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New Syncerid Mollusks from the Marianas Islands¹
(Gastropoda, Prosobranchiata, Synceridae)

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During 1945, the last year of World War II, I collected a number of apparently undescribed syncerid mollusks on the islands of Saipan and Guam in the Marianas. The acquisition by the United States National Museum of similar material from Dr. Charles S. Richards of Stanford University and Dr. W. H. Lange of the University of California has prompted the beginning of a study of this group. The holotypes are deposited in the Division of Mollusks in the United States National Museum, and a set of paratypes in the Bernice P. Bishop Museum and the Museum of Comparative Zoölogy at Harvard College. William J. Clench kindly sent the Saipan material in the Museum of Comparative Zoölogy to me for study.

The most extensive work on the Synceridae of the Marianas Islands was done in 1894 by *Quadras* and *Moellendorff*, who jointly named 18 species of *Omphalotropis* and *Paludinella* from Guam Island. It is interesting to find that Saipan Island to the north has a very similar, though more depauperate, representation of the two genera. The morphological differences in the shells of the two islands are relatively slight.

The gross anatomy of the genera *Omphalotropis*, *Heteropoma*, *Paludinella*, and *Quadrasia* were hitherto unknown, although the radulae have been excellently illustrated in a number of omphalotropid genera by *Kondo* (*B. P. Bishop Mus., Occ. Papers* 17 (23) : 313-318, 1944). There seems to be some justification from our present knowl-

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edge of the anatomy to separate Thiele's subfamilies of Syncerinae and Omphalotropinae [Zool. Jahrb. Syst. 53: 113-146, 1927; Handbuch der Systematischen Weichtierkunde (1), 1929] into separate families. However, in view of the incompleteness of our studies, it seems best at present to retain these groups under the one family, Synceridae. A brief résumé of the more important distinguishing characters of these two groups is given below. It will be noted that the genus *Paludinella* has been removed from the Syncerinae and added to the Omphalotropidinae. Jaume and Abbott have already shown [Rev. Soc. Mal. Torre 6 (1): 5-8, 1948] that the genus *Nanivitrea* is not a syncerid, but an annicolid freshwater mollusk.

FAMILY SYNCERIDAE
SUBFAMILY SYNCERINAE

Animal with simple head and proboscis; without proboscis cape. Eyes and tentacles fused into a stubby eyestalk. Foot often dorso-ventrally doubled at the anterior half. Pedal gland large, bulbous, embedded in the dorsal surface of anterior part of foot. Operculum paucispiral. Radula with a moderately fan-shaped outer marginal, but never split into secondary ribbons. (Genera: *Syncera*, *Acmella*, *Turbacmella*, *Conacmella*.)

SUBFAMILY OMPHALOTROPIDINAE

Animal with proboscis cape overlying posterior section of proboscis. Eyes at base of moderately developed tentacles. Foot with a deep and wide slit at its posterior end, behind which is located the diffused pedal gland. Operculum paucispiral with nucleus more central than that in the Syncerinae. Radula with a fan-shaped outer marginal which is pectinate or split into several secondary ribbons, each of which bears minute denticles. (Genera: *Omphalotropis*, *Paludinella*, *Electrina*, *Rapanella*, *Quadrasiella*, *Garretia*, *Fijianella*, *Heteropoma*.)

Genus **Omphalotropis** Pfeiffer

Omphalotropis Pfeiffer, Zeitschr. f. Malakoz., year 8 (11):176, 1851.

Genotype: designated by Iredale 1941; *O. hieroglyphica* Ferussac.

Eurytropis Kobelt and Moellendorff, Cat. Pneumon., Deutsche Malak. Gesell., Nachr. 30: 148, 1898.

Animal is unique in the possession of a fleshy cephalic cape, which extends over a small portion of proboscis. Anterior end of foot bears a wide and deep slit, within which is found a small, notched flap protecting the mucus slit. The corneous operculum of many of the species (*Omphalotropis s.s.*) is coated with small, coarse, brown granules of calcium.

The genus *Omphalotropis* has well over 100 species which are endemic to many sections of the tropical land areas of the Indian and Pacific Oceans. The 19 species and "varieties" which have been described from Guam exhibit an interesting series of modifications, not only from species to species, but quite often within each colony of one species.

