FLORIDA FOSSIL INVERTEBRATES

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BRACHIOPODS

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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 within the state. Each part deals with a specific taxonomic group and contains a brief discussion of that group's life history along with the pertinent geological setting. This series deals solely with published taxa; no new species descriptions are included. Some of the specimens figured in this series are on display at Powell Hall, the museum's Exhibit and Education Center. **This publication is made possible through the generous financial support of James and Lori Toomey.**

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Part 2. Oligocene and Miocene echinoids (Craig W. Oyen and Roger W. Portell).

Part 3. Pliocene and Pleistocene echinoids (Roger W. Portell and Craig W. Oyen).

Part 4. Pliocene and Pleistocene decapod crustaceans (Roger W. Portell and Jeffrey G. Agnew).

Part 5. Eocene, Oligocene, and Miocene fossil decapod crustaceans (Roger W. Portell).

Part 6. Larger Foraminifera - Introduction, Biology, Ecology, Taxonomic and Stratigraphic Listings – Comments on Florida Fossil Assemblages (Jonathan R. Bryan).

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BRACHIOPODS

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INTRODUCTION

The brachiopods or lamp-shells are a distinctive and diverse group of marine, mainly sessile (non-motile), benthic invertebrates with a long and varied geological history dating back to the Early Cambrian. Over 12,000 fossil species and approximately 350 living species have been reported belonging to nearly 6,000 genera. Brachiopods have of two shells, the dorsal valve and ventral valve, which grow by accretion. The group is distinguished by a ciliated feeding organ (the lophophore), and in the majority of taxa, a fleshy attachment stalk or pedicle (Figure 1). Most brachiopods have a characteristic set of muscles that act in opposition to open and close the valves together with a variety of skeletal structures that support both the lophophore and musculature. Generally, brachiopods require little food or oxygen and are rather minimalist animals. Nevertheless, the Phylum Brachiopoda has evolved a huge range of morphologies and a wide array of ecological strategies during its history of nearly 600 million years.

In contrast to the bivalves, where the right valve is typically a mirror image of the left, the plane of symmetry in brachiopods bisects both valves perpendicular to the commissure (the point of closure). The larger of the two valves is the ventral or pedicle valve; in many brachiopods a fleshy stalk or pedicle emerges from the posterior of this

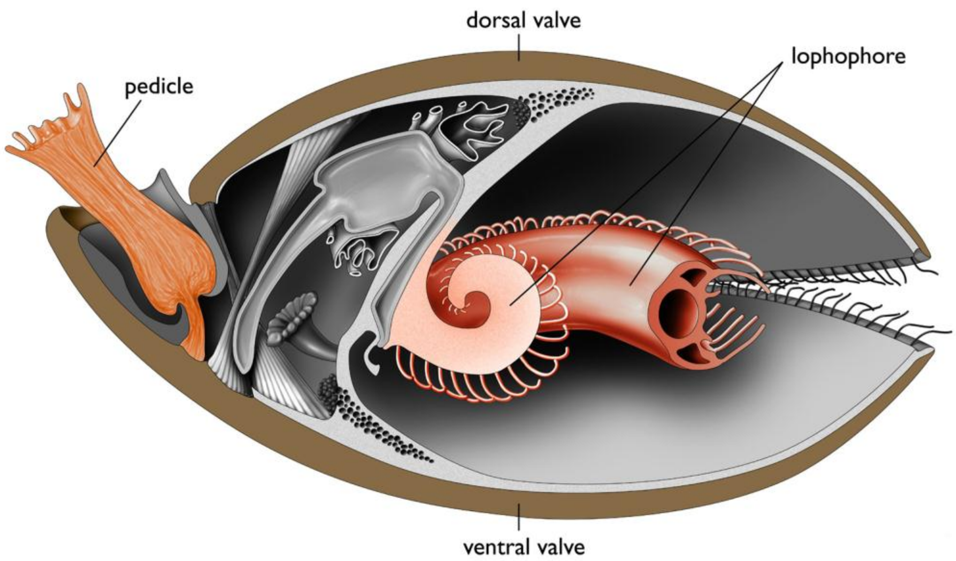


Figure 1. The brachiopod animal showing the key characters of the phylum: the lophophore, pedicle and dorsal and ventral valves.

valve and attaches the animal to the seabed. The pedicle can vary from a thick, fleshy stalk to a bunch of delicate, threadlike strands that can anchor the brachiopod in fine mud. Some brachiopods lost their pedicles during ontogeny (developmental history) and adopted a free-living mode of life, lying recumbent on, or partially in, the sediments on the seafloor. The dorsal or brachial valve contains an extendable food-gathering organ, the lophophore, together with its supports.

Traditionally brachiopods were classified as inarticulate (essentially the hinge lacking teeth and sockets) or articulate (hinge with teeth and sockets). However, recent studies have suggested that shell composition and structure is more important in defining higher taxa within the phylum. Three subphyla are now recognized: the Linguliformea, the Craniiformea, and the Rhynchonelliformea; the former two were included in the Class Inarticulata whereas the last formed the Class Articulata.

The linguliformeans have organophosphatic shells with pedicles that either emerge between both valves or through a foramen (opening). The shells develop from a planktotrophic (feeding on plankton) larval stage, and the group has an alimentary tract ending in an anus. In the lingulates (e.g., the genus *Glottidia*), the opening and closing of the valves is achieved by a complex system of muscles, and the pedicle emerges between both valves (Figure 2A).

The craniiformeans contain a diverse group of shapes centered on the genus *Crania*. The shells consist of organocarbonate and the animal develops separate dorsal and ventral mantle lobes after the settlement of a nektobenthonic (swimming from the sea floor) larval stage (Figure 2B).

The rhynchonelliformeans (Figure 3) have a pair of calcitic valves with variable convexity, hinged posteriorly and opening anteriorly along the commissure, and containing a fibrous secondary layer. A pair of ventral teeth and dorsal sockets provides articulation and the valves are opened and closed by opposing diductor and adductor muscles. In the majority of rhynchonelliformeans, the valves are attached to the substrate by a pedicle that developed from a larval rudiment, and emerges through a foramen in the delthyrial region. The two main classes, the Rhynchonellata and Strophomenata, contain respectively over 2700 and 1500 genera and dominated Phanerozoic brachiopod faunas.

