FLORIDA FOSSIL INVERTEBRATES

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PLIOCENE AND PLEISTOCENE ECHINOIDS

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FLORIDA FOSSIL INVERTEBRATES

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Florida Fossil Invertebrates is a publication of the Florida Paleontological Society, Inc., and is intended as a guide for identification of the many common invertebrate fossils found around the state. It will deal solely with named species; no new taxonomic work will be included. Two parts per year will be completed with the first three parts discussing echinoids. Part 1 (published June 2001) covered Eocene echinoids, Part 2 (published January 2002) pertained to Oligocene and Miocene echinoids, and Part 3 (June 2002 publication) is about Pliocene and Pleistocene echinoids. Part 4 (January 2003 publication) and Part 5 (June 2003 publication) will cover fossil decapods (crabs, shrimps, and lobsters). Each issue will be image-rich and, whenever possible, specimen images will be at natural size (1x). Some of the specimens figured in this series soon will be on display at Powell Hall, the museum's Exhibit and Education Center. **This publication is possible through the generous financial support of James and Lori Toomey.**

The Florida Paleontological Society, Inc., a non-profit group of avocational and professional paleontologists, is dedicated to the advancement of paleontology in Florida. Annual dues are $5.00 for Associate Membership (persons under age 18) and $15.00 for Full Membership and Institutional Subscriptions. Members receive the quarterly Florida Paleontological Society Newsletter, *Florida Fossil Invertebrates*, and another new series, *Fossil Species of Florida*, that will discuss a single taxon each issue. In addition, there are FPS sponsored fossil collecting trips (both invertebrate and vertebrate) in conjunction with our society meetings.

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INTRODUCTION

The Pliocene Epoch (5.3 to 1.8 million years ago) and Pleistocene Epoch (1.8 million to 10,000 years ago) of Florida are interesting with respect to species diversity of echinoids. The Pliocene formations contain 15 described species, while the Pleistocene formations have only six species. Two echinoids occur in both epochs, Clypeaster rosaceus (Linnaeus, 1758) and Clypeaster subdepressus (Gray, 1825) (see Table 1). The drastic decrease in echinoid diversity from the Pliocene to Pleistocene is partly an artifact of preservation potential, collector bias toward whole or nearly whole specimens, and epoch duration (the Pliocene having lasted 3.5 million years compared to 1.79 million years for the Pleistocene). Ten of the Florida Plio-Pleistocene echinoid species are still found today in our shallow coastal waters (which contain 27 living species). Two of these ten fossil species were assigned subspecific designations by Kier (1963), who described Lytechinus variegatus pluritubercula tus and Clypeaster rosaceus dalli based on consistent but minor differences when compared to the living species. In this work, however, we did not consider subspecies. Additionally, readers should be aware that not all of the echinoid species found in the Pliocene and Pleistocene are formally described or reported in the scientific literature yet and therefore are not included in this publication. Our work is continuing to describe the new echinoid species collected from rocks of both epochs.

GEOLOGICAL SETTING

The Pliocene stratigraphy of Florida is complex and far from being clearly defined and accepted by those geoscientists interested in that time period. The unifying theme throughout the Pliocene, just as it is through many of Florida's Cenozoic intervals, is the use of fossils to help identify the formations. It is inevitable that formation descriptions include paleontological discussions because some of the world's richest and most densely packed fossil beds are found in our state's strata (e.g., the Pinecrest beds of the Tamiami Formation). In some cases, bioclasts are more than 75% of the sediment component of the unit and many stratigraphers used fossils to aid in their stratigraphic descriptions. Therefore, formational boundaries and descriptions were debated in the past, and likely will continue to be in the future as research continues to clarify Pliocene stratigraphy in our state. Exposures of echinoderm-bearing Pliocene rocks in Florida can be found from the central panhandle region southward along the east and west coasts of the peninsula (Figure 1). Florida's Pliocene has many fossil-rich zones with five formations containing echinoids (Figure 2).

Florida Pliocene units range in composition from dominantly quartz sand beds, to carbonate-rich layers, to shell beds with little matrix. Variation in lithofacies occurs within the formations, but in general, these units tend to be higher in siliciclastic (i.e., quartz sand) content than the Paleogene formations. Thickness of the Pliocene units also varies significantly, ranging from only a few meters (in surface and subsurface intervals) to over 100 meters in the thickest sections (subsurface intervals only).

The Jackson Bluff Formation consists of varying amounts of limestone, shelly sands, and clays. The Intracoastal Formation is very sandy, poorly consolidated, and a locally clay-rich, calcarenite limestone. The Nashua Formation is a fossiliferous, sometimes clayey, quartz sand unit with variable concentrations of calcareous matrix. The fossil content (usually mollusks) also is variable, thereby producing a formation that ranges from shelly sand to a shell hash. The Tamiami Formation is well known for fossil echinoids [particularly the sand dollar Encope tamiamiensis (Mansfield, 1932)], and the lithology varies from limestone to shelly sands and clay-rich zones. Most of the echinoids found in the Tamiami Formation are from beds that range from a poorly indurated, quartz sand facies to sandy clay facies (sometimes called barnacle-echinoid-oyster facies). Other units are poorly to moderately indurated, sandy limestone facies or a shelly, quartz sand facies (i.e., the mollusk-rich portion also known as the Pinecrest beds or Pinecrest sand). Finally, the last of the five Pliocene units that contain fossil echinoids is the Caloosahatchee Formation. The Caloosahatchee is well known for its densely packed molluscan shell beds in portions of the formation, but it also contains echinoids. Most of the Caloosahatchee

beds are poorly consolidated sandy marls, while some beds have been converted to hard limestones or calcarenites by the action of groundwater and/or subaerial weathering. For interested readers, more details for each Pliocene formation can be found in publications cited in the suggested reading list as well as throughout numerous Florida Geological Survey publications.

