Annotated Checklist of the Land snails of the Mariana Islands, Micronesia

by

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SUMMARY

This paper provides descriptions for all of the known species of land snails in the small, tropical islands of the Mariana archipelago in Micronesia, western Pacific Ocean. Many of the species are unique to the archipelago, or even to only one of the islands there. Sadly, much like the native terrestrial snail faunas across the tropical Pacific, the land snails of the Marianas are experiencing precipitous declines and extinctions due to the introduction of predators and loss of habitat. Indeed, many of the snails in this paper have not been seen alive in a decade or more and are likely already extinct.

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INTRODUCTION

The land snails of the Indo-west Pacific are not at all well documented. In the Mariana Islands of western Micronesia (Fig. 1), there are about 110 known distinct species, and even some of these still require formal description. Many of the Mariana Island species have only been collected from the southern islands, Saipan, Tinian, Rota and Guam. The fauna of the northern islands remains the least known.

The land snails from the Mariana Islands were first described and reported by Jean-René Constant Quoy and Joseph Paul Gaimard, the naturalists aboard the French naval vessel *Uranie*, Captain L. Freycinet commanding, which stopped on Guam in April of 1819 during its circumnavigation of the world during the years 1817 to 1820. The next important addition to the fauna was by J. F. Quadras and O. F. von Möllendorff beginning 1893, who added substantially to the tally of endemic forms. Important work in the 20th century includes that of Henry E. Crampton (1925), H. Barrington Baker, beginning in 1938, as well as C. Montague Cooke, Jr., Yoshio Kondo and others beginning in the 1960s, Alan Solem in the 1980s, and later, David R. Hopper and Barry D. Smith (1992), Taiji Kurozumi (1994) and Scott

Figure 1. A plate from Sowerby's (1842) *Thesaurus Conchyliorum* showing some freshwater nerites native to south-east Asia and western Pacific Islands. (From Biodiversity Heritage Library.)

Bauman (1996a-b). The most recent and authoritative checklists for land snails from the Mariana Islands are Smith (2003) for the Assimineidae and Bauman (1996a-b) who provided an annotated list of all Mariana species then known.

The indigenous inhabitants of the Mariana archipelago, the Chamorros, arrived about 4000 BCE. In the Chamorro language, land snails in general are called *akaleha'*. Land snails appear not to have been used as food or otherwise in material culture, given their absence from the archaeological record and oral culture. The only known use for land snails was to bead partulid snails into purses, a practice of uncertain origin, but one that ceased as the Marianas switched to a market economy after World War II and as partulids became rarer on human populated islands after the mid-20th century.

Across the Pacific, there is an ongoing and unprecedented rate of extinctions documented for native snail species (Cowie 1992; Lydeard et al. 2004). Sadly, the same holds true for the snail fauna of the Mariana Islands, where the numbers of nearly all species have declined precipitously during the latter half of the 20th century (Hopper and Smith, 1992; Bauman 1996b). Many species in this book have not been seen alive in half a century, some in fact not since the publication of their original descriptions. The cause of the declines in the Marianas are primarily due to habitat destruction and the at best naive introductions of generalist predators such as the gastropods *Gonaxis* spp. and *Euglandina rosea* to control yet another invasive gastropod, the agricultural pest *Achatina fulica*. In unparalleled biological irony these predators, as well as their endemic prey, have themselves now fallen prey to an introduced generalist predatory flatworm *Platydemas manokwari*. The worm appears to have essentially eliminated the *Gonaxis* and *Euglandina*. Nevertheless, the forests of the southern Marianas are nearly

devoid of native snail species, including on most islands the iconic and once prolific *Partula*. The faded, pocked and empty shells of these and other snails now litter the forest floors, in some areas crunching under foot.

Motivated in part by the decline of Mariana snails, we have assembled this annotated account of all known species. For all species, we provide an abbreviated synonymy, one or more illustrations of at least the shell, a description of notable and diagnostic aspects of the animal's morphology, color, diurnal activity pattern, habitat, and lifestyle, followed by the species' geographic distribution and occurrence in Micronesia. Scientific names generally follow the taxonomic decisions of Cowie (e.g., 2001) and for Charopidae, those of Solem (e.g., 1982). Higher taxonomy generally follows Bouchet and Rocroi (2005), except when contraindicated by Bruere et al. (2010, 2012).

Geographical setting

The Mariana Islands are a north-south oriented, arc-shaped archipelago of small (10 to 540 km^2) islands in the western tropical Pacific Ocean (13° to 20° N, 142° to 144° W), approximately 2400 km east of the Philippines. Of the 14 main islands, seven are currently inhabited by people, most quite sparsely. The climate is tropical maritime with marked wet and drier seasons, influenced by the Asian monsoons and frequent typhoons, especially between June and November.

The Mariana archipelago formed by the volcanism resulting from the tectonic subduction of the Pacific plate under the Philippine plate. The largest and southernmost

islands (Saipan, Tinian, Rota, Guam) are the oldest (ca. 40 my), volcanically quiescent, and of volcanic rocks or tectonically uplifted limestone. The islands to the north are much younger (to 5 my) and volcanically active, and entirely of volcanic composition.

As a result of this geologic history, terrestrial habitats in the Mariana Islands include two main types of forests, typified by different communities of plants. Limestone forest is a forest type found only rarely worldwide. The limestone forests unique to the Mariana Islands are found in the southern and older, Mariana Islands with tectonically uplifted limestone members. Ravine forests, by contrast are found on the volcanic soils of most islands in the archipelago, and as the name implies tend to be restricted to ravines and river basins. The more exposed areas are usually of savanna and covered in tall grasses. Guam and Saipan also possess minor, but significant areas of mangrove. The tallest mountains of Rota are just high enough to possess patches of another habitat, cloud forest, a forest type more common in the highest islands of the neighbouring Caroline archipelago.

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SYSTEMATIC ACCOUNT

Class GASTROPODA

Subclass PROSOBRANCHIA

Family ASSIMINEIDAE

Genus *Allepithema* Tomlin, 1931

***Allepithema* spp.**

Heteropoma Quadras & Möllendorff, 1894.

The genus *Allepithema* according to Thiele (1929) has a top-shaped or depressed shell and an operculum with an inner horny and outer calcareous layer, usually with an indistinctly spiral plate lacking a marginal furrow. There are two undescribed species of *Allepithema* reported from the Mariana Islands by Bauman (1996b). *Allepithema* sp. 1 (above left) appears closest to *A. glabratum*, but with a smoother and higher-spired shell. *Allepithema* sp. 2 (above right) is most similar to *A. pyramis*, but lacks the distinct carina of that species. The habitat of *Allepithema* sp. 1 is not reported, while *Allepithema* sp. 2 is apparently common where it occurs in closed canopy limestone forest (Bauman 1996b), presumably under leaf letter. *Allepithema* sp. 1 is known from Guam and Rota, while *Allepithema* sp. 2 is only known from Mt. Santa Rosa, Guam (Bauman 1996b).

***Allepithema fulvum* (Quadras & Möllendorff, 1894)**

Heteropoma fulvum Quadras & Möllendorff, 1894

A. fulvum appears most similar to *A. tuberculatum*, which has more pronounced ribs. From the original Latin description: Shell 2.8 mm high, 2.5 mm wide, umbilicus narrow, turbinate,

solid, with the subtlest of striae, slender, widely spaced ribbing, flattened costae, spire fairly well elevated, apex obtuse. Five convex whorls, deep distinct sutures, towards the base becoming surrounded by thick, but well-exerted carina, peripherally and mid-basally, subalate where it crosses the costae. Aperture rather oblique, subcircular, peristome simple, obtuse, the upper margin sinusoidal. The operculum like that of *A. quadrasi*. Endemic to Guam in the Marianas.

Allepithema glabratum (Quadras & Möllendorff, 1894)

Heteropoma glabratum Quadras & Möllendorff, 1894

Distinct appearance among the Mariana *Allepithema*. From the original Latin description in Quadras & Möllendorff (1894): Shell 2.3 mm high, 2.3 mm wide, perforate, turbinate, scarcely striatulate, almost shiny, light horn colour, spire rather elevated, almost conical, apex obtuse, five convex whorls, suture deep and distinct, aperture nearly vertical, rounded ovate, simple unreflexed lip, peristome blunt. Endemic to Guam in the Marianas.

Allepithema pyramis (Quadras & Möllendorff, 1894)

Heteropoma pyramis Quadras & Möllendorff, 1894

The shell of *A. pyramis* has a high spire, but not as high as *A. turritum*. From the original Latin description in Quadras & Möllendorff (1894): Shell 2.8 mm high, 2.0 mm wide, rather open umbilicus, pyramidal, solid, subtlest of striae, slender flattened costae widely spaced, horn brown; spire very elevated, almost exactly conical, the apex fairly obtuse. Whorls six, slowly increasing in size, suture deep and distinct, convex but a little compressed laterally, the last whorl with two carina, peripheral and medial, the bottom one a pronounced exsert

band, somewhat alate where it crosses the costae. Aperture vertical, spreading and elliptic, peristome quite blunt. Operculum external lamina very concave, the margins elevated and separated. Endemic to Guam in the Marianas.

Allepithema quadrasi (Möllendorff, 1894)

Heteropoma quadrasi Möllendorff, 1894

non *Quadrasiella clathrata* in Bauman (1996a), according to Bauman (1996b).

A. quadrasi is very similar to *A. fulvum* and *A. tuberculatum*, but somewhat larger and wider, with slightly stronger sculpture and angulation of the whorls. From the original Latin description in Quadras & Möllendorff (1894): Shell 3.3 mm high, 3.2 mm wide, rather open umbilicus, pyramidal, solid, quite subtle striae, narrow flattened and widely-spaced costae, horn brown; spire very elevated, almost exactly conical, fairly obtuse apex. Whorls six, slowly increasing in size, curving towards the upper suture very deeply and discretely, a subangular groove, then a little bit flattened, towards the inferior suture as a blunt crest, and on the last whorl towards the periphery a strong, blunt, crenulate and exsert carina, and the other, a lesser, medial basal carina, both extending to the peristome. Aperture almost vertical, rather elliptical, peristome in multiple layers, thickened, not spreading. Described from Guam. Bauman (1996b) tentatively identifies specimens from Rota and Tinian as this species.

Allepithema tuberculatum (Quadras & Möllendorff, 1894)

Heteropoma tuberculatum Quadras & Möllendorff, 1894

A. tuberculatum is very similar to *A. fulvum*. From the original Latin description in Quadras & Möllendorff (1894): Shell 3.1 mm high, 2.5 mm wide, perforate, conico-turritiform, solid,

with closely spaced intersecting spiral lines, costae well separated, strong, slightly winding, horn yellow; spire well elevated, almost exactly conical, apex obtuse. Whorls 5.5, convex, laterally compressed, suture a deep disjunct groove, the last whorl with two thick carina but more exert at the costae. Aperture vertical, ellipsoidal, peristome blunt, obtuse, the upper margin receding, the middle extended and the columella somewhat deeply curved. Endemic to Guam in the Marianas.

Allepithema turritum (Quadras & Möllendorff, 1894)

Heteropoma turritum Quadras & Möllendorff, 1894

A. turritum has the highest spire of the Mariana *Allepithema*. From the original Latin description in Quadras & Möllendorff (1894): Shell 3.0 mm high, 2.0 mm wide, narrow umbilicus, elongate conico-turritiform, with solid, narrow, closely spaced, intersecting spiral lines, very thick widely spaced costae, thinner beneath, horn brown; spire well elevated, exactly conical, apex obtuse. Whorls six, slowly expanding, convex, laterally compressed, suture a deep discrete groove, the last whorl with two somewhat thick, exsert carina with closely spaced tuberculae. Aperture vertical, ellipsoidal, peristome blunt, obtuse, multiple, extended. Endemic to Guam in the Marianas.

Genus *Assiminea* xxxx, xxx

Assiminea parvula guamensis (Abbott, 1949)

Hydrocena parvula Mousson, 1865

Hydrocena nitida Pearse, 1865. The species is commonly considered as *A. nitida*, but Cowie (1998) indicates that *A. parvula* has precedence.

This subspecies belongs to the globally distributed and taxonomically difficult *A. parvula* complex. *A. p. guamensis* is very similar in appearance to *A. p. quadrasi* from the Philippines, hence they may only be ecophenotypes of a single more widespread species. In the Marianas it is most similar to *Paludinella conica* and is most easily distinguished from it by a thin subsutural ridge (a 'thread'). Shell 3.0 to 3.5 mm in length, dark brown shell, dark brown columella, usually with very faint umbilical thread. Eyestalks without distinct pigmentation, small black area posterior to eyestalks; mantle almost entirely black with occasional diagonal or transverse streaks of cream; anterior border of mantle is translucent cream. (Description primarily from Abbott 1958.) Species of this genus for which information exists are all gonochoric and egg laying. Found in shade in moist areas and rotting vegetation near river mouths or other source of brackish water. Guam, Hawaii, Palmyra Island. Abbott (1958) suspects that this species was transported by man or birds from the Philippines.