Living and fossil brachiopods have developed a wide range of life styles. The majority attached by a pedicle cemented to a hard substrate or rooted into soft sediment. A number of quite different inarticulated and articulated taxa were cemented directly to the substrate, whereas some groups evolved clasping spines and possibly extended mantle fibers to help stabilize their shells. In a number of groups, the pedicle atrophied during ontogeny. Many taxa thus developed strategies involving inverted, pseudo-infaunal, and recumbent life modes; a number lived in co-supportive clusters and others mimicked corals. Not all brachiopods were sessile (attached); a few, such as *Lingula*, adopted an infaunal lifestyle, whereas the articulated forms, *Camerisma* and *Magadina*, were semi-infaunal.

Despite their relative rarity after the end-Permian extinction event, Mesozoic and Cenozoic brachiopods were actually widespread, represented mainly by pedunculate forms attached to a variety of substrates through a range of water depths. In the tropics, however, many species were micromorphic (very small forms), exploiting cryptic habitats in reef crevices or in the shade of corals and sponges. Larger taxa lived in

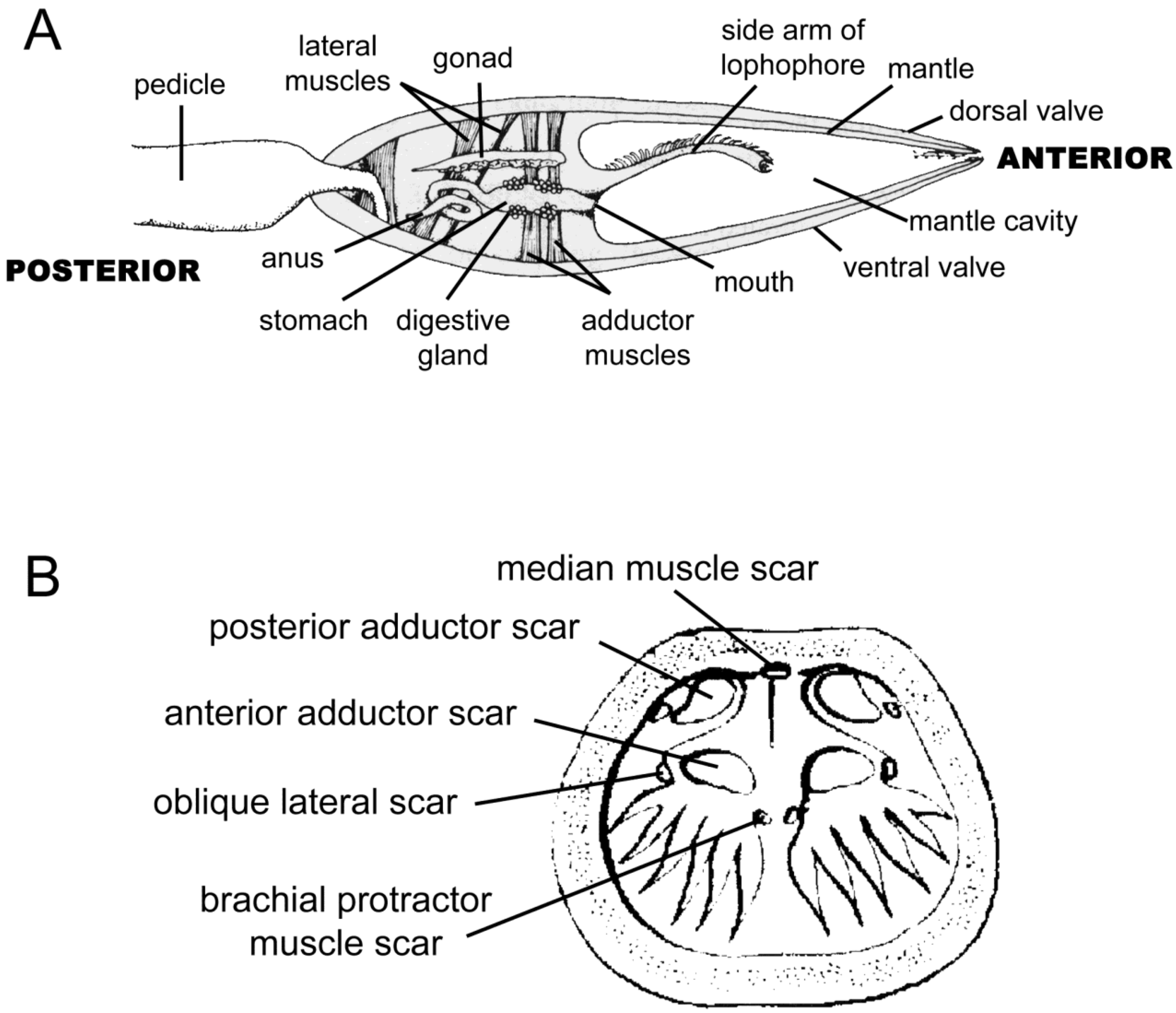


Figure 2. A) Linguliformean morphology based on the genus *Lingula.* B) Craniiformean morphology based on the genus *Novocrania*.

