ZONITID SNAILS FROM PACIFIC ISLANDS

PARTS 3 AND 4

3. GENERA OTHER THAN MICROCYSTINAE
4. DISTRIBUTION AND INDEXES

BY

H. BURRINGTON BAKER

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Zonitid Snails from Pacific Islands—Part 3

3. GENERA OTHER THAN MICROCYSTINAE

By H. Burrington Baker
Professor of Zoology, University of Pennsylvania

INTRODUCTION

Parts 1 and 2 of these studies discuss the Microcystinae. The general introductory notes to part 1 also apply in main to the present part, which includes the other subfamilies of the Helicarionidae and all the Zonitidae in the area surveyed and concludes the taxonomic discussion.

As in the previous parts, under each species, the citation of localities from which material has been studied is arranged as follows:

1. Type island group (subdivisions of Fiji in parentheses; also synonyms, (indicated by =) : type island (natural divisions, islets, and districts of Hawaiian islands in parentheses; also synonyms as indicated) : museum number of type specimen or lot when examined by me (followed in parentheses by number of type lot if type specimen has been segregated, or of other type lots if one contains the type), type habitat and locality (followed in parentheses by collector! and date), [localities not given by original author included in brackets]; after semicolon, other type or authentic material studied.

2. After first period, without repetition of island group or island, additional material from type island or district.

3. After successive periods, material studied from other island groups (in separate paragraphs), islands, or recognized subdivisions, arranged as in 1.

Abbreviations used in the references to literature and in the citations of museum lots of specimens collected are listed in Part 1 (pp. 4-5).

Condensed Definitions of Families

A. Helicarionidae: primitively with tripartite sole, well-developed caudal foss overhung by "horn" and multicuspid radular marginals, all of which are usually accentuated or reverted to when shell is reduced; advanced groups with well-developed amatorial organs or dart-apparatus on female side of genitalia; shell rarely umbilicate and with perforation or rimation often closed by internal callus.

AA. Zonitidae: primitively with undivided sole, becoming tripartite when shell is reduced; caudal foss not overhung and often obsolescent or lacking (rarely accentuated when shell is reduced); principal radular marginals not more than bicuspid and more usually unicuspid; amatorial organs or dart-apparatus (when rarely developed) penial; shell usually umbilicate or with open perforation or rimation.

The superfamily Limacacea, which is characterized by its elongate radular marginals without entocones, and in which both the Helicarionidae and the Zonitidae belong, is also represented on the islands of the Pacific Ocean by introduced species of a third family, the Limacidae. These last are true slugs, with the shell completely covered by the mantle, and lack a caudal "horn" or mucous foss. The Limacidae are almost exclusively palearctic, but a few members have been widely disseminated by commerce to all parts of the habitable world; even in Polynesia, these have sometimes been accepted as native species and carelessly given new synonyms. Further discussion will not be attempted in these studies.

The following very artificial key is inserted here to assist identification on the bases of conchological characters and distribution. Within the geographic limits of these studies, it should render possible the assignment of any described species of zonitid snail to its subfamily, under which keys to the minor groups and species are given. However, the dubious species listed under "incertae sedis" are not included.

Artificial Key for Subfamilies of Pacific Limacacea

A_1 (5). Slugs with internal shell; widely disseminated by commerce.....**Limacidae.**

A_2. Shell unguiform; *Parmella*; Fiji: .....**Sesarinae** (?).

A_3. Shell completely imperforate, rendered so by attachment of columellar reflection;

B_1 (3). Angulate, with peristome thickened internally and 5 whorl diameter 9 to 12 mm.; *Trochomorpha carolinae*; Caroline Islands (Ponape:) :....**Trochomorphinae.**

B_2. Becoming evenly rounded, with 5 whorl diameter 20 mm.; *Orpiella assavaensis*; Fiji: Yasawa Group (Naviti Islet) :.....**Sesarinae.**

B_3. Smaller or peristome thin; species from western Fiji much smaller; absent from Caroline Islands: .....**Microcystinae.**

A_4. Shell with rimation, perforation or (very rarely) umbilicus closed by an internal callus [N.B. Often thin and sometimes broken away; some are also included in A_5];

C. With 5 whorl diameter over 10 mm.; western Fiji and Caroline Islands (Truk and Ponape):

D. Last whorl expanded near peristome, which is weakly thickened internally; *Dyakia striata*; western Fiji (introduced by commerce) :.....**Dyakiinae.**

DD. Last whorl not so expanded; peristome usually thinner in western Fiji (*Orpiella*) but well thickened (*Ryssota*) or reflected (*Dendrotrochus*) in Caroline Islands: .....**Sesarinae.**

CC. With 5 whorl diameter less than 10 mm. (usually much smaller);

E_1 (3). *Euconulus*: Hawaiian islands .....**Euconulinae.**

E_2. South of the equator;

F. With numerous fine spiral lines or quite polished above and not thread-carinate when almost evenly rounded; growth-threads becoming obsolescent on base; *Liardetia* .....**Microcystinae.**

FF. With few (11-12) spiral lines and dullish above or thread-carinate although almost evenly rounded (*Coneuplecta*) or growth-threads distinct on base (*Euconulus*) .....**Euconulinae.**

E_3. Caroline and Palau Islands:

G. Dullish, with evident spirals between or crossing growth-threads, above and turbinate, although much broader than high or with last whorl markedly descending and rounded; *Liardetia*.....**Microcystinae.**

GG. Depressed and rather polished above (*Kororia* and *Discoconulus*) or about as high as broad with last whorl not markedly descending and thread-carinate (*Coneuplecta*) .....**Euconulinae.**

A_5. Shell with rimation, perforation or umbilicus perspectively open;

H. Vitriniform; rimate or perforate:

I. Hawaiian islands:

J. Dullish, with distinct growth-threads above; 3 whorl diameter over 7 mm.; *Godwinia*; Kauai: .....**Zonitinae.**

JJ. Highly polished and thin; 3 whorl diameter less than 7 mm.; *Vitrina tenella;* Maui and Hawaii:.....**Vitrininae.**

II. *Orpiella*; Fiji (western): .....**Sesarinae.**

HH. Shell with much more gradual whorl-increase or umbilicate (*Retinella*);

K. Embryonic or later whorls with protractive or retractive sculpture or carina with large serrations (*Kondoa*);

L. Shell not attaining diameter over 2.5 mm.; embryonic whorls with sharp spiral ridgelets and later ones with anastomosing growth and protractive threads above; *Striatura*; Hawaiian islands: .....**Gastrodontinae.**

LL. Shell attaining a far greater size; embryonic or later whorls with fine, epidermal retractive or protractive striae, or carina with large serrations (*Kondoa*); absent from Hawaii: .....**Trochomorphinae.**

KK. Without such diagonal sculpture or large serrations;

M. Dullish with growth-threads, but apparently without definite spiral striae, above; 5 whorl diameter 6.8 mm.; *Pukaloa obconica;* Society Islands (Raiatea): .....**Microcystinae.**

MM. With definite spiral striae when dullish above, or larger;

N_1. (3). With 4 whorl diameter 2.5 mm. or less; glossy with mediocre spiral striae and growth-threads above; umbilicate; *Hawaiia minuscula*; widely disseminated by commerce: .....**Vitreinae.**

N_2. With 4 whorl diameter over 3 and less than 8 mm.; umbilicus quite large, less than 8 times in shell-diameter; not known from Caroline and Palau Islands:

O. With 4 whorl diameter 4.5 mm. or more; quite polished; known only from Hawaiian islands:

P. Vitreous, twice as broad as high and appearing to have quite rapid whorl-increase; *Retinella;* .....**Zonitinae.**

PP. Brightly corneous and less depressed, with more gradual whorl-increase; *Zonitoides arboreus*; carried by commerce:..... **Gastrodontinae.**

OO. With 4 whorl diameter much less or duller; south of equator:

Q. Polished, with lightly impressed suture, with umbilicus actually closed by callus (often broken) and with 4 whorl diameter 3.3 mm.; *Liardetia mooreana*; Society Islands (Moorea):.....**Microcystinae.**

QQ. With satiny gloss or duller, actually umbilicate; 4 whorl diameter around 4 mm.; *Orpiella*; Fiji and (?) Cook Islands:..... **Sesarinae.**

N_3. With 4 whorl diameter over 8 mm. or umbilicus smaller (usually perforate or rimate); [See note under A_4.];

R. *Orpiella*; Fiji (western and central):.....**Sesarinae.**

RR. Caroline and Palau Islands:

S_1.(3). Shell thin, perforate and not very dull above;

T. Quite polished and depressed (diameter at least 1.5 times altitude) ..... **Euconulinae.**

TT. Burnished (somewhat glossy) above; less depressed (diameter about 1.45 times altitude); *Kusaiea frivola*..... **Microcystinae.**

S_2. Shell heavy or umbilicate or dull above or much elevated..... **Trochomorphinae.**

S_3. If shell is apparently rimate and very large (*Ryssota*) or has well-reflected peristome (*Dendrotrochus*) or is small, dullish and elevated, go back to A_4.

HELICARIONIDAE

Because all the subfamilies of the Helicarionidae except the Microcystinae are groups of the continental areas, which usually have invaded only the nearest of the oceanic islands of the Pacific Ocean, study of the members from other parts of the world has been necessary. Dissections of some of the most pertinent of these are described; extralimital groups are indicated by asterisks (*). This survey has resulted in a somewhat iconoclastic classification, of which the principal subfamilies are outlined in the following key.

Key to Principal Subfamilies of Helicarionidae

A. Euconulinae: epiphallus without lime-sac, flagellum or much calc; spermatophore simple and rarely with horny wall; spermatheca weak, obsolete or on male side (penial prepuce of atrium); stimulators or darts, when rarely present, penial; outer radular marginals (at least) usually multicuspid;

B. Spermatheca on female side or absent; rarely ovoviviparous (*Guppya*)..... **Euconulinae.**

BB. Spermatheca opening into atrial prepuce of penis; ovoviviparous..... **Microcystinae.**

AA. Epiphallus secreting abundant calc, mainly with lime-sac or flagellum and often quite complicated; spermatophore with horny wall and often with complex ridges and spines; spermatheca well-developed and on female side; or, if all these are absent, complex amatorial apparatus is present on female genitalia;

C. Helicarioninae: dart-sac or amatorial apparatus absent; epiphallus with at most an apical lime-sac or flagellum and a small retractor-caecum; Australia to islands around Africa:

D. Epiphallus with at most an apical lime-sac or flagellum..... **Sesarinae.**

DD. Epiphallus with retractor-caecum..... **Helicarioninae*.**

CC. Dart-sac or amatorial apparatus present, or epiphallus with proximal lime-sac, or with large retractor-caecum;

E. Ariophantinae: epiphallus with retractor-caecum or female side of genitalia with dart-sac, containing a dart-papilla, through which extrinsic glands (apparently absent in *Pseudoplecta*) open; Oriental:

F. Dart-sac with large papilla and often developing calcareous dart; epiphallus usually without retractor-caecum;

G. Dart-glands (apparently absent in *Pseudoplecta*) distinct from dart-sac; sole undivided and radular ectocones usually obsolescent..... **Dyakiinae.**

GG. Slugs with tripartite sole and bicuspid radular marginals; dart-apparatus externally more like FF.....**Parmarioninae*.**

FF. Dart-sac (rarely lost) continuous with its gland, with short papilla and without calcareous dart; epiphallus usually with retractor-caecum;

H. Tripartite sole, caudal foss, caudal "horn" and ectocones of radular marginals tending to become obsolescent; spermatheca usually more or less subspherical, with or without slender stalk; vagina often long..... **Ariophantinae*.**

HH. Tripartite sole, caudal "horn" and bicuspid (at least) marginals commonly retained; spermatheca usually larger and roughly clavate; vagina often obsolescent;

I. Epiphallus with lime-sac or flagellum; radular laterals present;

J. Retractor-caecum straight and usually smaller; penis proper often well-developed .....**Girasiinae*.**

JJ. Retractor-caecum with free tip and tending to be spirally coiled; penis proper typically almost vestigial....**Tanychlamydinae*.**

II. Epiphallus apparently without lime-sac; radular laterals reduced or absent and marginals typically multicuspid.....**Durgellinae*.**

EE. UROCYCLINAE: epiphallus with proximal caecum free from retractor or genitalia with amatorial sac, without extrinsic glands opening through a dart-papilla; mainland of Ethiopian region:

K. Typically with visceral mass distinct from foot and without amatorial sac .....**Trochozonitinae*.**

KK. Typically with visceral mass incorporated in foot and with amatorial sac .....**Urocyclinae*.**

In the foregoing key, a choice between broader (capitals and small capitals) and more restricted subfamilies is offered. In the remainder of this paper, the more limited ones will be utilized as subfamilies, but the broader ones will be employed as convenient, and, I believe, natural groups by giving them masculine endings (e.g., Euconulini).

In order to elucidate the affinities and relative simplicity of the Helicarionidae which have reached the islands of the Pacific Ocean, a brief résumé of the contents of extralimital subfamilies is included here. Since the names for subfamilies are not determined by priority, either of the name itself or of its typical genus, no great accuracy in the dates or authorities for these groups is guaranteed.

The name Euconulinae was proposed by me (1928) but Conulinae dates from Strebel and Pfeffer (1879). *Euconulus,* under its preoccupied name, was one of the oldest genera of Helicarionidae and certainly is the best known group of the Euconulini.

Thiele (1931, Handbuch) included a heterogeneous assemblage in his Microcystinae. Probably, in addition to the genera discussed in parts 1 and 2 of these studies, it will be found to include most of Preston's "genera" from Norfolk Island. However, Odhner's (1917) *"Microcystis" fulva* from Australia apparently belongs in the Helicarionini, although he evidently mistook

the spermatheca and a spermatophore for a "dart sac" containing a "chitinous cord"; Iredale's "Microcystidae" (1937) probably go with it.

Sesarinae and Kaliellinae were both utilized by Thiele (1931).

Godwin-Austen (1888) proposed Helicarioninae* and Kobelt (1909) adopted Helicarionidae. *Helicarion* Férussac (1820 or 1821) is the oldest generic name in the family. Further discussion is included on page 263.

The name Dyakiinae was spelled Dyakinae by Gude and Woodward (1921); Laidlaw (1931) used the correct form. As used here, it is practically Thiele's (1931) Xestinae, minus *Xesta* itself.

The subfamily Parmarioninae* was proposed by Blanford and Godwin-Austen (1908). I have dissected *Parmarion pupillaris* (Humbert) from Java (ANSP. material). As Wiegmann suspected in the case of *P. dubius,* the principal nerve to the penis arises from the lateral (mediolateral) pedal nerve where the latter passes under the inferior tentacular retractor. The large size of the dart-papilla in this group is as striking a feature as the calcareous dart, which is easily removed.

The name Ariophantinae* was proposed by Godwin-Austen (1888) and Ariophantidae was used for a family by Germain (1921). *Naninia* Sowerby (1842) + *Xesta* Albers (1850), despite the longer stalk on its spermatheca, certainly should be added to the groups included by Thiele (1931) in this subfamily. *Platymma* Tomlin (1938) appears to belong here. I have dissected *Hemiplecta (Koratia) distincta* (Pfeiffer) from Cambodia (Cockerell!) and *Euplecta gardneri* (Pfeiffer) from Ceylon (ANSP. material). In the former, the interior of the large penis proper is strikingly like that in *Ryssota* (pl. 46, figs. 9, 10), the organ is enervated from the pedal ganglion, the foot is also similar, the tail lacks a dorsal groove and the dart-sac proper is fairly long. The genitalia of the *Euplecta* were not quite mature but the penis appears to be similarly armed. On the whole, the Ariophantinae seem closer to the next group than to the Dyakiinae.

Thiele (1931) seems to have first used Girasiinae*; it scarcely seems separable from the Tanychlamydinae. As tentatively used here, it would also include *Sarika* Godwin-Austen (1907), *Taphrospira* Blanford (1905), *Otesia* H. and A. Adams (1858), *Microcystina* Moerch (1876), *Holkeion* Blanford and Godwin-Austen (1908), *Bapuia* Godwin-Austen (1918), *Rotungia* Godwin-Austen (1918), *Megaustenia* Cockerell (1912) and *Apoparmarion* Collinge (1902). The soft parts of *Cryptosemelus* Collinge (1902) and of *Paraparmarion* Collinge (1902) are insufficiently known. I have dissected *Megaustenia siamensis* (Haines) and *"Helix" hainesi* Pfeiffer from Pah Meeung Mountain, Siam (T. D. A. Cockerell! 1928) and *"Macrochlamys" cincta* Möllendorff from Hainan, China (Gressitt!). In the first, the epiphallic retractor-caecum is extremely short and simple but the penis proper is much as in

Tanychlamys indica. In the other two, the penial retractor inserts on the apex of a straight retractor-caecum; the penis proper is quite long, armed somewhat as in *Pseudhelicarion* (or *Ryssota*) and mainly enervated from the right pedal ganglion; and a dart-sac and gland are present. Their generic position has not been decided but their anatomy seems quite similar to that of either *Otesia* or *Taphrospira* and their geographic incidences effectively bracket *Glyptobensonia* Möllendorff (1894).

The name Tanychlamydinae* was first used by me (1928) but Macrochlamydinae Godwin-Austen (1888) was founded on a later name (vested by Gray, 1847) for the same genus. *Tanychlamys* Benson (1834), *Khasiella* Godwin-Austen (1899), *Pangania* Laidlaw (1932), *Bensonies* Baker (1938) and *Oxytes* Pfeiffer (1856) evidently belong here. *Syama* Blanford and Godwin-Austen (1908) quite certainly and *Dalingia* Godwin-Austen (1907) with more doubt are included; apparently both have lost the dart-apparatus. I have dissected *Tanychlamys indica* (Godwin-Austen) from Calcutta and *Oxytes orobia* (Benson) from Senchal, near Darjeeling (both J. Percy Moore! 1931). In the former, the penis proper is very short and simple and is mainly enervated from the pedal ganglion; in the latter, it is quite long and contains a large vergic papilla. In either, the apex of the heavy-walled dart-gland receives a retractor from the columellar muscle.

The subfamily Durgellinae* Godwin-Austen (1888) needs more study; from the published accounts its epiphallus seems remarkably simple. *Durgella* Blanford (1863), *Ibycus* Heynemann (1862), *Sakiella* Blanford and Godwin-Austen (1908) and *Conulema* Stoliczka (1871) appear to belong here. *Sitala* H. Adams (1865) should also be included if its retractor-caecum is epiphallic (see discussion of *Coneuplecta*). Thiele (1931) seems to suggest that *Sophina* Benson (1859) also may be related; this genus constitutes the Sophininae Blanford and Godwin-Austen (1908), evidently has a radula more like that in some Ariophantinae, and is confessedly omitted from my key. *Myotesta* Collinge (1901) is another group with certain similarities to the Durgellinae; *Minyongia* Godwin-Austen (1916) is even more inadequately described.

Iredale (1914) proposed Trochozonitinae* as new; nomenclatorially, Trochonaninidae Germain (1921), Trochonanininae Thiele (1931) and Ledoulxiinae Pilsbry (1919) are all founded on *Trochonanina* Mousson (1869), a related genus. Practically all the native genera of Helicarionidae from the continental part of the Ethiopian region seem to belong to the Urocyclini, including *Zingis* Martens (1878), *Sheldonia* Ancey (1887), *Mesafricarion* Pilsbry (1919) and *Zonitarion* Pfeffer (1883). In *Trochonanina mesoglea* Martens (ANSP. 117945), the penis receives a large nerve from the cerebral ganglion and a small branch from the pedal. *Thapsia troglodytes*

(Morelet), approaching *T. pellucida* (Gould), from near Tringa, Lake Nyassa (ANSP. 146228, from P. Hesse) has no distinct shell-lobes. Its penial retractor inserts on the apex of its large penis and also on the tip of a big epiphallic flagellum, so that the epiphallus, without proximal lime-sac, forms almost a complete ring. A small penial nerve comes from its cerebral ganglion and a large one from the pedal. Into its atrium, opens an amatorial sac that is twice as long as the penis and consists of a thick-walled basal half containing transverse papillate folds and a broader thin-walled apical half with longitudinal plicae. In one spermatheca was found a horny spermatophore with a bipinnately fringed tail. *Gudeëlla (?) cinnamomeozonata* (Pilsbry), on the other hand, has a tongue-shaped right shell-lobe fully as long as the diameter of its mantle-collar and a broad but short left one. Its genitalia (ANSP. 46420) are quite similar to those of *Gymnarion medjensis* Pilsbry (ANSP. 46509 dissected); in one animal, the extruded penis is covered with minute warty excrescences and the simple amatorial sac contained hard brownish material. In both species, bands of muscle connect the apex of the amatorial organ to the body wall. These amatorial organs of the Urocyclini have almost nothing in common with the dart-sac, papilla and extrinsic glands of the Ariophantini.

Because the name Urocyclidae*, although used by Simroth at least as early as 1889 (vernacular form in 1888), has always been employed in a restricted sense, Helicarionidae seems preferable for the entire family.

EUCONULINAE

In addition to the genera discussed in this paper, the subfamily seems to include *Guppya* Moerch* (1867), *Velifera* W. G. Binney* (1879), *Luchuconulus* Pilsbry* (1928), *Eurychlamys* Godwin-Austen* (1899), *Macroceras* Semper* (1870), and *Cancelloconus* Rensch* (1932). Additional genera mentioned in the discussion of *Coneuplecta* are admitted with more doubt. The range of Euconulinae appears to be almost world-wide; some of the smaller species have undoubtedly been disseminated by human agencies.

Key to Genera of Euconulinae from Pacific Islands

A. Radula with broader, tricuspid central and more numerous, oblong, bicuspid or tricuspid laterals; shell (outside Cocos and Hawaiian Islands) either with growth-threads distinct on base (*Euconulus* from Society Islands) or as in BB or CC;

B. Spermatheca present; shell with perforation closed by an internal callus; protoconch not markedly beaded;

C. Mantle without shell-lobes; radula with principal marginals bicuspid; shell at least subangulate when depressed and with more gradual whorl-increase or with evident growth-threads above periphery; Hawaiian and Society Islands and holarctic: ..... genus **Euconulus** Reinhardt.

CC. Mantle with long right and left shell-lobes; radular marginals with blade ectocones; shell quite evenly rounded although depressed, with fairly rapid whorl-increase and without marked growth-threads; Palau and Caroline Islands and northwestward: .....genus **Kororia,** new.

BB. Spermatheca lacking; extralimital (D) or shell with perforation open or protoconch with spaced beads as most evident sculpture;

D. Free oviduct with fairly prominent glandular zone; radular central and laterals elongate, with prominent lateral cusps; penis and epiphallus reduced (typical) or penial retractor inserting around epiphallus; mantle without shell-lobes; shell at least angulate when depressed and with superficial rimation closed by internal callus; Cocos Island and neotropical:..... .....genus **Habroconus** Fischer et Crosse*.

DD. Free oviduct without evident glandular zone; radular central and laterals broader; penial retractor inserting at apex of epiphallus or of penis proper; shell quite evenly rounded although depressed; Caroline and Palau Islands and northwestward:

E. Mantle with at most a rudimentary right shell-lobe; penis not extremely elongate; penial retractor inserting near penial apex; inner radular laterals with subequal lateral cusps; shell with perforation closed by internal callus; protoconch with spaced beads separated by more vague spiral and growth sulci;.....genus **Discoconulus** Reinhardt.

EE. Mantle with right and left shell-lobes; penis extremely elongate; penial retractor arising at apical cross-wall of diaphragm and inserting on epiphallic apex; radular laterals with reduced entocone; shell with open perforation; protoconch without marked beading....genus **Palaua,** new.

AA. Radula with very slender 5-cusped central and with not more than 2 laterals, which are almost as elongate as marginals and have more than one ectocone; shell-lobes absent; spermatheca present; penis without diverticulum; shell like C but Society Islands species larger, without distinct growth-threads on base; Marquesas to Fiji and Caroline Islands and westward.....genus **Coneuplecta** Möllendorff.

Genus EUCONULUS Reinhardt, 1883

Conulus Fitzinger, 1833, Beitr. Land. Oest. 3:94; not Mantell (1822).

Euconulus Reinhardt, 1883, Sitz. Ges. Naturf. Berlin: 86; type by subsequent designation of Pilsbry 1910, Proc. ANSP. 62: 131, *E. fulvus* = *Helix fulva* Müller, 1774, Hist. Verm. II: 56, from Denmarck (holarctic); Baker, 1928, Proc. ANSP. 80:9, anatomy and additional synonymy.

Euconulops Baker, 1928, Proc. ANSP. 80:11; type by original designation, *Conulus chersinus polygyratus* Pilsbry, 1899, Naut. 12:116, from Cheboygan County, Michigan (anatomy).

Nesoconulus, new subgenus, type *E. subtilissimus* (Gould) from east Maui (BBM. 11286).

Chetosyna, new subgenus, type *E. thurstoni,* new species.

Pellucidomus, new subgenus, type *E. lubricella* (Ancey) from Hawaii (Kau): (BBM. 11288).

Monoconulus, new subgenus, type *E. conoides,* new species.

The Hawaiian species of *Euconulus* have been included in the genus *Kaliella* Blanford (1863) by most authors. The type of the latter genus, *K. barrakporensis* (Pfeiffer), from India, has, according to Godwin-Austen, a prominent calc-sac on its epiphallus and tricuspid radular marginals; it is apparently a member, one of the most primitive, of the subfamily Sesarinae.

Key to Subgenera of Euconulus

A. Penis with diverticulum; shell becoming almost as high as broad, with fine growth-threads above;

B. Spermathecal sac ovoid; epiphallus poorly differentiated; penial diverticulum long; shell subconoid; holarctic: .....subgenus **Euconulus,** s. s.

BB. Spermatheca clavate; epiphallus well-developed; penis with papillate apical chamber and shorter diverticulum; shell more dome-shaped (nearctic) or larger (Society Islands: Tahiti:) .....subgenus **Euconulops,** Baker.

AA. Penis without diverticulum; shell more depressed or quite polished, larger than in mainland species; Hawaiian islands: Molokai to Hawaii.....
.....subgenus **Nesoconulus,** new.

Comparative whorl-sizes in Monoconulus and Nesoconulus

	1½	4 wh.	5 wh.	5.5 wh.	6 wh.	Maxima	Index
E. subtilissimus	.89	2.9(2.61)	4.2(3.76)	4.7(4.2)?	.....	5⅛+	189
	.90	2.9(2.58)	4.0(3.64)	4.6(4.15)	5.1(4.6)?	5.6+	188
	.88	.....	4.0(3.50)	4.6(4.02)	5.1(4.5)?	5.5	170
E. s. kaunakakai	.91	2.7(2.49)	3.6(3.32)	4.2(3.81)	4.7(4.25)	6.1	187
	.94	2.6(2.49)	3.5(3.26)	3.9(3.70)	4.4(4.11)	6⅜	179
E. gaetanoi	1.05	3.0(3.12)	4.0(4.21)	4.5(4.68)	5.1(5.4)?	5.7+	161
E. g. vivens	.93	3.0(2.79)	4.0(3.72)	4.6(4.26)	5.2(4.8)?	5.9	158
E. thaanumi	.96	2.6(2.52)	3.3(3.21)	3.9(3.7)?	4.3(4.1)?	5⅛	142
E. thurstoni	1.10	3.2(3.56)	4.3(4.7)?	.....	.....	4	150
E. lubricella	1.02	2.4(2.42)	3.1(3.11)	3.7(3.7)?	.....	5	125
E. conoides	1.32	2.2(2.94)	2.7(3.60)	3.1(4.1)?	.....	5⅛	118

Euconulus (Monoconulus) conoides, new species (pl. 62, fig. 15; pl. 53, figs. 7, 8; pl. 43, figs. 8, 9).

Society Islands: Tahiti: BBM. 11291 (145273, dissected; 145275), open ridge, Aorai trail near top, alt. 5,600-6,300 ft. (Mang. Exped.! Sept. 15, 1934).

Shell (pl. 62, fig. 15; pl. 53, figs. 7, 8) almost trochiform, subcarinate (weakly margined below but not above); light tan-color, dullish above and slightly more glossy below. Embryonic whorls around 1¾, soon developing fine, subequal growth-threads and spiral striae. Later whorls at first with decussating growth-threads and spirals, but with latter becoming weaker and considerably less evident than former (60 per mm. on 5th) above; base with lower growth-threads (more distinct than in *Liardetia* or *Coneuplecta*), decussated by subequal spiral striae (more closely spaced and weaker than in *L. decussata*); suture distinctly impressed. Aperture almost transverse, sharply angulate; peristome 20° to shell-axis, weakly arcuate below; columella shortly but quite broadly reflected, hiding about half of superficial perforation (12 times in diameter of shell).

