a new geologic map of Florida began in the 1980s with a county-level mapping effort as part of a statewide radon investigation. The county maps created for the radon project were merged and modified to produce a new State map. The geologists from the Florida Geological Survey (FGS) involved in the project included Jon Arthur, Ken Campbell, Joel Duncan, Frank Rupert, and Tom Scott. Tom Missimer, Missimer International, Ft. Myers, Florida was part of the mapping team for Charlotte and Lee Counties. Previous mapping provided a basis for this project. Geologists involved in the preliminary mapping included Paulette Bond, Richard Johnson, Ed Lane, Walt Schmidt and Bill Yon.

METHODS

Much of Florida is covered by a blanket of Pliocene to Holocene, undifferentiated siliciclastics that range in thickness from less than one foot to greater than 100 feet. As a result, in developing the criteria for producing this map, FGS geologists decided to map the first recognizable lithostratigraphic unit occurring within 20 feet (6.1 meters) of the land surface. In areas where highly karstic limestones underlie the undifferentiated siliciclastics, paleosinkholes may be infilled with significantly thicker sequences of siliciclastics. If the shallowest occurrences of the karstic carbonates were 20 feet (6.1 meters) or less below land surface, the carbonate lithostratigraphic unit was mapped. If the carbonates lie more than 20 feet (6.1 meters) below land surface, an undifferentiated siliciclastic unit was mapped.

Undifferentiated siliciclastic sediments occur in significant thickness (>20 feet [6.1 meters]) over much of the Gulf Coastal Lowlands (White, 1970; Scott, in preparation) and the eastern part of the Florida peninsula. Where these sediments were mapped, efforts were made to determine if beach-ridge or dune topography was present in order to subdivide the siliciclastic sediments.

Lithostratigraphic terminology applied in this mapping effort followed, with limited changes, the lithostratigraphic framework delineated for the Gulf Coast Region chart from the Correlation of Stratigraphic Units of North America Project (COSUNA) (Braunstein *et al*., 1988). Although some of the units depicted on the COSUNA chart have a significant biostratigraphic basis, the COSUNA chart represents the best effort to date to provide an accurate stratigraphic framework for the Florida Platform and surrounding regions.

A peer review of the geologic map and this text by members of the geologic community outside the FGS was done by S. Upchurch, R. Portell, T. Missimer, J. Bryan, J. Vecchioli, A. Tihansky, K. Cunningham, G. L. Barr and R. Spechler. The FGS greatly appreciates the efforts of these geologists.

FGS cartographers Jim Jones and Ted Kiper worked on the initial phase of this project. CAD analyst Amy Graves assisted in the map preparation. Lou Cross and Peter Krafft from Florida Resources and Environmental Analysis Center, Florida State University, finalized the map in preparation for publication.

STRATIGRAPHIC COLUMN AND CROSS SECTIONS

Lithostratigraphic units expressed on the State geological map range from Middle Eocene to Holocene. The stratigraphic column showing the lithostratigraphic units utilized on the map delineates only the formations occurring at or near the surface (Figure 1). Table 1 lists the stratigraphic units and provides a brief lithologic components list. Cross sections (Figures 2 and 3) were constructed utilizing cores and well cuttings from the FGS well cuttings and core repository. By necessity, the cross sections show some lithostratigraphic units that do not crop out. These include the Pensacola Clay, Coarse Clastics, Bruce Creek Limestone, and the Long Key Formation. Table 2 lists information for the wells used in the cross sections.

Table 1. Stratigraphic units and lithologies.

Unit		Lithologies
	TERTIARY	
	Middle Eocene	
Tap	Avon Park Formation	limestone, dolostone
	Upper Eocene	
To	Ocala Limestone	limestone, dolostone
	Lower Oligocene	
Ts	Suwannee Limestone	limestone
Tsm	Suwannee-Marianna Limestones Undif.	limestone
	Upper Oligocene to Middle Miocene	
Tha	Hawthorn Group, Arcadia Formation	dolostone, limestone, sand, clay, phosphate
That	Hawthorn Group, Tampa Member	limestone, dolostone, sand, clay
	Miocene	
Tsmk	St. Marks Formation	limestone, sand
Tch	Chattahoochee Formation	dolostone, limestone, sand, clay,
Th	Hawthorn Group	dolostone, limestone, sand, clay, phosphate
Tht	Hawthorn Group, Torreya Formation	clay, sand, limestone
Ths	Hawthorn Group, Statenville Formation	dolostone, sand, clay, phosphate
Thc	Hawthorn Group, Coosawhatchie Formation	sand, clay limestone, dolostone, phosphate
Tab	Alum Bluff Group	clay, sand
	Miocene-Pliocene	
Thp	Hawthorn Group, Peace River Formation	sand, clay, dolostone, phosphate
Thpb	Hawthorn Group, Peace River Formation, Bone Valley Member	sand, clay, phosphate, dolostone
Thcc	Hawthorn Group, Coosawhatchie Formation, Charlton Member	clay, sand, limestone

TABLE 1 (CONTINUED)

TERTIARY/QUATERNARY

	Unit	**Lithologies**
	Pliocene	
Tt	Tamiami Formation	limestone, sand, clay
Tjb	Jackson Bluff Formation	clay, sand
Tic	Intracoastal Formation	limestone, sand, clay
Tmc	Miccosukee Formation	sand, clay
Tci	Citronelle Formation	sand, clay
Tc	Cypresshead Formation	sand, clay
TQuc	Reworked Cypresshead Formation	sand, clay
TQd	Dunes	sand
TQu	Undifferentiated sediments	sand, clay
TQsu	Shell-bearing sediments	shells, sand, clay

QUATERNARY

	Pleistocene	
Qtr	Trail Ridge sands	sand, heavy minerals
Qm	Miami Limestone	limestone, sand
Qk	Key Largo Limestone	limestone
Qa	Anastasia Formation	limestone, coquina, sand
	Pleistocene/Holocene	
Qu	Undifferentiated	sand, clay, organics
Qbd	Beach Ridge and Dune	sand
Qal	Alluvium	sand, clay, organics
	Holocene	
Qh	Holocene sediments	sand, clay, organics

Table 2. Wells used in cross sections.

W #	County	Section	Town ship	Range	Elevation (msl)	Composite with W#	Cross Section & Well #
148	Walton	12	1N	19W	200	7951	4 A-A'
275	Lake	se/se 17	24S	25E	113		5 B-B'
935	Dade	sw/sw 31	53S	35E	18		9 B-B'
1345	Okaloosa	sw/ne 1	3N	25W	189		3 A-A'
1465	Alachua	ne/se/sw 23	8S	18E	102		3 B-B'
1482	Marion	sw/nw 16	16S	23E	74		4 B-B'
1596	Madison	sw/se 6	1S	10E	107	15803	9 A-A'
1610	Calhoun	nw/se 31	2N	9W	217	11270	6 A-A'
1754	Polk	sw/sw 18	30S	28E	147		6 B-B'
1758	Washington	sw/sw 31	2N	13W	125	10954	5 A-A'
1768	Gadsden	ne/nw 35	2N	3W	200	15795	7 A-A'
1789	Columbia	se 22	1N	17E	129		1 B-B'
1832	Columbia	ne/ne 24	2S	16E	138	15162	10 A-A' 2 B-B'
1854	Jefferson	1	2S	3E	51	6931	8 A-A'
3455	Santa Rosa	ne/ne 10	2N	27W	35		2 A-A'
4597	Escambia	nw/nw 2	1N	31W	110		1 A-A'
6931	Jefferson	se/ne 29	1S	4E	200	1854	8 A-A'
7971	Walton	se/sw 9	1N	18W	195	148	4 A-A'
8736	Duval	ne/ne 23	1S	24E	82	8881	11 A-A'
8881	Duval	ne/ne 23	1S	24E	81	8736	11 A-A'
10954	Washington	ne 16	1N	14W	125	1758	5 A-A'
11270	Calhoun	nw/ne 13	1N	10W	125	1610	6 A-A'
15162	Columbia	se/sw 23	2S	17E	140	1832	2 B-B'
15644	Highlands	17	37S	30E	104		7 B-B'
15795	Gadsden	ne/ne 6	1N	2W	200	1768	7 A-A'
15803	Madison	ne/se 34	1N	9E	161	1596	9 A-A'
16058	Hendry	se/sw 27	45S	34E	18		8 B-B'
17156	Monroe	sw 26	64S	35E	1		11 B-B'
17273	Dade	sw 36	58S	36E	5		10 B-B'
ODAW#1	Duval	4	2S	29E	15		12 A-A'

