A NEW SPECIES OF *RHYNCHOLAMPAS* (ECHINOIDEA: CASSIDULIDAE) FROM THE CHIPOLA FORMATION: THE FIRST CONFIRMED MEMBER OF THE GENUS FROM THE MIOCENE OF THE SOUTHEASTERN U.S.A. AND THE CARIBBEAN

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The cosmopolitan echinoid genus *Rhyncholampas* is found in deposits ranging from the Paleocene to the Recent. In the southeastern United States and the Caribbean, the genus is a common constituent of Eocene, Oligocene and Plio-Pleistocene strata. Three different species of *Rhyncholampas* have been reported from "Miocene" units in Florida, North and South Carolina, and Cuba over the last seventy years. However, no verifiable records of the genus as occurring in the Miocene of the southeastern United States or the Caribbean can be substantiated.

Revisions in paleontologic taxonomy and stratigraphic age interpretations for *Rhyncholampas* species require a new interpretation for the history of this echinoid genus. Sanchez Roig (1926) first reported the species description and geologic age for *Rhyncholampas rodriguezi* Lambert and Sanchez Roig, 1926, as a new taxon from the lower Oligocene of Cuba. In the same monograph, Sanchez Roig reported collecting specimens he referred to as *Rhyncholampas* sp. cf. *R. alabamensis* (a species in the genus *Cassidulus*), from a lower Oligocene unit as well. More than twenty years later, Sanchez Roig (1949) listed both taxa as occurring in Tertiary rocks in Cuba, but altered his original interpretation for the ages of the stratigraphic units from which these two species were collected. He indicated the formation containing *R. rodriguezi* was a lower Miocene unit and the formation containing *Rhyncholampas* sp. cf. *R. alabamensis* potentially was an Oligo-Miocene unit (rather than Oligocene as previously had been proposed for both taxa).

More recently, Kier and Lawson (1978) compiled an index of living and fossil echinoids from papers published prior to 1971, and included *R. rodriguezi* as part of lower Oligocene stratigraphic units only, not the Miocene as reported by Sanchez Roig. Kier (1984) briefly addressed the stratigraphic age problem of several echinoids previously reported from Cuba, and the uncertainty of the stratigraphic units' status and potential correlation to units in the United States. During this discussion, the list of echinoid taxa provided by Kier did not specifically pertain to cassiduloids (and therefore did not include any species of *Rhyncholampas*). It is of relevance to this paper, however, because he stated that several of the stratigraphic distribution reports for the Miocene echinoids should be used with caution when trying to correlate stratigraphic units in Cuba to regions outside the island. The second potential Miocene echinoid from Cuba, listed by Sanchez Roig (1926) as *Rhyncholampas* sp. cf. *R. alabamensis*, no longer is of concern either, since Cooke (1959) synonomized *Cassidulus alabamensis* with *Rhyncholampas gouldii* (Bouve, 1846), which has been reported only from Oligocene strata.

The third species of echinoid of significance to this paper was reported from the Miocene in Florida. Cooke (1959) reported *Cassidulus sabistonensis* Kellum, 1931, present in the late Miocene Tamiami Formation of Florida as well as localities in North and South Carolina. Kier (1962) did not formally place this species in the *Rhyncholampas* genus in his monograph, but strongly suggested a detailed analysis would warrant a revision from its position within the *Cassidulus* genus as Cooke (1959) proposed. Regardless of the taxonomic status of the echinoid, the stratigraphic age of the Tamiami Formation is no longer interpreted to be Miocene as Cooke reported in his monograph. The age of the Tamiami Formation in Florida presently is considered to be Pliocene (see the details in the discussion section) and therefore, this echinoid would not repre-

sent a Miocene record of the genus *Rhyncholampas*.

In 1993, a single, fairly well-preserved specimen of *Rhyncholampas* was found in early Miocene Chipola Formation sediment by Andrew and Greta Murray while snorkeling along the Chipola River in Calhoun County, Florida. This specimen, named *Rhyncholampas chipolanus,* n. sp., herein represents the first record of the genus from the Miocene of Florida, as well as the rest of the southeastern United States and Caribbean.