Genus *Omphalotropis* Pfeiffer, 1851

***Omphalotropis cookei* Abbott, 1949**

Adult shell 7-8.5 mm, umbilicate and brightly coloured, whorls 5-6, embryonic whorls microscopically granulose, post-embryonic whorls barely convex above, rounded below, umbilicus open and framed by columella and raised, rounded and rather white carina extending to lower lip edge below columella, aperture subovate and oblique, spiral sculpture of small raised threads developed in early whorls, last 1/3 of last whorl sometimes pocked, shell colour pink to orange yellow or reddish brown often with narrow diffused band of flammules of cream just below suture, outer lip often much lighter than whorls. Distinguishable from other congeners by the presence of 'pronounced spiral threads. Closest

to *O. erosa* from Guam, but with many pronounced spiral threads, brighter colour. (Description from Abbott 1949.) Found under decaying leaves. Guam, Rota, Saipan and Sarigan.

Omphalotropis elegans Quadras & Möllendorff, 1894

Shell small with well-defined, abundant fine axial ribs, faint spiral striae and an umbilical carina. From the original Latin description in Quadras & Möllendorff (1894): Shell 4.3 mm high, 6.0 mm wide, narrow umbilicus, super turbinate, thin, translucent, widely spaced filiform costae, clear horn in colour; spire exactly conical, apex acute. Whorls six, convex, with discrete deep suture, on the body whorl towards the periphery a faint angulation fading towards the aperture, additional well-developed carina somewhat removed from the umbilicus. Aperture a little oblique, oval, a little exsert, peristome blunt, scarcely labiate, towards the columella somewhat curved. Found in Guam and Rota.

Omphalotropis elongatula Quadras & Möllendorff, 1894

Omphalotropis elongatula var. *brunnescens*

Omphalotropis elongatula var. *chrysostoma*

Omphalotropis elongatula var. *contracta*

Distinctly smooth, solid shell, color varies from light tan to yellow to reddish brown. From the original Latin description in Quadras & Möllendorff (1894): Shell 8.3 mm high, 4.5 mm wide, umbilicate, oblong conical, quite subtle transverse striae, impressed, intersecting spiral lines moderately spaced, pale yellow to red; spire turritiform, almost exactly conical, apex obtuse. Whorls seven, somewhat flattened, suture a little flattened, disjunct, distinct crest

next to the columellar groove. Aperture scarcely oblique, oval, peristome scarcely expanded, almost labiate, flaring more basally. *O. e.* var. *brunnescens*: Horn-brown colour, sometimes two-toned, whorls slightly convex, slightly more distinct basal carina. *O. e.* var. *chrysostoma*: Whorls a little more quickly increasing in size, the body whorl more convex, colours various: yolk yellow, flesh-toned, reddish, aperture interior light yellow or orange or reddish. *O. e.* var. *contracta*: closest to preceding variety, but whorls 6.5, peristome stronger, the basal part more flaring. Height 6.3, width 4 mm. Usually lives near the ocean on rock faces and in adjacent leaf litter (Bauman 1996b). Known from Guam and Rota.

Omphalotropis erosa **(Quoy & Gaimard, 1832)**

Cyclostoma erosa Quoy & Gaimard, 1832

Shell ovate-conical, perforate, reddish or purplish yellow, with small reddish stripes near the apex, spire acute, whorls 5.5, rounded, the last one comprising half of the shell height, ventricose, with minute oblique wrinkles, and indistinctly keeled near the umbilicus; aperture half-circular, slightly angulated posteriorly, peristome simple, continuous, rose red. Height 4 mm, width 2 mm. Native forest (Smith 2008b). Appears to consist, or is part, of a complex of morphologically similar species. Known from Guam and Sarigan.

Omphalotropis gracilis **Quadras & Möllendorff, 1894**

Omphalotropis (*Scalinella*) *pilosa* Quadras & Möllendorff, 1894.

From the original Latin description in Quadras & Möllendorff (1894): Shell 8.3 mm high, 4.5 mm wide, narrow umbilicus, gracefully turritiform, thin, thick costae, and between them carved the thinnest spiral lines, horn brown; spire very elongate, gradually attenuated, apex

subacute. Whorls 7.5, almost convex, the last well rounded, the umbilical keel next to a distinct groove. Aperture barely oblique, acuminate oval; peristome just a little expanded, barely labiate, near the columella curved. Photos of the lectotypes of *O. pilosa* and *O. gracilis* in Zilch (1967) appear similar enough that these two nomina may be synonymous. Endemic to Guam in the Marianas.

***Omphalotropis granum* (Pfieffer, 1854)**

Hydrocena granum Pfeiffer, 1854

Omphalotropis submaritima Quadras and Möllendorff 1894

Shell dextral, ovate-conic, solid, pellucid, corneous yellow, occasional faint, narrow white band over peripheral angulation of body whorl, 4 1/2 suture whorls, spire moderately elevated, acute in profile, apex blunt, suture simple and deep, with the plano-convex whorls arched sharply below, spire stepped in profile, body whorl vaguely, obtusely angled at periphery, umbilicus rimate and concealed by the partially reflexed columellar lip, aperture ovate-conic, outer and basal lip simple, sharp, umbilicus circled by flattened carina, carina variable in prominence, beginning at the parieto-columellar lip junction, ending at the baso-columellar junction by a slight angulation of the lip. In fresh shells the embryonic and first whorl sculpted with minute, close-set spiral lines, later whorls smooth, but not polished. (Description from Harry, 1966). Widely ranging; known from Australia, Melanesia and Micronesia. In the Marianas, found in Guam, Saipan and Rota.

***Omphalotropis guamensis* (Pfeiffer, 1857)**

Hydrocena (*Omphalotropis*) *guamensis* Pfeiffer, 1857

"Typical *Omphalotropis* with well-developed cape, anterior end of tentacles and edge of cape are dusted with dark gray, operculum whorls coated externally with increasingly larger brown calcareous granules" (Abbott 1949). From the original Latin description in Pfeiffer (1857): Shell 6.5 mm high, 4.0 mm wide, umbilicate, ovate-conic, solid, closely packed striate, opaque, "flesh" coloured, marbled and banded in reddish; spire conical, acute; sutures shallow grooves; whorls 5.5, flattened somewhat, last whorl barely shorter, the umbilicus surrounded by a flattened carina; aperture barely oblique, oval; peristome thin, the right margin expanded a little, and basally by the umbilical carina, columella scarcely expanded. Endemic to Guam in the Mariana Islands.

Omphalotropis laevigata **Quadras & Möllendorff, 1894**

Omphalotropis (*Chalicopoma*) *laevigata* Quadras & Möllendorff, 1894

Shells from Guam have a mottled pattern. From the original Latin description in Quadras & Möllendorff (1894): Shell 5.0 mm high, 3.0 mm wide, rimate, oblong conical, solid, very subtle striae, shiny, yellow, pale marbling; spire rather elongate, perfectly conical. Whorls six, convex, discrete rather impressed suture, last whorl quite rounded, basal crest outlining a distinct groove. Aperture slightly oblique, acuminate ovate; peristome a little flaring, a little labiate, a wavy margin towards the columella. Guam and Rota.

Omphalotropis laticosta **Quadras & Möllendorff, 1894**

Very distinctive; only *O. ochthopyra* approaches it in form. Distinct in its high spire, slight mid-whorl keel forming an umbilical carina and irregular thickened axial ribbing. From the original Latin description in Quadras & Möllendorff (1894): Shell 5.75 mm high, 2.5 mm

wide, very narrowly perforate, gracefully elongated turrete, transverse striae, compact spiral lines, slender but distinctly crosshatched, strong wide but flattened costae, elegantly carved out in white, alternating yellow and reddish stripes; graceful elongate conical spire, apex obtuse. Whorls 8.5 convex, the last whorl submedially subacutely angulate, below this angle the basal portion is smooth, columellar groove fairly distinct. Aperture a little oblique, acuminate oval, peristome obtuse, a little flaring, not quite labiate. Commonly occurs with *O. quadrasi* in leaf litter (Bauman 1996b). Endemic to Guam in the Marianas.

Omphalotropis latilabris Quadras & Möllendorff, 1894

'Similar in shape to *O. quadrasi*, but has less prominent spiral and axial sculpture' (Bauman 1996b). From the original Latin description in Quadras & Möllendorff (1894): Shell 7.5 mm high, 6.0 mm wide, wide perforation, ovate conical, solid, fairly compactly coiled with moderately separated and elevated spiral lines, a yellow or brownish horn or brown, sometimes as two stripes; a rather elevated cone-like spire, the sides a little convex, apex acute. Whorls six, flattened, carina quite exsert, suture a deep discrete groove, last whorl quite large, whorls subequal, a flattened and crenulate basal carina surrounding at some distance from the perforation. Aperture a little oblique, acuminate oval, double peristome, continuous internally, separated from the coil above, a little bit flared, rather widely so for a member of the genus, ..., subalate, at the base confluent with the basal carina, auriculate. Operculum ordinary [for the genus]. Endemic to Guam in the Marianas.

Omphalotropis ochthogyra Quadras & Möllendorff, 1894

Omphalotropis ochthogyra var. *attenuata* Quadras & Möllendorff, 1894

From the original Latin description in Quadras & Möllendorff (1894): Shell of *O. ochthogyra* 6.5 mm high, 3.5 mm wide, narrow perforation, a graceful conical turrete, thin shell, translucent, shiny, indistinct and microscopic crosshatched spiral lines, horn brown, marbled in yellow; spire turrete, the apex obtuse. Whorls eight slowly expanding, suture thin and discrete, upper whorls convex becoming successively more flattened, the last whorl a little curved, submedially obtusely angulate, strong basal carina, strongly exsert near the perforation. Aperture almost vertical, acuminate oval, peristome quite expanded, almost labiate within, more flared basally, more curved near the columella. *O. o.* var. *attenuata*, slightly smaller, 6.0 mm high, 3.0 mm wide, a little slimmer, the last whorl less angulate, columella more curved, spiral lines a little more distinct. Guam and Rota.

Omphalotropis picta Quadras & Möllendorff, 1894

Moderate in size, degree of spire protrusion, with a brown mottled color pattern and with a slight to moderate umbilical carina. *Omphalotropis picta* resembles *O. ochthogyra* in shape, but lacks its characteristic sculpture. From the original Latin description in Quadras & Möllendorff (1894): Shell 5.5 mm high, 3.20 mm wide, narrow perforation, elongate pyramidal, thin shelled, translucent, smooth, shiny, reddish brown with yellowish blotches; spire elongate, perfectly conical. Whorls seven almost convex, suture thin and discrete, last whorl almost angulate, flattened basal carina, well exsert nearest the perforation. Aperture almost vertical, acuminate oval, peristome not flaring, interior sublabiate. Endemic to Guam in the Marianas.

Omphalotropis pilosa Quadras & Möllendorff, 1894

Omphalotropis (*Scalinella*) *pilosa* Quadras & Möllendorff, 1894.

From the original Latin description in Quadras & Möllendorff (1894): Shell 5.5 mm high, 3.20 mm wide, narrow perforation, fairly elongate turrete, thin shelled, translucent, fairly closely spaced costae, jaunty golden colour; spire elongate, exactly conical, apex acute. Whorls seven convex, very slowly descending, discrete deep suture. aperture moderately oblique, acuminate oval, peristome blunt, obtuse, columellar margin barely curved. *Omphalotropis pilosa* and *O. gracilis* are quite similar in appearance possibly synonymous. Endemic to Guam in the Marianas.

***Omphalotropis quadrasi* Möllendorff, 1894**

Omphalotropis quadrasi var. *dimidiata* Möllendorff, 1894.

A very distinctive species with well developed keel, pronounced sculpture, triangular shape and an umbilical carina with an uneven margin. From the original Latin description in Quadras & Möllendorff (1894): Shell 5.5 mm high, 3.20 mm wide, fairly open umbilicus, somewhat depressed turbinate, solid, transverse striae, lightly engraved with elevated, well-spaced, wavy spiral lines, horn brown or brown or yellow, sometimes marbled; spire almost exactly conical, apex obtuse. Whorls six, initially convex, then the rest with deep, angular suture and whorls flattened, the last whorl with an acute elegant undulating carina and a basal crest that is far from the umbilicus, very elevated, compressed and crenulate. Aperture fairly oblique, acuminate oval, two layered, ..., subalate, grooved at the basal carina, ... From Abbott (1949): Mantle a solid cream, tentacles and sides of the proboscis tinged in black. Under stones and in leaf litter of native forest to at least 100 m altitude. Found in Guam and Rota.