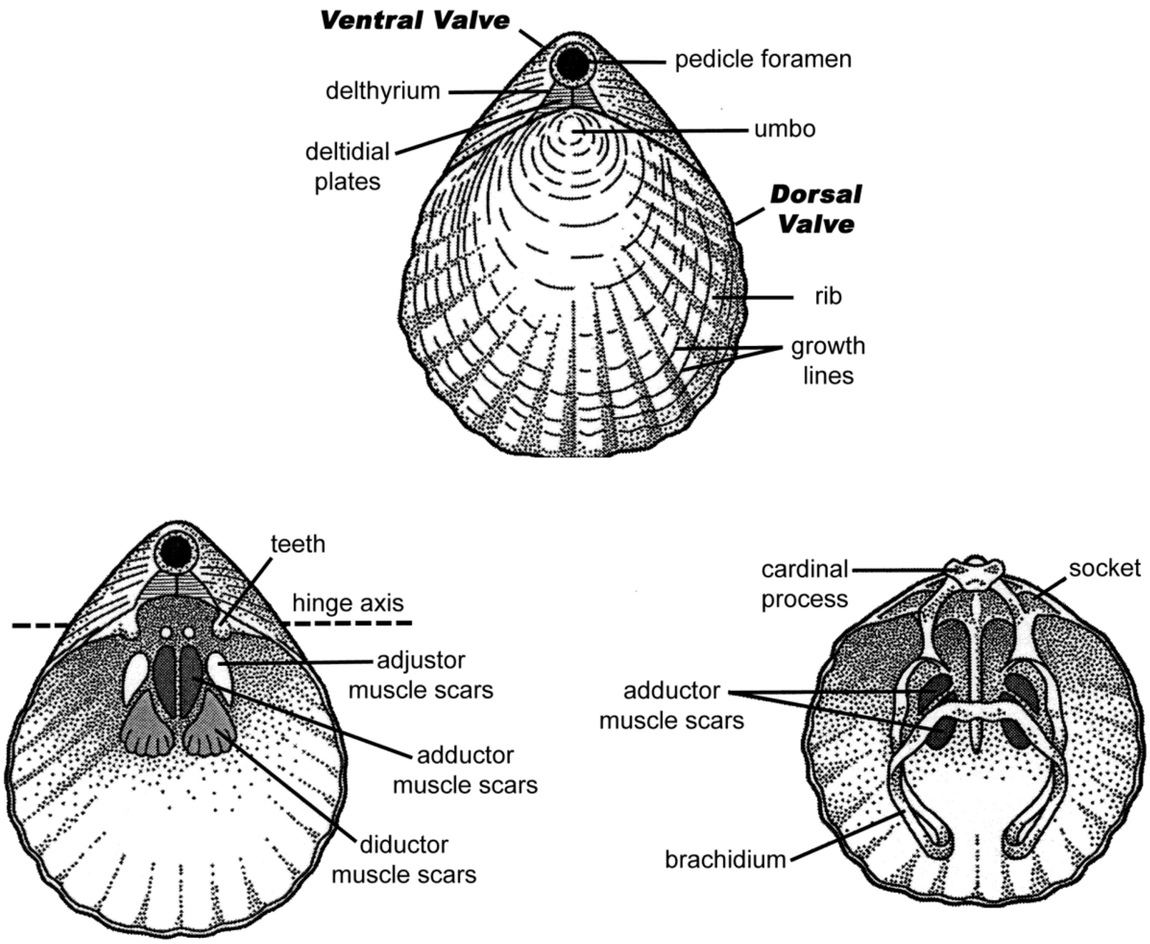


Figure 3. Rhynchonelliformean morphology showing (from left to right) features of the exterior, ventral, and dorsal valves, based on the living genus *Magellania*.

deeper-water environments, evading groups of predators that might graze on meadows of newly attached larvae.

In Florida, the oldest reported brachiopods were obtained from cores of deep exploratory wells that penetrated Paleozoic sedimentary rocks (e.g., Figure 4). In 1949, Howell and Richards described *Lingulepis floridaensis*, a linguloid, from Dixie County based on two specimens retrieved at approximately 1118 meters depth. These fossils, along with associated specimens of graptolites and linguloids reported by Berdan and Bridge (1951) from a Levy County core and large oboloid brachiopods reported in Pojeta et al. (1976) from a Gilchrist County core, are thought to be Early Ordovician, thus making them the oldest fossil invertebrates ever found in Florida. Rocks of Middle to Late Ordovician age overlay the Lower Ordovician strata, and in one Madison County core, small linguloid brachiopods (probably belonging to the Family Obolidae), *Plaesiacomia exsul* (the only known Florida trilobite), and conulariids were found (Jones, 1997). Overlying Florida's Ordovician strata are sediments dated as Silurian-Devonian. From those sediments, Berdan (1970) reported impressions of the genus *Camarotoechia* (a rhynchonellid) and linguloid brachiopods. Further occurrences of

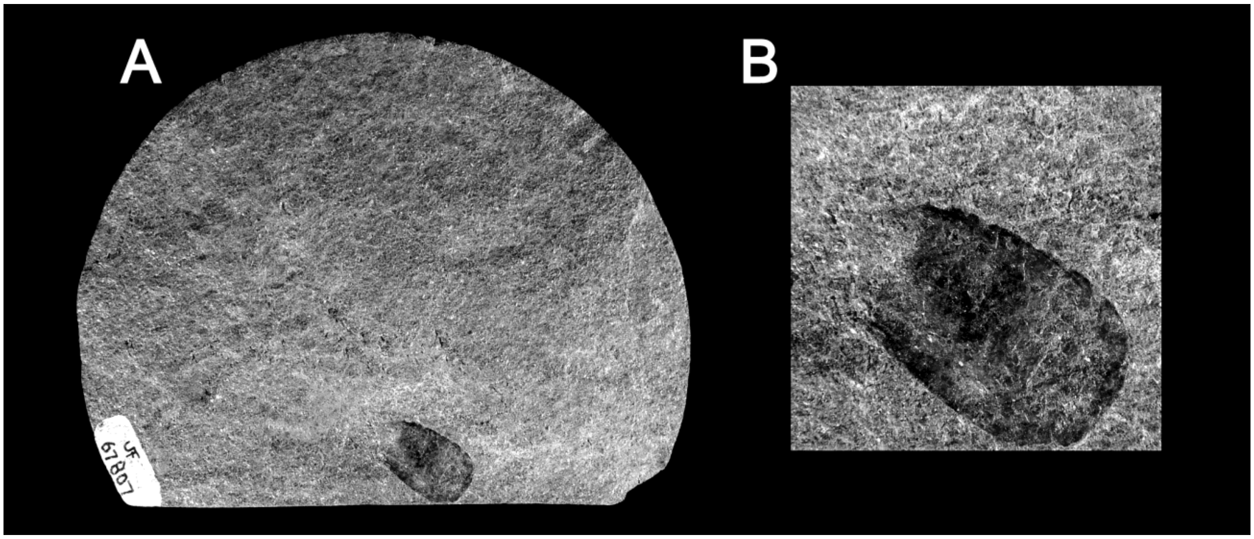


Figure 4. Paleozoic linguloid brachiopod (UF 67807) recovered from core sample in Alachua County (see Figure 2) at depths between 794 to 827 meters. (A) Natural size 1x. B) Close-up 3x.

Florida brachiopods are not known until the Cretaceous, where the genera *Kingena* and *Cyclothyris* (both rhynchonellids), were collected from well cuttings on Key Largo (Applin and Applin, 1965). Younger brachiopods from Florida well cores and cuttings include *Argyrotheca wegemanni* Cole, 1929, from Upper Oligocene deposits at 335 meters depth in Monroe County (Cole, 1941) and a *Terebratulina* from Middle Eocene deposits in Escambia or Santa Rosa County (Marsh, 1966). Marsh (1966) also listed *Argyrotheca* and *Terebratulina* as occurring in well cuttings from the Ocala Limestone of westernmost Florida but neither figures nor exact localities were given.