Exposures of Pleistocene echinoid-bearing rocks in Florida are distributed only in the peninsular region of the state and most occurrences are recorded along the east coast (Figure 3). Five Pleistocene formations in Florida have records of echinoderms, including the Miami Limestone and the Anastasia, Satilla, Fort Thompson, and Bermont formations (Figure 4). Just as with the older fossiliferous units in the state, stratigraphic definitions and boundaries are under debate for the Pleistocene formations. The lithology of these units ranges from dominantly quartz sand with limited fossils in the Satilla Formation, to interbedded quartz sands and well-cemented coquinas in the Anastasia Formation, to shell-rich, unconsolidated sandy marls in the Bermont and Fort Thompson formations. The Miami Limestone is composed of two primary facies, including a bryozoan-rich facies and an oolitic facies, both of which are dominantly sandy limestones with localized concentrations of fossils (particularly in the bryozoan facies). The thickness of the Pleistocene formations ranges from less than one meter in outcrop to nearly 38 meters in the subsurface.

Two important points must be noted regarding the stratigraphy and our use of formation names in this paper. First, our use of the Tamiami Formation identifies no formal subunits or members. Much debate and controversy exists regarding the status of portions of the Tamiami, including the Bayshore Clay and Murdock Station members (lower? Tamiami Formation) and the Buckingham limestone, Ochopee limestone, and Pinecrest beds or Pinecrest sand (upper? Tamiami Formation). Some geologists believe these members should be elevated to formation status while others believe no differentiation of the members is necessary. It is not the purpose of this paper to debate the merits of these stratigraphic designations, yet we do want the readers to recognize that some echinoids are found only in certain facies of the Tamiami Formation and not throughout the unit.

The second point is regarding the age of the stratigraphic units. In this paper, the Caloosahatchee and Nashua formations are listed as being only Pliocene (Figure 2) even though we recognize that these formations may cross into the Pleistocene Epoch. We cannot determine with certainty the exact chronological age for all of the fossil echinoids since most are collected as spoil. Therefore, we have chosen to include them solely in the Pliocene, even though this may be a simplified approach to a complex problem in determining the stratigraphic range of these Florida fossils.