Omphalotropis semicostulata Quadras & Möllendorff, 1894

The photo in the centre is a specimen identified by Smith (2008) as *Omphalotropis* sp. cf. *O. semicostulata*. From the original Latin description in Quadras & Möllendorff (1894): Shell 6.0 mm high, 4.5 mm wide, very narrow umbilicus, globose conical, near the suture costae widely spaced and strong, subtlety carved, generally however, smooth, shiny, white, brown and white marbling; spire fairly elevate, laterally quite convex, apex obtuse. Whorls six, convex, deep suture with a indistinct disjunct margin, last whorl quite convex, barely angulated, basal carina barely distinct and near to and surrounding the umbilicus. Aperture scarcely oblique, acuminate oval, peristome not expanded, flaring at the base near the carina, columella fairly curved, dilated above, appressed parietal callus. Normal operculum. Found in native forest in Guam and Rota (Smith 2008).

Omphalotropis suturalis Quadras & Möllendorff, 1894

The photo in the centre is a specimen identified by Smith (2008) as *Omphalotropis* sp. cf. *O. suturalis*. From the original Latin description in Quadras & Möllendorff (1894): Shell 5.0 mm high, 3.5 mm wide, rimate, ovate conical, solid, subtly striatulate, yellow; gradually ascending, convex-conical spire. Whorls six with a impressed white-lined suture, convex but laterally compressed, the last whorl peripherally scarcely angulated, for the most part with a white stripe, pale basally, carina a little bit distinct, ... Aperture vertical, acuminate oval, peristome blunt, obtuse, internally labiate, base almost flaring, curved columella. Normal operculum. Found in native forest (Smith 2008) and restricted to coastal margins of forests often with truncatellids (Bauman 1996b). Known from Ulithi (Harry, 1966), Guam and Rota (Bauman 1996b).

Omphalotropis spp. 1-5 "The carinate complex"

Bauman (1996b) discovered several conchologically similar undescribed species (i.e., a species "complex") from subfossil deposits on Rota having strongly carinate whorls with high to very high spires. He tentatively distinguishes five species and places them in *Omphalotropis* based on the shape of the umbilicus and apertural margin. Species numbers follow Bauman (1996b). Known only from Rota in the Marianas.

Omphalotropis sp. 6

An undescribed species. Species number follows Bauman (1996b). *Omphalotropis* sp. 6 appears closest to *O. elongatula*, *O. cookei* and *O. erosa*. Shells 3.8 to 4.0 mm in height, light reddish brown with blotches of paler brown and a peripheral reddish brown band, basal carina and apertural lip white, conical, apex obtuse, suture deep, corrugated because of many wrinkle-like ribbing on teleoconch, 5.5 whorls, slightly stepped, body whorl convex with light peripheral carina and super-peripheral wrinkle-like ribbing, keel-like and crenulate basal carina surrounding columellar groove, aperture acuminate oval, labiate, basal and palatal margins expanded, basal margin with flared broad groove, operculum *Omphalotropis*-like, thin dark brown, smooth, two whorls, expanded portion covered in lighter coloured granules that increase in size towards the flat margin. *Omphalotropis* sp. 6 is moderately abundant where found and living under limestone rubble in native forest, but does not occur on the undersides of decaying leaves in Rota (Bauman 1996b).

Omphalotropis sp. 7

An undescribed species. Species number follows Bauman (1996b). *Omphalotropis* sp. 7 appears closest to *O. elegans*, but the basal carina is much closer to the umbilicus. Shell dextral, ovate-conic, solid, many fine oblique spiral striae, faint subperipheral angulation of body whorl, 5.5 whorls, spire moderately elevated and stepped in profile, obtuse apex, suture deep and straight, with the plano-convex whorls, body whorl barely angled at periphery, umbilicus rimate and concealed by the partially reflexed columellar lip, aperture ovate-conic, outer and basal lip simple, sharp, umbilicus surrounded by distinct carina, beginning at the parieto-columellar lip junction, ending at the baso-columellar junction by a slight spreading and angulation of the lip. The habitat of *O*. sp. 7 is not recorded, is known from Rota.

***Omphalotropis* sp. 8**

Quadrasiella? sp. 1 in Bauman (1996b).

Bauman (1996b) reports an undescribed assimineid to which he tentatively assigns the name *Quadrasiella*? sp. 1. The species, shown above, is conchologically more similar to *Opthalmotropis*. However, no opercula were found preserved in association with the specimens, hence generic assignment remains somewhat tentative. There are probably other undescribed *Opthalmotropis* in the Mariana Islands. For example, Kurozumi (1994) collected in the northern Mariana Islands two *Omphalotropis*, his spp. A and B, unfigured and undescribed, are deposited in the National History Museum and Institute, Chiba, Japan. Kurozumi's (1994) *Omphalotropis* sp. A is from Sarigan, Guguan, Alamagan and Pagan, while his *Omphalotropis* sp. B is from Sarigan. Found in Rota and Tinian (Bauman 1996b).

Genus *Paludinella* Pfeiffer, 1841

Paludinella conica (Quadras & Möllendorff, 1894)

Omphalotropis (Solenomphala) conica Quadras & Möllendorff, 1894

Adult shells to 4-5 mm, elongate to ovate-conical, fragile, smooth, light translucent brown, embryonic whorls smooth, rounded, glassy, post-embryonic whorls five to six, moderately rounded, irregular axial growth lines, suture fine and minutely impressed, umbilicus small, deep, partially obscured by columella, base of shell bordering umbilicus a faint white band, aperture obliquely ovate, constricted above, lip slightly flared near base, mantle translucent cream with variegated black transverse blotches and stripes visible through the shell when the animal is retracted, no or only a slightly developed umbilical carina which is lighter brown in *P. c. saipanensis* Abbott, 1949. The columellar lip is reflected, aperture does not form a distinct ring with a heavy parietal callous or detached aperture as in many *Allepithema*, *Omphalotropis* and *Quadrasiella* species. (From Abbott 1949). Found in native forests of Guam, Rota, Saipan, Sarigan (Smith 2008b).

Genus *Quadrasiella* Moellendorff, 1894

Quadrasiella clathrata Möllendorff, 1894

Differs from *Q. mucronata* in having a taller spire and lacking a flared apical end on its operculum. Slightly variable in degree of spiral carination, hence in this respect rather resembles *Allepithema quadrasi*. From the original Latin description in Quadras & Möllendorff (1894): Shell 3.5 mm high, 4.0 mm wide, aperture 1.75 mm by 1.66 mm, operculum 2.5 mm by 2 mm, always with a wide open umbilicus, shell depressed conical, solid, elevated spiral lines and sharp costae giving a lattice appearance, hairy with short hairs all over, horn brown; spire fairly elevated, ..., apex acute and reddish. Whorls five convex,

deep discrete suture, last whorl a little bit laterally compressed, not carinate. Aperture about vertical, wide oval, peristome blunt, obtuse. Operculum externally very concave, of four whorls, the last one with wide folds, margin crenulate, not reflexed, internally lamellate with transverse costae. Found under stones and in leaf litter of native forest to at least 100 m altitude. Endemic to Guam in the Marianas.

Quadrasiella mucronata Möllendorff, 1894

Shells similar to other *Quadrasiella* in general shape with well-developed axial ribs and carination. From the original Latin description in Quadras & Möllendorff (1894): Shell 2.25 mm high, 4.0 mm wide (without operculum), aperture 1.5 mm wide, operculum 2.0 mm by 1.66 mm, wide and open umbilicus, shell flattened, for the most part discoidal, thin shelled, very strong and compact spiral lines, thin costae rather widely spaced, horn brown; spire very little elevated, ..., apex pointed, obtuse, reddish. Whorls five, convex, ascending quickly enough, discrete deep groove-like suture, last whorl becoming obtusely angular, near and below the periphery carinate, the costae crossing the carina elongate, flattened in between. Aperture almost vertical, subcircular, peristome quite blunt. Operculum acuminate oval, four plicate striatulate whorls, the last very broad, on all sides curving over the peristome. Co-types found in limestone forest under stones and logs (Hornbostel in Cooke and Clench 1943). Described from Guam in the Marianas. Specimens tentatively identified as this species have been collected on Rota and Tinian (Bauman 1996b).

CYCLOPHORIDAE

cf. *Lagochilus* sp. or *Ditropis* sp.

Bauman (1996b) tentatively identifies a cyclophorid, possibly a *Ditropis* sp. or *Lagochilus* sp., from 20 shells collected from Guam based on illustrations in van Benthem Jutting (1963; his fig. 6) of several species from Papua New Guinea. Shells ca. 1 mm high and 2 mm wide, lack colour, solid, heliciform, apex obtuse, 3.5 whorls, strongly angulate and carinate, body whorl comprising 3/4 of shell height, suture thin and stepped, umbilicus open and surrounded by a basal carina, distinct spiral striae, wavy growth striae, aperture oblique, peristome angular, columellar margin arcuate, outer lip sharp, flaring basally. Known only from empty, possibly subfossil shells (Bauman 1996b). Species in the genus *Lagochilus* and *Ditropis* are operculate and appear to be moist forest, litter dwellers. *Lagochilus* and *Ditropis* spp. are found from at least India through SE Asia and New Guinea. *Ditropis* is also found in Australia. In the Mariana Islands, known only from Guam.

DIPLOMMATINIDAE

Genus *Palaina* Semper, 1865

Palaina hyalina Quadras & Möllendorff, 1894

Diplommatina hyalina (Quadras & Möllendorff, 1894).

From the original Latin description in Quadras & Möllendorff, 1894: Shell 2.4 mm in height, 1.4 mm maximal diameter, sinistral or dextral, not rimate, ovate, very thin, widely spaced, well-defined filiform axial ribs; whorls rounded, six in number, deep discrete suture, the last part less deep, the very beginning becoming more inflated and prominent; aperture almost vertical, subcircular, double peristome, the external part expanded, the internal portion extended barely. Young specimens are lighter in colour. Some authors consider *P. hyalina* a junior synonym of *P. taeniolata* (e.g., Bauman 1996b). Found in leaf litter and under rubble in forests. A Mariana Island endemic. Known from Guam, Sarigan and Aguiguan.

Palaina taeniolata Quadras & Möllendorff, 1894

Diplommatina taeniolata (Quadras & Möllendorff, 1894).

From (Quadras & Möllendorff, 1894): Shell 2.3 mm in height, 1.3 mm diameter, sinistral, rarely dextral, rimate, ovate-conical, thin, almost transparent, widely spaced sharp axial ribs, yellowish through pale reddish-brown to reddish brown or horn brown; 6.5 rounded whorls, penultimate largest, ultimate whorl initially constricted; for most of the suture from the second whorl, there is sometimes a reddish brown material; aperture vertical, subcircular, peristome with four or five thin distinct lamellae. Young specimens white. From the original description of *P. t. apapensis*: Shell 1.9 mm in height, 1.0 mm diametre, has a constant and smaller, more spherical overall shape; narrower spacing of axial ribs on last whorl than for typical *taeniolata*, the aperture more rounded. Zilch (1953) distinguishes between *P.* (*P.*) *t. taeniolata* Q. & M. and *P.* (*P.*) *t. apapensis* Zilch, 1953. The type locality of *P. t. a.* is Apra, probably Sumay. Under rotting leaves and on limestone rubble in primary and secondary forests. Known from Guam, Rota, Saipan and Aguiguan.

HYDROCENIDAE

Genus *Georissa* Blanford, 1864

Georissa biangulata Quadras & Möllendorff, 1894

From the original description in Latin (Quadras & Möllendorff, 1894): Shell 1.75 mm in height, 1.5 to 1.66 mm maximal diameter, shell globose conic, thin, fine striae, very thin membranous costae sticking out, whitish or yellowish horn colour. Whorls four, convex, laterally flattened with obtuse angles resulting above and below, at the angles, short wing-like

projections. Aperture very oblique, a wide oval, truncate, peristome quite blunt, columellar margin reflected and appressed. Guam and Sarigan.

Georissa elegans Quadras & Möllendorff, 1894

Shells of *G. elegans* have a sculpted and angled body whorl compared to the more rounded and weakly sculptured shell of *G. laevigata*. From the original description in Latin (Quadras & Möllendorff, 1894): Shell 2.5 mm in height, 2.5 mm in diameter, shell conical globose, thick, transverse striations, brownish horn colour; spire fairly elevated, laterally a bit convex, apex acute and smooth. Whorls four, convex, slightly flattened medially, forming an angle below the suture along which run curved, wing-like costae. Aperture oblique, truncated oval, peristome simple and blunt, sublatiate within, columellar margin reflexed and flattened. Operculum typical. Known from Guam, Rota, and Aguiguan, Mariana Islands.