Iredale, in 1941 (*The Australian Zoologist* 10 (1): 59), discussed the use of the name *Realia* Gray, 1850, as a replacement for *Omphalotropis* Pfeiffer 1851. His argument hinges on his belief that Gray's "Figures of molluscos animals" (4: 120) was published before June 1850. The date appears to be still in doubt, and I am accordingly accepting *Realia* with its type *egca* Gray (*Zool. Soc. London, Proc.*, 167, 1849 [1850]) as the earliest valid introduction of this name. Therefore, *Omphalotropis* should continue in use until an earlier date is discovered for Gray's "Figures of molluscos animals." This will be in accordance with all recent monographers and revisors of this group, except Iredale.

***Omphalotropis cookei*, new species (fig. 1, a-e).**

Adult shell small, 7.0 to 8.5 mm. in length, relatively thin but strong, moderately globose, umbilicated and brightly colored. Whorls 5 to 6 in number. Nuclear whorls microscopically granulose. Postnuclear whorls barely convex above, rounded below. Periphery of body whorl sometimes bears a slight or well-developed carina. Suture well-indented, forming a minute but well-developed channel above last whorl. Umbilicus moderately to well-opened, but constricted above by columella and basal carina. Umbilicus is bordered on side opposite columella by a raised and moderately rounded carina, which is generally white in color. Carina extends down to lower edge of lip of shell just below columella. Columella arched, rounded, but with a sharp edge on umbilical side. Parietal wall covered over by a moderately thick glaze. Aperture subovate and oblique. Outer lip slightly thickened, increasingly flared below, and slightly reflected below columella. Spiral sculpture prominent under magnification, consisting of small, raised and distinct threads, ranging in number from 12 to 21, with 16 occurring most commonly. Threads are most evenly spaced and developed on early whorls, often becoming indistinct on last whorl, and rarely present on base of last. Some specimens in a few localities become heavily

pustulose or pock-marked on last third of body whorl. In extreme cases, this sculpturing is in form of irregular, diagonally slanting furrows. Color of shell variable, some specimens being a rosy pink, a purplish pink, an orange yellow, or a reddish brown. A narrow diffused band or a series of flammules of whitish cream is often found just below suture. In a few yellowish-tan specimens, there are four narrow brown spiral bands, one well below the suture, two on either side of white peripheral carina, and the fourth just below white umbilical carina. One chocolate-brown specimen shows three cream spiral bands on body whorl, center one in area of peripheral carina being wider than the rest.

Outer lip is often white, in darker specimens tinted with light orange brown or chocolate brown. Operculum pauci-spiral, corneous, thin, translucent, with a fine coating of minute, brown calcium granules on outside. Radula is similar to that drawn in figure 5, *c* for *Paludinella conica* Q. and M. Central tooth is twice as long as broad with a denticle count of 3-1-3. Lateral count is 1-1-4 and 1-1-3; inner marginal, 8; and outer marginal, 24 to 25, with each individual or separated ribbon bearing 3 extremely fine subdenticles.

Verge in males is broad and flattened with a rapidly narrowing distal end, which bears a small papilla on one side. Underside of bulbous portion of verge bears one large, laminated gland and one small convoluted gland. Mantle is thickened at its border and lightly dusted with gray specks. No gills present; tentacles moderately shortened, and dusted with gray. Head cape overlapping posterior portion of proboscis is well-developed, bifurcate dorsally, and rounded on side flaps. Just below cape, on right side is a fairly long, needle-like protrusion pointing anteriorly. Below this, and running posteriorly from juncture of proboscis and foot, is a fairly deep groove on each side of body extending a short way back. A very wide slit at anterior end of foot, within which is a thin, centrally notched skin flap. A black band of color runs across anterior portion of head cape and sides of body. Dimensions of shell (in millimeters):

	LENGTH	WIDTH	APERTURE	
Holotype.....	7.9	5.2	3.3 × 4.0	USNM 591306
Paratype.....	7.8	5.5	3.4 × 4.0	USNM 591307
Paratype.....	8.2	5.6	3.5 × 4.1	MCZ 182894

Type locality: Marpi Cliff, Saipan Island, Marianas; W. H. Lange, March 4, 1948.