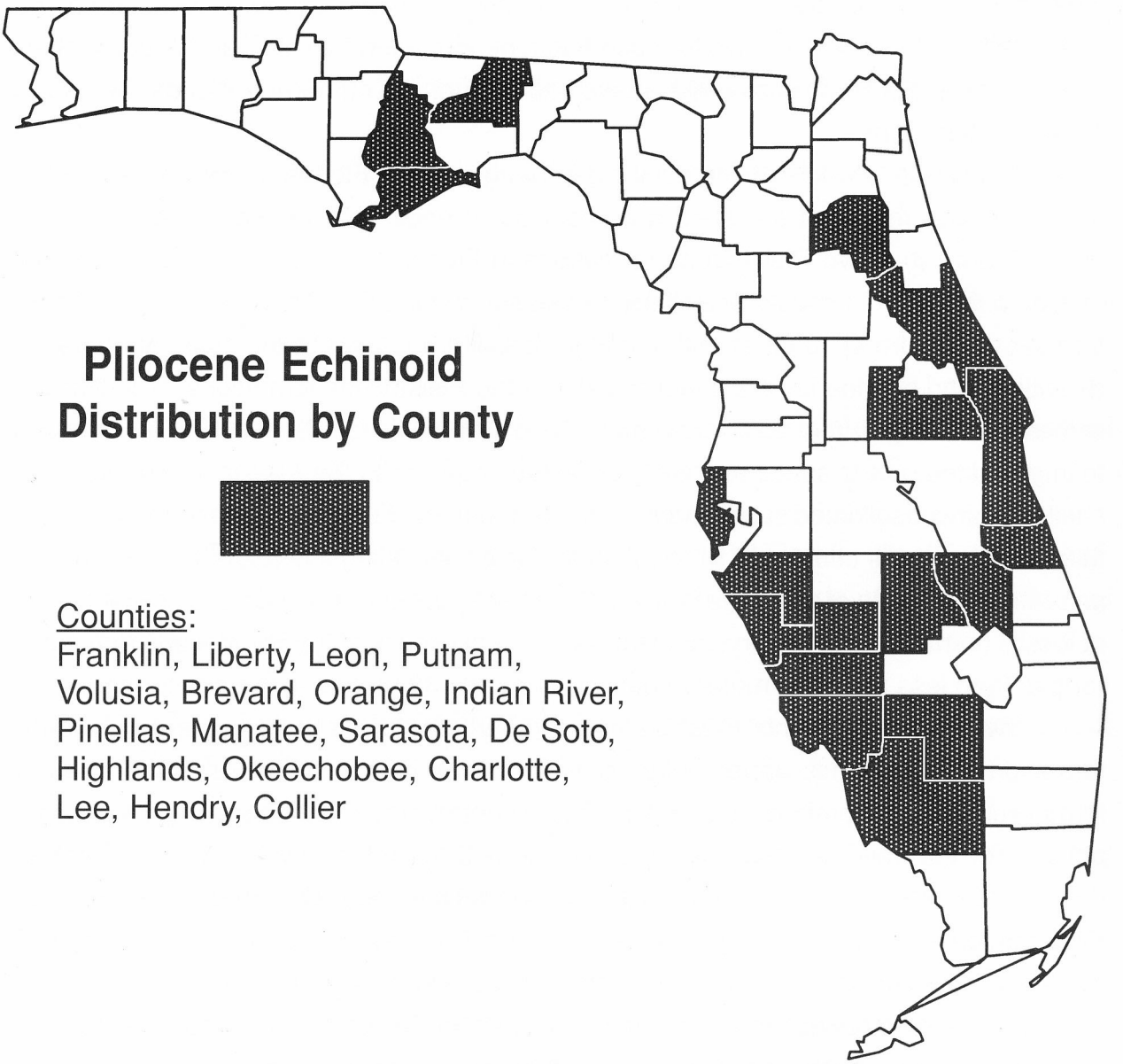


Figure 1. Pliocene echinoid distribution in Florida. Shaded counties have records of echinoids from surface exposures, quarries (mined above groundwater or below groundwater levels), and along rivers or streams (either above or below water level). Data are from the Invertebrate Paleontology Collection in the Florida Museum of Natural History in Gainesville, Florida.

EPOCH	STRATIGRAPHIC UNITS		
Pliocene	Nashua Formation	Caloosahatchee Formation	
	Jackson Bluff Formation	Intracoastal Formation	Tamiami Formation

Figure 2. Pliocene stratigraphic units containing echinoids.

