U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Preliminary Analysis of Integrated Stratigraphic Data from the South Venice Corehole, Sarasota County, Florida

by

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INTRODUCTION

The South Venice corehole (Florida Geological Survey # W-16814) was drilled in September, 1992, by Florida Geological Survey (FGS), in cooperation with the U.S. Geological Survey (USGS). The corehole is located in Sarasota County, on the southwestern coast of peninsular Florida (N 27°3'52", W 82°25'52"; T. 39 S., R. 19 E., sec. 29) (Figure 1). Drilled as a lithostratigraphic and hydrostratigraphic test boring, the corehole penetrated 701 feet of Paleogene, Neogene, and Quaternary section.

Developing an integrated stratigraphic framework for Florida is critical to understanding the distribution of geologic and hydrologic units within the subsurface of the southern portion of the state. Surficial exposure of units in the southern peninsula is limited primarily to quarrying operations, which usually expose only Pliocene and younger units; many of the type sections of the older geologic units are cores. The water resources of southern Florida are drawn in large part from the subsurface. Within Sarasota County water is primarily drawn from the intermediate aquifer system, which is composed of Neogene Hawthorn Group sediments, and the Floridan aquifer system, which encompasses Paleogene and earliest Neogene carbonate sediments. As water resources come under increasing demand, a thorough understanding of the geologic units through which the water flows is invaluable.

This report compiles the lithostratigraphic analyses of FGS scientists with the biostratigraphic, chronostratigraphic, and diagenetic analyses of USGS scientists as part of an ongoing cooperative study between the two agencies to interpret the age and depositional history of the subsurface units in southern Florida. The initial focus of the study is the Arcadia and Sarasota 1:100,000 map areas. South Venice corehole is one of five cores selected for detailed analysis in order to serve as reference sections; other cores within the study area will be compared to the reference sections.

Regional Stratigraphy and Geologic Setting

The South Venice corehole, located on the southwestern portion of the Florida peninsula, lies near the center of the southern half of the broad Florida platform. The exposed portion of the platform forms the State of Florida and the present day western coast of peninsular Florida, where South Venice is located, approximates the axis of the Florida Platform; the western half of the platform forms the continental shelf. The main structural features that affected Cenozoic deposition in the study area include the Sarasota Arch, South Florida Basin, Ocala Platform, and Okeechobee Basin. The Sarasota Arch and the South Florida Basin influenced deposition during the Paleogene while the Ocala Platform and the Okeechobee Basin affected deposition during the Neogene.

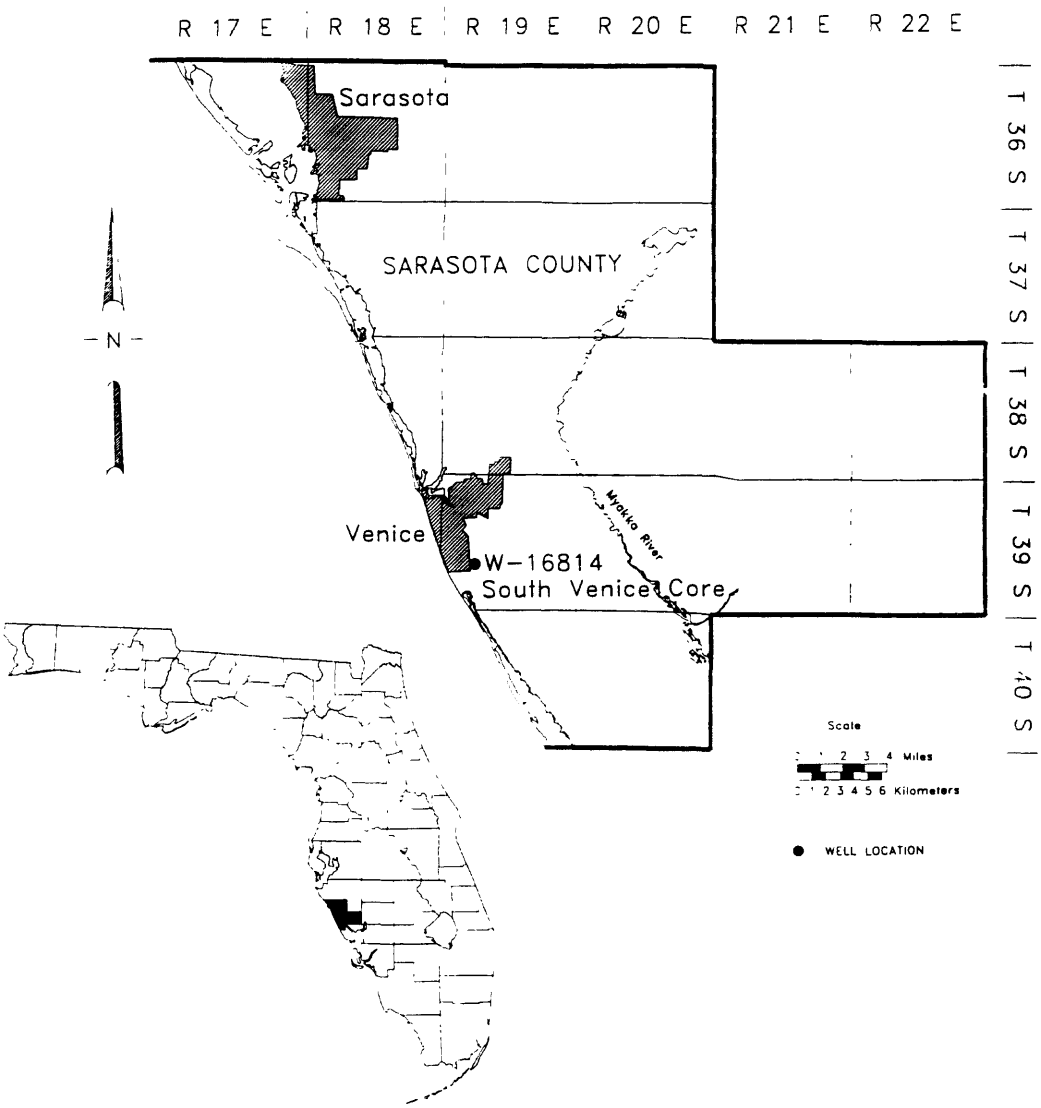

Figure 1: Location map and core location.

The interfingering of lithologic facies from two coastlines and the mixture of siliciclastic and carbonate deposition has made the definition and recognition of well-defined, mappable lithostratigraphic units difficult. Scott (1988) redefined much of the subsurface stratigraphy of southern Florida when he raised the Hawthorn Formation to Group status, and defined the Arcadia and Peace River Formations (Figure 2), thus establishing a lithostratigraphic framework that conformed to the North American Stratigraphic Code. The lack of subsurface biostratigraphic or chronostratigraphic information, however, left many questions about the age and depositional history of the region.

Methods of Investigation

The purpose of this cooperative study is to determine the age and geologic history of southern Florida within the lithostratigraphic framework established by Scott (1988). Samples from the South Venice corehole were collected in July, 1993, by the USGS for paleontologic, isotopic, and petrographic analysis. The summary of the preliminary analyses are presented in Appendix 1 in conjunction with the Florida Geological Survey core log.

Paleontologic samples were selected and processed primarily for mollusks and dinocysts; samples collected for benthic foraminiferal and pollen analysis have not yielded any information to date. Dinoflagellate cysts were processed according to standard palynological techniques. Samples were treated with hydrochloric and hydrofluoric acids, oxidized with nitric acid, separated by floating in heavy liquid ($ZnCl_2$), and stained with Bismark brown. All samples were observed by using light microscope using Nomarski interference contrast. Dinoflagellate cysts identified are listed in Table 1.

The majority of the mollusks present in the South Venice corehole exist as molds and casts in the indurated carbonates. Latex castings were prepared from the most well preserved molds to facilitate comparison to published species. Castings and core pieces were examined under a binocular microscope to observe diagnostic characters. Since the majority of the molds are partial, assumptions were made during the process of identifying species; if several parts within the sample appeared to be from the same species, it was assumed that they were. In some cases this may have lead to erroneous identifications, or several species may have been excluded that were present. Table 2 lists mollusks that could be identified with some level of confidence in the samples studied; it is by no means a complete list of all mollusks present.

$^{87}Sr/^{86}Sr$ analyses on the South Venice core were performed at Rutgers University by Peter J. Sugarman on 2 samples collected prior to 1993, and at USGS labs in Denver on 13 samples collected in July, 1993. Rutgers University cleans, crushes and dissolves the material in a solution of 1.5 N HCl. Ion exchange is used to separate strontium for analysis on the mass spectrometer; the Rutgers instrument has an intrarun precision of ±0.000008 and an interrun variability of 0.000026 to 0.000030. The National Bureau of Standards strontium sample ratio at Rutgers University is 0.710252 (2 σ standard deviation is 0.000026; n=35) normalized to $^{87}Sr/^{86}Sr$ of 0.1194 (Miller, and others 1991). The USGS lab in Denver uses similar procedures, but they report their data using the standard δ notation, and they use a giant clam (*Tridacna*, coded EN-1) for their modern seawater standard. To facilitate comparison of the two data sets, the Rutgers lab ran an analysis on EN-1; their results were 0.000040 higher than the USGS Denver lab. $^{87}Sr/^{86}Sr$ values from the USGS lab were then "corrected" to correspond to Rutgers

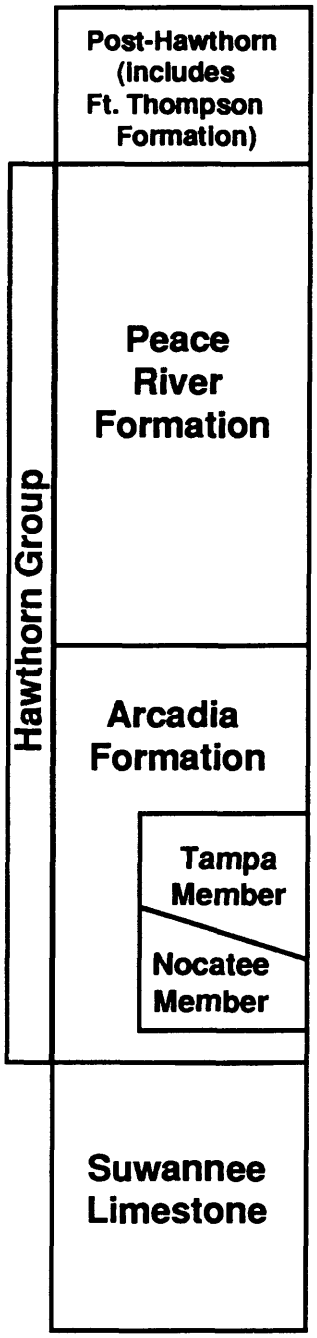

Figure 2. Generalized stratigraphic column

Table 1. Dinocyst occurrences in the South Venice core.

	Arcadia Formation												Peace River Formation					
					Tampa Member													
Taxon R4783 depth (ft)	A 616	AJ 584	AM 501	AN 467	AV 305	AZ 253	BA 240	BD 190	BG 135	B 125	BJ 104	C 82	BM 72	BN 70	BP 64	BQ 54	BS 40	BX 19
Achomosphaera sp.																	X	
Forma D of Wrenn and Kokinos (1986)																X	X	
Barssidinium sp.							?									X		
Achomosphaera andalousiensis															X	X		
Nematosphaeropsis rigida															X		X	
Spiniferites splendidus															?	X		
Selenopemphix brevispinosa s.l.															X	X		
Selenopemphix brevispinosa conspicua														X				
Multispinula sp.													?	?				
Nematosphaeropsis sp.													X			X		
Trinovantedinium? *xylochoporum*													X	X				
Erymnodinium delectabile												?						
Operculodinium spp.												X	X	X		X		
Selenopemphix dionaeacysta												X	X					
Spiniferites mirabilis												X			X	X	X	X
Reticulatasphaera actinocoronata											X			X				
Impagidinium patulum											X							
Labyrinthodinium truncatum											cf	X						
Cerebrocysta n. sp.											X							
Invertocysta lacrymosa											?							
Operculodinium sp. aff. *O. placitum*												X						
Operculodinium cf. *giganteum* of Manum											X				X			
Trinovantedinium harpagonum										cf				X				
Trinovantedinium papulum										X			?	?				
Quadrina? *condita*										cf			cf	X				
Sumatradinium hispidum										X								
Sumatradinium soucouyante										X								
Areoligera sp.										X	X							
Apteodinium tectatum										X								
Systematophora placacantha									X	X								
Hystrichokolpoma spp.									X									
Melitasphaeridium choanophorum									X		X	X						
Batiacasphaera sphaerica							?				X		X	X				
Trinovantedinium capitatum							X											
Trinovantedinium spp.							?					X			X			
Heteraulacacysta spp.							X			X								
Dapsilidinium pseudocolligerum							X						X					
Hystrichosphaeropsis obscura							X		X	X	X	X	X	X	X			
Operculodinium centrocarpum of Wall							X				X					X	X	
Operculodinium israelianum							X				X							
Lingulodinium machaerophorum						X	X		X	X	X	X	X	X	X	X	X	X
Lejeunecysta spp.						X	X		X	X	X		X	X	X	X		
Cordosphaeridium cantharellum/*inodes*						X												
Sumatradinium spp.						?						X				X		
Pentadinium sp. I of Edwards (1990)						X												
Cribroperidinium tenuitabulatum					X	X	X	X	X	X								
Selenopemphix spp.					X				X	X		X	X		X	X		
Multispinula quanta					X				X	X		X	X	X	X	X	X	X
Pentadinium sp. cf. *P.lati. granulatum*					X	X					X							
Tuberculodinium vancampoae					X	X	X		X	X		X	X	X	X	X	X	X
Adnatosphaeridium sp.					X													
Tectatodinium pellitum					X	X	X		X		X	X	X	X			X	
Hystrichokolpoma rigaudiae				X		X	X			X	X	X	X	X	X		X	
Brigantedinium cariacoensis													?		X	?	?	
Brigantedinium simplex				X						?						?		
Spiniferites spp.				X	X	X	X		X	X	X	X	X	X	X	X	X	X
Chiropteridium spp.			X															
Polysphaeridium zoharyi			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Operculodinium centrocarpum		?		?			X		X	X					X	X	X	
Riculacysta perforata	X																	
Polysphaeridium congregatum	X																	

X present
? questionably present
cf specimen present compares with named taxon

Table 2: Molluscan Occurrence.

	Molluscan Species (arranged in order of occurrence)	Suwannee Limestone							Lower Undifferentiated										
		691'3"	690'4"-9"	688'3"-7"	687'7"	684'-685'	683'0"-9"	682'4"-8"	670'7"-9"	660'3"-7.5"	659'0"-3"	658'8"-659'1"	658'2"-4"	649'1"-11"	632'11"-633'6"	630'3"-631'8"	538'0"-3"	537'8"-538'	
Pleistocene and Recent Assemblage	*Turbo*? sp. (operculum)																		
	Glycymeris pectinata Gmelin, 1792																		
	Chione cancellata Linnaeus, 1767																		
	Carditimera floridana Conrad, 1838																		
	Argopecten irradians Lamarck, 1819																		
	Mulinia lateralis Say, 1822																		
	Melanella sp.																		
	Anadara transversa Say, 1822																		
Upper Oligocene and Lower to Middle Miocene Assemblage	*Trachycardium cestum*? Dall, 1900																		
	Glycymeris lamyi? Dall, 1915																		
	Turritella sp. cf. *T. segmenta* Gardner, 1947																		
	Calliostoma sp.																		
	Chione sp.																		
	Scapharca staminata Dall, 1898																		
	Tellina segregata? Dall, 1900																		
	Chlamys marionensis Mansfield, 1937																		
	Chlamys burnetti Tucker, 1934																		
	Dosinia sp.																		
	Turritella sp. cf. *T. tampae* Heilprin, 1887																		
	Semele? sp.																		
	Glycymeris? sp.																		
	Turritella sp. cf. *T tampae pagodaeformis* Heilprin, 1887																		
	Spondylus? sp.																		
	Cardium sp.																		
	Tellina chipolana? Dall, 1900																		
	Transenella sp.																		
	Divarciella sp.																		
	Trigoniocardia sp.																		
	Corbula sarda? Dall, 1898																		
	Lyria sp.																		
	Corbula sp.																		
	Modulus turbinatus (Heilprin, 1887)																		
	Conus sp.																		
	Olivella sp.																		
	Brachidontes grammatus (Dall, 1898)																		
	Chione (Lirophora) ballista? Dall, 1903																		
	Cerithium praecursor Heilprin, 1887																		
	Olivella? sp. cf. *O. lata* Dall, 1890																		
	Diplodonta? sp.																		
	Chamelea rhodia? Dall, 1903																		
	Anadara hypomela Dall, 1898																		
	Fusiturricula condominia silicata Mansfield, 1937																		
	Phacoides ? sp. cf. *P. silicatus* Mansfield, 1937																		
	Glyptoactis serricosta (Heilprin, 1887)																?		
	Turritella sp. cf. *T. tarponensis* Mansfield, 1937																X	X	
	Chione sp. B																X		
	Orthalax? sp. cf. *O. pugnax* Heilprin, 1887															X			
	Anadara tarponensis Mansfield, 1937															X			
Lower Oligocene Assemblage	*Cerithium*? sp.															X			
	Corbula engonata? Conrad, 1848														X				
	Tellina? sp.														X				
	Pitar? sp. cf. *P. megacostata* Dockery, 1982														X	?			
	Turritella caelatura? Conrad, 1848												?	X	?	X			
	Meretrix? sp.											X							
	Chamelea mississippiensis? (Conrad, 1848)									X	X	X		X	X	?			
	Bittium? sp. cf. *B. ottoi* MacNeil, 1984								?		X	X				X			
	Scapharca invidiosa (Casey, 1903)				X	X													
	Pyrazisinus sp.							X											
	Crepidula sp.						X												
	Ampulina? sp. A					X													
	Chione sp. A			X			X												
	Cerithia? sp.			X	X														
	Turritella sp. cf. *T. boycensis* MacNeil, 1984			X															
	Glyptoactis serricosta brooksvillensis? Mansfield, 1937		X																
	Divaricella sp. cf. *D. subrigaultiana* (Meyer, 1886)		X																
	Chione bainbridgensis Dall, 1916		?			X	X	X											
	Trigoniocardia sp.	X																	

Table 2: Molluscan Occurrence.