The Murrays collected the specimen at UF locality CA025, *in situ,* from one meter below the top of the Chipola Formation shell bed. At the site, Chipola strata is known to be at least 2.5 meters thick and consists of a loose, fine- to coarse-grained, quartz sand with limy boulders, coral head fragments, and numerous mollusk shells.

Taxa collected in association with the Chipola *Rhyncholampas* include test fragments and spines of the echinoid *Prionocidaris cookei* Cutress, 1976, *Clypeaster concavus* Cotteau, 1875, and an unconfirmed species of *Abertella* (see Cooke, 1959, p. 45). Numerous mollusks also are common, including the gastropods *Rhinoclavis chipolana* (Dall, 1892), *Terebralia dentilabris* (Gabb, 1873), *Tenuicerithium chipolanum* (Dall, 1892), *Orthaulax gabbi* Dall, 1890; and the bivalves *Donax trueloides* Gardner, 1928, *Chione chipolana* Dall, 1903, *Linga glenni* (Dall, 1903), *Armimiltha chipolana* (Dall, 1903), and *Pteria chipolana* Dall, 1898.

Species of *Rhyncholampas* inhabit environments similar to other cassiduloids, preferring sandy substrates in which they are infaunal to semi-infaunal dwellers, and water depths of intertidal zones to greater than 20 meters (Kier, 1962; 1975). *Rhyncholampas chipolanus*, n. sp., was collected from sandy sediments and appears to fit the generalized ecologic conditions typical for cassiduloids.

Additional collecting at UF locality CA025 and a search of the collections of Chipola Formation materials at Tulane University, the Hoerle Collection at the National Museum of Natural History, the Florida Museum of Natural History (FLMNH), and the Florida Geological Survey Collection (recently transferred to the FLMNH) yielded no additional specimens.

Other echinoids previously found in the Chipola Formation include *Echinocyamus chipolanus* Cooke, 1942, and an undescribed brissid. The Chipola Formation echinoderm fauna, as well as the rest of the Florida Miocene echinoderm fauna is inadequately documented, due mainly to poor preservation and collector bias (Oyen and Portell, 1993; 1994). Currently, Portell and Oyen are conducting additional studies that should yield a number of new Florida Miocene taxa.

ACKNOWLEDGMENTS

Andrew and Greta Murray of Bradenton, Florida are thanked for discovering the holotype and for donating this rare specimen, along with many other rare taxa, to the Florida Museum of Natural History. Emily and Harold Vokes permitted access to the Tulane University Collection. Thomas Waller and Warren Blow provided assistance while examining the Hoerle Collection of Chipola Formation fossils at the National Museum of Natural History. Burchard Carter, Georgia Southwestern College and Stephen Donovan, University of the West Indies kindly reviewed the manuscript. This is University of Florida Contribution to Paleontology 471.