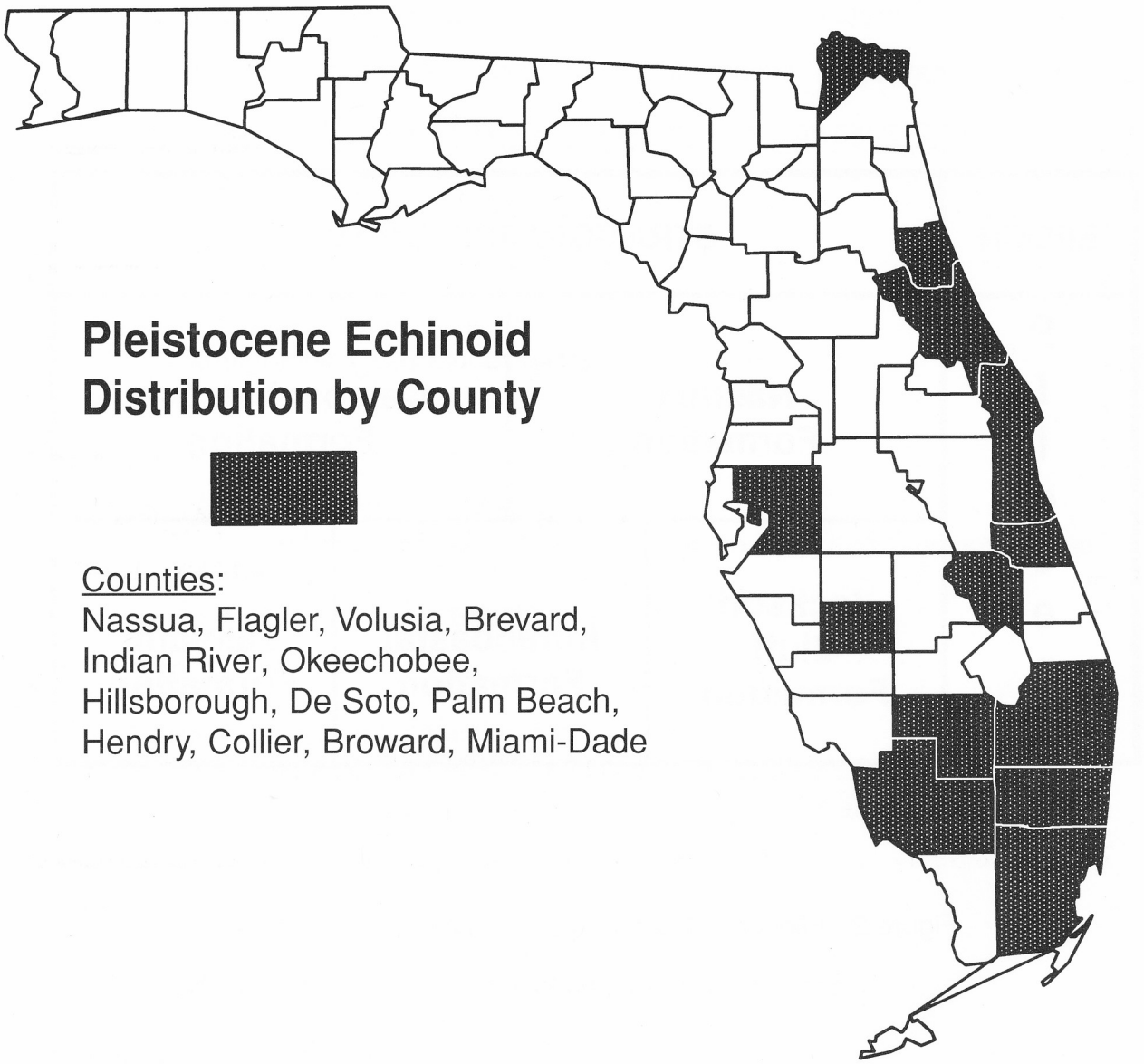


Figure 3. Pleistocene echinoid distribution in Florida. Shaded counties have records of echinoids from surface exposures, quarries (mined above groundwater or below groundwater levels), and along rivers or streams (either above or below water level). Data are from the Invertebrate Paleontology Collection in the Florida Museum of Natural History in Gainesville, Florida.

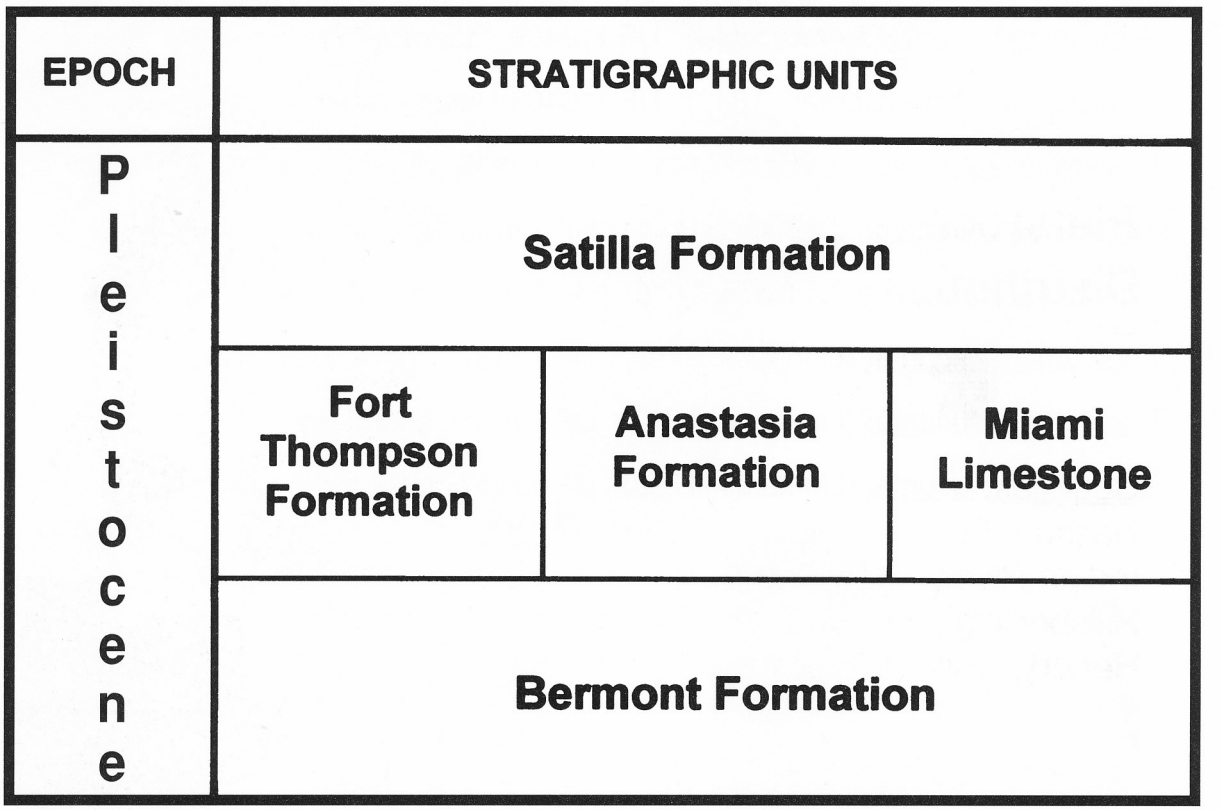


Figure 4. Pleistocene stratigraphic units containing echinoids.

PLATE 1 (PLIOCENE AND/OR PLEISTOCENE ECHINOIDS)

A) Eucidaris tribuloides (Lamarck, 1816); UF 72022; aboral view of collapsed test; 1x.

B) Eucidaris tribuloides (Lamarck, 1816); UF 72022; adoral view of collapsed test showing partially exposed lantern; 1x.

C) Arbacia improcera (Conrad, 1843); UF 110409; aboral view; 1x.

