

A new *Siphocypraea* species from the Immokalee Reef Tract (Unit 2) of the Tamiami Formation, Florida

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ABSTRACT A new species of *Siphocypraea* is described from the Immokalee Reef Tract (Unit 2), Tamiami Formation that represents an evolutionary link between *Siphocypraea (Lokossea) dimasi* Petuch, 1998 and *S. (L.) mulepenensis* Petuch, 1991.

KEYWORDS Cypraeidae, fossil cowries, Tamiami Formation, Fordville Member, Caloosahatchee Formation, Immokalee Reef Tract, *Siphocypraea*, *Siphocypraea (Lokossea)*, *Siphocypraea (Lokossea) daughenbaughi*, *Siphocypraea (Lokossea)*, *Siphocypraea (Lokossea) mulepenensis*, *Siphocypraea (Lokossea) dimasi*

INTRODUCTION

The genus *Siphocypraea* Heilprin, 1886 was the first group of Plio-Pleistocene fossil cowries discovered in southern Florida and encompasses a group of related Cypraeidae species characterized by a curled apical sulci and narrow apertures (Heilprin, 1886; Petuch, Berschauer & Myers, 2018). The species were extant from the Buckingham Member (Unit 10) of the Tamiami Formation, circa 4.2 million years ago (“mya”), to the Ayers Landing Member of the Caloosahatchee Formation, circa 2 mya. In addition, the genus *Siphocypraea (sensu stricto)* has been further divided into three other subgenera, representing evolutionary lineages of species bearing similar features. The four subgenera are:

***Siphocypraea (Seminolecypreae)* Petuch and Drolshagen, 2011.** This subgenus represents the primitive stem stock of *Siphocypraea* from which all other subgenera evolved.

***Siphocypraea (Siphocypraea)* Heilprin, 1886 (sensu stricto).** This is the nominate subgenus and evolved from the deeper

lagoonal subgenus *Seminolecypreae* in Unit 3 of the Fruitville Member of the Tamiami Formation.

***Siphocypraea (Floridacypraea)* Petuch and Drolshagen, 2011.** This subgenus has a slightly coiled apical sulcus, an elongate, narrow shell and aperture. Confined to the Gelasian Pleistocene Caloosahatchee Formation.

***Siphocypraea (Lokossea)* Petuch and Drolshagen, 2011.** This subgenus has a tightly coiled multi-whorl apical sulcus, is large, inflated and rotund. Ranges from the late Piacenzian Pliocene to the late Gelasian Pleistocene. See below for the revised description of *Lokossea*. Previously named *S. (Lokossea)* species include: *S. (L.) dimasi* Petuch, 1998 (herein moved from the nominate subgenus), *S. (L.) mulepenensis* Petuch, 1991, *S. (L.) swearingeni* Petuch and Drolshagen, 2011, *S. (L.) wigginsi* Petuch and Drolshagen, 2011, and *S. (L.) registeri* Petuch and Drolshagen, 2011 (E.J. Petuch, personal communication; Petuch, Berschauer & Myers, 2018).

With the exception of *Siphocypraea* (*Lokossea*), the lineages of the other subgenera are complete. *Siphocypraea dimasi* was originally described in the genus *Siphocypraea* (*sensu stricto*) and based upon further study of its morphology it has been moved to the subgenus *Lokossea* (E.J. Petuch, personal communication; Petuch, 1998; Petuch and Drolshagen, 2011; Petuch, Berschauer & Myers, 2018). There is a gap in the fossil record between *Siphocypraea*

(*Lokossea*) *dimasi* Petuch, 1998 and *Siphocypraea* (*Lokossea*) *mulepenensis* Petuch, 1991, and as shown herein the new proposed Goldengate species *Siphocypraea* (*Lokossea*) *daughenbaughi* fills that gap (E.J. Petuch, personal communication). With the addition of this new species the *S. Lokossea* lineage (youngest to oldest) is as follows:

<u>Species</u>	<u>Stratigraphic layer</u>	<u>Figure(s)</u>
<i>S. (L.) registeri</i>	Ayers Landing, Caloosahatchee Formation	(Figure 2 K-L)
<i>S. (L.) wigginsi</i>	Bee Branch, Caloosahatchee Formation	(Figure 2 I-J)
<i>S. (L.) swearingeni</i>	Fort Denaud, Caloosahatchee Formation	(Figure 2 G-H)
<i>S. (L.) mulepenensis</i>	Unit 2 equivalent, Tamiami Formation	(Figure 2 E-F)
<i>S. (L.) daughenbaughi</i>	Unit 3 equivalent, Tamiami Formation	(Figures 1 A-F/2 C-D)
<i>S. (L.) dimasi</i>	Unit 4 equivalent, Tamiami Formation	(Figure 2 A-B)

SYSTEMATICS

Class: Gastropoda
 Subclass: Orthogastropoda
 Order: Sorbeoconcha
 Suborder: Hypsogastropoda
 Superfamily: Cypraeoidea
 Family: Cypraeidae
 Subfamily: Cypraeinae
 Genus: *Siphocypraea* Heilprin, 1886
 (*sensu stricto*)
 Subgenus: *Lokossea* Petuch & Drolshagen, 2011

Siphocypraea (*Lokossea*) *daughenbaughi*
 Berschauer and Waller 2020
 (Figures 1A-F, 2 C-D)

Description. Shell of average size for the genus and subgenus, heavy, callous, inflated, oval/elongate with a slightly flattened to flattened base, anterior extremity slightly calloused and blunt, posterior extremity blunt, auricles small, apical sulcus tightly coiled, uncovered, aperture narrow throughout, curved to the left posteriorly, columella with 20-22

long, thin teeth extending well into the aperture, lip with 22-24 thin labral teeth extending into the coil of the apical sulcus and onto the base, fossula absent.

Type Material. HOLOTYPE - Figures 1A-C measuring 69.8 mm in length, LACMIP No. 42927.1 (type 14868). OTHER MATERIAL EXAMINED - two specimens measuring 63.2 (Figures 1D-F) and 61.0 mm in length in the study collection of John D. Daughenbaugh and one specimen measuring 62.0 mm in the study collection of Dr. Edward Petuch. Photographs of nine specimens (with measurements ranging up to 69.7 mm in length) from the collection of Melanie Briskin, Cape Coral, Florida, and two specimens from the collection of Maurice Guy (with measurements ranging from 59.0 to 69.0 mm in length) were also examined.

Type Locality. Bonita Grande Aggregate Pit, Bonita Springs, Lee County, Florida; LACMIP locality 42927.

Stratigraphic Range. Restricted to the upper beds of the Golden Gate Member, the equivalent of Unit 3, Fruitville Member, Tamiami Formation at Sarasota (Petuch & Roberts, 2017, p. 73). All known specimens have come from the Bonita Grande Aggregates Pit, Bonita Springs, Lee County, Florida.

Etymology. Named for John D. “Duffy” Daughenbaugh, Los Angeles, California, an avid collector and researcher of recent and fossil Cypraeidae and author of a series of articles on the fossil Cypraeidae of the Tamiami and Caloosahatchee Formations by stratigraphic unit.

Discussion. The subgenus *Lokossea* as modified is represented by variably shaped species that are slightly inflated/inflated with tightly coiled apical sulci, long thin columellar dentition that extends deep into the aperture and labral dentition that extends well onto/over the base, forming corrugations (Petuch and Drolshagen, 2011; Daughenbaugh, 2020).

As the successor of *S. (L.) dimasi*, the oldest member of the subgenus, *S. (L.) daughenbaughi* retains the flattened base, tightly coiled apical sulcus, reduced number of long thin columellar teeth that extend well into the aperture as well as corrugated labral dentition. Despite its diminutive size, which has obscured its presence and position in the subgenus, *S. (L.) dimasi* presaged these main features which are present in all of the *Lokossea* species. The principle differences between the two species is a covered apical sulcus in *S. (L.) dimasi* and a more open sulcus in *S. (L.) daughenbaughi*, the number of columellar and labral teeth, and *S. (L.) daughenbaughi* has a much larger shell and is higher domed and more inflated than *S. (L.) dimasi*. The degree to which the apical sulcus is covered or open varies among the species of the subgenus.