Holotype, USNM 591306; paratypes, MCZ 182894 and BBM 212195. Other paratypes: Saipan: Mt. Nafutan, Lange (USNM 591309, MCZ 182898); westernmost gulley, south side of Kagman Point, R. T. Abbott, April 16, 1945 (USNM 591311, MCZ 182896 and BBM 212197); highest hill on Kagman Point (USNM 591308); grove, 6.8 miles north of Kagman Point (USNM 591310, MCZ 182897, BBM 212196); gulley, north end of Magicienne Bay (USNM 591314 and MCZ 182890); hill, 83° from Maniagassa Island and 352° from Kagman Point (USNM 591313 and MCZ 182895). (Above six lots collected by Abbott April 14-16, 1945.) Saipan, W. Langford, 1948 (MCZ 183558). Guam, Quadras (USNM 201181).

O. cookei is closest in morphological characters to *O. erosa* Quoy and Gaimard from Guam, but differs in having the many, pronounced spiral threads; brighter and more varied color patterns; and, in some specimens, a more constricted umbilicus. *O. cookei* exhibits in the same colony a remarkable amount of variation in color pattern, width of umbilicus, strength of umbilical carina and peripheral carina, and

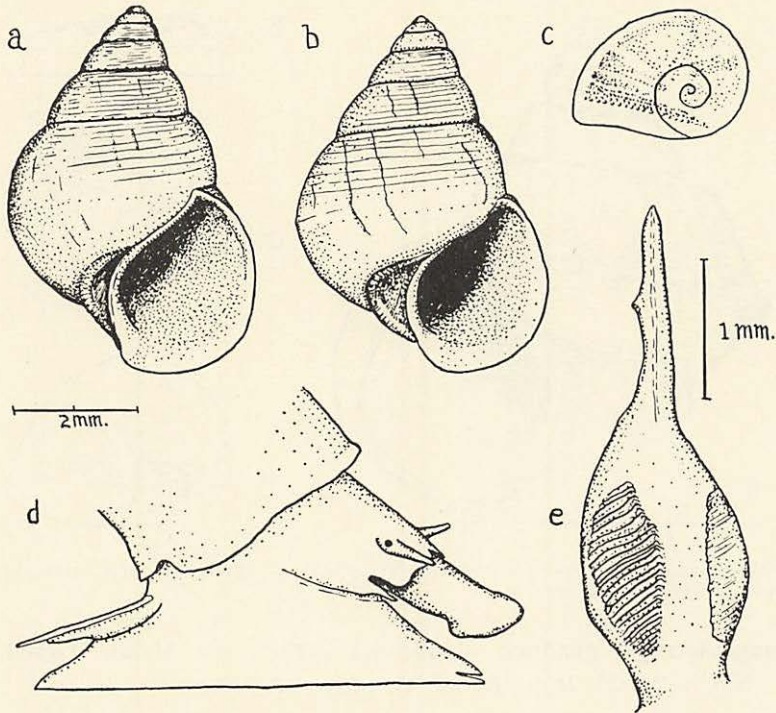


FIGURE 1.—*Omphalotropis cookei*: a, holotype; b, paratype shell; c, operculum exterior; d, side view of animal; e, underside of verge of male.

degree of pock-marking on the last whorl. Some sections of Saipan appear to have more brightly hued specimens, but no pattern of distribution could be ascertained from the material at hand. We have only two specimens which show diagonal, pitted furrows on the last part of the body whorl. Although we have not seen similar furrows in specimens from Guam, the original description of *erosa* mentions this character. A single lot of six specimens from Guam is of particular interest, since it shows that *O. cookei*, like *Partula gibba* Ferus-

sac, is common to these fairly distantly separated islands. This lot was received from the Quadras collection, identified erroneously as *O. erosa* Quoy and Gaimard.

While writing this paper, I learned with deepest regret of the death of Dr. C. Montague Cooke, Jr. on October 29, 1948, after whom this species is named.