D) Arbacia improcera (Conrad, 1843); UF 110409; adoral view; 1x.

E) Arbacia improcera (Conrad, 1843); UF 110409; lateral view; 1x.

F) Lytechinus variegatus (Lamarck, 1816); UF 12895; aboral view; 1x.

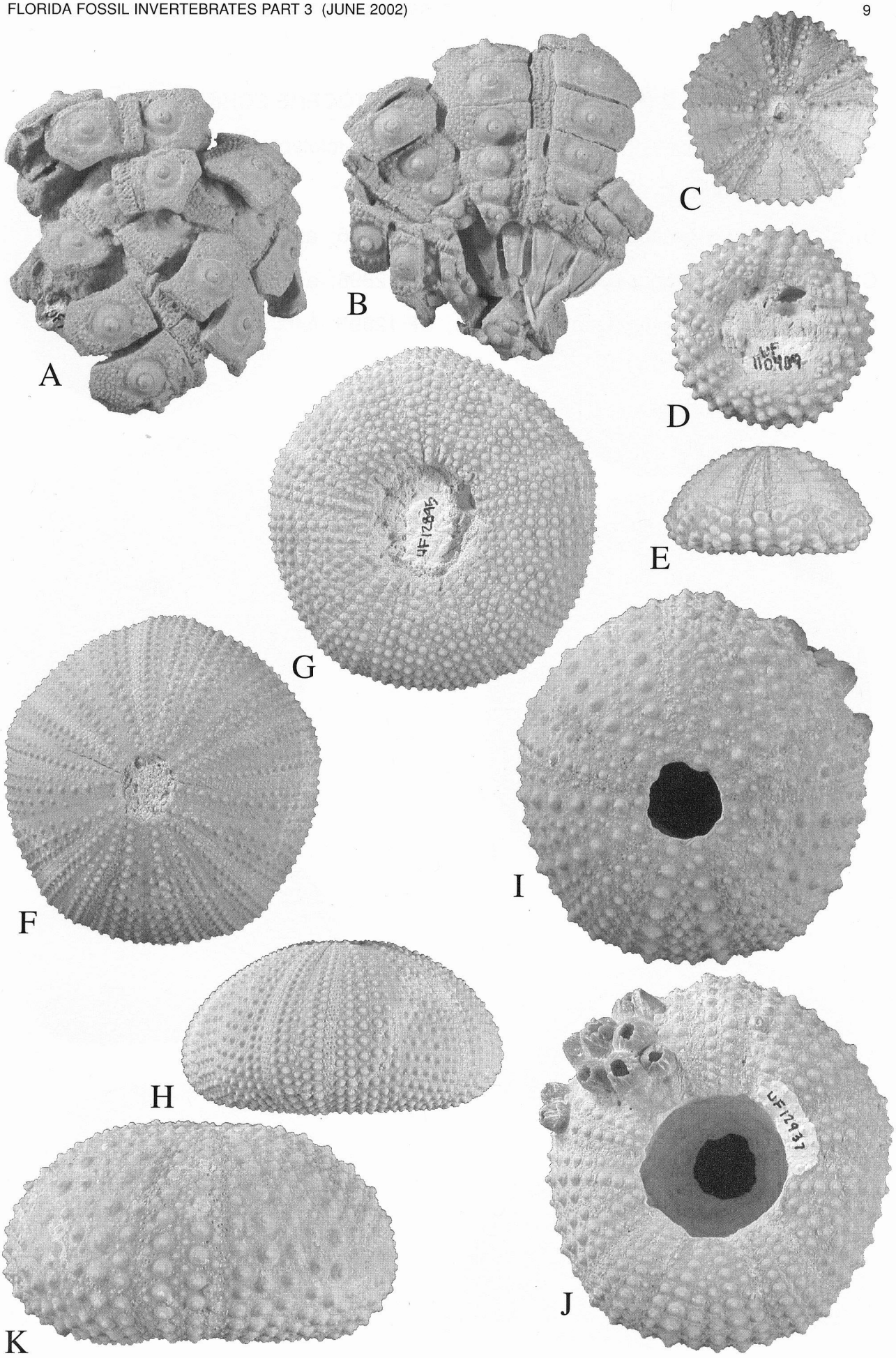
G) Lytechinus variegatus (Lamarck, 1816); UF 12895; adoral view; 1x.

H) Lytechinus variegatus (Lamarck, 1816); UF 12895; lateral view; 1x.

I) Echinometra lucunter (Linnaeus, 1758); UF 12937; aboral view; 1x.

J) Echinometra lucunter (Linnaeus, 1758); UF 12937; adoral view; 1x.

K) Echinometra lucunter (Linnaeus, 1758); UF 12937; left lateral view; 1x.