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	whs.
Type	3.08	118(3.62)	114(3.50)	38(1.17)	151(1.77)	5⅛

Animal similar to *E. subtilissimus* but with dark pigment on sides of foot and top of head. Mantle-collar pale. Lung with transverse black stripes as wide as or wider than spaces between them; 5.5 times as long as its base or 3.5 times kidney length, which is 2.3 times its base or 1.7 pericardial length. Apical whorls with considerable dark pigment above. Uterus (pl. 43, fig. 8) less elongate; free oviduct more so. Epiphallus short, containing no prominent papilla, lying between two forks of penial retractor; penis proper relatively larger, with apex (or base of epiphallus) swollen into an ellipsoid chamber, which internally is vaguely papillate and below which branches of penial retractor insert, and with a small subcylindric appendix (PL[1]) near its base. Radula (pl. 43, fig. 9) has broader central with shorter reflection and longer mesocone, 12 laterals, of which inner are almost symmetric (much more so), and 20 marginals, of which 12 are bicuspid and last 8 assume another minute ectocone; 99 rows counted.

E. conoides, the only known species of the new section *Monoconulus* (subgenus *Euconulops*), has a larger shell and a much smaller penial appendix than those in the nearctic section, *Euconulops,* s.s In both these characters, it approaches the subgenus *Nesoconulus.* Its habitat seems to indicate that it is a native Tahitian species.

Euconulus (Nesoconulus) subtilissimus (Gould), (pl. 53, figs. 1-4; pl. 43, figs. 1-3).

Helix subtilissima Gould, 1847, Proc. Boston Soc. N. H. 2: 177 [24]; Pfeiffer, Monogr. 1: 431 [3: 273-4: 18-5: 59-7: 73]; Gould, Exped. Shells: 48, pl. 5, fig. 62,a-c. *Nanina subtilissima* Tryon, Manual 2: 117, pl. 39, figs. 92-94.

Hawaiian islands: Maui [probably east]: USNM. 5464; NYSM. 275 (A 5881); also A 5876 (high form). East Maui (Makawao): BBM. 11286 (typical), dissected, under dead leaves, Kaipoipoi Gulch, alt. 3,750 ft. (Baker! June 4, 1935); BBM. 38476, dissected by Dr. Cooke, halfway down slope of Ainaho, top of Keanae Gap, Haleakala Crater (von Tempski and Cooke! May 26, 1915). West Maui (Lahaina): BBM. 21021, dissected, high above camp Maunahooma (Cooke! May 19, 1910); BBM. 21243, Wainee Gulch (Forbes! June 10, 1910).

Shell (pl. 53, figs. 1-4) depressed conic (somewhat variable in height), sharply angulate, almost carinate; light brownish, with satiny surface above and more glossy below. Protoconch with about 1.75 whorls; first half whorl with very low, but rather coarse growth-wrinkles; remainder with low growth-threads, crossed by weak, but fairly sharp, spiral grooves (11 visible). Later whorls gradually increasing, with extremely fine, sharp, minor growth-threads (about 100 per mm. on 5th), with obscured spirals and with weak traces of coarser wrinkles above periphery; base with growth-sculpture weakening until about central half shows more distinct but quite weak spirals; suture fairly well impressed, marginate, often dropping below angle in typical form. Aperture narrow,

[1] For explanation of symbols see p. 337.

angulate at 65° to shell-axis; peristome sharp, almost vertical (about 15° to shell-axis), weakly arcuate low on base; columella lightly reflected, hiding about ¼ of superficial perforation (closed by internal callus and 15 to 20 times in diameter).

Foot pale, compressed laterally; caudal horn blunt, about reaching tip of sole (much as in *E. fulvus*). Mantle-collar with almost no shell-lap and without shell-lobes; left mantle-lobe deeply bipartite. Lung with transverse, brownish or blackish bands for some distance behind mantle-collar; almost 5 times as long as base or length of kidney, which is 1.5 times as long as its base or length of pericardium. Apical whorls with considerable black pigment above. Ovotestis consisting of about 7 groups of clavate alveoli, imbedded in basal ¾ of apical liver lobe; hermaphroditic duct swollen below; talon (GT; pl. 43, fig. 1) clavate; carrefour (X) ovoid. Albumen gland (GG) very much elongated, opaque whitish; uterus (UT) quite slender; free oviduct with extensive yellow glandular collar (UG); spermatheca (S) minute, sausage-shaped; vagina (V) short. Prostate (DG) almost as long as uterus and attached to it (forming spermoviduct); vas deferens (D) opening into epiphallus through pronounced papilla; epiphallus (E) slender, almost as long as penis proper; penial retractor (PR) arising from diaphragm and inserting around base of epiphallus; penis proper (P) simple and small, largely surrounded by a thin sheath (PS), which is attached to epiphallus. Jaw (pl. 43, fig. 3) crescentic, with prominent, longitudinally striate, median lobe. Radula (pl. 43, fig. 2) has elongate tricuspid central, 11 elongate laterals, with large entocone becoming obsolescent on last, and 22 marginals, of which principal ones are long and bicuspid and outer 7 or 8 add one more ectocone; 95 rows counted.

All the "type" material examined is this species, but USNM. 5464 and NYSM. A-5881 consist of shells of the more depressed form, such as occurs at lower elevations on Haleakala (BBM. 11286; pl. 53, figs. 1-3) and is represented in Gould's figure; the USNM. specimen is taken as type. NYSM. A-5876 represents a more elevated race, such as is found at higher altitudes (BBM. 38476; pl. 53, fig. 4).

Key to Sections, Species, and Subspecies of Subgenus Nesoconulus

A. Shell dull, with distinct growth-threads or wrinkles above; usually lower and more angulate;

B. Depressed trochiform, with gradual whorl-increase and with last whorl narrow above ..... section **Nesoconulus,** s. s.

C. Shell most depressed, sharply angular, with about 100 growth-threads per mm. and with obscure major wrinkles above periphery; base with weak spirals ..... **E. subtilissimus** (Gould).

D. Shell with more rapid whorl-increase; Maui: ..... typical subspecies.

DD. With more gradual whorl-increase and developing columellar nodule; Molokai and Lanai: ..... subspecies **kaunakakai,** new.

CC. Shell with not more than 50 growth-threads per mm. and with strong spiral grooves below; Hawaiian islands:

E. Largest, with pronounced major growth-wrinkles; quite depressed and markedly angulate ..... **E. gaetanoi** (Pilsbry and Vanatta).

F. Probably duller, with quite distinct, minor growth-threads; subfossil: ..... typical subspecies.

FF. Shell bright, without prominent minor growth-threads; living: ..... subspecies **vivens,** new.

EE. Shell smaller, with obscure major wrinkles and with subequal distinct rounded minor growth-threads (about 40 per mm.) above periphery;

G. Shell more depressed and markedly angulate.....**E. konaensis** (Sykes).

GG. Shell less depressed and becoming barely angulate.....
.....**E. thaanumi** (Ancey).

BB. Shell depressed turbinate, weakly subangulate, with largest embryonic whorls and much largest 4th whorl; sculpture like *E. thaanumi* but sharper; Hawaii:.....
.....section **Chetosyna,** new: **E. thurstoni,** new species.

AA. Shell polished, with weakly impressed major growth-lines (about 13 per mm. above periphery on 5th whorl); scarcely angulate and most elevated; Hawaii:.....
.....section **Pellucidomus,** new: **E. lubricella** (Ancey).

Dimensions in Subgenus Nesoconulus

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	5.5 wh.	whs.
E. subtilissimus								
Gould	1.6	(3.2)	.....	.....	.....	.....	.....	5
fig.	1.7	190(3.2)	.....	62(1.05)	165(1.7)	.....	.....	
NYSM. 275	2.12	189(4.01)	170(3.60)	67(1.43)	153(2.18)	.89	4.7(4.2)?	5⅛+
BBM. 11286	2.28	188(4.28)	175(4.00)	67(1.53)	154(2.10)	.90	4.6(4.15)	5.6+
BBM. 38476	2.36	170(4.02)	157(3.70)	58(1.38)	143(1.97)	.88	4.6(4.02)	5.5
E. s. kaunakakai								
type	2.33	187(4.36)	174(4.06)	62(1.45)	149(2.16)	.91	4.2(3.81)	6.1
BBM. 34283	2.49	179(4.46)	172(4.29)	59(1.46)	154(2.25)	.94	3.9(3.70)	6⅜
E. gaetanoi								
Pils. & Van.	2.87	(4.84)	.....	.....	.....	.....	.....	5.5
ANSP. 95779	2.94	161(4.74)	158(4.63)	53(1.57)	153(2.41)	1.05	4.5(4.68)	5.7+
E. g. vivens								
type	3.00	158(4.74)	150(4.51)	56(1.68)	141(2.37)	.93	4.6(4.26)	5.9
E. konaensis								
Sykes	2	(3.5)	(3.2)	.....	.....	.....	(3.2)?	5¾
fig.	2.15	162(3.5)	.....	56(1.2)	154(1.85)	.....	.....	
E. thaanumi								
Ancey	2.5	(3.5)	.....	.....	.....	.....	(3.5)	5.5
fig.	2.5	140(3.5)	.....	62(1.55)	110(1.70)	.....	.....	
BBM. 39572	2.36	142(3.36)	133(3.13)	54(1.27)	136(1.72)	.96	3.9(3.70)	5⅛
BBM. 11287	2.76	142(3.91)	.....	52(1.44)	140(2.02)	.....	.....	5⅝
E. thurstoni								
type	2.38	150(3.56)	139(3.30)	62(1.48)	126(1.87)	1.10	.....	4
E. lubricella								
Ancey	2.5	(3.2)	.....	.....	.....	.....	.....	5-5¼
fig.	2.45	131(3.2)	.....	56(1.35)	121(1.65)	.....	.....	
BBM. 11288	2.49	125(3.11)	120(2.98)	44(1.09)	142(1.55)	1.02	3.7(3.7)?	5

Euconulus (Nesoconulus) subtilissimus kaunakakai, new subspecies (pl. 62, fig. 3; pl. 53, figs. 5, 6).

Hawaiian islands: Molokai (east): BBM. 11445 (89215, dissected), under stones, landslide above cut, east side of Kaunakakai Valley (Cooke and Adamson! June 21, 1928). Lanai: BBM. 34283 (high form), eastern end from Captain Sowles' house (Forbes! June 1, 1913).

Shell very similar to typical form but with more gradual whorl-increase and with tendency to form a columellar nodule in large shells. Animal similar.

Euconulus (Nesoconulus) gaetanoi (Pilsbry and Vanatta).

Kaliella gaetanoi Pilsbry and Vanatta, 1908, Nautilus 22 (8): 73, fig. 1, fossil, Palihoukapapa.

Hawaiian islands: Hawaii (Hamakua): ANSP. 95779, fossil, Palihoukapapa. (South Kohala): BBM. 11103, fossil, Waikii.

Euconulus (Nesoconulus) gaetanoi vivens, new subspecies (pl. 62, fig. 9; pl. 53, figs. 9, 10; pl. 43, fig. 5).

Hawaiian islands: Hawaii (South Hilo): BBM. 11285 (39276, dissected by Cooke), large *kipuka* between Hilo and Kilauea trails from Humuula, alt. about 5,000 ft., 1855 flow (Forbes! June 9, 1915); BBM. 39321, dissected, Palakea, Puu Kulani (Forbes! June 28, 1915).

Shell (pl. 62, fig. 9; pl. 53, figs. 9, 10) depressed conic (with higher spire than in *E. subtilissimus*), distinctly angulate; light brownish, almost glossy above. Embryonic whorls about 1.5; first half whorl almost smooth; remainder with very weak growth-wrinkles and extremely fine spirals. Later whorls more rapidly increasing, with major growth-wrinkles coarse but rounded and irregular and with obsolescent minor sculpture above; base with growth-wrinkles dying out shortly below periphery so that sharply cut spirals are apparent; suture slightly more impressed. Aperture narrow, oblique and quite angulate at about 70° to shell-axis; columella hiding more than half of superficial perforation (about 23 times in diameter).

Animal similar to *E. subtilissimus*. Lung with weaker pigment bands; 4 times as long as kidney, which is twice its base or pericardial length. Ovotestis consisting of similar groups; albumen gland and uterus (pl. 43, fig. 5) relatively stouter; spermatheca smaller. Penis relatively much larger. Radula has 12 laterals, and 27 marginals, of which outer 8 or 9 are often tricuspid; 107 rows counted.

The principal difference between *E. gaetanoi* and the subspecies *vivens* lies in the weaker minor growth-threads of the latter.

Euconulus (Nesoconulus) konaensis (Sykes).

Kaliella konaensis Sykes, 1896, Proc. Malac. Soc 2: 299; Fauna Hawaii. 2: 286, pl. 11, fig. 33.

Hawaiian islands: Hawaii [North or South Kona?]: Mount Kona, alt. 3,000 ft. (Perkins!).

Mount Kona probably means some part of the Kona Coast. I have seen no specimens of such large whorl-size that are as sharply angulate as Sykes' figure, but young specimens of *E. thaanumi* are nearer it in shape and the two may not be specifically separable. Although similar in form, it is evidently a much smaller shell than *E. gaetanoi vivens*.

Euconulus (Nesoconulus) thaanumi (Ancey), (pl. 36, fig. 4; pl. 43, fig. 4).

Kaliella thaanumi Ancey, 1904, Proc. Malac. Soc. 6: 119, pl. 7, fig. 6.

Hawaiian islands: Hawaii (Puna): BBM. 18883 (18884), Olaa (Thaanum!). BBM. 39572, under rocks and cut wood, 29 miles out from Hilo, past Olaa (Thurston! July 1915); BBM. 11287, dissected, mainly on ground, crater of Puu Huluhulu, alt. 3,400 ft., about 5 miles southeast of

Volcano House (Cooke and Baker! Aug. 12, 1935). (Kau): BBM. 53685, dissected, on dry *hapuu* leaves, about ½ mile below Twin Craters, about 4 miles from Kilauea (Gouveia! Feb. 13, 1923); BBM. 39323, dense Koa jungle, Palakea, Puu Kulani (Forbes! June 28, 1915). (South Kona): BBM. 44078, dissected, alt. 3,000 ft., Kapua; BBM. 44094, alt. 6,000 ft., Honomalino (both A. Gouveia! July 15, 1917). (Hamakua?): ANSP. 91383, Kaiwiki (Thaanum!). (South Kohala): ANSP. 95780, Waimea and ANSP. 108387, Kohala Mountains (Thaanum!), slightly more depressed [2.73×148 (4.03 mm.), 5.5+ whorls].

Shell (pl. 36, fig. 4) depressed conic (higher than *E. konaensis*), sharply angulate when small, but becoming rounded angulate on 5th whorl; light brownish, dull above and more glossy below. Embryonic whorls over 1.5; first half whorl almost smooth; remainder with very obscure growth-wrinkles. Later whorls gradually increasing, with fine rounded but distinct, subequal growth-threads (about 40 per mm. on 5th) above, crossed by fine rather obscure spirals; base much as in *E. gaetanoi vivens*; suture well impressed. Aperture broader than in *E. subtilissimus*, oblique (about 75° to shell-axis) and weakly angulate; peristome about 20° to shell-axis; columella hiding about half superficial perforation (18 times in diameter).

Animal similar to *E. subtilissimus*. Lung with five black, transverse, triangular stripes in lower half. Apical whorls lighter. Epiphallus (pl. 43, fig. 4) containing smaller papilla; penis relatively stouter. Radula has 11 laterals and 22 marginals (BBM. 53685) or 12 and 27 of each (44078); 104 rows counted.

Euconulus (Chetosyna) thurstoni, new species (pl. 62, fig. 12; pl. 53, figs. 11, 12).

Hawaiian islands: Hawaii (North Kona?): BBM. 59168, Puu Huluhulu (which?), with *Nesopupa forbesi* and *E. gaetanoi vivens* (Thurston! Sept. 7, 1922).

Shell depressed turbinate, weakly subangulate; pale greenish horn-colored, dull above and more glossy below. Embryonic whorls 1.5, similar to *E. thaanumi*, but decidedly larger and with considerably more distinct spirals. Later whorls quite gradually increasing but considerably larger than in the other species; with similar sculpture to *E. thaanumi*, but with sharper growth-threads (about 40 per mm.) and spirals above and with very sharp, spiral grooves below periphery. Aperture large for the genus, and scarcely angulate at 70° to shell-axis; peristome about 20° to shell-axis; columella reflected, hiding more than half superficial perforation (15.5 times in diameter).

Because of their few large whorls, the two shells of *E. thurstoni* do not look like *Euconulus*, but another whorl or more would make them resemble *E. thaanumi* on a large scale. The museum label indicates that they came from wet *lehua* leaves on the floor of the crater of the Puu Huluhulu near Kilauea, but Dr. Cooke and I spent two days in this small area and found neither *E. thurstoni* nor the species associated with it in the original lot, although *E. thaanumi* and *E. lubricella* were common. Hawaii has many "rough hills"; neither *Euconulus* nor *lehua* occurs in the Puu Huluhulu near Humuula.

Euconulus (Pellucidomus) lubricella (Ancey), (pl. 62, fig. 6; pl. 43, figs. 6, 7).

Kaliella lubricella Ancey, 1904, Proc. Malac. Soc. **6**: 120, pl. 7, fig. 7.

Hawaiian islands: Hawaii (Puna): BBM. 18886, Olaa (Thaanum!). BBM. 11288, dissected, mainly climbing on shrubs and wet rocks, crater of Puu Huluhulu, alt. 3,400 ft. (Cooke and Baker! Aug. 12, 1935). (Kau): BBM. 92910, dissected, on shrubs and dead leaves between Haao and Mountain House, Kaunamano; BBM. 92888, alt. 2,650 ft., nearby (both W. H. Meinecke! Aug. 23, 1936). (Hamakua?): ANSP. 95781, Kaiwiki (Thaanum!), up to 5.3 whorls.

Shell (pl. 62, fig. 6) turbinate (highest of Hawaiian species), angulate when small but with almost evenly rounded 5th whorl; horn-colored, polished above and quite transparent. Embryonic whorls similar to *E. thaanumi* but smoother. Later whorls very gradually increasing, with impressed major growth-striae (about 13 per mm. on 5th) without marked threads between them; spirals rather vague above but prominent below periphery; suture deeply impressed. Aperture narrowly crescentic, oblique (75° to shell-axis) and quite evenly rounded; peristome about 15° to shell-axis, scarcely arcuate; columella hiding about half of superficial perforation (19 times in diameter).

Animal similar to *E. subtilissimus,* but with dark pigment below pedal grooves and on top of head; dorsal groove of tail prominent. Right shell-lap more (but very narrowly) expanded. Lung with 8 broad transverse bands or with squarish spots over hindgut; 4 times as long as base or thrice kidney length, which is twice its base. Apical whorls jet black above. Albumen gland and uterus (pl. 43, fig. 6) stouter and spermatheca smaller (more as in *E. gaetanoi vivens*). Prostate poorly developed; penis relatively much smaller. Jaw with slightly stronger longitudinal striations. Radula (pl. 43, fig. 7) has central with longer mesocone, 9 tricuspid laterals, and 22 marginals, of which outer 11 have 3 or more cusps; 103 rows counted.

E. lubricella and *E. thaanumi* often occur together, but the former is the better climber and is more often found on shrubs and other vegetation.

Genus **KORORIA,** new genus

Kororia, new genus, type *K. palaensis* (Semper) from Koror (BBM. 89839).

Of the two groups, with which *Kororia* seems to have certain features in common, *Macroceras* is said to have unicuspid radular teeth, *Eurychlamys* to show bicuspid marginals and both to lack the penial diverticulum.

Kororia palaensis (Semper), (pl. 53, figs. 13-15; pl. 43, figs. 10-12).

Microcystis palaensis Semper, 1870, Reisen **3** (1): 45, pl. 2, fig. 16, pl. 6, fig. 34, from Peleliu to Kreiangel [= Kayangel], Palao, *Helix palaënsis* Pfeiffer, Monogr. **7**: 94. *Nanina palaensis* Tryon, Manual **2**: 120, pl. 40, fig. 37. *Lamprocystis palaënsis* Möllendorff, 1900, Jour. Malac. **7**: 102, Yap (Kubary!).

Palau: Koror: on ground, under stones and leaves. BBM. 87544, from Möllendorff; BBM, 89839, dissected, limestone, base of quay (H. E. Crampton! July 13, 1928); BBM. 154561, on ground, back of town, alt. 100 ft. (Y. Kondo! April 9, 1936). Angaur: BBM. 154596, ground, southeast part (Kondo! April 15). Peleliu: BBM. 154622, 154689, Ngalkol, alt. 50 ft. to 300 ft. on Mount Omurbrogol (Kondo! April 21, 23). Babelthuap: BBM. 154924, alt. 60 ft., Melekeiok (S. Ito! April 12, 1936). Kayangel: BBM. 154995, on ground, alt. 10 ft. (Ito! May 1).

Caroline Islands: Yap: BBM. 87539, from Möllendorff; BBM. 155062, on ground, alt. 150 ft., back of Colony Town (Kondo! May 20). Truk (Dublon Islet): BBM. 153473, 153476, 153479, dissected, on dead leaves, alt. 10 ft., near Meseram (Kondo! Dec. 23, 1935); BBM. 153870, on dead leaves, slopes of Mount Fugaron (Kondo! Jan. 1, 1936). (Tol Islet): BBM. 153894, in copra plantation (Mrs. Kondo! Jan. 4). Ponape: BBM. 154119, on ground, Jokai Islet (Kondo! Feb. 24); BBM. 154130, alt. 300-900 ft., Metalanim District (Ito! Feb. 29); BBM. 154200, slopes of Mount Kuporujo, U District (Kondo! March 3). Kusaie: BBM. 153959, on dead leaves, alt. 50-200 ft., Mount Matante (Kondo! Jan. 22).

Shell (pl. 53, figs. 13-15) superficially rimate, moderately depressed, with conoid obtuse spire, evenly rounded periphery and convex base; bright to brownish horn-color; quite polished, thin and rather transparent. Embryonic whorls about 1.75, gradually assuming shallow but distinct (often worn in large shells) spiral striae, crossing weak growth-lines; suture widely overriding and weakly impressed. Later whorls with similar or weaker spirals and irregularly spaced major and minor growth-lines above and below; suture widely overriding and weakly impressed, but appearing more so because of broad transparent attachment. Aperture crescentic, evenly rounded; peristome thin and sharp, about 20° to shell-axis and concave below; columella abruptly reflected, so as to appear obliquely subtruncate, and broadly sulcate, so that free edge is convex and covers 1/3 to 1/2 of superficial perforation, which goes about 10.5 times in shell-diameter and is closed by a concave callus.

Dimensions

	alt.	maj. diam	min. diam.	alt. ap.	diam. ap	1½	5 wh.	whs.
Semper	3.5	(5.5)	(5)	.....	.....	.....	.....	5
BBM. 89839	3.63	154(5.60)	142(5.16)	62(2.26)	128(2.90)	1.14	5.4(6.2)?	4⅝
BBM. 153870	3.44	157(5.42)	143(4.92)	67(2.33)	125(2.91)	1.11	5.8(6.4)?	4.5—
K? nitidus	3.42	177(6.07)	163(5.58)	69(2.36)	125(2.95)	1.19	5.6(6.7)?	4.7

Animal similar to *Euconulus fulvus*. Sides of foot blue-black, sole and visceral stalk whitish; tail with prominent dorsal groove and very prominent, curved "horn" (not quite so long and slender as in *Macroceras*), which is hollowed beneath by vertical fusiform mucous foss. Mantle-collar (pl. 43, fig. 12) with two right shell-lobes connected by wider shell-lap, of which more anterior (LR, situated as the one in *Philonesia*) is broad, 4 times as long as its base and equals in length diameter of mantle-collar, while the more posterior one (LR') is slightly narrower, and one left shell-lobe (LL), which is very

broad, 3 times as long as its base and almost as long as either right one; mantle-lobes dark and left one (MA, MP) deeply bipartite. Lung blue-black behind mantle-collar and along hindgut; 4 times as long as base or twice length of kidney, which is relatively larger and thrice as long as its base or 1.75 pericardial length. Apical whorls pale. Ovotestis consisting of 7 circular groups of short alveoli, imbedded in basal 0.9 of apical liver lobe; hermaphroditic duct fairly long; talon similar; carrefour larger, laterally expanded. Uterus (UT: pl. 43, fig. 10) rather short and swollen [one animal containing a subspherical, white-shelled egg which is about 1.5 mm. long]; free oviduct long with yellowish glandular zone (UG) around basal 0.6; spermatheca (S) fairly large, swollen near base; vagina (V) short. Penial sheath (PS) heavy and muscular, surrounding apical half of penis proper (P) and basal halves of its diverticulum (PL) and epiphallus; penial retractor (PR) arising from diaphragm 1/3 length of uterus above base of last and inserting laterally below penial apex; epiphallus (E) fairly long and slender; penis proper (P) enervated from pedal ganglion, not greatly swollen, with longitudinal folds internally, and developing, between apical and middle thirds, a diverticulum (PL) which is longer and stouter than remainder of penis but which has thinner and simpler walls. Atrium (Y) moderate in length, opening shortly behind right inferior tentacle. Jaw with very weak median point, often almost eroded away, and with prominent growth-striae. Radula (pl. 43, fig. 11) has tricuspid, somewhat elongate central, 8 tricuspid laterals, which become progressively more elongate, and 87 or 88 long marginals, of which principal ones have 2 subequal terminal cusps and 4 to 6 minute blade-ectocones, and outer ones increase size of blade-ectocones until truly multicuspid; 100 rows counted.

K. palaensis is evidently a species that has been disseminated by human agencies. *Macrochlamys nitidus* Pilsbry and Hirase, 1906, Proc. ANSP. **57**: 741, from Hotowa, Formosa (= Taiwan), seems very similar to *K. palaensis* but is considerably more depressed; dimensions of the type are given.

Kororia pseudosuccinea (Möllendorff)*.

Microcystis succinea (Pfeiffer) Semper, 1870, Reisen 3: 44, pl. 3, fig. 11; pl. 6, fig. 22, anatomy, Bohol. Not *Helix succinea* Pfeiffer (1845) nor Müller (1774).

Lamprocystis pseudosuccinea Möllendorff, 1893, Ber. Senckenberg. Nat. Ges.: 70.

Philippines: Cebu, Negros, Leyte, Mindanao. Panay: ANSP. 78159 (Steere Exped.!).

From Semper's account, the anatomy of this species seems to be very similar to that of *K. palaensis,* but only one right shell-lobe is mentioned, the spermatheca is subspherical and very short stalked and the undivided base of the penis is much longer. The radula of a dried-in animal from Panay has 8 laterals, of which last is bicuspid, and 90 marginals with similar blade-ectocones; 97 rows are present.

A dried-in animal of *K. (?) goniogyra* (Möllendorff) from Basilan, Philippines (ANSP. 78179, Steere Exp.!) has a long tail horn like *K. palaensis.* Its similar radula has 11 marginals, with entocone absent from last, and 88

marginals, of which innermost two usually lack blade-ectocones and remainder assume them more gradually.

Genus **HABROCONUS** Fischer et Crosse*, 1872

Habroconus Fischer et Crosse, 1872, Miss. Mex. Moll. I: 154; type by original designation, *Helix selenkai* Pfeiffer, 1866, Malak. Bl. **13**: 77, from Mexico; Baker, 1928, Proc. ANSP. **80**: 11, anatomy and additional synonymy.

Pseudoguppya Baker, 1925, Mus. Zool. Univ. Mich. Occ. Papers **156**: 10, 12; type by original designation, *Helix cassiquiensis* Pfeiffer, 1853, Monogr. 3: 59, from British Guiana.

Cocoslens, new subgenus, type *H. pallidus,* new species.

Cocosconus, new subgenus, type *H. hopkinsi* (Dall), from Wafer Bay (ANSP. 170396).

Although the genus *Habroconus* is, strictly speaking, extralimital, it is found on islands in the Pacific Ocean. *Zonites bauri* Dall (1892) and *Conulus galapaganus* Dall (1893) from Galapagos Islands may belong here.