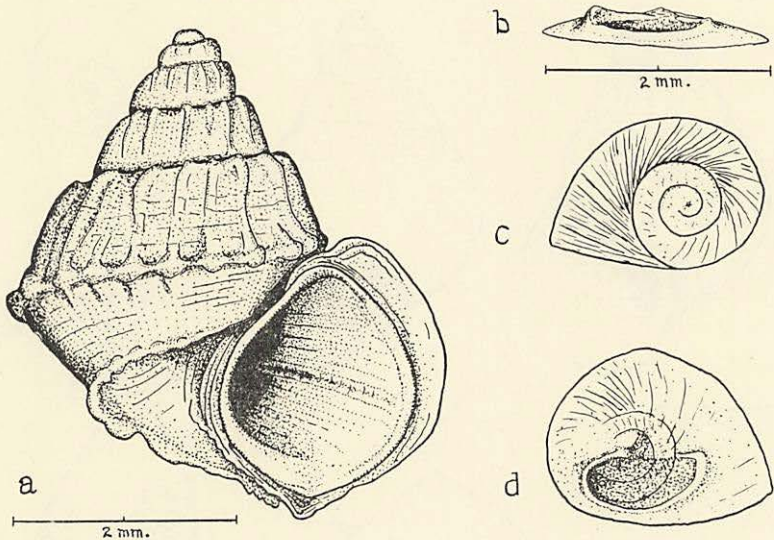


FIGURE 2.—*Omphalotropis quadrasi* (cotype): a, shell; b, operculum side view; c, exterior; d, interior.

Omphalotropis quadrasi Moellendorff, *Deutsche Malak. Gesell., Nachr.* 26: 21, 1894 (figs. 2, *a-d*; 3, *a-c*).

Operculum bears a rather heavy, horseshoe-shaped, chitinous ridge for muscle attachment on inner surface. Outer surface is coated with a very fine layer of brown calcareous grains. Shells of several specimens possess several rather strong, spiral, raised threads similar to those in *O. cookei* Abbott. Animal is shown in figure 3, *a-c*. Mantle is colored a solid cream. Tentacles and sides of proboscis are lightly tinged with black. Cephalic cape is well-developed. Radula is typically omphalotropid with the following count: central, 3-1-3; lateral, 1-1-3; inner marginal, 6 to 7; outer marginal 20 to 22.

Type locality: Guam Island, Marianas.

Guam: "cotypes" from the Quadras collection, Inarajan (USNM 201173), Tumon Bay (USNM 591404), Retillan (USNM 591403) (BBM 86234); Ukudu, alt. 300 ft., H. G. Hornbostel, Nov. 11, 1925

(BBM 82752); Anao Point, Abbott, 1945 (USNM 591316); Pago Bay, C. S. Richards, Aug. 1945 (USNM 589988).

This species is figured here for the first time.

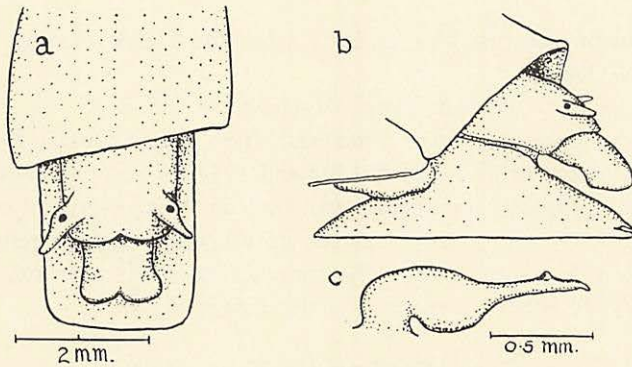


FIGURE 3.—*Omphalotropis quadras*: a, dorsal view of animal; b, side view of animal; c, verge of male.

Omphalotropis guamensis Pfeiffer, Zool. Soc. London, Proc., 113, 1857 (fig. 4, a, b).

Animal is typically omphalotropid with a well-developed cephalic cape. Anterior end of tentacles and anterior edge of cape are dusted with dark gray. Operculum is externally coated with progressively larger grains of brown calcareous material.

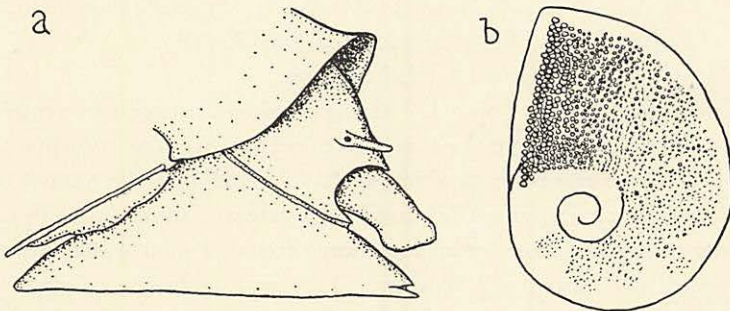


FIGURE 4.—*Omphalotropis guamensis*: a, side view of animal; b, operculum exterior.