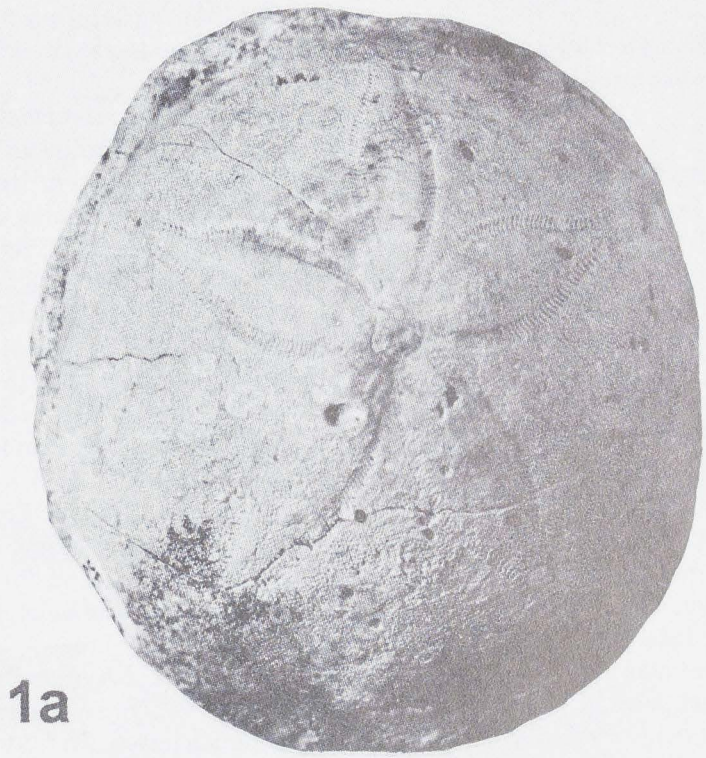
SYSTEMATIC PALEONTOLOGY

Class ECHINOIDEA Leske, 1778
Order CASSIDULOIDA Claus, 1880
Family CASSIDULIDAE
A. Agassiz and Desor, 1847
Genus RHYNCHOLAMPAS
A. Agassiz, 1869

PLATE 1

Figures

1a-1b. *Rhyncholampas chipolanus* Oyen and Portell, n. sp.; UF 66633 (holotype).
1a. Adapical view, x1.
1b. Adoral view, x1.



1a

1b

PLATE 1

Rhyncholampas A. AGASSIZ, 1869, Bull. Mus. Comp. Zool., v. 1, p. 270.

Type species: *Pygorhynchus pacificus* A. Agassiz, 1863, by subsequent designation, Lambert, 1918.

RHYNCHOLAMPAS CHIPOLANUS
Oyen and Portell, n. sp.
Plate 1, figures 1a,b
Plate 2, figures 2a,b

Description:

Diagnosis: Species characterized by slightly truncated oval outline, moderately sloping sides with focused peak at apical system, depressed adoral surface, nearly closed lanceolate petaloid ambulacra, and pentagonal periproct.

Shape: Large, having test length of 77.8 mm; width relatively uniform and measures 64.9 mm at mid-length of test; margin relatively sharp and angular in posterior, subrounded to moderately truncated along lateral margins; height measures 40.3 mm from adoral surface to peak at apical system; highest point at apical system, slightly anterior of test center; sides slope moderately with slightly shallower slope in upper half and slightly steeper slope in lower half of specimen.

Apical System: Located central to slightly anterior of test length midpoint; compact size.

Ambulacra: Petals well developed, broad, lanceolate, with greatest width at approximately 35% of petal length; petals I and V are longest, III is slightly shorter, and II and IV are shortest; petals extend about 65% of distance to test margin; petal widths nearly equal, with petal III 25% narrower than others; petals almost closed at distal end.

Periproct: Supramarginal; width approximately 1.5x greater than height; pentagonal shape with apex oriented toward apical system; slight groove extending from opening to posterior margin; base of opening located 10.4 mm above adoral surface.

Peristome: Moderately anterior, pentagonal, and depressed; width approximately 1.7x greater than anterior-posterior length; anterior margin of opening located 26.9 mm from anterior test margin.

Floscelle: Bourrelets distinct and pointed.

Tuberculation: Adapical tubercules small and uniformly distributed; limited visible adoral tubercules near peristome are distinctly larger.

Holotype: UF 66633; length 77.8 mm, width 64.9 mm, and height 40.3 mm.

Type locality: UF locality CA025, west bank of the Chipola River, approximately 0.5 miles upstream from the mouth of Fourmile Creek, Calhoun County, Florida (NW1/4, SW1/4, Sec.29, T1N, R9W, Clarksville Quadrangle USGS 7.5' series).

Occurrence: Chipola Formation, northwestern Florida; early Miocene.

Etymology: Named for the Chipola River from whose bank the holotype was collected.

Discussion: Rhyncholampas chipolanus, n. sp., is extremely rare, with only one specimen known and available for examination. Comparison with the Pliocene species *Rhyncholampas ayresi* Kier, 1963, from the Caloosahatchee Formation in Florida shows only minor morphological similarities. *Rhyncholampas chipolanus* is distinguished from *R. ayresi* by its angular adapical-adoral surface contact, lower width-to-length and height-to-length ratios, pentagonal periproct, concave adoral surface, and its more conical adapical shape. Comparison with another Pliocene species, *Rhyncholampas evergladensis* (Mansfield, 1932), shows a stronger morphological resemblance. Both *R. chipolanus* and *R. evergladensis* have similar width-to-length ratios (of approximately 0.83), a concave adoral surface, a transverse oriented periproct, and the test length of *R. chipolanus* falls within the