Georissa laevigata (Quadras & Möllendorff, 1894)

Hydrocena (Georissa) laevigata (Quadras & Möllendorff, 1894)

More rounded whorls that *G. elegans*. "Shell thick, translucent, amber, dextral, conic-turbinate, whorls evenly rounded, subcircular, large specimens imperforate, and ca. three suture whorls, initial whorl smooth, unpolished and usually separated abruptly from later whorls by a transverse line, immediately beyond which are numerous linear spiral grooves. On the apical part of the body whorl these become vague, and usually do not continue on the later parts of this whorl, where they are replaced by faint incremental lines. Aperture subcircular, its height slightly shorter than spire height. Outer lip simple. In sub-mature and mature shells is a thick columello-parietal plate. Operculum flattened, calcareous, semi-

hyaline, smooth internally, with an apophysis arising from a slightly elevated area near the base. Apophysis narrow, elongate, directed obliquely outward in gentle curve, of two fused pieces, one not extending to the tip, line of fusion vague. Operculum outer surface covered by thin, polished, horny layer, reflected along the entire labial margin to form a narrow free membrane." (Harry 1966). Abundant on Rota. Found among limestone rubble and under leaf litter. Described from Guam. Also found on Rota and Aguiguan.

TRUNCATELLIDAE

Taheitia alata (Quadras & Möllendorff, 1894)

Truncatella (Taheitia) alata Quadras & Möllendorff, 1894

Easy to identify by its large, flaring palatal lip which no other Mariana island truncatellid species has. From the original description in Latin (Quadras & Möllendorff, 1894): Shell 10 mm in height, about 3 mm in diameter, width of aperture at the peristome 3 mm, across the peristome about 4 mm in length and 3.5 in width, shell imperforate, elongate turritiform, rather solid, ribbed, 22 ribs on the last whorl, whitish; spire gradually attenuating, then decollate. Six lower whorls, suture deep, disjunct, appearing crest-like above the last whorl. Aperture vertical, narrow oval, peristome is duplex, the internal one quite expanded, a little thickened, the external one widely expanded, wavy, the top part more spread out, like opened wings. Operculum cartilaginous, externally convex with lamelliform ribs radiating ornately. The genus lives close to the seashore. Endemic to Guam in the Marianas.

Taheitia lamellicosta (Quadras & Möllendorff, 1894)

Truncatella (Taheitia) lamellicosta Quadras & Möllendorff, 1894

From the original description in Latin (Quadras & Möllendorff, 1894): Shell 7 mm in height, 2.75 mm in diameter, not rimate, subcylindrical, turrete, narrow, ribs narrow, acute, sharp, rather separated - 18 on the last whorl. The lower whorls five, convex, slowly ascending, sture deep and discrete, strongly crest-like atop the last whorl, very flattened, ... Aperture vertical, slanted oval, peristome simple and free all around, rather expanded, the right margin rather flaring. The genus lives close to the seashore. Endemic to Guam in the Marianas.

Taheitia mariannarum (Quadras & Möllendorff, 1894)

Truncatella mariannarum Quadras & Möllendorff, 1894

Shells 9 mm length, uniform chestnut brown or brown with lighter sutures, decollate, 3 3/4 suture whorls, fine costae, about 40 to a whorl, whorls with moderately vague, linear constriction just below suture, above this line costae more bladelike than below, constriction less prominent on the last 1/4 of the last whorl and whorls of the spire; imperforate, with a basal ridge moderately developed on the last half of the last whorl. Aperture symmetrical, ovoid, scarcely expanded, unilabiate, the costae in even size-series before the lip, none enlarged. Parietal lip moderately thickened, but adnate to body whorl. Costae do not extend over the basal ridge. Apex of 1 1/4 whorls, minutely and uniformly costate transversely, with abrupt transition to grosser costae of later shell. Costae of early pre-decollate shell more acute than those of post-decollate whorls. About same size and shape as *T. guerinii*, differing in that the latter has larger, more sharply defined costae. (Description from Harry 1966.) Close to the seashore, sometimes in spray zone, on mixed karstic limestone and vegetation and often microsympatric with assimineids. Widespread in Pacific Islands. Common on Guam, Rota and Saipan in the Marianas.

Taheitia parvula (Quadras & Möllendorff, 1894)

Truncatella (Taheitia) parvula Quadras & Möllendorff, 1894.

From the original description in Latin (Quadras & Möllendorff, 1894): Shell 5.5 mm in height, 2.5 mm in diameter, shell imperforate, almost cylindrical, fairly solid, not quite translucent, the strong ribs well spaced with 13 to 14 on the basal whorl. The bottom whorls four, not a little flattened, ... Aperture vertical, slanted oval, peristome duplex, the external one rather expanded, very thick, ..., the internal one very extended .... The genus lives close to the seashore. Endemic to Guam in the Marianas.

Taheitia subauriculata (Quadras & Möllendorff, 1894)

Truncatella subauriculata Quadras & Möllendorff, 1894

Description: From the original description in Latin (Quadras & Möllendorff, 1894): Shell 10 mm high, 4 mm wide, rimate, subcylidric turritiform, opaque, rather separated costa with 23 to 25 on the body whorl, yellowish white; spire gradually narrowing. Whorls five, convex, deep discrete suture, ... Aperture vertical, acuminate oval, peristome simple, continuous, adjoining the whorl above, somewhat expanded, the base gently reflexed. Clench and Turner (1948) considered *T. subauriculata* a junior synonym of *T. mariannarum* after examining the types of both forms and failing to find differences between them. However, Bauman (1996b) has examined specimens in the field and writes that *T. subauriculata* differs from *T. mariannarum* in being lighter in color, nearly white, and somewhat translucent, as well as living further from shore. Lives further from shore than does *T. mariannarum* (Bauman 1996b). Described from Guam in the Marianas.

Truncatella expansilabris Quadras & Möllendorff, 1894

Description: From the original description in Latin (Quadras & Möllendorff, 1894): Shell 10.5 mm in height, 4.5 mm in diameter, barely rimate, turrete, little bit solid, not quite translucent, strong narrow ribs with equally wide interstices, towards the sutures becoming subtuberculate, 31 ribs on the basal whorl, yellowish white. Basal whorls five rather convex, suture with a discrete margin, the last whorl in front slightly ascending, ... Aperture vertical, pointed oval, peristome exterior widely expanded, more flaring basally, a little bit folded at the bottom, towards the columella less expanded, the top the least expanded and joined to the whorl above. Operculum externally very convex with radiating folds. *Truncatella expansilabris* appears to be a valid name: While it's not listed in Bauman (1996b) or Smith (2003), the name is also not found in Clench and Turner's (1948) presumably full synonymy of *T guerinii*, plus the expanded labiate palatal apertural margin is distinct from the latter species. Habits presumably typical of the genus: under leaf litter in beach strand and back-strand vegetation. Described from Guam.

Truncatella guerinii A. & J. Villa, 1841

The full and considerable synonymy in Clench and Turner (1948).

A wide variable appearance tallied by Clench and Turner (1948). Adult size height, 6-10 mm, width, 2-4 mm. Thin, cylindrical shell with marked transverse ridges and a somewhat flared aperture. The only Samoan Island land snail species with a truncated shell (Cowie and Rundell 2001). About the same size and shape as *T. mariannarum*, but differs in that the latter has thinner, less exsert, less sharply defined costae. Under leaf litter and other debris close to the seashore, usually in sheltered places just above the high water mark. Generally

rare wherever it is found. Widespread, from Africa to Japan and in the Pacific Islands. Known from Guam and Saipan in the Marianas.

ACHATINELLIDAE

Genus *Elasmias* Pilsbry, 1910

Elasmias quadrasi (Möllendorff, 1894)

Tornatellina quadrasi Möllendorff, 1894

Small size, ca. 2.5 mm, characteristically flat columellar barrier and one small parietal barrier distinguishes this species from other Mariana land snails. Pilsbry and Cooke's (1915-1916) translation of Möllendorff's (1894) original Latin description runs: Shell imperforate, ovate-globose, thin, pellucid, delicately striate, somewhat shining, pale buff-corneous; spire little elevated, the apex rather obtuse; whorls 3.5, a trifle convex, rapidly increasing, the last large, swollen; aperture moderately oblique, oval peristome simple, acute; columellar margin very slightly reflexed, appressed; parietal lamella strongly elevated, spirally entering; columella strongly lamellarly dilated, deeply excised at base in a right angle; length 2.5 mm. Arboreal and on ferns and shrubs. Guam, Rota, Aguiguan, Tinian, and Saipan. Cooke and Kondo (1960) say the species "extends northward into the smaller Mariana Islands". Kurozumi (1994) reports an unidentified *Elasmias* sp., possibly *E. quadras*, from Anatahan, Alamagan, Agrihan and Asuncion. Smith (2008b) reports a *E.* sp. cf. *E. quadrasi* from Sarigan.

Genus *Lamellidea* Pilsbry, 1910

Lamellidea (*Lamellidea*) *microstoma* (Quadras & Möllendorff, 1894)

Tornatellina (Lamellina) microstoma Quadras & Möllendorff, 1894

"Adult shells recognizable by being higher spired, without a concave palatal wall as found in *Lamellidea subcylindrica,* and having more impressed sutures than in *Pacificella variabilis*" Bauman (1996b). Pilsbry and Cooke's (1915-1916) translation of Möllendorff's (1894) original Latin description runs: Shell subrimate, oblong-conic, thin, subpellucid, delicately striate, slightly shining, buff-corneous; spire turreted, sides slightly convex, apex acute; whorls 6.5, rather flattened, parted by slightly impressed suture, slowly increasing, the last spirally impressed, subsulcate before the aperture; aperture rather oblique, rhombic; peristome simple, acute, columellar margin a little dilated, spreading; columella strongly twisted spirally, lamellarly entering, excised above, projecting in dentiform process externally; parietal lamella moderately elevated, deep; a single palatal plica remote from the margin; length 3.5 mm; young shell columella trilamellate, parietal lamella more elevated, last whorl with three internal transverse denticulate ribs absent in adults. According to Cooke and Kondo (1960) a more abundant species that *L. microstoma* on both Guam and Rota. Guam, Rota, Tinian, Saipan (Cooke and Kondo 1960). Kurozumi (1994) reports unidentified *Lamellidea* spp. from Sarigan, Alamagan, Agrihan, Asuncion and Maug.

***Lamellidea* (*Lamellidea*) *moellendorffiana* (Pilsbry, 1915)**

Tornatellina (Lamellina) moellendorffiana Pilsbry, 1915.

Shell imperforate, oblong-conic, brownish-corneous, shining, very distinctly marked with growth striae; spire slightly convex outline, apex obtuse; 5.5 whorls, moderately convex, separated by delicately margined suture, last whorl flattened in middle, last half of which rather deeply impressed, base quite convex, sack-like, impressed around axis; aperture quite oblique, ovate; columella short and vertical, heavily calloused; well-developed parietal lamella enters deeply; length 3.7 mm; adult shell slightly more robust with more convex

whorls than *L. microstoma*. (Description after Pilsbry and Cooke 1915-1916). Most authors since Cooke and Kondo's (1960) examination of the type specimens follow their conclusion that this is a form of *L. microstoma*. Pilsbry and Cooke (1915-1916) say the species is found in close association with *L. microstoma*. Known from Guam, Rota, Tinian, Saipan (Cooke and Kondo 1960). Kurozumi (1994) reports unidentified *Lamellidea* spp. from Sarigan, Alamagan, Agrihan, Asuncion and Maug.

Lamellidea (*Lamellidea*) *subcylindrica* (Quadras & Möllendorff, 1894)

Tornatellina (Lamellina) subcylindrica Quadras & Möllendorff, 1894.

Description: Shell length to over 3 mm, non-rimate, subcylindric-turreted, delicately striatulate, thin, subpellucid, a little shining, buff-corneous; spire gradually tapering, apex rather obtuse; whorls 6/5, rather convex, body whorl distinctly plicate-striate, from the beginning rather deeply impressed spirally in the middle; aperture moderately oblique, rounded-trapezoidal, peristome simple and acute; columella dilated above, palatal dentiform process, strongly twisted spirally, sub-dentate above; parietal lamella oblique, strongly elevated, extending deep within, no palatal plicae; young with tridentate columella, the central largest, and convex whorls, the last marked with one or two whitish, vertical streaks outside following internal strong whitish, palatal, serrated laminae. (Möllendorff in Pilsbry and Cooke 1915-1916.) Redescribed in Cooke and Kondo (1960). Less abundant than *L. microstoma* on both Guam and Rota (Cooke and Kondo 1960). Found on the undersides of leaves (Bauman 1996b). Known from Guam and Rota. Kurozumi (1994) reports unidentified *Lamellidea* spp. from Sarigan, Alamagan, Agrihan, Asuncion and Maug.