Type locality: "Isle of Guam."

Guam: 200 ft. south-southwest of Mt. Alifan peak, Abbott, Oct. 23, 1945 (USNM 591315); Agana, Quadras (USNM 201176); Pago Bay, Richards, Aug. 1945 (USNM 589979).

Genus **Heteropoma** Quadras and Moellendorff

Heteropoma Q. and M., Deutsche Malak. Gesell., Nachr. 26: 36, 1894.

Genotype: *Heteropoma quadrasi* Moellendorff.

Heteropoma quadrasi Moellendorff, Deutsche Malak. Gesell., Nachr. 26: 36, 1894.

Type locality: Guam Island, Marianas.

The animals of "cotype" material from Asan, Guam, from the Quadras collection (USNM 591405 and 591406) were examined and found to be typically omphalotropid, both in their verge and cephalic cape characters. The inner surface of the operculum is reinforced with a low, chitinous ring. The radula formula is: central, 2-1-2; lateral, 2-1-3; inner marginal, 4; outer marginal, 18.

Genus **Quadraziella** Moellendorff

Quadraziella Moellendorff, Deutsche Malak. Gesell., Nachr. 26: 38, 1894.

Genotype: *Quadraziella mucronata* Moellendorff.

Quadraziella mucronata Moellendorff, Deutsche Malak. Gesell., Nachr. 26: 38, 1894.

Quadraziella mucronata Moellendorff, Cooke and Clench, B. P. Bishop Mus., Occ. Papers 17 (20): 260-261, fig. 9, 1943; Kondo, B. P. Bishop Mus., Occ. Papers 17 (23): 317, 1944.

Type locality: Guam Island, Marianas.

Cooke and Clench (op. cit.) have published an excellent drawing by Y. Kondo of a cotype shell, and Kondo (op. cit.) has recorded the radulae. From alcoholic material we have found that the animal has the following typically omphalotropid characters: Mantle smooth and slightly thickened at border, a translucent cream. Tentacles moderately shortened and dusted a light gray. Body and proboscis colored (in alcohol) a light tan cream. The foot has a deep, wide slit at its anterior edge. A fleshy short cape extends down from the head, just in front of the tentacles for a short distance over the dorsal and posterior portion of the proboscis. The cape is bifurcated on the dorsal midline. A narrow body groove extends from the juncture of the proboscis and foot posteriorly and upward along the side of the body. It is

more pronounced on the right side. The verge is a simple prong with a small papilla near the distal end.

Guam: Agana (Quadras Collection, USNM); Ucode (Cooke and Clench); Pago Bay (Richards, Aug. 1945).

Genus *Paludinella* Pfeiffer

Paludinella Pfeiffer, Arch. f. Naturg. 7 (1):227, 1841 (non Beck 1897; non Rossmassler 1851).

Solenomphala (Heude) O. Boettger, Jahrb. Malak. Gesell. 17:152, 1887.

Assiminella Monterosoto, Naturalista Siciliano 18 (6):5, 1906.

Genotype: *Helix litorina* Delle Chiaje, 1825.

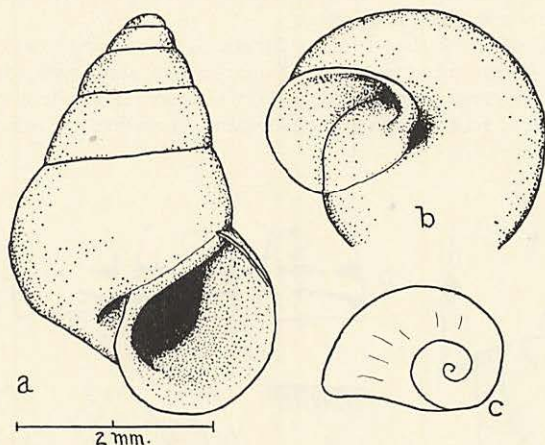


FIGURE 5.—*Paludinella conica* (cotype): a, apertural view of shell; b, umbilical view of shell; c, operculum.