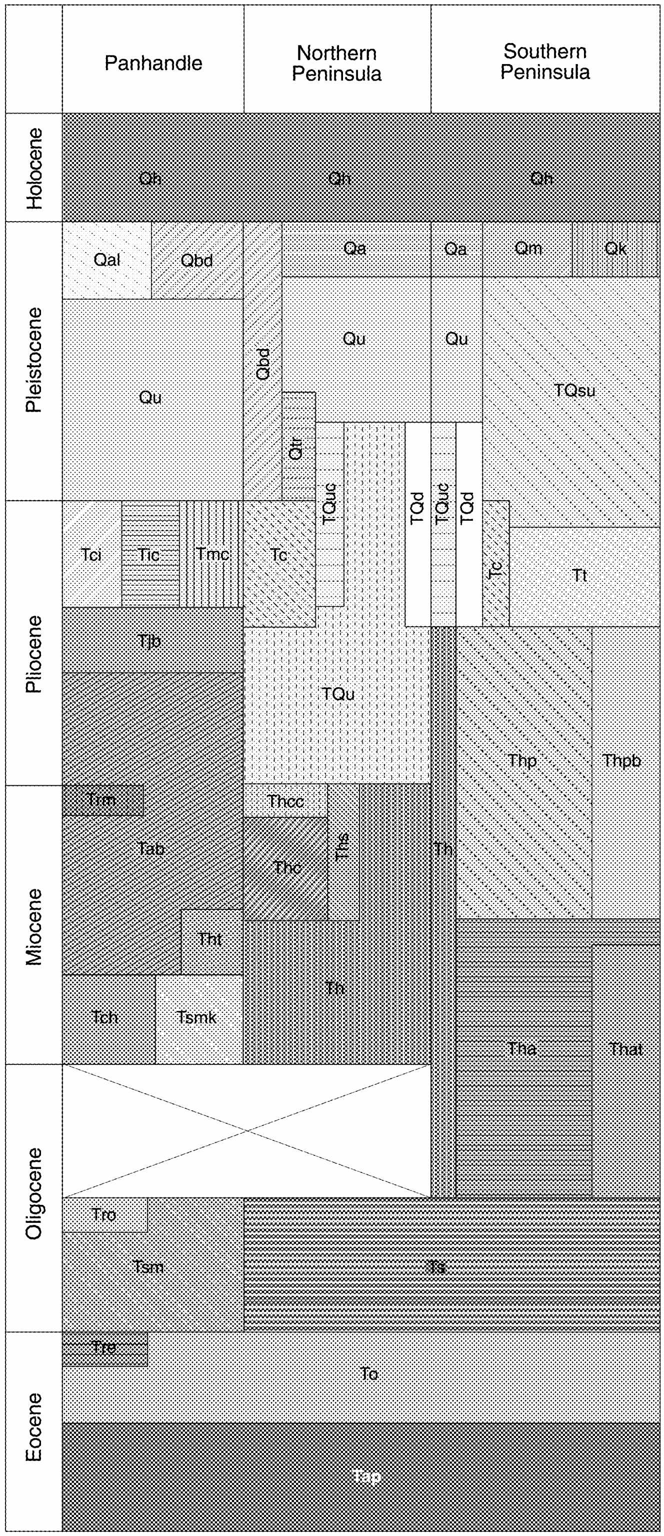

Figure 1. Stratigraphic column showing the lithostratigraphic units used on the map.

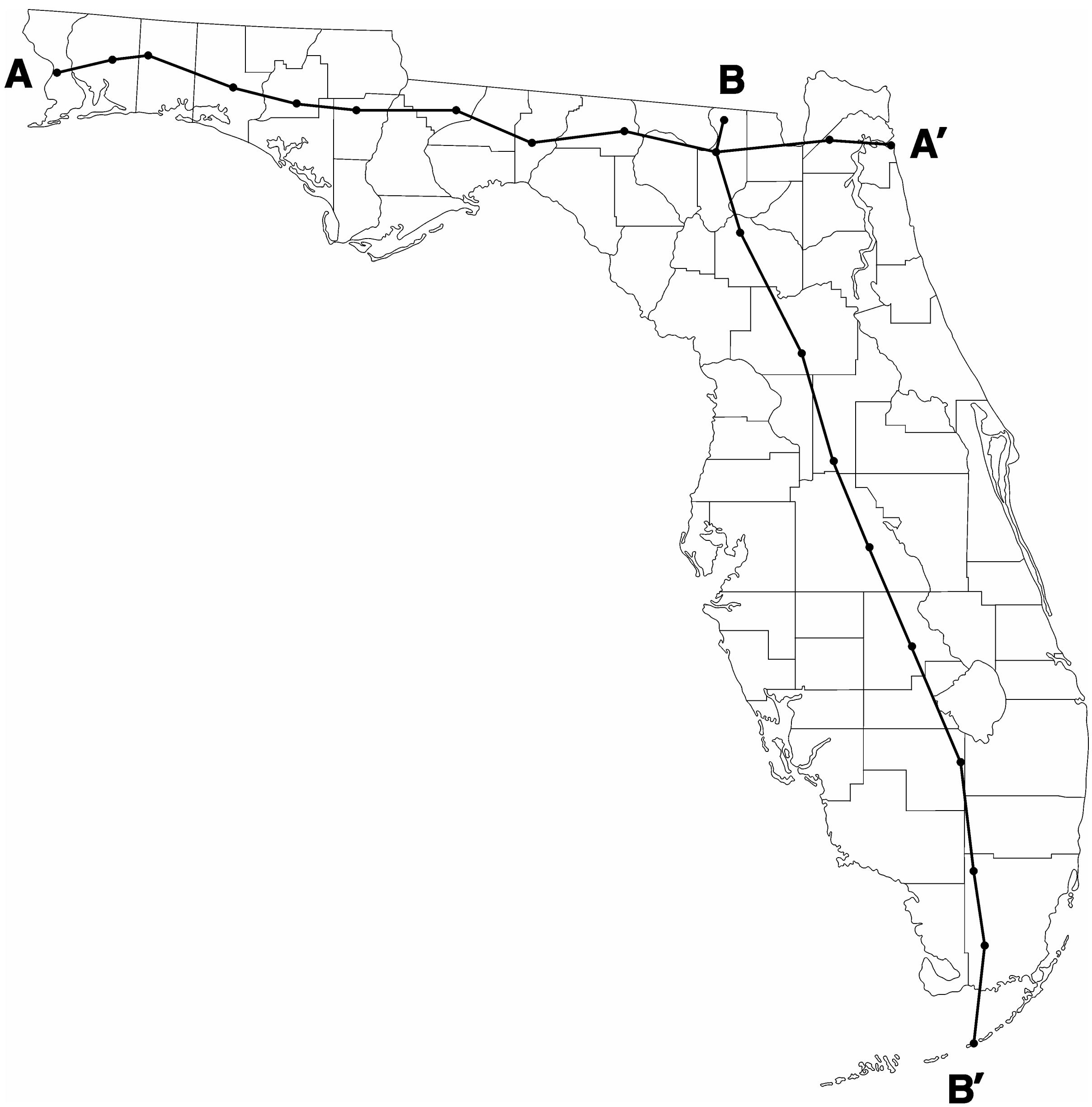

Figure 2. Geological cross section locations.