Genus *Pacificella* Odhner, 1922

Pacificella variabilis Odhner, 1922

Tornatellinops variabilis (Odhner, 1922)

Lamellidea variabilis (Odhner, 1922)

Quite similar to *Lamellidea*, however, '*Pacificella* is separated by its slightly shorter length, proportionately wider diameter, fewer whorls, blunter apex, larger aperture, and weaker parietal lamella' (Cooke and Kondo 1960). Juvenile shells do not have palatal ribbing found in *Lamellidea* (Bauman 1996b). Found on the leaves of ferns and other plants, particularly in coastal areas (Preece 1998). Widespread in the Pacific islands; Guam and Rota in the Marianas. Cooke and Kondo (1960) suggest that this species' distribution in the Pacific indicates its ancient transport by man. Kurozumi (1994) reports an unidentified *Tornatellinops* sp., possibly *P. variabilis***,** from Sarigan, Alamagan, Agrihan, Asuncion and Maug. Smith (2008a) reports a cf. *P. variabilis* from Sarigan.

ACHATINIDAE

Genus *Achatina* Lamarck, 1799

Achatina fulica Bowdich, 1822

Lissachatina fulica (Bowdich, 1822)

Achatina (Lissachatina) fulica Bowdich, 1822

Adult shell to 20 cm in length, usually 10 cm, conical, whorls rounded with somewhat impressed sutures, aperture ovate lunate, lip sharp, thin, convex, surface smooth with faint axial striae, columella truncated even in very small juveniles, columella and parietal callus white to bluish white, seven to nine whorls, shell reddish brown with yellowish axial streaking, protoconch not bulbous, body usually mottled brown. Herbivorous, an agricultural

and garden pest. Lays ovoid calcified white eggs in moist soil and fallen vegetation. In the Marianas, the empty shell is used by the land hermit crabs *Coenobita* spp. Native to tropical eastern Africa and now worldwide. Introduced to the Mariana Islands in Guam in 1945 and Rota, Tinian, Saipan, Pagan and Agrihan between 1936 to 1939 (Cowie 2000).

BRADYBAENIDAE

Bradybaena similaris (Férussac, 1821)

Helix similaris Rang, 1831

Description: Shell width about 14 mm, shell colour cream to brown, sometimes with a single reddish brown peripheral band (see inset photo), translucent with darker mottled mantle and viscera visible beneath, apex obtuse, spire depressed turbinate, 5.5 whorls, convex to obtuse angulate, sculptured with fine, irregular growth lines, aperture lunate, parietal callus absent or superficial, peristome of adult shell reflexed, columellar lip most strongly and partially covering umbilicus. Superficially similar to *Ganesella succinta*, but the shell is about half the diameter of the latter species. Rang (1831) cited Férussac (1821) as author of the name, but *similaris* Férussac, 1821 is a *nom. nud.* (Cowie 1997). Bradybaenidae is considered by some authors as a part of Camaenidae. Egg laying, hermaphroditic, herbivorous. Found in gardens, on the ground and among leaf litter, as well as low on vegetation and trees. Native to southeast Asia and now widespread across the tropics. Historic introduction in the Mariana Islands before 1948 (Lange 1950). Known from Guam and Saipan (Hopper and Smith 1992; Robinson and Hollingsworth 2006).

BULIMULIDAE

Drymaeus multilineatus (Say, 1825)

Bulimus multilineatus Say, 1825.

Off-white, elongate conical, high-spired shell with conspicuous black to brownish axial streaks basally, black sutural line and bluish apically; adult height 18 to 25 mm. Bulimulids are considered by some authors as a subfamily within Orthalicidae. Dry, exposed to sunny arboreal habitats. Most often seen attached to a branch with the animal retracted inside. Its native range is Central and northern South America, Caribbean islands and southern Florida. In the oceanic Pacific islands, it is known only from Guam, where it was likely inadvertently introduced with cultivated plants sometime before 1978 (C. Christensen, pers. comm. 2012).

CAMAENIDAE

Ganesella succincta (H. Adams, 1866)

Helix (*Camaena*) *succincta* H. Adams, 1866

Description: Superficially similar to *Bradybaena similaris*, but shell about twice the diameter, to 3 cm. Shell umbilicate, depressed conical, solid, oblique growth striae, spiral lines irregularly decussate, whitish brown, darker bands, whorls six, just about circular, the last whorl descending more rapidly, blunt peripheral carina, umbilicus narrow, aperture oblique, lunate-elliptic, paler inside, parietal callus thin and transparent, peristome white, expanded, narrowly reflexed, columellar margin expanded. (Based on Adam's 1866 original Latin description.) Identification is based on Cowie (2001). This is the *Satsuma succincta* (H. Adams, 1866) of many recent authors. This species is also apparently the *S. mercatoria* (Pfeiffer, 1845) from Guam of some authors (e.g., Robinson and Hollingsworth 2006). Currently one of the most commonly encountered snails on Guam. A crop pest, but found on the ground and low on vegetation in residential areas and all forest types. Native to Taiwan.

First found on Guam in 1982 (C.C. Christensen, pers. comm. 2012); not detected elsewhere in the Marianas or oceanic Pacific (Cowie 2001; Robinson and Hollingsworth 2006).

CHAROPIDAE

Genus *Himeroconcha* Solem, 1983

Himeroconcha fusca (Quadras & Möllendorff, 1894)

Patula fusca Quadras & Möllendorff, 1894

Himeroconcha fusca is by far the largest Micronesian charopid land snail. It differs from *H. quadrasi* in its narrower umbilicus, acutely angulated periphery, stronger radial elements in the apical sculpture, and much larger size. *Himeroconcha rotula* is very much smaller and lacks the peripheral angulation seen in the two species mentioned above. (Description from Solem, 1982.). A forest species known from Guam, Mariana Islands. Genus only known from Guam.

Himeroconcha lamlanensis Solem, 1982

Although *Himeroconcha rotula* has an elevated spire, is more than half a millimeter larger in mean diameter, and averages three-quarters of a whorl more, *H. lamlanensis* can be derived from that species by a few simple modifications. Depression of the apex and spire, shifting of the whorl flattening from the lower palatal wall to the basal margin, reduction in sculpture, loosening in coiling pattern, and eduction in whorl count are the required changes. Some of the above changes tend to be correlated." "Color of apical whorls light yellow-horn, lower whorls progressively darker with termination of body whorl a deep reddish purple. (Description from Solem, 1982.) The specific epithet *lamlanensis* is derived from a

mispelling of the type locality Mt. Lamlam. Under rocks, in forests, in litter, on branches and leaves. Known from Guam, Mariana Islands. Genus only known from Guam.

Himeroconcha quadrasi (Möllendorff, 1894)

Patula quadrasi Möllendorff, 1894

H. quadrasi is easily separated from *H. rotula* by its strongly angulated body whorl. *H. fusca* averages more than 1 mm larger, has a proportionately narrower umbilicus, and the apical cording is reduced. *H. quadrasi* is reddish yellow-horn without the darker flammulations; the apex is light yellow-brown (Solem, 1982). Inhabits litter and under rocks in native forest. All species in the genus *Himeroconcha* are only known from Guam and Rota.

Himeroconcha rotula (Quadras & Möllendorff, 1894)

Patula rotula Quadras & Möllendorff, 1894

Himeroconcha rotula differs from *H. quadrasi* and *H. fusca* in its rounded periphery and smaller size, from *H. lamlanensis* by its elevated (not sunken) spire and prominent secondary spiral cording. *Ladronellum mariannarum* is a much smaller, higher shell with apertural barriers. *Himeroconcha rotula* is only slightly smaller than *H. quadrasi*, but differs most obviously by the strongly angulated periphery and lower H/D ratio of the latter. *Himeroconcha fusca* is very much larger and prominently keeled; *H. lamlanensis* is smaller, has a depressed apex and spire, and lacks the very prominent

secondary spiral cording. (Description from Solem, 1982.) Under rocks, in forests, in litter, on branches and leaves. All species in the genus *Himeroconcha* are only known from Guam and Rota.

Himeroconcha spp.

Bauman (1996b) found two subfossil, apparently undescribed species of *Himeroconcha* on Rota. *Himeroconcha* sp. 1 is close to *H. rotula*, but differs by its rapidly descending body whorl. *Himeroconcha* sp. 2 has an apertural periphery expanded compared to *H. rotula* and the body whorl does not descend as rapidly as that in *Himeroconcha* sp. 1. Another species, *Himeroconcha* sp. 3, has been found by Bauman (1996b) in archaeological digs in Tinian, but no description or figure is given. Species numbers follow Bauman (1996b). Inhabits litter and under rocks in native forest. *Himeroconcha* sp. 1 and sp. 2 are only known from Rota. The genus *Himeroconcha* is only known from Tinian, Guam and Rota.

Ladronellum mariannarum (Quadras & Möllendorff, 1894)

Endodonta mariannarum Quadras & Möllendorff, 1894

In color and general sculptural appearance this species seems closely related to *Himeroconcha rotula*. The latter has very prominent secondary spiral cording, a much lower spire, no apertural denticles, and the anatomy is distinctly different.... Body color light yellow-white on foot sides and tail, light gray tone on back of head and edge of mantle collar. *Ladronellum* is most apt to be confused with *Himeroconcha*. In color, size, and general sculptural appearance, *Ladronellum mariannarum* compares quite well with *Himeroconcha rotula*. There are both conchological and anatomical differences. *Ladronellum* has apertural barriers, lacks the very prominent secondary spiral cording on the shell, and has a much more elevated spire and a greater number of more tightly coiled whorls at similar diameters.

(Description from Solem, 1982.) Known from ravine forest; semi-arboreal. The genus *Ladronellum* is only known from Guam.

Genus *Semperdon* Solem, 1983

Semperdon heptaptychius (Quadras & Möllendorff, 1894)

Endodonta heptaptychia Quadras & Möllendorff, 1894

Description: Might be confused with *S. rotanus*. However, *S. heptaptychia* usually has only four (occasionally five) palatals and much less lateral compression of the whorls. In contrast, *S. rotanus* has seven (occasionally six) palatals and the whorls are nearly circular in cross section (Solem, 1982). The genus *Semperdon* occurs only in the Mariana Islands and Palau. *S. heptaptychius* is known from Rota and northern Guam, Mariana Islands.

Semperdon rotanus Solem, 1982

S. rotanus is perhaps most similar to *S. heptaptychius*. However, the former is smaller, with fewer and more rounded whorls, usually six or seven (rarely more) palatal teeth, and generally more narrowly umbilicated. In contrast, *S. heptaptychius* normally has four or five palatals (rarely six or more). Further, its whorls are noticeably more compressed laterally above and below the rounded periphery (Solem, 1982). The genus *Semperdon* occurs only in the Marianas and Palau. *Semperdon rotanus* is known only from Rota.

Semperdon spp.

Bauman (1996b) and Kurozumi (1994) report at total of at least six unidentified *Semperdon* spp. from the Marianas. Bauman's *S*. sp. 1 from Rota, shown above, is "easily distinguished from other Mariana Island *Semperdon* by its extremely high spire." Bauman also lists and describes sans figures five other undescribed species he places tentatively in the genus, ?*Semperdon* spp. 2-6 from Tinian and Guam. Species numbers follow Bauman (1996b). Kurozumi does not figure his species, which is perhaps distinct, as species in the genus tend to be endemic to single islands and his nine specimens were all found on Maug, of three tiny islets distant from the other Mariana Islands known to be inhabited by *Semperdon*. Ground-dwelleing species. The genus *Semperdon* occurs only in the Marianas and Palau. Likely undescribed *Semperdon* spp. are known from Rota, Tinian, Guam, and Maug (Kurozumi 1994; Bauman 1996b; Bauman unpubl.).

ELLOBIIDAE

Genus *Pythia* Röding, 1798

Pythia scarabaeus (Linnaeus, 1758)

Helix scarabaeus Linnaeus, 1758

Pythia argenvillei Pfeiffer, 1853

A distinctive large flattened shell with apertural barriers. Usually found at low elevations and in limestone forest near the coast. Also found in intertidal mangrove forest. Sometimes worn and empty shells are found in beach wrack. Found widely in the western Pacific islands. In the Marianas, it is found on Guam, Rota, Aguiguan and Saipan (Bauman 1996b; Smith 2008a).