There has been a natural confusion between this genus and *Syncera*, since the shells of each are so much alike. This has been particularly true in the case of the very small, smooth, and brown-colored species. On Guam the *Syncera* species is represented by *S. nitida guamensis* Abbott and the *Paludinella* species by *P. conica* Quadras and Moellendorff. The former may be distinguished from the latter by the presence of a fine, distinct, raised thread running just below the suture, by the absence of an umbilicus at the base of the shell, and by the more excentric and more closely spiralled nucleus of the operculum.

Paludinella conica (Quodras and Moellendorff) (figs. 5, *a-c*; 6, *a-c*).

Omphalotropis (Solenomphala) conica Q. and M., Deutsche Malak. Gesell., Nachr. 26: 34, 1894 (Marianas).

Adult shells small, about 4 to 5 mm. in length, elongate to ovate-conical, relatively fragile, smooth and colored a light translucent brown. Nuclear whorls smooth, rounded, glassy and lightly tinged with brown. Postnuclear whorls moderately rounded. Number of whorls 5 to 6. Last whorl slightly over 0.5 of total length of shell. Irregular axial lines of growth present. Suture fine and minutely impressed. Umbilicus small, fairly deep, and partially obscured by columella. On base of shell, bordering umbilicus, is a faint white band, which in a few specimens is barely raised to form a low carina. Aperture obliquely ovate, constricted above. Outer lip is not swollen, but is slightly flared in adults, especially at base. Parietal wall thickened by a translucent glaze. Columella short, rounded, pushed back and constricted in middle. Operculum thin, corneous, translucent tan, and paucispiral.

Radulae as shown in figure 6, *c*. Mantle is translucent cream with black markings, as shown in figure 6, *a, b*. Tentacles very short with eye at base. A cephalic cape overlaps proboscis for a short distance. There is a very deep slit at anterior end of foot. Verge in males located on midline of back, as shown in figure 6, *a*.

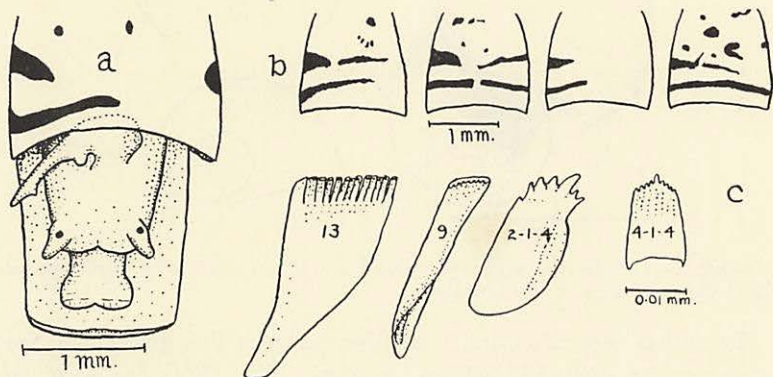


FIGURE 6.—*Paludinella conica*: a, dorsal view of animal; b, four variations in mantle pattern; c, radula.

Type locality: Inarajan, Guam Island, Marianas.

Cotypes: USNM 590980 (Inarajan), 201175 (Torgoyay-Agana, Guam).

Guam: Inarajan, Torgoyay-Agana, Pago Bay, Point Taguan, Oca Point (all USNM).

Paludinella conica saipanensis, new subspecies.

Carina at base of shell is always more developed than in *P. conica*, or often quite well-developed and much whiter. A peripheral, narrow, lighter band of color is present on body whorl in a few specimens. Columella is not as constricted in middle, and in fresh specimens is strongly tinted with reddish brown, especially on upper half. There appears to be a wider range in hue of browns of entire shell, which in certain localities may be reddish brown, whereas in other colonies there may be a mixture of specimens of reddish brown, light chocolate brown or yellowish brown. Bleached specimens are often quite yellow. Measurements (in millimeters):

	LENGTH	WIDTH	
Holotype.....	4.7	2.8	USNM 590981
Paratype.....	4.4	2.8	MCZ 182889
Paratype.....	4.6	3.0	MCZ 182889

Type locality: grove 6.8 mi., 358° from Kagman Point and 85° from Maniagassa Island, northern end of Saipan, Marianas, Abbott, April 14, 1945.