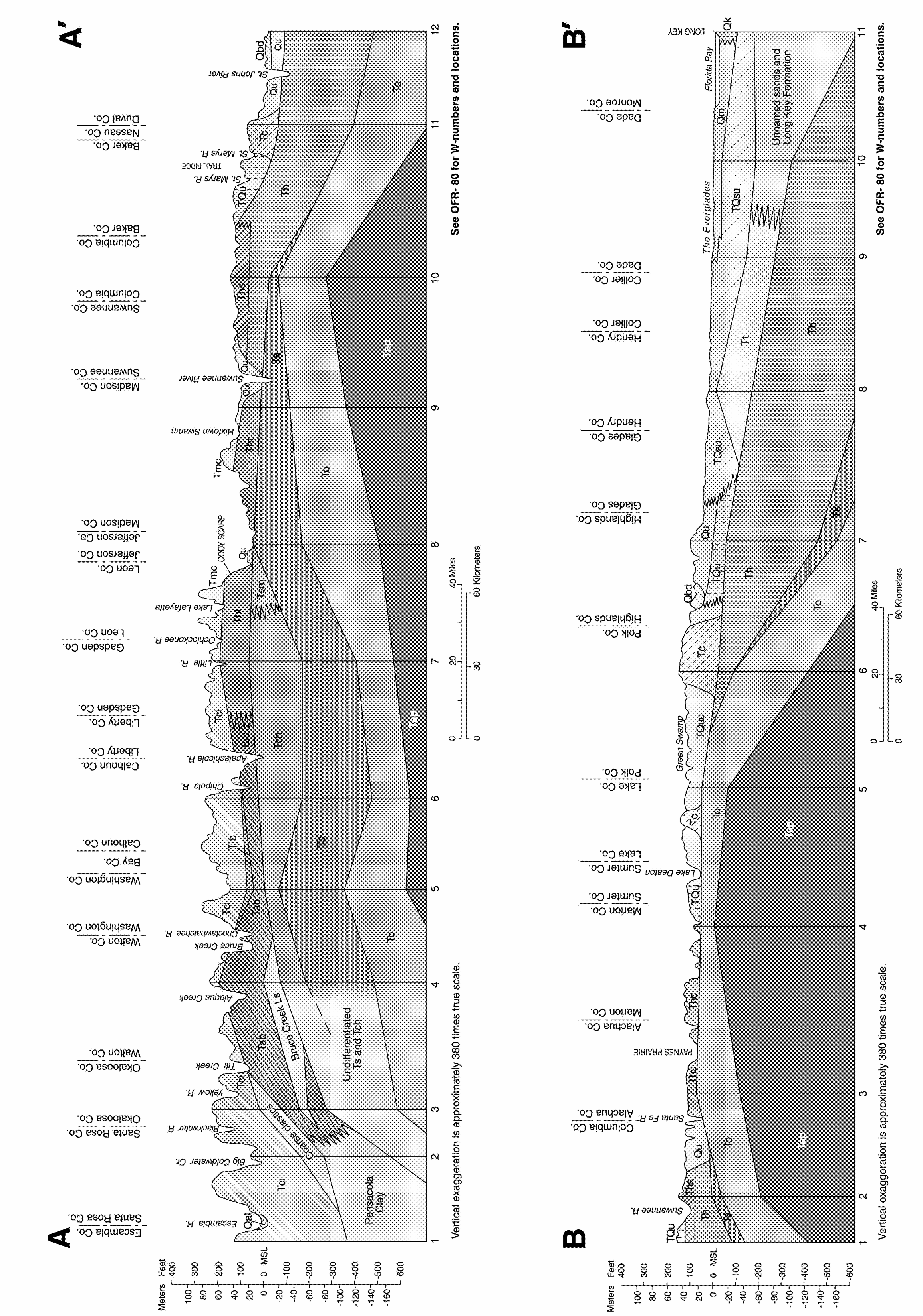

Figure 3. Geologic cross sections.

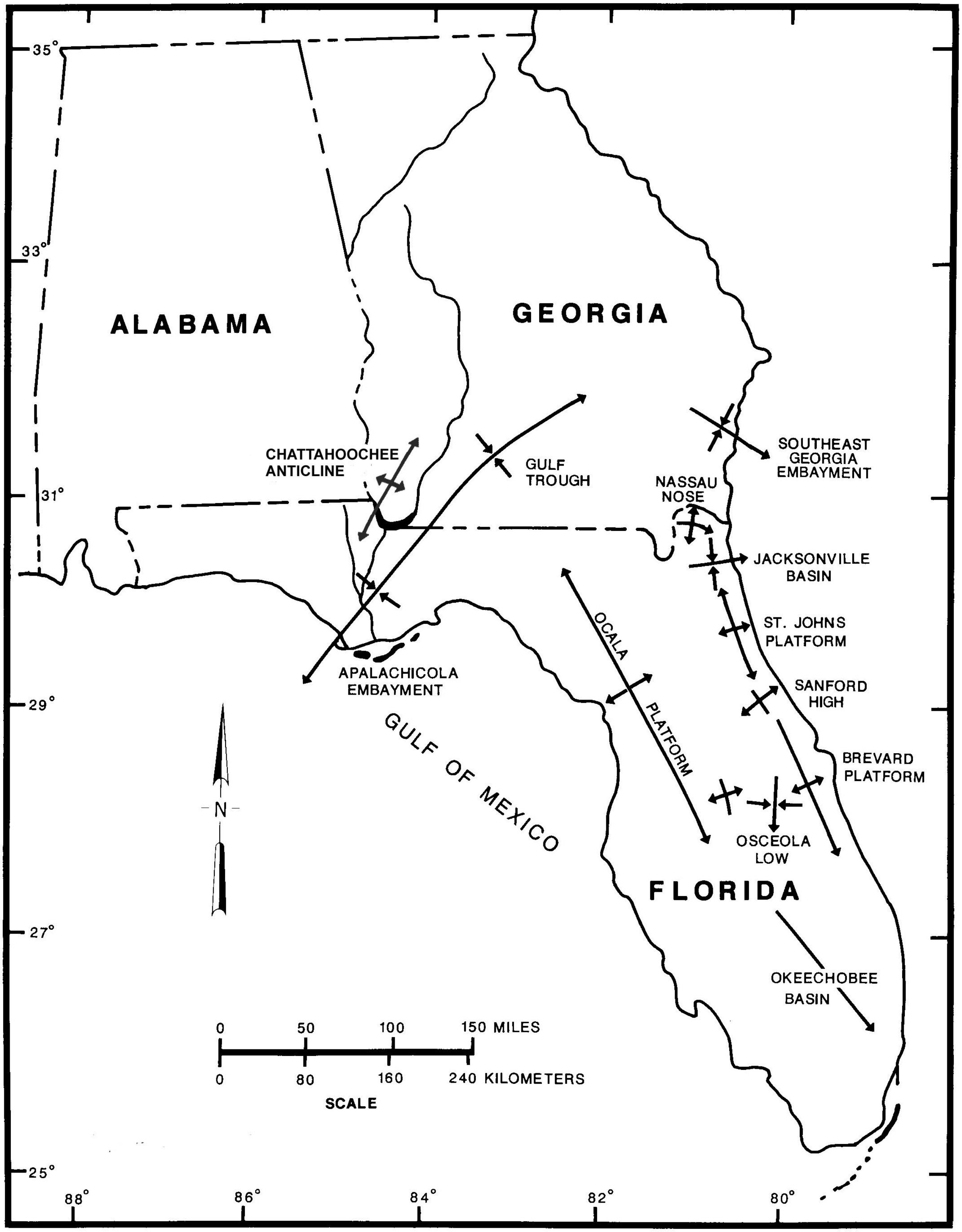

Figure 4. Geologic structures in Florida (modified from Scott, 1988).

GEOLOGIC STRUCTURES

The geologic structures (Figure 4) that have affected shallow Tertiary and Quaternary sediments of the Florida Platform have been defined by numerous authors (Puri and Vernon, 1964; Miller, 1986; Scott, 1988; Scott, 1991). The majority of the structures recognized as influencing the deposition, erosion and alteration of the Cenozoic sediments in Florida do not appear to have had a significant effect on the surface expression of the lithostratigraphic units. These geologic structures include the Gulf Basin, Jacksonville Basin, St. Johns Platform, Sanford High, Brevard Platform, Osceola Low and the Okeechobee Basin (Scott, 1992). Those structural features that exerted an influence on the surficial or very near surface distribution of the Cenozoic sediments, or mark areas of significant facies changes, include the Gulf Trough/Apalachicola Embayment, Chattahoochee "Anticline" and the Ocala Platform. Eocene sediments crop out on the Chattahoochee Anticline and the Ocala Platform. The Gulf Trough/ Apalachicola Embayment formed an important bathymetric and environmental barrier from the latest Eocene or earliest Oligocene into the Miocene. As a result, the Oligocene carbonate facies east and south of the Gulf Trough/Apalachicola Embayment are distinctly different from those occurring to the west and north (see Schmidt [1984] and Bryan [1991] for discussion).