EUCONULIDAE

Coneuplecta (*Durgellina*) *calculosa* (Gould, 1852)

Helix calculosa Gould, 1852

Kurozumi (1994) collected nine exemplars of an unidentified *Coneuplecta* (*Durgellina*) sp. on Agrihan. There are 13 described species in the subgenus *Durgellina*, only one of which occurs, and occurs quite widely, in the Pacific islands, *C*. (*D*.) *calculosa*, hence our tentative identification here. This species is "readily distinguished by its globose-pyramidal form, angulate body whorl and oblique aperture; the umbilicus, though generally closed is sometimes punctiform, the columella reflexed" (Garrett 1884). Solem (1988) writes that the species is "recognisable by its comparatively large size, diameter 4-5 mm, obtusely angulated periphery, and complex micro-sculpture of initially predominant radial ridgelets that shift to predominant spiral grooves by mid-spire." *C*. (*D*.) *calculosa* is found in foliage in forests (Garrett 1884). Known from India, through northern Australia, Indonesia, Melanesia and Polynesia. Thought to be originally a Polynesian species spread by islanders and later by Western commerce (Solem 1961). In the Mariana Islands, a *C*. (*D*.) sp. has been only reported from Agrihan (Kurozumi 1994).

Genus *Liardetia* Gude, 1913

Liardetia spp. Gude, 1913

Helix Clayi Liardet, 1876

From the original description: Shell small, trochoid, thin, finely but distinctly costulate, periphery carinated (Gude, 1913). Two unidentified *Liardetia* shown above have been collected in Rota by Bauman (1996a) and in Sarigan by Smith (2008b). Kurozumi (1994) also reports without figures multiple species from the northern Marianas. A total of three

described species in this genus are known from the Mariana Islands, and these unidentified specimens may well belong to them. Growth thread density, i.e., spacing, appears to be a well-defined and species-specific character among them. Arboreal, on the undersides of leaves of vegetation. Members of this genus are still abundant on at least Guam and Rota. The genus *Liardetia* is widespread in the Philippines, SE Asia, Polynesia and Micronesia. Unidentified species in the Marianas are known from Rota, Anatahan, Sarigan, Alamagan, Pagan, Agrihan, Asuncion and Maug (Kurozumi 1994; Bauman 1996a; Smith 2008b)

***Liardetia* (*Belopygmeus*) *doliolum* (Pfeiffer, 1846)**

Helix doliolum Pfeiffer, 1846

Kaliella doliolum (Pfeiffer, 1846)

Similar to *L. stirolata* but slightly larger, subcarinate to markedly angulate when young, distinctly, but somewhat bluntly angulate on the fifth whorl, light brownish, reddish yellow color, embryonic whorls with sharper spiral striae and coarser, more prominent growth threads, later whorls with similar sub-equal growth threads, beaded by spiral striae above, base with much more closely spaced, finer spiral straiae, fifth whorl with suture dropping below angle of penult, aperture rounded angulate, peristome oblique at 30^{o} to shell axis, columella suddenly and strongly reflected, appearing weakly emarginate. Animal whitish. (Description from Baker 1938). 3.5 mm wide, 2.5 mm high (Pfeiffer, 1846). Arboreal, on the undersides of leaves of vegetation, on and under stones and fallen logs. Members of this genus, perhaps including this one, are still abundant on Guam and Rota. Probably native to the Philippines (Möllendorff, 1900). Occurs in Guam, Tinian, and Rota in the Mariana Islands, as well as Chuuk, Pohnpei, and Kosrae in greater Micronesia (Baker 1938).

Liardetia (*Liardetia*) *sculpta* (Möllendorff, 1893)

Microcystis sculpta Möllendorff, 1893

Similar to *L. tenuisculpta* but more turbinate with descending fifth and sixth whorls, rounded angulate on fourth whorl, light tan, considerably duller below, later whorls with very fine minor growth wrinkles, interspersed with narrow but high, major riblets not beaded by finer spiral striae above; base with growth threads fading near half distance to columella, suture well impressed, aperture rounded to subangulate, columella hiding more than half of superficial perforation. (Description from Baker 1938). Arboreal, on the undersides of leaves of vegetation, on and under stones and fallen logs. Members of this genus, perhaps (including) this one, are still abundant on Guam and Rota. Southern China, Guam in the Mariana Islands, Pohnpei and Yap elsewhere in Micronesia, (Baker 1938).

Liardetia (*Liardetia*) *tenuisculpta* (Möllendorff, 1893)

Kaliella tenuisculpta Möllendorff, 1893

Similar to *L. striolata* but smaller, depressed tubinate, weakly angulate on third whorl, quite evenly rounded on fourth; reddish amber color, dull above, distinctly glossy below, embryonic growth whorls with much stronger and coarser growth striations, approaching those of *L. doliolum*, later whorls beaded by sharp spiral striae above, suture more impressed and dropping below angle with fourth whorl, aperture evenly rounded, but depressed, columella hiding ca. 1/4 of superficial perforation. (Description from Baker 1938.) Arboreal, on the undersides of leaves of vegetation, on and under stones and fallen logs. From three to five large eggs with embryos (Baker 1938). Members of this genus, perhaps (including) this

one, are still abundant on Guam and Rota. Philippines, Saipan and Rota in the Mariana Islands, Chuuk and Yap elsewhere in Micronesia (Baker 1938).

Genus *Lamprocystis* Pfeffer, 1883

Lamprocystis spp. Pfeffer, 1883

Lamprocystis Pfeffer, 1883

There are four described spp. of *Lamprocystis* reported from the Mariana Islands: The photo is of an unidentified *Lamprocystis* from Rota (Bauman 1996b). Kurozumi (1994) notes two potentially new species (his sp. A and B) from the northern Marianas. Found on the underside of decaying leaves on the forest floor (Bauman 1996b). The genus is found throughout the continental and oceanic palaeotropics, including nearly all islands of the Marianas: Guam, Rota, Tinian, Aguiguan, Saipan, Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, and Asuncion (Kurozumi 1994; Bauman 1996b).

Lamprocystis denticulata Quadras & Möllendorff, 1894

Lamprocystis (*Microcystina*) *denticulata*

Lamprocystis (*Lamprocystis*) *denticulata*

Shell about 4 mm high and 6 mm across. Shell with subconoid, obtuse spire, with evenly rounded periphery and broad, quite deep foveola; horn-colored, highly glossy above and polished below. Embryonic whorls 1.9 or more, with fairly strong, very fine, spiral striae. Later whorls with weaker spirals above and still more polished base; suture lightly impressed and vertically overriding. Aperture narrow, evenly rounded, without palatal or basal lamella at 3.25 whorls. Columella very oblique, with heavy short lamella inclined downwards and

adnate below (almost to tip, even at 3.5 whorls, and becoming stouter with age). (Description from Baker 1938.) Members of the genus are found arboreally and on the underside of decaying leaves on the forest floor (Bauman 1996b). Known from Guam, Rota, Saipan (Baker 1938).

Lamprocystis (*Guamia*) *fastigata* (Gude, 1917)

Pseudhelicarion fastigata Gude, 1917

Shell very similar to *L. misella* but with larger and slightly more rapidly increasing whorls, angulate when young but barely so at beginning of fifth whorl, base convex with rather narrow and fairly deep favoeola, slightly darker brown color and more polished, embryonic whorls 1.8 to 2 in number with sharper spiral striae, especially on the first whorl with about 100 visible, later whorls more polished and with weaker growth wrinkles, but with stronger spirals than in *L. misella* above and below, aperture more broadly lunate, almost evenly rounded, columella concave and moderately thickened behind peristome at four whorls. (Description from Baker 1938.) Members of the genus are found arboreally and on the underside of decaying leaves on the forest floor (Bauman 1996b). Guam, Rota, Tinian (Baker 1938).

Lamprocystis (*Guamia*) *hornbosteli* Baker, 1938

Shell about 4 mm high and 6 mm across. Shell very similar to *L. misella* but smaller and slightly more angulate at all whorl sizes, base more tumid with narrower foveola, embryonic whorls about 2 1/4, sculpture throughout mush as in *L. misella* but growth striae on late fifth whorl slightly sharper above, aperture barely angulate, columella concave, but thickened

behind peristome; animal also similar. (Description from Baker 1938.) Members of the genus are found arboreally and on the underside of decaying leaves on the forest floor (Bauman 1996b). Known from Guam (Baker 1938).

Lamprocystis (*Guamia*) *misella* (Férussac, 1821)

Helix (helicostyla) misella Férussac, 1821

Shell depressed turbinate, angulate when young and weakly so at 5.2 whorls, base convex with broad and fairly shallow foveola, horn color, faily well polished and translucent when fresh, embryonic whorls 2.2 to 2.5 with impressed, spiral lines extremely fine and closely spaced, later whorls with somewhat weaker spirals and very low growth wrinkles above and more polished below, although spiral striae still visible under high light, suture moderately impressed, overriding, aperture lunate, depressed but scarcely angulate, peristome almost 20^{o} to shell axis, columella rather oblique. (Description from Baker 1938). Members of the genus are found arboreally and on the underside of decaying leaves on the forest floor (Bauman 1996b). Endemic to Guam (Baker 1938).

FERUSSACIIDAE

Cecilioides (*Geostilbia*) *aperta* (Swainson, 1840)

Macrospira aperta Swainson, 1840

Geostilbia aperta (Swainson, 1840)

Caecilioides aperta (Swainson, 1840)

Description: Smith (2008b) reported *Geostilbia* sp. cf. *G. philippinica* Möllendorff, 1890 from Sarigan (above left). However, Möllendorff's (1890) original description via Pilsbry's (1909-1910) translation indicates a truncate columella and amarginate suture not seen in Smith's specimen. Hence, we provisionally place his (likely subadult) material closer to the circumtropical invasive *C.* (*Geostilbia*) *aperta* (above right), which is listed as occurring on Guam and on many other tropical western Pacific islands (Cowie 1997). Appears to be a widespread, easily introduced and conchologically variable species. Hence, *C.* (*Geostilbia*) *aperta* probably includes *C. gundlachi* (Pfeiffer, 1850), *C. caledonica* (Crosse, 1867), *C. baldwini* (Ancey, 1894) and others (see Pilbry 1909-1910 and Cowie 1997). A blind, burrowing form of moist soil to at least a metre in depth, also under rocks or leaf litter in primary and secondary forests. *C. aperta* is a Caribbean species introduced historically worldwide, including Hawaii. Known in the Mariana Islands from Guam (Cowie 1997) and tentatively from Sarigan (Smith 2008b) and Alamagan (as *Geostilbia* sp.; see Kurozumi 1994).

PARTULIDAE

Genus *Partula* Ferussac, 1821

Partula gibba Férussac, 1821

Partula mastersi Pfeiffer, 1857

Partula bicolor Pease, 1872

Shell dextral or sinistral, conic-ovate, perforate, pellucid. Spire acute, 4 to 4½ whorls, the last gibbous. Sculpture of spiral striae, crossed by weak longitudinal growth striae; suture slightly adpressed, various shades of white or brown. Aperture oblong-ovate, subquadrangular; peristome reflexed, broadly dilated, white. Background color variable, chestnut brown to

whitish-yellow; also purple. Adult length 14 to 18 mm, width 10 to 14 mm. (Description from Smith et al. 2008b.) Ovoviviparous. Once the most commonly encountered *Partula* on Guam. Still common on some northern islands, such as Pagan and Sarigan. *Partula gibba* is the most widely distributed partulid in the Mariana Islands, occurring on Guam, Rota, Aguiguan, Tinian, Saipan, Anatahan, Sarigan, Alamagan, and Pagan (Kurozumi 1994; Smith et al. 2008b).

Partula langfordi Kondo, 1970

Much smaller and with whorls less convex than *P. gibba*. Dextral shell described by Kondo (1970) as ovate-conic and moderately thin, a spire of five, slightly convex whorls, and an obtuse apex, aperture oblong-ovate with a white peristome thickened and expanded, background color buff superimposed by maroon. A band on whorls two and three also maroon. The band begins at whorl one and a half as a faint brown marking one-third the width of the whorl and gradually widens to one-half width of the whorl deepening to maroon at whorl three. The band expands to three-fourths width of whorl four and dissipates into a vague blend of buff-maroon at the beginning of whorl five to the end of the shell. The holotype has a length of 14.0 mm, a diameter of 9 mm, and a aperture length of 8 mm. (Description from Kondo 1970). Hermaphroditic. Ovoviviparous. *P. langfordi* prefers cool, shaded forest (Smith 2008a). An endemic of Aguiguan. Likely extinct. A survey conducted there in 1995 found no live *P. langfordi* and only fresh, dead shells (Bauman 1996b), while a survey in 2006, also found no live animals, but only old, degraded shells. This is compelling evidence that the species on this very small island is extinct (Smith 2008a).