A
B
C
D
E
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G
H
I
J
K

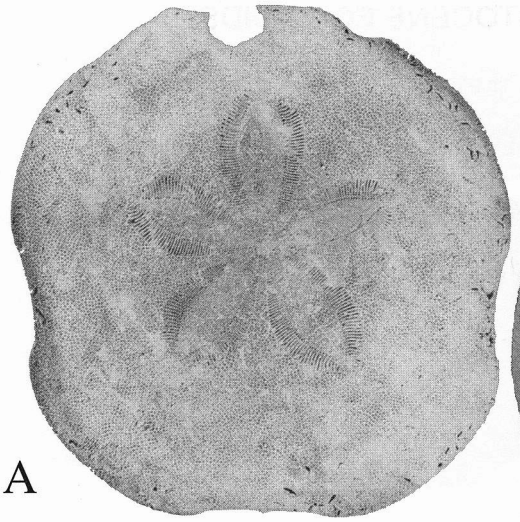
PLATE 2 (PLIOCENE AND/OR PLEISTOCENE ECHINOIDS)

A) Clypeaster crassus Kier, 1963; USNM 648142 (Holotype); taken from Kier,1963, plate 11, figure 1; aboral view; 1x.

B) Clypeaster rosaceus (Linnaeus, 1758); UF 12896; aboral view; 1x.

C) Clypeaster rosaceus (Linnaeus, 1758); UF 12896; adoral view; 1x.

D) Clypeaster rosaceus (Linnaeus, 1758); UF 12896; left lateral view; 1x.



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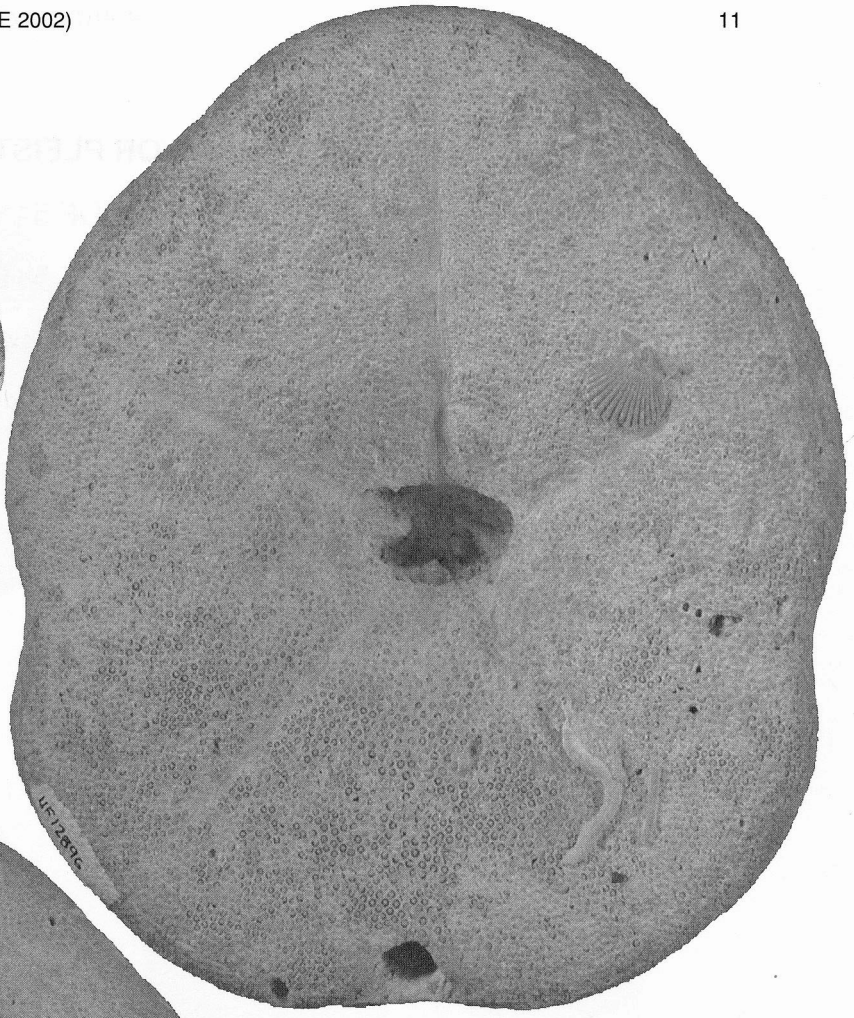