LITHOSTRATIGRAPHIC UNITS

TERTIARY SYSTEM

Eocene Series

Middle Eocene - Bartonian Stage

Tap - Avon Park Formation - Middle Eocene carbonate sediments of peninsular Florida, as originally described by Applin and Applin (1944), were subdivided, in ascending order, into the Lake City Limestone and the Avon Park Limestone. Miller (1986) recommended combining the Lake City Limestone with the Avon Park Limestone and, due to the common occurrence of dolostone, referred to the unit as the Avon Park Formation. Carbonates of the Avon Park Formation are the oldest sediments exposed in the state. The Avon Park Formation crops out in a limited area in west-central peninsular Florida in Levy and Citrus Counties on the crest of the Ocala Platform.

The Avon Park Formation consists of cream to light-brown or tan, poorly indurated to well indurated, variably fossiliferous, limestone (grainstone, packstone and wackestone, with rare mudstone). These limestones are interbedded with tan to brown, very poorly indurated to well indurated, very fine to medium crystalline, fossiliferous (molds and casts), vuggy dolostones. The fossils present include mollusks, foraminifers, echinoids, algae and carbonized plant remains. Molds and casts of gypsum crystals occur locally.

The Avon Park Formation is part of the Floridan aquifer system (FAS). Parts of the Avon Park Formation comprise important, subregional confining units within the FAS (Miller, 1986).

Upper Eocene - Priabonian Stage

To - Ocala Limestone - Dall and Harris (1892) referred to the limestones exposed near Ocala, Marion County, in central peninsular Florida as the Ocala Limestone. Puri (1953, 1957) elevated the Ocala Limestone to group status recognizing its component formations on the basis of foraminiferal faunas (biozones). Scott (1991) reduced the Ocala Group to formational status in accordance with the North American Stratigraphic Code (North American Commission on Stratigraphic Nomenclature, 1983).

The Ocala Limestone consists of nearly pure limestones and occasional dolostones. It can be subdivided into lower and upper facies on the basis of lithology. The lower member is composed of a white to cream-colored, fine to medium grained, poorly to moderately indurated, very fossiliferous limestone (grainstone and packstone). The lower facies may not be present throughout the areal extent of the Ocala Limestone and may be partially to completely dolomitized in some regions (Miller, 1986). The upper facies is a white, poorly to well indurated, poorly sorted, very fossiliferous limestone (grainstone, packstone and wackestone). Silicified limestone (chert) is common in the upper facies. Fossils present in the Ocala Limestone include abundant large and smaller foraminifers, echinoids, bryozoans and mollusks. The large foraminifera *Lepidocyclina* sp. is abundant in the upper facies and extremely limited in the lower facies. The presence of these large foraminifers in the upper facies is quite distinctive.

The Ocala Limestone is at or near the surface within the Ocala Karst District in the west-central to northwestern peninsula and within the Dougherty Plain District in the north-central panhandle (Scott, in preparation). In these areas, the Ocala Limestone exhibits extensive karstification. These karst features often have tens of feet (meters) of relief, dramatically influencing the topography of the Ocala Karst District and the Dougherty Plain District (Scott, in preparation). Numerous disappearing streams and springs occur within these areas.

The permeable, highly transmissive carbonates of the Ocala Limestone form an important part of the FAS. It is one of the most permeable rock units in the FAS (Miller, 1986).

Tre - Residuum on Eocene sediments - The post-Eocene residuum lying on Eocene sediments in the panhandle consists of reddish brown, sandy clays and clayey sands with inclusions of weathered Eocene limestones. Some of the inclusions are silicified carbonates.

Oligocene Series

Lower Oligocene - Rupelian Stage

Previous geologic maps of Florida presented the Lower Oligocene sediments exposed at the surface or in the shallow subsurface in a variety of ways. Cooke (1945) mapped, in ascending order, the Marianna Limestone, Byram Formation, Suwannee Limestone and the Flint River Formation. Vernon and Puri (1964) identified the Marianna Limestone, “Byram” Formation, Duncan Church beds and the Suwannee Limestone. Brooks (1982) recognized the Marianna Limestone, Suwannee Limestone and the Duncan Church facies of the Suwannee Limestone. The variations in the stratigraphic units are indicative of the confusion over the lithologic recognition and subdivision of the Lower Oligocene sediments. The confusion is at least partially due to the use of biostratigraphic data to subdivide the lithostratigraphic units.

Huddlestun (1993) recognized a tripartite subdivision in the type area of the Suwannee Limestone in northwestern peninsular Florida and proposed the Ellaville Limestone, Suwannacoochee Dolostone and Suwannee Limestone. In the panhandle, west of the Gulf Trough, Huddlestun (1993) recognized the Marianna Limestone and an undifferentiated residuum as the Oligocene sediments extending into Florida's panhandle from Georgia. Huddlestun (1993) also recognized Bucatunna Formation, Florala Limestone, Bridgeboro Limestone and an unnamed marl in Okaloosa and Walton Counties.

Bryan (1991, 1993) provides a better framework for the recognition of the various facies within the Lower Oligocene sediments. Within this framework, the Ellaville Limestone, Suwannacoochee Dolostone and Suwannee Limestone occur within his Florida Platform Association east and south of the Gulf Trough. West of the Gulf Trough in the Florida panhandle (Bryan's Eastern Gulf Shelf Association), Bryan (1991) recognized the Bumpnose Limestone, Marianna Limestone, Bridgeboro Limestone, Florala Limestone, Suwannee Limestone, Byram Marl and Bucatunna Formation.

The limited data available, the occurrence of thin beds of some of these units and the questionable occurrence of other units made mapping the Lower Oligocene sediments in the central panhandle problematic. The approach selected by FGS geologists was to combine the units into several mappable units appropriate for the scale of the present map. These mappable units include: undifferentiated Oligocene sediments composed of the Bumpnose Limestone, Marianna Limestone, Bridgeboro Limestone, Florala Limestone, Suwannee Limestone, thin beds of the Byram Marl and Bucatunna Formation and undifferentiated Oligocene residuum (see Huddlestun [1993] for a discussion of the origin of the residuum).

The Lower Oligocene sediments of peninsular Florida are mapped as the Suwannee Limestone and are not subdivided into the Ellaville Limestone, Suwannacoochee Dolostone and Suwannee Limestone. This mapping convention was adopted by FGS geologists due to the limited data on the areal distribution of the Ellaville Limestone and Suwannacoochee Dolostone.

Ts - Suwannee Limestone - Peninsular Lower Oligocene carbonates crop out on the northwestern, northeastern and southwestern flanks of the Ocala Platform. The Suwannee Limestone is absent from the eastern side of the Ocala Platform due to erosion, nondeposition or both, an area referred to as Orange Island (Bryan, 1991).

The Suwannee Limestone, originally named by Cooke and Mansfield (1936), consists of a white to cream, poorly to well indurated, fossiliferous, vuggy to moldic limestone (grainstone and packstone). The dolomitized parts of the Suwannee Limestone are gray, tan, light brown to moderate brown, moderately to well indurated, finely to coarsely crystalline, dolostone with limited occurrences of fossiliferous (molds and casts) beds. Silicified limestone is common in Suwannee Limestone. Fossils present in the Suwannee Limestone include mollusks, foraminifers, corals and echinoids.

Tsm - Undifferentiated Lower Oligocene Sediments - The undifferentiated Lower Oligocene sediments of the central panhandle consist of white to cream-colored, poorly to well indurated, variably fossiliferous limestones (grainstone, packstone, wackestone and mudstone). Glauconite occurs in some sediments. Siliciclastics form a minor component in some sediments. Thin beds of siliciclastics (Byram Marl and Buccatuna Formation) are included in the undifferentiated Lower Oligocene sediments. The Lower Oligocene carbonates form important parts of the upper FAS (Miller, 1986).