Holotype in USNM, 590981; paratypes from the above locality in MCZ, 182889. Other paratypes: Saipan: gully, north end of Magicienne Bay, Abbott, April 16, 1945 (USNM 590982, MCZ 182891 and BBM 212192); hill, 1,100 yards and 83° from Maniagassa Island, Abbott, April 4, 1945 (USNM 590985); Japanese Shrine, 2,900 yards and 232° from Tsukimi Island (USNM 590985 and MCZ 182892). Hill slope, 2,100 yards, 135° from Flores Point, Tanapag Harbor, Abbott, April 14, 1945 (USNM 590986, MCZ 182893, and BBM 212191). Another paratype lot labeled "Saipan Id., W. B. Langford, 1948" (USNM 590983, MCZ 183560 and BBM 212190).

This subspecies is extremely close to its parent, Guamanian species but appears to be fairly well-differentiated in all of our lots by the above characters.

SUBFAMILY SYNCERINAE

Genus **Syncera** Gray

Nerita (subgenus) *Syncera* Gray, London Medical Repository 15: 239, 1821 [genotype: monotypic, *Nerita* (*Syncera*) *hepatica* Gray].
Assimineia Fleming, Hist. British Anim., 275, 1828 (genotype: monotypic, *Assimineia grayana* Fleming).

Syncera nitida (Pease) (fig. 7, a-c).

Hydrocena nitida Pease, Zool. Soc. London, Proc., 674, 1864 [1865]; Jour. de Conch. 17: 165, pl. 7, fig. 11, 1869 (Huaheine [Huahine]).

There has been considerable difficulty in the identification of Pease's *S. nitida*. Nevill (Handlist Mollusca in Indian Museum (2): 71, 1885) believed that Pease had erroneously numbered the figure of his type (op. cit.) as 10 instead of 11. After looking at cotype

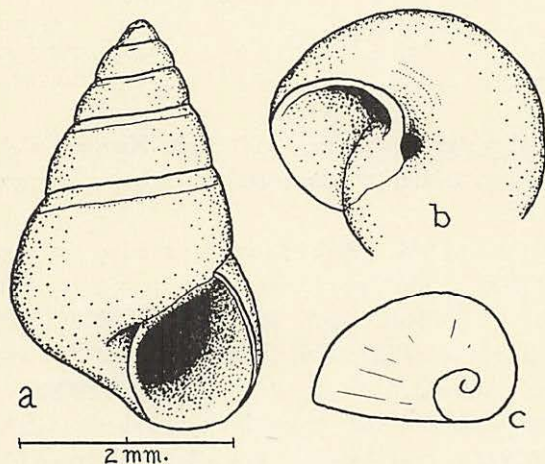


FIGURE 7.—*Syncera nitida* (cotype): a, apertural view of shell; b, umbilical view of shell; c, operculum.

material, I do not agree with Nevill that an error was made. Figure 10, labeled "*Assiminea lucida* Pease," shows a shell which fits the text description of *lucida* and not that of *nitida* as Nevill assumed. The cotypes of *nitida* in the U. S. National Museum lot 319748, one of which is depicted in my figure 7, all possess a minutely raised, spiral thread just below the suture. Pease did not mention this character, but easily might have overlooked it. I am omitting a description of the shell and operculum, but have carefully figured them. Several authors have in the past labeled closely resembling species or subspecies from the Philippines, the Marshall Islands, Mauritius, and China as *nitida* Pease. It is more than likely that Quodras and Moellendorff did the same for the common form on Guam, which is described below as a new subspecies of *nitida*.

Syncera nitida guamensis, new subspecies (figs. 8, a-c; 9, a-c).

Adult shell small, about 3.0 to 3.5 mm. in length, elongate-ovate, strong, colored a rich chestnut brown. Nuclear whorls rounded, glassy and lightly tinged with brown. Postnuclear whorls rounded with last whorl slightly greater than 0.5 total length of shell. Extremely fine axial sculpture of slightly retracted slanting lines of growth. There is an indistinct single, minutely raised thread running spirally around whorls a little below suture. Umbilicus sealed over by columellar callus, even in young specimens. In young specimens is a minute spiral carina at base of shell near umbilicus. Columella strong, rounded, and colored a rich chocolate brown. Outer lip of shell sharp. Opposite and below columella the lip is slightly reflexed.