Siphocypraea (Lokossea) daughenbaughi is closest to its successor *S. (L.) mulepenensis* but differs in its less inflated oval/elongate shape versus high domed and globular shape, slightly flattened/flattened base versus rounded base, more open apical sulcus versus partially covered apical sulcus, lesser columella teeth (20-22 versus 25-27), lesser labral teeth (22-24 versus 30-32) and labral teeth that extend onto and over the base. The new species *S. (L.) daughenbaughi* is relatively uncommon in the Bonita Springs Aggregate Pit (Melanie Briskin, personal communication), but has previously been incorrectly assigned to other species. Specimens of *S. (L.) daughenbaughi* exhibit a significant amount of variability in width, height, and the degree to which the apical sulcus is open. It is unknown whether this variability is environmental, temporal or a result of genetic plasticity.

The assignment of *S. (L.) daughenbaughi* to Unit 3 of the Immokalee reef tract is provisional. The Immokalee Reef Tract (Unit 3) facies intertongue with the Fordville facies. As these sediments are close to the surface, the mining of these sediments tends to intermingle the two strata, which makes it impossible to definitively assign a specific Unit. However, based upon morphological features, it is placed in Unit 3 time (an estimated 2.8 million years ago) as the successor to *S. (L.) dimasi* and predecessor to *S. (L.) mulepenensis*, the later provisionally assigned to the Unit 2 equivalent, Tamiami Formation. (See Daughenbaugh, 2020) The best preserved specimens were found in muddy clay and sand between 2013-2020 (personal communications Briskin and Guy).

Characteristic	<i>S. (L.) mulepenensis</i>	<i>S. (L.) daughenbaughi</i>
Shape	Domed, globular	Less inflated, oval, elongate
Base	Rounded	Slightly flattened/flattened
Sulcus	Partially covered	More open/uncovered
Columellar Teeth	25-27	20-22
Labial Teeth	30-32	22-24 extending onto base

Table 1. Comparison of *S. (L.) mulepenensis* and *S. (L.) daughenbaughi*.

The specimen shown in Figure 1 D-F was particularly well preserved and retained some of the spotting on its dorsal margins. The use of ultraviolet light in the study of fossil shells is a well recognized technique. (Krueger, 1974; Hendricks, 2018) Accordingly, the right side of the two specimens shown in 1A-C and 1D-F were photographed both in natural daylight and ultraviolet light in order to identify any pattern that may have existed in the living species, and are illustrated here in Figure 3. Marginal spotting is clearly visible in these images.

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Figure 1. New species of *Lokossea*. **A, B, C** = *Siphocypraea (Lokossea) daughenbaughi* Berschauer and Waller, new species, holotype, 65.6 mm in length, LACMIP 42927.1 (type 14868); **D, E, F** = *Siphocypraea (Lokossea) daughenbaughi* Berschauer and Waller, new species, 62.3 mm in length (Daugenbaugh Collection).