Tro - Residuum on Oligocene sediments - The undifferentiated Oligocene residuum, mapped on parts of the Chattahoochee "Anticline", characteristically consists of reddish brown, variably sandy clay with inclusions of variably fossiliferous, silicified limestone (Huddlestun, 1993). The residuum includes Lower and Upper Oligocene weathered sediments (Huddlestun, 1993).

Oligocene - Miocene Series

Upper Oligocene - Middle Miocene - Chattian - Serravalian Stage

PENINSULA

Lower Hawthorn Group

Recent investigations into the Oligocene of southern Florida documented the existence of a thick (>330 feet [100 meters]) Upper Oligocene section previously considered Miocene (Scott *et al*., 1994; Missimer and Scott, 1995; Brewster-Wingard *et al*., 1997). The Arcadia Formation, Hawthorn Group, previously thought to be predominantly Early Miocene (Scott, 1988), is now known to be late Early Oligocene to Middle Miocene (Brewster-Wingard *et al*., 1997; Missimer, 1997). The Tampa Limestone (or Formation of previous usage [Puri and Vernon, 1964]) is a member of the Arcadia Formation, Hawthorn Group (Scott, 1988). The Tampa Member's previous age assignment was latest Oligocene to Early Miocene (Scott, 1988). Brewster-Wingard *et al*. (1997) recognized the Tampa Member as being Late Oligocene to Early Miocene.

Tha - Hawthorn Group, Arcadia Formation - The undifferentiated Arcadia Formation and the Tampa Member crop out on the southwestern flank of the Ocala Platform from Pasco County southward to Sarasota County. Although ages of the outcropping sediments have not been accurately determined, stratigraphic position suggests that the Upper Oligocene parts of the Arcadia Formation and Tampa Member are exposed in this region, particularly from Hillsborough County northward to Pasco County.

The Arcadia Formation, named by Scott (1988), is predominantly a carbonate unit with a variable siliciclastic component, including thin beds of siliciclastics. Within the outcrop area, the Arcadia Formation, with the exception of the Tampa Member, is composed of yellowish gray to light olive gray to light brown, micro to finely crystalline, variably sandy, clayey, and phosphatic, fossiliferous limestones and dolostones. Thin beds of sand and clay are common. The sands are yellowish gray, very fine to medium grained, poorly to moderately indurated, clayey, dolomitic and phosphatic. The clays are yellowish gray to light olive gray, poorly to moderately indurated, sandy, silty, phosphatic and dolomitic. Molds and casts of mollusks are common in the dolostones. Silicified carbonates and opalized claystone are found in the Arcadia Formation.

That - Arcadia Formation, Tampa Member - The Tampa Member consists predominantly of limestone with subordinate dolostone, sand and clay (Scott, 1988). The lithology of the Tampa Member is very similar to that of the subsurface limestone part of the Arcadia Formation except that the Tampa Member contains noticeably less phosphate (Scott, 1988). The limestone in the Tampa is white to yellowish gray, fossiliferous and variably sandy and clayey mudstone, wackestone and packstone with minor to no phosphate grains. Sand and clay beds are like those in the undifferentiated Arcadia Formation. Mollusks and corals are common in the Tampa Member as molds and casts, silicified pseudomorphs and original shell material. The Tampa Member and the lower part of the Arcadia Formation form the upper part of the Floridan aquifer system (FAS) in parts of southern Florida (Miller, 1986; Scott, 1991).

PANHANDLE

Upper Oligocene sediments are not known to crop out in the Florida panhandle. The Chickasawhay Formation of Alabama has been traced in the subsurface into the central panhandle but is not exposed on the Chattahoochee Anticline (Miller, 1986).

Miocene Series

Lower Miocene to Upper Miocene - Aquitanian to Messinian Stage

Sediments of the Miocene Series have been the focus of numerous investigations due to their complex nature and widespread occurrence in Florida (see Schmidt and Clark [1980], Huddlestun [1988] and Scott [1988] for a review of previous investigations). The Miocene sediments consist of siliciclastics, carbonates and mixed siliciclastic-carbonate lithologies with numerous lateral and vertical facies changes. Exposures are limited and most investigations dealt with these sediments in the subsurface.

Miocene sediments crop out or occur in the shallow subsurface on the northwestern flank of the Ocala Platform in the eastern panhandle to the flanks of the Chattahoochee “Anticline” in the central panhandle then into the western panhandle to Okaloosa County. In the peninsula, the Miocene sediments crop out or are in the shallow subsurface from the northern flank of the Ocala Platform in Hamilton, Columbia and Baker Counties southward to Charlotte County. Some of the most beautiful landscapes in the State occur where the Miocene sediments are exposed, eroded and often affected by karstification of underlying Paleogene carbonates.

The importance of the Miocene sediments in Florida is twofold - first, these sediments contain valuable mineral resources, primarily phosphate and adsorptive clays; and, second, the Miocene sediments comprise the intermediate confining unit and aquifer system. Whereas the principle geological hazard associated with Paleogene carbonates is karst development, the hazards associated with the Miocene sediments are radon gas and swelling clays.

Significant changes in age determinations or interpretations have occurred for the sediments traditionally considered as Miocene in the peninsula. Puri and Vernon (1964) recognized a simple three-fold subdivision of the Miocene in peninsular Florida. Their subdivision of the Miocene was that all Lower Miocene sediments were St. Marks Formation (Tampa [Note that they used Tampa as a stage name so all sediments that had been called Tampa were placed in the St. Marks Formation statewide]), Middle Miocene sediments were Hawthorn Formation and Upper Miocene sediments were Tamiami Formation. Poag (1972) placed the lower portion of the Chattahoochee Formation in the Upper Oligocene. Currently, geologists recognize that the Hawthorn Group spans from the mid-Oligocene to Early Pliocene (Brewster-

Wingard *et al.*, 1997; Missimer, 1997). The Tamiami Formation is Early to Late Pliocene (Missimer, 1997).

The Miocene lithostratigraphic units recognized by this study in the panhandle include the Chattahoochee Formation, St. Marks Formation, Alum Bluff Group, Torreya Formation (Hawthorn Group) and residuum. In the peninsula, the Miocene units mapped include the undifferentiated Hawthorn Group, Coosawhatchie Formation, Charlton Member, and the Peace River Formation and its Bone Valley Member.

Tch - Chattahoochee Formation - The Chattahoochee Formation, originally named by Dall and Stanley-Brown (1894), is predominantly a yellowish gray, poorly to moderately indurated, fine-grained, often fossiliferous (molds and casts), silty to finely sandy dolostone (Huddlestun, 1988). Siliciclastic beds and limestones may be present.

The Chattahoochee Formation is exposed in Jackson County, central panhandle, on the Chattahoochee "Anticline". It grades laterally across the Gulf Trough into the St. Marks Formation through a broad transition area (Scott, 1986). The Chattahoochee Formation forms the upper part of the FAS in the central panhandle.

Tsmk - St. Marks Formation - The Lower Miocene St. Marks Formation, named by Finch (1823), is exposed in Wakulla, Leon and Jefferson Counties on the northwestern flank of the Ocala Platform. It is a white to yellowish gray, poorly to moderately indurated, sandy, fossiliferous (molds and casts) limestone (packstone to wackestone). Mollusk molds and casts are often abundant. The St. Marks Formation makes up the upper part of the FAS in part of the eastern panhandle.

Hawthorn Group

The Hawthorn Group in Florida is composed of a number of different formations and members (Scott, 1988; Huddlestun, 1988). Most of the formations are defined from subsurface evaluations. As a result, for mapping purposes, all the component formations are not recognized on the geologic map.

In the eastern panhandle, the upper Lower Miocene Torreya Formation, including the Dogtown and Sopchoppy Members (Huddlestun and Hunter, 1982), comprises the entire Hawthorn Group (Scott, 1988). The Dogtown and Sopchoppy Members are not delineated on the map.