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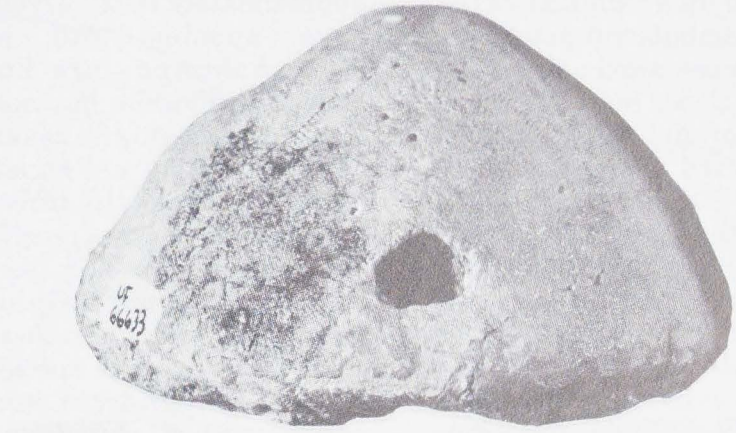
PLATE 2

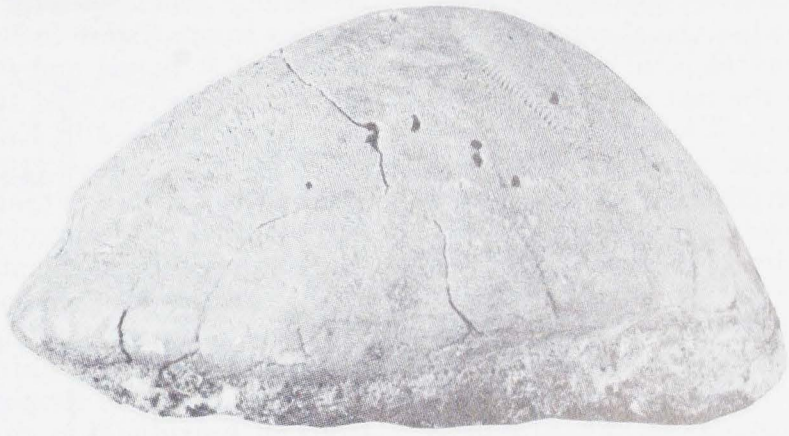
Figures

2a-2b. *Rhyncholampas chipolanus* Oyen and Portell, n. sp.; UF 66633 (holotype).
2a. Posterior view, x1. Note pentagonal shape of periproct with apex of pentagon directed upward.
2b. Lateral view showing general conical shape of test with the peak of the cone located approximately at apical system, x1.

3. *Rhyncholampas evergladensis* (Mansfield, 1932); UF 24524, x1. Lateral view showing less conical shape of test in comparison with the new species shown in Figure 2b.