Fossil brachiopods found at the surface in the state are uncommon (see Figures 5, 6, and Table 1). Eocene Ocala Limestone exposed in the western panhandle has yielded plentiful *Terebratulina* and a few *Argyrotheca*. Toulmin (1977) recorded *Terebratulina lachryma* (Morton, 1933) from this interval but his species determination is questionable. Other than the above-mentioned *Argyrotheca* from an Oligocene core, no further brachiopods are known from this epoch. In the Miocene, only *Discradisca aldrichi* (Gardner, 1928) from the Shoal River Formation has been described. The most abundant fossil brachiopod in Florida is *Discradisca lugubris* (Conrad, 1834). Occurrences in the Pliocene Tamiami (including the Pinecrest Beds), Intracoastal, and Jackson Bluff formations are common, however, only dorsal valves have been found. From limited exposures, in the Pliocene Tamiami Formation and Bone Valley Member of the Peace River Formation, incomplete valves of *Glottidia inexpectans* Olsson, 1914 have been found (Campbell *et al.*, 1997). Dall (1903) described well-preserved *Argyrotheca schucherti* and reported one poorly preserved, juvenile brachiopod, *Terebratula* sp., from the Jackson Bluff Formation. Based on FLMNH specimens, we believe Dall's *Terebratula* sp. is probably *Cryptopora* sp. From the Plio-Pleistocene, *D. lugubris* has been recorded from the Caloosahatchee Formation. And from dredge sites (511-520 meters depth) off Florida in the Gulf of Mexico, numerous, large phosphatized brachiopods of the genus *Tichosina* sp. have been recovered (Oyen et al., 2000).

Additional taxa from the Ocala Limestone, and the Chipola, Intracoastal, and Caloosahatchee formations await description (Harper, Portell, and Bryan, in prep.).

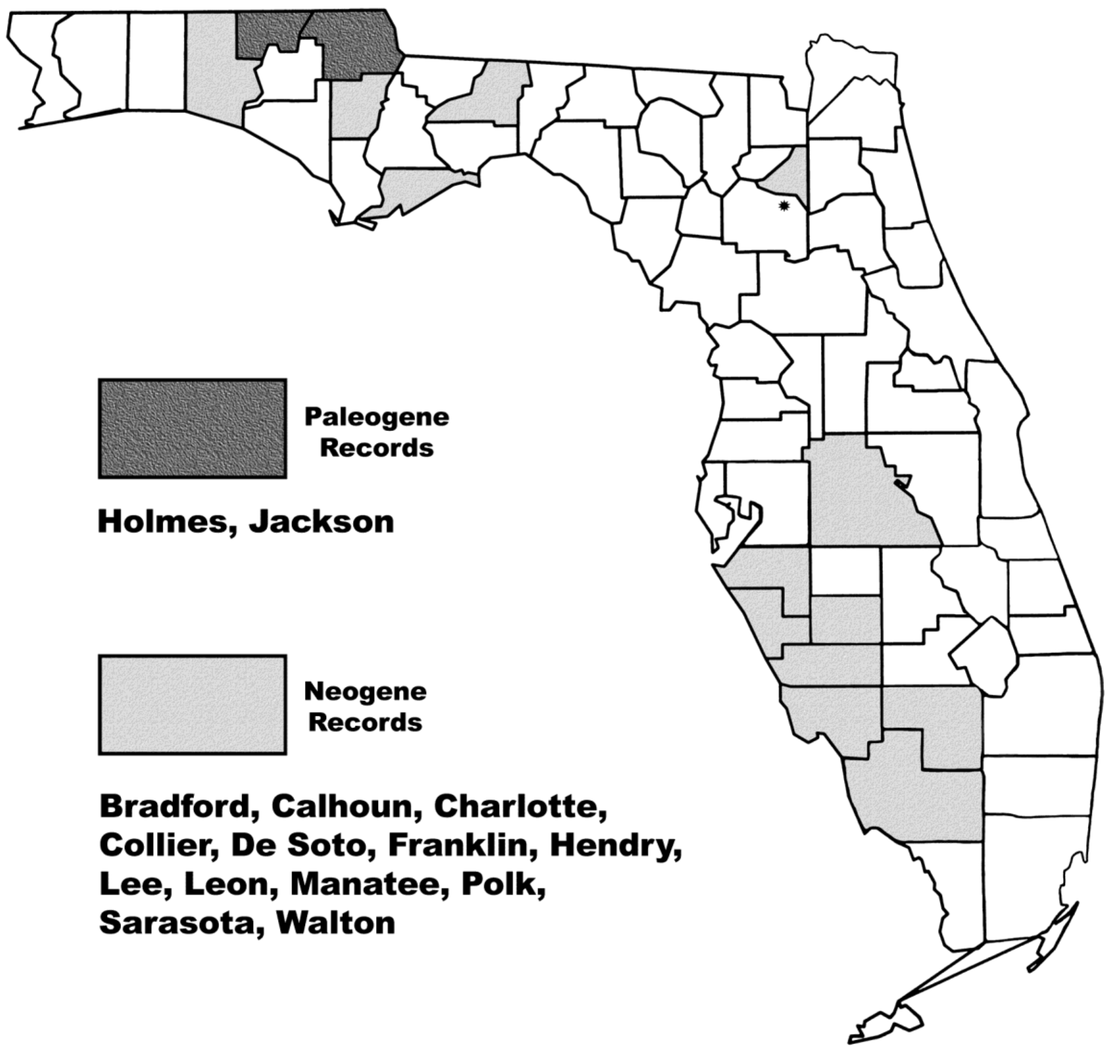


Figure 5. Eocene, Miocene, and Pliocene brachiopod distribution in Florida. Shaded counties have brachiopod records from surface exposures, quarries (mined above groundwater or below groundwater levels), and along rivers or streams (either above or below water level). Brachiopods reported from drill cores are not included. Occurrence data from the Invertebrate Paleontology Collection in the Florida Museum of Natural History were used to augment published records. Asterisk (*) in northeastern Alachua County signifies location of the Ordovician linguloid brachiopod shown in Figure 4.