Arcadia Formation									Tampa Limestone Member							Upper Undifferentiated Arcadia Formation									Fort Thomp.			
537'6"-7"	475'0"-6"	472'5"-9"	407'11"-408'8"	400'4"-401'1"	391'10-395'5"	388'8"-11"	388'6"	385'0"-6"	337.8'	333.2'	332.5'	331'0"-3"	330.5'	329.5'	321'	235'	231'7"	213'10"-214'2"	168.3'-169'	166'7"-9"	165'0"-6"	161'8"-9"	152'2"-4"	148'	140'10"-141'2"	26'10"-27'2"	24'-25'3"*	Molluscan Species (arranged in order of occurrence)	
																										X	Turbo? sp. (operculum)	Pleistocene and Recent Assemblage
																										X	Glycymeris pectinata	
																										X	Chione cancellata	
																										X	Carditimera floridana	
																										X	Argopecten irradians	
																									X		Mulinia lateralis	
																									X		Melanella sp.	
																									X	X	Anadara transversa	
																								X			Trachycardium cestum?	Upper Oligocene and Lower to Middle Miocene Assemblage
																							X				Glycymeris lamyi?	
																						X					*Turritella* sp. cf. *T. segmenta*	
																					X						*Calliostoma* sp.	
																					X			X			*Chione* sp.	
																				X							*Scapharca staminata*	
																			X								*Tellina segregata*?	
																	X								?		*Chlamys marionensis*	
																X		X		X			?				*Chlamys burnetti*	
															X												*Dosinia* sp.	
												X	X	X	?												*Turritella* sp. cf. *T. tampae*	
												X															*Semele*? sp.	
											X			X													*Glycymeris*? sp.	
									X																		*Turritella* sp. cf. *T. tampae pagodaeformis*	
								X																			*Spondylus*? sp.	
							X																				*Cardium* sp.	
							X																				*Tellina chipolana*?	
							X																				*Transenella* sp.	
							?																				*Divarciella* sp.	
							X																				*Trigoniocardia* sp.	
							X																				*Corbula sarda*?	
							?																				*Lyria* sp.	
						X																					*Corbula* sp.	
						X																					*Modulus turbinatus*	
						X																					*Conus* sp.	
						X																					*Olivella* sp.	
						X	?																				*Brachidontes grammatus*	
					X			X				X		X														*Chione (Lirophora) ballista*?	
				X		X	X	X																			*Cerithium praecursor*	
				?																							*Olivella*? sp. cf. *O. lata*	
			?																								*Diplodonta*? sp.	
			X				?																				*Chamelea rhodia*?	
			X											X													*Anadara hypornela*	
			X	X																							*Fusiturricula condominia silicata*	
		X																									*Phacoides* ? sp. cf. *P. silicatus*	
					?					X		X	X	X										?			*Glyptoactis serricosta*	
X	X																										*Turritella* sp. cf. *T. tarponensis*	
																											Chione sp. B	
																											Orthalax? sp. cf. *O. pugnax*	
																											Anadara tarponensis	
																											Cerithium? sp.	Lower Oligocene Assemblage
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																											Turritella caelatura?	
																											Meretrix? sp.	
																											Chamelea mississippiensis?	
																											Bittium? sp. cf. *B. ottoi*	
																											Scapharca invidiosa	
																											Pyrazisinus sp.	
																											Crepidula sp.	
																											Ampulina? sp. A	
																											Chione sp. A	
																											Cerithia? sp.	
																											Turritella sp. cf. *T. boycensis*	
																											Glyptoactis serricosta brooksvillensis?	
																											Divaricella sp. cf. *D. subriaultiana*	
																											Chione bainbridgensis	
																											Trigoniocardia sp.	

results for this preliminary analysis. Numerical ages on all the $^{87}Sr/^{86}Sr$ values were estimated using the regression equations of Miller, and others (1988, 1991), Hodell, and others (1991), and Oslick, and others (1992, 1994); stage boundaries are based on the time scale of Berggren and others (1985).

Samples from 81.5 to 677 feet that contained abundant macrofossils were selected for petrographic analysis; no samples were collected above 81 feet. Fifty one blue epoxy-impregnated thin sections were examined petrographically to identify grains, determine cement compositions, describe textures, and assess the degree of diagenetic alteration.

LITHOSTRATIGRAPHY

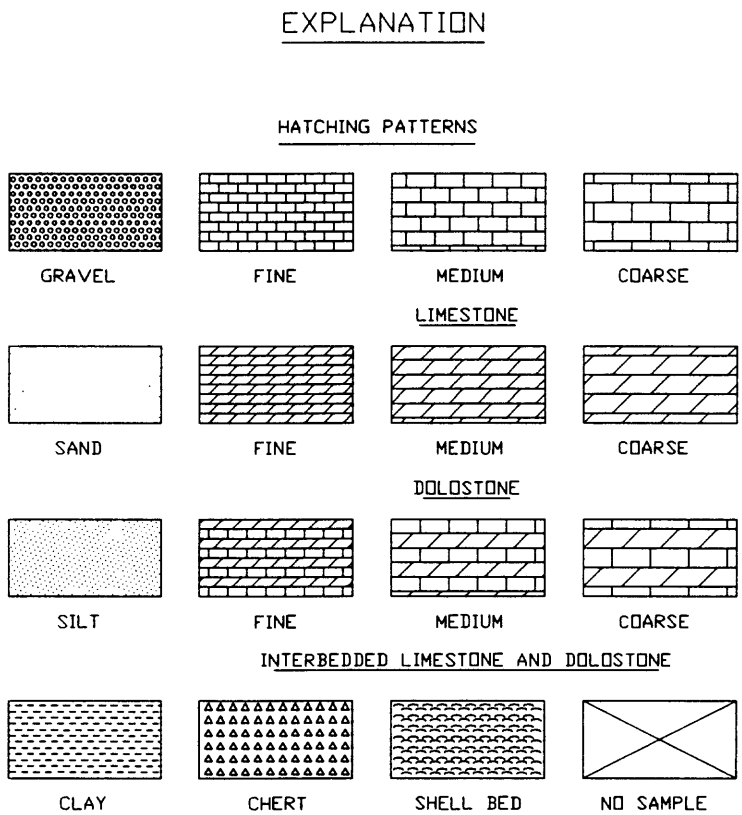
The South Venice core penetrated 701 feet of late Paleogene, Neogene, and Quaternary siliciclastic and carbonate sediments from the Suwannee Limestone, the Arcadia Formation, the Peace River Formation, and the Fort Thompson Formation (Figure 3). The core was completed in the top of the lower Oligocene Suwannee Limestone.

The Suwannee Limestone occurs throughout most of southern Florida, but it is absent in northeastern and east central Florida, presumably due to erosion. It crops out around the northern and southern flank of the Ocala Platform, and thickens to the south into the Okeechobee Basin. In the study area, the Suwannee Limestone is between 300 and 400 feet thick. Approximately 26 feet of the yellowish-gray, moderately- to well-indurated, fossiliferous carbonate packstones and grainstones of the Suwannee were cored at South Venice.

The Hawthorn Group sediments lie suprajacent to the Suwannee Limestone in the study area. Two formations are recognized in the Hawthorn in southern Florida, the Arcadia and Peace River Formations. Two named members are recognized in the Arcadia Formation, the Tampa and Nocatee Members. The South Venice core site is located on the fringe of the area where the Tampa Member has been recognized and outside the area where the Nocatee Member occurs. Within the Arcadia Formation in this area a thin clay unit, the Venice Clay, is recognized; the Venice Clay is present from 120-133 feet in the South Venice core. The South Venice core penetrated nearly 600 feet of the varied lithologies of the Arcadia Formation. Carbonates dominate this part of the section, with siliciclastic beds being less abundant; phosphate is present throughout the undifferentiated Arcadia. The Tampa Member is predominantly a non-phosphatic to slightly phosphatic sandy carbonate.

The Peace River Formation overlies the Arcadia Formation in southern Florida. It is thin to absent in this portion of the peninsula. In the core, the Peace River Formation is less than 60 feet thick. It includes a lower zone that has not been reworked and an upper zone that has been reworked and weathered. A lag deposit occurs at the top of the Peace River Formation where late Pleistocene shell-bearing sediments occur. In the study area, this lag zone may contain phosphate gravel and quartz gravel and cobbles.

Approximately 4 feet of the Fort Thompson Formation overlie the Peace River Formation in the South Venice core. This unit occurs widely in southern Florida, and is recognized primarily by the molluscan fauna it contains. A proposed revision (Scott, 1992) of the Plio-Pleistocene beds of southern Florida would incorporate the Fort Thompson into the Okeechobee formation (not yet formally adopted). The Fort Thompson is overlain by undifferentiated Quaternary sediments in the South Venice core.



COMMENTS

M	MICRITE	T	SILT
S	SAND	C	CLAY
P	PHOSPHATE GRAVEL	Sh	SHELL
p	PHOSPHATE SAND	D	DOLOSTONE
O	ORGANICS	L	LIMESTONE
R	SPAR	H	HEAVY MINERALS
I	IRON STAIN	NO SPL	NO SAMPLE
Q	QUARTZ	G	GYPSUM
A	ANHYDRITE	Py	PYRITE
Ch	CHERT		

Figure 3a. Lithologic symbols used in Fig. 3b.

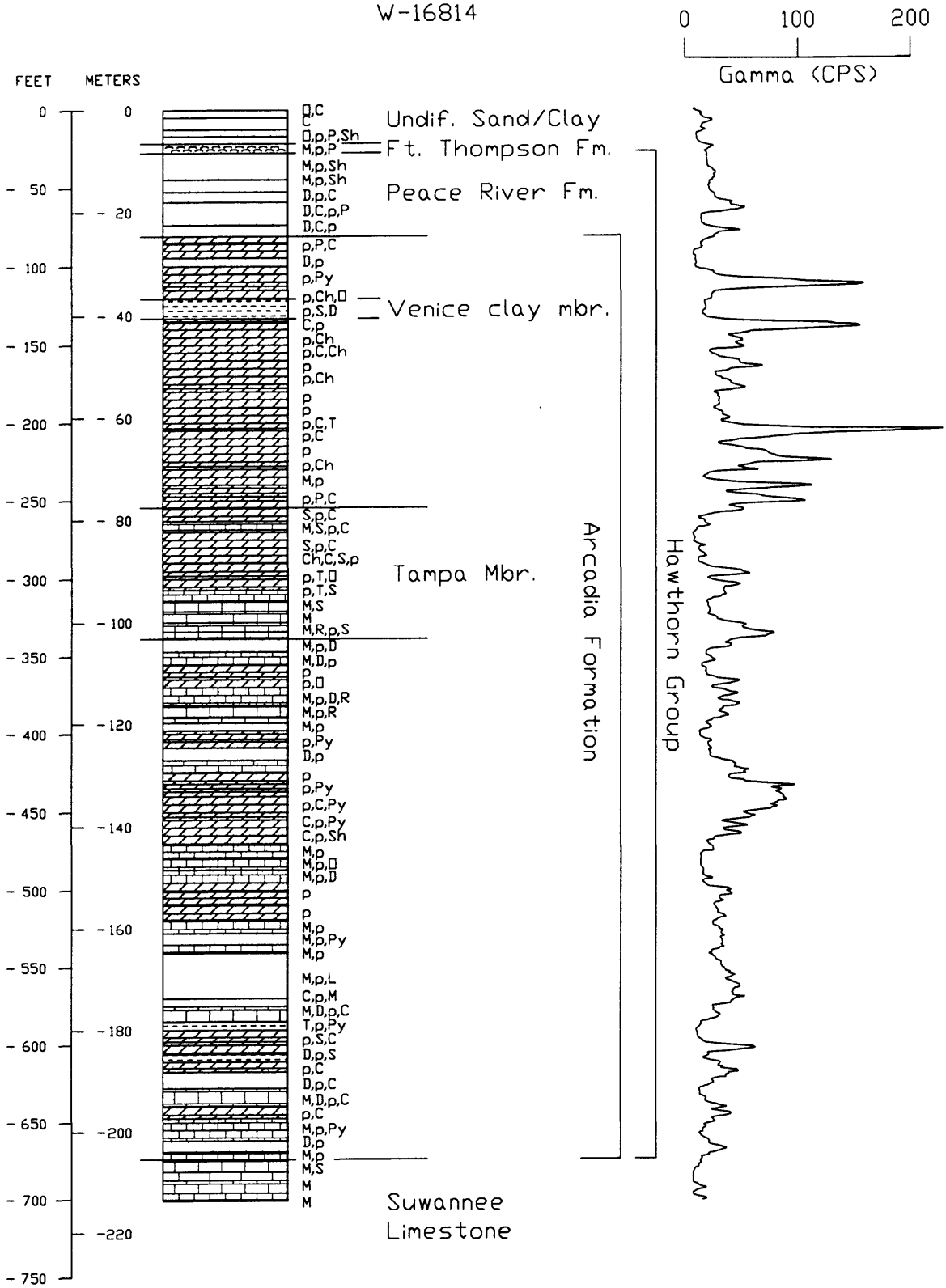
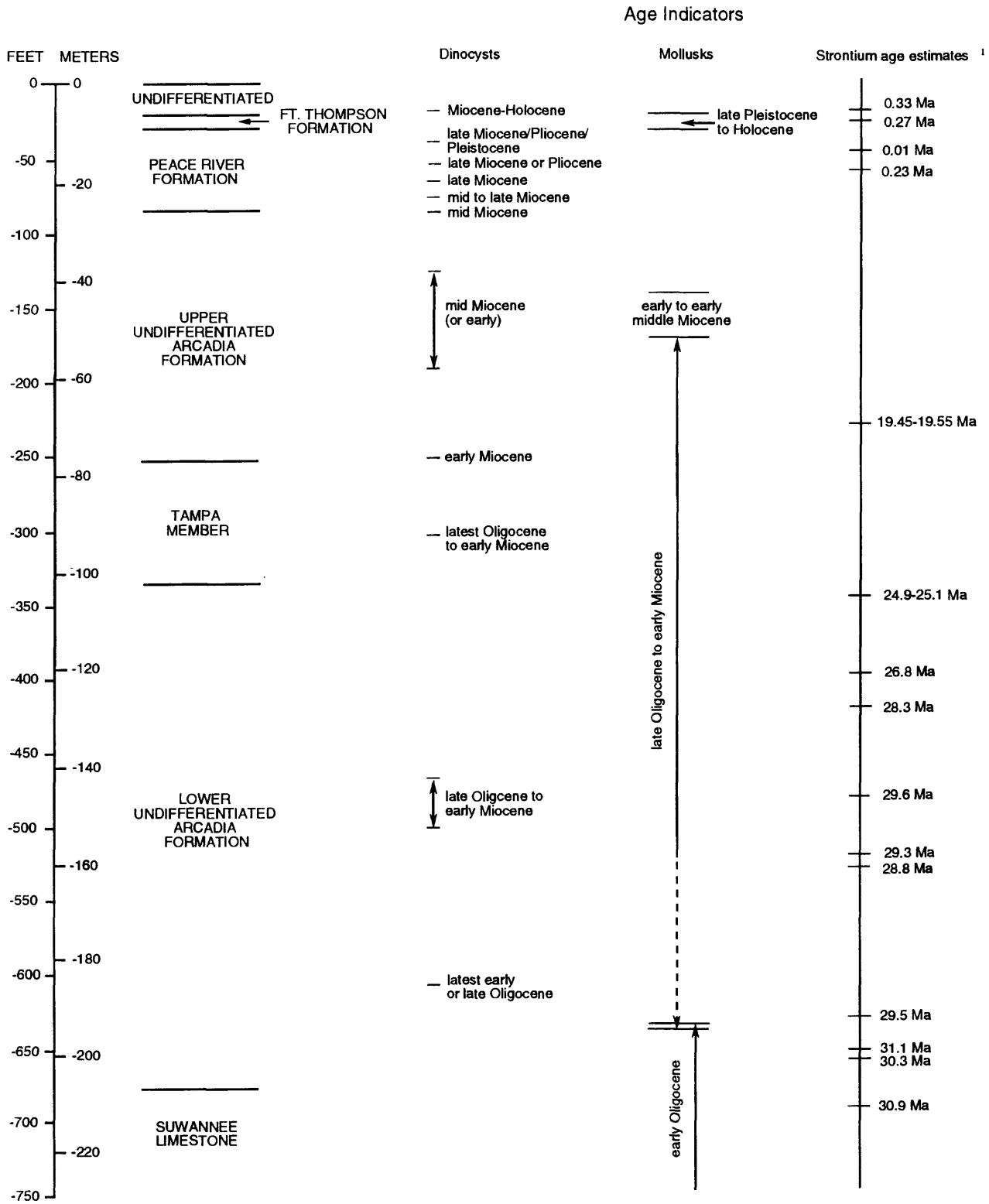


Figure **3b.** Stratigraphic column and gamma-ray log for South Venice Core.



[1] Complete strontium data in Table 3.

Figure 3c. Distribution of faunal and isotopic age indicators.

CHRONOSTRATIGRAPHY AND BIOSTRATIGRAPHY

Three independent methods were used for determining relative and numeric ages in the South Venice core: 1) dinocyst data; 2) molluscan data; 3) $^{87}Sr/^{86}Sr$ values.

Dinocysts:

Complete dinocyst assemblage data are given in Table 1 and Appendix 2. The following is a summary of key findings.

A single sample from the Suwannee was barren of dinocysts. Samples from the undifferentiated lower part of the Arcadia Formation contain very sparse dinocyst assemblages; one suggests an earliest late Oligocene age. Two samples from the Tampa Member of the Arcadia were processed; one was barren and the other yielded a poorly preserved dinocyst assemblage of probably Miocene age.

Seven samples from the upper part of the Arcadia Formation contain generally well preserved, diverse dinocysts assemblages. The dinocysts in the lower samples indicate correlation with the Edisto or Marks Head Formations in South Carolina (lower Miocene). The uppermost sample contains *Labyrinthodinium truncatum*, whose range indicates a middle Miocene age. Cysts of the family Congruentidiaceae are common in many of the upper Arcadia samples and, as their ranges become better established, offer the potential for high-resolution correlation.

Five samples from the Peace River Formation contain generally well preserved, diverse dinocyst assemblages. The two lowest samples are of late Miocene (possibly late middle Miocene) age and contain many cysts of the family Congruentidiaceae. Two higher samples are of late Miocene (to possibly Pliocene) age. The age of the highest Peace River sample is not well constrained by the dinocysts present and could be as young as Pleistocene.

A single sample from the undifferentiated sand and clay at the top of the section contains a sparse, but well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and species of *Spiniferites*. The age could be Miocene to Holocene, but because all the species present are extant, the assemblage is most likely to be above the highest occurrences of Pliocene and Pleistocene species, thus Holocene.

Mollusks:

The majority of the mollusks in the South Venice core are preserved as molds and casts in the indurated carbonate units of the section. The exception is the abundant fauna in the sands of the Fort Thompson Formation at the top of the core. This lack of preservation of original material has caused the molluscan fauna of the subsurface units to be largely overlooked over the years, but many of the molds preserve diagnostic characters, so that valuable biostratigraphic information can be extracted. Mollusks that could be identified to generic level with some degree of confidence for the samples examined are listed in Table 2, and a summary of the most significant data is included in appendix 1.

Chione bainbridgensis Dall, 1916 and *Scapharca invidiosa* (Casey, 1903) are the two molluscan species from the Suwannee Limestone section of the South Venice core that can be positively identified. These species have been reported from the following lower Oligocene units in the Gulf Coastal Plain by Dockery (1982):

Scapharca invidiosa	Red Bluff Formation, Miss.
Chione bainbridgensis	Flint River Formation, Ga.
	Byram Formation, Miss.
	Chickasawhay Limestone, Miss.

Three other species found in the Suwannee Limestone in South Venice are closely related to, or are questionably identified with the following reported lower Oligocene species: *Glyptoactis serricosta brooksvillensis* (Mansfield, 1937), *Turritella boycensis* MacNeil, 1984 and *Divaricella subrigaultiana* (Meyer, 1886).

The molluscan assemblage from 670'9" to 632'11" in the lower undifferentiated Arcadia section of the South Venice core indicates deposition during the lower Oligocene. Although no species can be positively identified due to the incomplete nature of their preservation, three species reported from the lower Oligocene (Dockery, 1982; MacNeil and Dockery, 1984) are questionably identified:

Chamelea mississippiensis (Conrad, 1848)	Byram Formation, Miss.
Turritella caelatura Conrad, 1848	Mint Spring Formation, Miss.
Corbula engonata Conrad, 1848	Red Bluff Formation, Miss.
	Mint Spring Formation, Miss.
	Byram Formation, Miss.

Two other species closely resemble the lower Oligocene species *Bittium ottoi* MacNeil, 1984 and *Pitar megacostata* Dockery, 1982.

The sample analyzed at 630'3" to 631'8" from the lower undifferentiated Arcadia Formation contains a relatively diverse molluscan assemblage that contains some species indicative of lower Oligocene deposition, and some species indicative of upper Oligocene deposition. *Bittium*? sp. cf. *B. ottoi*, *Chamelea mississippiensis*?, *Turritella caelatura?*, and *Pitar*? sp. cf. *P. megacostata*, all possible lower Oligocene indicators are present in the sample. *Anadara tarponensis* Mansfield, 1937, a species reported from the Tampa Limestone, was positively identified in the sample. The Tampa Limestone, originally thought to be exclusively Miocene, has been shown in recent years to be late Oligocene to Miocene (Scott, 1988; Weedman, and others, 1993).

The molluscan species in the samples analyzed from 538'3" down to 104'5" in general indicate deposition during the late Oligocene to middle Miocene; this part of the section covers the upper portion of the lower undifferentiated Arcadia, the Tampa Limestone Member of the Arcadia, and the upper undifferentiated Arcadia. A number of species could be positively identified in this part of the section: *Glyptoactis serricosta* (Heilprin, 1887), *Fusiturricula condominia silicata* Mansfield, 1937, *Anadara hypomela* (Dall, 1898), *Cerithium praecursor* Heilprin, 1887, *Brachidontes grammatus* (Dall, 1898), *Modulus turbinatus* (Heilprin, 1887), and *Chlamys burnetti* Tucker, 1934. All of these species have been reported from the Tampa Limestone (Dall, 1915), so their occurrence in this part of the section does not impart any age information. However, their occurrence does provide supporting evidence for correlation of the subsurface Tampa Limestone in the South Venice core to the type area (Ballast Point, Tampa Bay), and because many of the species characteristic of the Tampa occur in the undifferentiated

portions of the Arcadia this lends biostratigraphic support to the reduction of the Tampa to member status within the Arcadia Formation (Scott, 1988).