In northern peninsular Florida, the Hawthorn Group consists of the lower Lower Miocene Penney Farms Formation and, rarely, the Parachucla Formation; the upper Lower Miocene Marks Head Formation; the Middle Miocene Coosawhatchie Formation and the Statenville Formation (Scott, 1988; Huddlestun, 1988). The Charlton Member of the Coosawhatchie Formation is recognized in a limited area. The Penney Farms and Marks Head Formations are not recognized cropping out in significant exposures. The undifferentiated Hawthorn Group was mapped where component formations were questionable or difficult to differentiate due to very limited data.

In southern peninsular Florida, the Hawthorn Group formations include the Upper Oligocene to Middle Miocene Arcadia Formation including the Tampa and Nocatee Members and the Middle Miocene to Early Pliocene Peace River Formation with its Bone Valley Member and Wabasso beds (Scott, 1988). The Nocatee Member of the Arcadia Formation and the

Wabasso beds of the Peace River Formation were not recognized at or near land surface and do not appear on the geologic map.

Tht - Torreya Formation - The Torreya Formation is exposed or near the surface from western Gadsden County eastward to western-most Hamilton County. It is informally subdivided into a lower carbonate unit and an upper siliciclastic unit (Scott, 1988). The majority of Torreya Formation outcrops expose the siliciclastic part of the unit. The carbonate sediments are white to light olive gray, generally poorly indurated, variably sandy and clayey, fossiliferous (molds and casts) limestone (mudstone and wackestone). The limestones often grade into calcareous-cemented sands. Phosphate is present in the carbonate sediments, particularly in the Sopchoppy Member. The siliciclastics vary from white to light olive gray, unconsolidated to poorly indurated, slightly clayey sands with minor phosphate to light gray to bluish gray, poorly consolidated, variably silty clay (Dogtown Member). The siliciclastics are sporadically fossiliferous. The Torreya Formation overlies the FAS and forms part of the intermediate confining unit/aquifer system.

Thc - Coosawhatchie Formation - The Coosawhatchie Formation is exposed or lies beneath a thin overburden on the eastern flank of the Ocala Platform from southern Columbia County to southern Marion County. Within the outcrop region, the Coosawhatchie Formation varies from a light gray to olive gray, poorly consolidated, variably clayey and phosphatic sand with few fossils, to an olive gray, poorly to moderately consolidated, slightly sandy, silty clay with few to no fossils. Occasionally the sands will contain a dolomitic component and, rarely, the dominant lithology will be dolostone or limestone. Silicified nodules are often present in the Coosawhatchie Formation sediments in the outcrop region. The sediment may contain 20 percent or more phosphate (Scott, 1988). Permeability of the Coosawhatchie sediments is generally low, forming part of the intermediate confining unit/aquifer system.

Thcc - Coosawhatchie Formation, Charlton Member - The Charlton Member (originally the Charlton formation, Veatch and Stevenson, 1911), crops out only in northern Nassau County near and along the St. Marys River. The Charlton Member in this area consists primarily of light gray to greenish gray, poorly to moderately consolidated, dolomitic to calcareous, silty, sandy, locally fossiliferous clays. Few carbonate beds occur.

Ths - Statenville Formation - The Statenville Formation occurs at or near the surface in a limited area of Hamilton, Columbia and Baker Counties on the northeastern flank of the Ocala Platform. The formation consists of interbedded sands, clays and dolostones with common to very abundant phosphate grains. The sands predominate and are light gray to light olive gray, poorly indurated, phosphatic, fine to coarse grained with scattered gravel and with minor occurrences of fossils. Clays are yellowish gray to olive gray, poorly consolidated, variably sandy and phosphatic, and variably dolomitic. The dolostones, which occur as thin beds, are yellowish gray to light orange, poorly to well indurated, sandy, clayey and phosphatic with scattered mollusk molds and casts. Phosphate occurs in the Statenville Formation in economically important amounts. Silicified fossils and opalized claystones are found in the Statenville Formation. Permeability of these sediments is generally low, forming part of the intermediate confining unit/aquifer system.

Th - Undifferentiated Hawthorn Group - The undifferentiated Hawthorn Group occurs at or near the surface near the southern flank of the Ocala Platform from Gilchrist County southward to Pasco County with isolated occurrences in Pinellas County. Correlation of these sediments to the formations of the Hawthorn Group exposed to the east and in the subsurface is uncertain. There is little to no phosphate present in these sediments and fossils are rare. Ages have not been documented but stratigraphic position suggests inclusion in the Hawthorn Group. These sediments may be residual from the weathering and erosion of the Hawthorn Group. The Hawthorn Group sediments on the Brooksville Ridge are deeply weathered and in some outcrops look like Cypresshead Formation siliciclastics.

The undifferentiated Hawthorn Group sediments are light olive gray and blue gray in unweathered sections to reddish brown in deeply weathered sections, poorly to moderately consolidated, clayey sands to silty clays and relatively pure clays. These sediments are part of the intermediate confining unit/aquifer system and provide an effective aquitard for the FAS, except where perforated by karst features.

Hard-rock phosphate deposits are associated with the undifferentiated Hawthorn Group sediments on the eastern flank of the Brooksville Ridge. The hard rock phosphate deposits were formed by the dissolution of phosphate in the Hawthorn sediments and redeposition in karst features.

Tab - Alum Bluff Group - West of the Apalachicola River, the Hawthorn Group is replaced by the Alum Bluff Group. The Alum Bluff Group includes the Chipola Formation, Oak Grove Sand, Shoal River Formation, Choctawhatchee Formation and the Jackson Bluff Formation (Huddlestun, 1984; Braunstein *et al*., 1988). The formations included in this group are generally defined on the basis of their molluscan faunas and stratigraphic position (Schmidt and Clark, 1980). Puri (1953) described sediment facies as they relate to the formations of the Alum Bluff Group These sediments are lithologically distinct as a group, not as individual units. Brooks (1982) mapped much of the Alum Bluff Group as the Shoal River Formation. The Alum Bluff Group crops out or is beneath a thin overburden in the western panhandle from river valleys in Okaloosa County eastward to western Jackson County.

The Alum Bluff Group consists of clays, sands and shell beds which may vary from fossiliferous, sandy clays to unfossiliferous sands and clays and occasional carbonate beds (Huddlestun, 1984). Mica is a common constituent and glauconite and phosphate occur sporadically. Induration varies from essentially nonindurated in sands to well indurated in carbonate lenses. Colors range from cream to olive gray with mottled reddish brown in weathered sections. Sand grain size varies from very fine to very coarse with sporadic occurrences of gravel. These sediments generally have low permeabilities and are part of the intermediate confining unit/aquifer system.

Trm - Residuum on Miocene sediments - The undifferentiated Miocene residuum, mapped on parts of the Chattahoochee “Anticline”, characteristically consists of reddish brown, variably sandy clay with inclusions of variably fossiliferous, silicified limestone. The residuum includes Lower to Upper Miocene and younger weathered sediments.

Miocene - Pliocene Series

Middle Miocene-Lower Pliocene, Serravalian - Zanclean Stage

Thp - Peace River Formation - The Peace River Formation crops out or is beneath a thin overburden on the southern part of the Ocala Platform extending into the Okeechobee Basin. These sediments were mapped from Hillsborough County southward to Charlotte County. Within this area, the Peace River Formation is composed of interbedded sands, clays and carbonates. The sands are generally light gray to olive gray, poorly consolidated, clayey, variably dolomitic, very fine to medium grained and phosphatic. The clays are yellowish gray to olive gray, poorly to moderately consolidated, sandy, silty, phosphatic and dolomitic. The carbonates are usually dolostone in the outcrop area. The dolostones are light gray to yellowish gray, poorly to well indurated, variably sandy and clayey, and phosphatic. Opaline chert is often found in these sediments. The phosphate content of the Peace River Formation sands is frequently high enough to be economically mined. Fossil mollusks occur as reworked casts, molds, and limited original shell material. Silicified corals and wood, and vertebrate fossils are also present. The Peace River Formation is widespread in southern Florida. It is part of the intermediate confining unit/aquifer system.