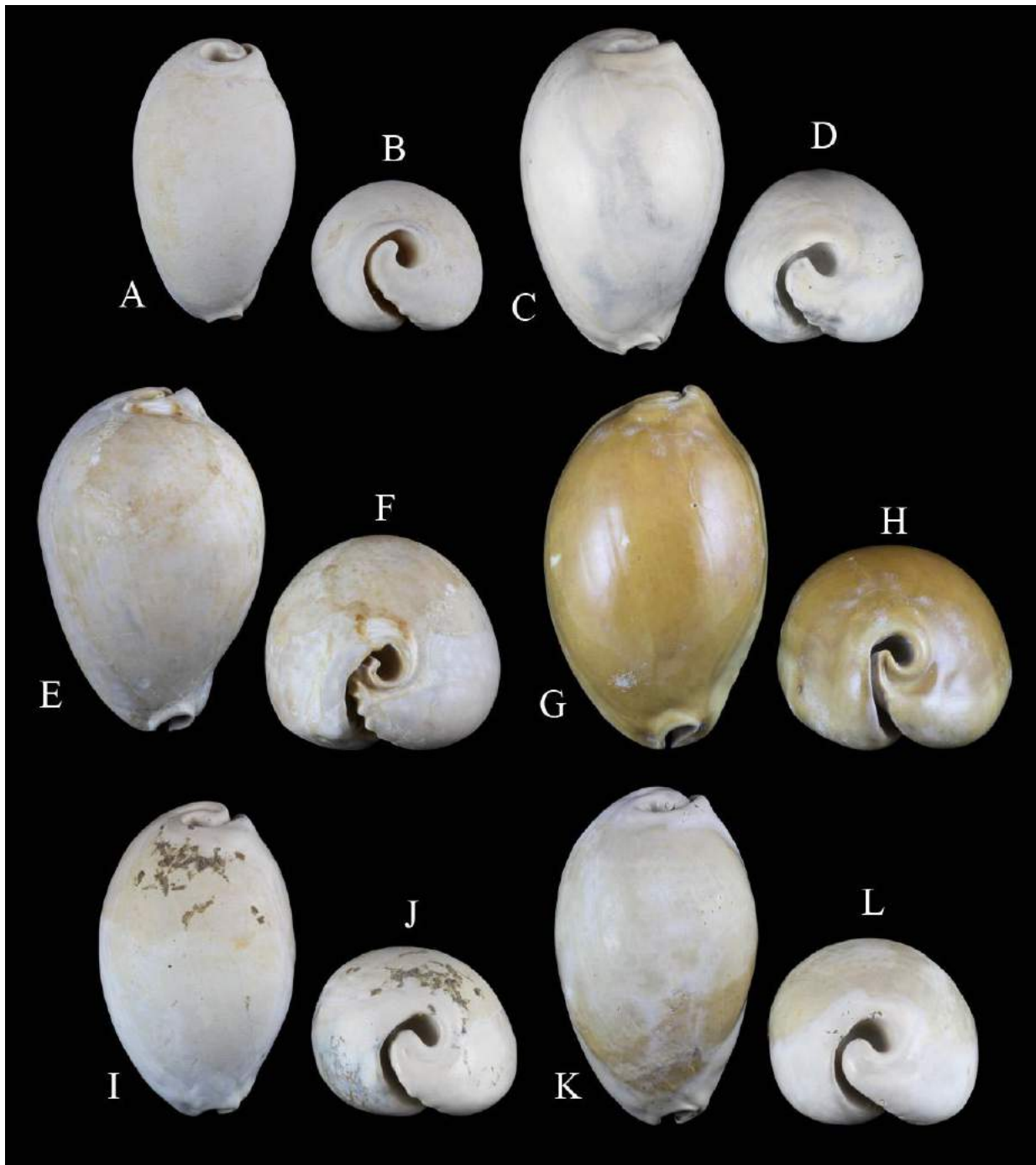


Figure 2. Comparison of *Lokossea* species. **A, B** = *Siphocypraea (Lokossea) dimasi* Petuch, 1998, 50.1 mm in length, Florida Rock Industries, Old Mule pen Quarry, Naples, Collier County. **C, D** = *Siphocypraea (Lokossea) daughenbaughi* Berschauer and Waller, new species, holotype, 65.6 mm in length, Bonita Grande Aggregates Pit, Bonita Springs, Lee County; LACMIP 42927.1 (type 14868). **E, F** = *Siphocypraea (Lokossea) mulepenensis* Petuch, 1991, 71.3 mm in length, Florida Rock Industries, Old Mule pen Quarry, Naples, Collier County. **G, H** = *Siphocypraea (Lokossea) swearingeni* Petuch and Drolshagen, 2011, 74.4 mm in length, Griffin Brothers Pit, Holey Land Wildlife Conservation Area, Palm Beach Co. **I, J** = *Siphocypraea (Lokossea) wigginsii* Petuch and Drolshagen, 2011, 61.2 mm in length, Star Ranch Pit, Palm Beach County. **K, L** = *Siphocypraea (Lokossea) registeri* Petuch and Drolshagen, 2011, 65.4 mm in length, Bergeron Star Pit Mine, Palm Beach County.