Between 169' and 148' in the upper undifferentiated Arcadia Formation several species indicate stronger affinities with reported middle Miocene forms. *Scapharca staminata* Dall, 1898 is reported from the Chipola Formation at Alum Bluff by Gardner (1926). Species with affinities to, or questionably assigned to, *Turritella segmenta* Gardner, 1947 reported from the Shoal River Formation, and *Trachycardium cestum* Dall, 1900 from the Tampa Limestone and Chipola Formation are also present. The occurrence of these three forms indicates a slightly younger assemblage than the underlying fauna with nearly exclusive affinities to the Tampa. The molluscan species present in the samples from 26'10" to 27'2" and from 24' to 25'3" in the Fort Thompson Formation are characteristic Fort Thompson fauna (Portell, Schindler, and Morgan, 1992).

$^{87}Sr/^{86}Sr$ Age Estimates:

The results of the Sr isotopic analyses are shown in Table 3. In general, the data are internally consistent for the South Venice core, within the margin of error for the analyses, so that the age estimates fall within expected stratigraphic order. The only exception are the samples from 39'6" to 39'8" and from 58'-59'; these samples yield age estimates of 10,000 years and 230,000 years. These estimates are out of stratigraphic order with respect to the overlying and underlying samples, and would place Peace River deposits in the Pleistocene, and right at the Holocene-Pleistocene boundary, an age that is inconsistent with all other known data on the Peace River. These anomalous results could be contributed to many factors including the preservational state of the specimens, diagenetic alteration of the specimens, contamination during analysis, or errors in the basic formulae for calculating age estimates for Pliocene to Holocene samples. The latter is the most likely explanation; Sugarman (oral communication, 1994) explains that there is a great deal of work that needs to be done to refine this part of the strontium curve.

The remainder of the age estimates place the upper undifferentiated Arcadia sample in the early Miocene, the lower undifferentiated Arcadia samples from 630'-341' in the upper Oligocene, and the Suwannee Limestone sample in the lower Oligocene. The lower undifferentiated Arcadia samples from 651'-659' are very close to the early-late Oligocene boundary of Berggren (1985) at 30.6 Ma, with one sample falling within the early and one within the late. This early Oligocene age estimate for the lower undifferentiated Arcadia was initially viewed as an anomaly by the authors, because it represented an extension of the Arcadia Formation, but we have obtained additional lower Oligocene indicators as will be discussed in the Summary section below.

These results are viewed as preliminary and subject to revision, because only the data from the Rutgers lab have been examined and interpreted by an isotope stratigrapher. Future analyses will include replicate samples where the material is available. Additionally, we are examining patterns such as the clustering of age estimates from ~420' down to 683' (ages range from a high of 31.1 to a low of 28.3) to determine if these represent the depositional age of the units, or if a diagenetic event in the late Oligocene altered the Sr ratios.

TABLE 3: $^{87}Sr/^{86}Sr$ Data

Depth	Formation	Condition/Nature of material sent	LAB	$^{87}Sr/^{86}Sr$ Ratio	Error	Conversion of USGS data (+0.000040)	Age (EQ# gives reference to equation)	Series Based on Berggren (1985)
20'6"-20'8"	Undifferentiated Sand & Clay	Small slightly worn shell fragments, 1 minute whole Olivella	USGS	0.709119	26	0.709159	0.33^{EQ1}	Pleistocene
26'10"-27'2"	Fort Thompson	1 large well preserved shell fragment	USGS	0.709123	17	0.709163	0.27^{EQ1}	Pleistocene
39'6"-39'8"	Peace River	Small slightly worn shell fragments	USGS	0.709138	14	0.709178	0.01^{EQ1}	Holocene
58'-59'	Peace River	2 large somewhat worn shell fragments	USGS	0.709125	12	0.709165	0.23^{EQ1}	Pleistocene
233'11"-234'1"	Upper unidfferentiated Arcadia	Flakes off single large specimen - still looks aragonitic but very fissile	USGS	0.708504	12	0.708544	19.45^{EQ2} 19.55^{EQ3}	Early Miocene
341'4"-341'8"	Lower unidfferentiated Arcadia	Crumbled chalky material	USGS	0.708181	6	0.708221	24.97^{EQ3} 25.18^{EQ4}	Late Oligocene
388.5'	Lower unidfferentiated Arcadia	Unknown	RUTGERS	0.708166	5		26.8^{EQ4}	Late Oligocene
~420'?	Lower unidfferentiated Arcadia	Fragments from single specimen	USGS	0.708071	21	0.708111	28.34^{EQ4}	Late Oligocene
472'5"-472'9"	Lower unidfferentiated Arcadia	Powdered flecks from Sorites	USGS	0.708025	22	0.708065	29.66^{EQ4}	Late Oligocene
~519'6"?	Lower unidfferentiated Arcadia	Chalky flakes from single ribbed Pelecypod	USGS	0.708036	12	0.708076	29.35^{EQ4}	Late Oligocene
525'6"-525'8"	Lower unidfferentiated Arcadia	Chalky flakes from single ribbed Pelecypod	USGS	0.708055	7	0.708095	28.8^{EQ4}	Late Oligocene
629'8"-630'	Lower unidfferentiated Arcadia	Chalky material - numerous small pelecypods	USGS	0.70803	12	0.70807	29.52^{EQ4}	Late Oligocene
651'2"-651'4"	Lower unidfferentiated Arcadia	Chalky material - numerous small pelecypods	USGS	0.707975	11	0.708015	31.1^{EQ4}	Early Oligocene
659'	Lower unidfferentiated Arcadia	Unknown	RUTGERS	0.708042	5		30.3^{EQ4}	Late Oligocene
683'-683'9"	Suwannee Limestone	Chalky material lining couple of mold cavities	USGS	0.70798	20	0.70802	30.96^{EQ4}	Early Oligocene

EQ1: Hodell, et al., 1991
EQ2: Oslick, et al., 1994
EQ3: Miller, et al., 1991
EQ4: Miller, et al., 1988

OPTICAL PETROGRAPHY

Fifty one blue epoxy-impregnated thin sections of samples from this core were examined petrographically to identify grains, determine cement compositions, describe textures, and assess the degree of diagenetic alteration. Emphasis has been given to the diagenetic processes related to subaerial exposure and dolomitization. The units sampled include the Arcadia Formation (and its Tampa Member) and the uppermost Suwannee Formation. Distinctive features seen in thin section are included in the summary comments beside the graphic log, and more lengthy descriptions are given in the appendix.

Samples range from mudstones to packstones in textural composition; no true grainstones were observed. A few samples, however, resemble grainstones but appear to be well-washed packstones, with micrite adhering to skeletal and quartz grains. Quartz, feldspar, and phosphate silt and sand are common constituents of the limestones and dolostones of the Arcadia Formation, but are rare in the Suwannee Formation. Most skeletal grains in the carbonates of both formations have been micritized to some degree, probably very soon after deposition. Intergranular calcite and dolomite cement are rare and occur in very small quantities, generally as a layer one crystal thick. Syntaxial calcite overgrowth cement is commonly observed on echinoid fragments. Primary skeletal voids (such as foraminiferal chambers) as well as leached skeletal voids (intragranular pores) commonly are lined with small calcite or dolomite crystals that increase in size toward the center of the pore. Dolomitization of limestones in the Arcadia Formation, is quite common at this site and may be somewhat anomalous in central Florida at this time interval. The replacement of a previous calcite matrix by sparry dolomite can give the appearance of pore-filling dolomite.

All samples have experienced dissolution of skeletal fragments derived from aragonitic mollusks (gastropods and some pelecypods) indicating that subaerial exposure or contact with corrosive meteoric waters has been a common repeated occurrence in the history of these rocks. The presence of aragonite-grain porosity suggests that mineralogical stabilization (i.e., the conversion of aragonite to calcite with shell structure preservation) did not occur before exposure to corrosive meteoric water. All extremely leached samples are dolomitized as well, but some dolomitized samples have well preserved calcareous skeletal grains such as echinoid and bryozoan fragments, suggesting that dolomitization occurs in the micrite matrix first, and in skeletal grains second. Samples were examined in which coralline algae and echinoid fragments were dolomitized along with the matrix, but bryozoans, foraminifera, and oysters remain calcite, indicating that high-Mg skeletal grains are dolomitized before low-Mg grains.

Aragonitic mollusks are observed to be the first to dissolve, followed by foraminifera, bryozoans, ostracodes, oysters, echinoids, and red (coralline) algae. Skeletal grain dissolution is recognized in thin section by the occurrence of blue epoxy, with which the samples have been vacuum impregnated, within the shell or within the fossil mold. Table 4 shows the degree of leaching of each sample by indicating the fossil groups in which leaching has occurred.

Zones of intense leaching alternate with zones of minor leaching, suggesting a periodicity of exposure to corrosive meteoric water. Intense leaching is indicated by the dissolution of originally calcitic shells, such as those secreted by echinoids, bryozoans, pectens, oysters, and coralline algae. Minor leaching is indicated by dissolution of originally aragonitic shells of gastropods and other pelecypods, whose morphologies are characteristically well-preserved in an

Table 4. Dissolution of Skeletal Grains

Depth (ft)	Unit	Lithology	Aragonitic Moll.	Forams	Bryozoans	Ostracodes	Oysters	Echinoids	Red Algae
81.5	ARCADIA	dolostone	.....	.....	.....				.....
94.5	ARCADIA	dolostone	.....	.....				.....	
113.5	ARCADIA	dolostone	.....	.....				.....	
154.5	ARCADIA	dolostone	.....					.....	
155.5	ARCADIA	dolostone	.....						
175.5	ARCADIA	dolostone		.....				.....	.....
186.5	ARCADIA	dolostone		.....	.....			.....	.....
200	ARCADIA	dolostone	.....	.....	.....			.....	.....
210	ARCADIA	dolostone	.....	.....	.....			.....	.....
220.5	ARCADIA	dolostone	.....		.....			.....	
228	ARCADIA	dolostone	.....	.....	.....			.....	.....
234	ARCADIA	dolostone		.....	XXXXXXXXXX		XXXXXXXX	XXXXXXXXX	
234.5	ARCADIA	dolostone	.....	.....	.....		XXXXXXXX	XXXXXXXXX	XXXXXXXX
240	ARCADIA	dolostone						.....	
243	ARCADIA	dolostone	.....	.....				.....	XXXXXXXX
269	TAMPA	dolostone		.....	.....			.....	
271.7	TAMPA	dolostone						XXXXXXXXX	XXXXXXXX
285.2	TAMPA	dolostone		.....	.....			.....	
310	TAMPA	limestone		.....		.....			
321	TAMPA	limestone	.....	.....	XXXXXXXXX	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	
334	ARCADIA	limestone	.....	.....	XXXXXXXXX	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	XXXXXXXX
347.5	ARCADIA	limestone		XXXXXXXX	XXXXXXXXX		XXXXXXXX	XXXXXXXXX	
354	ARCADIA	limestone	.....	.....	XXXXXXXXX	XXXXXXXXX		XXXXXXXXX	XXXXXXXX
358.2	ARCADIA	dolostone							
370.1	ARCADIA	limestone		.....		XXXXXXXXX	XXXXXXXXXXXXXXXX		
391	ARCADIA	dolo/lime.	.....	.....	.....	XXXXXXXXX	XXXXXXXXXXXXXXXX		XXXXXXXX
402	ARCADIA	dolostone	.....	.....	.....	.....		XXXXXXXXX	
424.5	ARCADIA	dolostone	.....				.....		
432	ARCADIA	dolostone	.....						
448.3	ARCADIA	dolostone		.....		.....			
480	ARCADIA	dolostone	.....	.....		XXXXXXXXX	XXXXXXXXX	XXXXXXXXX	
482.5	ARCADIA	dolostone		.....				XXXXXXXXX	
490.7	ARCADIA	dolostone	.....	XXXXXXXX		XXXXXXXXX		XXXXXXXXX	XXXXXXXX
497.6	ARCADIA	dolostone	.....	.....		.....		.....	
500	ARCADIA	dolostone		.....				XXXXXXXXX	
515.7	ARCADIA	dolostone		.....					
569	ARCADIA	dolostone							
597.6	ARCADIA	dolostone	.....			.....			
612.1	ARCADIA	dolostone							
633	ARCADIA	limestone	.....	.....	.....	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	
635	ARCADIA	limestone	.....		XXXXXXXXX	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	
650	ARCADIA	limestone	.....	.....	XXXXXXXXX	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	
662.8	ARCADIA	dolostone	.....	.....	.....	XXXXXXXXX		XXXXXXXXX	
666.3	ARCADIA	dolostone							
669	ARCADIA	dolostone							
673	SUWANNEE	limestone	.....	.....		XXXXXXXXX		XXXXXXXXX	
677	SUWANNEE	limestone	.....	.....	XXXXXXXXX	XXXXXXXXX	XXXXXXXX	XXXXXXXXX	
696	SUWANNEE	limestone	.....	.....		XXXXXXXXX		XXXXXXXXX	

..... DISSOLVED
XXXXXXX PRESENT

early-cemented calcareous or dolomitized matrix. Several factors are responsible for the rate of skeletal dissolution such as original shell composition and composition, pore water volume and composition, and time; intensity of leaching is not necessarily a proxy for duration of exposure to meteoric water. Echinoids and coralline algae, originally formed of high-Mg calcite, are commonly either dolomitized or converted to a stable low-Mg calcite and, are very well preserved relative to other skeletal grains.

In addition to leaching, numerous samples show evidence of subaerial exposure and/or supratidal deposition such as desiccation and circum-granular cracks, pedogenic structures and textures, mottling, root voids, concretions, evaporite mineral (gypsum or anhydrite) ghosts, and algal mat laminae (supratidal). These features are helpful in defining tops of depositional units. Silicification, phosphoratization (hardgrounds), and rip-up clasts are associated with some of these subaerial exposure surfaces.

Within the Arcadia Formation, dolomite rhombohedra typically have leached centers, and in some cases leached zones, the intensity of which appears to decrease downward from depths of 81.5 feet to about 285 feet, where nearly all rhombs observed are unleached. One isolated sample with a small quantity of leached dolomite does occur at 432 feet, in a void filling dolomite cement. No dolomite was observed in the upper ~30 feet of the Suwannee Formation, though soil-like textures are observed at ~ 673' depth, suggesting a period of subaerial exposure occurred before deposition of the Arcadia Formation.

Timing of dolomitization remains a problem and will be addressed in the next phase of our project. Dolomite appears to replace calcareous matrix before skeletal grains, then high-Mg calcite skeletal grains (mimically, i.e., retaining internal structures), then low-Mg calcite skeletal grains non-mimically, by simply engulfing them with dolomite rhombs. In general, dolomite appears to be very resistant to dissolution. Samples that have been extensively leached contain leached dolomite rhombs, fragments of dolomitized coralline algae and echinoids, faint ghosts of foraminifera and bryozoans, and quartz and phosphatic sand grains, and are found in the upper Arcadia Formation, of approximately middle Miocene age.

SUMMARY

Mollusks and Sr data in the South Venice core strongly suggest that the Suwannee Limestone is early Oligocene. There has been some doubt whether the Suwannee in the subsurface of southern Florida correlates with the lower Oligocene type Suwannee to the north (see discussion in Scott, 1988, p. 58), but our preliminary data suggest that it does.

A lower Oligocene molluscan assemblage, and an early Oligocene Sr age estimate indicate that the lowermost undifferentiated Arcadia (from the contact with the Suwannee up to 632' in the core) is early Oligocene. This represents an extension of the lower age limit for the Arcadia Formation.

A molluscan assemblage at 630'-631'8" indicates a mixture of early and late Oligocene forms and a dinocyst assemblage at 616' is middle or late Oligocene. The Sr age estimates from 683' to 472' are all clustered near the early Oligocene-late Oligocene boundary at 30.6 Ma (based on Berggren, and others, 1985). These three independent age indicators demonstrate that this part

of the lower undifferentiated Arcadia Formation probably straddles the boundary between early and late Oligocene. The overlap in molluscan assemblages in a single sample implies a gradual transition occurred.

Mollusks and dinocysts indicate that the upper portion of the lower undifferentiated Arcadia is late Oligocene to early Miocene. Many of the mollusks present in this part of the core are characteristic of the Tampa Limestone as originally described from the type area and provide further support to the inclusion of the Tampa Member in the Arcadia Formation. The Sr age estimates all indicate a late Oligocene age for the upper portion of the lower undifferentiated Arcadia.

The molluscan assemblage in the Tampa Member of the Arcadia Formation is characteristic of the Tampa as described from surficial exposures; this does not impart any age information about the core, but does indicate that the surficial Tampa correlates to the subsurface. The dinocysts in the Tampa Member are poorly preserved but are early Miocene or possibly latest Oligocene. No Sr age estimates were obtained from the Tampa.

The upper undifferentiated Arcadia, just above the contact with the Tampa Member is early Miocene on the basis of the dinocyst assemblage present, and a Sr age estimate of early Miocene was recorded at 233'. The molluscan assemblage of the lower portion of the upper undifferentiated Arcadia is upper Oligocene to lower Miocene.

The dinocyst assemblages from 190' up to 125' in the upper portion of the upper undifferentiated Arcadia are middle Miocene or possibly early Miocene. The sample at 125' is within the Venice clay and places that informal unit well within the Arcadia Formation (see Campbell, and others, 1993, for a discussion of the significance of the Venice clay). The dinocyst assemblage at 103' is probably middle Miocene and at 81', just below the boundary with the Peace River, the assemblage is middle Miocene. The molluscan assemblage from 169'-148' has some affinities to late early or middle Miocene fauna from the Florida panhandle. These data suggest the upper undifferentiated Arcadia is probably early Miocene, and the uppermost portion may be earliest middle Miocene.

Dinocysts are abundant and well preserved in the Peace River Formation, and the assemblages range from middle to late Miocene in the lower part of the unit to late Miocene, or Pliocene, or Pleistocene in the uppermost reworked portion of the Peace River. No identifiable mollusk fragments were recovered from the Peace River. The Sr age estimates here appear to be anomalous.

This report is a preliminary compilation of data on the South Venice core, which demonstrates the necessity for integrating lithologic, biostratigraphic, chronostratigraphic, and petrologic data. Without the combination of the three independent age indicators, we would not have been able to refine the age of these lithologic units. The dinocysts are absent or sparse in the lower portion of the core, but the molluscan data and Sr data have refined that part of the section. In contrast, the mollusks are completely absent from the Peace River, but the dinocysts are abundant and well-preserved. The next phase of this project will examine the timing of dolomitization and diagenetic alteration of the units within this core, and determine to what extent those events have altered the original Sr signature of the sediments. Other reference cores will be examined in a similar way to determine if the extensive Oligocene deposition demonstrated in this core was a regional event, or a local anomaly.

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APPENDIX 1

ANNOTATED CORE LOG

Left hand side of page contains summary comments and age information. Right hand side of page is the Florida Geological Survey lithologic core log for South Venice core, W-16814.

Comments	Age indicators
0 - 8 Loose unconsolidated sediments and soils; no obvious beds or structures.	

LITHOLOGIC WELL LOG PRINTOUT SOURCE - FGS

WELL NUMBER: W-16814 COUNTY - SARASOTA
TOTAL DEPTH: 00701 FT. LOCATION: T.39S R.19E S.29 AA
701 SAMPLES FROM 0 TO 701 FT. LAT = 27D 03M 52S
LON = 82D 25M 52S
COMPLETION DATE: 09/04/92 ELEVATION: 13 FT
OTHER TYPES OF LOGS AVAILABLE - GAMMA

OWNER/DRILLER:OWNER: SARASOTA COUNTY. DRILLER: F.G.S.

WORKED BY:RICHARD GREEN 10/92. SAMPLE QUALITY GOOD
SOUTH VENICE CORE.