Thpb - Bone Valley Member, Peace River Formation - The Bone Valley Member (originally the Bone Valley Formation of Matson and Clapp, 1909), Peace River Formation occurs in a limited area on the southern part of the Ocala Platform in Hillsborough, Polk and Hardee Counties. Throughout its extent, the Bone Valley Member is a clastic unit consisting of sand-sized and larger phosphate grains in a matrix of quartz sand, silt and clay. The lithology is highly variable, ranging from sandy, silty, phosphatic clays and relatively pure clays to clayey, phosphatic sands to sandy, clayey phosphorites (Webb and Crissinger, 1983). In general, consolidation is poor and colors range from white, light brown and yellowish gray to olive gray and blue green. Mollusks are found as reworked, often phosphatized casts. Vertebrate fossils occur in many of the beds within the Bone Valley Member. Shark's teeth are often abundant. Silicified corals and wood are occasionally present as well.

The Bone Valley Member is an extremely important, unique phosphate deposit and has provided much of the phosphate production in the United States during the twentieth century. Mining of phosphate in the outcrop area began in 1888 (Cathcart, 1985) and continues to the present.

Pliocene Series

Lower Pliocene to Upper Pliocene - Zanclean to Piacenzian Stage

Florida's Pliocene sediments have been the focus of numerous, primarily paleontologic, investigations due to abundant and diverse molluscan faunas. Although the majority of the Pliocene sediments are unfossiliferous siliciclastics, well preserved shell beds in southern Florida have attracted much attention (see papers in Scott and Allmon [1992]; Zullo *et al.*[1993]; Missimer [1997]). Despite the attention to these units, the lithostratigraphy of the Pliocene units remains poorly understood.

Pliocene sediments are distributed widely in Florida. In the panhandle and northern two-thirds of the peninsula the Pliocene sediments are predominantly unfossiliferous siliciclastics. In the southern one-third of the peninsula, the Pliocene sediments are often fossiliferous siliciclastics with carbonates becoming more abundant in southwestern Florida. The facies relationships within the marine Pliocene sediments of southern Florida are quite complex.

Tt - Tamiami Formation - The Tamiami Formation (Mansfield, 1939) is a poorly defined lithostratigraphic unit containing a wide range of mixed carbonate-siliciclastic lithologies and associated faunas (Missimer, 1992). It occurs at or near the land surface in Charlotte, Lee, Hendry, Collier and Monroe Counties in the southern peninsula. A number of named and unnamed members are recognized within the Tamiami Formation. These include: the Buckingham Limestone Member; an unnamed tan clay and sand; an oyster (*Hyotissa*) facies, a sand facies, the Ochopee Limestone Member, the Bonita Springs Marl Member; an unnamed limestone facies; the Golden Gate Reef Member; and the Pinecrest Sand Member (Missimer, 1992). The individual members of the Tamiami Formation were not separately mapped on the geological map.

Lithologies of the Tamiami Formation in the mapped area include: 1) light gray to tan, unconsolidated, fine to coarse grained, fossiliferous sand; 2) light gray to green, poorly consolidated, fossiliferous sandy clay to clayey sand; 3) light gray, poorly consolidated, very fine to medium grained, calcareous, fossiliferous sand; 4) white to light gray, poorly consolidated, sandy, fossiliferous limestone; and 5) white to light gray, moderately to well indurated, sandy, fossiliferous limestone. Phosphate is present in virtually all lithologies as limited quantities of sand- to gravel-sized grains. Fossils present in the Tamiami occur as molds, casts and original material. The fossils present include barnacles, mollusks, corals, echinoids, foraminifers and calcareous nannoplankton.

The Tamiami Formation has highly permeable to impermeable lithologies that form a complex aquifer. Locally, it is part of the surficial aquifer system. In other areas, it forms a part of the intermediate confining unit/aquifer system.

Tjb - Jackson Bluff Formation - The Jackson Bluff Formation, named by Vernon and Puri (1964), occurs at or near the surface in a limited area of the panhandle in Leon, Liberty and Wakulla Counties. It has attracted much attention due to its abundant fossil molluscan fauna (Huddlestun, 1984; Schmidt, 1984).

In the outcrop area, the Jackson Bluff Formation is described as a sandy, clayey shell bed (Schmidt, 1984). It is composed of tan to orange-brown to gray green, poorly consolidated, fossiliferous, sandy clays to clayey sands. Fossils present include abundant mollusks, corals, foraminifers and occasional vertebrate remains.

Tic - Intracoastal Formation - Limited exposures and shallow subsurface occurrences of the Intracoastal Formation have been reported in northwestern Florida (Bay, Franklin, Liberty and Wakulla Counties) (Schmidt, 1984). In the subsurface, it occurs to the west across the Apalachicola Embayment (Huddlestun, 1984; Schmidt, 1984).

The Intracoastal Formation is composed of light gray to olive gray, poorly indurated, sandy, clayey, highly fossiliferous limestone (grainstone and packstone). The fossils present include foraminifers, mollusks, barnacles, echinoids and ostracods. Quartz sand varies from very fine to coarse grained (Huddlestun, 1984).

<u>Tci</u> - Citronelle Formation - The Citronelle Formation is widespread in the Gulf Coastal Plain. The type section for the Citronelle Formation, named by Matson (1916), is near Citronelle, Alabama. The Citronelle Formation grades laterally, through a broad facies transition, into the Miccosukee Formation of the eastern Florida panhandle. Coe (1979) investigated the Citronelle Formation in portions of the western Florida panhandle. The Citronelle Formation is a siliciclastic, deltaic deposit that is lithologically similar to, and time equivalent with, the Cypresshead Formation and, at least in part, the Long Key Formation (Cunningham *et al*., 1998) of the peninsula. In the western panhandle, some of the sediments mapped as Citronelle Formation may be reworked Citronelle. The lithologies are the same and there are few fossils present to document a possible younger age.

The Citronelle Formation consists of gray to orange, often mottled, unconsolidated to poorly consolidated, very fine to very coarse, poorly sorted, clean to clayey sands. It contains significant amounts of clay, silt and gravel which may occur as beds and lenses and may vary considerably over short distances. Limonite nodules and limonite-cemented beds are common. Marine fossils are rare but fossil pollen, plant remains and occasional vertebrates are found.

Much of the Citronelle Formation is highly permeable. It forms the Sand and Gravel Aquifer of the surficial aquifer system.

<u>Tmc</u> - Miccosukee Formation - The Miccosukee Formation, named by Hendry and Yon (1967), is a siliciclastic unit with a limited distribution in the eastern panhandle. It occurs in the Tallahassee Hills from central Gadsden County to eastern Madison County, often capping hills. The Miccosukee Formation grades to the west, through a broad facies transition, in central Gadsden County into the Citronelle Formation. The Miccosukee Formation is a prodeltaic deposit.

The Miccosukee Formation is composed of grayish orange to grayish red, mottled, poorly to moderately consolidated, interbedded clay, sand and gravel of varying coarseness and admixtures (Hendry and Yon, 1967). The unit is relatively impermeable but is considered a part of the surficial aquifer system (Southeastern Geological Society, 1986).

<u>Tc</u> - Cypresshead Formation - The Cypresshead Formation named by Huddlestun (1988), is composed of siliciclastics and occurs only in the peninsula and eastern Georgia. It is at or near the surface from northern Nassau County southward to Highlands County forming the peninsular highlands. It appears that the Cypresshead Formation occurs in the subsurface southward from the outcrop region and similar sediments, the Long Key Formation, underlie the Florida Keys. The Cypresshead Formation is a shallow marine, near shore deposit equivalent to the Citronelle Formation deltaic sediments and the Miccosukee Formation prodeltaic sediments.

The Cypresshead Formation consists of reddish brown to reddish orange, unconsolidated to poorly consolidated, fine to very coarse grained, clean to clayey sands. Cross bedded sands are common within the formation. Discoid quartzite pebbles and mica are often present. Clay beds are scattered and not areally extensive. In general, the Cypresshead Formation in exposure occurs above 100 feet (30 meters) above mean sea level (msl).

Original fossil material is not present in the sediments although poorly preserved molds and casts of mollusks and burrow structures are occasionally present. The presence of these fossil "ghosts" and trace fossils documents marine influence on deposition of the Cypresshead sediments.

The permeable sands of the Cypresshead Formation form part of the surficial aquifer system.