Key to Cocos Island Species of Genus Habroconus

A. Penis and epiphallus well developed;

B. Principal radular marginals tricuspid; free oviduct shorter than uterus; penis with almost no lobe; shell usually lenticular, distinctly carinate; later whorls most flattened, with spiral striae sharply beading subequal growth-threadlets (like on protoconch), above; suture dropping below carina; Cocos: ..... subgenus **Cocoslens,** new: **H. pallidus,** new species.

BB. Principal radular marginals bicuspid; free oviduct as long as or longer than uterus; shell becoming weakly angulate to evenly rounded; later whorls less flattened and less markedly beaded above..... subgenus **Pseudoguppya** Baker.

C. Penis without diverticulum; shell with more rapid whorl-increase, with lower (but variable), conoid spire; later whorls more convex, with weaker growth-threads, so spiral striae are more evident, above; suture fairly well impressed and overriding; Cocos:.... section **Cocosconus,** new: **H. hopkinsi** (Dall).

CC. Penis with large diverticulum; neotropical mainland and Cocos: ..... section **Pseudoguppya,** s. s.

D. Shell smaller (than C), thread carinate to angulate, with more elevated, subfornicate spire; later whorls more flattened, with stronger growth-threads obscuring spirals, above; suture less impressed and gradually dropping below angle; Cocos: ..... **H. pacificus** (Pfeiffer).

AA. Penis and especially epiphallus much reduced; neotropical mainland: ..... subgenus **Habroconus,** s. s.

Dimensions of Habroconus from Cocos Island

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
H. pallidus							
type	2.61	171(4.45)	158(4.13)	59(1.54)	143(2.20)	16.5(.27)	5.3
H. pacificus							
Pfeiffer	4	(5.7)	(5)	.....	.....	.....	6-6.5
type fig.	4.5	127(5.7)	.....	56(2.5)	114(2.85)	.....	
Reeve fig.	?	150	.....	59	122	.....	?
(conulus)	4	137(5.5)	125(5)	.....	.....	.....	6
	4?	150(6)	131(5.25)	.....	.....	.....	6.5
(fultoni)	3.5	143(5)	.....	.....	.....	.....	6¼
ANSP. 84695	4.13	132(5.47)	127(5.24)	50(2.07)	131(2.70)	16.5(.33)	6¼
H. hopkinsi							
Dall	4.2	143(6)	.....	.....	.....	.....	5.5
fig.	3.85	156(6)	140(5.4)	56(2.15)	151(3.25)	.....	
ANSP. 167111	3.62	159(5.77)	148(5.34)	62(2.26)	134(3.03)	21 (.27)	5+

Comparative whorl-sizes

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	6 wh.	6.5 wh.
H. pallidus	.85	3.7(3.11)	4.2(3.60)	4.8(4.09)	5.4(4.6)?	.....	.....
H. hopkinsi	.....	.....	.....	.....	(6)	.....	.....
ANSP. 167111	1.13	3.5(3.94)	4.2(4.73)	5.0(5.65)	5.8(6.6)?	.....	.....
H. pacificus	.....	.....	.....	.....	.....	(5.7)	(5.7)
(conulus)	.....	.....	.....	.....	.....	(5.5)	(6)
(fultoni)	.....	.....	.....	.....	.....	(5—)	.....
ANSP. 84695	1.27	.....	3.0(3.87)	3.4(4.31)	3.8(4.78)	4.1(5.23)	4.5(5.7)?

Habroconus (Cocoslens) pallidus, new species* (pl. 60, figs. 10-12; pl. 44, figs. 3, 4).

Cocos Island: ANSP. 170394, dissected, Wafer Bay (Pilsbry! June 26, 1929).

Shell (pl. 60, figs. 10-12) sublenticular, with base about as convex as spire, acutely angulate and distinctly carinate; very pale corneous, dull above but highly glossy below; thin but little translucent. Embryonic whorls between 1.5 and 1.6, soon assuming fine growth-threads, beautifully beaded by spiral striae; convex above with overriding suture. Later whorls flattened, with similar sculpture to protoconch above; base with weak growth-lines but evident spiral striae; suture soon dropping to edge and later just below carina. Aperture lunate, rostrate at 80° to shell-axis; peristome thin, 30° to shell-axis; columella gradually reflected and hiding about 1/3 of superficial perforation, closed by an internal callus and with major diam. 16.5 times and minor diam. 26 times in diam. of shell.

Animal similar to *H. selenkai*; foot with dark line between pedal grooves; tail with deep middorsal groove. Mantle-collar light; left mantle-lobe deeply cut. Lung with dark band behind mantle-collar and with dark spots; 5 times as long as base or 4 times kidney length, which is twice its base or pericardial length. Ovotestis with more groups of alveoli; carrefour with larger diverticulum (XL; pl. 44, fig. 3); uterus (UT) more moderate in length; free oviduct about 0.6 as long as uterus, with longer glandular zone (UG). Penial retractor (PR) inserted near middle of epiphallus;

penial sheath including basal 1/3 of epiphallus (E), which is large, conical, with internal folds showing through wall and enters penis through very low vergic papilla; penis proper (P) large, containing a big, transversely folded pilaster, and enervated from pedal ganglion; atrium (Y) short. Radula (pl. 44, fig. 4) has 8 similar laterals and 78 marginals, with 3 or more cusps (mesocone and 2+ ectocones); 104 rows counted.

H. pallidus, the rarest *Habroconus* on Cocos Island, is remarkably opaque for such a thin shell and has more the appearance of an endodont than a zonitid. In some ways, this species seems to approximate Gude's description of *Guppya fultoni,* but the shells appear to attain only 5.5 whorls, are less elevated, do have distinct spiral striae and lack brown varices (common in *H. pacificus*).

Habroconus (Cocosconus) hopkinsi (Dall)*, (pl. 44, figs. 5, 6).

Guppya hopkinsi Dall, 1900, Proc. ANSP. **52**:97, pl. 8, figs. 5-6; Pilsbry, Proc. ANSP. **52**:105, fig., anatomy.

Guppya pacifica (Pfeiffer) Ancey, 1903, Jour. de Conch. **51** (1): 101; Biolley, 1907, Mollusques de l'isla del Coco: 14; 1935, Rev. Coleg. Señoritas 2 (6): 8; Hanna and Hertlein, 1938, A. Hancock Pac. Exp. 2 (8): 131, in part.

Cocos Island: on leaves (Heller and Snodgrass!); ANSP. 77881 (from Dall, broken). ANSP. 170396, dissected, Wafer Bay (Pilsbry!); ANSP. 167111 (R. L. Fricke! Feb. 11, 1936).

Shell similar to *H. pacificus* but with more rapid whorl-increase, with lower, more conoid, although rather obtuse spire, angulate when young, weakly so at beginning but evenly rounded near end of 5th whorl; glossy on later whorls above, quite polished below; corneous. Later whorls more convex, with sharp spiral striae (becoming more blurred on 5th) crossing weaker and more irregular growth-threads (about 36 per mm. at end of 5th); base with slightly stronger spirals but with weaker growth-lines; suture impressed and well overriding. Aperture evenly rounded; peristome about 25° to shell-axis, scarcely arcuate near columella, which is heavier and more gradually reflected; superficial perforation with major diameter 21 and minor 34 times in shell diameter.

Animal similar to *H. pallidus* but paler. Lung with 5 or 6 black blotches over hindgut, which are usually considerably narrower than their interspaces and are continued by tapering transverse bands. Ovotestis consisting of 9 masses in basal 0.8 of apical liver lobe. Carrefour with large diverticulum (XL, pl. 44, fig. 6); uterus shorter than free oviduct. Penial retractor arising on right side of uterus, near and loosely connected to tail-fan; epiphallus less tapering; penis without trace of lobe. Radula (pl. 44, fig. 5) has 9 or 10 laterals with entocone lost from last, and 45 to 51 marginals, of which 10 to 32 are usually bicuspid; 115 and 133 rows counted.

The dimensions given represent a large and depressed form of *H. hopkinsi*; the figures of dissections are based on more typical material. A still smaller paedogenetoid form is also present in the ANSP. material and has been dissected.

Habroconus (Pseudoguppya) pacificus (Pfeiffer)*, (pl. 60, fig. 13; pl. 44, fig. 7).

Helix pacifica Pfeiffer, 1846, Symbolae III: 66; Monogr. **1**:52 [**3**:58-**4**:33-**5**:85-**7**:99], Conch.-Cab. **2**:125, pl. 88, figs. 3-5. (?) Reeve, Conch. Icon. **7**: pl. 112, fig. 640; Tryon, Manual **3**: pl. 14, fig. 28?

Guppya pacifica Hanna and Hertlein, 1938, in part (see *H. hopkinsi*).

Guppya hopkinsi conulus Martens, 1902, Sitz. Ges. Naturf. Berlin: 59.

G. fultoni Gude, 1903, Proc. Malac. Soc. **5**:265, pl. 7, figs. 18-20.

Cocos Island. ANSP. 170395, dissected, Wafer Bay (Pilsbry!); ANSP. 84695, "cotypes of *G. fultoni*" (purchased from Fulton).

Shell (pl. 60, fig. 13) similar to *H. pallidus* but usually with fairly high, subfornicate spire, thread carinate on 6th whorl but becoming weakly angulate on 7th; light to brownish corneous, sometimes with brown varices, dullish above but somewhat polished below, thin and subtransparent. Later whorls more moderately flattened above, with growth-threads considerably stronger than and rendering spiral striae obscure, above; base with weak spiral striae. Aperture barely angulate at 80° to shell-axis; peristome about 15° to shell-axis, weakly arcuate near columella, which is shorter and more nearly vertical; superficial perforation with major diam. 16.5 and minor 24 times in diam. of shell.

Animal similar to *H. hopkinsi*. Epiphallus (pl. 44, fig. 7) more conical (like in *H. pallidus*); penis relatively shorter (even when less contracted than in animal figured), with a large lateral lobe (PL) and internally with longitudinal folds, of which heaviest extends into diverticulum. Radula, very similar, has 10 laterals, of which last loses entocone, and 51 marginals, of which only 2 or 3 of outer teeth show tendency to become more than bicuspid; 137 rows counted.

Pfeiffer's dimensions are too small for *H. hopkinsi*. Reeve's figure and Tryon's copy are more carinate and depressed than usual, but the species is quite variable in both particulars, although it is always separable from *H. pallidus* on form alone. From Pilsbry's collections, *H. pacificus* appears to be the commonest *Habroconus* on Cocos Island, although, in one locality on Wafer Bay, *H. hopkinsi* was more abundant.

Genus DISCOCONULUS Reinhardt, 1883

Discoconulus Reinhardt, 1883, Sitz. Ges. Naturf. Berlin: 85, type by subsequent designation of Pilsbry, 1928, Proc. ANSP. **80**:210 (fig. 8, radula), *Conulus* = *Hyalina sinapidium* Reinhardt, 1877, Jahrb. Deutsch. Malak. Ges. **4**:318, pl. 10, fig. 5, from Japan: Yedo, Uweno and Nikko Mountains.

Discoconulus species near **D. sinapidium** (Reinhardt), (pl. 60, fig. 14; pl. 44, figs. 1, 2).

Caroline Islands: Ponape (Kiti): BBM. 155177, dissected, on dead leaves, alt. 1,200 ft., Mount Tolotom; BBM. 11319, Wone, alt. 800 ft., Mount Tolotom (both Y. Kondo! Feb. 15, 1936).

Shell (pl. 60, fig. 14) depressed, with evenly rounded whorls, bright bronze-color, iridescently burnished, thin and transparent. Embryonic whorls 1.7, soon assuming very fine but sharp beads, marked off by subequally wide spiral and growth sulci; suture well overriding. Later whorls with low spiral wrinklets, which are scarcely beaded by the weaker minor growth-lines, and with widely and irregularly spaced (11 per mm. on early 4th) major growth-sulci above; base with similar spirals but with weaker growth-lines; suture distinctly impressed, but overriding and with moderately wide bevel. Aperture lunate; peristome 25° to shell-axis, sharp, very weakly convex above and concave below; columella very concave, narrowly reflected and weakly lobate. Umbilicus 13.5 or 23.3 times in shell-diameter, if measured to attachment or to overhang of last whorl; closed by a very thin and fragile callus.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whorls
D. sinapidium							
Reinhardt	1—	(1.75)	.....	.....	.....	perforate	4
fig.	1.07	164(1.75)	150(1.60)	64(0.69)	122(0.84)	19 (0.09)	
ANSP. 78810	1.17	162(1.90)	153(1.79)	68(0.79)	120(0.95)	.....	4.2
BBM. 155177	1.13	161(1.82)	145(1.64)	75(0.85)	111(0.94)	23 (0.08)	3.5+

Animal similar to *Palaua straminea* but sides of foot dark slate-color; caudal "horn" shorter and foss smaller (more as in *Euconulus fulvus*). Mantle-collar dark, without left shell-lobe and with right one only indicated by a small triangular projection. Lung pale or grayish; 6 times as long as base or about thrice kidney length, which is almost thrice its base or twice pericardial length. Apical whorls pale. Ovotestis not observed. Talon (pl. 44, fig. 1) very small; free oviduct slenderer (in one animal, greatly distended by an ellipsoid egg 0.6 by 0.8 mm.), without evident glandular zone. Prostate relatively shorter; epiphallus quite large, entering (EP) side of penial apex through a small orifice; penial retractor arising near base of uterus and inserting around penial apex; penis relatively much shorter but with apex extending beyond sheath. Jaw with still weaker growth-lines. Radula (pl. 44, fig. 2) similar to that of *D. sinapidium,* but centrals and 9 laterals with shorter backs, inner laterals more symmetric, and marginals about 19, with relatively smaller ectocone and rapid decrease in length; more than 63 rows.

Comparative Whorl-sizes in Euconulinae from Caroline Islands

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	6 wh.	Maxima	whs.
K. palaensis	1.14	4.0(4.50)	4.7(5.33)	5.4 (6.2)?	.....	.....	4⅝	154
BBM. 153870	1.11	4.1(4.53)	5.0(5.5)?	5.8 (6.4)?	.....	.....	4.5—	157
K? nitida	1.19	4.0(4.77)	4.8(5.77)	5.6 (6.7)?	.....	.....	4.7	177
D. sinapidium	.....	(1.75)	.....	.....	.....	.....	4	164
ANSP. 78810	.58	3.1(1.82)	3.5(2.0)?	.....	.....	.....	4.2	162
BBM. 155177	.62	3.5(2.2)?	4.1(2.5)?	.....	.....	.....	3.5+	161
P. straminea	1.24	4.9(6.10)	6.2(7.70)	7.5 (9.3)?	.....	.....	4⅝—	184
P. minor	1.33	4.3(5.74)	5.3(7.10)	6.4 (8.55)	7.5(10.0)?	.....	5⅛	155
P. wilsoni	1.52	4.8(7.36)	6.1(9.26)	7.4(11.3)?	8.8(13.5)?	.....	4¾	165
P. ngarduaisi	.77	3.7(2.85)	4.5(3.44)	5.2 (4.0)?	6.2 (4.8)?	.....	4.9+	158
P. babelthuapi	1.09	.....	4.3(4.65)	5.1 (5.59)	6.1 (6.63)	7.1(7.7)?	5⅝	150
P. margaritacea	.98	.....	.....	5.0 (4.87)	5.9 (5.78)	6.7(6.60)	6.3+	164
C. t. palauensis	.92	2.8(2.56)	3.2(2.95)	3.6 (3.29)	3.9 (3.60)	4.2(3.9)?	5.9	99

These shells from the Caroline Islands are very similar to *D. sinapidium* but are slightly larger; they do not resemble any other Japanese species in the ANSP., but very probably are a recent introduction through human agencies. ANSP. 78810 is from Japan; Kashima, Harima (Y. Hirase! 1900).

The very similar radula of *D? appendiculata* (Möllendorff), from Cataduanes, Philippines (ANSP. 96788), has 7 laterals, with entocone obsolescent on last, and 20 or 21 marginals, of which 11 or 12 are bicuspid; 79 rows counted. The protoconch has much weaker sculpture.

Genus **PALAUA,** new genus

Palaua, new genus, type *P. straminea* (Semper) from Angaur (BBM. 89891).

All the species of *Palaua* dissected have very similar genitalia. The genus probably includes Philippine species; *Microcystis lactea* Semper seems quite similar in appearance.

Key to Palau Species of Genus Palaua

A. Shell with columella more reflected and convexly lobate at free edge but without basal cord internally and with remainder of peristome thin;

B. More corneous, with much more rapid whorl-increase, with larger whorls and with stronger spiral striae than in *P. margaritacea;*

C. Smaller and most corneous;

D. Most depressed, with more rapid whorl-increase and with wider sutural bevel; Angaur: ..... **P. straminea** (Semper).

DD. Less depressed, with less rapid whorl-increase and with narrower sutural bevel; Peleliu, Auluptagel, Babelthuap: ..... **P. minor** (Semper).

CC. Larger, with more milky cloudiness, with whorl-increase more like D and with sutural bevel more as in DD; Angaur, Peleliu, Babelthuap: ..... **P. wilsoni** (Semper).

BB. Shell somewhat similar to young *P. margaritacea* but smaller, thinner and more transparent; Babelthuap (Ngarduais Islet): ..... **P. ngarduaisi,** new species.

AA. Shell with columella less reflected and not lobate but internally with spirally entering cord (more evident in young shells) or with remainder of peristome definitely callused;

E. More elevated, with larger whorls, with peristome callused internally throughout its arc and with scarcely a trace of columellar cord; Babelthuap: Melekeiok ..... **P. babelthuapi,** new species.

EE. More depressed, with smaller whorls, with a spirally entering cord near base of columella (reduced in older shells) and with palatal wall of peristome thin; Peleliu, Auluptagel, Koror, Babelthuap (Ngarduais): ..... **P. margaritacea** (Semper).

Dimensions in genus Palaua

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	5 wh.	whs.
P. straminea								
Semper	4	(8.5)	(6.5)	.....	.....	.....	.....	4.5
BBM. 89891	4.33	184 (7.98)	166 (7.20)	72(3.10)	129(4.01)	1.24	7.5 (9.3)?	4⅝—
P. minor								
Semper	4	(6.5)	(5.5)	.....	.....	.....	.....	.....
BBM. 154919	5.75	155 (8.89)	141 (8.08)	66(3.82)	125(4.75)	1.33	6.4 (8.55)	5⅛
P. wilsoni								
Semper	7	(12.5)	(11)	.....	.....	.....	.....	4.5-5
BBM. 154618	6.29	165(10.4)	147 (9.26)	70(4.41)	127(5.54)	1.52	7.4(11.3)?	4¾
P. ngarduaisi								
type	2.50	158 (3.94)	147 (3.68)	70(1.74)	108(1.88)	.77	5.2 (4.0)?	4.9+
P. babelthuapi								
type	4.56	150 (6.86)	137 (6.26)	64(2.92)	120(3.51)	1.09	5.1 (5.59)	5⅝
P. margaritacea								
Semper	5.5	(7)	(6.5)	.....	.....	.....	.....	6-6.5
fig.	4.25	165 (7)	.....	70(3.0)	113(3.4)	.....	.....	
BBM. 154830	4.48	164 (7.34)	156 (6.69)	66(2.94)	126(3.70)	.98	5.0 (4.87)	6.3+

Palaua straminea (Semper), (pl. 54, figs. 1-3; pl. 43, figs. 13-15).

Microcystis straminea Semper, 1870, Reisen 3 (1): 48. *Helix straminea* Pfeiffer, Monogr. 7: 127

Palau: [Angaur:]. BBM. 89891, dissected, 89894-6, on bushes and tree trunks (H. E. Crampton! July 14, 1928); BBM. 154567, on ground, alt. 30 ft., South Point (Kondo! April 14, 1936); BBM. 154797, on ground, alt. 10 ft., north part (Ito! May 10).

Shell (pl. 54, figs. 1-3) similar to *Kororia palaensis* but openly perforate and more depressed; pale horn-color, thicker and more moderately transparent because of milky cloudiness. Embryonic whorls 1.5 to 1.7, soon assuming more distinct although more superficial spiral striae and more evident growth-lines. Later whorls with somewhat stronger major growth-lines; suture more widely overriding and concave over broad bevel. Aperture more broadly lunate, slightly more convex considerably above middle of whorl; columella gradually reflected narrowly and thickened internally, more convexly lobate just below attachment and hiding ¼ of perforation, which is open, ellipsoid and with greatest width about 24 times in shell diameter.

Animal also similar. Foot pale, with some dark pigment on dorsum of tail, with black on top of head and with some spots on sides of foot; tail with rounded pyramidal "horn" which equals or slightly exceeds tip of sole and overlies large mucous foss. Mantle-collar (pl. 43, fig. 14) with right shell-lobe (LR, contracted) somewhat pigmented, twice as long as its base and 1/3 diameter of mantle-collar; left shell-lobe (LL) distant, about half size of right. Lung deeply invaded by mantle glands and pigmented with large black blotches; 4.3 times as long as base or 3.3 kidney length, which is over twice its base or 1.3 pericardial length. Apical whorls with broad black band above. Ovotestis consisting of about 7 conoid groups of clavate alveoli, imbedded in basal half of apical liver lobe. Talon (GT; pl. 43, fig. 13) clavate; free oviduct (UV) quite long [in one animal, containing a subspherical, chalky-shelled egg about 1.5 mm. in diameter], with glandular zone very poorly demarcated; spermatheca absent. Prostate (DG) almost as long as uterus; vas deferens (D) becoming free

shortly below prostate and entering apex of epiphallus (E), which is included in the rather thin and transparent penial sheath; epiphallus short, filled with yellow material; penis proper (P) extremely long and slender, without diverticulum. Penial prepuce (YP) present; atrium proper (Y) short. Retractor system with buccal muscle almost free; free retractors arising shortly after and soon dividing into tentacular muscles; right lateral with branch to base of oviduct; right ommatophoral in peniovidual angle. Jaw with weak growth-lines and longitudinal striae, with the latter strongest in low rounded median lobe. Radula (pl. 43, fig. 15) has subquadrate tricuspid central, 8 laterals with small entocone becoming obsolescent on last, and 40 marginals, of which inner 25 have subequal mesocone and ectocone and remainder add accessory ectocones; 86 rows counted.

Palaua minor (Semper), (pl. 54, figs. 7-9).

Microcystis wilsoni minor Semper, 1870, Reisen 3 : 48. *Helix wilsoni minor* Pfeiffer, Monogr. 7 : 109.

Palau : Peleliu : with *P. wilsoni.* Babelthuap : BBM. 154919, dissected, on ground, alt. 60 ft., Melekeiok (S. Ito! April 12, 1936). Auluptagel (= Aurapushekaru) : BBM. 154734, younger and more pallid, on ground, alt. 50-150 ft. (Kondo! May 5).

Shell similar to *P. straminea* but with less rapid whorl-increase and more elevated; as much or more straw-colored. Suture more as in *P. wilsoni.* Umbilicus with greatest width 21 times in major diameter, at right angle 33 times and to overhang of last whorl 27 times.

Animal also similar. Radula has more oblong central and inner laterals, 9 laterals with entocone lost from last, and 60 marginals, of which 31 are bicuspid and outer 29 add more ectocones; 98 rows counted.

Whether Semper meant to use *minor* as a one word description or a subspecific term is not entirely clear, but, in either case, *Palaua minor* is apparently not preoccupied. As will be noted, this species has more radular teeth and many more marginals than the considerably larger *P. wilsoni.*

Palaua wilsoni (Semper), (pl. 54, figs. 4-6).

Microcystis wilsoni Semper, 1870, Reisen 3 : 47, pl. 2, figs. 11a-c, Peleliu and Nermalck bei Coröre (= Koror). *Helix wilsoni* Pfeiffer, Monogr. 7 : 109. *Nanina wilsoni* Tryon, Manual 2 : 118, pl. 29, figs. 16-18.

Palau : Peleliu : on ground, under stones and leaves. BBM. 154618, dissected, on ground, alt. 50-75 ft., Ngalkol (Y. Kondo! April 21, 1936). Angaur : BBM. 154588, on ground, alt. 40 ft., southeast part (Kondo! April 15). Babelthuap : BBM. 154881, on ground, alt. 180 ft., 5 miles inland, Melekeiok (S. Ito! April 7). Palau : BBM. 87545, from Möllendorff.

Shell similar to *P. straminea* but larger and less depressed; still paler horn-color; more polished. Embryonic whorls with spiral striae much weaker, almost obsolescent and with growth-lines less evident. Later whorls with spirals somewhat weaker and major growth-wrinkles considerably less prominent; suture relatively less widely overriding and appearing more narrowly impressed. Umbilicus narrowly ellipsoid; greatest width 13.5, width at right angles 38 and width to overhang of last whorl 27 times in shell diameter.

Animal also similar but with dark pigment only on tip of tail, on top of head, where it often tends to form 3 middorsal stripes, and on ommatophores. Mantle-collar pale; right shell-lobe (less contracted) 5 times as long as its base and half diameter of mantle-collar; left shell-lobe about 2/3 as long as right. Lung almost 4 times as long as base or 2.3 kidney length, which is 3.3 its base. Apical whorls with black spots. Free oviduct somewhat longer. Extruded penis a simple smooth cylinder; in one animal, part of sheath also exserted with coils of penis still inside it. Radula has more oblong central and inner laterals, 12 laterals with entocone obsolescent on last, and 49 marginals, of which 41 are bicuspid and outer 8 add one or two ectocones; 102 rows counted.

Central nervous system similar to that of *Microcystis ornatella,* but each cerebral ganglion with longer lobe laterad of origin of ommatophoral nerve. Buccal retractor nerves paired. Tentacular retractor nerves from pleuropedal connectives. Left lateral pedal nerve almost immediately dividing into 3 branches; two posterolateral nerves on each side soon bifurcating; two caudoventral pedal nerves present on each side.

Palaua ngarduaisi, new species, (pl. 55, figs. 1-3).

Palau: Babelthuap: BBM. 11487 (154950), 10-100 ft., Ngarduais (=Nardueis) Islet (S. Ito! April 16, 1936).

Shell similar to young *P. margaritacea* but considerably smaller, slightly more elevated, thinner and much more transparent. Later whorls with very slightly more evident spiral striae and less distinct growth-lines; suture equally overriding but with narrower bevel. Aperture more broadly lunate; columella much less thickened, without basal cord, more reflected and markedly lobate near attachment (more so than in any other *Palaua*). Umbilicus almost circular, 13.5 times in major diameter.

Animal similar to *P. straminea* but with only tail-horn and ommatophores dark. Mantle-collar pale; right shell-lobe about 4 times as long as its base; left one about 2/3 as long as right. Lung with black blotches in a row along hindgut and forming almost continuous band over pericardium; 5 times as long as base or over thrice kidney length, which is twice its base or 1.5 pericardial length. Ovotestis with very few alveoli in each group; talon relatively longer and slenderer [a common feature in small species]; free oviduct 2/3 as long as uterus. Prostate about 0.6 of uterus; penis even longer and slenderer. Radula has central with more elongate mesocone, 6 laterals, and 28 marginals, of which 23 are bicuspid and outer 5 add more ectocones; more than 66 rows.

Palaua babelthuapi, new species (pl. 54, figs. 10-12).

Palau: Babelthuap: BBM. 11486 (154927, dissected), on ground, alt. 60 ft., Melekeiok (S. Ito! April 12, 1936).

Shell similar to *P. margaritacea* but with higher spire and slightly larger whorls (more rapidly increasing); slightly more corneous and a little less polished. Embryonic whorls with very slightly more distinct spiral striae. Later whorls with considerably more evident spirals and less marked major growth-lines (thus approaching *P. wilsoni*); suture less widely bevelled and appearing more impressed. Aperture less narrowly lunate; peristome gradually thickened internally throughout its arc; columella more heavily thickened, more reflected (although not lobate) but with scarcely a trace of basal cord. Umbilicus with greatest width 16.5 and width at right angles 28 times in shell diameter.

Animal similar to *P. straminea* but with only eyes black. Mantle-collar pale; right shell-lobe 4 times as long as its base; left one about half as long as right. Lung pale with some black along anterior half of hindgut. Apical whorls with chalky white along veins. Uterus of one animal with large egg in upper part. Radula has central markedly narrower than first lateral, 7 laterals with entocone obsolete on last, and 43 marginals, of which 27 are biscuspid and outer 16 often divide ectocone or add more; 93 rows counted.

Palaua margaritacea (Semper), (pl. 54, figs. 13-15).