NOTE: IN THE DOLOMITE ALTERATION CODES, THE PERCENTAGE OF ALTERATION
REFERS TO TEXTURAL ALTERATION, NOT TO CHEMICAL ALTERATION.

FORMATION PICKS BY T. SCOTT, K. CAMPBELL, AND R. GREEN 12/92.
20-21.5' IS REWORKED FORT THOMPSON FORMATION.
27.5-52.4' IS REWORKED PEACE RIVER FM. (CLEANER,PHOSPHATIC
QUARTZ SANDS).
120-133' IS VENICE CLAY.

0. -	21.5	090UDSC	UNDIFFERENTIATED SAND AND CLAY
21.5 -	27.5	112FTMP	FT. THOMPSON FM.
27.5 -	81.0	122PCRV	PEACE RIVER FM.
81.0 -	674.2	122ARCA	ARCADIA FM.
254.5 -	338.5	122TAMP	TAMPA MEMBER OF ARCADIA FM.
27.5 -	674.2	122HTRN	HAWTHORN GROUP
674.5 -	TD	123SWNN	SUWANNEE LIMESTONE

0 - 1 SAND; DARK YELLOWISH BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CLAY-01%, PYRITE-01%
PLANT REMAINS-15%, SHELL-01%
FOSSILS: FOSSIL FRAGMENTS
SOIL ZONE. TRACE OF PHOSPHATE AND SHELL FRAGMENTS MOLLUSKS
AND BARNACLES -WEATHERED.

1 - 2 SAND; MODERATE DARK GRAY TO BLACK
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): ORGANIC MATRIX
ACCESSORY MINERALS: ORGANICS-05%, CLAY-01%
PLANT REMAINS-02%
PIECES OF WOOD MATERIAL PRESENT.

	Comments	Age indicators
0 - 8	Loose unconsolidated sediments and soils; no obvious beds or structures. (Cont.)	

2 - 3.5 SAND; LIGHT GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-02%, PLANT REMAINS-02%
OTHER FEATURES: FROSTED
BECOMES MORE FROSTED AND ORGANICS DECREASE WITH DEPTH.
PLANT REMAINS ARE PIECES OF WOOD.

3.5- 4.5 SAND; BLACK TO DARK BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): ORGANIC MATRIX
ACCESSORY MINERALS: ORGANICS-15%, CLAY-01%
ORGANIC RICH AT TOP. GRADES INTO BROWN SAND AT 4.2'. WOOD FRAGMENTS PRESENT.

4.5- 5 SAND; MODERATE GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): ORGANIC MATRIX
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: ORGANICS-05%, CLAY-01%
PLANT REMAINS-02%
MOTTLED WITH ORGANICS. SOME ROOTLETS AND WOOD FRAGMENTS.

5 - 7 SAND; MODERATE BROWN TO GRAYISH BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CLAY-01%

7 - 11 SAND; GRAYISH BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
WELL SORTED.

11 - 12.5 AS ABOVE
BEGIN TO PICK UP 2-5% OF COARSE-VERY COARSE, WELL ROUNDED QUARTZ GRAINS SCATTERED THROUGHOUT INTERVAL. OTHERWISE, AS ABOVE.

	Comments	Age indicators
12.5	Shallowest in-place phosphate grains.	
19	Contains a sparse, but well preserved dinocysts assemblage dominated by *Polysphaeridium zoharyi* and species of *Spiniferites*.	19 Dinocyst assemblage indicates that age based on occurrences alone, the age could be Miocene to Holocene. Because all the species present are extant, the assemblage is most likely to be younger than the highest occurrences of Pliocene and Pleistocene species, and thus Holocene in age.
20	Shallowest occurrence of abundant in-place shell material.	20.5-20.6 Strontium ratio indicates: 0.74 Ma (BIG).

12.5- 14.9 SAND; GRAYISH BROWN TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY COARSE TO FINE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%
POORLY SORTED. PHOSPHATE IS TAN-BLACK.

14.9- 15 SAND; GRAYISH BROWN TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: VERY COARSE; RANGE: MEDIUM TO VERY COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%
GRANULE LAG OF PHOSPHATE AND WELL ROUNDED QUARTZ. PHOSPHATE IS BLACK-TAN-WHITE.

15 - 17 SAND; VERY LIGHT ORANGE TO GRAYISH BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-01%

17 - 18 SAND; DARK BROWN TO DARK YELLOWISH BROWN
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: COARSE; RANGE: VERY COARSE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-10%, PHOSPHATIC SAND-10%
PHOSPHATIC GRAVEL-02%
POORLY SORTED. PHOSPHATE IS BLACK TO BROWN.

18 - 21.5 SAND; GRAYISH BROWN TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%
PHOSPHATIC GRAVEL-01%, ORGANICS-01%
MINOR GRANULE-VERY COARSE QUARTZ SAND AND PHOSPHATE
COARSER FROM 20-20.5'. MINOR SHELL FRAGMENTS NEAR BASE.

	Comments	Age indicators
FT. THOMPSON FORMATION		
21.5	Erosional surface. Top of the Ft. Thompson Formation. Shell hash; abundant mollusks.	
24-25.2		Molluscan assemblage consists of typical Fort Thompson species.
25.3-27.5	Reworked Peace River Formation asigned to Ft. Thompson Formation.	
PEACE RIVER FORMATION		
26.1-27.2		Strontium ratio indicates: 0.65 Ma (BIG). Molluscan assemblage consists of typical Fort Thompson species.
27.5	Contact between the Ft. Thompson Formation, which includes some reworked Peace River Formation, above and the Peace River Formation below.	
30 - 42.5	Phosphate grains fine upwards in grain size; no obvious sedimentary structures, bedding, or macro-fossils.	

21.5- 25.3 SHELL BED; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-40%, PHOSPHATIC SAND-05%
PHOSPHATIC GRAVEL-01%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BRYOZOA
PLACES ARE A VERY SHELLY QUARTZ SAND--INTERVAL WAS PROBABLY
MOSTLY LIKE THIS WITH SAND WASHING OUT DURING DRILLING.
SHELLS ARE MOSTLY WEATHERED AND BROKEN. BECOMES FINER
GRAINED, MORE CALCILUTITIC NEAR BASE AND GRADES INTO UNIT
BELOW.

25.3- 27.5 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-05%
SHELL-02%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS
MINOR PHOSPHATE GRANULES AND SHELL ACCUMULATIONS 27-27.1'.
BURROWS AROUND 26'.

27.5- 28 NO SAMPLES
DRILLER SAYS CLAY.

28 - 30 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-05%
SHELL-02%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS
SPLIT SPOON SAMPLE. DRILLER SAYS SAND.

30 - 37 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
MEDIUM SPHERICITY; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-08%
SHELL-01%
PHOSPHATE AND CALCILUTITE VARIABLE 2-10%.

	Comments	Age indicators
30 - 42.5	Phosphate grains fine upwards in grain size; no obvious sedimentary structures, bedding, or macro-fossils. (cont.)	
39.5- 39.7	Contains a well preserved dinocyst assemblage dominated by species of *Spiniferites*.	39.5- 39.6 Strontium ratio indicates: 0.33 Ma (BIG). 39.5- 39.7 Dinocyst assemblage indicates a late Miocene, Pliocene, or Pleistocene age above the highest occurrences of late Miocene species. The highest occurrence of *H. rigaudiae* is within the Pleistocene according to Williams and others (1993).
48.5	Coarse-grained, very poorly sorted; 8 mm clasts; bone fragments.	
52.2	Contact between reworked Peace River Formation above and un-reworked Peace River Formation below.	

37 - 38 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-08%
SHELL-01%
SPLIT SPOON SAMPLE.

38 - 42.5 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-08%
SHELL-01%

42.5- 44.5 AS ABOVE

44.5- 46.5 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%, PHOSPHATIC SAND-08%
SHELL-01%
SPLIT SPOON SAMPLE.

46.5- 52.4 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CALCILUTITE-08%, PHOSPHATIC SAND-10%
SLIGHT INCREASE IN GRAIN SIZE. PHOSPHATE IS COARSER AND
BROWN-BLACK. MINOR CLAY BLEBS NEAR BASE OF UNIT. ALSO
BECOMES DOLOMITIC NEAR BASE.

52.4- 52.7 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
10-50% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
CLAY-01%
MARLY ZONE. SAND VARIABLE TO 25%. INCREASES WITH DEPTH.

	Comments		Age indicators
54.3-54.5	Contains a well preserved dinocyst assemblage in which no particular species was dominant.	54.3-54.5	Dinocyst assemblages indicate late Miocene or Pliocene age, more likely to be Pliocene because it is above the highest occurrences of late Miocene species.
58-59		58-59	Strontium ratio indicates: 0.61 ma (BIG).
61-62	Thin clay seams broken by desiccation cracks.		
64.3-64.5	Contains a dinocyst assemblage in which no particular species was dominant. Preservation is fair.	64.3-64.5	Dinocyst assemblage indicates late Miocene age based on the overlap of the ranges of *A. andalousiensis* and *H. obscura* (most authors show the range top of *H. obscura* at the top of the Miocene; however, Williams and others (1993) extend it into the Pliocene).
65	Very poorly sorted; ranges from silt to very coarse sand.		
~68	Reworked hardground surface; phosphate pebbles and calcitic clayey chunks.		

52.7- 57 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, DOLOMITE-08%
CLAY-01%
DOLOMITIC MATRIX VARIABLE 2-10%. UP TO 2 MM PHOSPHATE GRAINS PEPPERED THROUGHOUT. QUARTZ GRAINS ARE LESS THAN OR EQUAL TO 1 MM.

57 - 59 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, DOLOMITE-08%
CLAY-01%
SPLIT SPOON SAMPLE.

59 - 62 SAND; LIGHT OLIVE GRAY TO OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%, PHOSPHATIC SAND-05%
OTHER FEATURES: DOLOMITIC
THIN CLAY BEDS PRESENT. VARIABLE PHOSPHATE AND CLAY.

62 - 64 NO SAMPLES
DRILLER SAYS SANDY CLAY--WASHED AWAY.

64 - 68.5 SAND; LIGHT OLIVE GRAY TO OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%, PHOSPHATIC SAND-05%
PHOSPHATIC GRAVEL-01%
OTHER FEATURES: DOLOMITIC
PHOSPHATE GRAVEL AND QUARTZ PEBBLES SCATTERED THROUGHOUT INTERVAL. ALSO CALCITIC CHUNKS- EITHER CONCRETIONS OR WORN SHELL MATERIAL.

	Comments	Age indicators
69-72	Mottled, but no obvious burrowing; mixture of sand, silt, and clay.	
70-70.2	Contains a moderately well preserved dinocyst assemblage dominated by cysts of the family Congruentidiaceae.	Dinocyst assemblage indicates middle or late Miocene age, most likely late Miocene, because this is above the highest occurrence of *Labyrinthodinium truncatum*.
72-72.2	Contains a well preserved dinocyst assemblage dominated by species of *Spiniferites*. Cysts of the family Congruentidiaceae are common.	Dinocysts assemblage indicates middle or late Miocene age, most likely late Miocene, because this is above the highest occurrence of *Labyrinthodinium truncatum*.

68.5- 69 SAND; LIGHT OLIVE GRAY TO OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: INTERBEDDED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-25%, CLAY-25%
PHOSPHATIC SAND-10%, PHOSPHATIC GRAVEL-02%
COMPLEX MIX OF DOLOSTONE, CLAY AND SAND. DOLOMITE INCREASES WITH DEPTH.

69 - 69.8 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY, INTERGRANULAR
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: INTERBEDDED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-10%, PHOSPHATIC SAND-05%
QUARTZ SAND-25%

69.8- 74 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, DOLOMITE CEMENT
ACCESSORY MINERALS: DOLOMITE-08%, CLAY-08%
PHOSPHATIC SAND-05%
VARIABLE CLAY AND DOLOMITE. MINOR CLAY BEDS NEAR BASE.

74 - 76 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, DOLOMITE CEMENT
ACCESSORY MINERALS: DOLOMITE-08%, CLAY-08%
PHOSPHATIC SAND-05%
SPLIT SPOON SAMPLE.

76 - 80.5 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: DOLOMITE-08%, PHOSPHATIC SAND-05%

	Comments	Age indicators
	ARCADIA FORMATION	
81	Contact of the Peace River Formation above and the Arcadia Formation below.	
81.5	Thin section: Dolomite rhombs are multi-zoned and leached. Three generations of dolomite: dark brown, leached rhombs replace mollusks; lighter brown, less-leached rhombs form matrix; clear, unleached rhombs on void surfaces.	
81.8	Contains a sparse, but moderately well preserved dinocyst assemblage dominated by species of *Spiniferites* and *Hystrichokolpoma rigaudiae*.	81.8 Dinocyst assemblage indicates middle Miocene (or earliest late Miocene) age based on the range of *L. truncatum*.
88	Poorly sorted; lots of sand-sized phosphate grains, and a few scattered quartz sand grains and phosphate pebbles.	

80.5- 81 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CLAY-02%, QUARTZ SAND-15%
PHOSPHATIC SAND-03%

81 - 85 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED
ACCESSORY MINERALS: CLAY-02%, PHOSPHATIC GRAVEL-02%
PHOSPHATIC SAND-05%, QUARTZ SAND-20%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS, MOLLUSKS, BRYOZOA
BRECCIATED AND BIOTURBATED NEAR TOP OF INTERVAL. SOME
PHOSPHATIZED INTRACLASTS AND/OR CLAY FILLED BURROWS AT TOP
OF INTERVAL. DOLOMITIZED MOLLUSKS AND RED ALGAE PRESENT.
FORAMS MOLDS PRESENT.

85 - 86 NO SAMPLES
SET CASING.

86 - 87 DOLOSTONE; GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, QUARTZ SAND-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, BRYOZOA, CORAL

87 - 90 DOLOSTONE; GRAYISH BROWN TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, SUCROSIC
INCREASE IN PHOSPHATE AND SAND (VARIABLE 10-20%).

	Comments	Age indicators
94.5	Thin section: Similar to the sample at 81.5, but the mollusks are voids and are not infilled with dolomite.	
103.4-103.7	Contains a moderately well preserved dinocyst assemblage. No species is particularly dominant.	103.4-103.7 Dinocyst assemblage indicates probably middle Miocene.

90 - 94.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, CORAL, MOLLUSKS
MISSING 1 FOOT BETWEEN 89.5-94.5'.

94.5- 100 SAND; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: VERY FINE; RANGE: FINE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: DOLOMITE-40%, PHOSPHATIC SAND-03%
VARIABLY DOLOMITIC. (VERY SANDY DOLOSTONE IN PLACES.) GOOD
TO MODERATE INDURATION.

100 - 101.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, PYRITE-01%
QUARTZ SAND-25%
PHOSPHATE INCREASES AND QUARTZ SAND DECREASES WITH DEPTH.
PIECES OF MOLLUSKS AND BRYOZOANS PRESENT.

101.5- 105 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
PYRITE-01%
PELECYPODS. VUGS WITH RECRYSTALLIZED CALCITE PRESENT.
104-105' MISSING FROM BOX.

105 - 110 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-15%, QUARTZ SAND-15%
SAND AND PHOSPHATE VARIABLE TO 25%. CALCITE-LINED VUGS.

	Comments	Age indicators
112.2-114.5	Clasts of bored, transported hardground surface.	

110 - 112.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-10%
VARIABLE TO DOLOMITIC SAND IN PLACES.

112.5- 114.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED
ACCESSORY MINERALS: CHERT-02%, PHOSPHATIC SAND-05%
QUARTZ SAND-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS, MOLLUSKS
BURROWED AND BORED, WITH BURROWS BECOMING HIGHLY
RECRYSTALLIZED- CHERTY(?). VUGS PRESENT. PHOSPHATE GRAINS
PEPPERED THROUGHOUT.

114.5- 116.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-08%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS

116.5- 118 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED, LAMINATED, MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-15%, QUARTZ SAND-15%
ORGANICS-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
BURROWED. FEWER VUGS THAN 112-114'.

	Comments	Age indicators
120-133	Venice Clay	
125.5	Contains a well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and species of *Spiniferites*. Cysts of the family Congruentidiaceae are common.	125.5 Dinocyst assemblage indicates a middle (or possibly early) Miocene age. The highest occurrence of *C. tenuitabulatum* (middle part of the middle Miocene according to Williams and others, 1993) places an upper limit on the age.
135-135.2	Contains a moderately well preserved dinocyst assemblage. No species is particularly dominant.	135-135.2 Dinocyst assemblage indicates a middle (or possibly early) Miocene age.

118 - 120 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED, MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, QUARTZ SAND-03%
PYRITE-01%
MINOR SULFIDES IN ROOTLET(?) TRACES. DOLOMITIZED
MUDSTONE-WACKESTONE.

120 - 122 NO SAMPLES
DRILLER SAYS "GREEN CLAY - NOT RECOVERED".

122 - 126 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
OTHER FEATURES: DOLOMITIC

126 - 128 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
OTHER FEATURES: DOLOMITIC
SPLIT SPOON SAMPLE.

128 - 131 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
OTHER FEATURES: DOLOMITIC

131 - 133 AS ABOVE
131-133' IS ACTUALLY 3' LONG--CLAY HAS EXPANDED??

133 - 136 SILT-SIZE DOLOMITE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE; POOR INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: CLAY-15%, QUARTZ SAND-25%
PHOSPHATIC SAND-05%
SAND IS VERY FINE TO FINE. CLAY CONTENT IS VARIABLE AND
DECREASES WITH DEPTH.

Comments	Age indicators
	140.8-141.2 Molluscan fragments of pectens assigned to *Chalmys marionensis*?, a species reported from the Tampa which indicates late Oligocene or early Miocene age.
	148 Molluscan assemblage could be late Oligocene to early or mid-Miocene, but presence of *Trachycardium cestum*?, a Chipola species indicates sample has some affinities to the middle Miocene.
154.5 Thin section: dolomite rhombs are leached in centers and on surfaces.	

136 - 140 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-01%
SAND IS VERY FINE TO FINE, VARIABLE. DIFFICULT TO
DIFFERENTIATE BETWEEN SAND AND DOLOMITE. MINOR SULFIDES AND
INCREASE IN PHOSPHATE SAND 138-140'. LARGER PEBBLE CONTENT
INCREASES TOWARD BOTTOM.

140 - 142 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
FOSSILS: FOSSIL MOLDS, MOLLUSKS
POOR RECOVERY--LOSS OF SOFT ZONES?. SOME SHELL FRAGMENTS
PORTIONS FRIABLE- BURROWED?

142 - 145 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
CHERT-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS
CHERT FILLED BURROWS(?) AT 142 AND 146.5'.

145 - 155.1 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-08%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS, BRYOZOA
SILICIFIED ZONE 146.7-147'. SLIGHTLY MORE MOLDIC BELOW
152'. PHOSPHATE TO 15% IN PLACES. LOTS OF VUGS. OSTRACODS
FORAMS (SORITIDS) PRESENT.

	Comments	Age indicators
158-159	Blocky, broken-up clay.	
161.7-161.8		Identifiable mollusk *Turritella* sp. has affinities to *T. segmenta* a Chipola species so this sample could be late early or early middle Miocene.
166.6-166.7		Identifiable mollusk *Chlamys burnetti* has been reported from the Tampa, which indicates late Oligocene or early Miocene age.
168.3-169		Identifiable mollusk *Scapharca staminata* has been reported from the Chipola, so this sample could be late early or early middle Miocene.

155.1- 156 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-15%
DOLOMITE-20%
OTHER FEATURES: DOLOMITIC
UP TO 30% PHOSPHATE NEAR 156'. GRADES INTO UNIT BELOW. XRD INDICATES PALYGORSKITE.

156 - 160 DOLOSTONE; YELLOWISH GRAY
POROSITY: LOW PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED, MOTTLED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
SAND AND PHOSPHATE VARIABLE. CLAYEY ZONE 158-159'.

160 - 165 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BIOTURBATED, MOTTLED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
FOSSILS: FOSSIL MOLDS, CORAL, BRYOZOA
BURROWED AND BIOTURBATED. SAND AND PHOSPHATE DECREASE WITH DEPTH. RECRYSTALLIZATION INCREASES WITH DEPTH. 80% RECOVERY.

165 - 170 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CHERT-02%, QUARTZ SAND-08%
PHOSPHATIC SAND-08%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS
CHERT BED 166.9-167.5--SILICIFIED DOLOSTONE AS ABOVE.