Partula radiolata (Pfeiffer, 1846)

Bulimus (*Partula*) *radiolatus* Pfeiffer, 1846.

Shell dextral, oblong-tapering, subperforate, thin. Spire obtuse, whorls typically five, slightly convex, the last about equal to the spire. Sculpture of faint, impressed lines. Aperture obliquely oval; peristome simple, thin, white, expanded, the right margin somewhat straightened, columellar margin dilated above, spreading above the umbilicus. Background color pale straw with darker axial rays and brown lines. Adult length 13 to 18.5 mm, width 8 to 12 mm. (Description from Smith et al. 2008b.) Ovoviviparous. The most commonly encountered *Partula* on Guam. Found in bushes on the undersides of leaves. Endemic to Guam. Crampton (1925).indicates that the species been erroneously reported to occur on the island of New Ireland in the Bismarck Archipelago by Pfeiffer (1846), Hartman (1881), and Parkinson et al. (1987).

Partula salifana **Crampton, 1925**

Shell dextral, ovate-conic, thick and heavy. Umbilicus open, slightly flattened. Spire somewhat protracted, whorls 5 to 5¼, slightly impressed below the suture. Sculpture of spiral striae on embryonic whorls becoming weaker on postembryonic whorls. Aperture elongate, interior purplish and shining, peristome expanded and flattened, gradually narrowing as it approaches contact with body whorl, color variable from white to yellowish brown or purple. Background color is a rich chestnut-brown or seal-brown to yellowish or olive; the apex color is often purple as a result of decortication. Adult length 17 to 19 mm, width 10.5 to 11.7 mm. (Description from Crampton 1925.) Ovoviviparous. *Partula salifana* is the most geographically restricted of the partulids in the Mariana Islands. It was known only from the

summit of Mount Alifan and two adjacent peaks on the southwest coast of Guam. Probably extinct.

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Partula sp. Férussac, 1821

Partula sp. cf./aff. *gibba* of Bauman 1996b

Four shells of a distinctive *Partula* were collected from archaeologic test pits in caves at Payapai and As Matmos, Rota. The specimens are close in general shell shape to *P. gibba,* but differ in having an extremely thickened and heavy shell, including a proportionately larger peristome. Similar shells are not mentioned in Crampton's (1925) monograph on variation in Partulidae of Saipan or Guam, or Kondo's (1970) analysis of *Partula* on Aguiguan. Known only from a few subfossil specimens. Limited material leaves the status of these shells uncertain; they could represent an extinct undescribed (sub)species or a local race of *P. gibba*. Only known from the island of Rota, Mariana Islands (Bauman 1996b).

Genus *Samoana* Pilsbry, 1909

Samoana fragilis (Férussac, 1821)

Partula fragilis Férussac, 1821

Partula quadrasi Möllendorff, 1894

Shell dextral, ovate-conic, narrowly and half-covered perforate, fragile, pellucid. Spire conic, apex somewhat obtuse; whorls typically four, slightly convex, separated by adpressed, marginated suture; last whorl distinctly convex, nearly tumid. Sculpture of delicate spiral striae intersected by transverse growth striae. Aperture oblique, oval; peristome thin, well expanded, columella dilated above, recurved, forming distinct angle with parietal wall.

Background color buff; narrow darker maculations and whitish banding due to viscera visible through the shell. Adult length 12 to 16 mm, width 10 to 12 mm. (Description from Smith et al. 2008b.) Usually in the northern half of Guam in limestone forest. Unique among Mariana Islands partulids, the eggs are large (4.2 mm × 3.3 mm) and encapsulated by a calcareous shell. Further, *S. fragilis* reaches sexual maturity before growing a reflexed peristome, a trait not reported for any other partulid species (Crampton 1925). The only species of *Samoana* to occur outside of southeastern Polynesia. Reported from Guam and Rota in the Mariana Islands (Kondo 1970; D. Sischo, pers. comm.).

PUPILLIDAE

Ptychalaea sp. Boettger, 1889

Nesopupa Pilsbry, 1900 in part, *Vertigo* Müller, 1774 in part. *Ptychalaea* is currently a monotypic genus endemic to the adjacent Bonin (Ogasawara) Islands, *P. dedecora* (=*Vertigo dedecorata* Pilsbry, 1901). Kurozumi (1994) reports a *Ptychalaea* sp., from the northern Mariana Islands. *Ptychalaea* is distinguished from *Nesopupa* in that the "angular lamella connects by a curved callous ridge with the termination of the outer lip; there is a rounded crest behind the peristome." (Pilsbry and Cooke 1918-1920). In addition to the Bonin Islands, *Ptychalaea* sp. is reported from Sarigan, Alamagan, Pagan, Agrihan, Asuncion, and Maug (Kurozumi 1994).

SPIRAXIDAE

Euglandina rosea (Férussac, 1821)

Helix rosea Férussac, 1821.

Distinctive appearance; shell to 80 mm long, 27 mm wide, brownish-pink, lighter in juveniles, non-umbilicate, solid, fusiform, whorls four, arcate, with prominent growth striae, suture shallow and uneven, apex obtuse, aperture asymmetrical, narrow, ovate-lunate, columella truncate. Feeds on other snails and slugs, preferring smaller individuals, which it swallows whole, but will attack large snails by entering through the shell aperture. Obligate out-crossing, egg-laying hermaphrodite. Individuals live up to 24 months. About 30 eggs are laid in a shallow pocket in the soil and hatch after about 35 days. Placed by some authors in Oleacinidae. Native to the southeastern United States. Introduced into the Pacific islands and Asia by at least 1957 (Mead 1961 in Eldredge 1988). In the Mariana Islands, this species is known from Guam, Saipan and Agrihan (Kurozumi 1994).

STREPTAXIDAE

Genus *Gonaxis* Taylor, 1877

Gonaxis kibweziensis (E. A. Smith, 1894)

Streptaxis kibweziensis E. A. Smith, 1894

Adult size to 22 mm. Distinct off-axis coiling; an orange or yellowish foot often visible through the shell, antennae dark when everted, rather than bright orange as in *G. quadrilateralis*. Additionally, almost half the size of, and possessing a proportionally narrower aperture than *G. quadrilateralis*. Similar to *G. quadrilateralis* in feeding and habitat as a ground-dwelling predator of other snails and snail eggs. Found in disturbed habitats and secondary forest (Cowie 2000). Native range is thought to be tropical east Africa; first introduced in the Mariana Islands on Aguiguan in 1950 (Pemberton 1954) and in Guam in 1954 (Mead 1961 in Eldredge 1988). Also collected from Pagan in 1992 (Kurozumi 1994).

Gonaxis quadrilateralis (Preston, 1910)

Streptaxis quadrilateralis Preston, 1910

Distinct off-axis coiling. To 35 mm in length, almost twice as large as *Gonaxis kibweziensis*, and has a wider aperture and bright orange antennae, while *G. kibweziensis* has dark antennae. Similar to *G. kibweziensis* in feeding and habitat as a ground-dwelling predator of other snails and snail eggs. Native to eastern tropical Africa and introduced to the Mariana Islands at Guam in 1967 (Mead 1961 in Eldredge 1988). *G. quadrilateralis* was also released on Saipan prior to 1979, but may not have established (Mead 1979 in Cowie 2000).

Huttonella bicolor (Hutton 1834)

Pupa bicolor Hutton, 1834; often as *Gulella bicolor* (Hutton, 1834) or less so, as *Indoennea bicolor* (Hutton, 1834). The shell is small, 5 to 7.5 mm in height and 1.5 to 2.0 mm in diameter), elongate and sturdy. Shell color is translucent and a very pale brown to white, but the living animal gives the shell an orange or pinkish cast. Shell sculpture is smooth, except at sutures where axial riblets are present. Well-developed axial ribs are present behind apertural lip and in the umbilical region. Aperture with four prominent teeth. (Description from Auffenberg and Stange 2001.) Color of the mantle yellow and eyestalks bright orange; reddish animal shows through translucent shell. Predator of other snails, often of subulinids. Found in disturbed habitats. Hermaphroditic. Originally from Asia or Africa, now circumtropical. Widespread in Pacific Islands, its introduction perhaps prehistoric. Known from Guam, Saipan and Pagan in the Marianas (Kurozumi 1994; Bauman 1996b).

SUBULINIDAE

Allopeas gracile (Hutton, 1834)

Bulimus gracile Hutton, 1834

Lamellaxis gracile (Hutton, 1834)

Unlike the Mariana subulinid *Subulina octona*, this species is smaller, perforate when subadult, non-truncate columella, and with much smaller nuclear whorls. *A. gracilis* also has the same basic shape as another Mariana subulinid *Paropeas achatinaceum*, but the much less pronounced radial sculpture, more convex whorls, and smaller size of *A. gracilis* make it easy to differentiate the two species (Solem 1988). *Paropeas achatinaceum* seems to displace *A. gracilis* when it is introduced to the same areas (Solem, 1988). Probably originally from the New World tropics, now circumtropical. Introduced to the Pacific islands prehistorically (Christensen and Kirch 1981). In the Marianas, known from Guam, Tinian and Saipan. Kurozami (1994) reports unidentified *Allopeas* spp. from Agrihan, Alamagan, Asuncion, Guguan, Maug, Pagan, and Sarigan. These may include other *Allopeas* sp(p). widespread in the Pacific islands but as yet unreported from the Marianas, *A. clavulinum* and *A. micra*.

Opeas hannense (Rang, 1831)

Helix hannense Rang, 1831

O. goodalli (Miller, 1822)

Opeas pumilum (Pfeiffer, 1840)

Aperture near suture characteristically incised or arcate, even in subadult specimens. Animal a greenish-yellow, visible through the shell (J. S. Miller 1822 in Pilsbry 1906-1907). The small size, shell height 5-7 mm, flat-sided whorls, and sinuate sculpture separate *0. hannense* from other subulinids known from the Mariana Islands (Solem 1988). Six to seven whorls in

adult, length to 6.5 mm, max width 2 mm. Like other subulinids, the live animal has a pale yellow body, showing through the shell anteriorly, while the posterior shell transmits a dark brown. Seems common in leaf litter around residential areas and disturbed forests. Originally the New World tropics, now a circumtropical introduction (Solem 1988).

Paropeas achatinaceum (Pfeiffer, 1846)

Bulimus achatinaceus Pfeiffer, 1846

Prosopeas (Paropeas) achatinaceum (Pfeiffer, 1846)

Adult shells about 12-15 mm in height. Most similar in shape to *Lamellaxis gracilis*, but with stronger growth striae, less rounded whorls, and larger size (Solem 1988). Like other subulinids, the foot and antennae are pale yellow. Pilsbury's (1906) translation of Pfeiffer's original description reads: Shell 13 mm long, 4.5 mm wide, imperforate, long-turrited, solid, closely, rudely striate, opaque, waxen. Spire elongate, rather acute. Whorls 8, a little convex, the last about one-third the length. Columella straightened, nearly reaching the base. Aperture oblong-oval; peristome simple, acute, the columellar margin very narrowly reflexed, adnate. *P. achatinaceum* seems to displace *Lamellaxis gracilis* when it is introduced to the same areas (Solem, 1988). Indonesia, introduced to many Pacific islands (Solem, 1988). Known from Guam and Sarigan in the Marianas (Bauman 1996b; Smith 2008b).

Genus *Subulina* Beck, 1837

Subulina octona (Bruguière, 1789)

Bulimus octonus Bruguière, 1789–1792

Shell auger-like, to 15 mm length, 4 mm wide, colourless, polished, transparent, fine growth lines, apex obtuse; approximately eight convex whorls, suture deep and emarginate, truncate columella, imperforate at all growth stages, aperture oblique and acuminate oval; in life posterior half of shell brown, anterior half pale yellow; animal pale yellow, foot to 5 mm length. Gets much larger than *Lamellaxis (Allopeas) gracilis*, and with much larger, nuclear whorls (Solem 1959). One of the most common snails of disturbed habitats, including around houses. Circumtropical. Native to the New World tropics and introduced prehistorically and historically into many Pacific islands. Known in the Marianas from Guam, Aguiguan, Tinian, Saipan, Anatahan, and Pagan (Kurozumi 1994; Bauman 1996b; Smith 2008a).

SUCCINEIDAE

Calcisuccinea luteola (Gould, 1848)

Succinea (*Calcisuccinea*) *luteola* Gould, 1848

Like other succineids, *Calcisuccinea* shells are oval with rapidly descending spires and wide apertures; juveniles with shells sometimes yellowish green to tan, while adults tan to almost white, to 12.5 mm in height and about 6 mm in width, relatively high spire, to four whorls less rapidly enlarging than in *Succinea*, wide oval aperture, thin oblique lip, broad foot, superior tentacles short and thick, inferior tentacles poorly developed. Considered a significant pest of fruit and horticultural crops in the southern U.S. On Guam, it has been found on cultivated papaya trees. Its native range is the southern U.S., from Florida to Arizona. Known from the Marianas on Guam since 2012 (Moore, 2012); an unidentified *Calcisuccinea*, perhaps this species, was also seen on Guam in 2003 (B. Smith, pers. comm.).