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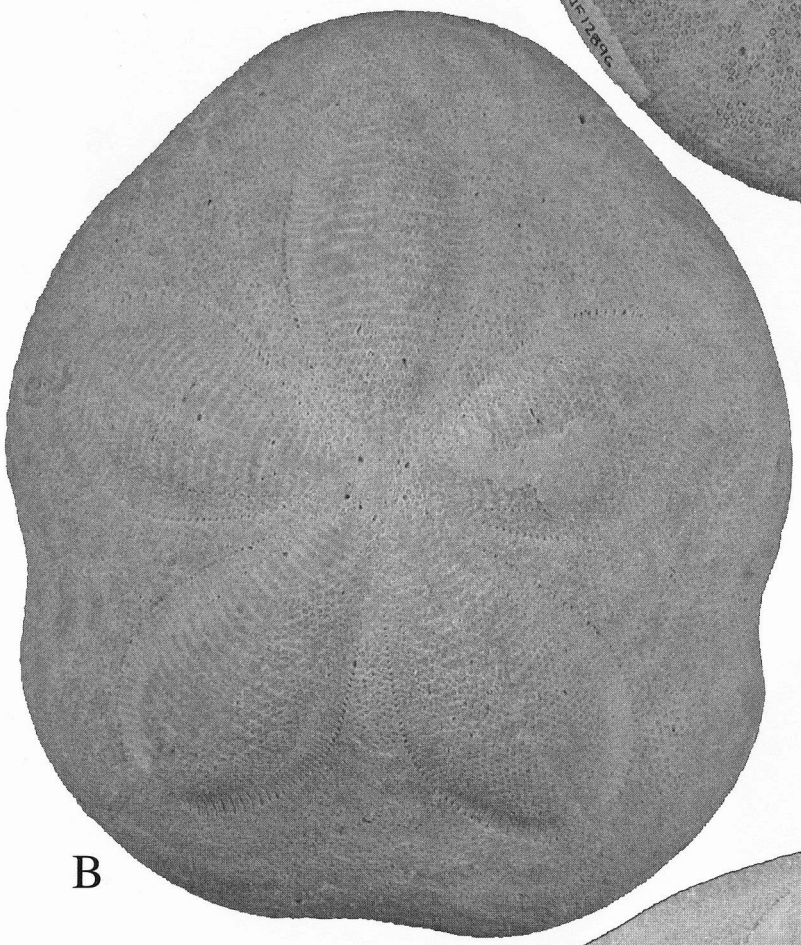

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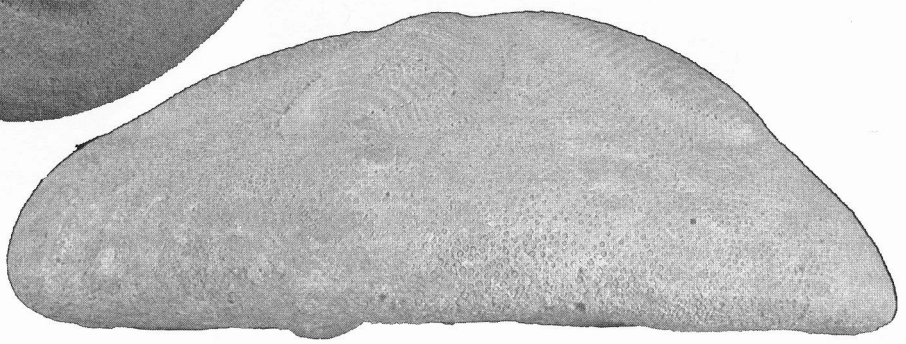


D

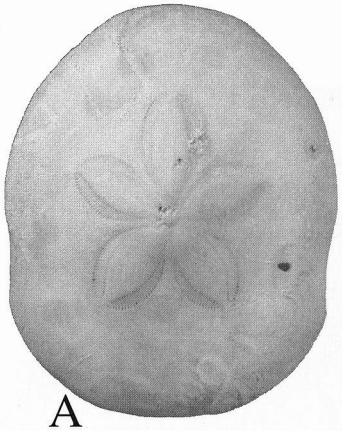
PLATE 3 (PLIOCENE AND/OR PLEISTOCENE ECHINOIDS)

A) Clypeaster subdepressus (Gray, 1825); UF 54188; aboral view of juvenile; 1x.

B) Clypeaster subdepressus (Gray, 1825); UF 54188; adoral view of juvenile; 1x.

C) Clypeaster sunnilandensis Kier, 1963; UF 22148A; aboral view; 1x.

D) Clypeaster sunnilandensis Kier, 1963; UF 22148B; adoral view; 1x.



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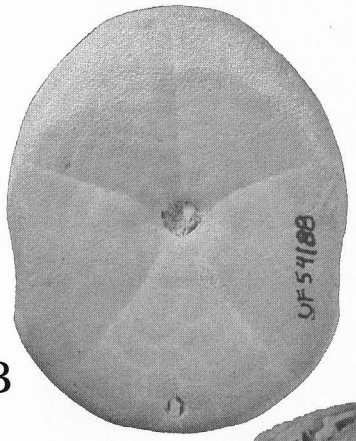