	Comments	Age indicators
184-188	Bedding in the fine phosphatic grains.	
186	Discontinuity between an unfossiliferous dolosilt above and a fossiliferous dolostone below.	
186.5	Thin section: Extremely leached dolomite, fragments of echinoids, red algae, bryozoans, small forams, leached mollusks and ostracodes. Two generations of dolomite differ in degree of leaching in centers of rhombs.	
188-190	Lenses of clastic quartz grains and vitreous phosphate grains.	

170 - 177.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
LESS POROSITY THAN ABOVE. MOLLUSKS AT 171 AND 171.6'.

177.5- 183 DOLOSTONE; YELLOWISH GRAY
POROSITY: LOW PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
DOLOMITIZED MUDSTONE. "TIGHT". SCATTERED MOLLUSKS AT 180.6
AND 181.25'. ECHINOID FRAGMENTS AT 180.6'.

183 - 185.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
MINOR BRECCIA FRAGMENTS 184'. ECHINOID FRAGMENTS AT 183.66
AND 185.25'. SOME EVIDENCE OF BEDDING- FINE PHOSPHATE
GRAINS ARE LAYERED.

185.5- 190 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BRYOZOA, ECHINOID
PHOSPHATE TO 10%, SAND AND SILT TO 5%. GENERALLY INCREASES
BELOW 187'. BURROWED. MISSING SOME CORE.

	Comments	Age indicators
190.2-190.5	Contains only a few partial specimens of dinocysts: *Cribroperidinium tenuitabulatum* and *Polysphaeridium zoharyi*.	Dinocysts assemblage indicates middle, or possibly early, Miocene.
190-192	Scattered quartz and vitreous phosphate grains.	
192-194	Phosphate and quartz grains concentrated in lenses and laminae.	
196-200	Phosphate and quartz grains concentrated in lenses and laminae.	
200	Thin section: Dolomitized red algae, and echinoid fragments, leached and dolomitized bryozoans and foraminifera. Dolomite rhombs have leached centers.	
200-201.5	High concentrations of quartz and phosphate grains.	

190 - 193.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
MINOR BEDDING (SAND AND PHOSPHATE).

193.5- 200 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BRYOZOA
LESS POROSITY THAN ABOVE. 1" SILICIFIED ZONE AT 197'. SAND
VARIABLE 3-15%, PHOSPHATE VARIABLE 5-15%--CONCENTRATED IN
BURROWED ZONES. INCREASES BELOW 197'. MOLLUSC AT 199'.

200 - 201.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-20%
DOLOMITIC SAND IN PLACES. GRADES INTO UNIT BELOW.

201.5- 203.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CLAY- %, SILT- %
PHOSPHATIC SAND-02%, QUARTZ SAND-01%
MINOR CLAY AND SILT. DECREASE IN SAND AND PHOSPHATE.

	Comments	Age indicators
210	Thin section: Dolostone with leached red algae, bryozoans, mollusk, and echinoid fragments. Dolomite centers are not leached.	
211	Nearly a coquina of mollusks, echinoids, and bryozoans.	
213	Dark porous burrow fill in lighter, denser material.	
213.8-214.2		Identifiable mollusks present *Chlamys burnetti* and *Tellina segregata?*, both reported from the Tampa, which indicates late Oligocene or early Miocene age.

203.5- 208 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-08%
VERY HIGHLY RECRYSTALLIZED ZONE 205.5-205.7'. SAND AND PHOSPHATE VARIABLE (MOSTLY IN BURROWS). SAND AND PHOSPHATE DECREASE AND RECRYSTALLIZATION INCREASES WITH DEPTH.
POSSIBLY SOME BONE FRAGMENTS AROUND 207'.

208 - 210 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY; 10-50% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-08%
CLAY-%
POOR-MODERATELY INDURATED ZONE WITH HARD, RECRYSTALLIZED DOLOSTONE CLASTS (BORED) AT TOP OF INTERVAL. INTERVAL IS VERY JUMBLED UP AND WAS APPARENTLY SOFT, MUDDY DOLOSTONE WHEN DRILLED.

210 - 213 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-08%, PHOSPHATIC SAND-08%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS, BRYOZOA, ECHINOID
GOOD MOLDIC POROSITY AND PERMEABILITY. RED ALGAE PRESENT.

213 - 215 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-08%, PHOSPHATIC SAND-08%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS, BRYOZOA
PHOSPHATE CONCENTRATED IN BEDDING PLANES AND BURROWS. MIXED WITH MUDDIER ZONES WITH LESS SAND AND PHOSPHATE NOT AS WELL INDURATED OR RECRYSTALLIZED AS ABOVE.

	Comments	Age indicators
220.5	Large burrows filled with darker, more porous material.	
220.5	Thin section: Silicified fossils in a dolomite matrix: echinoids, gastropod molds, and bryozoans (some phosphatized). Dolomite rhombs are leached in centers and in zones. Collapsed, clay or micrite lined voids that may be of soil origin.	
228-236	Moldic texture from leaching of echinoids and pelecypods.	
228	Thin section: Extremely leached (even the phosphate grains) dolostone. Red algae and echinoids are mimically replaced with dolomite.	
231.6		Identifiable mollusk present *Chlamys marionensis*, reported from the Tampa; which indicates late Oligocene to early Miocene age.
233.9-234.1		Strontium ratio indicates: 19.45-19.55 Ma (BIG).
234	Thin section: Dolostone with partly leached rhombs, echinoid is calcareous and partly infilled with silica. There are two types of dolomite: a tight interlocking low porosity matrix and a more loosely fitted, slightly interlocking network of euhedral rhombs.	

215 - 220 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BRYOZOA

220 - 228 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-20%, QUARTZ SAND-15%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
SILICIFIED BED OF LITHOLOGY DESCRIBED FROM 220-220.2'.
MINOR INTRACLASTS. SOIL TEXTURES AT 220.5'.

228 - 233 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-02%
PYRITE-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BRYOZOA, MOLLUSKS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
DOLOMITIZED WACKESTONE-PACKSTONE. ABUNDANT LARGE (1/3"+)
DARK GRAY FOSSIL FRAGMENTS AND INTRACLASTS. BURROWS
PRESENT. ECHINOIDS AND RED ALGAE PRESENT.

233 - 234.5 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-03%
OTHER FEATURES: DOLOMITIC
FOSSILS: BRYOZOA, MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID
LOSE DARK GRAY CLASTS BY BOTTOM OF INTERVAL. OYSTER AND
FORAMS PRESENT. DOLOMITE WAS SEEN IN THIN-SECTION.

	Comments		Age indicators
		235	Identifiable mollusk present *Chlamys burnetti,* reported from the Tampa which indicates late Oligocene to early Miocene age.
238.8-240	Contains a well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and *Cribroperidinium tenuitabulatum.*	238.8-240	The highest occurrence of dinocyst *C. tenuitabulatum* (middle part of the middle Miocene according to Williams and others, 1993) places an upper limit on the age. *B. graminosum* has been reported only from the latest middle and late Miocene (Lentin and others, 1994), but this species is only questionably identified here.
240	Thin section: Dolomitized fossils in a sandy, dolomitic matrix.		
242-236	Grain size of quartz and phosphate sand increases upward over this interval.		
243	Thin section: Dolostone with leached skeletal grains; echinoid, red algae, foraminifera, and bryozoans are preserved in phosphatic clasts.		
243.3	Erosional surface: clasts, up to 10mm occur just above a surface on a fine grained dolomite. Second surface about 6-8" below this one.		

234.5- 236.7 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-02%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, ECHINOID
LOADED WITH ECHINOIDS FROM 233-236'.

236.7- 242 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC
SAND AND PHOS. OFTEN CONCENTRATED IN BURROWS (DECREASE
BELOW 238.5'), BECOMES MORE RECRYSTALLIZED AND DARKER WITH
DEPTH. BURROWS. GRAIN SIZE INCREASES UPWARD FROM 242-236'.

242 - 243.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
MOLDIC; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-08%
PHOSPHATIC GRAVEL-03%, QUARTZ SAND-08%
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC
FOSSILS: FOSSIL MOLDS
EROSIONAL SURFACE AT 243.25'. LOTS OF LARGE CLASTS JUST
ABOVE SURFACE. SECOND SURFACE 6-8" BELOW FIRST ONE. MINOR
MOLDIC POROSITY. PHOSPHATIZED DOLOMITE CLASTS (1/4") AND
QUARTZ PEBBLES SCATTERED THROUGHOUT INTERVAL. BARNACLES.

243.5- 247.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC
MINOR BURROWS NEAR TOP FILLED WITH SAND AND PHOSPHATE.

	Comments	Age indicators
252.5-252.8	Contains a well-preserved dinocyst assemblage dominated by species of *Spiniferites*.	According to Edwards (1990), dinocysts *Pentadinium* sp. cf. *P. laticinctum granulatum* and *Pentadinium* sp. I overlap in the Marks Head Formation in South Carolina, which has been dated as early Miocene (Abbott and Huddlestun, 1980).
	TAMPA MEMBER	
254.5	Top of the Tampa Member of the Arcadia Formation.	

247.5- 254.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-20%
PHOSPHATIC GRAVEL-01%, QUARTZ SAND-20%, CLAY-%
A FEW CLASTS OF LITHOLOGY BELOW AT BOTTOM OF INTERVAL.
MISSING SOME SEDIMENT. PHOSPHATE PEBBLES 2-3 MM, INCREASING
TO 1 CM RIGHT AT CONTACT.

254.5- 258 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS; 50-90% ALTERED
EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
SOME BURROWS FILLED WITH LITHOLOGY ABOVE PRESENT TO 256'.
DECREASE IN PHOSPHATE. TOP OF TAMPA.

258 - 260.5 AS ABOVE
50% RECOVERY--LOSS OF SOFT ZONES?. CONTAINS BURROW FILL AS
ABOVE.

260.5- 262 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: LAMINATED
ACCESSORY MINERALS: CLAY- %, QUARTZ SAND-01%

262 - 263 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: CLAY- %, QUARTZ SAND-01%
BRECCIATED FRAGMENTS OF UNIT BELOW INCORPORATED INTO BASE
OF THIS INTERVAL.

	Comments	Age indicators
268.7	Surface of brecciated dolomite below and limestone above.	
269-280	Structures indicating subaerial exposure, including root voids.	
269.1	Thin section: Dolostone with minor leaching of bryozoans, foraminifera, and echinoids. Structures include planar voids and laminar crusts may be pedogenic.	
271.1	Thin section: Dolostone with dolomitized red algae and echinoids.	
285	Thin section: Silicified dolostone with silicified foraminifera, echinoids, and bryozoans.	

263 - 268.7 LIMESTONE; WHITE TO VERY LIGHT GRAY
POROSITY: LOW PERMEABILITY, INTERGRANULAR
GRAIN TYPE: BIOGENIC, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC SAND-01%
CLAY-%
TRACE OF CLAY NEAR TOP. BECOMES LESS MUDDY WITH DEPTH.

268.7- 271.7 DOLOSTONE; YELLOWISH GRAY
POROSITY: LOW PERMEABILITY, INTERCRYSTALLINE
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: LAMINATED
ACCESSORY MINERALS: QUARTZ SAND-01%, PHOSPHATIC SAND-01%
CLAY-%
MINOR CLAY LAMINAE PRESENT. SURFACE AT 268.7'.

271.7- 280 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY, FRACTURE
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED, BRECCIATED
ACCESSORY MINERALS: QUARTZ SAND-01%, PHOSPHATIC SAND-01%
BECOMES BRECCIATED AND BETTER INDURATED BELOW 273'. (SOME
OF BRECCIATION DUE TO HEALED FRACTURES?) EXPOSURE
STRUCTURES IN THIS INTERVAL.

280 - 285 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-01%, PHOSPHATIC SAND-01%
282-83' LAMINATED WITH CLAY. ALSO SOME SMALL INTRACLASTS.
SCATTERED MOLLUSK MOLDS.

285 - 285.2 CHERT; OLIVE GRAY
POROSITY: LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): SILICIC CEMENT
SILICIFIED DOLOSTONE AS ABOVE.

Comments	Age indicators

285.2- 286.2 CLAY; LIGHT OLIVE GRAY TO OLIVE GRAY
POROSITY: LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE- %, PHOSPHATIC SAND-01%
QUARTZ SAND-01%
OTHER FEATURES: DOLOMITIC
MOTTLED AND BRECCIATED NEAR BASE. GRADES INTO UNIT BELOW.

286.2- 289 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY, FRACTURE
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
CLAY-%
SILT-SIZED DOLOMITE. NEARLY VERTICAL FRACTURE FROM
287-289'. XRD SHOWS PRESENCE OF SEPIOLITE AND PALYGORSKITE.

289 - 289.5 CHERT; MODERATE GRAY TO OLIVE GRAY
POROSITY: LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): SILICIC CEMENT
SEDIMENTARY STRUCTURES: BRECCIATED, BANDED
ACCESSORY MINERALS: PHOSPHATIC SAND-01%
BANDED CHERT (SILICIFIED DOLOSTONE.)

289.5- 298 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
DOLOMITIZED MUDSTONE. 3' LOSS OF SOFT MATERIAL. BLOCKY CLAY
FRAGMENTS PRESENT. XRD FROM 287.2, 291.5, AND 298' SHOWS
ONLY TRACE OF DOLOMITE.

298 - 299.5 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-01%
CLAY- %
FOSSILS: BRYOZOA
POORLY SORTED PHOSPHATE COMPONENT (FINE - GRANULE SIZED)
XRD SHOWS MOSTLY MOSTLY PALYGORSKITE, TO 304'. MORE CLAY IN
ZONES SHOWING DESSICATION CRACKS, LITTLE CLAY IN UNCRACKED
ZONES.

	Comments		Age indicators
305-305.3	Contains a poorly preserved dinocyst assemblage dominated by *P. zoharyi.*	305-305.3	Dinocyst assemblage indicates an early Miocene, or possibly latest Oligocene age. The lowest occurrences of *M. quanta* and *Tuberculodinium vancampoae* are found near the Oligocene/Miocene boundary (Powell, 1992; Stover, 1977; Williams and others, 1993). Edwards reported *Pentadinium* sp. cf. *P. laticinctum granulatum* from the Edisto and Marks Head Formations in South Carolina.

299.5- 301 DOLOSTONE; VERY LIGHT GRAY TO LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED, LAMINATED
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, SILT-%
1" BORED CLAST OF PHOSPHATIZED DOLOSTONE AT 300'. MOTTLED LIGHT GRAY AND VERY LIGHT GRAY. MINOR LAMINAE OF DIFFERENT COLORS. BECOMES DARKER GRAY WITH DEPTH AND GRADES INTO UNIT BELOW. 1/2" BURROW JUST BELOW PHOSPHATE CLAST. EVIDENCE OF CALLIANASA BURROW 299.8-300.5'.

301 - 305.5 DOLOSTONE; LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SILT-%
VERY SILTY (COULD BE QTZ OR DOLOMITE)--COULD ACTUALLY BE A DOLOMITIC SILTSTONE. PHOSPHATE INCREASES TO 5-7% WITH DEPTH. MINOR CLAY.

305.5- 307 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
PIN POINT VUGS; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
OTHER FEATURES: HIGH RECRYSTALLIZATION
TRACE OF ORGANICS. ROOTLET TRACES FAIRLY COMMON. CLEAN DOLOMITIZED MUDSTONE MIXED WITH LESS RECRYSTALLIZED DOLOSTONE WITH 5% PHOSPHATE AND 2% QUARTZ SAND BELOW 306.5'--COULD BE BURROW FILL.

307 - 308.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
OTHER FEATURES: HIGH RECRYSTALLIZATION
SOME 1/2" BURROWS PRESENT FILLED WITH MORE PHOSPHATIC DOLOMITE.

	Comments	Age indicators
310	Thin section: Limestone with soil structures that include mottled matrix, coated grains, rooting, silicification, and leached calcareous grains of foraminifera.	
318-320	Fossil hash.	
320	Whole molluscan molds.	
321	Thin section: Limestone, relatively unleached with oysters, ostracodes, bryozoans, and red algae.	321 Identifiable mollusk present *Turritella* sp. with affinities to *T. tampae*. *T. tampae* is found in the Tampa at the type area indicating correlation to the type area.

308.5- 309.8 DOLOSTONE; LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SILT- %
AS 305.5-307'. SHARP CONTACT WITH UNIT BELOW.

309.8- 314 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: PIN POINT VUGS, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-03%
OTHER FEATURES: DOLOMITIC, MEDIUM RECRYSTALLIZATION
HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
MINOR BLEBS OF GRAY DOLOSTONE WHICH HAS 3% PHOSPHATE AND 2%
QUARTZ SAND PRESENT--BURROW FILL(?). ROOT TRACES COMMON.
MINOR MOLDIC POROSITY. BECOMES WHITER AND MORE CALCAREOUS
WITH DEPTH AND GRADES INTO A LIMESTONE. SOIL TEXTURES.
LARGE NUMBER OF BURROWS NEAR BASE OF INTERVAL FILLED WITH
DARKER COARSER-GRAINED MATERIAL.

314 - 317.5 LIMESTONE; VERY LIGHT GRAY
POROSITY: PIN POINT VUGS, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-02%
OTHER FEATURES: DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
SORITES COMMON.

317.5- 321 LIMESTONE; VERY LIGHT GRAY
POROSITY: MOLDIC, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY COARSE TO FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, MOLLUSKS
FOSSIL MOLDS
PACKSTONE. SORITES COMMON.

Comments	Age indicators
	329.5 A fairly diverse molluscan assemblage present including several very distinctive species: *Chione ballista*?, *Anadara hypomela*, and *Glyptoactis serricosta*. *Turritella* sp. cf. *T. tampae* also present. This assemblage is typical of the Tampa, and lends biostratigraphic support for assignment of these beds to the Tampa Member.
	330.5 Mollusks present: *Glyptoactis serricosta* and *Turritella* sp. cf. *T. tampae*. This assemblage is typical of the Tampa, and lends biostratigraphic support for assignment of these beds to the Tampa Member.
334 Thin section: Limestone with ostracodes, bryozoans, echinoids, and red algae.	331-331.2 Mollusks present: *Glyptoactis serricosta , Chione ballista?* and *Turritella* sp. cf. *T. tampae*. This assemblage is typical of the Tampa, and lends biostratigraphic support for assignment of these beds to the Tampa Member.
LOWER UNDIFFERENTIATED ARCADIA FORMATION	
338.5 Contact between the Tampa Member above and the lower undifferentiated Arcadia Formation below at a lithologic change from limestone above to sandstone below.	337.8 Identifiable mollusk present *Turritella* sp. cf. *T. tampae pagodaeformis*, a typical species reported from the Tampa at the type area indicating correlation to the type area.

321 - 328 LIMESTONE; VERY LIGHT GRAY
POROSITY: MOLDIC, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY COARSE TO FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, MOLLUSKS
FOSSIL MOLDS, BRYOZOA
2' CORE. 5' LOSS OF SOFT LIMESTONE. FOSSILS AND MOLDS
LARGER THAN ABOVE. OYSTERS, ECHINOIDS, RED ALGAE
OSTRACODS.

328 - 334 LIMESTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: MOLDIC, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY COARSE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
SPAR-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, MOLLUSKS
FOSSIL MOLDS
HIGHLY RECRYSTALLIZED BEGINNING AT 333' WITH MICROSPAR
COATING MOST MOLDS. LESS MOLDIC POROSITY THAN ABOVE.
SPONGES PRESENT. MOTTLED, POSSIBLY BURROWED.

334 - 338.5 LIMESTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: MOLDIC, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, MOLLUSKS
FOSSIL MOLDS, BRYOZOA
"CRUMBLY". OSTRACODS, ECHINOIDS, RED ALGAE PRESENT.

Comments	Age indicators
	341.3-341.6 Strontium ratio indicates: 24.97-25.18 Ma (BIG).
347.5 Thin section: Limestone with bryozoans, echinoids, red algae, and foraminifera; small rhombs of dolomite in the micrite matrix, no void cements.	

338.5- 340 SAND; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-40%, PHOSPHATIC SAND-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS, MOLLUSKS, BRYOZOA
MINOR BURROW FILL WITH LIMESTONE AS ABOVE. VARIABLE TO VERY SANDY LIMESTONE IN PLACES.