Microcystis margaritacea Semper, 1870, Reisen **3**: 48, pl. 2, fig. 15, Nermalck and Peleliu. *Helix margaritacea* Pfeiffer, Mongr. **7**: 110. *Nanina margaritacea* Tryon, Manual **2**: 118, pl. 39, fig. 6.

Palau: Koror (= Coröre): on ground, under stones and leaves, Nermalck Islet. BBM. 154830, dissected, 154832, on ground, alt. 100-200 ft., Kamakan, south part (Y. Kondo! May 11, 1936). Auluptagel: BBM. 154744, on ground, alt. 50-150 ft. (Kondo! May 5). Peleliu: BBM. 154626, younger, on ground, alt. 50-75 ft., Ngalkol (Kondo! April 21). Babelthuap: BBM. 154947, younger, on ground, alt. 10-100 ft., Ngarduais Islet (Ito! April 16). Palau: BBM. 87543, from Möllendorff.

Shell similar to *P. wilsoni* but with much smaller whorls and much less rapid whorl-increase; paler, except at apex, more polished and with denser milky cloudiness (translucent). Embryonic whorls with spiral striae almost obsolete and with growth-lines noticeable only near end; suture very widely overriding. Later whorls with spiral striae less evident and more broken but with major growth-lines sharper and more regularly spaced (16.2 per mm. on late 6th); suture relatively much more widely overriding and bevelled and appearing less narrowly impressed (more as in *P. straminea*). Aperture more narrowly lunate; columella more obliquely inclined, less reflected and not lobate at edge but more thickened internally, especially near base, where it tends to develop a low spirally entering cord (higher and more evident in young shells but always dying out toward peristome). Umbilicus with greatest width 13 and that at right angles 29 times in shell diameter.

Animal similar to *P. straminea* but pale with two dark lines bordering dorsomedian pale band on head and dark ommatophores. Mantle-collar pale; right shell-lobe almost 5 times as long as its base or over half diameter of collar; left about 2/3 as long as right. Lung with dark brown spots that tend to form rows along hindgut; 5 times as long as base or almost 4 times kidney length, which is 2.7 times its base. Apical whorls with some white along vessels and with black spots that form sutural band over ovotestis. Free oviduct of one animal with similar egg. Radula has similar central, 8 laterals, and 44 marginals, which reduce in size more rapidly and of which 27 are bicuspid and 17 usually add more ectocones; more than 88 rows.

Genus CONEUPLECTA Möllendorff, 1893

Coneuplecta Möllendorff, 1893, Ber. Senckenberg. Ges., 64; type by original designation *Euplecta scalarina* = *Helix scalarina* Pfeiffer, 1851, Zeitschr. Malak. **8**: 128, from Philippines: Leyte.

Sitala (H. Adams) Hedley, 1894, Proc. Lin. Soc. N. S. Wales (ser. 2) **8**: 385, anatomy, New Guinea; Odhner, 1917, Kungl. Svenska Vetenskap. Handl. **52** (16): 83, anatomy, Australia.

Durgellina Thiele, 1928, Zool. Jahrb., Syst. **55**: 135; type by original designation, *D. vitrina* Thiele, 1928: 136, from Bismarck Islands: New Britain: Ralum.

Conibycus Thiele, 1928: 136, 137; type by original designation, *C. dahli* Thiele (1928) from New Britain; Rensch, 1937, Zeitschr. wiss. Zool. B, **6** (4): 559, fig. 20, genitalia.

Parasitala Thiele, 1931, Sitz. Ges. Naturf. Berlin: 398; type by original

designation, *P. osumiensis* Thiele, 1931: 399, fig. III, 10, from Osumi Islands: Yakushima.

Sitalina Thiele, 1931, Handb. Syst. Weichtierk. **2**: 635; type (only species) *S. circumcincta* = *Conulus circumcinctus* Reinhardt, 1883, Sitz. Ges. Naturf. Berlin, 85, from Japan: Yokohama.

(?) *Turrisitala* Iredale, 1933, Rec. Austr. Mus. Sydney **19**: 55, 59 [no description]; type by original designation, *T. normalis* Iredale (1933) + *Helix turriculata* Cox, 1867, Proc. Zool. Soc.: 724, from Australia: Queensland: Miriam Vale, Port Curtis.

The species of *Coneuplecta* which have been dissected are evidently very closely related to the Euconulinae and may as well be included among them. Apparently, reduction of the radular laterals has taken place more than once in the Helicarionidae, just as it has in the Zonitidae (e.g., in the type of *Mesomphix* and in the Plutoniinae).

Because the type of *Sitala* H. Adams* (1865) is said to be without a dart-apparatus, the subfamily name Sitalinae Sykes (1900) might be utilized for *Satiella* Blanford and Godwin-Austen* (1908) and the species now included in *Coneuplecta.* However, the resemblances between the genitalia of *Sitala* and *Conulema,* which is included in the Durgellinae, are very perplexing; if the large rectractor-caecum of *Sitala* is on the epiphallus, instead of being simply the apex of the penis proper, Adams' genus also belongs in the Ariophantini. From the published figures, the dart-apparatus of the Durgellinae seems similar to that in other Ariophantini and the development of such a complicated structure in independent groups would seem highly improbable, although its secondary loss would not be so surprising.

Recently (1937), Iredale has irrupted again with additional Australian synonyms.

Dimensions in Genus Coneuplecta

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
C. calculosa							
Gould	.....	(2.54)	.....	.....	.....	.....	4 (?)
(pinnocki)	.....	.....	.....	.....	.....	.....	6 (?)
fig.	3.72	107(4.0)	.....	.....	.....	.....	
(vitrina)	5.5	(5)	.....	.....	.....	.....	6
fig.	5.5	91(5)	.....	44(2.42)	107(2.60)	.....	
BBM. 86521	3.85	113(4.33)	107(4.12)	50(1.93)	118(2.27)	17(.26)	5
C. microconus							
Mousson	2	(2)	(1.7)	.....	.....	.....	5.5
(sansitus)	2.29	122(2.8)	111(2.5)	.....	.....	.....	6
(barkasi)	.....	.....	.....	.....	.....	.....	5.5
fig.	7.0	127(8.9)	.....	.....	.....	.....	
BBM. 78358	2.12	125(2.64)	119(2.52)	36 (.76)	172(1.31	15(.18)	5
C. t. palauensis							
type	3.89	99(3.85)	93(3.63)	41(1.61)	122(1.96)	11(.36)	5.9

Comparative whorl-sizes

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	6 wh.	Maxima	Index
C. calculosa	.98	3.3(3.22)	3.9(3.78)	4.4(4.33)	4.9(4.8)?	.....	5	113
C. microconus	.60	3.5(2.08)	3.9(2.36)	4.4(2.64)	4.9(2.9)?	.....	5	125
C. t. palauensis	.92	2.8(2.56)	3.2(2.95)	3.6(3.29)	3.9(3.60)	4.2(3.9)?	5.9	99

KEY TO INTRALIMITAL SPECIES OF GENUS CONEUPLECTA

A. Radula with entocone on inner one or two teeth; last whorl of shell with spiral lines more or less evident above;

B. Radula with entocone on inner 2 teeth; penis longer than free oviduct; vagina distinct (section *Durgellina* + *Parasitala* Thiele); shell larger, becoming almost evenly rounded although thread-carinate and with more closely spaced major spirals; Marquesas Islands westward: .....**C. calculosa** (Gould).

BB. Radula with entocone only on first tooth; penis shorter than free oviduct; vagina practically absent (section *Sitalina* Thiele); shell smaller, more angulate and with more widely spaced major spirals; Samoa to Fiji and westward:.....
.....**C. microconus** (Mousson).

AA. Radula without entocones; genitalia more like B, but penis relatively larger and epiphallus longer (section *Coneuplecta,* s. s.); last whorl of shell with spirals obscured by growth-threads above; Palau Islands: Auluptagel and Peleliu:.....
.....**C. turrita palauensis,** new subspecies.

Coneuplecta (Durgellina) calculosa (Gould), (pl. 62, fig. 13; pl. 55, figs. 4, 5; pl. 44, figs. 8, 9).

Helix calculosa Gould, 1852, Exped. Shells: 48 [224], but not (about 1860) pl. 5, fig. 63, *a-c*; Pfeiffer, Monogr. 3:41 [4:18-5:59-7:73] *Trochonanina calculosa* Garrett, 1884, Jour. ANSP. 9:22, on foliage, up to 1,000 ft., Society, Marquesas (Hivaoa) and Fiji (Malolo) Islands. *Nanina calculosa* Schmeltz, Cat. Mus. Godeffroy V: 91, Rarotonga; Tryon, Manual 2:49, but not pl. 23, fig. 71.

Helix pinnocki Liardeti, 1876, Proc. Zool. Soc., 100, pl. 5, figs. 5, 5a, Taveuni, Fiji [type examined by Cooke]. *(Zonites) Hyalinia pinnocki* Tryon, Manual 2:180, pl. 54, figs. 5, 6.

Durgellina vitrina Thiele, 1928, Zool. Jahrb., Syst. **55**:136, pl. 5, fig. 25, Bismarck Islands: New Britain: Ralum.

Society Islands: Tahiti. BBM. 86521, dissected, on shrubs and ferns, 5 miles inland, alt. 850 ft., Vaihiria Valley (MacDaniels! June 5, 1927). Huahine: ANSP. 49300 (Garrett!). Moorea: BBM. 89667, Faaroa Valley (Adamson, Nov. 28, 1928).

Marquesas Islands: Nukuhiva: BBM. 95961, dissected, on shrubs, alt. 2,000 ft., Teuanui (P. Ent. Surv.! Oct. 25, 1929). Mohotani, Fatuhiva, Uapou, Uahuka, Tahuata, Hivaoa: BBM.

Cook Islands: Atiu: Totiko, BBM. 95070 (Buck, Aug. 28, 1929).

New Caledonia: ANSP. 49150, labeled *Helix vimontiana* Crosse, Anse Vata (G. Dupuy!).

Bismarck Islands: New Britain: ANSP. 167836, Ralum (from type lot of *Durgellina vitrina*).

Shell (pl. 62, fig. 13; pl. 55, figs. 4, 5) conoid-turbinate, very thin, distinctly angulate when young but often becoming almost evenly rounded at 5 whorls, but always with low peripheral thread; base convex with deep narrow foveola; corneous to very pallid, almost white, with horn-colored apex; dullish, with satin-like finish above, more glossy below. Embryonic whorls 1.5 to 2, nipple-shaped, with closely spaced, rounded growth-threads, beaded by subequally spaced, spiral, impressed lines (about 32 visible at end of first whorl). Later whorls more rounded, with weaker growth-threads (42 per mm. on 5th) and more widely spaced spiral striae (about 35 visible on 5th) separating broader wrinkles above; base with growth-threads obsolescent shortly below periphery but with spirals usually distinct and sharply cut; suture well impressed. Aperture fairly broad, evenly rounded except for thread-carina; peristome about 35° to shell-axis, concave below. Columella sharply and broadly reflected above, hiding more than half of small (17 times in shell-diameter), superficial perforation, which is closed internally by a thin whitish callus.

Animal similar to *Euconulus fulvus* but light colored; tail with prominent dorsal groove and poorly developed "horn." Shell-laps rather narrow, without shell-lobes; left mantle-lobe deeply bipartite. Lung pale, with chalky line along pulmonary vein; 2.5 times as long as base or over twice kidney length, which is twice its base or 1.5 pericardial length. Apical whorls with diffuse chalky network and solid band along sutural angle. Hermaphroditic duct (GD; pl. 44, fig. 8) rather short, swollen; carrefour with lateral sac (XL); uterus (UT) quite short; free oviduct long with glandular zone (UG) in middle half; spermatheca (S) stout, enlarged basally and apically with very short stalk; vagina (V) short. Prostate (DG) about half as long as uterus; free vas deferens (D) entering epiphallus through a small papilla; epiphallus (E) small, internally with boss-like thickenings; penial retractor (PR) investing base of epiphallus; penial sheath (PS) heavy and muscular, surrounding basal 0.7 of penis proper (P) which has heavy wall and is lined by minute, closely packed papillae. Penial prepuce (YP) distinctly represented, thin walled and developing a low thickening or boss at apical end; atrium proper (Y) short, opening through a vertical slit shortly behind inferior tentacle. Retractor system giving off buccal muscle almost immediately and right and left lateral retractors very shortly afterwards; right lateral with band to vagina. Each lateral retractor gives off, from dorsal surface near original, a tentacular muscle that divides, near level of cerebral ganglia, into ommatophoral and inferior tentacular retractors. Jaw thin, crescentic, with practically no median point. Radula (pl. 44, fig. 9) has very elongate 5-cusped central, two 5-cusped laterals, which differ from marginals only by each having an entocone, and 137 marginals, of which innermost have large mesocone and 3 progressively smaller ectocones, but majority have smaller mesocone, larger first ectocone and more accessory ectocones; 132 rows counted.

The type of *C. calculosa* appears to have been lost. USNM. 5465 contains one shell, which is probably that figured as this species in the Expedition Shells, but which is actually an example of *Liardetia discordiae* (Garrett). However, the label of this lot states that it formerly contained two shells of different species and the catalog adds that one was destroyed in 1873. Gould's description, which is fairly good and about 8 years prior to the figures, can only apply to the *Coneuplecta,* as Garrett must have realized.

C. calculosa has evidently been carried from island to island by human agencies and probably will be found to have a much wider range and addi-

tional synonyms. *C. vitrina* (Thiele) is identical in form but has weaker spirals, as might be expected in an old, dead shell. *C. osumiensis* (Thiele) has slightly stronger spirals but even its specific separation is also questioned; its radula (ANSP. 87935, Hirase!) has teeth of almost indistinguishable form, but 154 marginals and 133 rows are present; Thiele's figure is woefully inadequate. Thus, *Parasitala* is considered a synonym of *Durgellina,* which is used here as a section of *Coneuplecta.* Also, although I have seen no authentic material of *Helix rimicola* Benson (1859), the occurrence of *C. calculosa,* or a related species, in India would not be surprising, especially since the Polynesian peoples, according to some students, may have come from that region.

Coneuplecta (Sitalina) microconus (Mousson), (pl. 55, fig. 6; pl. 44, figs. 10, 11).

Nanina microconus Mousson, 1865, Jour. de Conch. **13**: 192 [29]. *Helix microconus* Pfeiffer, Monogr. **5**: 94 [7: 106]. *Zonites microconus* Schmeltz, Cat. Mus. Godeffroy IV: 70, Fiji (Oneata) and Samoa (Tutuila); Mousson, 1871, Jour. de Conch. **19**: 10 [6], Futuna. *Trochonanina microconus* Garrett, Proc. Zool. Soc. 1887, 171, Fiji (widely diffused), Tonga and Samoa.

Helix sansitus Cox, 1870, Proc. Zool. Soc., 83, Fiji (Viti Levu) and Banks (Vanua Lava); Pfeiffer, Monogr. **7**: 204. *Sitala sansita* Gude, 1913, Proc. Malac. Soc. **10**: 328, pl. 14, f. 7a-c, Suva, Viti Levu, also Totoya (central Fiji).

(?) *Helix barkasi* Liardet, 1876, Proc. Zool. Soc.: 100, pl. 5, fig. 6, Taveuni. *(Zonites) Hyalinia barkasi* Tryon, Manual **2**: 180, pl. 54, fig. 7. (?) *Liardetia barkasi* Gude, 1913, Proc. Malac. Soc. **10**: 328, Fiji (west): Ngau and Vatou (= Vatuleile?).

Fiji: (Lau): Vanua Mbalavu: Lomma Lomma (Graeffe!). Namuka-i-Lau: BBM. 78558, dissected, damp hillside and flat, ⅛ to ½ mile inland, alt. 30-100 ft., east end forest (Bryan! Aug. 13, 1924). Mothe: BBM. 78576, under dead leaves, 1 mile inland, alt. 590 ft., central wooded peak (Bryan! Aug. 14). (West): Viti Levu: BBM. 77014, dissected, under logs, ¼ mile inland, alt. 50 ft., Suva Bay (Bryan! June 26).

Shell (pl. 55, fig. 6) similar to *C. calculosa,* but smaller, trochiform, relatively heavier, sharply angular and narrowly carinate; base flattened with extremely narrow foveola; light fulvous horn-color, duller and glossy only near columella. Embryonic whorls almost 1.5, with growth-wrinkles relatively wider and much lower and with much more widely spaced, spiral lines (11-12 visible at end of first). Later whorls with growth-wrinkles relatively coarser (42 per mm. on 5th) and more irregular, and with distant spirals (12 on 5th) above; base with growth-wrinkles persisting to near columella and with conspicuous spirals; suture less impressed and dropping below carina on 5th whorl. Aperture trapezoidal, very angulate at 100° to shell-axis; peristome weakly concave below. Columella more gradually and less broadly reflected above, hiding about half of superficial perforation (15 times in shell diameter).

Animal also similar. Lung almost 5 times as long as base or 4 times length of kidney. Carrefour sac smaller. Glandular zone including most of free oviduct (pl. 44, fig. 11); spermatheca clavate with longer stalk and smaller basal swelling. Penial retractor attaching near middle of stouter epiphallus; penis proper relatively shorter. Penial prepuce with a hemispherical boss internally just laterad of its apex. Radula (pl. 44, fig. 10) has central with shorter reflection, one lateral with more nearly equal ectocones and more than 80 marginals; rows not counted.

The radula of *C. circumcincta elata* (Gude), from Takayama, Iyo, Shikoku, Japan (ANSP. 81907; Hirase! 1901) is very similar to that of *C. microconus,* but the inner ectocones of the central diverge more from the mesocone (the one accuracy of Thiele's sketch), the entocone on the first tooth is slightly more prominent, and 73 marginals are present. The terminal genitalia from another dried-in animal (ANSP. 81897) are also very similar but the spermatheca has a longer, slenderer stalk. Since the shells also show resemblances, *C. microconus* is included in the section *Sitalina* Thiele.

Coneuplecta (s. s.) confusa (Möllendorff)*.

Helix tongana (Quoy et Gaimard) Pfeiffer, 1848, Monogr. 1:38 [3:40-4:17-5:58-7:71,523] in part, Negros (Cuming!); not Quoy et Gaimard (1832). *Vitrinoconus tonganus* (Gray) Semper, 1873, Reisen 3 (2):94; Tryon Manual 1:161, pl. 36, fig. 25.

Euplecta confusa Möllendorff, 1887, Jahrb. Deutsch. Malak. Ges. 14:263, pl. 8, figs. 2-2c. *Otesia confusa* Möllendorff, 1898, Semper's Reisen 8:102, pl. 7, fig. 22.

Philippines: Cebu: in mountains Uling and Licos. ANSP. 96863, radula, Bariti (Quadras!).

A radula from a dried-in animal is similar to that of *C. turrita palauensis,* but has 151 marginals. From its shell, *C. confusa* seems very closely related to *C. scalarina* (Pfeiffer), the type of the genus. Although extralimital, *C. confusa* superficially resembles and has often been identified with *Diastole tongana* (Quoy et Gaimard).

Coneuplecta (s. s.) turrita palauensis, new subspecies (pl. 62, fig. 14; pl. 55, figs. 7, 8; pl. 44, figs. 12, 13).

Cf. *Vitrinoconus turritus* Semper, 1873, Reisen 3 (2):93, Philippines: Luzon. *Helix turrita* Pfeiffer, Monogr. 7:522. *Otesia turrita* Möllendorff, 1898, Semper's Reisen 8:106, pl. 7, fig. 30.

Palau: Auluptagel: BBM. 11488 (154727, dissected), alt. 50-150 ft. (Y. Kondo! May 5, 1936). Peleliu: BBM. 154612, alt. 50-75 ft., Ngalkol (Kondo! April 21).

Shell (pl. 62, fig. 14; pl. 55, figs. 7-8) superficially perforate, with subconical spire and convex base, angulate with low thread-carina; golden tan-colored, dullish above but more glossy below, thin and translucent. Embryonic whorls 1.6, soon assuming fine, shallow and irregular, spiral striae and more gradually developing very fine,

obscurely beaded growth-ridgelets; suture impressed and overriding. Later whorls weakly convex, with slightly sharper growth-wrinkles, above; base with growth-sculpture gradually dying out below carina and with shallow, undulating spiral striae again appearing; suture moderately impressed, descending to just below carina. Aperture subrectangular, carinate at 90°; peristome simple and sharp, 10° to shell-axis; columella gradually reflected but hiding little of perforation, which has a visible gape of 1/19 the shell diameter, but is closed by an internal callus.

Animal similar to *C. calculosa* but foot dark. Mantle-collar with some pigment. Lung colorless, 4 times as long as base or 2.8 kidney length, which is 2.5 times its base or twice pericardial length. Diaphragm lightly pigmented. Ovotestis with 7 triangular masses of few alveoli, in basal 0.8 of apical liver lobe. Talon (pl. 44, fig. 12) slenderer; carrefour with more tongue-shaped lobe (XL). Free oviduct shorter; uterus grayish; spermatheca longer. Penial retractor inserting on epiphallus (E), which is longer, marked off from penis (EP) only by constriction and contains longitudinal folds; penis proper larger, almost completely surrounded by sheath, with larger internal papillae, and enervated mainly from pedal ganglion. Jaw with very low median lobe. Radula (pl. 44, fig. 13) has central with longer mesocone and with inner ectocones near to and not much larger than outer ones, no laterals with entocones, and 123 marginals, with 4 or more ectocones; more than 111 rows.

This Palau *Coneuplecta* seems very close to *C. turrita* (Semper), but is more markedly carinate, has finer but sharper growth-threadlets, which more completely obscure the spiral striae, above, and shows finer and weaker spirals on its base. ANSP. 63967, a lot of the typical subspecies, was obtained through Möllendorff from Isabella, North Luzon.

SESARINAE

In addition to the groups discussed in more detail, *Kaliella* Blanford* (1863), *Rasama* Laidlaw* (1932), *Tadunia* Godwin-Austen* (1918), *Sivella* Blanford* (1863) and *Sesara* Albers* (1860) from India, *Eurybasis* Gude* (1913) from Borneo, *Antinous* Robson* (1914) from New Guinea, *Malandena* Iredale* (1933) from Australia, *Rhysotina* Ancey* (1887) from San Thomé in the Gulf of Guinea, and *Hemitrichia** and *Hemiglypta* Möllendorff* (1888 and 1893) from the Philippines, seem to belong in this subfamily, which apparently once had a very wide distribution that has been interrupted on the mainlands by the more advanced Helicarionidae. Until their soft parts are known, *Nesonanina* Böttger* (1916) and *Nitor* Gude* (1911), because of their resemblance to *Orpiella, Advena** and *Chiroktisma* Gude* (1913), because of their similarity to *Dendrotrochus,* and *Rahula* Godwin-Austen* (1907) might be tentatively added.

Key to Intralimital Genera of Sesarinae

A. Shell haliotiform; anatomy unknown; Fiji:.....genus **Parmella** Adams.

AA. Shell not haliotiform;

B. Sole tripartite; epiphallus with calc-sac; radular teeth mainly at least bifid and marginals often multicuspid (i.e., more like Helicarioninae); shell with more gradual whorl-increase or smaller and thinner;

C. Epiphallus basally surrounded by heavy muscular sheath that extends beyond insertion of retractor; penis without vergic papilla; shell peristome not reflected; Cook Islands (?), Fiji and westward: ..... genus **Orpiella** Gray.
CC. Epiphallus not included in penial sheath; penis with vergic papilla; shell peristome reflected; Solomon Islands and westward; Caroline Islands: Ponape: ..... genus **Dendrotrochus** Pilsbry.
BB. Sole undivided; epiphallus without apical calc-sac; radular teeth tending to lose side cusps (somewhat like Ariophantinae); shell with more rapid whorl-increase and mainly larger and heavier; peristome not reflected; Philippines and Caroline Islands: Truk: ..... genus **Ryssota** Albers.

Genus ORPIELLA Gray, 1855

Orpiella Gray, 1855, Pulm. British Mus., 147; type (only species) *O. scorpio* (Gould).

Eurypus Semper, 1870, Reisen 3 (1): 36; type by subsequent designation of von Martens, 1871, Zool. Rec. for 1870, **7**: 154, *Helix casca* Gould. Not *Eurypus* Kirby (1819).

Aulacopus Pfeffer, 1878, Jahrb. Deutsch. Malak. Ges. **5**: 258, 273; only species, 1882, Abh. Naturw. Ver. Hamburg-Altona **7** (2): 18, *Nanina hoyti* Garrett. Not *Aulacopus* Serville (1832).

Fretum Sykes, 1900, Proc. Malac. Soc. **4**: 140; type by original designation *E. casca* (Gould) = *O. scorpio* (Gould).

Kalendyma Gude, 1911, Proc. Malac. Soc. **9**: 273; type by original designation *Helix compluviata* Cox, 1871, Proc. Zool. Soc.: 646, pl. 52, fig. 10, from Solomon Islands; Rensch, 1936, Rev. Suisse Zool. **43**: 654, figs. 15-17, anatomical notes from Guadalcanar.

Fijia Gude, 1913, Proc. Malac. Soc. **10**: 325; type by original designation *Fijia macgillivrayi* Gude.

Irenella Gude, 1913: 326; type by original designation *Helix nouleti* Le Guillou.

Halozonites Pilsbry and Cooke, new subgenus, type *O. cookensis* (Gude) from Vatuleile (BBM. 87993).

Eufretum, new subgenus, type *O. similis* (Semper) from Colo-i-Suva (BBM. 77021).

Owaraha, new subgenus, type *O. solidiuscula* (E. A. Smith) from Owa Raha (BBM. 119238).

Orpiella will not be properly revised until far larger series of accurately localized material, both of shells and of animals, have been studied; the genus has already suffered too greatly from those who have worked on it. The confusion started when Gould described *O. scorpio* from manuscript figures, and, as usual, Gray made a genus of it. Semper added much to future knowledge but ignored the past. The author of *"Aulacopus"* need not even be mentioned, but, to cap the climax, *Orpiella* had the misfortune to be afflicted with both the careless Liardet and the guessing Gude.

Key to Subgenera and Sections of Genus Orpiella

A. Principal marginals of radula with more than two cusps; mantle with shell-laps scarcely expanded; shell umbilicate to perforate, 4 whorl diam. less than 7 mm.;

B. Penis not much longer than broad, with a short apical caecum; principal marginals multicuspid; left mantle-lobe typically bipartite; shell smoothish; Fiji (introduced in Cook Islands: Aitutaki?): ..... subgenus **Halozonites** Pilsbry and Cooke, new.

BB. Penis more elongate and without apical caecum; principal marginals with two large cusps and minute blade ectocones; left mantle-lobe typically undivided; shell (later whorls) with low growth-threads dividing spiral grooves into series of fusiform pits; Fiji (central and west?): ..... subgenus **Fijia** Gude.

AA. Principal marginals bicuspid; right shell-lap (at least) somewhat expanded; shell rimate to imperforate, 4 whorl diam. over 9 mm.;

C. Tail with slightly flattened dorsal area bounded laterally by rounded periphery; penis short, containing a large stimulator-papilla; right shell-lap weakly expanded; radular laterals elongate with slender mesocone and obscure entocone; shell large and heavy, dull to glossy; Fiji (west and north): ..... subgenus **Irenella** Gude.

CC. Tail with markedly flattened or concave dorsal area, bounded laterally by sharp carinae or large conic bosses; penial papilla small or lacking; right shell-lap well expanded; shell thinner and more shining (or with gradual whorl-increase or with peripheral sulcus); Fiji (west and north) to Solomon Islands: ..... subgenus **Orpiella**, s. s.

D. Penis almost as long as epiphallus; spermatophore smooth; inner laterals of radula squarish with distinct entocone; left shell-lap moderately expanded; tail like FF; shell similar to *Irenella* but with much more gradual whorl-increase; Solomon Islands: ..... section **Owaraha***, new.

DD. Spermatophore with denticulate ridge; inner laterals more elongate; shell quite smooth;

E. Shell with peripheral carina and supracarinal sulcus; radula like F but central and laterals more elongate; details of mantle-collar and penis (Rensch did not open its sheath) unknown; Solomon Islands: ..... section **Kalendyma** Gude*.

EE. Shell thin, without carina or sulcus; penis much shorter than epiphallus; left shell-lap broadly expanded; shell with rapid whorl-increase; Fiji (west and north):

F. Inner laterals of radula oblong with slender mesocone and distinct entocone; dorsal area of tail bordered by large conical bosses; left shell-lap longer than right; shell quite polished but with fairly sharp, fine spiral striae above (when fresh) and usually with more fornicate spire and more widely overriding suture: ..... section **Orpiella**, s. s.