2a



2b

3

PLATE 2

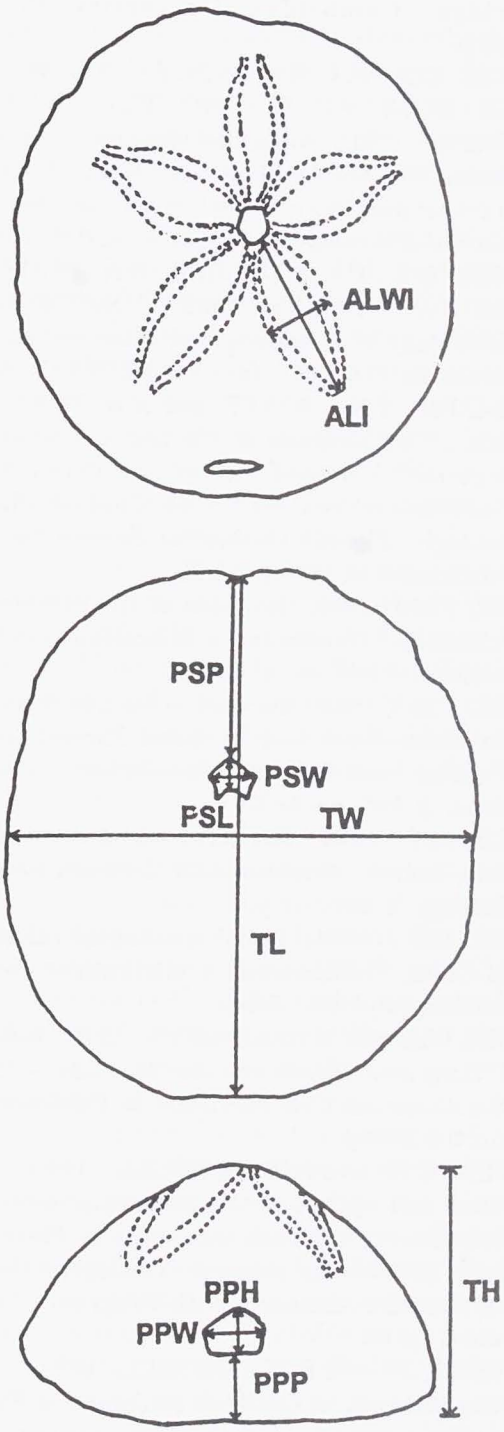
size range for test lengths of *R. evergladensis* as described by Kier (1963).

However, differentiation of the two species can be accomplished using several characteristics. *Rhyncholampas chipolanus* has adapical ambulacral petals that terminate slightly more proximally to the apex and are nearly closed but petals on *R. evergladensis* remain distinctly open and extend further toward the test margin. The distal petaloid ambulacral width (when expressed as the ratio of distal petal width to test length) averages 0.040 for *R. chipolanus,* while the ratio averages 0.073 for the sample population of ten individuals of *R. evergladensis.* Since only a single holotype specimen exists, no statistical tests for significance can be used to compare the mean ratios of petaloid distal width between the two species. It does, however, support the visual estimate and interpretation that the petal widths (at the distal ends near the test margin) are different. The periproct is transversely oriented in both species, but in *R. chipolanus* it is pentagonal in outline, with the apex of the pentagon pointing up (*i.e.,* adapical), whereas the periproct of *R. evergladensis* is more oval or elliptical shaped, and the lower edge of the opening is depressed slightly downward (toward the adoral surface). Finally, *Rhyncholampas chipolanus* has a more highly peaked, conical, apical system but most of the 50 specimens of *R. evergladensis* examined in the Florida Museum of Natural History have a less conical adapical surface (see Plate 2, figures 2 and 3). It should be noted that several specimens do have surfaces approaching a conical shape, but none to the degree found in the newly described species. Furthermore, the very few specimens of *R. evergladensis,* which are more conical in form, represent an exceptionally small percentage of the total sample population examined during the course of this comparison.

Comparison with other species of *Rhyncholampas* known from the Tertiary resulted in no other close morphological matches. *Rhyncholampas gouldii* (Bouve, 1846), an Oligocene cassiduloid from the Suwannee Limestone, has modest shape similarities, but none of the hundreds of specimens examined or measured in the FLMNH collections have test lengths within approximately 20 mm of *R. chipolanus,* and the width-to-length ratio of *R. gouldii* is significantly greater than in *R. chipolanus* (W/L ratio averages approximately 0.92; Oyen, unpubl. data). Five species and subspecies of *Rhyncholampas* are known from the Eocene in Florida, but none of these taxa have morphologic resemblance to *R. chipolanus.* All are significantly smaller and have distinctly different test shapes and, therefore, have no effect on this taxonomic description and species designation. Both of the valid Cuban species, *R. rodriguezi* and *R. cervatesi* Sanchez Roig, 1949, (an Oligocene species) are much too small to be considered reasonable for comparison with *R. chipolanus.* Overall body size as interpreted from test length measurements seems to limit the reasonable species comparisons to the two Pliocene species of *R. ayresi* and *R. evergladensis.* A thorough review of taxonomic synonymies described in Kier (1962, 1963) and Kier and Lawson (1978) revealed no other potential species that are morphologically similar or of appropriate age to dissuade this species designation.