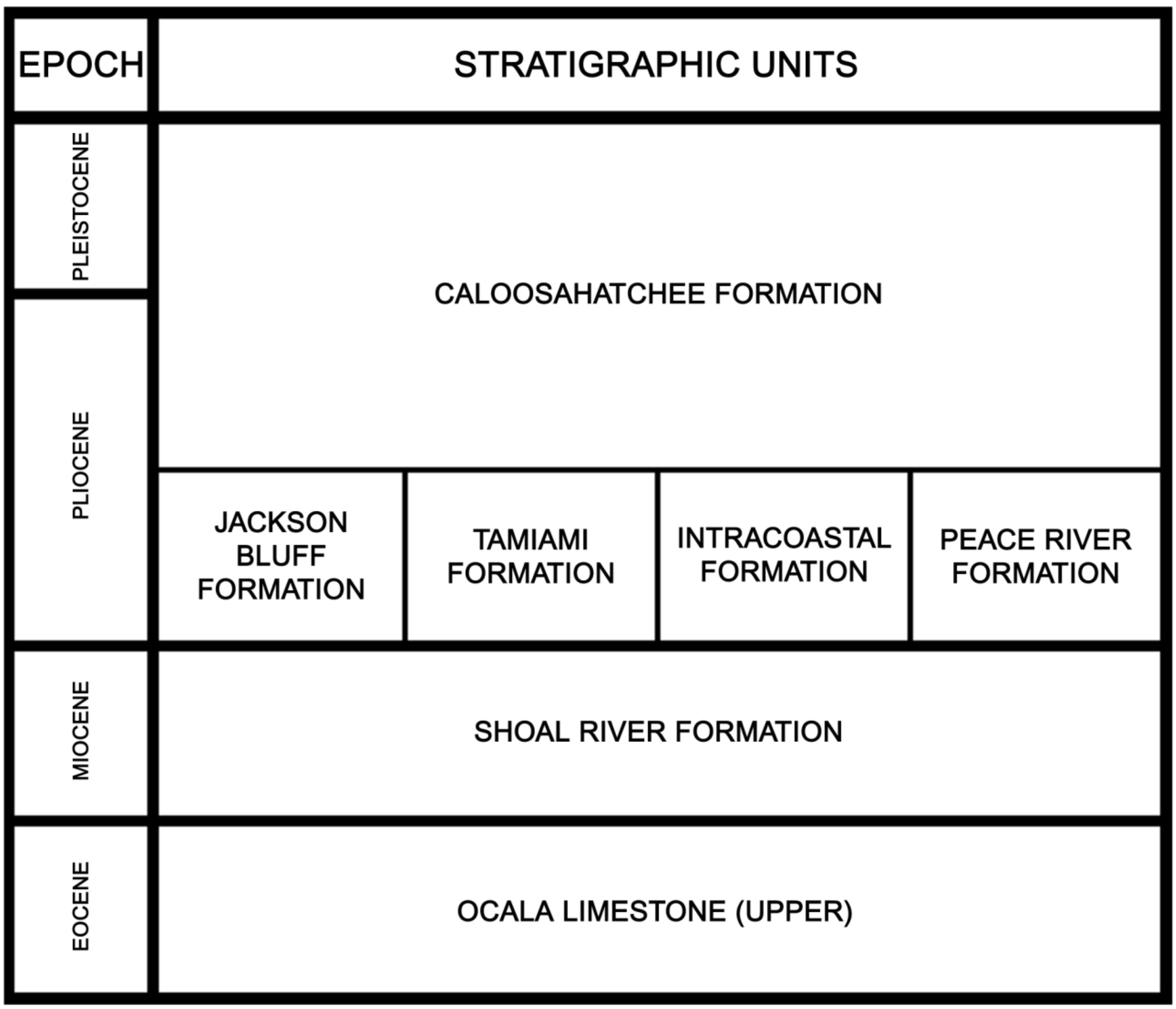


Figure 6. Eocene, Miocene, Pliocene, and Pleistocene epochs and stratigraphic units in Florida with reported brachiopods (does not include occurrences from cores or offshore deposits).

PLATE 1

Family Lingulidae

A) *Glottidia inexpectans* Olsson, 1914; UF 11840; external view of incomplete dorsal valve of conjoined pair; 2x.

B) *Glottidia inexpectans* Olsson, 1914; UF 11840; external view of incomplete ventral valve (note the predatory gastropod borehole) of conjoined pair; 2x.

C) *Glottidia inexpectans* Olsson, 1914; UF 10112; internal view of incomplete ventral valve (note the median septum); 2x.

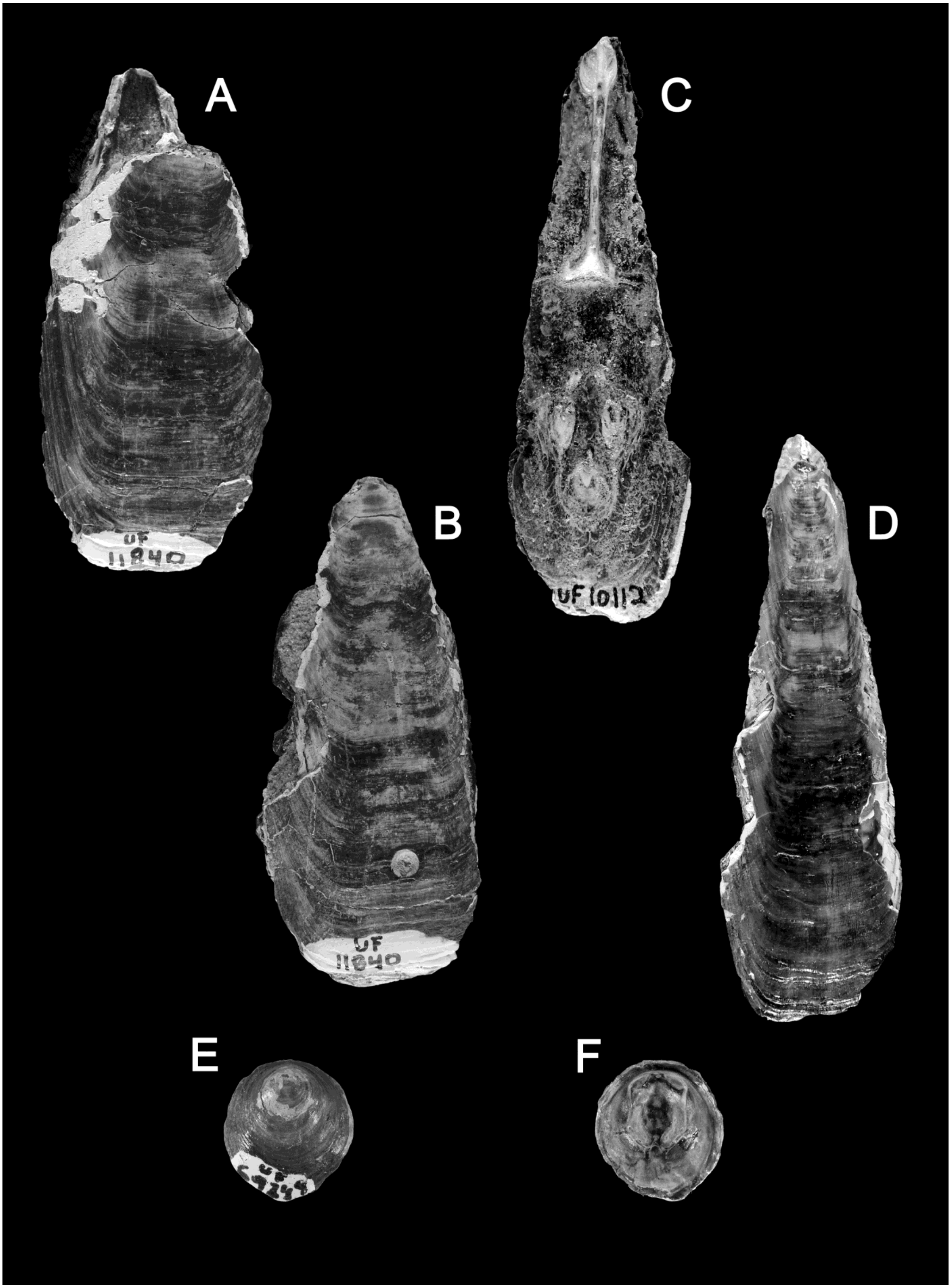
D) *Glottidia inexpectans* Olsson, 1914; UF 10112; external view of incomplete ventral valve; 2x.