FF. Inner laterals elongate with broad mesocone and obscure entocone; dorsal area of tail with lateral carinae; right shell-lap longer than left; shell more polished, with spiral striae much more obscure, with slightly more conoid spire (becoming suborbicular with age) and with suture usually less overriding and slightly more impressed: ..... section **Eufretum**, new.

Comparative whorl-sizes in genus Orpiella

	1½	4 wh.	5 wh.	5.5 wh.	6 wh.	6.5 wh.	Maxima	Index
O. cookensis	.87	3.8 (3.31)	5.7 (5.0)?	.....	.....	.....	4¼	187
O. proxima	1.12	4.5 (5.02)	6.9 (7.7)?	.....	.....	.....	4.2	195
O. schmeltziana	1.56	4.6 (7.11)	7.0(10.9)?	.....	.....	.....	4.6	183
O. macgillivrayi	1.51	4.2 (6.34)	6.1 (9.20)	7.4(11.0)?	.....	.....	5.3	166
O. plicostriata	.....	(4.1)	.....	.....	.....	.....	4	205
O. nouleti	3.00	.....	.....	9.0(27.1)	10.3(30.8)	.....	6	149
(rubricata)	2.97	.....	.....	8.1(24.0)	9.2(27.3)	.....	6	141
O. n. tawalekae	3.13	.....	5.8(18.08)	6.8(21.2)	8.0(25)?	.....	5.5	156
O. otareae	2.85	.....	5.7(16.2)?	6.7(19.0)?	7.9(22.6)	9.3(26.5)	6⅝	143
O. pfeifferi	3.20	.....	6.7(21.3)	8.5(27.1)	9.9(32–)?	.....	5.6	164
(high form)	3.11	.....	.....	8.0(24.8)	9.4(29.2)	.....	6.1	144
O. godeffroyana	2.69	.....	.....	.....	10.5(28.2)	12.7(34.1)	6.8	158
O. hoyti	2.12	.....	7.7(16.2)	9.0(18.9)	10.4(22)?	.....	5.8+	146
O. assavaensis	.....	.....	(20)?	.....	.....	.....	5	167
O. scorpio	2.53	.....	7.3(18.6)	9.1(23.0)?	.....	.....	5¼	152
O. s. fragillima	2.59	4.3(11.07)	7.1(18.4)?	8.9(23.0)?	.....	.....	4⅛	165
ANSP. 49375	2.53	5.0(12.6)?	7.8(19.7)	9.6(24.2)?	.....	.....	5.4	160
O. tenella	2.25	4.4 (9.4)?	6.3(14.2)	7.6(17.1)?	.....	.....	5—	152
O. lepida	.....	(9)	.....	.....	.....	.....	4	154
O. similis	2.39	4.1 (9.8)?	6.9(16.55)	8.2(19.55)	9.6(23)?	.....	5.7	148
appr. richardi	2.16	4.3 (9.34)	7.1(15.3)?	8.9(19.2)?	.....	.....	4½	151
past richardi	2.34	4.7(11.00)	7.5(17.5)?	.....	.....	.....	4.3	176
O. placita	.....	(10)	.....	.....	.....	.....	4	158
O. vitrinina	.....	(7.5)?	.....	.....	.....	.....	4¼	170
O. solidiuscula	2.90	.....	4.5(13.0)	5.1(14.9)	5.8(16.8)	6.6(19+)?	6	150

Orpiella (Halozonites) cookensis (Gude), (pl. 56, figs. 1-3; pl. 44, figs. 14, 15).

Zonites vitiensis Mousson, 1865, Jour. de Conch. **13**: 193 [30], Viti Levu (= Lewou), Fiji; not *Helix vitiensis* Pfeiffer, 1855, synonym (?) of *O. scorpio*. *Helix vitiensis* Pfeiffer, Monogr. **5**: 146 [**7**: 147]. *Z. vitiensis* Mousson, 1870, Jour. de Conch. **18**: 115 [7], also Ovalau and Vanua Mbalavu. *Nanina vitiensis* Tryon, Manual **2**: 120, pl. 40, figs. 46-48. (?) *Philonesia vitiensis* Gude, 1913, Proc. Malac. Soc. **10**: 328, Fiji (central): Moala (= Moalu) and Totoya.

Thalassia cookensis Gude, 1905, Jour. Malac. **2**: 11, pl. 3, figs. 4,*a,b*.

Cook Islands: Aitutaki (?): most localities in this "contribution" seem to be incorrect; BBM. 106227 (from type lot).

Fiji: ANSP. 49173 (from Schmeltz); ANSP. 49172 (Garrett!). (West): Vatuleile: BBM. 87993, dissected, on cliffs, damp valley, 600 ft. inland, alt. 10 ft., northwest corner (H. S. Ladd! July 24, 1928).

Shell (pl. 56, figs. 1-3) depressed (more so when young), barely angulate at beginning and quite evenly rounded at end of 4th whorl, umbilicate; horn-color, with satin-like gloss above, more polished below. Embryonic whorls 1.5, smoothish, with traces of impressed spiral lines. Later whorls with very fine low anastomosing threads, parallel to weakly impressed growth-lines (slightly stronger in type lot) and obscuring weak spiral striae above; base almost polished, with very weak impressed spiral lines only visible in high light; suture weakly impressed, overriding (margined). Aperture fairly broad, quite evenly rounded; peristome about 20° to shell-axis; columella scarcely reflected. Umbilicus open, about 6.5 times in shell diameter.

Animal similar to *O. nouleti tawalekae*; tail with all bosses large; caudal "horn" not reaching tip of sole. Mantle-collar with narrow shell-laps; left mantle-lobe bipartite. Lung and apical whorls not observed. Spermatheca (pl. 44, fig. 14) with much shorter, relatively stouter stalk; vagina practically absent. Penial retractor inserting between basal and middle thirds of epiphallus and continued only by investment. Penis heart-shaped, with an apical caecum shaped like a liberty cap above entrance (EP) of epiphallus; containing lateral thickenings but without free stimulator. Jaw not observed. Radula (pl. 44, fig. 15) has subquadrate central, 5 short laterals, all with fairly strong entocone and last with an accessory ectocone, and 30 broadish marginals, which accentuate mesocone and mainly develop 3 ectocones; more than 55 rows.

The following key separates *O. cookensis* from the two other species tentatively included in *Halozonites*.

KEY TO SPECIES OF SUBGENUS HALOZONITES

A. Shell smaller; later whorls glossy, with very fine anastomosing growth-wrinkles obscuring spiral striae, above; umbilicus 6.5 times in shell diameter; widely diffused in Fiji (introduced into Aitutaki: at least by Gude): ..... **O. cookensis** (Gude).

AA. Shell larger; later whorls with minor growth-wrinkles indistinct and with very fine spiral striae more evident above; Fiji (west):

B. Shell smaller; later whorls quite polished with shallow spiral striae above (like base of BB); perforation 8 times in shell diameter; Viti Levu: Tawaleka..... ..... **O. proxima,** new species.

BB. Shell larger; later whorls glossy with deeper spiral striae separating fine convolutions above; perforation 15-16 times in shell diameter; Malolo: .... **O. schmeltziana** (Garrett).

Orpiella (Halozonites?) proxima, new species (pl. 56, figs. 4-6).

Fiji (west): Viti Levu: BBM. 11424 (94724), under stones, logs, leaves, etc., densely wooded hillside, 25 miles inland, alt. 750 ft., Tawaleka (Ladd! Aug. 4, 1926).

Shell similar to *O. cookensis* but larger, more depressed, evenly rounded on 4th whorl and much more polished above. Embryonic whorls 1.6 with slightly more distinct, very fine, spiral striae (20 visible at end of first). Later whorls with major growth-wrinkles somewhat stronger (7 per mm. on 4th), with minor ones very weak and only visible under high light, and with sharper (more distinct) but shallow spiral striae, above; suture even less impressed, broadly overriding and margined. Aperture evenly rounded; columella rather gradually reflected and weakly emarginate. Umbilicus smaller, 8 times in shell diameter.

Dimensions in Subgenus Halozonites

	alt.	maj. diam	min. diam.	alt. ap.	diam. ap.	1½	4.5 wh.	whs.
O. cookensis								
Gude	2.5	180(4.5)	.....	.....	.....	.....	.....	5
fig.	2.85	158(4.5)	151(4.3)	63(1.8)	122(2.2)	.....	.....	
(vitiensis)	3	167(5)	142(4.25)	.....	.....	.....	.....	5
BBM. 87993	1.95	187(3.66)	170(3.31)	67(1.31)	132(1.73)	0.87	4.5(4.0)?	4¼
O. proxima								
type	2.71	195(5.28)	183(4.96)	69(1.88)	134(2.51)	1.12	5.4(6.0)?	4.2
O. schmeltziana								
Garrett	4	(9)	.....	.....	.....	.....	.....	5
ANSP. 49162	4.88	183(8.92)	167(8.17)	79(3.86)	117(4.52)	1.56	5.5(8.62)	4.6

O. proxima looks very much like *O. schmeltziana,* but is smaller and much more polished, with decidedly shallower spiral striae on its later whorls. Both species have more rapid whorl-increase than *O. cookensis.*

Orpiella (Halozonites?) schmeltziana (Garrett), (pl. 56, figs. 7-9).

Zonites schmeltziana Garrett, 1887, Proc. Zool. Soc.: 173. *Fretum schmeltzianum* Gude, 1913, Proc. Malac. Soc. **10**: 329, pl. 14, figs. 5, a-c.

Fiji (west): Malolo: BBM. 2490 (ANSP. 49192) (Garrett!).

Shell similar to *O. proxima* but typically less depressed, obtusely and weakly angulate on 4th whorl and barely so on 5th; glossy above and quite polished below. Embryonic whorls 1⅞, soon assuming sharper, but very fine, decussating, growth-lines and spiral striae. Later whorls with similar growth-wrinkles (7 major per mm. on 5th), crossed by much deeper, closely spaced spiral striae and very fine convolutions, above; base with about as strong spirals as on upper surface of *O. proxima*; suture sometimes dropping below angle on 5th whorl. Aperture barely angulate at 75° to shell-axis; peristome 25° to shell-axis, weakly arcuate just below suture; columella slightly more emarginate, hiding less than 0.2 of smaller perforation (15.5 times in shell diameter; Gude's fig. about 10 times).

Orpiella (Fijia) macgillivrayi (Gude), (pl. 42, fig. 12; pl. 45, figs. 4-6).

Fijia macgillivrayi Gude, 1913, Proc. Malac. Soc. **10**: 327, pl. 14, figs. 2, a-c.

Fiji (central): Matuku: under dead leaves (MacGillivray!). BBM. 77040, dissected, under stones and fallen leaves, 1 mile inland, alt. 900 ft., summit of ridge near Koro Levu (E. H. Bryan, Jr.! July 5, 1924).

Shell (pl. 42, fig. 12) depressed turbinate, weakly angulate on 5th whorl, almost evenly rounded on 6th; light tan-colored, dull above and glossy below. Embryonic whorls 1.6; first almost polished with very faint spiral striae (like in *O. cookensis*) and growth-lines; last half whorl with closely spaced growth-threads. Later whorls with spiral furrows (9-10 visible) above, which scarcely affect fairly strong growth-threads (8-9 per mm. on 6th) a little wider than their interspaces (closer on last half whorl), but form fusiform pits between them, and with obscure minor spirals; central ¾ of base without prominent growth-sculpture but with very fine wavy sharp spiral striae (more evident than in *Halozonites*); suture distinctly impressed. Aperture rounded subtrape-

zoidal, almost transverse; peristome about 30° to shell-axis; columella gradually but shortly reflected; umbilicus about 10 times in shell diameter.

Animal similar to *O. nouleti tawalekae* but foot whitish; sole with middle zone wider than either lateral one; tail with very prominent dorsomedian groove and coarse radiating ones; caudal horn spatulate and not reaching tip of sole. Mantle-lobes dark; left one undivided. Lung black behind mantle-collar and with heavy black network beyond; also with transverse chalky stripes; about 3 times as long as base or twice kidney length which is 3.5 times its base or 1.5 pericardial length. Ovotestis not observed; uterus (pl. 45, fig. 4) containing an egg (UO) with chalky shell; free oviduct much longer; spermatheca (containing spermatophore) with relatively larger sac and shorter stalk; vagina extremely short. Spermatophore (pl. 45, fig. 6) long fusiform with coarse, smooth, spiral threads around most of tail. Penis relatively longer, separated from epiphallus by heavy sphincter and internally developing 3 heavy and many finer, longitudinal folds but without distinct stimulator. Jaw with almost no lobe; growth-lines prominent. Radula (pl. 45, fig. 5) has 9 laterals with fairly strong entocone becoming obsolescent on last, and 48 fundamentally bicuspid marginals, which accentuate mesocone and develop minute blade-ectocones; rows not counted.

Key to Species of Subgenus Fijia

A. Shell larger (4 whorl diam. 6.3 mm.), weakly angulate on 5th whorl, with coarser spiral furrows not crossing rounded growth-threads; Fiji (central): Matuku: ..... **O. macgillivrayi** (Gude).

AA. Shell smaller, sharply angulate on 4th whorl, with finely incised spiral lines crossing sharp growth-threads; Fiji (west): Viti Levu and Kandavu: ..... **O. plicostriata** (Mousson).

Dimensions in Subgenus Fijia

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	4 wh.	whs.
O. macgillivrayi								
Gude	7	(12)	(11)	.....	.....	.....	.....	5.5
fig.	7.2	167(12)	.....	65(4.7)	138(6.4)	.....	.....	
BBM. 77040	5.94	166 (9.83)	158 (9.36)	56(3.30)	147(4.84)	1.51	4.2(6.34)	5.3
O. plicostriata								
Mousson	2	(4.1)	.....	.....	.....	.....	(4.1)	4

Orpiella (Fijia?) plicostriata (Mousson).

Zonites plicostriatus Mousson, 1870, Jour. de Conch. **18**: 116 [8], Viti Levu and Kandavu. *Helix plicostriata* Pfeiffer, Monogr. *7*: 197.

Fiji (west): Viti Levu: north shore (Graeffe!). BBM. 94725, with *O. proxima,* Tawaleka (Ladd! Aug. 4, 1926).

This species looks like a miniature edition of *O. macgillivrayi,* but its umbilicus is narrower and the 4th whorl is acutely angulate above periphery.

Orpiella (Irenella) nouleti tawalekae, new subspecies (pl. 63, figs. 13, 14; pl. 45, figs. 1-3).

Fiji (west): Viti Levu: BBM. 11425 (94726, dissected), under stones, logs, leaves, etc., densely wooded hillside, 25 miles inland, alt. 750 ft., Tawaleka (H. S. Ladd! Aug. 4, 1926).

Shell (pl. 63, figs. 13-14) helicoid, barely angulate on 5th, evenly rounded on 6th whorl, superficially rimate; brownish olive and dull above (more reddish and shining

toward apex); olive and glossy, with darker varices, below. Embryonic whorls 2¼, apparently smooth (no very young shells seen). Later whorls assuming (first ones smoothish) coarse angular major growth-threads (3.6 per mm. on 6th) and finer minor ones, often crossed (sometimes not) but about 22 irregular, impressed, spiral grooves and with fine minor spiral wrinkles visible sporadically, above; base glossy, with minor spirals sharp, but weak and very wavy; suture quite well impressed, narrowly margined. Aperture quite narrowly lunate; peristome about 20° to shell-axis and barely arcuate above; columella quite suddenly reflected and thickened, almost completely hiding superficial perforation (22 times in shell diameter) which is closed internally by a thin callus.

Animal with large and heavy, pigmented foot; sole tripartite; tail slightly flattened where shell rests but with rounded sides, with quite prominent dorsal groove, caudal "horn" and mucous foss. Mantle-collar with very shortly expanded right shell-lap and narrow left one; without shell-lobes; mantle-lobes rather narrow but left lappets larger and deeply demarcated. Lung with minor venation evident; not measured. Ovotestis (G; pl. 45, fig. 1) with about 10 groups of clavate alveoli; hermaphroditic duct (GD) fairly long; talon (GT) quite small; carrefour (X) ovoid. Uterus (UT) voluminous and much convoluted; free oviduct (UV) moderately long, without evident glandular zone; spermatheca (S) of short type with ellipsoid sac and fairly long stalk; vagina (V) extremely short. Prostate (DG) as long as and attached to uterus; vas deferens (D) caught into penioviducal angle by right ommatophoral retractor. Penial sheath (laid open) consisting of two parts: a thin basal sac (PS) surrounding penis and base of epiphallus and a heavy muscular cylinder (PS') enclosing 0.6 or 0.7 of epiphallus; marked off from each other by a constriction which is attached near base of epiphallus by bands of muscle. Penial retractor (PR) arising from diaphragm, entering penial sheath and inserting near middle of epiphallus but continued by muscular investment of epiphallus and by free bands of muscle that bind constriction of penial sheath to base of epiphallus. Penis short, clavate; internally (pl. 45, fig. 2) separated from epiphallus by two heavy sphincteric folds (EP), obliquely rugate and containing a large, transversely wrinkled stimulator-papilla (PD). Atrium (Y) short and stout, opening shortly behind right inferior tentacle.

Retractor system gives off buccal retractor almost immediately and then, from its dorsal surface, very heavy right and left free or lateral retractors to sides of foot and around atrium. Each free retractor gives off almost immediately, from its internal face, a relatively slender tentacular retractor, which divides, near cerebral ganglia, into ommatophoral and inferior tentacular muscles.

Buccal mass sphaeroid. Salivary glands lanceolate; right one more anteriad; in close juxtaposition but not fused above oesophagus; each 0.7 and duct 3 times as long as buccal mass. Jaw thickened and heavily, longitudinally striate at center; two examples with prominent rounded median lobe but one without. Radula (pl. 45, fig. 3) has quite elongate central; 13 equally elongate laterals with entocone obsolescent on all; and 64 moderately slender marginals, of which practically all have a large mesocone and a small ectocone although outer 15 occasionally add another ectocone; 107 rows counted.

Cerebral ganglia almost confluent; pleural connectives short; pedal connectives a little longer; large penial nerve from right pedal ganglion apparently joined by a small branch from right cerebral center (as in *O. fragillima*).

Key to Species of Subgenus Irenella

A. Shell with prominent growth-threads, crossed by major spiral grooves above; mantle typically with left shell-lap scarcely expanded.....typical group.

B. Shell with sharp growth-wrinkles and major spirals above, slightly to considerably larger with less flattened base; chocolate to brownish olive, without bands or umbilical spot; Fiji (west):.....**O. nouleti** (Le Guillou).

C. Shell with much more rapid whorl-increase and thus attaining larger size, with coarser sculpture; chocolate color; Ovalau: ..... typical subspecies.
CC. With more gradual whorl-increase and with finer sculpture; brownish olive above and olive below; Viti Levu: ..... subspecies **tawalekae, new.**

BB. Shell with broad, low growth-wrinkles and obsolescent major spirals above, smaller (whorl-increase like CC) with more flattened base; brownish fulvous, with indication of broad subsutural band and with large whitish umbilical spot; Fiji (north): Vanua Levu: ..... **O. otareae** (Garrett).

AA. Shell with weaker growth-wrinkles and without major spirals and so much more glossy above; mantle (in *O. pfeifferi*) with left shell-lap considerally expanded..... ..... group of *O. pfeifferi.*

D. Shell rimate;

E. With slightly more conoid spire, with very weak minor spiral striae and practically unicolor chocolate (similar to *O. nouleti*); Fiji (west): Viti Levu and Kandavu: ..... **O. pfeifferi** (Philippi).

EE. Shell with slightly more fornicate spire, with stronger minor spirals, lightish horn-color, assuming broad subsutural, fulvous-brown band with age and sometimes a narrower basal one; Fiji (north):

F. Similar in size to *O. pfeifferi* but less glossy and with more regular growth-lines; Vanua Levu: ..... **O. godeffroyana** (Garrett).

FF. Smaller, thinner and with less impressed suture than *O. pfeifferi* but about as glossy; Taveuni, Ngamea and Lauthala: ..... **O. hoyti** (Garrett).

DD. Shell imperforate, about size of *O. pfeifferi,* with rather coarse growth-lines but smoothish and glossy, smoky horn-color; Fiji (Yasawa Group): Naviti: .... **O. assavaensis** (Garrett).

Dimensions in subgenus Irenella

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	6 wh.	whs.
O. nouleti								
LeGuillou	15	(29)	.....	.....	.....	.....	.....	5.5
(rubricata)	15.2	(25.4)	.....	.....	.....	.....	.....	6
NYSM. 276	19.4	141(27.3)	135(26.2)	54(10.45)	133(13.85)	2.97	9.2(27.3)	6
ANSP. 1407	20.6	149(30.8)	144(29.6)	56(11.5)	134(15.45)	3.00	10.3(30.8)	6
O. n. tawalekae								
type	13.65	156(21.2)	147(20.1)	63 (8.55)	127(10.87)	3.13	8.0(25.0)?	5½
O. otareae								
Garrett	22	(29)	.....	.....	.....	.....	.....	6½
fig.	21.5	135(29)	.....	59(12.7)	120(15.2)	.....	.....	
ANSP. 49436	18.9	143(27.1)	134(25.3)	60(11.3)	127(14.35)	2.85	7.9(22.6)	6⅝
O. pfeifferi								
Philippi	19	(33.5)	.....	.....	.....	.....	.....	6½
Pfr. fig.	17.35	161(28)	.....	70(12.1)	116(14.05)	.....	.....	6+
BBM. 94384	17.14	164(28.1)	149(25.5)	71(12.1)	120(14.5)	3.20	9.9(31.7)?	5.6
(lurida)	12.7	(25.4)	.....	.....	.....	.....	.....	6(?)
fig.	17.1	149(25.4)	.....	72(12.3)	102(12.6)	.....	.....	
ANSP. 49374	20.8	144(29.9)	134(27.8)	63(13.1)	120(15.7)	3.11	9.4(29.2)	6.1
O. godeffroyana								
Garrett	25	(38)	.....	.....	.....	.....	.....	7
fig.	24.3	156(38)	.....	63(15.4)	128(19.7)	.....	.....	
type	24.4	158(38.6)	143(35.0)	64(15.6)	137(21.4)	2.69	10.5(28.2)	6.8
O. hoyti								
Garrett	15	(21)	.....	.....	.....	.....	.....	6
fig.	14.45	145(21)	.....	64 (9.3)	122(11.3)	.....	.....	
type	14.75	146(21.5)	132(19.45)	65 (9.6)	118(11.3)	2.12	10.4(22)?	5.8+
O. assavaensis								
Garrett	12	167(20)	.....	.....	.....	.....	.....	5

Orpiella (Irenella) nouleti (Le Guillou).

Helix nouleti Le Guillou, 1842, Rev. Zool.: 137, Fiji; Pfeiffer, Monogr. 1: 69 [3: 71-4: 58-5: 116-7: 122]. *Nanina nouleti* Tryon, in part, Manual 2: 77, pl. 22, fig. 23.

Helix rubricata Gould, 1847, Proc. Boston Soc. N.H. 2: 178 [25], Levuka, Ovalau; Pfeiffer, Monogr. 1: 69 [3: 71]. *Nanina rubricata* Gould, Exped. Shells: 29, pl. 5, figs. 66,a.

Fiji [(west): Ovalau: near Levuka.] NYSM. 276 (A-582, probably type of *H. rubricata*); ANSP. 1407, probably from Gould (A. D. Brown Collection, marked S); BBM. 65, ANSP. 7765 (Garrett!). Fiji: ANSP. 49376-8; 49379 (Cuming!).

Shell similar to subspecies *tawalekae* but with more rapidly increasing whorls and thus becoming larger and usually more elevated; chocolate color (much less greenish), with coarser sculpture above (growth-wrinkles about 3 per mm. on 6th whorl). Large shells often with base somewhat flattened and with peristome more arcuate above.

Most of the specimens in the NYSM. and ANSP. lots are larger than Gould's dimensions.

Orpiella (Irenella) otareae (Garrett).

Nanina otareae Garrett, 1872, Amer. Jour. Conch. 7: 222, pl. 19, fig. 8. *Helix otareae* Pfeiffer, Monogr. 7: 524. *N. otareae* Pfeiffer, Conch.-Cab. IV: 542, pl. 164, figs. 10-12; Tryon, Manual 2: pl. 22, fig. 24. (?) *Irenella otareae* Gude, 1913, Proc. Malac. Soc. 10: 329, Viti Levu?

Fiji (north): Vanua Levu: ANSP. 49436, BBM. 2466 (from type lot), in damp forest, north coast of Natawa Bay (Garrett!).

Shell similar to *O. nouleti tawalekae* but smaller (although attaining greater whorl-size), more elevated, with more flattened base and with broader and shallower foveola; fulvous brown (fading to fulvous) with broad subsutural band (like in *O. godeffroyana*) just indicated, with similar reddish apex and with creamy white umbilical spot (about ½ diameter of base). Later whorls assuming broader and lower, quite regular, major growth-wrinkles (2.2 per mm. and 3-4 times as broad as interspaces on 7th), scarcely waved by very much more obscure and irregular, major spirals, although with similar minor ones above; juncture more impressed below narrowly overriding suture. Aperture more trapezoidal; peristome about 30° to shell-axis and quite arcuate near suture; columella even more completely hiding superficial perforation.

Orpiella (Irenella) pfeifferi (Philippi), (pl. 34, fig. 3).

Helix pfeifferi Philippi, 1845, Arch. Naturg. 11: 62, China (sic); Pfeiffer, Monogr. 1: 54 [3: 62-4: 42-5: 98-7: 112]; Conch.-Cab. I: 204, pl. 31, figs. 9-10, *Helicarion pfeifferi* Semper, 1870, Reisen 3: 31, pl. 3, figs. 8a,b; pl. 6, fig. 14, anatomy, Fiji. *Nanina pfeifferi* Tryon, Manual 2: 77, pl. 22, figs. 20, 21; Garrett, Proc. Zool. Soc. 1887: 167, Kandavu and Viti Levu.

Helix lurida Gould, 1847, Proc. Boston Soc. N. H. 2: 179 [25], Fiji;

Pfeiffer, Monogr. **1**: 47 [**3**: 47]. *Nanina lurida* Gould, Exped. Shells: 31, pl. 5, figs. 68, a, b. Not *H. lurida* Lowe (1831) nor Pfeiffer (1828).

Helix nouleti (Le Guillou) Reeve, 1852, Conch. Icon. **7**: pl. 77, fig. 405. *Nanina nouleti* Tryon, Manual **2**: pl. 22, fig. 22.

(?) *Nanina nouleti polita* Mousson, 1865, Jour. de Conch.**13**: 190 [27], Viti-Lewou (Graeffe!).

[Fiji (west): Viti Levu.] BBM. 92384, dissected, 20 miles inland, alt. 900 ft., Rewasan (Ladd! July 29, 1926); ANSP. 131054, juvenile, near Rewa River (Hughes! 1922). Fiji: BBM. 1268 (Garrett!); USNM. 5470 (probably type of *H. lurida*); ANSP. 1406 (A. D. Brown Collection, marked S), intermediate; ANSP. 49374 (Swift Collection), most elevated.

Shell (pl. 34, fig. 3) similar to *O. nouleti nouleti* but typically more depressed, weakly angulate at end of 4th whorl but becoming evenly rounded on 5th; chocolate color and glossy above, lighter and brighter towards apex; very weakly tinged with olive and glossy below. Embryonic whorls about 2.5. Later whorls assuming obscure, superficial, major growth-wrinkles (2.3 per mm. on 7th), without major spirals but with minor spiral striae (similar to those on base of *O. nouleti*) above; juncture less (but distinctly) impressed below overriding suture. Columella more gradually reflected, hiding most of rimation, which appears to be without internal callus (perforation almost 30 times in shell diameter).

Animal very similar to *O. nouleti tawalekae*; black on top of head. Right shell-lap narrow; left one more expanded (fairly large). Lung black with minor venation coarse. Penis with more attenuate stimulator-papilla. Jaw with low rounded median lobe. Radula has 13 laterals with entocone completely lacking from last, and 68 marginals; 115 rows counted.

Orpiella (Irenella) godeffroyana (Garrett).

Nanina godeffroyana Garrett, 1872, Amer. Jour. Conch. **7**: 223, pl. 19, fig. 9. *Helix godeffroyana* Pfeiffer, Monogr. **7**: 524. *N. godeffroyana* Pfeiffer, Conch.-Cab. IV: 525, pl. 162, figs. 1-3; Tryon, Manual **2**: 77, pl. 22, fig. 19.