Another aspect of support for our interpretation is the length of species durations exhibited in other echinoids from the Cenozoic. Based on stratigraphic distributions in Florida, it is rare for echinoid species to be found in more than one stratigraphic unit (although this fact is a function of the current stratigraphic status of the various formations). In any case, the temporal range for known echinoid species from the southeastern U.S. is relatively short. One would expect to have a unique species of *Rhyncholampas* present in the Miocene since the prior species known is *R. gouldii* from the Oligocene and the subsequent species known is *R. evergladensis* from the Pliocene. Using Sr isotopic age calculations, Jones *et al.* (1993) determined the age assigned to the Suwannee Limestone (early Oligocene) to be approximately 34.8 Ma, and the age assigned to the Chipola Formation (early Miocene) to be approximately 18.7 Ma. The age assigned to the Tamiami Formation (early Pliocene) cannot be resolved to a single age value using Sr isotopic calculations alone because of limitations in the technique, but Jones *et al.*

(1991) have estimated the potential age range for a portion of the Tamiami Formation exposed near Sarasota, FL to be constrained within an age range older than 3.0 Ma (using Sr isotopic age calculations) and restricted to the early Pliocene. Using Harland *et al.* (1989), the age applied to the early Pliocene starting time



BIOMETRIC MEASUREMENTS

Test Dimensions	
Test Length (TL)	= 77.8 mm
Test Width (TW)	= 64.9 mm
Test Height (TH)	= 40.3 mm
Peristome Dimensions	
Peristome Length (PSL)	= 4.3 mm
Peristome Width (PSW)	= 7.2 mm
Peristome Position (PSP)	= 26.9 mm
Periproct Dimensions	
Periproct Width (PPW)	= 10.3 mm
Periproct Height (PPH)	= 6.8 mm
Periproct Position (PPP)	= 10.4 mm
Ambulacra Dimensions	
Amb. I Length (ALI)	= 32.1 mm
Amb. II Length (ALII)	= 25.8 mm
Amb. III Length (ALIII)	= 29.8 mm
Amb. IV Length (ALIV)	= 26.9 mm
Amb. V Length (ALV)	= 32.8 mm
Amb. I Width (ALWI)	= 10.8 mm
Amb. II Width (ALWII)	= 11.6 mm
Amb. III Width (ALWIII)	= 8.5 mm
Amb. IV Width (ALWIV)	= 11.4 mm
Amb. V Width (ALWV)	= 10.8 mm

TEXT-FIGURE 1

This figure illustrates the location where biometric data from morphological features were derived. Morphologic trait abbreviations are associated with full name in biometric data table provided next to the specimen illustrations.

is 5.2 Ma, therefore the early Pliocene (which includes the *R. evergladensis* - bearing Tamiami Formation) is likely found within an age range of about 3.0 to 5.2 Ma. Thus, the species distribution gap for *Rhyncholampas* was from 34.8 to 5.2 Ma, which is an exceptionally large interval of time to have no species evolve within the genus, and the addition of another species (*R. chipolanus*) to the record of this genus is reasonable and would be an expected component to fill the temporal and stratigraphic gap of species distribution in this Cenozoic echinoid genus.

Several important points regarding the measurements should be noted, and the biometric measurements taken on the holotype specimen are provided in Textfigure 1 as well as illustrations showing measurement positions. The test width (TW) was measured at the midpoint of the test length (TL). Test height (TH) is the maximum height from the adoral surface to the peak at the apical system. Periproct height (PPH) was measured at the midpoint of the periproct width (PPW), and the peristome width (PSW) is the maximum width. Finally, all ambulacrum lengths (ALI - ALV) were measured from the apical system margin to the last pore pair of each petal and ambulacrum widths (ALWI - ALWV) were measured at the maximum width between outer pores on the petal.

LOCALITY DATA

The following is a collecting locality of the Invertebrate Paleontology Division, Florida Museum of Natural History, University of Florida (UF) in the early Miocene, Chipola Formation.

CA025 West bank of the Chipola River, approximately 0.5 miles upstream from the mouth of Fourmile Creek, Calhoun County, Florida (NW1/4, SW1/4, Sec.29, T1N, R9W, Clarksville Quadrangle USGS 7.5' series). Equivalent to Tulane University locality 1545.

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