Genus *Succinea* Drapamaud, 1801

Succinea sp.

Succinea Draparnaud, 1801

Succinea shells are oval, inflated, fragile and translucent brown, short spire, few whorls rapidly enlarging, wide oval aperture, thin oblique lip, broad foot, superior tentacles short and thick, inferior tentacles poorly developed. Three species are described from the Mariana Islands. A fourth, conchologically distinct species "*Succinea* sp." from Guam and housed in the Bernice P. Bishop Museum, Honolulu, Hawaii, is reported by B.D. Smith (unpubl. in Bauman 1996b). The species pictured above is of an unidentified, although potentially known, *Succinea* from Sarigan. Tropical *Succinea* are ovoviviparous, gonochoric, arboreal, and found in shaded forest. All likely feed on micro-fungi, algae and cyanobacteria. The genus occurs worldwide. *Succinea* unidentified to species in the Marianas are known from Guam, Rota, Tinian, Saipan, Pagan, Aguiguan, Alamagan, Sarigan, Maug, Uracas (Kurozumi 1994; Smith 2008).

Succinea guamensis Pfeiffer, 1857

From the original description in Latin of *S. guamensis* in Pfeiffer (1857): Shell length 12 mm, maximum diameter 7 mm, height 5.5 mm, ovate conical, thin, wrinkled-folded and not quite granulate, translucent, pale yellowish brown, irregular white erosion and pitting, short spire, whorls scarcely 2.5, the penultimate whorl convex, the last comprising 3/4 of the shell's length, the base scarcely narrower, aperture oblique, angular oval, peristome simple, its margin thin and hardened, columellum slightly arched, threaded. Reeve (1873) describes it in part as pale-orange to red-brown, lightly wrinkled, whorls two, columellar fold strong, slightly arched. Arboreal and found in shaded forest. Probably ovoviviparous and gonochoric

and feeding on micro-fungi, algae and cyanobacteria, like many other *Succinea* spp. Described from and presumably restricted to Guam.

Succinea piratarum Quadras & Möllendorff, 1894

Succinea (Amphibina) piratarum Quadras & Möllendorff, 1894

From the original description in Latin of *S. piratarum* in Quadras & Möllendorff (1894): Shell height 11.25 mm, diameter 7 mm, oblong-ovate, thin with close-lying fold-like grooves, indistinct malleation, light yellowish-brown, yellow at apex, three convex whorls, the last rapidly descending, slightly flattened above, aperture slightly oblique and acuminate oval, 8 mm high, 5 mm wide. Arboreal and found in shaded forest. Like other *Succinea* spp., probably ovoviviparous and gonochoric. Likely feeds on micro-fungi, algae and cyanobacteria. The species has only been reported from Guam.

Succinea quadrasi Möllendorff, 1894

Succinea (Neritostoma) quadrasi Möllendorff, 1894.

From the original description in Latin of *S. quadrasi* in Quadras & Möllendorff (1894): Shell height 13.5, diameter 8 mm, oblong-ovate, a little bit thinner, almost transparent, strongly enough multiply striate, indistinctly malleated, yellow, apex reddish, Three whorls quickly becoming wider, deep discrete suture, convex, the last somewhat inflated to 3/4 of the shell's height, aperture moderately oblique, almost exactly oval, aperture height 10 mm, width 5.5 mm, peristome edge acute, columella not quite folded. Arboreal and found in shaded forest. Like other *Succinea* spp., probably ovoviviparous and gonochoric. Likely feeds on micro-fungi, algae and cyanobacteria. The species has only been reported from Guam.

VALLONIIDAE

Pupisoma orcula (Benson, 1850)

Helix orcula Benson, 1850

Kurozumi (1994) reports an unidentified *Pupisoma* sp. in the northern Mariana Islands that is likely the common and widespread tropical western Pacific, *P. orcula*. Pilsbry (1920-1921) provides a description of the genus: Shell ovate or globose-conic with obtuse apex, usually perforate, thin, 3.5 to 5.5 whorls, strongly convex, aperture truncate-rounded, oblique, peristome thin, slightly or not expanded, the columellar margin dilated and reflected, animal with short eye stalks, no inferior tentacles. Closely related species are distinguished primarily by the pattern of the striae. Figured above is a typical species, the most common and widespread form of *Pupisoma* occurring in the tropical western Pacific, *P. orcula* (= *Helix orcula* Benson, 1850). Valloniidae is sometimes considered as part of Vertiginidae, while the latter family is sometimes also considered part of Pupillidae. *Pupisoma* are "viviparous and live on the bark and leaves of trees and other plants" (Pilsbry 1920-1921). Native to South Africa through southern Asia to Japan and introduced widely in Oceania, including Hawaii and French Polynesia (Solem 1988; Cooke 1934). In the Marianas, a *Pupisoma* sp. that is likely this species has been collected from Sarigan, Alamagan, Pagan, Agrihan, Asuncion, and Maug (Kurozumi 1994).

VERONICELLIDAE

Veronicella cubensis (Pfeiffer, 1840)

Onchidium cubense Pfeiffer, 1840.

The mantle covering the full length of the body is a diagnostic characteristic of family Veronicellidae. However, species identification of veronicellids usually relies on anatomical characters. *V. cubensis* is a large slug to 120 mm long. Although its mantle has highly variable coloration (see above photos), it always presents with a with a thin pale dorsomedial line, and is usually light brown with two longitudinal dorsolateral rows of irregular spots, sometimes joining to form longitudinal bands. (Description based on McDonnell et al. 2009). The species is a serious agricultural and horticultural pest, eating a wide range of cultivars. In the Marianas, the slug is found in native and secondary forests to agricultural and residential areas, where it can be very abundant. Usually emerges at night to feed. Eggs are ovoid, jelly-like, translucent greenish brown, and laid in bunches of about 50 in moist soil under decaying wood, stones and other debris. Native to Cuba and now found worldwide, including Pohnpei in Micronesia. Introduced, probably via Hawaii, to Guam prior to 1993 and to Rota in 1997. Not known from the other Mariana Islands.

Vaginulus alte (Férussac, 1822)

Laevicaulis alte (Férussac, 1822).

Body length about 75 mm, dark greyish brown with a pale brown median line along its dorsal surface, foot about 4.-5 mm wide in adults, tentacles short, rarely extending beyond the edge of the mantle, dorsal surface with many small tubercles (description from White-McLean 2011). Always with a pale median dorsal stripe similar to that of *Veronicella cubensis*, but at least sometimes less distinct (as above) and the foot is narrower. Further, unlike *V. cubensis*, it is never pale or white or sporting darker dorsolateral bands or blotches. The species is a serious agricultural and horticultural pest, eating a wide range of cultivars. Lays a clutch of translucent eggs in moist soil. Usually emerges on vegetation at night to feed. Native to

central Africa and now naturalised worldwide, including the Philippines and Melanesia. Has since invaded many places worldwide, including Hawaii. Kurozumi (1994) collected a veronicellid from Alamagan that he identified as this species; otherwise not reported from Micronesia or Polynesia, excepting Western Samoa.

Sarasinula plebeia (Fischer, 1871)

Vaginula plebeja Fischer, 1871

Body length to about 75 mm, mantle dark grey brown to brown with tiny irregular blotches concentrated medially (description from White-McLean 2011). Distinguished from other veronicellids in the Marianas as the only brown slug lacking a pale median stripe and is never pale or white. The species is a serious agricultural and horticultural pest, eating a wide range of cultivars. Lays clutch of translucent eggs in soil. Usually emerges on vegetation at night to feed. Native to Brazil and the Caribbean islands and now naturalised worldwide, including the Philippines, Polynesia and Melanesia. Introduced, probably via Hawaii, to Tinian and Saipan in the Mariana Islands (Robinson and Hollingsworth 2006).

VERTIGINIDAE

Genus *Gastrocopta* Wollaston, 1878

Gastrocopta pediculus (Shuttleworth, 1852)

Pupa pediculus Shuttleworth, 1852

Gastrocopta (*Sinalbinula*) *pediculus* (Shuttleworth, 1852)

Shell minute, ovate-oblong, thin, slightly striatulate, pellucid, hyaline, spire obtues, whorls six, convex, the last slightly compressed at the base, suture deep, aperture rounded-

subauriform, pentaplicate, angular fold strong, flexuous, immersed and somewhat emarginate in front, one strong columellar, three immersed palatals, the middle stronger, peristome thin, narrowly expanded, right margin roundly curved above, middle part subparallel with columellar border (from Pilsbry 1916-1918). Strongly rounded whorls, short spire, quadrate aperture, relatively large size (shell height 2.4-2.8 mm), and larger apertural barriers (Solem 1988). Probably originally from Philippines and SE Asia (Cowie 1997). Widespread in the Pacific islands and likely distributed by man in prehistoric times. In the Marianas, Guam. *Gastrocopta* (*Sinalbinula*) spp., probably including *G. pediculus* have been collected on Rota, Sarigan, Guguan, Alamagan Asuncion and Maug (Kurozumi 1994; Bauman 1996b).

***Gastrocopta servilis* (Gould, 1843)**

Pupa servilis Gould, 1843

G. lyonsiana (Ancey, 1892)

Shell dextral, glossy, obliquely striatulate, oblong, subcylindric, obliquely rimate-perforate, thin, bright corneous, spire more or less slender, subcylindric, tapering at obtuse summit, whorls 5-5.25, convex, regularly increasing, suture impressed, last whorl somewhat tapering, hardly constricted, aperture truncate-oval, lamellate, one parietal arising at the margin but hardly noticeable, becoming upright, strong and slightly sinuous, one columellar lamella simple, appearing as an acute tooth, two drop-shaped palatals, the first smaller, the second elongate and more remote from margin, peristome expanded, scarcely thickened, dilated at columellar margin, length 2.3 mm, diametre 1 mm.. (Description of the Pacific form *G. lyonsiana* in Pilsbry 1916-1918.) Originally a west Indian species probably introduced historically to the Pacific islands on plants (Pilsbury 1916-1918). Identified from Guam and Saipan (Pilsbry 1916-1918; Lange 1950). A non-*Sinalbinula* subgenus and unidentified

Gastrocopta sp., likely *G. servilis*, has been collected on Rota, Sarigan, Guguan, Alamagan Asuncion and Maug (Kurozumi 1994; Bauman 1996b).

Genus *Nesopupa* Pilsbry, 1900

Nesopupa sp(p). Pilsbry, 1900

At least one other species of *Nesopupa* besides *N. quadrasi* occurs in the Mariana Islands. Bauman (1996b) found two distinct forms that he was unable to identify to species that differed from each other in the presence or absence of an infraparietal barrier. Above is his only figured specimen, from Rota, displaying reduced parietal lamellae and absent the characteristically well-developed palatal teeth of *N. quadrasi*. Unidentified *Nesopupa* sp(p). have been collected on Rota, Aguiguan, Tinian and Saipan (Bauman 1996b).

Nesopupa (*Nesopupa*) *quadrasi quadrasi* (Möllendorff, 1894)

Vertigo (*Prychochilus*) *quadrasi* Möllendorff, 1894

Shell subperforate, oblong-ovate, thin, sculptured with quite delicate, rather widely-spaced riblets, silky, brown; whorls five, convex, slowly increasing, separated by a deep suture, the last slightly ascending in front, compressed at base, distinctly pitted behind the lip; aperture nearly vertical, rounded-triangular, the peristome well expanded, with a brown thickening, the margins converging, right margin deeply sinuate, with a noduliform callus; angular lamellar rather high, curving outward, and together with the nodule of the external lip forming an elliptical sinulus; two parietal lamellae, one strongly elevated, entering deeply, the other smaller, two columellar lamellae, three deeply placed palatal plicae, of which the right one is rather long and lamelliform; length 2 mm. (Description from Möllendorff 1894

translated in Pilsbry and Cooke 1918-1920.) Described from Guam. Unidentified *Nesopupa* sp(p). possibly belonging to this species have also been collected on Rota, Aguiguan, Tinian and Saipan (Bauman 1996b).

FAMILY INDET.

Genus and sp. indet.

Resembles Achatinellidae in that it has an unsculptured shell with a strong and large parietal barrier. However, unlike Achatinellidae, this species displays a distinct umbilicus. Found only as subfossil shells. Known only from Rota.

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