Fiji (north): Vanua Levu (= Vanna Levu): ANSP. 49425 (BBM. 2463), on ground in damp forests, interior of northeast part (Garrett!).

Shell very similar to *O. pfeifferi* but fundamentally smaller, with more rapid whorl-increase and attaining larger whorl-sizes, with more fornicate spire, scarcely angulate at end of 5th whorl; yellowish to light brownish horn-color with darker apex, with broad fulvous-brown subsutural band, less evident on earlier whorls but extending 0.8 distance to periphery on last (often tending to divide into two bands), and rarely with a much narrower basal one; considerably less glossy. Later whorls with slightly more regular major growth-wrinkles (4 per mm. on 7th) above and with sharper minor spiral striae above and below. Peristome 30° to shell-axis; columella more abruptly thickened and reflected, broadly fused to penult whorl so as to hide perforation completely.

Orpiella (Irenella) hoyti (Garrett).

Nanina hoyti Garrett, 1872, Amer. Jour. Conch. **7**: 221, pl. 19, fig. 6. *Helix hoyti* Pfeiffer, Monogr. **7**: 525. *N. hoyti* Pfeiffer, Conch.-Cab. IV: 528, pl. 162, figs. 18, 19; Tryon, Manual **2**: 77, pl. 22, fig. 25; Garrett,

Proc. Zool. Soc. 1887: 168, Ngamea (= Gomea) and Lauthala (= Lanthala). (?) *Fretum hoyti* Gude, 1913, Proc. Malac. Soc. **10**: 329, Viti Levu, Ovalau?

Fiji (north): Taveuni (= Tavinni): ANSP. 49439, BBM. 2464 (Garrett!).

Shell similar to *O. godeffroyana* but smaller and more elevated; coloration generally similar but lighter, apex usually darker with purplish tinge, and without basal band; thinner and more polished. Embryonic whorls with arcuate growth-wrinkles visible on one shell. Later whorls with less distinct growth-wrinkles but with similar or even sharper minor spirals above; suture less impressed and more widely overriding. Aperture slightly flattened above (more so than in Garrett's figure). Columella gradually thickened and reflected above but completely hiding perforation.

According to Pfeffer (1878), *O. hoyti* [?] has a spermatophore similar to that of *O. similis* but with its carina entire.

Orpiella (Irenella?) assavaensis (Garrett).

Nanina assavaensis Garrett, 1887, Proc. Zool. Soc.: 169.

Fiji: Yasawa (= Assawa) Group: Naviti Islet. I have not seen this species.

Orpiella (Owaraha) solidiuscula (E. A. Smith)*, (pl. 63, fig. 15; pl. 45, figs. 7-9).

Helix solidiuscula Smith, 1885, Proc. Zool. Soc.: 589, pl. 36, figs. 2,a-b.

Nanina solidiuscula Tryon, Manual 2: 111, pl. 37, figs. 3-5.

Solomons (east): Owa Raha (= Santa Anna): on trunks of cocoanut palms (Guppy!). BBM. 119238-9, dissected, ½ mile inland (Crocker Exped.! March 30, 1933).

Shell (pl. 63, fig. 15) turbinate, with gradual whorl-increase, weakly angulate at 4.5 whorls, barely so at 5.5 and evenly rounded at 6; bright chestnut and weakly glossy above, lighter and almost polished below, shading into white around columella. Embryonic whorls about 1.7, smoothish but with weak major spirals. Later whorls with sharp major spirally impressed lines (18 visible on 6th) crossing fine rounded, closely spaced growth-threads (11-12 per mm. on 6th) above, and with obsolescent minor spirals above and below; suture quite deeply impressed, with 6th whorl dropping below angle. Aperture quite narrowly lunate, becoming evenly rounded; peristome 20° to shell-axis, weakly arcuate below suture; columella quite gradually reflected and thickened, almost completely hiding superficial perforation (about 20 times in shell diameter), which is closed internally by a thin callus.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	6 wh.	whs.
Smith	12	(18)	(16.5)	(4.5)	(8)	.....	.....	6.5
fig.	11.75	153(18)	146(17.1)	64(7.55)	119(9.0)	.....	.....	
BBM. 119238	9.93	150(14.9)	142(14.1)	63(6.29)	125(7.88)	2.90	5.8(16.8)	5.5

Animal similar to *O. nouleti tawalekae* but sides of foot and outer zones of sole pale; top of head dark with narrow white stripes either side of black dorsomedian line; tail with large flattened area bordered on either side by an alate carina; caudal "horn" pyramidal, reaching to tip of sole; foss large. Right shell-lap much wider (quite extensive) and left somewhat expanded, especially posteriad. Lung black behind mantle-collar and with clumps of black dots throughout; 4.5 times as long as base or twice kidney length, which is over 4 times its base or 2.5 pericardial length. Free oviduct (pl. 45, fig. 8) much longer (0.7 as long as uterus); spermatheca relatively larger (longer than uterus); vagina practically absent. Spermatophore (pl. 45, fig. 7, from spermatheca) smooth, with flattened body and rounded tail. Epiphallus relatively shorter, separated by slight constriction (EP) from penis, which almost equals it in length, internally develops 6 thin high longitudinal folds and is attached below middle to constriction in penial sheath. Jaw with weak median point. Radula (pl. 45, fig. 9) has squarish central, 14 short laterals with distinct entocone most prominent on 2d and 3d but becoming obsolescent on 12th, and 45 marginals, of which 25 to 28 have spatulate mesocone slightly larger than the one sharp ectocone, and outer ones often develop one or two small accessory ectocones; rows not counted.

Orpiella (s. s.) scorpio (Gould).

Helix scorpio Gould, 1847, Proc. Boston Soc. N. H. 2:178 [24], Fiji; Pfeiffer, Monogr. 1:431 [3:272-4:54-5:111-7:115]. *Nanina scorpio* Gould, Exped. Shells: 33, pl. 5, figs. 67,a-b; Tryon, Manual 2:68, pl. 28, fig. 2.

Helix calva Gould, 1847: 179 [25]; Pfeiffer, Monogr. 1:41; not *H. calva* Lowe (1831).

Nanina casca Gould, 1852, Exped. Shells: 31 [243], pl. 5, figs. 69,a-b (aperture too high), Fiji. *H. casca* Pfeiffer, Monogr. 3:42 [4:43-5:99-7:112]. *Eurypus cascus* Semper, 1870, Reisen 3:37, pl. 1, fig. 17, pl. 3, fig. 9, pl. 6, fig. 12, Viti (Gräffe). *Nanina casca* Mousson, 1865, Jour. de Conch. 13:119 [28], Ovalan and Viti Lewou (Gräffe!); Tryon, Manual 2:110, pl. 37, figs. 96-98; Garrett, Proc. Zool. Soc. 1887: 166, Viti Levu and Ovalau.

(?) *Helix vitiensis* Pfeiffer, 1855, Proc. Zool. Soc.: 108, pl. 32, fig. 9, Ovalau (Macgillivray!).

Fiji [(west): Ovalau:]. NYSM. 269 (G-2625); USNM. 21012; ANSP. 1404 (A. D. Brown Collection, marked S). Fiji: ANSP. 49155 (Graeffe!).

Gould never saw the shell of his *O. scorpio,* but the animal figured is that of this group and the "shell" is evidently a careless sketch of its naked apical whorls. *O. scorpio,* the animal, probably came from one of the shells on which *O. casca* was founded. The dimensions of the largest shell in the NYSM. 284 seem to fit Gould's dimensions for *O. casca* most closely; the second biggest specimen is a *Tanychlamys* from India. The examples in USNM. 21012 are either too large or too small, but the figure in the Expedition Shells, which exaggerates the rotundity of the aperture, may have been drawn from the largest one.

KEY TO "SPECIES" OF SECTION ORPIELLA, S. S.

A. Shell angulate on 4th whorl, suture widely overriding;
  B. Shell larger (5 wh. diam. 18-19 mm.); Fiji (west):
    C. More elevated, certainly attaining more than 5 whorls and becoming heavier and scarcely angulate.....**O. scorpio** (Gould).
    CC. More depressed, typically with about 4.5 whorls, thinner and distinctly angulate .....**O. fragillima** (Mousson).
  BB. Shell smaller (5 wh. diam. 14 mm.), with sharper spiral striae; Fiji (north): .....**O. tenella** (Garrett).

AA. Shell rounded on 4th whorl, suture channelled, milky white unicolor or dark fulvous above (like *O. similis*), with slightly entering callus fold on columella (like *O. scorpio*), about size of *O. tenella*; Fiji (west): Ngau:.....**O. lepida** (Gude).

Dimensions in sections Orpiella, s. s. and Eufretum

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	5 wh.	whs.
O. scorpio								
Gould (?)	10.2	(15.2)	.....	.....	.....	.....	.....	4.5
(casca)	12.7	(20.3)	.....	.....	.....	.....	.....	5
fig.	14.8	137(20.3)	.....	70(10.4)?	103(10.7)	.....	.....	
NYSM. 268	13.65	152(20.7)	137(18.7)	66 (8.99)	121(10.85)	2.53	7.3(18.6)	5¼
(vitiensis)	10	(18)	(16.5)	.....	.....	.....	.....	5.5
fig.	12.6	143(18)	.....	67 (8.45)	115 (9.75)	.....	.....	
O. fragillima								
Mousson	8	(13)	.....	.....	.....	.....	.....	4.5
fig.	7.9	164(13)	.....	75 (5.9)	122 (7.2)	.....	.....	
BBM. 79143	6.97	165(11.51)	149(10.42)	79 (5.52)	115 (6.35)	2.59	7.1(18.4)?	4⅛
ANSP. 49375	14.85	160(23.7)	144(21.4)	72(10.75)	115(12.4)	2.53	7.8(19.7)	5.4
O. tenella								
Garrett	11	155(17)	.....	.....	.....	.....	.....	6.5
fig.	11.9	143(17)	.....	62 (7.4)	128 (9.5)	.....	.....	
ANSP. 49438	9.28	152(14.1)	140(13.0)	71 (6.63)	111 (7.36)	2.25	6.3(14.2)?	5—
O. lepida								
Gude	5.5	(9)	(8)	.....	.....	.....	.....	4
fig.	5.83	154(9)	.....	.....	.....	.....	.....	
O. similis								
Semper	10.25	(17)	(15.5)	.....	.....	.....	.....	5.5
fig.	11.7	145(17)	.....	65 (6.71)	133 (8.93)	.....	.....	
ANSP. 49155	14.0	148(20.7)	138(19.35)	63 (8.85)	119(10.55)	2.39	6.9(16.55)	5.7
BBM. 77021	7.70	151(11.60)	136(10.49)	64 (4.94)	127 (6.26)	2.16	7.1(15.3)?	4.5
O. richardi								
Gude	9	158(14.25)	144(13)	.....	.....	.....	.....	.....
Gude, type	9	(15.5)	(13.5)	.....	.....	.....	(15.5)?	5
fig.	9.35	166(15.5)	145(13.6)	70 (6.55)	122 (8.00)	.....	.....	
(atrofusca)	9.5	163(15.5)	142(13.5)	.....	.....	.....	.....	.....
BBM. 79140	7.29	176(12.84)	155(11.30)	68 (4.94)	138 (6.80)	2.34	7.5(17.5)?	4.3
O. placita								
Gude	6	(10)	(8.75)	.....	.....	.....	.....	4
fig.	6.35	158(10)	.....	.....	.....	.....	.....	.....
O. vitrinina								
fig.	4.82	170 (8.2)	.....	70 (3.39)	136 (4.59)	.....	.....	4¼

Orpiella (s. s.) fragillima (Mousson), (pl. 56, figs. 10 to 12; pl. 45, figs. 15, 16).

Nanina fragillima Mousson, 1870, Jour. de Conch. **18**: 112 [4], pl. 7, fig. 3, Viti Levu and Kandavu (Gräffe!). *Helix fragillima* Pfeiffer, Monogr. **7**: 91. *N. fragillima* Pfeiffer, Conch.-Cab. IV: 549, pl. 166, figs, 4-5; Tryon, Manual 2: 78, pl. 22, fig. 29 (poor). (?) *Fretum fragillimum* Gude, 1913, Proc. Malac. Soc. **10**: 329, Ngau and Ovalau?

Fiji (west): Viti Levu: Vuni-Vatu (Gräffe!). BBM. 77022, under logs and shrubs, damp clearings in rain forest, 6 miles inland, alt. 600 ft., Colo-i-Suva (Bryan! June 21, 1924); BBM. 87881, 87885, on cliffs, medium damp limestone hillside, 12 miles inland, alt. 165 ft., near Wailitua (Ladd! June 14, 1928); BBM. 87892, Tovo Peak (Ladd! June 17). Ovalau: BBM. 79143, dissected, on leaves of banana-like plant, damp valley, ½ mile inland, alt. 300-800 ft., behind Levuka (Bryan! Oct. 15, 1924). Fiji: ANSP. 49375 (from J. C. Cox), very large shells (identity dubious).

Shell (pl. 56, figs. 10-12) orbicular, much less convex above than below, sharply angulate on early 5th whorl (49375 barely so on 6th); pallid to light horn-color (more pronounced toward apex), thin, translucent (when fresh) and quite well polished. Embryonic whorls around 1.75, smoothish, with traces of impressed spiral lines (similar to *O. cookensis*). Later whorls with weak growth-wrinkles and fairly sharp and distinct but extremely fine spiral striae above (more as in *O. schmeltziana*); suture widely overriding and very weakly impressed. Aperture quite narrow, distinctly angulate at 65° to shell-axis [in 49375, evenly rounded and broader]; peristome about 20° to shell-axis. Columella, in juvenile shells, with weak and sometimes angular swelling (like vestigial spiral cord); in larger shells, only slightly convex; quite abruptly thickened and reflected, hiding most of open perforation (20-25 times in shell diameter).

Animal similar to *O. nouleti tawalekae* but foot pale; top of head darker with mid-dorsal row of dark spots bordered by light stripes; top of tail with large, very flat, triangular area bordered on either side by 4 prominent conical bosses; caudal "horn" quite long, extending beyond tip of sole. Mantle-collar with extensively expanded right shell-lap and very large left one; left mantle-lobe deeply bipartite. Lung with black and white bands, either longitudinal or transverse; 3 times as long as base or twice kidney length, which is 1.7 its base or 1.5 pericardial length. Free oviduct (pl. 45, fig. 16) longer; spermatheca with relatively shorter stalk. Epiphallus stouter; penis shorter, internally with two branching pilasters, of which one develops a small projecting knob. Jaw with very low rounded median lobe. Radula (pl. 45, fig. 15) has less elongate central, 9 shorter laterals with entocone not becoming obsolescent until last, and 49 marginals, of which about 25 have subequal mesocone and ectocone and outer ones add ectocones; 82 rows counted.

Central nervous system similar to that of *Dendrotrochus ponapensis*. Cerebral ganglia larger when compared to suboesophageal ones; right cerebral with a penial nerve which arises between frontal nerve and nuchal proper and is about as large as last. Right parietal ganglion demarcated from abdominal by a groove. One large caudoventral pedal nerve on each side; penial branch from right lateral much larger than cerebral one. Buccal ganglia more elongate.

O. fragillima is evidently very closely related to *O. scorpio* and may be only a more depressed, paedogenetoid form.

Orpiella (s. s?) tenella (Garrett).

Nanina tenella Garrett, 1872, Amer. Jour. Conch. **7**: 222, pl. 19, fig. 7. *Helix tenella* Pfeiffer, Monogr. **7**: 525. *N. tenella* Tryon, Manual **2**: 77, pl. 22, fig. 28; Garrett, Proc. Zool. Soc. 1887: 168, southeast Vanua Levu.

Fiji (north): Kioa (= Kiva): ANSP. 49438, BBM. 2467 (from type lot), among dead leaves and under rotten wood (Garrett!).

Shell similar to *O. scorpio* but smaller and more elevated, quite distinctly angulate at beginning but evenly rounded at end of 5th whorl; somewhat thinner (in shells of same size) and translucent. Later whorls with fine spiral striae sharper and more distinct (giving young shells an iridescent sheen) above but rather obscure on base; suture similar. Peristome 25° to shell-axis. Perforation about 35 times in shell diameter.

Orpiella (s. s?) lepida (Gude).

Fretum lepidum, 1913, Proc. Malac. Soc. **10**: 326, pl. 14, figs. 3a-c.

Fiji (west): Ngau: (MacGillivray! Oct., 1855). I have not seen this species; the suture and coloration read like *Eufretum,* but the spiral striae are more like *Orpiella,* s.s. It is probably a young shell.

Orpiella (Eufretum) similis (Semper), (pl. 56, figs. 13-15; pl. 45, figs. 10-12).

(?) *Helix vitiensis* Pfeiffer, 1855, Proc. Zool. Soc.: 108, pl. 32, fig. 9, Ovalau.

Eurypus similis Semper, 1870, Reisen **3** (1): 37, pl. 1, fig. 18; pl. 2, fig. 14; pl. 3, fig. 10; pl. 6, fig. 13, Fiji (Gräffe!). *Helix similis* Pfeiffer, Monogr. **7**: 112. *Nanina similis* Tryon, Manual **2**: 110, pl. 37, fig. 99; Garrett, Proc. Zool. Soc. 1887: 167, Viti Levu.

Fiji [(west): Viti Levu:] (Gräffe!); ANSP. 49155 (Graeffe! in lot of *O. scorpio*). BBM. 77019-21, dissected, under logs and shrubs, damp clearings in hillside rain forest, 6 miles inland, alt. 600 ft., Colo-i-Suva (Bryan! June 21, 1924); BBM. 77011-2, ditto, on ferns and shrubs, 7-8 miles inland, alt. 700 ft. (June 30); ANSP. 134737, near Lookout, about 8 miles from Suva (Pilsbry! July, 1923); all lots paedogenetoid. Fiji: BBM. 1264 (Garrett!).

Shell (77021; pl. 56, figs. 13-15) depressed turbinate, with rather conoid spire [49155 becoming more orbicular with age], weakly angulate on 4th whorl, becoming almost evenly rounded on 5th [49155 evenly rounded on 6th], with deep, fairly narrow foveola; pallid unicolor (77012) to bright horn-color, or with upper surface fuscous horn-color (77021), often accentuated near suture (typical) and periphery; thin, slightly pearly and very translucent [49155 more pearly, quite solid and nearly opaque]. Embryonic whorls 1.7 to 2, with very weak spiral striae (weaker than on last whorl of *O. scorpio*). Later whorls with shallowly impressed, fairly regular growth-lines and extremely weak spiral striae above; base with obsolescent, blurred spirals; suture mediocrely impressed but less overriding (margined) than in *O. scorpio* [49155 better impressed on last whorl]. Aperture quite broad, evenly rounded (even at 4.3 whorls); peristome about 10° to shell-axis; columella gradually but quite widely reflected and weakly thickened [more so when juve-

nile but without spiral cord; shortly and abruptly reflected in 49155], hiding more than half of open perforation, which goes about 30 times in shell diameter [in 49155, hidden more completely and 20-25 times in diameter].

Animal similar to *O. richardi*. Right shell-lap larger than left but both extensively expanded. Lung with minor venation not prominent; with two almost broken chalky-white longitudinal bands, of which one along hindgut becomes more continuous on apical whorls; 3.5 times as long as base or twice kidney length, which is thrice its base or twice pericardial length. Ovotestis consisting of 5 groups of clavate alveoli; free oviduct (pl. 45, fig. 12) shorter; spermatheca with sac more swollen. Spermatophore (pl. 45, fig. 10; from inside spermatheca) elongate and spirally coiled; first 1.5 of 5.5 whorls with continuous thin carinal expansion, which later becomes undulate and, on flattened tail, breaks up into triangular serrations (pl. 45, fig. 11). Epiphallus similar (coiled inside sheath in figure); penis shorter and stouter and containing a small clavate papilla (outlined at PD) with free end toward atrium. Radula has about 10 laterals with entocones even more reduced, and 115 marginals, of which outer 15 develop accessory ectocones; 94 rows counted.

Key to "Species" of section Eufretum

A. Animal (in alcohol) light or lung with black blotches anteriad; Fiji (west):
  B. Shell least depressed, with 3d whorl more than half of 4th and with 5th becoming almost evenly rounded; Viti Levu: ..... **O. similis** (Semper).
  BB. Shell more depressed, with 3d whorl less than half width of 4th; Ngau: ..... **O. placita** (Gude).
  BBB. Shell most depressed, with rapid whorl-increase and still angulate on 5th whorl; Viti Levu (and Ovalau?): ..... **O. richardi** (Gude).

AA. Animal (alive) red or black; shell perhaps smaller; Fiji (north):
  C. Animal red; Taveuni: ..... **O. ramsayi** (Liardet).
  CC. Animal black; probably Taveuni: ..... **O. vitrinina** (Liardet).

Orpiella (Eufretum) richardi (Gude), (pl. 45, figs. 13, 14).

Fretum richardi (with color form *atrofusca* from Suva) Gude, 1913, Proc. Malac. Soc. **10**: 327, pl. 14, figs. 1a-c.

Fiji (west): Viti Levu: under dead leaves (Raynor and McDonald! Sept. 1856). Ovalau: BBM. 79140, dissected, 79144, on shrubs and tree trunks and leaves, damp hills and valley, ½ mile inland, alt. 300-800 ft., behind Levuka (Bryan! Oct. 14, 1924)?

Shell (79140) similar to *O. similis* but more depressed, with larger whorls, distinctly angulate on 4th and weakly but distinctly so on 5th; pearly to greenish white. Columella more abruptly reflected and more thickened (one juvenile with weak trace of spiral swelling), hiding half of open perforation (20 times in shell diameter).

Animal similar to *O. fragillima* but paler; dorsal flat area of tail edged by carina which are only crenulated by radiating furrows (much as in *Owaraha*). Right shell-lap more broadly expanded; left one less so except posteriad. Lung with large black blotches anteriad and around kidney and with big chalky-white spots, which become confluent on apical whorls. Free oviduct (pl. 45, fig. 13) slightly shorter; spermathecal sac more subspherical. Epiphallus similar (uncoiled more for figure); penis slenderer, internally with 5 longitudinal folds which are crested above but without distinct stimulator. Jaw with median lobe scarcely represented. Radula (pl. 45, fig. 14) has more elongate central with much broader mesocone, on which small ectocones are superimposed, about 12 laterals, of which 1st has very broad mesocone and obsolescent entocone, and others gradually become narrower and intergrade with inner marginals, and 90 marginals, of

which about 80 are bicuspid and increase relative size of ectocone until it is larger and more spatulate than mesocone and of which outer 10 develop accessory cusps; 95 rows counted.

The Ovalau shells are even more depressed than *O. richardi* and may be a distinct species or subspecies, but far too little is known about the variation in this group.

Orpiella (Eufretum?) placita (Gude).

Fretum placitum Gude, 1913, Proc. Malac. Soc. **10**: 326, pl. 14, figs. 4a-c.

Fiji (west): Ngau: (MacGillivray! Oct., 1855). I have not seen this shell, but it is probably immature.

Orpiella (Eufretum?) ramsayi (Liardet).

Nanina? ramsayi Liardet, 1876, Proc. Zool. Soc.: 100, pl. 5, fig. 3; Tryon, Manual **2**: 121, pl. 40, fig. 52.

N? vitrinina Liardeti, 1876: 100, figs. 2, 2a; Tryon: figs. 41, 42.

Fiji (north): Taveuni. According to Cooke, a single shell in the British Museum is the "type" of both these "species." Supposedly, they came from Taveuni, but Liardet gives only Fiji for *O. vitrinina.*

Genus PARMELLA H. Adams, 1867

Parmella H. Adams, 1867, Proc. Zool. Soc.: 308; type (only species) *P. planata* H. Adams.

Parmella planata H. Adams.

P. planata Adams, 1867, Proc. Zool. Soc.: 308, pl. 19, fig. 20; Pfeiffer, Monogr. **6**: 522 [**7**: 4]; Tryon, Manual **1**: 160, p. 35, fig. 17.

Fiji. Genus and species remain nomina dubia. However, a *Helicarion*-like derivative of *Orpiella* would not be surprising.

Dimensions

	alt.	maj. diam.	min. diam.	whs.
H. Adams	.....	15	10	3

Genus DENDROTROCHUS Pilsbry, 1894

Dendrotrochus Pilsbry, 1894, Manual **9**: 143; type by original designation *Papuina helicinoides* (Hombron et Jaquinot) = *Helix cleryi simboana* Smith; Hedley, Rec. Austr. Mus. **2**: 90, pl. 21, anatomy; Rensch, 1934, Amer. Mus. Novitates, no. 763: 22, figs. 3-5, anatomy.

Trochonanina (Mousson) Rensch, 1930, Zool. Anz. **92**: 231, figs. 8-9, anatomy; 1935, Zool. Anz. **110**: 282, anatomical notes.

Ponapea, new subgenus, type *D. ponapensis,* new species.

The genus *Dendrotrochus* is evidently quite closely related to *Orpiella,* although as a primitive member of the Helicarionidae, it does have some features like such primitive Zonitidae as the Trochomorphinae. It is only distantly related to *Diastole* Gude (+ *Trochonanina* Garrett; Microcystinae) and has little in common with *Trochonanina* Mousson (Trochozonitinae); see *Diastole* (part 1).

Apparently more subgenera must be recognized; *D. dendrotrochoides* (Rensch, 1930:230) has a penial diverticulum, like that in some Euconulinae and Microcystinae, while *D. sororcula* (Rensch, 1935:282) is said to lack this structure, although these species from New Britain have a superficially rimate shell; details of the penes were unfortunately omitted from their descriptions.

KEY FOR DEFINITION OF SUBGENUS PONAPEA

A. Penis with vergic papilla in a small, thin-walled utricle, that is much smaller than basal sac, which internally is demarcated by a low sphincteric fold and contains a heavy pilaster and a bilobed thickening; vagina very short; shell superficially perforate; Caroline Islands: Ponape: ..... subgenus **Ponapea,** new.

AA. Penis without external utricle, but with vergic papilla partially enclosed in a fleshy spathe with free tip; vagina longer; shell typically imperforate; Solomon Islands and westward: ..... subgenus **Dendrotrochus*,** s. s.

Dendrotrochus (s. s.) cleryi simboana (Smith)*.

Helix helicinoides "Jaquinot" Pfeiffer, Nov., 1849, Zeitschr. Malak. **7**:77, Solomon Islands; Hombron et Jaquinot, 1852 (?), Voy. Pôl Sud, livr. **22**: pl. 7, figs. 34-37; Pfeiffer, Monogr. **3**:204 [**4**:203-**5**:273-**7**:579]; Rousseau, Voy. Pôl Sud **5**:28; Pfeiffer, Conch-Cab. II:294, pl. 125, figs. 14-15; Pilsbry, Manual **7**:76, pl. 15, figs. 72-74. *D. helicinoides* Rensch, 1934, Amer. Mus. Novitates, no. 763: 24, fig. 8, St. George or Ysabel Island. Not *Helix helicinoides* Mousson, 1849, Mitth. Nat. Ges. Zürich **1** (3):266.

Helix cleryi simboana Smith, 1885, Proc. Zool. Soc.: 593, pl. 36, fig. 6a, Solomon Islands: Simbo: (Guppy!).

Since Mousson's homonym was cited by Pfeiffer (1849: 75) in the same paper in which the *Dendrotrochus* was described, *H. helicinoides* "Jaquinot" must have been originally preoccupied, and the subspecies which is the type of the genus will apparently take the name *D. cleryi simboana* (Smith).

Dendrotrochus (s. s.) cleryi (Récluz)*, (pl. 46, figs. 1, 2).

Helix cleryi Récluz, 1851, Jour. de Conch. **2**:211, pl. 5, fig. 10; Pfeiffer, Monogr. **3**:179, 644 [**4**:203-**5**:273-**7**:579]. *Helix helicinoides cleryi* Pilsbry, Manual **7**:76, pl. 15, figs. 81-83, 86-87. *D. h. cleryi* Rensch, 1934, Amer. Mus. Novitates, no. 763: 24, fig. 10, San Cristobal, St. Anna, Ugi, Ulawa and Bio Islands.

Solomon Islands [western]. Olu Malau (= Three Sisters): ANSP. 151452, dissected (W. M. Mann!)