Family Discinidae

E) *Discradisca aldrichi* (Gardner, 1928); UF 69249; external view of cap-shaped valve; 2x.

F) *Discradisca aldrichi* (Gardner, 1928); UF 69249; internal view of valve (note the muscle scars); 2x.

Notes: **1)** See Table 1 (page 18) for stratigraphic occurrence of each taxon in plates 1-4. **2)** Sean Roberts (FLMNH) assisted with digital photography on plates 1-4. **3)** For more information about UF specimens figured here and in previous issues of the Florida Fossil Invertebrates series, please see our recently updated web site (www.flmnh.ufl.edu/invertpaleo/).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UF 11840
UF 11840
UF 10112

PLATE 2

Family Discinidae (continued)

A) *Discradisca lugubris* (Conrad, 1834); UF 30879; external view of cap-shaped valve exhibiting faint radial ribs; 2x.

B) *Discradisca lugubris* (Conrad, 1834); UF 30879; internal view of valve (note well-defined muscle scars); 2x.

C) *Discradisca lugubris* (Conrad, 1834); UF 32218; external view of cap-shaped valve exhibiting more prominent radial ribs than seen on UF 30879; 2x.

D) *Discradisca lugubris* (Conrad, 1834); UF 32218; internal view of valve; 2x.

E) *Discradisca lugubris* (Conrad, 1834); UF 39531; external view of cap-shaped valve with beautifully preserved ornamentation; 2x.

F) *Discradisca lugubris* (Conrad, 1834); UF 39531; internal view of valve (note scarring from unknown infestation); 2x.

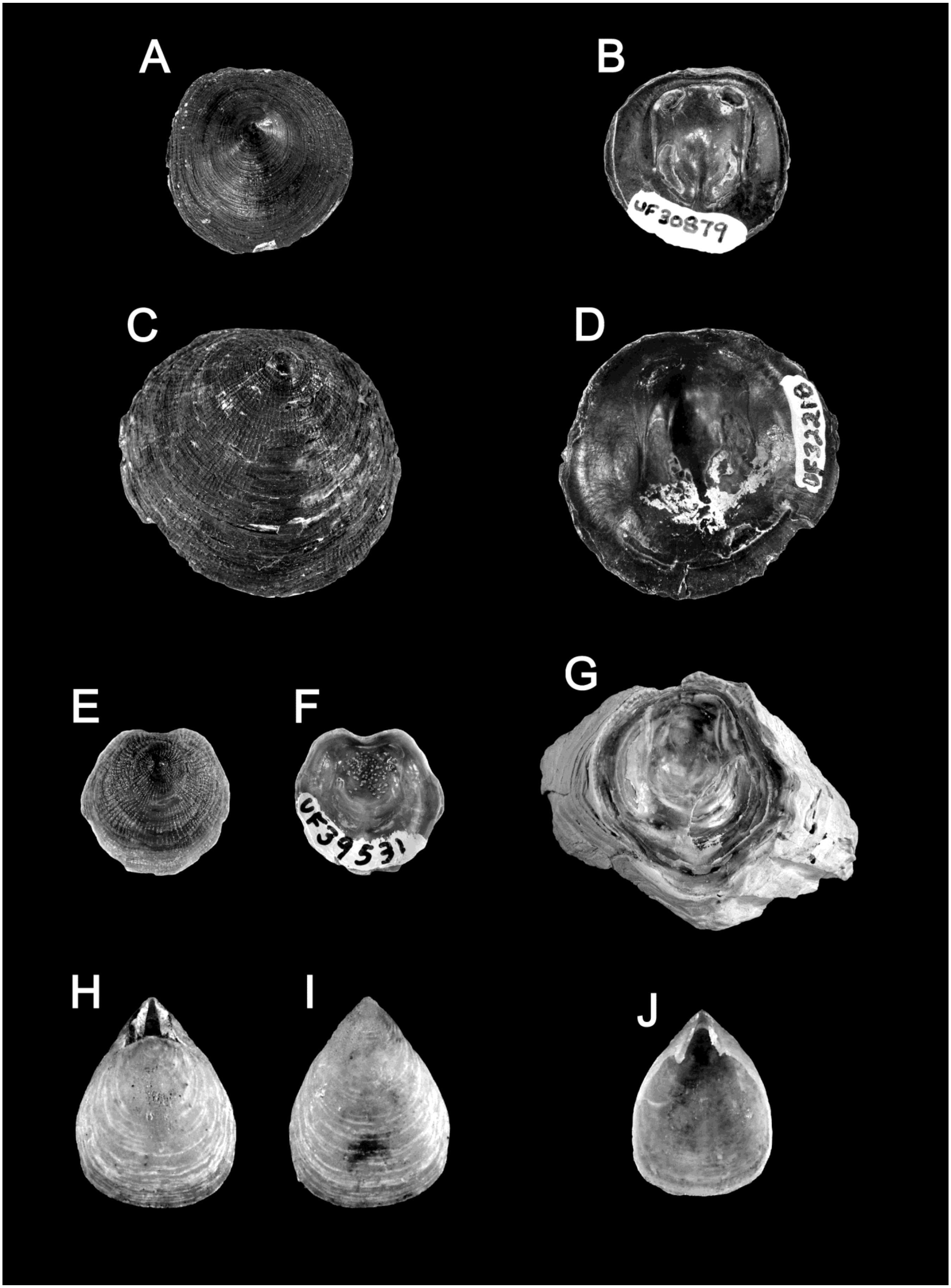
G) *Discradisca lugubris* (Conrad, 1834); UF 115763; internal view of valve with barnacles attached to its outer surface. In the Lower Tamiami Formation barnacle attachment to *Discradisca* valves is common; 2x.