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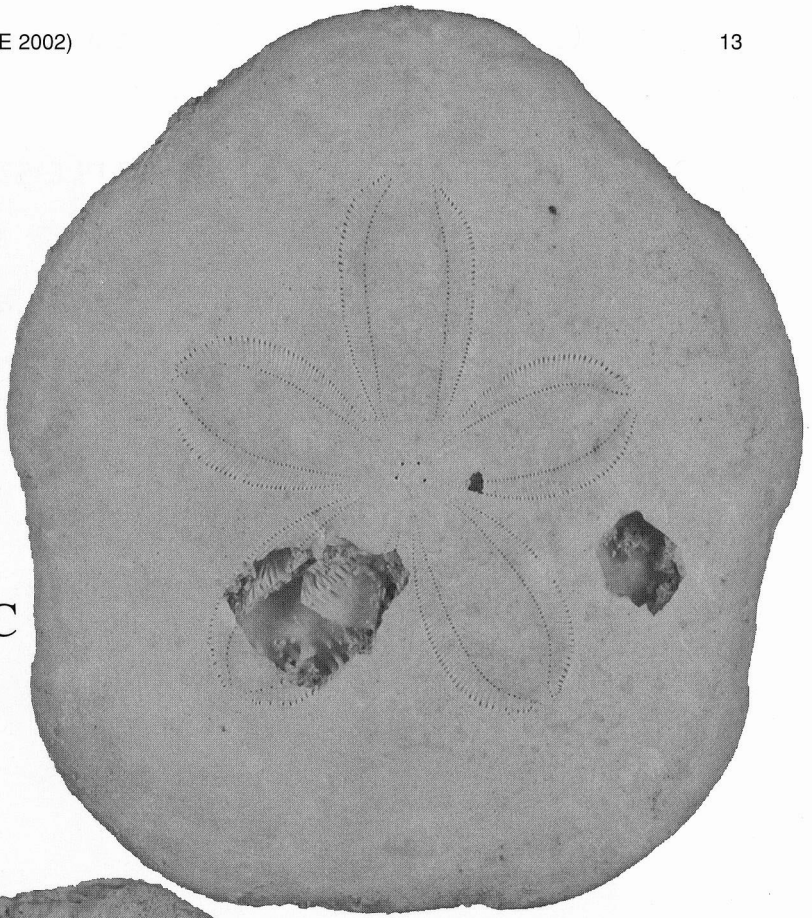

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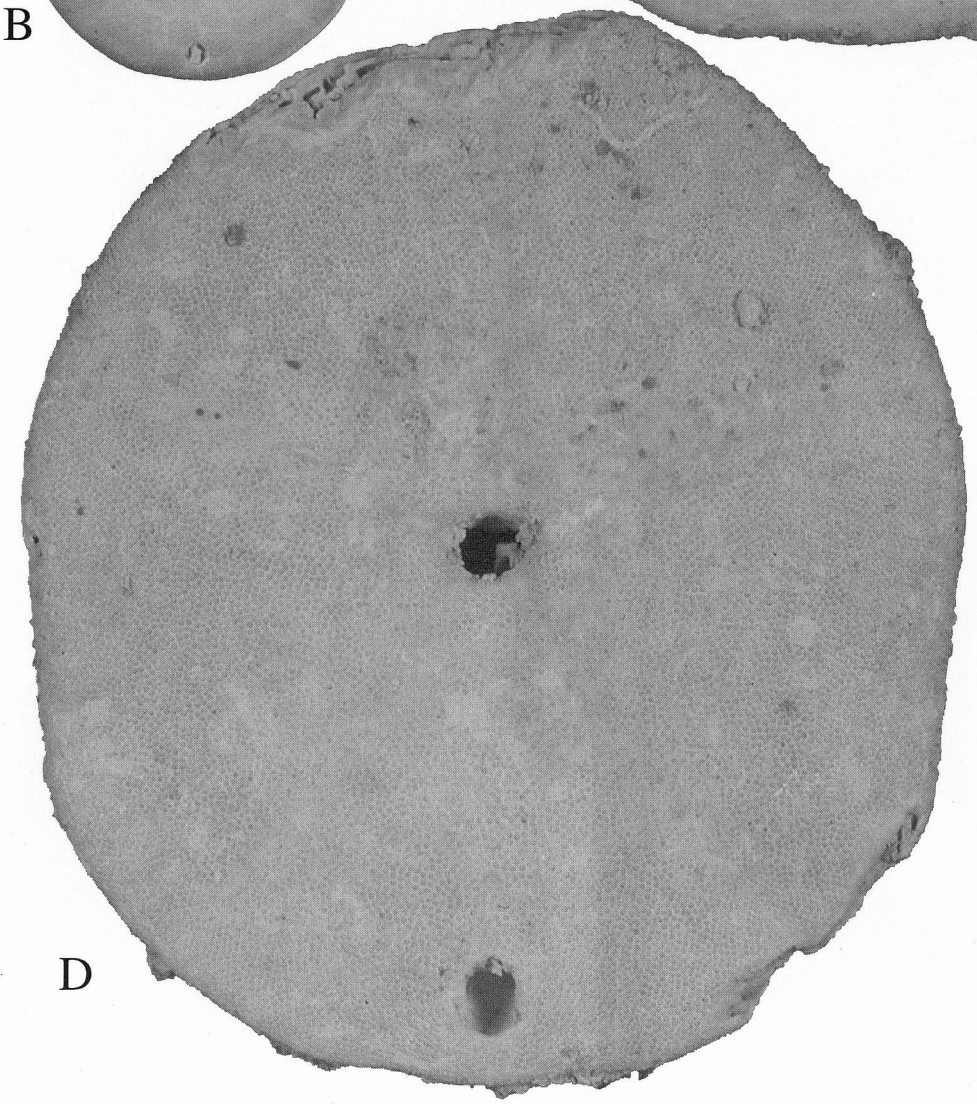

D

PLATE 4 (PLIOCENE AND/OR PLEISTOCENE ECHINOIDS)

A) Encope aberrans Martens, 1867; UF 101422; aboral view; 1x.

B) Encope aberrans Martens, 1867; UF 111402; adoral view; 1x.