340 - 342.5 SAND; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CALCILUTITE-40%, PHOSPHATIC SAND-01%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, BRYOZOA, FOSSIL MOLDS
VARIABLE TO A VERY SANDY LIMESTONE.

342.5- 347 SAND; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CALCILUTITE-30%, PHOSPHATIC SAND-01%
OTHER FEATURES: DOLOMITIC, VARIEGATED
FOSSILS: MOLLUSKS, FOSSIL MOLDS, FOSSIL FRAGMENTS
DOLOMITIZED IN PLACES (342.5-343.5') MINOR BEDS OF HIGHLY RECRYSTALLIZED LIGHT BROWN DOLOSTONE WITH ABUNDANT QUARTZ SAND. SOME OF THESE BEDS HAVE BURROW FILL OF CALCILUTITE CEMENTED SAND. LITHOLOGY VARIES BETWEEN SANDY DOLOSTONE/LIMESTONE AND DOLOMITIC SAND. MORE CALCAREOUS WITH DEPTH.

347 - 350 LIMESTONE; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-01%
OTHER FEATURES: VARIEGATED
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
50% RECOVERY- SOME DOLOSTONE BEDS PRESENT. MINOR MOLDIC POROSITY. SAND MAY BE BURROW-FILL FROM OVERLYING UNIT.

	Comments	Age indicators
354	Thin section, leached mollusk with micrite envelopes; ostracodes, bryozoans, red algae, forams. Micrite-coating of sand grains suggests pedogenic origin.	
358	Thin section: Dolostone with no fossils.	

350 - 353 LIMESTONE; VERY LIGHT GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-01%
OTHER FEATURES: LOW RECRYSTALLIZATION
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
33% RECOVERY--LOSS OF SANDY ZONES?. COLOR MAY INDICATE
OXIDATION IN SOIL HORIZON.

353 - 355.5 AS ABOVE
POOR RECOVERY (18" OF CORE RECOVERED). SLIGHTLY MORE
PHOSPHATIC.

355.5- 363 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
HIGH RECRYSTALLIZATION
SAND DECREASES WITH DEPTH.

363 - 369.7 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
INTERGRANULAR; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, ECHINOID, FOSSIL FRAGMENTS
TRACE OF ORGANICS BELOW 365'. MINOR SAND FILLED BURROWS.
LESS POROSITY THAN ABOVE. 6" SAND BED (MEDIUM TO FINE) WITH
DOLOMITE CEMENT AND 2% PHOSPHATE PRESENT FROM 369.3-369.9'.
POSSIBLE ROOT TRACES.

	Comments	Age indicators
370.1	Thin section: Limestone with forams, oysters, ostracodes, and echinoids; a few pyrite framboids; mottled matrix.	
385-385.5		Identifiable mollusks present *Cerithium praecursor* and *Chione ballista*?. This assemblage indicates late Oligocene or early Miocene age.
388.5-388.9		Most diverse molluscan assemblages in this core; 13 species identifiable to generic level. This assemblage indicates late Oligocene or early Miocene age.

369.7- 375 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-02%
OTHER FEATURES: DOLOMITIC
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, ECHINOID
2' OF CORE MISSING BETWEEN 370-376': OYSTER AND OSTRACODS
PRESENT.

375 - 381.5 LIMESTONE; WHITE TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-01%
OTHER FEATURES: DOLOMITIC, HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, BRYOZOA, BENTHIC FORAMINIFERA
ARCHAIAS SP. NOTED. MINOR SPAR IN VUGS. POROSITY AND
PERMEABILITY AND RECRYSTALLIZATION VARIABLE. MODERATE TO
GOOD PERMEABILITY OVERALL. MORE DOLOMITIC BELOW 379'.

381.5- 389 LIMESTONE; VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BRYOZOA, CORAL, MOLLUSKS, FOSSIL MOLDS
ABUNDANT BRYOZOAN(?) COLONIES AND CORALS 381.5-387'. VERY
POROUS AND PERMEABLE. VERY FINE SPAR COATS MOST SURFACES.

	Comments	Age indicators
391.0	Thin section: Limestone with bryozoans, foraminifera, molluscan molds, ostracods, oysters, echinoids, red algae, coral, and bryozoan fragments.	
391.8-395.4		Identifiable mollusks present *Glyptoactis serricosta*? and *Chione ballista*. This assemblage indicates late Oligocene or early Miocene age.
400.3-401		Identifiable mollusks present *Cerithium praecursor* and *Fusiturricula condominia silicata*. This assemblage indicates late Oligocene or early Miocene age.
402	Thin section: Sandy dolostone with two generations of dolomite, with bryozoan, echinoid, and ostracode fragments.	
403.5	Mottled, possibly burrowed.	

389 - 393 LIMESTONE; VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, MOLDIC
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA, MOLLUSKS
FOSSIL MOLDS, ECHINOID
SORITES COMMON. LESS POROUS AND PERMEABLE THAN ABOVE.
BECOMES LESS RECRYSTALLIZED AND NOT AS WELL INDURATED BELOW
391.5'. SMALL PIECES OF CORAL, OSTRACOD, RED ALGAE, OYSTER.

393 - 396 NO SAMPLES
DRILLER SAYS " SOFT MUD".

396 - 398 SAND; VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-40%, PHOSPHATIC SAND-01%
VARIABLE TO VERY SANDY MUDSTONE. 50% RECOVERY.

398 - 401 DOLOSTONE; VERY LIGHT ORANGE TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS, BENTHIC FORAMINIFERA
BRYOZOA, ECHINOID
MINOR MOLDIC POROSITY AND SORITES NOTED. BURROWED?
RECRYSTALLIZATION DECREASES WITH DEPTH. GRADES INTO A
MUDDIER CARBONATE. OSTRACODS NOTED.

401 - 403.5 DOLOSTONE; WHITE TO YELLOWISH GRAY
POROSITY: LOW PERMEABILITY, INTERGRANULAR; 50-90% ALTERED
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: BRECCIATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CALCAREOUS
FOSSILS: MOLLUSKS
BRECCIATED APPEAREANCE NEAR TOP. MOTTLED, POSSIBLY
BURROWED. SOME ROOT TRACES.

Comments	Age indicators
	407.9-408.7 Identifiable mollusks present *Chamelea rhodia?, Anadara hypomela,* and *Fusiturricula condominia silicata.* This assemblage indicates late Oligocene or early Miocene age.

403.5- 406.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
PIN POINT VUGS; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: VERY FINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-01%
PYRITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION

406.5- 409 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY, MOLDIC
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS, BENTHIC FORAMINIFERA
SORITES COMMON. RECRYSTALLIZATION INCREASE WITH DEPTH.

409 - 416 SAND; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, DOLOMITE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
VERY POROUS AND PERMEABLE.

416 - 417 SAND; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, DOLOMITE-25%
OTHER FEATURES: HIGH RECRYSTALLIZATION

417 - 421 LIMESTONE; WHITE TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-35%, PHOSPHATIC SAND-03%
OTHER FEATURES: DOLOMITIC
FOSSILS: MOLLUSKS
30% RECOVERY 417-421'. PROBABLY SAND BEDS WASHED OUT.

	Comments	Age indicators
424.5	Thin section: Sandy dolomite with partly silicified, calcareous oysters, dolomitic and calcareous echinoid, calcareous bryozoan and calcite filled mollusk molds. Rip-up clasts observed in core at 424.5.	
432	Thin section: Dolostone with mollusk molds (no calcite infilling). Void-filling dolomite rhombs have slightly leached centers -- the opposite of void-filling dolomite in shallower units where the void filling was unleached.	

421 - 424.5 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BENTHIC FORAMINIFERA
VARIABLE RECRYSTALLIZATION.

424.5- 428.5 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
RECRYSTALLIZATION AND INDURATION DECREASE SLIGHTLY BELOW 428'.

428.5- 432 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
SAND INCREASES TO 30-40% WITH DEPTH.

432 - 435.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
PIN POINT VUGS; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-35%, PHOSPHATIC SAND-02%
PYRITE-01%
FOSSILS: FOSSIL MOLDS, MOLLUSKS
MORE POROUS AND PERMEABLE THAN ABOVE. MOLDIC FROM 434-434.5'.

	Comments	Age indicators
448	Thin section: Dolomitic sandstone with ostracode; silicification along laminae.	

435.5- 437 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-03%
MOTTLED GRAY IN PLACES. MINOR CLASTS AND BURROW FILL OF SAND. CHERT NODULE 435.5'.

437 - 453 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-02%
PYRITE-01%, CLAY-01%
MINOR GREENISH GRAY CLAY BLEBS AND PYRITE. SAND VARIABLE TO 50%. SOME SHELL "GHOSTS"? MAYBE SILICA. LAMINATED FROM 447-449'.

453 - 456.5 SAND; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: VERY FINE; RANGE: MEDIUM TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, LAMINATED
ACCESSORY MINERALS: PHOSPHATIC SAND-04%, PYRITE-01%
DOLOMITE-25%
VERY SANDY DOLOSTONE TO DOLOMITIC SANDSTONE. MINOR LAMINATIONS AND BEDDING. SULFIDES PRESENT ALONG ROOT TRACES.

456.5- 457 CLAY; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-30%, DOLOMITE-20%
PHOSPHATIC SAND-03%, PYRITE-01%
MOTTLED AND BURROWED DOLOMITIC CLAY MIXED WITH SAND AND PHOSPHATE. GRADES INTO UNIT BELOW.

	Comments		Age indicators
466.8-467	Contains a sparse dinocyst assemblage dominated by *P. zoharyi*.	466.8-467	Dinocyst assemblage indicates late Oligocene or early Miocene.

457 - 460 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
SAND AND PHOSPHATE VARIABLE. 1 FOOT OF CORE MISSING FROM 456.5-460'.

460 - 461 SAND; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-25%, PHOSPHATIC SAND-08%
DOLOMITIZATION INCREASES WITH DEPTH.

461 - 463.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-05%
MOTTLED AND BURROWED (FILLED WITH SANDIER SEDIMENT) MINOR SHELL FRAGMENTS.

463.5- 465 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-05%
FOSSILS: FOSSIL FRAGMENTS

465 - 467 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-10%, PHOSPHATIC SAND-10%
TRACE OF CLAY AND MINOR SHELL MOLDS PRESENT. SOME MATERIAL MISSING FROM 460-467'.

Comments	Age indicators
	475-475.6 Identifiable mollusk *Turritella* sp. cf. *T. tarponensis*; *T. tarponensis* indicates late Oligocene or early Miocene age.
479-489 A zone of interbedded carbonate and organics, especially around 484.3 to 484.6; some wood fragments observed.	
480 Algal lamination, dolomitic in the top foot. Thin section: Sandy dolostone with calcareous mollusk (rare), ostracodes, echinoids, foraminifera, and silica laminae.	

467 - 469 CLAY; LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-10%, QUARTZ SAND-02%
PHOSPHATIC SAND-01%, PYRITE-01%
MINOR ORGANICS, SULFIDES, ROOT TRACES AND BURROWS.
CARBONATE CONTENT INCREASES WITH DEPTH.

469 - 471 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY
INTERCRYSTALLINE
GRAIN TYPE: BIOGENIC, CALCILUTITE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CLAY-05%, QUARTZ SAND-05%
PHOSPHATIC SAND-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, MOLLUSKS
SORITES AND ARCHAIAS NOTED. MORE CALCAREOUS WITH DEPTH.

471 - 476 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: MEDIUM TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-05%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BENTHIC FORAMINIFERA
FOSSIL MOLDS
FORAMS-SORITES, ARCHIAS--PUNKY AND WEATHERED. BORING
SPONGES.

476 - 479 AS ABOVE
MINOR INCREASE IN SAND AND PHOSPHATE. MOLLUSKS DECREASE.

479 - 489 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: CALCILUTITE; 60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: MEDIUM TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: LAMINATED, MOTTLED
ACCESSORY MINERALS: ORGANICS-03%, QUARTZ SAND-15%
PHOSPHATIC SAND-05%
OTHER FEATURES: DOLOMITIC
VERY FINE LAMINAE OF CLAY/ORGANICS COMMON. MINOR SAND
FILLED BURROWS AND LAMINAE OF SAND. SAND AND PHOSPHATE
MOSTLY IN LAMINAE. ORGANIC LAMINAE VERY COMMON TO 487'
LESS COMMON BELOW. VARIABLE DOLOMITIZATION.

	Comments	Age indicators
490	Thin section: Dolostone with calcareous fossils, ostracodes, foraminifera, echinoids, mollusk, and red algae.	
497.3-501	Angular leached voids in the shape of gypsum crystals occur in this interval.	
497.6	Thin section: Dolostone with angular, gypsum crystal-shaped voids; very few foraminifer molds.	
501-513	Bedded is accentuated by phosphate sands.	
501.3-501.6	Contains very few dinocysts. Only two forms were encountered: *Chiropteridium* sp. (single specimen) *Polysphaeridium zoharyi* (short processes, transitional to *P. congregatum)*	501.3-501.6 Dinocyst assemblage indicates late Oligocene or early Miocene age.
515.7	Thin section: sparry mottled dolomite; faint foraminifer ghost.	

489 - 495 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
25% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-10%
OTHER FEATURES: DOLOMITIC
SAND AND PHOSPHATE INCREASE WITH DEPTH. ROOT TRACES
495-496'.

495 - 501 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: LAMINATED
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
ROOT TRACES. LAMINATED WITH SAND AND PHOSPHATE. VERY POROUS
ZONE 499.5-500.5' WITH LESS SAND AND PHOSPHATE AND NO
LAMINAE, THEN BACK INTO LAMINATED DOLOSTONE. SAND GENERALLY
INCREASES WITH DEPTH.

501 - 509 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-50%
VARIABLE FROM DOLOMITIC SANDSTONE TO A SANDY DOLOSTONE.
SAND DECREASES WITH DEPTH.

509 - 510.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-25%
3" OF CORE RECOVERED. SCATTERED EVIDENCE OF BARNACLES
PELECYPODS.

510.5- 519 AS ABOVE
SAND VARIABLE 10-50% AND PHOSPHATE VARIABLE 3-12%.

Comments	Age indicators
	537.5-538.2 Identifiable mollusk *Turritella* sp. cf. *T. tarponensis*; *T. tarponensis* indicates late Oligocene or early Miocene age. *Glyptoactis serricosta*? present at 538.

519 - 528 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-25%
OTHER FEATURES: DOLOMITIC
LOOKS LIKE 510.5-519' BUT IS NOT DOLOMITIZED. VARIABLE TO A CALCAREOUS SANDSTONE. SCATTERED MOLLUSKS.

528 - 537 SAND; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO FINE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, CALCILUTITE-40%
PYRITE-01%
VARIABLE FROM CACLILUTITIC SANDSTONE TO VERY SANDY CALCILUTITE. SCATTERED REMNANTS OF SORITES, PUNKY WEATHERED. WOOD AT 533.5'.

537 - 539.5 LIMESTONE; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, SKELETAL
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-08%
OTHER FEATURES: CHALKY
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
SAND INCREASES TO 20% BELOW 537' AND LIMESTONE BECOMES MEDIUM GRAINED. SORITES NOTED.

539.5- 541 LIMESTONE; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
OTHER FEATURES: CHALKY
LESS POROUS AND PERMEABLE THAN ABOVE.

	Comments	Age indicators
557-561	Friable layers are interbedded with strongly indurated.	
569	Thin section: Dolostone with bryozoan, echinoid, foraminifera, oyster, mollusk molds, and phosphatic rip-ups.	

541 - 569 SAND; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: MEDIUM TO FINE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CALCILUTITE-40%, PHOSPHATIC SAND-10%
OTHER FEATURES: CHALKY, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
CALCILUTITE VARIABLE 30-60%. MOSTLY A SUBEQUAL MIX OF SAND AND CALCILUTITE WITH 10% PHOSPHATE. MINOR WEATHERED REMAINS OF ALLOCHEMS SCATTERED THROUGHOUT. MODERATE TO GOOD INDURATION. SORITES SP. NOTED.

569 - 570 LIMESTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-15%, QUARTZ SAND-10%
OTHER FEATURES: CHALKY
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
WACKESTONE TO PACKSTONE. MINOR CLAYEY BLEBS AT BASE. BURROWED SURFACE AT 570'. BURROWS- FILLED WITH DARKER MATRIX.

570 - 575 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: MEDIUM TO FINE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CLAY MATRIX, SPARRY CALCITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CLAY-15%, PHOSPHATIC SAND-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS
VERY MOTTLED AND BIOTURBATED. GHOSTS OF ALLOCHEMS PRESENT. POSSIBLE ROOT CASTS. CEMENT SEEMS TO BE CALCAREOUS NEAR BASE.

	Comments	Age indicators
582.6	Massive burrows at erosional surface with overlying lighter material filling burrows.	
583.8-584	Contains only a single poorly preserved dinocyst: ?*Operculodinium centrocarpum*	583.8-584 Insufficient dinocyst data to indicate age.

575 - 579 LIMESTONE; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, QUARTZ SAND-15%
SPAR-01%
OTHER FEATURES: CHALKY
FOSSILS: MOLLUSKS
SAND VARIABLE 5-20%. ALGAE?. ROOTS NEAR 575'.

579 - 583 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
INTERGRANULAR; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: VERY FINE TO MICROCRYSTALLINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, LAMINATED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-08%
OTHER FEATURES: CALCAREOUS, MEDIUM RECRYSTALLIZATION
FOSSILS: MOLLUSKS
MINOR ORGANIC/CLAYEY LAMINAE AT TOP OF INTERVAL.
DOLOMITIZED MUDSTONE WITH SAND AND PHOSPHATE VARIABLE.
CLASTS OF UNIT BELOW INCORPORATED INTO BASE OF THIS UNIT.
BURROWS PRESENT. SCATTERED MOLLUSKS.

583 - 585.5 SAND; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: MEDIUM TO FINE
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CLAY-15%, PHOSPHATIC SAND-01%
OTHER FEATURES: CALCAREOUS
AS 570-575'. SLIGHTLY FINER GRAINED AND LESS CLAYEY.

585.5- 590.4 CLAY; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: SILT- %, PHOSPHATIC SAND-01%
PYRITE-01%
HIGHLY MOTTLED AND BIOTURBATED. SOME FRACTURES(?) FILLED
WITH LIGHTER GRAY, DOLOMITIC(?) CLAY NEAR TOP OF INTERVAL.
XRD AT 589.1' INDICATES SEPIOLITE AND PALYGORSKITE.

Comments	Age indicators

590.4- 598 DOLOSTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-01%, PHOSPHATIC SAND-03%
MINOR CLAY FROM 590.4-591.4'. SAND AND PHOSPHATE INCREASE
SLIGHTLY WITH DEPTH.

598 - 602.3 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-02%
PHOSPHATE TO 5%.

602.3- 606 DOLOSTONE; VERY LIGHT GRAY TO LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
INTERGRANULAR; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-25%
MOTTLED AND BURROWED (FILLED WITH SEDIMENTS FROM ABOVE.)
SAND AND PHOSPHATE VARIABLE TO 15% AND 35%.

606 - 609 CLAY; MODERATE LIGHT GRAY TO LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; GOOD INDURATION
CEMENT TYPE(S): CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-01%
XRD-SEPIOLITE. SOME LAMELLAE FROM 608-609'. SAND IN LAST CM
ABOVE CONTACT.

609 - 611 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: CLAY-02%, PHOSPHATIC SAND-02%
QUARTZ SAND-02%
RELATIVELY CLEAN DOLOSTONE. PHOSPHATE INCREASES WITH DEPTH.

	Comments	Age indicators
612	Dolostone with no fossils.	
616.3-616.4	Contains very few dinocysts. Only two forms were encountered: *Polysphaeridium congregatum* (including forms transitional to *P. zoharyi) Riculacysta perforata* (single specimen).	Dinocyst assemblage indicates a middle to late Oligocene age, based on the overlap in ranges reported by Stover (1977).

611 - 615.5 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
50-90% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, QUARTZ SAND-10%

615.5- 617.5 DOLOSTONE; VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; EUHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-30%
CLAY-02%
MINOR CLAY BLEBS. SAND INCREASES WITH DEPTH.