Family Cryptoporidae

H) *Cryptopora* sp.; UF 115761; external view of dorsal valve of conjoined pair; 10x.

I) *Cryptopora* sp.; UF 115761; external view of ventral valve of conjoined pair; 10x.

J) *Cryptopora* sp.; UF 115762; interior view of ventral valve; 10x.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D
UF 32218
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F
UF 39531
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H
I
J

PLATE 3

Family Cancellothyrididae

A) *Terebratulina* sp. A; UF 115674; external view of the dorsal valve of conjoined pair (note small nodes are visible on valve ribs only in juveniles); 10x.

B) *Terebratulina* sp. A; UF 115674; external view of the ventral valve conjoined pair (note small nodes are visible on valve ribs only in juveniles); 10x.

C) *Terebratulina* sp. A.; UF 115675; external view of abraded dorsal valve of conjoined pair; 5x.

D) *Terebratulina* sp. A.; UF 115675; external view of abraded ventral valve of conjoined pair; 5x.

E) *Terebratulina* sp. A.; UF 115676; external view of dorsal valve of slightly compressed conjoined pair; 5x.

F) *Terebratulina* sp. A.; UF 115676; external view of ventral valve of conjoined pair exhibiting an attached bryozoan colony (zoarium); 5x.

G) *Terebratulina* sp. B.; Image from Marsh (1966), plate 1, figure 3; dorsal valve of conjoined pair (collected in core sample from an unknown Middle Eocene formation (Lisbon Fm. equivalent) in westernmost Florida; 10x.

H) *Terebratulina lachryma* (Morton, 1833). USNM 551516a; Image from Cooper (1988), plate 1, figure 16; external view of dorsal valve of conjoined pair shown for comparison with Florida *Terebratulina* sp. A.; 2x.

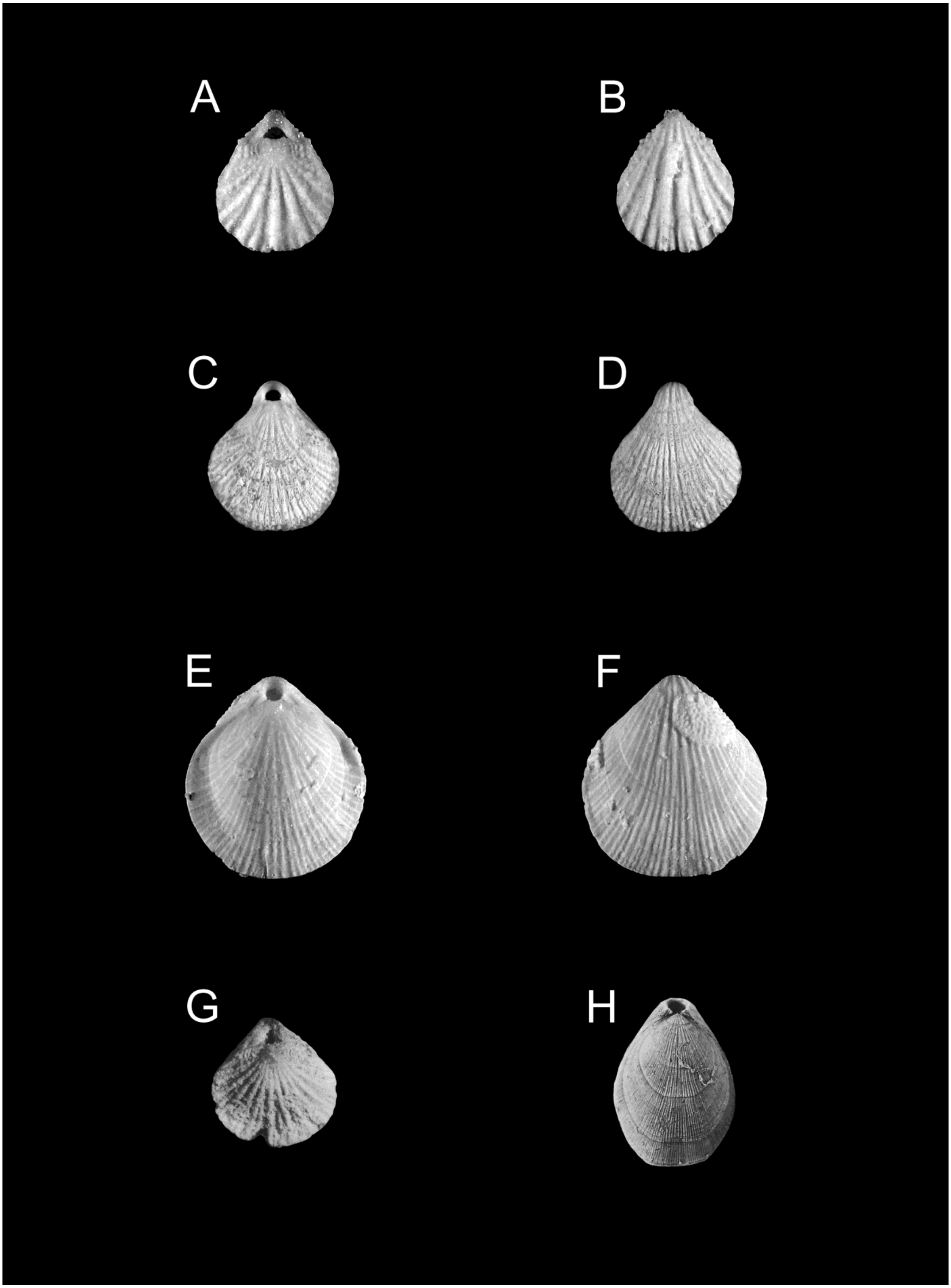
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PLATE 4

Family Terebratulidae

A) *Tichosina* sp.; UF 101882; view of dorsal valve of internal mold of conjoined pair; 1.5x.

B) *Tichosina* sp.; UF 101882; view of ventral valve of internal mold of conjoined pair; 1.5x.

C) *Tichosina* sp.; UF 101882; lateral view of internal mold of conjoined valves; 1.5x.

Family Terebratulidae

D) *Argyrotheca schucherti* Dall, 1903; UF 115699; external view of dorsal valve of conjoined pair; 7x.