Animal (bleached and broken) similar to *D. ponapensis*. Lung 3.3 times as long as base; kidney 2.5 times as long as its base or 2.3 pericardial length. Free oviduct (pl. 46, fig. 1) shorter, but with similar dark zone; spermatheca with longer stalk; vagina much longer. Epiphallus slenderer, with more swollen calc-sac and opening (EP) through more elongate vergic papilla (PV; mushroom-shaped in another example); penis short and subglobose, externally without distinct apical prolongation but internally with vergic chamber represented by a spathe-like outgrowth, of which tip is free. Atrium very short. Jaw with weak median point. Radula (pl. 46, fig. 2) has more elongate central and 159 marginals, of which 3 are strictly bicuspid and others have more nearly equal terminal cusps; 102 rows counted.

Dendrotrochus (Ponapea) ponapensis, new species (pl. 65, fig. 1; pl. 55, figs. 11, 12; pl. 46, figs. 3-7).

Caroline Islands: Ponape (Kiti District): BBM. 154051, dissected, excessively rare, arboreal in native forest, alt. 800 ft. (taken 500 to 1900 ft.), Mount Tolotom (Y. Kondo! Feb. 15, 1936). (U District): BBM. 154204, dissected, same mores, alt. 100 ft., Roi (Kondo! March 3).

Shell (pl. 65, fig. 1; pl. 55, figs. 11-12) superficially perforate, conoid-globose, acutely angulate when young, sharply so and subcarinate near end of 4th whorl and obtusely angled with low whitish thread-carina on 5th; fulvous-corneous (type) or whitish (154204), dullish to weakly glossy above and glossy below; fairly thin but quite opaque. Protoconch with 1.6 whorls, rapidly assuming fine, low and regular growth-threads, beaded by subequally spaced spiral striae (sculpture glazed by wear in type). Later whorls slightly flattened above, with minor sculpture diminishing in clarity until growth-threads are almost obsolete and spirals weak and wavy on 5th, but assuming low but distinct, rounded major growth-threads (5.8 per mm. on 5th); obesely rounded below, with growth-wrinkles much but spirals little reduced; suture scarcely impressed, overriding (type) or very slightly below rim of carina (154204). Aperture large, almost evenly rounded; peristome 25° to shell-axis, narrowly expanded and weakly thickened on palatal and basal walls but rounded and thickened towards columella, which is shortly reflected around (not over) small (24 times in shell diameter) superficial perforation (closed by internal callus); parietal film thin and transparent.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	4 wh.	5 wh.	whs.
type	10.85	130(14.1)	110(11.9)	60(6.55)	120(7.84)	1.87	6.0(11.25)	9.0(16.8)?	4.5+

Animal pale with brownish spots near tip of tail and on top of head; ommatophores pale with black eyes; sole with median zone narrower than either lateral one; tail with mediocre middorsal groove; caudal "horn" small, not covering large sagittiform foss. Mantle-collar spotted with brown; shell-laps heavy but narrow, without shell-lobes; left mantle-lappets with short gap between them. Lung pale or with considerable dark pigment (154051), with irregular chalky-white dots, forming heavy continuous network over hindgut, and sometimes with pearly excrescences; length along hindgut almost 5 times that on columellar side, about 2.3 times base or slightly over twice kidney length, which is over twice its base or 1.5 pericardial length; pulmonary vein with few but large and conspicuous tributaries. Apical whorls with chalky deposit along blood vessels. Ovotestis consisting of 3 or 4 groups of alveoli; imbedded in basal half of

apical lobe of liver; hermaphroditic duct (GD; pl. 46, fig. 5) rather short; talon (GT) clavate and weakly bipartite; carrefour (X) large and chalky-white. Uterus (UT) complexly folded and ruffled; free oviduct (UV) thick-walled at both ends but, most of its length, with thinner walls containing closely packed, dark chocolate spots (glandular zone; UG); vagina (V) scarcely represented. Spermatophore (pl. 46, fig. 6) smooth, long fusiform, more attenuate at tail than at apex and with heavy horny wall. Prostate (DG) practically as long as and forming spermoviduct with uterus; vas deferens (D) caught into penioviducal angle by right ommatophoral retractor, opening shortly below tip of small calc-sac (EF); epiphallus (E) expanded below attenuate apex, thickened at its base, on which penial retractor (PR) inserts, and opening into penis through an ovate vergic papilla (PV; pl. 46, fig. 3); penis proper (P) consisting of a subglobose, rather thin-walled, apical chamber (like hyperphallus of Basommatophora), which contains vergic papilla and is demarcated basally by sudden thickening of penial wall to form a low fold, and a larger stout thick-walled part, which internally develops a double thickening (PP) on its ventral side and a broad, irregular pilaster on its dorsal; penial sheath (PS) fused to penis until slightly below vergic chamber, of which it invests less than half, and attached to base of epiphallus by fibers continuous with penial retractor. Atrium (Y) moderately short, opening through a large vertical slit, little above pedal grooves and about 3 times their interspace behind right inferior tentacle.

Retractor system gives off buccal muscle almost immediately from left side and, a short distance below, very heavy lateral retractors, which are also connected to tail fan by small bands of muscle. Each lateral retractor gives off, almost immediately from dorsal surface, tentacular muscle that divides shortly above cerebral ganglia into ommatophoral and smaller inferior tentacular retractors.

Salivary glands quite small, apparently fused above oesophagus. Jaw with evident growth-striae but without median lobe. Radula (pl. 46, fig. 4) has tricuspid central, 11 laterals with entocone almost obsolete and with broad mesocone, and 188 marginals, of which first 2 are strictly bicuspid but remainder develop ectoconal serrations and on which principal ectocone becomes larger than mesocone; 126 rows counted.

Central nervous system (pl. 46, fig. 7) similar to that of *Microcystis ornatella* (Part 1, pl. 1, fig. 6). Each cerebral ganglion gives off, between frontal (NF) and inferior tentacular (TV) nerve, a small nuchal nerve proper (NN) in addition to the larger nerve (N) of more ventral origin that branches to upper lip and around ommatophoral base. Buccal retractor nerves (BR) are paired; tentacular retractor nerve (TR) arises from each pleuropedal connective. Right caudoventral pedal nerve (VP) has a short common trunk while two left ones arise separately; two posterolateral pedals (FP) are present on each side; right lateral pedal divides irregularly into two nerves to body wall and two larger ones (P) which receive small branch from cerebral ganglion, subdivide to pass mainly above but also below vas deferens and supply penis, lower female genitalia and adjacent body wall. Buccal ganglia are less elongate; each gives off a small oesophageal nerve (OP) caudad along oesophagus and a large one (OA) anteriad, in addition to small nerve (O) which accompanies ducts of salivary glands.

The new subgenus *Ponapea,* established for *D. ponapensis,* may possibly be found to include additional species, when more of the East Indian forms have been dissected.

Genus RYSSOTA Albers, 1850

Ryssota Albers, 1850, Die Heliceen: 45, 61; type subsequently designated for substitute *Rhysota.*

Rhyssota Pfeiffer, 1856, Malak. Bl. 2: 121, emendation; same type.

Rhysota Albers-Martens, 1860, Die Heliceen II: 54, substitute or emendation; type by original designation, *Nanina ovum* Valenciennes = *Ryssota otahietana* (Férussac); Semper, Reisen 3 (1): 68-70, anatomy.

Lamarckiella Möllendorff, 1898, Abhandl. Ges. Görlitz 22:66 [41]; type by original designation *Rhysota* = *Helix lamarckiana* Lea, 1841, Trans. Amer. Phil. Soc. 7: 461, Philippines: Masbate.

Trukrhysa, new subgenus, type *R. pachystoma* (Hombron et Jaquinot) from Param (BBM. 155660).

Although, as a primitive group, *Ryssota* has certain features in common with the Trochomorphinae, a much closer relationship to the Helicarionini is amply demonstrated by the large epiphallus, abundantly secreting calc, the well-developed spermatophore, the armature of the penis, which is enervated from the pedal ganglion, and the coarse minor venation of the lung. On the other hand, a discussion of the affinities of *"Rhysota" brookei* is included under the Trochomorphinae, where it apparently belongs.

Semper has suggested a close relationship between *Ryssota* and *Zonites,* the anatomy of which has been described, among others, by Semper (Reisen 3: 78), Sicard (Ann. Sci. Nat. Paris, 6 ser., 1: 1-86), Rouzaud (Assoc. Franç. Avanc. Sci. 1879, 8: 757-764), and Collinge (Proc. Malac. Soc. 4: 37). The two genera certainly do have some startlingly parallel features, but, in *Zonites* no caudal "horn" is present, the genital opening is much farther posteriad, the vagina (instead of the free oviduct) has a pronounced glandular collar, the penial armature appears to consist of much larger but sparser denticles, an apical penial caecum is present, and the penis is enervated from the cerebral ganglion.

Bad as *Ryssota* may be in form, it can scarcely be called a misprint, and, under the English and German wording of the International Rules, von Martens' emendation must be rejected.

Key for Definition of Section Trukrhysa

A. Spermathecal sac much longer than its stalk; spermatophore with most of body and short tail armed with several rows of palmate multicuspid hooks; penial sheath surrounding basal 0.4 of penis, which has another semi-detached sheath around penial-epiphallar junction; radular marginals all fundamentally bicuspid; Caroline Islands: Truk: ..... section **Trukrhysa,** new.

AA. Spermathecal sac much shorter than its stalk; spermatophore with smooth body and long tail, which is armed with one row of recurved hooks; penial sheath surrounding apical 2/3 of penis and basal 0.4 of epiphallus; over half of radular marginals unicuspid; Philippines: ..... section **Ryssota,** s. s.

Ryssota (Trukrhysa) pachystoma (Hombron et Jaquinot), (pl. 46, figs. 8-10).

Helyx pachystoma Hombron et Jaquinot, July, 1841, Ann. Sci. Nat. [2] (Zool.) **16**: 62, Hogoleu (= Truk). *Helix pachistoma* Hombron et

Jaquinot, 1852 (?), Voy. Pôl Sud, livr. 22: pl. 3, figs. 10-12; Rousseau 5:4.

Helix sowerbyana Pfeiffer, 1841, Symbolae I:36, no locality; Philippi, Abbild. Beschr. Conch. I: Helix, pl. 2, fig. 1; Pfeiffer, Monogr. 1:68, in part [3:70-4:58-5:116-7:121], Caroline Islands; Conch.-Cab. I:192, pl. 25, figs. 5-6. Not *H? sowerbiana* Férussac, 1821, Tabl. Limaçons: 74 [70], almost nude; Orb., 1835, Mag. Zool. 5:22, locality only; fully vested as *(Pupa) Cochlodina sowerbyana* Beck, 1837, Index: 88.

Helix hogoleuensis Le Guillou, 1845, Rev. Zool.: 187, Hogoleu; Pfeiffer, Monogr. 1:329 [3:221]. *H. hogoleunensis* Rousseau, Voy. Pôl Sud 5:4.

Caroline Islands: Truk [Param = Kaide Islet]. BBM. 155660, dissected, flat, 200 ft. inland, alt. 5 ft. (Y. Kondo and S. Ito! Jan. 7, 1936). (Tsis = Susuki): BBM. 155808, subfossil, dry north side, alt. 60 ft. (ditto!). (Tol = Suiyo): BBM. 155489, larger, alt. 1,400 ft., Urupot Mountain (Jan. 3).

Shell similar to subspecies *dubloni*, but more depressed; color of epidermis greenish-yellow to moderate olive-brown. Aperture less obliquely deflected and less evenly rounded; peristome more arcuate above periphery.

Dimensions in Truk Ryssota

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	whs.
R. p. pachystoma	.....	(55)	.....	.....	.....	.....
fig.	30.9	178(55)	145(44.7)	72(22.1)	139(30.8)	
(sowerbyana)	20	(38)	.....	.....	.....	4.5
Philippi fig.	19.9	195(38.6)	161(32.0)	60(12.0)	164(19.7)	
Conch. Cab. fig.	20.7	171(35.4)	.....	.....	.....	
(hogoleuensis)	28	175(49)	.....	.....	.....	5
BBM. 155489	24.2	185(44.7)	144(34.8)	62(14.9)	161(24.0)	4¾
Param (3)	19.6-23.9	152-184(36.0-36.3)	.....	.....	.....	4.5-4⅝
Tsis (2)	20.4-20.9	166-176(34.7-36.0)	.....	.....	.....	4.5±
Tol (3)	21.8-24.2	176-190(41.6-44.7)	.....	.....	.....	4.7-4¾
R. p. dubloni						
Type	33.8	136(45.9)	118(39.9)	55(18.6)	124(23.0)	5¼
BBM. 153308	33.6	134(44.9)	116(39.1)	54(18.2)	128(23.3)	5.2
Dublon (3)	33.9-34.1	134-152(44.9-51.8)	.....	.....	.....	5.2-5¼
Moen (8)	25.5-32.6	141-152(36.9-48.8)	.....	.....	.....	4.8-5.3
Reeve fig.	35.7	141(50.3)	.....	67(23.8)	120(28.4)	

Comparative whorl-sizes

	1½	4. wh.	4¼ wh.	4.5 wh.	4¾ wh.	5 wh.	5¼ wh.
R. p. pachystoma	4.34	5.9(25.7)	7.0(30.2)	8.0(34.8)	10.3(44.7)	11.4(50)?	12.6(55)?
R. p. dubloni	4.42	.....	.....	7.0(30.8)	8.1(36.0)	9.1(40.1)	10.6(45.9)
BBM. 153308	4.36	.....	.....	7.0(30.7)	8.3(36.4)	9.1(39.8)	10.5(46)?

Foot grayish, large and broad; pedal grooves both distinct; tail without evident dorsal groove, with large but shallow mucous foss, partly overhung by a short spatulate lobe; sole undivided, rounded or abruptly pointed posteriad. Mantle-collar pale, without shell-lobes; left mantle-lobe not bipartite but bilobate (anterior and posterior expansions separated by notch about third total depth). Lung pale, with irregular thin powdering of chalky-white and with numerous pearl-like excrescences; 3.6 times as long as its base or over 2.5 length of kidney, which is largely covered on internal surface by ureter and pericardium but is about 2.5 times as long as its base or 1.6 pericardial length; principal vein with many coarse tributaries. Apical whorls with chalk along blood-vessels. Ovotestis relatively short and broad, consisting of 6 subspherical groups of numerous clavate alveoli, imbedded in basal 2/3 of apical liver lobe; hermaphroditic duct (GD; pl. 46, fig. 8) moderately long; talon (GT) short and weakly bipartite; carrefour (X) small and hard. Uterus (UT) with apical end, above base of albumen gland (GG), coarsely and weakly folded but with about 0.7 of remainder finely plicate; free oviduct (UV) moderate in length with thin-walled glandular zone (UG) more brownish and sharply demarcated apically; spermatheca (S) with swollen base, short stalk and elongate sac (capable of considerable distension) reaching up 0.8 length of uterus; vagina (V) very short. Prostate (DG) almost as long as uterus; vas deferens (D) soon becoming free, caught into penioviducal angle by right ommatophoral muscle and enlarging rather abruptly into epiphallus; penial retractor (PR) arising from diaphragm to left of uterus and within 0.2 length of last from apical end of haemocoele, inserting between basal and middle thirds of epiphallus, but continued by fibers to penial sheath; epiphallus (E) long fusiform, attenuate at both ends, containing clouds and solid masses of calc, with heavy glandular wall, which internally develops low bosses, and marked off (EP) from penis only by a gradual constriction; penial sheath (PS) covering about 0.4 of penis proper, very thick basally but becoming thin at apical end and connecting broadly with epiphallus. Penis proper (P) fusiform, with apical end attenuate and sharply recurved inside heavy muscular investment so that it appears to have an apical caecum, and internally with apical 0.8 lined by closely packed papillae, each of which has a roughly diamond-shaped end (pl. 46, fig. 9), is 0.3 to 0.5 mm. across and contains (pl. 46, fig. 10) a corneous thorn with its tip projecting and pointing anteriad. Atrium (Y) short, opening close to pedal grooves and about 3 times interspace behind inferior tentacle. Retractor system with buccal muscle almost free; lateral retractors arising high but complexly connected with tail fan for some distance; tentacular muscles also beginning high but receiving a large strand from lateral retractors farther forward and dividing near anterior end of salivary glands; inferior tentacular muscles connecting with each other above buccal mass. Jaw with weak growth-lines and evident longitudinal striations but with median lobe almost obsolete. Salivary glands roughly rectangular and about 0.7 times as long as buccal mass but considerably wider, meeting but not fused above oesophagus; ducts 3 or 4 times length of glands. Radula similar to that of subspecies *dubloni* but with 29 laterals and 156 marginals; 132 rows counted.

Both the preoccupation and the subsequence of Pfeiffer's name are somewhat doubtful but *R. pachystoma* seems the safer term; its original spelling is retained although it may have been a lapsus and was embased by its original authors. The type apparently was an extremely old specimen of about 5¼ whorls.

Ryssota (Trukrhysa) pachystoma dubloni, new subspecies (pl. 55, fig. 15; pl. 46, figs. 11-13).

Helix sowerbyana Pfeiffer, 1848, Monogr. 1: 68, in part; Reeve, Conch. Icon. 7: pl. 74, fig. 386. *Nanina sowerbyana* Tryon, Manual 2: pl. 8, fig. 25.

Caroline Islands: Truk (Dublon = Natsu Islet): BBM. 11488 (153591, dissected), on trees and ground (Y. Kondo! Dec. 24, 1935); BBM. 153308, alt. 600-800 ft., Mount Tolowan (Dec. 20, 1935). (Moen = Haru Islet): BBM. 153686-7, Nebokos dry flat, ¼ mile inland, alt. 4-5 ft. (Kondo and Ito! Dec. 27, 1935); BBM. 155220, tree-trunks, south slope of Mount Tonatau (Dec. 28, 1935).

Shell (pl. 55, fig. 15) turbinate, usually evenly rounded on 5th whorl; color of epidermis tan to dark (moderate in type shell) chestnut-brown, often (typically) with a chestnut supraperipheral band and sometimes with a lighter band beneath it, very rarely also with traces of narrower basal bands; heavy and opaque, dullish to rather glossy (worn). Protoconch with almost 2 whorls; worn smooth (epidermis gone) in adults (no young shells seen); suture well overriding. Later whorls with distinct rounded growth-threads (2.2 per mm. on late 5th) and with major corrugations on senile growth, crossed by sharp macroscopic spiral striae (very much obscured on senile growth, although coarser injury-spirals occur) above; sculpture slightly weaker below; suture moderately impressed, overriding until near end of last whorl, which often drops below periphery of preceding. Aperture widened very obliquely but rounded; peristome about 40° to shell-axis, arcuate above periphery and concave below, thickened internally (often very much so in senile shells), gradually and narrowly reflected towards columella, where it is rapidly reflected to cover about half of superficial perforation (almost 20 times in shell diameter) which is closed by a heavy concave callus.

Animal similar to typical subspecies. Spermatophore (pl. 46, fig. 11), found in more swollen spermathecal sac and also observed inside epiphallus, has long rounded body, with apical 1/3 smooth but with remainder developing several irregular series of recurved, palmately divided, multicuspid hooks (pl. 46, fig. 12) on one side, and short, slightly more flattened tail, with narrower and less complex but similar hooks. Radula (pl. 46, fig. 13) has elongate central with weak ectoconal notches, about 38 laterals, of which innermost show traces of entoconal and all have ectoconal notches, and about 180 marginals, of which inner increase in length, all are fundamentally bicuspid and some of outermost always have subdivided cusps; 144 rows counted.

Central nervous system similar to that of *Dendrotrochus ponapensis* but enclosed in a heavier, opaque sheath. Cerebral ganglia relatively much smaller, necessitating right pleural connective about twice and left pedal one about 3 times as long as each cerebral ganglion; left pleural and right pedal connectives intermediate in length; pleuropedal and parietal connectives very short. Right cerebral ganglion without noticeable penial nerve. Otocysts relatively smaller. Two caudoventral pedal nerves occur on each side; practically all branches of right lateral pedal pass above vas deferens. Buccal connectives and commissure considerably shorter and stouter.

Ryssota (s. s.) otahietana (Férussac)*, (pl. 46, figs. 14-17).

(Helix) Helicogena otahietana Férussac, 1820, Histoire Nat. Moll., livr. 9, Expl. pls. 1: xii, citing livr. 7; pl. 29, figs. 4-5, Otaïti (sic). *Helix otahietana* Férussac, 1820, (livr. 10), Tabl. Limaçons: 34 [30].

Helix ovum Valenciennes, 1827, Humboldt Voyage, Intér. Amér., Zool. II: 240, pl. 57, fig. 1, Philippines: Luzon: Manila (Bastida!); Pfeiffer, Monogr. **1**: 66 [**3**: 69-**4**: 27-**5**: 76-**7**: 89, 527]. *Rhysota ovum* Semper, 1870, Reisen **3**: 69, pl. 4, fig. 1, anatomy. *Nanina ovum* Tryon, Manual **2**: 30, pl. 8, fig. 29. *Rhysota ovum* Cockerell 1918, Nautilus **32**: 58, notes on animals (Oro!). Not *H. ovum* Férussac, 1821, Tabl. Limaçons: 58 [54], nude.

Helix meridionalis Wood, 1828, Index Test. II, suppl.: 23, pl. 7, fig. 42, Otaeti.

(*Helix*) *Eurycratera otaheitana* Beck, 1837, Index: 46; not *Bulimus otaheitanus* Bruguiére (1792), Dillwyn (1817) in *Helix,* now in *Partula.*

(Helix) Chromocochlea tahitensis Hartmann, 1843, Erd.-u. Süssw. Gastr. (7): 186, pls. 65-66, Philippines.

[Philippines: Luzon:]. ANSP. 44092, dissected, Los Baños (Maximo Oro! 1919).

"The mantle is whitish, and the lung is extremely capacious, with a wide orifice. The foot above is white, with a large caudal mucus gland. Anterior three-fifths of sole pale brownish-grey, the posterior two-fifths dull white, contrasting. Head blackish; oculiferous tentacles blackish, stout basally, eye-bulb pale ochraceous; lower tentacles white at end, with bulb pale ochraceous." (Cockerell, from life.) Animal (very stiff, brittle and completely bleached) similar in form and structure to *R. sowerbyana* but tail with smaller triangular lobe impinging on large mucous foss. Free oviduct much slenderer (see Semper's figure), without so evident a glandular zone; spermatheca with much longer stalk but shorter sac, which contained empty spermatophore-cases in both animals examined. Spermatophore with much more attenuate apical end, smooth body and a tail which is markedly flattened, at least as long as the body and armed along edge with one row of large recurved hooks, that are quite simple near body (pl. 46, fig. 14) but develop thin triangular wings farther back (pl. 46, fig. 15). Penial retractor (PR; pl. 46, fig. 17) inserting around epiphallus and on penial sheath (PS, not so opened by Semper), which is heavy and muscular, surrounds basal 0.4 of epiphallus and apical 2/3 of penis and attaches at both ends; epiphallus (E) more swollen anteriad, with very heavy wall, folded internally into irregularly longitudinal ridges; penis proper (P) less attenuate anteriad, internally with 8 low pilasters in anterior 1/3 but with similar papilla above attachment of sheath. Radula (pl. 46, fig. 16) has broader central with more marked ectoconal notches, about 34 laterals, of which innermost 1 to 3 may show traces of entoconal notch, each has an ectocone and outer ones grow gradually narrower, and about 80 marginals, of which inner 6 are bicuspid, 48 are unicuspid and decrease in size, next 28 again tend to assume one ectocone and outermost 4 are mere denticles; 130 rows counted.

Helicogena otahietana, which was originally assigned to but not utilized in the genus *Helix,* is not preoccupied in either connection nor in *Ryssota.* Although certainly inappropriate, the name is 7 years prior to *Helix ovum.*

HELICARIONINAE*

Although no species of this group is known to occur within the limits of these studies, the typical genus is found in the Solomon Islands and the Fijian *Parmella* may be related. In addition to the genera discussed in more detail, this subfamily apparently includes *Parmacochlea* Smith (1884), *Pseudaustenia* Cockerell (1891), *Erepta* Albers (1850), with which most of Thiele's "Ereptinae" seems congeneric, *Colparion* Laidlaw (1938), *Nesaecia* Gude (1911), *Methvenia* Robson (1914), and *Petalochlamys* Godwin-Austen (1907). Möllendorff's Philippine groups *Pseudhelicarion* (1894), *Pareuplecta*

(1890) and *Pliotropis* (1899) and *Inozonites* Pfeffer (1882) seem to approach each other and some of the species probably belong here, although unfortunately Semper, 1870, Reisen 3:21, vacillates about the presence or absence of a dart-apparatus in *Pseudhelicarion ceratodes* (Pfeiffer). Until their soft parts are better known, the Malagasy groups, *Amphiblema* Gude (1911), *Pseudotrochatella* Nevill (1881), *Bathia* Robson (1914), and *Caldwellia* Adams (1873) may also be tentatively added. I have dissected *Petalochlamys formosana* (Schmacker und Böttger) from Formosa (Gressitt!); it lacks a dart-sac; the form and internal structure of its penis and epiphallus are almost identical with those in *Pseudhelicarion,* and its generic separation appears dubious.

Genus EPIGLYPTA Pilsbry*, 1893

Nanina (Gray) Hedley, 1891, Rec. Austral. Mus. 1 (7): 135-6, anatomy.

Epiglypta Pilsbry, 1893, Manual 8:133; type by original designation *Helix howinsulae* Cox.

Epiglypta howinsulae (Cox)*, (pl. 47, figs. 1-3).

Helix howinsulae Cox, 1873, Proc. Zool. Soc.: 148; Pfeiffer, Monogr. 7:205. *Nanina howinsulae* Hedley, 1891; Rec. Austral. Mus. 1 (7): 135, pl. 21, fig. 7; pl. 22, figs. 5, 8, anatomy.

Lord Howe Island. ANSP. 63208, dissected (Brazier!).

Animal (broken and incomplete) with weakly tripartite sole; tail with weak dorsomedian groove; caudal "horn" a broad, crescentic fold overhanging a wide, diamond-shaped foss. Mantle-collar (pl. 47, fig. 2) heavy; right shell-lobe (LR) short (contracted) and tongue-shaped; left one (LL) far posteriad and still shorter; right mantle-lobe (MR) pebbled externally; anterior left one (MA) large and separated from small posterior lappet. Kidney triangular, 2¼ times as long as its base and almost twice pericardial length. Uterus (UT; pl. 47, fig. 1) and prostate (DG) attached, forming spermoviduct; free oviduct (UV) slender, apparently without distinct glandular enlargement; spermatheca (S) with elongate sac (containing 2 spermatophores) and short stalk; vagina (V) long and slender. Spermatophore similar in shape to that of *Helicarion planospira* but tail (broken) apparently smooth. Vas deferens (D) caught into penioviducal angle by right ommatophoral retractor; epiphallus (E) with slender flagellum (EF) and small retractor-caecum (ER), opening into penis through large vergic papilla (PV); penis proper (P) longer than entire epiphallus and quite slender, internally with irregularly transverse rows of overlapping, soft, spatulate, flattened papillae and externally with basal 0.4 surrounded by sheath (PS) which is very thick and muscular in apical half but becomes thin basally. Atrium (Y) quite short, opening shortly behind right inferior tentacle. Penial nerve apparently from cerebral ganglion. Jaw heavy and reddish brown, with 7 weak longitudinal ribs on thickened central area, that forms prominent but rounded median lobe. Radula (pl. 47, fig. 3) has moderately elongate central, 25 narrowing laterals with entocone obscure even on first, and 103 marginals, of which about 54 are usually bicuspid, with broad mesocone and small ectocone (rarely more than one), and outer 49 become gradually multicuspid; 136 rows counted.

As indicated by Hedley, *Epiglypta,* although a distinct genus, must be quite closely related to *Helicarion,* and it is discussed in this paper because

its evident similarity to the group which is almost synonymous with shell reduction gives additional evidence against any division of this family on the basis of that characteristic. The genitalia of *"Microcystis" fulva* and *"Macrochlamys" suturalis* (type of *Malandena* Iredale), as figured by Odhner, 1917, Kungl. Sv. Vet. Akad. Handl. **52** (16) : 79-82, considerably resemble those of *Epiglypta,* and a short retractor-caecum would be easily overlooked.

Genus **HELICARION** Férussac*, 1820

Helixarion Férussac, 1820, Hist. Nat. Moll. (livr. 9) Expl. pls., vol. 1: vj; type (only species) *H. cuvierii* Férussac, 1820; Tabl. Limaçons: 19-20.