617.5- 620 SAND; LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: DOLOMITE-30%, PHOSPHATIC SAND-10%
DOLOMITE VARIABLE 20-60%. MINOR CLAY CONTENT. LESS DOLOMITE AND CLAY WITH DEPTH. (CLAY BECOMES GREATER THAN DOLOMITE ALSO).

620 - 628 AS ABOVE
DOLOMITE INCREASES BELOW 624.5'. FROM 624.5-628' IS MOTTLED AND INTERBEDDED SANDSTONE AS ABOVE AND DOLOSTONE WITH MINOR SAND. SCATTERED PELECYPOD MOLDS.

628 - 629 DOLOSTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERCRYSTALLINE, LOW PERMEABILITY
10-50% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-08%
CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BRYOZOA
BECOMES CALCAREOUS AND GRADES INTO UNIT BELOW.

	Comments	Age indicators
629.6-630		Strontium ratio indicates: 29.52 Ma (BIG).
630.2-631.7		Molluscan assemblage contains a mixture of typical upper Oligocene and typical lower Oligocene forms. *Anadara tarponensis* is reported from upper Oligocene to lower Miocene units. *Scapharca invidiosa* and *Turritella caelatura*? are lower Oligocene indicators.
632.9-633.5		Molluscan assemblage indicates lower Oligocene deposition. *Chamelea mississippiensis* and *Turritella caelatura*? are reported from the lower Oligocene of Mississippi.
633	Thin section: Limestone with mollusk and foraminifer molds, oysters and bryozoans.	
634.1	Abrupt change from lighter limestone above to darker burrowed limestone below.	
635	Thin section: Chert/limestone contact; chert is fractured and filled with calcite veins, and may be pedogenic. Limestone has echinoid grains and mollusk molds.	

629 - 634 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: BRECCIATED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-02%
OTHER FEATURES: CHALKY
FOSSILS: FOSSIL FRAGMENTS, BRYOZOA, MOLLUSKS
BENTHIC FORAMINIFERA
MINOR FOSSIL MOLDS. BRECCIATED APPEAREANCE 630-632'.BECOMES
MORE MOTTLED NEAR BASE. SOME MINOR MUDSTONE CLASTS AT BASE.

634 - 639.5 LIMESTONE; VERY LIGHT GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, QUARTZ SAND-10%
CLAY- %
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS
SANDY WACKESTONE WITH MINOR CLAY. BECOMES DOLOMITIC WITH
DEPTH. BURROWS. CHERT.

639.5- 647.5 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR
POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: PHOSPHATIC SAND-08%, CLAY- %
QUARTZ SAND-30%
SANDY DOLOMITIZED MUDSTONE-WACKESTONE. MINOR CLAY FILLED
BURROWS SCATTERED THROUGHOUT. SOME LIMESTONE LENSES.
640.5-641 HAS GRAY GREEN CLAY CLASTS (WELL ROUNDED)
PRESENT. VERY SANDY AND CLAYEY ZONE 642-642.5'. CLAY
DECREASES BELOW THIS.

	Comments	Age indicators
650	Thin section: Limestone is partly dolomitized, with calcareous oysters, foraminifera, and echinoids.	
649.1-649.9		Molluscan assemblage indicates lower Oligocene deposition. *Chamelea mississippiensis* and *Turritella caelatura*? are reported from the lower Oligocene of Mississippi.
651.2-651.3		Strontium ratio indicates: 31.10 Ma (BIG).
651.8-652	Barren of dinocysts.	
657-657.5	Duricrust overlain by breccia.	
658.7-659.2		Molluscan assemblage indicates lower Oligocene deposition. *Chamelea mississippiensis* is reported from the lower Oligocene of Mississippi.
659		Strontium ratio indicates: 30.3 Ma (Rutgers).
660.2-660.6		Molluscan assemblage indicates lower Oligocene deposition. *Chamelea mississippiensis* is reported from the lower Oligocene of Mississippi.
662	Thin section: Dolostone with mollusk molds, ostracodes, bryozoans, echinoids, and foraminifer. Fossils are partly replaced by dolomite and partly remain calcite.	

647.5- 652 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: COARSE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-01%
FOSSILS: FOSSIL FRAGMENTS, BRYOZOA, MOLLUSKS, FOSSIL MOLDS
MINOR MOLDIC POROSITY 648-650'. SAND VARIABLE 10-50%. SAND CONTENT INCREASES TO 35% AVERAGE BELOW 650'. INCIPIENT DOLOMITE. OYSTER, FORAMS, ECHINOIDS. FEWER MOLLUSK MOLDS 650-652'.

652 - 655 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: COARSE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-01%
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS, MOLLUSKS, BRYOZOA
FOSSILS ARE WEATHERED. ALGAE? PELLETS?

655 - 659 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: COARSE TO VERY FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED, LAMINATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-01%
PYRITE-01%
FOSSILS: MOLLUSKS
MOTTLED WITH SULFIDES AND VERY MINOR CLAY. LAMINATIONS PRESENT BELOW 657'. DURACRUST WITH BRECCIA OVERLYING IT 657-657.5'.

659 - 662 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-20%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
PACKSTONE-WACKESTONE. SHELL FRAGMENTS ARE PUNKY, WEATHERED. MINOR SHELL MOLDS. SAND INCREASES AND SHELLS DECREASE WITH DEPTH.

	Comments	Age indicators
669	Thin section: Slightly laminated, sucrosic dolostone with no fossils. This sample lies above a breccia zone in lowermost Arcadia.	
669.2	Breccia with crust.	
673	Thin section: Limestone with micritized grains and fossils, leached foraminifera, echinoids, and red algae; coated grains and calcareous nodules are possibly pedogenic.	
	SUWANNEE LIMESTONE	
674.2	Top of the Suwannee Limestone at a burrowed surface, below a brecciated zone. Crust.	
674.2-679	Coquina.	
677	Thin section: Limestone with leached mollusk, and unleached ostracodes, bryozoans, and forams.	

662 - 667 SAND; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
ROUNDNESS: ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: DOLOMITE-40%, PHOSPHATIC SAND-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILS: MOLLUSKS
NOT AS DOLOMITIZED 663-664'; PHOSPHATE TO 5%.; DIFFICULT TO TELL DIFFERENCE BETWEEN DOLOMITE CRYSTALS AND SAND BELOW 664'. VERY HIGHLY RECRYSTALLIZED.

667 - 668.8 AS ABOVE
EVEN MORE HIGHLY RECRYSTALLIZED THAN ABOVE--PROBABLY MORE DOLOMITIC THAN ABOVE. MOTTLED AND BIOTURBATED.

668.8- 671 LIMESTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC SAND-02%
BRECCIA. GOOD CLASTS WITH CRUSTS DEVELOPED ON THEM PRESENT AT 669.2' AND 671'.

671 - 674.2 LIMESTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MOTTLED, BIOTURBATED
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
SAND 1% OR LESS.

674.2- 679 LIMESTONE; YELLOWISH GRAY
POROSITY: POSSIBLY HIGH PERMEABILITY, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY COARSE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, BRYOZOA
PACKSTONE. MUCH MORE POROUS AND PERMEABLE THAN ABOVE. GRAIN SIZE INCREASES WITH DEPTH.

	Comments	Age indicators
679-683	Oolitic limestone; peloidal in places.	
682-701	Cyclic deposition with cycle tops at 682, 686, 694, and 696.5 . Cycles lighten upward and are characterized by an upward decrease in fossil content. The cycle from ~686 to 682 is a coquina from 685.2 - 683.	682.3-682.7 Identifiable mollusk *Chione bainbridgensis* indicates lower Oligocene deposition. 683-683.7 Strontium ratio indicates: 30.96 Ma (BIG). 683.0-683.7 Identifiable mollusk *Chione bainbridgensis* indicates lower Oligocene deposition. 684-685 Identifiable mollusks *Chione bainbridgensis* and *Scapharca invidiosa* indicate lower Oligocene deposition. 687.6 Identifiable mollusk *Scapharca invidiosa* indicates lower Oligocene deposition. 688.2-688.6 Identifiable mollusk *Turritella* sp. cf. *T. boycensis*. *T. boycensis* indicates lower Oligocene deposition. 690.3-690.7 Identifiable mollusks *Chione bainbridgensis?* and *Glyptoactis serricosta brooksvillensis* indicate lower Oligocene deposition.

679 - 682 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: COARSE TO FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-05%
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BENTHIC FORAMINIFERA
FOSSIL MOLDS
UP TO 5-8% QUARTZ SAND PRESENT. NO PHOSPHATE.

682 - 685.5 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: VERY COARSE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BRYOZOA, FOSSIL MOLDS
BENTHIC FORAMINIFERA
MUCH MORE POROUS AND PERMEABLE THAN ABOVE. LARGE MOLLUSK
MOLDS PRESENT NEAR TOP OF INTERVAL. PACKSTONE-GRAINSTONE.

685.5- 687.5 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: COARSE TO FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, MOLLUSKS
FOSSIL MOLDS
FAIRLY WELL SORTED PACKSTONE TO GRAINSTONE.

687.5- 694 LIMESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
95% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: VERY COARSE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, MOLLUSKS
FOSSIL MOLDS
FRIABLE.

	Comments	Age indicators
697-697.5	Barren of dinocysts.	

694 - 696 LIMESTONE; YELLOWISH GRAY
POROSITY: POSSIBLY HIGH PERMEABILITY, INTERGRANULAR
MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: COARSE TO FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, MOLLUSKS, BENTHIC FORAMINIFERA
FOSSIL MOLDS
FRIABLE. MISSING SOME MATERIAL 683-695'. MUDDIER AND LESS
RECRYSTALLIZED THAN ABOVE.

696 - 698.5 LIMESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MEDIUM TO VERY FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, MOLLUSKS
ECHINOID

698.5- 701 LIMESTONE; VERY LIGHT GRAY TO WHITE
POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MEDIUM TO VERY FINE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
BECOMES MUDDIER WITH DEPTH. POOR RECOVERY (RUBBLY)
699-701'.

701 TOTAL DEPTH

Appendix 2. Dinocyst sample descriptions.

The South Venice core was assigned U.S. Geological Survey Paleobotanical Number R4783.

19 ft depth (R4783BX) contains a sparse, but well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and species of *Spiniferites*. Dinocysts are:

Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Spiniferites mirabilis (Rossignol) Sarjeant
Spiniferites spp.
Tuberculodinium vancampoae (Rossignol) Wall

Age: based on occurrences alone, the age could be Miocene to Holocene. Because all the species present are extant, the assemblage is most likely to be younger than the highest occurrences of Pliocene and Pleistocene species, and thus Holocene in age.

39.5-39.7 ft depth (R4783BS) contains a well preserved dinocyst assemblage dominated by species of *Spiniferites*. Dinocysts are:

Achomosphaera sp.
Brigantedinium cariacoensis (Wall) Lentin & Williams ?
Forma D of Wrenn and Kokinos (1986)
Hystrichokolpoma rigaudiae Deflandre & Cookson
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Nematosphaeropsis rigida Wrenn
Operculodinium centrocarpum (Deflandre & Cookson) Wall(transitional to *O. israelianum*)
Operculodinium centrocarpum sensu Wall (1967)
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Spiniferites mirabilis (Rossignol) Sarjeant
Spiniferites spp.
Tectatodinium pellitum Wall
Tuberculodinium vancampoae (Rossignol) Wall

Age: late Miocene, Pliocene, or Pleistocene; above the highest occurrences of late Miocene species. The highest occurrence of *H. rigaudiae* is within the Pleistocene according to Williams and others (1993).

54.3-54.5 ft depth (R4783BQ) contains a well preserved dinocyst assemblage in which no particular species was dominant. Dinocysts are:

Achomosphaera andalousiensis Jan du Chêne
Barssidinium sp.
Brigantedinium sp.
Corrudinium? sp.
Forma D of Wrenn and Kokinos (1986)
Lejeunecysta sp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Nematosphaeropsis sp.
Operculodinium centrocarpum(transitional to *O. israelianum*)
Operculodinium centrocarpum sensu Wall (1967)
Operculodinium sp.
Polysphaeridium zoharyi (Rossignol) Bujak et al.

Selenopemphix brevispinosa Head et al. sensu lato
Selenopemphix nephroides Benedek
Spiniferites mirabilis (Rossignol) Sarjeant
Spiniferites splendidus Harland
Spiniferites spp.
Sumatradinium sp.
Tuberculodinium vancampoae (Rossignol) Wall

Age: late Miocene or Pliocene, more likely to be Pliocene because it is above the highest occurrences of late Miocene species.

64.3-64.5 ft depth (R4783BP) contains a dinocyst assemblage in which no particular species was dominant. Preservation is fair. Dinocysts are:
Achomosphaera andalousiensis Jan du Chêne
Brigantedinium cariacoensis (Wall) Lentin & Williams
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Lejeunecysta spp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Nematosphaeropsis rigida Wrenn
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Operculodinium cf. *giganteum* of Manum and others (1989)
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Selenopemphix brevispinosa Head et al. sensu lato
Selenopemphix sp.
Spiniferites mirabilis (Rossignol) Sarjeant
Spiniferites splendidus Harland ?
Spiniferites spp.
Trinovantedinium sp.
Tuberculodinium vancampoae (Rossignol) Wall

Age: late Miocene, based on the overlap of the ranges of *A. andalousiensis* and *H. obscura* (most authors show the range top of *H. obscura* at the top of the Miocene; however, Williams and others (1993) extend it into the Pliocene).

70-70.2 ft depth (R4783BN) contains a moderately well preserved dinocyst assemblage dominated by cysts of the family Congruentidiaceae. Dinocysts are:
Batiacasphaera sphaerica Stover
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Lejeunecysta spp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Multispinula? sp.
Operculodinium sp.
Quadrina ?condita Verteuil & Norris
Reticulatasphaera actinocoronata (Benedek) Bujak & Matsuoka
Selenopemphix brevispinosa subsp. *conspicua* Verteuil & Norris
Spiniferites pseudofurcatus (Klumpp) Sarjeant
Spiniferites spp.
Tectatodinium pellitum Wall
Trinovantedinium harpagonium Verteuil & Norris
Trinovantedinium papulum Verteuil & Norris ?

Trinovantedinium? *xylochoporum* Verteuil & Norris
Tuberculodinium vancampoae (Rossignol) Wall

Age: middle or late Miocene, most likely late Miocene because this is above the highest occurrence of *Labyrinthodinium truncatum.*

72-72.2 ft depth (R4783BM) contains a well preserved dinocyst assemblage dominated by species of Spiniferites. Cysts of the family Congruentidiaceae are common. Dinocysts are:
Batiacasphaera sphaerica Stover
Brigantedinium cariacoensis (Wall) Lentin & Williams ?
Dapsilidinium pseudocolligerum (Stover) Bujak et al.
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Lejeunecysta spp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Multispinula? sp.
Nematosphaeropsis sp.
Operculodinium sp.
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Quadrina cf. *Q.*? *condita* Verteuil & Norris
Selenopemphix dionaeacysta Head et al.
Selenopemphix nephroides Benedek
Selenopemphix sp.
Spiniferites pseudofurcatus (Klumpp) Sarjeant
Spiniferites spp.
Tectatodinium pellitum Wall
Trinovantedinium papulum Verteuil & Norris ?
Trinovantedinium? *xylochoporum* Verteuil & Norris
Tuberculodinium vancampoae (Rossignol) Wall

Age: middle or late Miocene, most likely late Miocene because this is above the highest occurrence of *Labyrinthodinium truncatum.*

81.8 ft depth (R4783C) contains a sparse, but moderately well preserved dinocyst assemblage dominated by species of *Spiniferites* and *Hystrichokolpoma rigaudiae.* Dinocysts are:
Erymnodinium delectabile (Verteuil & Norris) Lentin et al. ?
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Labyrinthodinium truncatum Piasecki
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Melitasphaeridium choanophorum (Deflandre & Cookson) Harland & Hill
Multispinula quanta Bradford
Operculodinium spp.
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Selenopemphix dionaeacysta Head et al.
Selenopemphix nephroides Benedek
Spiniferites mirabilis (Rossignol) Sarjeant
Spiniferites spp.
Sumatradinium sp.
Tectatodinium pellitum Wall
Trinovantedinium sp.
Tuberculodinium vancampoae (Rossignol) Wall

Age: middle Miocene (or earliest late Miocene) based on the range of *L. truncatum.*

103.4-103.7 ft depth (R4783BJ) contains a moderately well preserved dinocyst assemblage. No species is particularly dominant. Dinocysts are:

Areoligera sp.
Batiacasphaera sphaerica Stover
Cerebrocysta n. sp.
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Impagidinium patulum (Wall) Stover & Evitt
Invertocysta lacrymosa Edwards ?
Labyrinthodinium cf. *L. truncatum* Piasecki
Lejeunecysta communis Biffi & Grignani
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Melitasphaeridium choanophorum (Deflandre & Cookson) Harland & Hill
Operculodinium centrocarpum sensu Wall (1967)
Operculodinium israelianum (Rossignol) Wall
Operculodinium n. sp. aff. *O. placitum* Drugg & Loeblich
Operculodinium cf. *giganteum* of Manum and others (1989)
Pentadinium sp. cf. *P. laticinctum granulatum* of Edwards (1990)
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Reticulatasphaera actinocoronata (Benedek) Bujak & Matsuoka
Spiniferites pseudofurcatus (Klumpp) Sarjeant
Spiniferites spp.
Tectatodinium pellitum Wall

Age: probably middle Miocene.

125.5 ft depth (R4783B) contains a well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and species of *Spiniferites*. Cysts of the family Congruentidiaceae are common. Dinocysts are:

Apteodinium tectatum Piasecki
Areoligera sp.
Brigantedinium simplex (Wall) Lentin & Williams ?
Cribroperidinium tenuitabulatum (Gerlach) Helenes
Heteraulacacysta sp.
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Lejeunecysta communis Biffi & Grignani
Lejeunecysta globosa Biffi & Grignani
Lejeunecysta spp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Multispinula quanta Bradford
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Quadrina cf. *Q.*? *condita* Verteuil & Norris
Selenopemphix nephroides Benedek
Selenopemphix? n. sp.
Spiniferites spp.
Sumatradinium hispidum (Drugg) Lentin & Williams
Sumatradinium soucouyantae Verteuil & Norris
Systematophora placacantha (Deflandre & Cookson) Davey et al.
Trinovantedinium papulum Verteuil & Norris
Trinovantedinium cf. *T. harpagonium* Verteuil & Norris

Tuberculodinium vancampoae (Rossignol) Wall

Age: middle Miocene, or possibly early. The highest occurrence of *C. tenuitabulatum* (middle part of the middle Miocene according to Williams and others, 1993) places an upper limit on the age.

135-135.2 ft depth (R4783BG) contains a moderately well preserved dinocyst assemblage. No species is particularly dominant. Dinocysts are:

Cribroperidinium tenuitabulatum (Gerlach) Helenes
Hystrichokolpoma sp.
Hystrichosphaeropsis obscura Habib
Lejeunecysta fallax (Mogenroth) Artzner & Dörhöfer
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Melitasphaeridium choanophorum (Deflandre & Cookson) Harland & Hill
Multispinula quanta Bradford
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Selenopemphix sp. (spiny)
Spiniferites spp.
Systematophora placacantha (Deflandre & Cookson) Davey et al.
Tectatodinium pellitum Wall
Tuberculodinium vancampoae (Rossignol) Wall

Age: middle Miocene, or possibly early.

190.2-190.5 ft depth (R4783BD) contains only a few partial specimens of dinocysts:

Cribroperidinium tenuitabulatum (Gerlach) Helenes
Polysphaeridium zoharyi (Rossignol) Bujak et al.

Age: middle Miocene, or possibly early.

238.8-240 ft depth (R4783BA) contained a well preserved dinocyst assemblage dominated by *Polysphaeridium zoharyi* and *Cribroperidinium tenuitabulatum*. Dinocysts are:

?*Barssidinium graminosum* Lentin et al.
Batiacasphaera sphaerica Stover ?
Cribroperidinium tenuitabulatum (Gerlach) Helenes
Dapsilidinium pseudocolligerum (Stover) Bujak et al.
Heteraulacacysta sp.
Hystrichokolpoma rigaudiae Deflandre & Cookson
Hystrichosphaeropsis obscura Habib
Lejeunecysta beninensis Biffi & Grignani
Lejeunecysta sp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Operculodinium centrocarpum sensu Wall (1967)
Operculodinium israelianum
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Spiniferites spp.
Tectatodinium pellitum Wall
Trinovantedinium sp.
Trinovantedinium capitatum Reid
Tuberculodinium vancampoae (Rossignol) Wall

Age: The highest occurrence of *C. tenuitabulatum* (middle part of the middle Miocene according to Williams and others, 1993) places an upper limit on the age. *B. graminosum* has been reported only from the latest middle and late Miocene (Lentin and others, 1994), but this species is only questionably identified here.