TERTIARY-QUATERNARY SYSTEMS

TQu - Undifferentiated Tertiary-Quaternary Sediments - These sediments are siliciclastics that are separated from undifferentiated Quaternary sediments solely on the basis of elevation. Based on the suggestion that the Pleistocene sea levels reached a maximum of approximately 100 feet (30 meters) msl (Colquhoun, 1969), these sediments, which occur above 100 feet (30 meters) msl, are predominantly older than Pleistocene but contain some sediemnts reworked during the Pleistocene. This unit may include fluvial and aeolian deposits. The undifferentiated Tertiary-Quaternary sediments occur in a band extending from the Georgia-Florida state line in Baker and Columbia Counties southward to Alachua County.

These sediments are gray to blue green, unconsolidated to poorly consolidated, fine to coarse grained, clean to clayey, unfossiliferous sands, sandy clays and clays. Organic debris and disseminated organics are present in these sediments.

The undifferentiated Tertiary-Quaternary sediments are part of the surficial aquifer system.

TQd - Tertiary-Quaternary Dunes - The dune sediments are fine to medium quartz sand with varying amounts of disseminated organic matter. The sands form dunes at elevations greater than 100 feet (30 meters) msl.

TQuc - Undifferentiated reworked Cypresshead Formation - This unit is the result of post depositional reworking of the Cypresshead siliciclastics. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix.

Pliocene - Pleistocene Series

TQsu - Tertiary-Quaternary Fossiliferous Sediments of Southern Florida - Mollusk-bearing sediments of southern Florida contain some of the most abundant and diverse fossil faunas in the world. The origin of these accumulations of fossil mollusks is imprecisely known (Allmon, 1992). The shell beds have attracted much attention due to the abundance and preservation of the fossils but the biostratigraphy and lithostratigraphy of the units has not been well defined (Scott, 1992). Scott and Wingard (1995) discussed the problems associated with biostratigraphy and lithostratigraphy of the Plio-Pleistocene in southern Florida. These “formations” are biostratigraphic units.

The “formations” previously recognized within the latest Tertiary-Quaternary section of southern Florida include the latest Pliocene - early Pleistocene Caloosahatchee Formation, the early Pleistocene Bermont formation (informal) and the late Pleistocene Fort Thompson Formation. This section consists of fossiliferous sands and carbonates. The identification of these units is problematic unless the significant molluscan species are recognized. Often exposures are not extensive enough to facilitate the collection of representative faunal samples to properly discern the biostratigraphic identification of the formation. In an attempt to alleviate the inherent problems in the biostratigraphic recognition of lithostratigraphic units, Scott (1992) suggested grouping the latest Pliocene through late Pleistocene Caloosahatchee, Bermont and Fort Thompson Formations in to a single lithostratigraphic entity, the Okeechobee formation (informal). In mapping the shelly sands and carbonates, a generalized grouping as Tertiary-Quaternary shell units (TQsu) was utilized. This is equivalent to the informal Okeechobee formation. The distribution of the Caloosahatchee and Fort Thompson Formation are shown on previous geologic maps by Cooke (1945), Vernon and Puri (1964) and Brooks (1982).

The Nashua Formation occurs within the Pliocene - Pleistocene in northern Florida. However, it crops out or is near the surface is an area too small to be shown on a map of this scale.

Lithologically these sediments are complex, varying from unconsolidated, variably calcareous and fossiliferous quartz sands to well indurated, sandy, fossiliferous limestones (both marine and freshwater). Clayey sands and sandy clays are present. These sediments form part of the surficial aquifer system

Pleistocene Series

Qa - Anastasia Formation - The Atlantic Coastal Ridge is underlain by the Anastasia Formation from St. Johns County southward to Palm Beach County. Excellent exposures occur in Flagler County in Washington Oaks State Park, in Martin County at the House of Refuge on Hutchinson Island and at Blowing Rocks in Palm Beach County. An impressive exposure of Anastasia Formation sediments occurs along Country Club Road in Palm Beach County (Lovejoy, 1992). The Anastasia Formation generally is recognized near the coast but extends inland as much as 20 miles (32 kilometers) in St. Lucie and Martin Counties.

The Anastasia Formation, named by Sellards (1912),is composed of interbedded sands and coquinoid limestones. The most recognized facies of the Anastasia sediments is an orangish brown, unindurated to moderately indurated, coquina of whole and fragmented mollusk shells in a matrix of sand often cemented by sparry calcite. Sands occur as light gray to tan and orangish brown, unconsolidated to moderately indurated, unfossiliferous to very fossiliferous beds. The Anastasia Formation forms part of the surficial aquifer system.

Qk - Key Largo Limestone - The Key Largo Limestone, named by Sanford (1909), is exposed at the surface in the Florida Keys from Soldier Key on the northeast to Newfound Harbor Keys near Big Pine Key on the southwest (Hoffmeister, 1974). This unit is a fossil coral reef much like the present day reefs offshore from the Keys. An exceptional exposure of the Key Largo Limestone occurs in the Windley Key Quarry State Geological Site in the upper Florida Keys. Exposures of the limestone containing large coral heads are in a series of old quarries.

The Key Largo Limestone is a white to light gray, moderately to well indurated, fossiliferous, coralline limestone composed of coral heads encased in a calcarenitic matrix. Little to no siliciclastic sediment is found in these sediments. Fossils present include corals, mollusks and bryozoans. It is highly porous and permeable and is part of the Biscayne Aquifer of the surficial aquifer system

Qm - Miami Limestone - The Miami Limestone (formerly the Miami Oolite), named by Sanford (1909), occurs at or near the surface in southeastern peninsular Florida from Palm Beach

County to Dade and Monroe Counties. It forms the Atlantic Coastal Ridge and extends beneath the Everglades where it is commonly covered by thin organic and freshwater sediments. The Miami Limestone occurs on the mainland and in the southern Florida Keys from Big Pine Key to the Marquesas Keys. From Big Pine Key to the mainland, the Miami Limestone is replaced by the Key Largo Limestone. To the north, in Palm Beach County, the Miami Limestone grades laterally northward into the Anastasia Formation.

The Miami Limestone consists of two facies, an oolitic facies and a bryozoan facies (Hoffmeister *et al*. [1967]). The oolitic facies consists of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone (grainstone) with scattered concentrations of fossils. The bryozoan facies consists of white to orangish gray, poorly to well indurated, sandy, fossiliferous limestone (grainstone and packstone). Beds of quartz sand are also present as unindurated sediments and indurated limey sandstones. Fossils present include mollusks, bryozoans, and corals. Molds and casts of fossils are common. The highly porous and permeable Miami Limestone forms much of the Biscayne Aquifer of the surficical aquifer system.

Qal Qbd Qtr Qu - Undifferentiated Quaternary Sediments - Much of Florida's surface is covered by a varying thickness of undifferentiated sediments consisting of siliciclastics, organics and freshwater carbonates. Where these sediments exceed 20 feet (6.1 meters) thick, they were mapped as discrete units. In an effort to subdivide the undifferentiated sediments, those sediments occurring in flood plains were mapped as alluvial and flood plain deposits (Qal). Sediments showing surficial expression of beach ridges and dunes were mapped separately (Qbd) as were the sediments composing Trail Ridge (Qtr). Terrace sands were not mapped (refer to Healy [1975] for a discussion of the terraces in Florida). The subdivisions of the Undifferentiated Quaternary Sediments (Qu) are not lithostratigraphic units but are utilized in order to facilitate a better understanding of the State's geology.

The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. Gravel is occasionally present in the panhandle. Organics occur as plant debris, roots, disseminated organic matrix and beds of peat. Freshwater carbonates, often referred to as marls in the literature, are scattered over much of the State. In southern Florida, freshwater carbonates are nearly ubiquitous in the Everglades. These sediments are buff colored to tan, unconsolidated to poorly consolidated, fossiliferous carbonate muds. Sand, silt and clay may be present in limited quantities. These carbonates often contain organics. The dominant fossils in the freshwater carbonates are mollusks.

Holocene Series

Qh - Holocene Sediments - The Holocene sediments in Florida occur near the present coastline at elevations generally less than 5 feet (1.5 meters). The sediments include quartz sands, carbonate sands and muds, and organics.

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