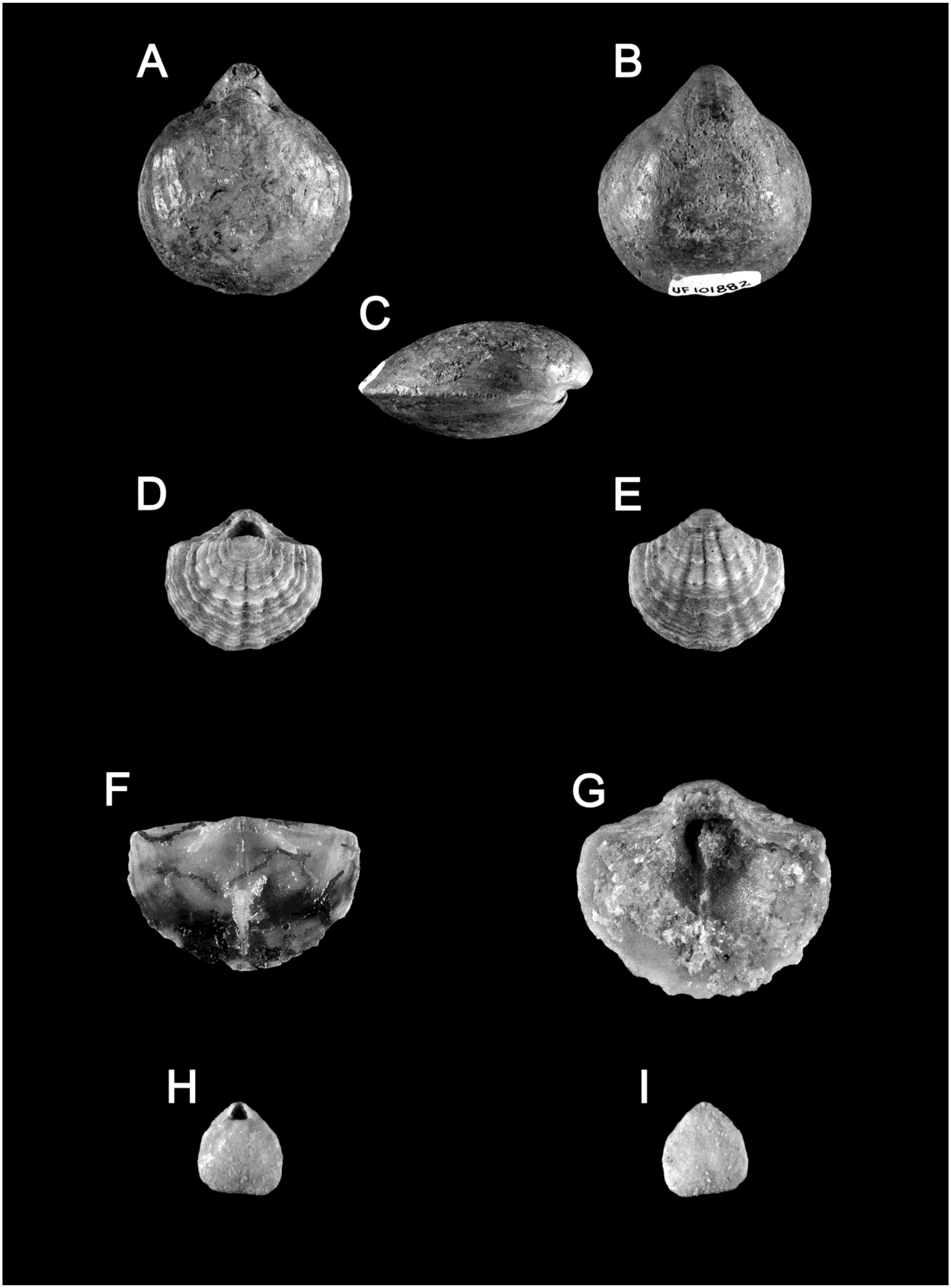
E) *Argyrotheca schucherti* Dall, 1903; UF 115699; external view of ventral valve of conjoined pair; 7x.

F) *Argyrotheca schucherti* Dall, 1903; UF 115700; internal view of slightly recrystallized dorsal valve; 7x.

G) *Argyrotheca schucherti* Dall, 1903; UF 1157001; internal view of slightly recrystallized ventral valve; 7x.

H) *Argyrotheca wegemanni* Cole, 1929; UF 115775 (formerly Florida Geological Survey S-1507); external view of dorsal valve of conjoined pair; 10x.

I) *Argyrotheca wegemanni* Cole, 1929; UF 115775 (formerly Florida Geological Survey S-1507); external view of ventral valve of conjoined pair; 10x.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UF 101882
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Table 1. List of described or reported (but as yet undescribed) Florida Eocene, Oligocene, Miocene, and Pliocene brachiopods with families arranged in systematic order following (in part) Williams, *et al*. (2000, 2002), and with genera and species listed alphabetically. For some, a brief synonymy (an older name no longer in use) is provided. Reported stratigraphic occurrence (updated to currently recognized formational names) for each species is listed. An asterisk (*) indicates the Florida record as problematic. However, for completeness, these reports were included.

Lingulidae

Glottidia inexpectans Olsson, 1914.

Stratigraphic Occurrence: Bone Valley Member of the Peace River Formation and Tamiami Formation (Lower).

Discinidae

Discradisca aldrichi (Gardner, 1928).

Stratigraphic Occurrence: Shoal River Formation.

Synonymy: *Discinisca aldrichi* Gardner, 1928.

Discradisca lugubris (Conrad, 1834).

Stratigraphic Occurrence: Tamiami (Lower and Upper), Intracoastal, Jackson Bluff, and Caloosahatchee formations.

Synonymy: *Discinisca lugubris* Conrad, 1834.

Cryptoporidae

Cryptopora sp.

Stratigraphic Occurrence: Jackson Bluff Formation.

Synonymy: Probably **Terebratula* sp. reported by Dall (1903).

Cancellothyrididae

Terebratulina sp. A.

Stratigraphic Occurrence: Ocala Limestone (Upper).

Synonymy: **Terebratulina lachryma* (Morton, 1833) reported from Florida by Toulmin (1977) and **Terebratulina* sp. reported from core sample by Marsh (1966).

**Terebratulina* sp. B.

Stratigraphic Occurrence: Unknown Middle Eocene formation (Lisbon equivalent) reported from core sample by Marsh (1966).

Terebratulidae

Tichosina sp.

Stratigraphic Occurrence: Unknown offshore Plio-Pleistocene unit.

Megathyrididae

**Argyrotheca* sp.?

Stratigraphic Occurrence: Ocala Limestone (Upper) reported from core sample by Marsh (1966).

Argyrotheca schucherti Dall, 1903.

Stratigraphic Occurrence: Jackson Bluff Formation.

Argyrotheca wegemanni Cole, 1929.

Stratigraphic Occurrence: Indeterminate Upper Oligocene formation reported from core sample by Cole (1929).

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