252.5-252.8 ft depth (R4783AZ) contains a well-preserved dinocyst assemblage dominated by species of *Spiniferites*. Dinocysts are:

Cordosphaeridium sp. intermediate between *C. inodes* (Klumpp) Eisenack and *C. cantharellum*(Brosius) Gocht
Cribroperidinium tenuitabulatum (Gerlach) Helenes
Hystrichokolpoma rigaudiae Deflandre & Cookson
Lejeunecysta sp.
Lingulodinium machaerophorum (Deflandre & Cookson) Wall
Pentadinium sp. cf. *P. laticinctum granulatum* of Edwards (1990)
Pentadinium sp. I of Edwards (1990)
Polysphaeridium zoharyi (Rossignol) Bujak et al.
Spiniferites spp.
?*Sumatradinium* sp.
Tectatodinium pellitum Wall
Tuberculodinium vancampoae (Rossignol) Wall

Age: According to Edwards (1990), *Pentadinium* sp. cf. *P. laticinctum granulatum* and *Pentadinium* sp. I overlap in the Marks Head Formation in South Carolina which has been dated as early Miocene (Abbott and Huddlestun (1980).

305-305.3 ft depth (R4783AV) contains a poorly preserved dinocyst assemblage dominated by *P. zoharyi*. Dinocysts are:

Adnatosphaeridium sp.
Cribroperidinium tenuitabulatum (Gerlach) Helenes
Multispinula quanta Bradford
Pentadinium sp. cf. *P. laticinctum granulatum* of Edwards (1990)
Polysphaeridium zoharyi (Rossignol) Bujak et al. (form with long processes)
Selenopemphix sp.
Spiniferites pseudofurcatus (Klumpp) Sarjeant
Spiniferites spp.
Tectatodinium pellitum Wall
Tuberculodinium vancampoae (Rossignol) Wall

Age: early Miocene, or possibly latest Oligocene. The lowest occurrences of *M. quanta* and *Tuberculodinium vancampoae* are found near the Oligocene/Miocene boundary (Powell, 1992; Stover, 1977; Williams and others, 1993). Edwards reported *Pentadinium* sp. cf. *P. laticinctum granulatum* from the Edisto and Marks Head Formations in South Carolina.

331.4-331.7 ft depth (4783AT) is barren.

466.8-467 ft depth (R4783AN) contains a sparse dinocyst assemblage dominated by *P. zoharyi*. Dinocysts are:

Brigantedinium simplex (Wall) Lentin & Williams
Hystrichokolpoma rigaudiae Deflandre & Cookson
?*Operculodinium centrocarpum* (Deflandre & Cookson) Wall
Polysphaeridium zoharyi (Rossignol) Bujak et al. (form with relatively short processes)
Spiniferites spp.

Age: late Oligocene or early Miocene.

501.3-501.6 ft depth (R4783AM) contains very few dinocysts. Only two forms were encountered:

Chiropteridium sp. (single specimen)

Polysphaeridium zoharyi (Rossignol) Bujak et al.(short processes, transitional to *P. congregatum*)

Age: late Oligocene or early Miocene.

583.8-584 ft (R4783AJ) contained only a single poorly preserved dinocyst.

?*Operculodinium centrocarpum* (Deflandre & Cookson) Wall

Age: nondiagnostic.

616.3-616.4 ft depth (R4783A) contains very few dinocysts. Only two forms were encountered:

Polysphaeridium congregatum (Stover) Bujak et al. (including forms transitional to *P. zoharyi*)

Riculacysta perforata Stover (single specimen)

Age: middle to late Oligocene, based on the overlap in ranges as reported by Stover (1977).

651.8-652 ft depth (R4783AE) is barren.

697-697.5 ft depth (4783AA) is barren.

Appendix 3.

Thin section sample descriptions

Arcadia Formation

All samples of the Arcadia Formation (upper undifferentiated) examined petrographically are pervasively dolomitized with extensive dissolution of skeletal and phosphatic grains, and of the dolomite rhombs that generally form the "matrix", indicating a complex diagenetic history of meteroic dissolution and dolomitization. Samples are described using the classification of Dunham, with the understanding that many of the original "grains" have been leached and are now porosity, and that, in many cases, the original calcareous mud matrix has been dolomitized, and is now a mosiac of dolomite rhombs. In some samples, due to extensive diagenetic alteration, a Dunham name is inadequate and the sample is simply described.

feet (meters)

81.5 (24.8) Dolo-packstone; skeletal grains include mollusk, bryozoan, and foraminifera molds (no shell material), dolomite-filled mollusk molds, and dolomitized coralline algae; other grains include quartz (~20%) and phosphate sand (<2%), multi-zoned and leached dolomite rhombs. The mollusks are now a mass of dark brown, inclusion-rich, leached dolomite with a non-planar fabric. Dolomitized mollusks are cemented with a lighter dolomite with more distinct rhombs, with relatively smaller leached centers compared to the dolomite infilling mollusk molds, indicating at least two generations of dolomitization. There is perhaps a third thin layer of unleached dolomite on void surfaces, having precipitated after the leaching of the earlier-formed dolomite.

94.5 (28.8) Dolo-wackestone; skeletal grains include mollusk, echinoid, and foraminifera molds, cemented by multi-zoned dolomite rhombs with a planar-s fabric, some rhombs have thick clear dolomite outer overgrowths. In contrast to the sample at 81.5 feet, the mollusks voids are not filled with dolomite. Dolomite rhombs forming the matrix are leached in zones as well as at their centers. This sample occurs at the very top of a dolostone section from ~123-95', and is overlain by a thin limestone.

113.5 (34.6) Phosphatic clast (reworked hardground?) overlain by a dolo-wackestone; skeletal grains include one small echinoid fragments and voids from unidentified platy fossils and *Turritella*; other grains include silt-sized quartz and phosphate grains. There are phosphatic clasts within the dolo-wackestone probably derived from the hardground surface. This sample is extremely leached, above and below the hardground surface, as indicated by partially dissolved echinoid fragments.

154.5 (47.1) Dolo-packstone (well-washed); all skeletal grains are leached and include pelecypod voids, bryozoans, ostracodes, foraminifera (soritids) (some of these fossils are visible in hand sample but are not well-resolved in thin section); other grains include fine quartz and coarse phosphate sand. The dolomite matrix is extremely leached and lacy, both the surfaces and centers of dolomite rhombs are leached. Classification of the dolomite mosiac fabric is difficult because leaching of dolomite obscures the grain boundaries.

186.5 (56.8) Dolo-wackestone (extremely leached); skeletal grains include fragments of echinoids, coralline algae, bryozoans (?) and small foraminifera; 1-3% quartz silt and sand, minor amounts of phosphate. In hand sample can see leached pelecypods and perhaps some ostracodes; the dolomitic matrix is two colors: grey and tan. This sample is 1/2 foot below a surface at 186'. Crystals in the tan areas are less well-defined, and have larger dark centers (leached areas) than the grey area where the rhombs are well formed and have fewer leached centers, which may indicate two generations of dolomite precipitation and two episodes of leaching. Classification of the dolomite mosiac fabric is difficult because leaching of dolomite obscures the grain boundaries.

200.0 (61.0) Sandy dolo-packstone; skeletal grains include mimically dolomitized coralline algae and echinoids, and leached and mosaically replaced bryozoans and foraminifera; other grains are quartz (~15%) and phosphate (~5%) sand. Dolomite rhombs of the matrix have leached centers. Dolomite grain boundaries are difficult to see to classify fabric.

210.0 (64.0) Dolo-wackestone (very coarse rhombs); all skeletal grains are leached and include fragments of coralline algae, bryozoan, mollusk molds, and echinoid; quartz and phosphate grains (combined ~5%), dolomite centers of the matrix (with a planar-s fabric) are not leached.

220.5 (67.2) Dolo-wackestone; skeletal grains include silicified fossils or their casts (echinoid fragments and gastropod molds), phosphatized bryozoans and echinoids. Other grains are phosphatized clasts with silica-filled fossil voids. The echinoid fragments are mimically replaced by silica. The etched dolomite rhombs that form the "matrix" are zoned and have a planar-e fabric. Compacted cutan-like structures (clay or micrite-lined voids) are scattered among the dolomite rhombs, suggesting possible soil origin.

228.0 (69.5) Sandy dolo-wackestone to packstone; skeletal grains include mollusk molds, leached bryozoan fragments, and foraminifera molds, and mimically dolomitized and leached coralline algae and echinoid fragments; other grains are quartz (5-10%) and phosphate (<2%) sand. The fabric of the dolomite mosaic ranges from planar-e to non-planar. This sample is extremely leached, even the phosphate grains.

234.0 (71.3) Dolo-wackestone; very large calcareous echinoid (sand dollar) pieces extend the full width of the thin section and are partially infilled with silica; other skeletal grains include bryozoans, oysters, and leached foraminifera; There are two matrix textures: one is medium grey, low porosity with a few dolomite rhombs with a planar-s fabirc, the other is more porous with larger

slightly interlocking dolomite rhombs with a planar-e fabric, some having leached centers, and occurs in elongate patches that may be void filling. Other grains include quartz and phosphate sands (combined ~5%).

234.5 (71.5) Dolo-wackestone; fossils are calcite and include bryozoans, mollusk molds, leached foraminifera (soritid type), coralline algae, and echinoids. There is silica in the echinoid pores. The dolomite matrix has a planar-e fabric and the rhombs are not as leached as they are at shallower depths. Burrows are filled with quartz and phosphate sand and calcareous fossils.

240.0 (73.2) Dolostone; only fossil in the sample is a leached and mimically replaced echinoid. Quartz silt and sand comprise 3-5%, and the matrix is a mosaic of interlocking dolomite rhombs with a planar-e fabric, with minor leaching in centers of the crystals.

243.0 (74.1) Dolo-wackestone; leached rhombs centers still visible; phosphatic sandy wackestone with large phosphate clast. Sample is at a contact of fine dolomitic mudstone with a darker phosphatic, leached sandy wackestone. The lower part has fine sand and phosphate grains, leached bivalves, possibly some bone fragment, and other holes. The upper part is more yellowish with fine phosphatic sand up to granules; fossils are encased in the phosphate grains and include echinoids, coralline algae, foraminifera, and bryozoans (?). Fossils in the dolomite rhomb matrix are all leached, only the ones encased in the phosphate clasts have resisted dissolution.

Tampa Member

(near the southern limit of the regional extent of the Tampa Member, and perhaps not typical Tampa lithology as described by Scott, 1988)

269.1 (82.0) Dolostone; very fine grain size, minor leaching of the rhomb centers; this sample is about a foot below a surface at 268' (top of a depositional unit), which is overlain by limestone. Leached skeletal grains include: bryozoans, foraminifera, and echinoids. Within the sample is a contact of recrystallized mudstone with phosphatic sand overlain by a phosphate layer (darker band) which is overlain by rubbly texture of clasts of different compositions with numerous phosphate granules. The dolomitic mosaic has a planar-e fabric. This sample has planar voids and laminar crusts that look like a soil.

271.7 (82.8) Dolo-mudstone; dolomite mosaic has a planar-e fabric and has few leached centers; skeletal grains include dolomitized coralline algae and echinoids; other grains include quartz and phosphate sands (combined >5%).

285.0 (86.9) Dolostone; skeletal grains and voids are all silicified and very hard to identify: foraminifera, echinoid, bryozoan; a very few euhedral dolomite rhombs have leached centers; other grains include quartz and phosphate grains, <1%.

310.0 (94.5) Wackestone; skeletal grains include leached foraminifera and ostracodes, sample is just below the contact of dolomite above and limestone below,

this sample is from slightly below 310' in the limestone; soil texures include mottled matrix with coated grains, bored or rooted, silicified in part; leached foraminifera; sand grains are dispersed (3-5%).

321.0 (97.8) Packstone; skeletal grains include oysters, leached and filled mollusks, ostracodes, bryozoans, echinoids, coralline algae, and foraminifera; the matrix is micrite. This sample is not very leached. Void filling is an isopachous and mosaic calcite, there is no dolomite.

Arcadia Formation
(lower undifferentiated)

334.0 (101.8) Sandstone with micrite cement; skeletal grains include oysters, leached mollusks, ostracodes, bryozoans, echinoids, coralline algae, and leached foraminifera; quartz sand forms ≤30%, and phosphate grains >2% .

347.5 (105.9) Sandstone/packstone; skeletal grains include calcareous bryozoans, echinoids, coralline algae, and foraminifera; calcareous matrix is well mixed (bioturbated) with small rhombs of dolomite, and no void cements; quartz sand ≤30% .

354.0 (107.9) Sandstone with micrite cement; skeletal grains include leached mollusks with micrite envelopes, ostracodes, bryozoans, coralline algae, and foraminifera; micrite-coated quartz grains (soil texture?), quartz sand ≤30%. No spar in voids.

358.2 (109.2) Sandy dolostone; very fine grained matrix with a planar-s fabric; no fossils observed; quartz sand <10%.

370.1 (112.8) Sandy wackestone; skeletal grains include oysters, ostracodes, echinoids, and foraminifera (some leached); matrix is porous and mottled; pyrite framboids; sand ≤20%. This sample is not very leached.

391.0 (119.2) Sandy packstone; skeletal grains include bryozoans with coarse calcite porosity filling, soritids (some crystals that line porosity are dolomite), mollusks, ostracodes, oysters, echinoderms, coralline algae, coral fragment, leached bryozoan; inicipient euhedral dolomite rhombs in the micritic matrix, ~15% sand.

402.0 (122.5) Sandstone/dolo-packstone; skeletal grains include leached mollusks, leached ostracodes, bryozoans, and foraminifera, and mimically dolmitized echinoids; shells have micrite envelopes with chambers filled with dolomite; cavities lined with dolomite rhombs; burrows (?) are filled with a coarser dolomite than the dolomicrite matrix; 30-40% sand.

424.5 (129.4) Dolomitic sandstone; skeletal grains include a ragged calcite oyster with knots of silica, half dolomite/half calcite echinoid fragment, calcite mollusk

cast (spar within micrite envelopes); dolomite is growing in the voids of the oyster as it breaks up; quartz sand 30-40%.

432.0 (131.7) Dolomitic sandstone; (dolomite has interlocking, non-planar fabric); skeletal grains include molluskmolds; quartz (~25%) and phosphate (<1%) sands. Matrix has a clotted texture, and is a bit cloudy. This sample differs from sample at 424 feet in that the mollusks have not been filled with sparry calcite, but remain voids. The last dolomite rhombs to be precipitation on the void surfaces have leached centers - anomalous at this depth.

The following (448 - 515.7) are from a laminated interval that has features of a supratidal environment: very few fossils, wavy lamination, and gypsum molds, absence of bioturbation.

448.0 (136.5) Dolomitic sandstone; skeletal grains include ostracode (only one attached to a dark mud clast) and foraminifera voids; matrix is faintly laminated with small amounts of silicification; no dolomite rhombs; quartz sand ~ 40-50%.

480.0 (146.3) Sandstone/dolomicrite; skeletal grains include calcareous mollusks (some leached), calcareous ostracodes, echinoids and foraminifera; horizontal laminae of silica. In hand sample dark leathery laminae (algal origin?) with delicate ostracodes and dolomite rhombs are seen. Faint peloidal structure in the dolomicrite between silica laminae. Cross-cutting relationships indicate that dolomitization postdates silicification because rhombs overgrow silica seams. Note: this may be a rare occurence of preserved mollusks.

482.5 (147.1) Dolo-micrite interbedded with siltstone-sandstone; skeletal grains include calcareous ostracodes, leached foraminifera, and echinoid fragments, and other unidentified calcareous fossils, dolomite rhombs, no algal structures; peloidal matrix texture between dark leathery laminae, small amounts of residual calcite, silt-to sand-sized quartz.

490.7 (149.6) Dolostone matrix with calcareous fossils: ostracodes, foraminifera, echinoderms, mollusks (may be replaced aragonite, structures are preserved, rare occurrence), coralline algae; quartz silt 20-30%. There are scattered rhombs of zoned dolomite in the mudstone matrix.

497.6 (151.7) Dolo-packstone; very fine dolosilt, with a non-planar fabric, with sharp edged voids, perhaps gypsum molds; skeletal grains include lots of leached foraminifera and ostracodes, some dolomitized echinoids, and a few mollusk molds; this sample is below a surface with rip-up clasts at 495'.

500.0 (152.4) Dolostone (same as 497.6)

515.7 (157.2) Dolostone (sparry)/sandstone; mottled, non-planar fabric; skeletal grain is a single faint phosphatized foraminifer; other grains are quartz sand (~40%).

569.0 (173.4) Sandy dolo-packstone; skeletal grains include bryozoan, echinoid, foraminifera, oyster, other mollusk voids, and unknown mollusk shell; matrix is loose framework of euhedral dolomite rhombs and phosphate

hardground rip-ups; there is no dolomite void filling; quartz and phosphate sand grains are ~25%.

597.0 (182.0) Dolo-micrite/dolo-packstone; skeletal grains limited to voids and quartz sand; mollusk and ostracode shapes can be made out but the other shapes are vaguely rectangular; matrix is a dolo-microsparite with a non-planar fabric; minor amounts of amorphous silica coat line some voids.

612.1 (186.6) Sandy dolostone (very fine grained, planar-e fabric); no fossils; grains include quartz (~20%) and phosphate (5%).

633.0 (193.1) Packstone; micritic matrix, skeletal grains include mollusk and foraminifera molds, oysters, ostracode, and leached bryozoans; equant calcite void filling, very little quartz sand.

635.0 (193.5) Chert/packstone; skeletal grains include leached mollusks, ostracodes, oyster, and echinoid; chert layer appears fractured with "veins" of calcite crystals; siliceous part has a rectilinear structure in cross-nicols that may be have pedogenic origin; limestone layer skeletal grains include echinoid spines, mollusk molds. The calcite crystals have an oblong shape suggesting that they may be psuedomorphs after gypsum.

650.0 (198.1) Sandy packstone (partly dolomitized); skeletal grains include some leached foraminifera, calcareous echinoids, gastropod molds, bryozoan fragment, oyster fragment with silica infilling; matrix is partly dolomitized, is a dark micrite, peloidal in places; quartz (~15%) and phosphate sand (1-2%).

662.8 (202.0) Sandy dolo-packstone (coarse); skeletal grains include leached mollusks, calcite and dolomitic ostracodes, calcite and dolomite bryozoans, calcite and dolomite (mimicly replaced) echinoids, calcite and dolomitic and leached foraminifera; dolomite mosaic is planar-e fabric; phosphatic clasts, and quartz sand (~20%).

666.3 (203.1) Dolomitic sandstone (coarse); no fossils observed; sand ~40%. (Same as 662.8 feet depth sample.)

669.0 (203.9) Sandy dolostone; this is the first dolomite above a breccia zone in lowermost Arcadia; dolomite is sucrosic with a planar-e fabric, has oxidized Fe-rich grains and silt-sized phosphate grains; no fossils visible; laminated in core. Looks very much like 666.3. and 662.8.

base of **Arcadia Formation**

Suwannee Limestone

All three samples in the Suwannee Limestone are similar in that they have a mottled, leached look, i.e., the fossils are very indistinct and may be microbially degraded, and can be classified as packstones.

673.0 (205.1) Packstone; skeletal grains include original, phosphatized, and leached foraminifera, echinoids, and algae; pedogenic structures such as coated grains and calcareous nodules with fissures, similar to 370'.

677.0 (206.3) Packstone; skeletal grains include leached mollusks, ostracodes, bryozoans, echinoids, and leached foraminifera in a micritic matrix; no leached void-lining cements.

696.0 (212.1) Foraminiferal packstone (well-washed); skeletal grains include foraminifera (some leached), leached mollusks, ostracodes, and echinoids, in a micrite matrix.