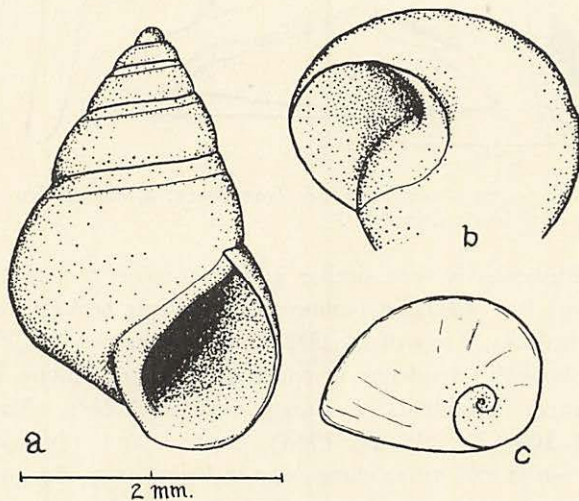


FIGURE 8.—*Syncera nitida guamensis* (holotype): a, apertural view of shell; b, umbilical view of shell; c, operculum.

Eyestalks bearing eyes are typically syncerid, there being no true tentacles. They are without distinct coloring, but posteriorly to them body of animal is marked with a small area of black. Proboscis is marked with a black splotch on either side. Mantle almost entirely black with an occasional diagonal or transverse streak of cream. Anterior border is translucent cream (fig. 9, a). Verge is a simple, pronglike appendage attached to center of neck. Radulae are drawn in figure 9, c. The drawing of the lateral tooth does not show a small detached handle that commonly occurs in this as well as other species. Operculum paucispiral, thin, corneous, and a translucent tan brown. Dimensions (in millimeters):

	LENGTH	WIDTH	NO. OF WHORLS	
Holotype.....	3.8	2.2	5.8	USNM 589997
Paratype.....	3.5	2.0	5.5	USNM 589992
Paratype.....	3.0	1.9	5.5	USNM 589992

Type locality: banks of the Pago River, Guam Island, Marianas (on moist logs, etc., not far from the ocean), Richards, Aug. 4, 1945.

Holotype, USNM 589997; paratypes, USNM 589992, MCZ 183904, and BBM 212193.

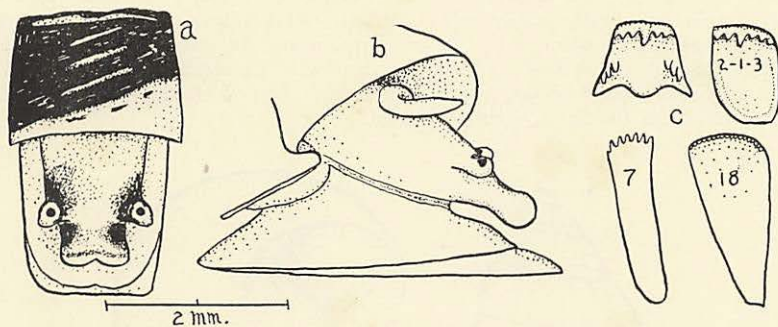


FIGURE 9.—*Syncera nitida guamensis* (paratype): a, dorsal view of animal; b, side view of animal; c, radula.

This subspecies is very similar in shape, color, and texture to *S. nitida* Pease, but differs in having the umbilicus sealed over by the columellar callus. A few of the 200 cotype specimens (MCZ 139120) of *nitida* show this tendency to cover over the umbilicus, especially in the younger individuals. *S. pseudoquadrasi* Abbott, (*Mus. Comp. Zoöl.*, Bull. **100** (3): 245-328, 1948), Leyte Island, Philippines, differs from *nitida* and *nitida guamensis* in being more elongate and in having a much more prominent spiral thread below the suture. *S. nitida* appears to be a widely dispersed species which exhibits a fairly wide range of variation. I have examined specimens from Raiatea Island, Society Islands, and Rarotonga, Cook Islands, which are similar to those from the type locality (Huahine Island, Society Islands). Elsewhere, the species appears to be replaced by subspecies or by closely related species.