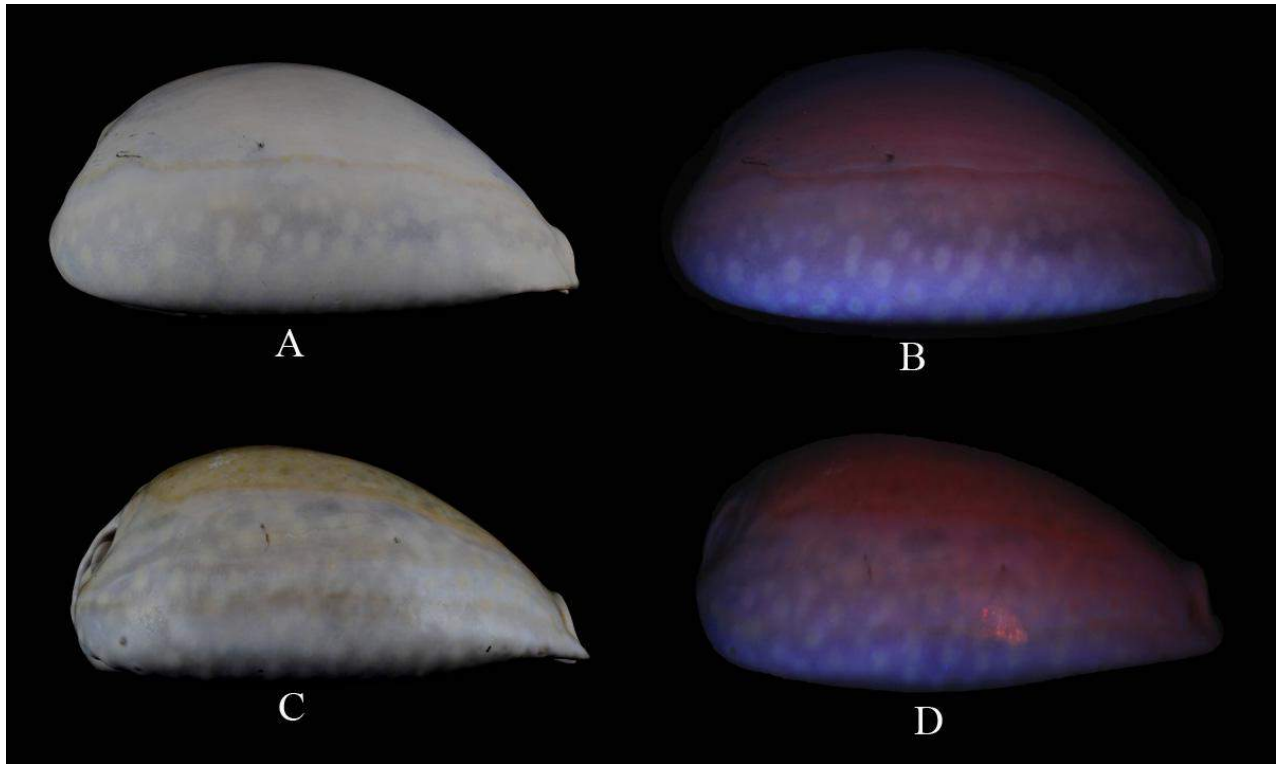


Figure 3. Ultraviolet light images of *Siphocypraea (Lokossea) daughenbaughi* Berschauer and Waller, new species. **A, B** = holotype, 65.6 mm in length, LACMIP 42927.1 (type 14868); **C, D** = 62.3 mm in length (Daughenbaugh Collection).



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