Helicarion Férussac, 1821 or 1822, Tabl. Syst. An. Moll. (with livr. 15): xxxj; type by subsequent designation of Gray, 1847, Proc. Zool. Soc.: 169, *H. cuvieri*; 1824, Voy. Uranie, Zool.: 465; Semper, Reisen **3**: 30-31, anatomy; Wiegmann, 1893, Weber's Zool. Erg. Reis. Niederl. Ost.-Ind. **2**: 114-119, anatomy; Wiegmann, 1898, Abhandl. Senckenberg. Ges. **24**: 319-345, anatomy; Rensch, 1930, Zool. Anz. **89**: 82-83, anatomy; 1932, Zool. Jahrb. Syst. **63**: 70-75, anatomy; 1932, Zool. Anz. **98**: 30-32, anatomy.

(?) *Laconia* Gray, 1855, Cat. Pulm. Brit. Mus.: 51, 63; type (only species) *L. ferussaci* Gray, 1855, nomen dubium of unknown habitat.

(?) *Fastosarion* Iredale, 1933, Rec. Austral. Mus. **19**: 37, 57; type by original designation, *H. superba* = *Vitrina superba* Cox, 1871, Proc. Zool. Soc.: 54, from Australia: Queensland: Mount Dryander, Port Denison.

(?) *Luinarion* Iredale, 1933: 38, 57; type by original designation, *H. thomsoni* Ancey, 1889, Le Naturaliste **11**: 19, West Australia (south): Geographe Bay.

(?) *Vercularion* Iredale, 1933:38, 57; type by original designation, *H. bullaceus* Odhner, 1917, Kungl. Sv. Vet. Akad. Handl. **52**(16): 87, Queensland: Cedar Creek.

Sitalarion, new subgenus, type *Helicarion planospira* (Pfeiffer) from Pamua (ANSP. 151450).

Although *Helixarion* is certainly the prior spelling, Férussac himself corrected it to *Helicarion* and the original form may have been a misprint, even if it does occur in two papers, both of which probably appeared with livraison 9.

Helicarion (Sitalarion) planospira (Pfeiffer)*, (pl. 46, fig. 18).

Vitrina planospira Pfeiffer, 1853, Zeitschr. Malak. **10**: 51; Monogr. **3**: 623 [**4**: 797-**5**: 20-**7**: 25]. *H. planospirus* Tryon, Manual **1**: 171, pl. 38, figs. 64-66; Hoffmann, 1931, Zeitschr. wiss. Zool. **138**: 99-122, figs. 1-16, anatomy.

Solomon Islands. Pamua: ANSP. 151450, dissected (W. M. Mann!).

Animal similar to that studied by Hoffmann. Extensive shell-laps pebbled and warty externally. Lung about as long as base or 1.3 times kidney length, which is little longer than its base or almost twice pericardial length. Spermatheca attached to prostate by terminal ligament; constricted in middle to form a short stalk above swollen base. Penial sheath heavy and muscular, surrounding basal 0.6 of penis and attached to apical part of epiphallus, base of flagellum and vas deferens; penis proper developing internally about 15 high longitudinal folds. Jaw of one example with a weak median point; in another without. Radula (pl. 46, fig. 18) has 11 rather elongate laterals with small entocone becoming obscure on last, and 252 marginals, of which first 2 are bicuspid but third develops fine blade-ectocones which become relatively stronger on outermost teeth [Hoffmann apparently drew badly worn teeth from one of the anterior rows]. Pedal ganglion also contributing to penial nerve.

The blade-ectocones on the principal radular marginals of this species are sufficient grounds for its separation as a new subgenus, *Sitalarion*. According to Wiegmann (1898), *H. minahassae* Kobelt, from Celebes, has a similar radula. The specific term *"planospira"* is a noun.

Helicarion (s. s.) leucospira (Pfeiffer)*, (pl. 47, figs. 4-5).

Vitrina leucospira Pfeiffer, 1857, Proc. Zool. Soc. 1856: 326, Australia; Monogr. 4:796. *H. leucospirus* Tryon, Manual 1: 168, pl. 38, fig. 39. (See *H. cuvieri* and *H. freycineti* Semper, 1870, Reisen 3: 31, pl. 3, figs. 6-7, pl. 6, figs. 10-11, for anatomy.)

Australia. New South Wales: ANSP. 63515, dissected, Lismore, Richmond River (J. Brazier! 1893).

Animal (dried up, requiring softening in dilute KOH; apical whorls lacking) similar to *H. planospira*; tail similarly compressed; obliquely erect caudal "horn" more prominent, not hiding large cruciform foss. Right shell-lap rather broadly expanded; left one narrow in anterior half but expanded posteriad to form large, truncate lobe; left mantle-lobe broad, apparently (?) undivided. Spermatheca (S; pl. 47, fig. 5) with smaller sac; vagina (V) shorter. Flagellum (EF) much smaller; retractor-caecum (ER) straight and partially imbedded in penial retractor (PR). Penial sheath (PS) similarly attached. Jaw of one example with distinct but rounded median lobe; in another, worn away. Radula (pl. 47, fig. 4) has broader central, 15 wider laterals, and 56 marginals, of which inner 26 to 36 are strictly bicuspid, next 5 or more add one accessory, ectocone and remainder gradually increase number of cusps; 93 rows counted.

DYAKIINAE

The amatorial organs in this subfamily, which mainly have bulky, poorly sheathed glands, look like experiments toward the evolution of the compact apparatus of most Ariophantini, with its heavily sheathed gland, externally continuous with the dart-sac and controlled by a retractor muscle. The contents of Thiele's (1931) Xestinae, with the exception of its typical genus, seem to belong here. *Staffordia* Godwin-Austen* (1907) and *Pseudoplecta* Laidlaw* (1932), although aberrant or primitive genera, also might well be included.

Genus **DYAKIA** Godwin-Austen, 1891

Ariophanta (Des Moulins) Semper, 1870, Reisen 3: 50-54, anatomy.

Xesta (Albers) Kobelt, 1880, Illust. Conchylienb.: 215, with type *Nanina stuartiae* = *Helix stuartiae* "Sowerby" Pfeiffer, 1845, Zeitschr. Malak. 2: 154, from Celebes (?); not *Xesta* Albers, 1850, Die Heliceen I: 58; type by subsequent designation of Nevill, 1878, Hand List Moll. India I: 50, *Nanina citrina* = *Helix citrina* Linné, 1758, Syst. Nat. X: 771, from Amboina.

Dyakia Godwin-Austen, 1891, Proc. Zool. Soc.: 29, pl. 5, figs. 5-5b (anatomy); type by original designation *Helix hugonis* Pfeiffer, 1863, Proc. Zool. Soc.: 523, from Borneo: Labuan; Wiegmann, 1898, Abh. Senckenberg. Naturf. Ges. **24**: 406, anatomy (juvenile).

Nanina (Gray) Wiegmann, 1893, Weber's Zool. Ergebn. **2**: 120-151, anatomy.

Semperia Godwin-Austen, 1898, Moll. India II: 82, type *Helix retrorsa* Gould, 1844, Jour. Boston Soc. N.H. **4**: 455, from Burma (Tenasserim): Tavoy. Not *Semperia* Crosse (1867).

Elaphroconcha Gude, 1911, Proc. Malac. Soc. **9**: 273; type by original designation, *Hemiplecta internota* = *Ariophanta internota* E. A. Smith, 1898, Proc. Malac. Soc. 3: 27, variety of *Nanina fruhstorferi* Martens, 1896, Sitz. Ges. Naturf. Berlin: 158, from Lombok; Rensch, 1932, Zool. Jahrb. Syst. **63**: 33-43, anatomy.

Asperitas Gude, 1911: 273; type by original designation, *Xestina rugosissima* Möllendorff, 1903, Nachr. Deutsch. Mal. Ges. **35**: 156, variety of *Helix inquinata* Busch, from Malay Archipelago: Roma; Rensch, 1932: 6-33, anatomy.

Rhinocochlis Thiele, 1931, Handb. syst. Weichtierk. I: 633; type (only species named) *R. nasuta* = *Helix nasuta* Metcalfe, 1852, Proc. Zool. Soc. 1851: 70, from Borneo.

Quantula, new subgenus, type *Dyakia striata* (Gray), from Viti Levu (BBM. 92345).

Semper's remarks on his *"Ariophanta"*, which is practically equivalent to *Dyakia,* as used here, are still applicable. Probably, this assemblage should be divided into smaller genera, but accurate studies of more species should be made before this is done. *Asperitas,* as dissected by Wiegmann, seems scarcely congeneric with *D. striata,* but, from Rensch's inadequate figure and notes, the type of *Elaphroconcha* would also appear to be very different from the latter and closer to the former. Only one species, the type of the new subgenus *Quantula,* occurs within the limits of these studies; it has been widely disseminated by commerce.

KEY TO SUBGENERA (?) OF DYAKIA

A. Spermathecal stalk much longer than its sac or atrial vagina (shared with dart-sac); penial prepuce apparently absent; dart-gland consisting of 3 or more separate lobes; radula with shorter laterals and with at least outer marginals bicuspid; extra-limital:

B. Common duct of dart-gland short or absent; penis said to be enervated from cerebral ganglion;

C. Principal radular marginals mainly bicuspid; shell usually dextral ..... subgenus **Asperitas** Gude*.

CC. Principal radular marginals mainly unicuspid; shell sinistral ..... subgenus **Dyakia,** s. s*.

BB. Common (?) duct of dart-gland longer; principal marginals unicuspid ..... subgenus **Elaphroconcha** Gude*.

AA. Spermathecal stalk as short as its sac and much shorter than atrial vagina; penial prepuce short; dart-gland with 2 separable lobes; 6 subdivided lobules and subequally long common duct; radula with elongate laterals and with all outer marginals unicuspid; penis enervated from pedal ganglion; introduced by commerce into Fiji: ..... subgenus **Quantula,** new.

Dyakia (Quantula) striata (Gray), (pl. 47, figs. 6, 7).

Nanina striata Gray, 1834, Proc. Zool. Soc.: 59, without locality. *Helix striata* Pfeiffer, Monogr. **1**: 55 [**3**: 62]. *Ariophanta striata* Semper, 1870, Reisen **3**: 53, pl. 3, fig. 21; pl. 7, fig. 5, anatomy from Malay Peninsula: Singapore. *Hemiplecta striata* Gude, 1913, Proc. Malac. Soc. **10**: 330, Viti Levu: Suva.

Helix naninoides Benson, 1842, Ann. Mag. Nat. Hist. **9**: 486, Singapore; Pfeiffer, Monogr. **1**: 70 [**3**: 71-**4**: 58-**5**: 122-**7**: 125, 533]; Conch.-Cab. I: 193, pl. 25, figs. 7-8. *Nanina naninoides* Tryon, Manual **2**: 79, pl. 22, fig. 37.

[Malay Peninsula: Singapore.] Fiji (west): Viti Levu: BBM. 92345, dissected, 92349-50, under stones and logs, damp open hillside, 9 miles inland, alt. 700 ft., Masongo (Ladd! April 27, 1926).

Shell depressed conical (quite variable in height), distinctly angulate to near peristome (when depressed); tan-color and dull above, lighter and more glossy at apex and near peristome and much paler and fairly glossy below. Embryonic whorls almost 2.2, worn but evidently with fairly distinct low growth-threads when fresh. Later whorls with low, closely spaced growth-threads (almost 6 per mm. on 6th), crossed by about 15 irregular major spiral grooves and with quite distinct minor spiral striae, above; most of base with much weaker growth-threads and with slightly less prominent spirals (much sharper than in *Orpiella rubricata*); suture distinctly impressed; end of last whorl flaring noticeably and dropping slightly below angle of penult. Aperture fairly broad and evenly rounded; peristome weakly thickened internally, about 30° to shell-axis; columella shortly thickened and reflected, but hiding little of superficial perforation (17.5 times in shell diameter), which is closed internally by a horny callus.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	6 wh.	whs.
Gray	19	(32)	.....	.....	.....	.....	.....	.....
(naninoides)	.....	.....	.....	.....	.....	.....	.....	.....
Pfr. fig.	20.3	123(25)	.....	.....	.....	.....	.....	6
BBM. 92345	14.3	173(24.7)	151(21.6)	56(8.06)	151(12.15)	3.07	8.2(25.1)?	6—

Animal similar to Semper's account; foot pale; upper pedal groove jagged; tail with indistinct, discontinuous middorsal groove; caudal foss large; "horn" absent. Mantle-collar without shell-lobes except small umbilical one; right shell-lap deeper than left; anterior and posterior left mantle-lappets separated by almost width of former. Lung with much chalky-white deposit, very shallowly invaded by mantle-glands; about 4 times as long as base or thrice kidney length, which is 4 times its base or twice pericardial length; pulmonary vein with large, branched tributaries evident. Apical whorls also with chalky deposit. Talon short ovoid, weakly bipartite; carrefour a large, chalky-white, oblate spheroid. Free oviduct (UV; pl. 47, fig. 6) moderately long, with indistinct glandular zone. Spermatheca (S) with obovoid, thin walled sac and very short, thick walled stalk, opening into atrial vagina at base of dart-sac; vagina (YV) continuous with and about as long as dart-sac but thin-walled. Dart-gland (WG) appearing acinose but actually with clavate alveoli, surrounded by a thin sheath, without definite retractor and consisting of two distinct lobes, of which apical one is made up of four and basal one of two, subdivided lobules; ducts from each lobe joining (doubted by Semper) very shortly to form a common duct (WD), which is about as long as entire gland and opens through dart-papilla and dart. Dart-sac (WS) about half as long as body of gland, swollen apically; thick wall internally (pl. 47, fig. 7) with one low and two very weak pilasters, crossed by more conspicuous transverse grooves; dart-papilla (WP) filling about apical 1/3 of sac, with very small dart (WB) surrounded by fleshy tip so that only apex projects; dart as figured by Semper but almost black at base and only 0.8 mm. long or about 0.2 length of its papilla. Vas deferens (D; pl. 47, fig. 6) caught into penioviducal angle by ommatophoral retractor and gradually enlarging to form epiphallus (E) which contains 5 or 6 high narrow longitudinal folds and opens into penial apex (EP) through a marked constriction; penial retractor (PR) arising low on diaphragm and inserting around base of epiphallus with fibers to penial apex; penis proper (P) small, without free sheath, with thick wall, internally with numerous very fine, low wrinkles, which are mainly longitudinal but are more irregular and anastomose anteriad. Atrium apparently a long, thin walled tube, consisting of atrial vagina (YV), continuous with dart-sac and spermathecal stalk but demarcated by their much thicker walls, short penial prepuce (YP) and small atrium proper (Y), which opens close to base of inferior tentacle. Radula (excellently figured by Semper) has 22 elongate, tricuspid laterals (Semper found 18), with entocone becoming very weak on outer 7, and 69 marginals, of which inner 5 or 6 (Semper says 2) commonly have some trace of ectoconal notch but remainder are unicuspid; 89 rows counted.

Central nervous system similar to that of *Dendrotrochus ponapensis*. Right pleural connective shorter than, and left one about twice length of each cerebral ganglion. Three posterolateral pedal nerves present on each side; right lateral with branch also to dart apparatus. Buccal connectives shorter and stouter.

ZONITIDAE

The Zonitidae are certainly very closely related to the Helicarionidae but seem to represent a divergent series. The Trochomorphinae retain the most

endodontoid shell in the entire Limacea but have standardized the development of the marginal field of the radula farther than is usual in the more primitive members of the Helicarionidae. Although exceptions are not rare, this tendency to develop bicuspid or unicuspid teeth in all parts of the marginal field is rather characteristic of the Zonitidae. Also, taking the group as a whole, most of the shells are umbilicate and even when perforate or rimate lack the internal callus which is so common in the Helicarionidae.

The family name accepted here was employed by Mörch (1864). Gill (1871) used Vitrinidae, but the form Vitrinida dates back to Beck (1837) and is founded on the oldest genus included.

Key to Subfamilies of Zonitidae[2]

A. Caudal foss absent; outer marginals (at least) often with two or more cusps; right and left shell-lobes developed when shell is reduced;

B. Trochomorphinae: penis without appendages and enervated mainly from cerebral ganglion; free oviduct with vague glandular zone and vagina very short or absent; epiphallus usually small or poorly demarcated (at least in large species); radular ectocones often more reduced on laterals than on marginals; mantle without shell-lobes; sole without distinct divisions; upper pedal groove weak; lung without distinct minor venation even in large species; epidermis of shell usually with protractive or retractive striae ..... **Trochomorphinae.**

BB. Vitrininae: penis enervated from pedal ganglion and often developing glands or appendages; radular laterals (when present) usually tricuspid; mantle developing right and left shell-lobes; sole tripartite;

C. Radular laterals present; shell more or less external ..... **Vitrininae.**

CC. Radular central reduced and laterals absent; shell internal ..... **Plutoniinae*.**

AA. Zonitinae: caudal foss or boss usually represented; outer marginals always unicuspid; mantle without shell-lobes even when shell is reduced;

D. Spermatheca simple; penial dart-sac never developed;

E. Sole undivided; genital opening near inferior tentacle; free oviduct usually with glandular zone ..... **Vitreinae.**

EE. Sole tripartite or genital opening far more posteriad; glandular zone (often vague) restricted to vagina ..... **Zonitinae.**

DD. Spermatheca with branch to penial sheath; penial dart-sac often developed; sole undivided (typically without locomotor waves); free oviduct with glandular zone; genital opening far behind inferior tentacle ..... **Gastrodontinae.**

TROCHOMORPHINAE

The term Trochomorphidae was used by Möllendorff at least as early as 1890. Beside the groups discussed, *Coxia* Ancey (1887) and *Calostropha* Ancey (1887) may be included in the Trochomorphinae.

The minute shell sculpture in this subfamily is complicated by a tendency for the fine granulations of the epidermis to be arranged in retractive and usually also in protractive rows. Thus, criss-cross lines are superimposed on the fundamental structure of the shell, which is always oriented along the

[2] These are also included in the artificial key at the beginning of the present part.

spiral and growth axes. In some groups, in species, or even on the basal surface of the later whorls of individuals, this epidermal sculpture is weak or obsolete and the fundamental shell-structure shows on the surface or may be strengthened so that, for example, distinct spiral striae may be visible. In the following classification, some use is made of these differences in accentuation of one or more kinds of superficial sculpture, especially of those on the apical or visible side of the protoconch. Neverthless, their taxonomic utility should not be overemphasized. Being, so to speak, conflicts for dominance, the divergences are often somewhat fluctuating, may appear in obviously related species, and often disappear completely from old shells, because of apical erosion.

The Trochomorphinae agree with the Euconulini in two rather important characters: the absence of visible minor venation in the lung of even large species and the relatively weak differentiation of the epiphallus and spermatophore. On the other hand, the radula, with its greater uniformity throughout the marginal field, appears to be more standardized, as is rather characteristic of the Zonitidae. In the smaller species, the epiphallus is often relatively larger than in the larger ones, as if this structure approached an absolute minimum size; this is perhaps correlated with the law that the cells which compose an organ do not vary so much in size as in number.

Key to Intralimital Genera of Trochomorphinae

A. Spermatheca entering on penial side of peniovidual angle, or radular marginals with aculeate cusps, or centrals and laterals markedly tricuspid; shell with embryonic whorls smoothish, or with large carinal serrations, or with peristome deeply incised below periphery, or with some trace of parietal lamella; Palau and Caroline Islands (Truk and Lugunar:):

B. Vagina present; radular marginals without aculeate cusps; central and laterals tricuspid; shell with big carinal serrations or smoothish without lamellae; Caroline Islands: Truk:

C. Penis with hood-shaped vergic papilla; shell lenticular with carina produced into large triangular serrations ..... genus **Kondoa,** new.

CC. Penis without vergic papilla but stimulator with structure like a honeycomb; shell elevated and smoothish ..... genus **Hogolua,** new.

BB. Vagina absent or marginals with aculeate cusps; shell without carinal serrations and, if smoothish, with palatal lamellae;

D. Penis either without vergic papilla or with longitudinal folds; radular marginals with aculeate cusps; shell with criss-cross striae more or less evident on embryonic whorls (becoming smooth with wear) and with parietal lamella or with marked excision of peristome below periphery; Caroline Islands: Truk and Lugunar: ..... genus **Brazieria** Ancey.

DD. Penis with vergic papilla and large stimulator-thickening and with spermatheca opening into its base; radular marginals with broader shorter cusps; shell with embryonic whorls smoothish (with weak growth-lines and spirals), without parietal lamella or marked excision of peristome; Palau and westward: ..... genus **Videna** H. and A. Adams.

AA. Spermatheca entering vagina or atrium below oviduct; radular marginals without aculeate cusps; centrals and laterals almost unicuspid (often with ectoconal notches but rarely with distinct entoconal ones); shell with sculpture on embryonic whorls and without large carinal serrations, marked excision of peristome or parietal lamella; Society and Caroline Islands (Ponape and *T. approximata* from Truk; absent from Palau) westward: .....genus **Trochomorpha** Albers.

Genus **KONDOA,** new genus

Kondoa asteriscus, new genus and species (pl. 65, figs. 13-15; pl. 47, figs. 8-10).

Caroline Islands: Truk (Dublon Islet): BBM. 11496 (153067, dissected), under stones, alt. 300-650 ft., Mount Tolowan (Y. Kondo! Dec. 2, 1935).

Shell (pl. 65, figs. 13-15) roughly lenticular, with very coarsely serrated carina; umbilicate; thinnish with heavy chestnut-brown epidermis, dull above but glossy below; almost opaque, especially above. Embryonic whorls nearly 1.8, sharply and evenly carinate, soon assuming very weak minor growth-wrinkles and coarse rounded widely spaced (22 on last whorl), arcuate growth-costulae, crossed by inconspicuous shallow broken spiral striae (about 30 visible on last) above. Later whorls with similar minor growth-wrinkles and sharper, more widely spaced costulae, which extend on to hollow, triangular serrations of carina (26 on last whorl of type), but with spirals soon disappearing and with surface becoming minutely granulate and quite dull above; shading into more glossy surface shortly below carina, so that minor growth-wrinkles (major ones scarcely evident) and very obscure spirals are more apparent; with rounded angulation around umbilicus (running just inside attachment of columellar peristome); suture scarcely impressed but very sharply marked because each whorl attaches under carina and serrations of preceding one. Aperture narrow, rostrate at 80° to shell-axis; peristome about 35° to shell-axis, markedly arcuate above carina and less so again at circumumbilical angle but decidedly concave between; thickened internally along base and becoming narrowly reflected towards columellar wall, which is weakly reflected and thickened. Umbilicus with steep wall; 5.7 times in major diameter.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap	umbilicus	whs.
Type	3.05	291(8.88)	269(8.19)	65(1.98)	198(3.92)	5.7(1.57)	5.1

Animal similar to *Trochomorpha typus,* foot brownish with pale reticulation; tail somewhat pointed; pedal grooves meeting behind in acute angle. Mantle collar pale, quite heavy; left mantle-lappets slightly overlapping. Lung with mantle-glands deeply invading anterior end as cream (basal) and brown (apical) tongue-shaped mass; black with some pearl-like excrescences; 4.7 times as long as base or 2.6 times kidney length, which is 3.3 times its base or over twice pericardial length. Apical whorls with considerable black pigment, forming a broad band along columellar edge. Ovotestis consisting of 5 or 6 conoid groups of clavate alveoli in basal 0.4 of long attenuate apical lobe of liver; hermaphroditic duct 2.5 times as long as albumen gland (GG; pl. 47, fig. 8) and swollen near its base (GD); talon (GT) ovoid, obscurely bipartite; carrefour (X) conoid; uterus (UT) with relatively coarser folds in apical 2/3 and undivided below; free oviduct (UV) with vague, white-spotted glandular

zone; spermatheca (S) with elongate sac and short stalk; vagina (V) stouter and more distinct. Penial retractor (PR) arising high on left side of uterus and inserting near middle of epiphallus, which is loosely covered with black connective tissue that is continuous with outer layer of penial wall; lateral entrance of vas deferens (D) almost surrounded by a high fold, the end of which resembles a minuscule letter omega; epiphallus (E) sacculate, with a low pilaster opposite vas deferens, and entering apex of penis through a large hoodlike vergic papilla (PV; pl. 47, fig. 9), which is about twice as high as either long or broad; penis proper (P) ellipsoid, with a double pilaster (PP) along side opposite vergic papilla and with about 9 low longitudinal folds near base. Atrium (Y) moderately long, thin-walled; opening 4 or 5 times pedal groove interspace behind inferior tentacle or less than 1/3 distance from last to anterior edge of visceral stalk. Jaw quite deep, moderately thick, with distinct growth-striae and low (unevenly eroded) median lobe. Radula (pl. 47, fig. 10) has much broader, distinctly tricuspid central, 11 moderately elongate, tricuspid laterals, and 29 marginals, of which about 23 are bicuspid, 4 or 5 have 3 or more cusps and outermost is a mere denticle; 105 rows counted.

This remarkable new genus is named for Yoshio Kondo, who obtained it. The comparative whorl-sizes of *K. asteriscus* are given in the table for *Brazieria.*

Genus HOGOLUA, new genus

Hogolua kondorum, new genus and species (pl. 65, fig. 7; pl. 58, figs. 14-15; pl. 47, figs. 11-13).

Caroline Islands: Truk (Moen Islet): BBM. 11495 (153787, dissected), under stones and logs, alt. 900 ft., Mount Teroken (Y. Kondo! Dec. 27, 1935). (Dublon Islet): BBM. 153065, same mores, alt. 300-650 ft., Mount Tolowan (Kondo! Dec. 2).

Shell (pl. 65, fig. 7, pl. 58, figs. 14-15) with domical spire, with blunt but prominent angulation, marked off below by obscure sulcus (stronger in 153065), at periphery with a cord narrowing umbilicus, and with moderately convex base; bright tan-colored to brownish, with oily gloss above and below; heavy and opaque. Embryonic whorls about 1.7, with overriding suture; rather polished (in adults) but gradually assuming neanic surface. Later whorls glossy with very obscure growth-wrinkles and very superficial irregular microscopic granulation above and below; suture lightly impressed, attached at peripheral angle. Aperture subquadrate, obtusely and bluntly angulate at 100° to shell-axis; peristome almost 35° to shell-axis, moderately arcuate above peripheral angle and opposite circumumbilical one; broadly thickened internally until near columellar attachment, where it has become narrowly reflected. Umbilicus 5.8 times in shell diameter, narrowed by encircling cord, which dies out towards peristome, is not demarcated basally and is sharply bounded apically by an angular furrow.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
type	8.03	135(10.8)	127(10.2)	46(3.71)	133(4.93)	5.8(186)	6+

Animal similar to *Kondoa asteriscus,* but foot much darker; sole narrowly rounded posteriad. Mantle-collar black. Lung with mantle-glands invading as orange lobe; with irregular network of dark pigment, most evident along vein and hindgut; almost 5 times as long as base or 2.5 kidney length, which is 4 times its base or 2.3 pericardial length. Ovotestis consisting of 5 lenticular groups of alveoli in basal 0.8 of apical liver lobe; uterus (pl. 47, fig. 11) with gelatinous zone near apex and with finer folds elsewhere; spermatheca with relatively shorter sac (containing a membranous capsule) and longer stalk. Penial retractor inserting on penial apex; vas deferens entering through a pilaster; epiphallus relatively smaller, externally purplish brown, internally with weak folds, containing brownish material and entering side of penial apex through a thickened region (without distinct vergic papilla); penis proper containing (pl. 47, fig. 13) along right side a complex pilaster, of which apical half is enlarged into a big, bilobed stimulator (PP) that looks like honey-comb with white partitions and brownish interstitial substance (looks corneous but appears to be fairly soft and has concave surfaces inside each compartment) and of which basal half develops, in its middle third, a high subpyramidal wedge-shaped smoothish stimulator-papilla (PP′). Atrium longer, opening twice pedal groove interspace behind inferior tentacle. Jaw with distinct growth-striae and weak longitudinal ones and with low rounded median lobe. Radula (pl. 47, fig. 12) has central with smaller ectocones, 12 laterals with smaller entocone becoming obsolescent on last, and 26 marginals, of which 8 are strictly bicuspid, next 14 develop blade serrations, 3 are often definitely multicuspid and last is a mere denticle; 121 rows counted.

This species is named for Yoshio and Kiyoko Kondo. The shell of *Hogolua* is not very remarkable, but the animal shows that it is another primitive member of the subfamily and quite closely related to *Kondoa.* The stimulator-papilla is a very peculiar feature and the marginal field of the radula is far less uniform than is usual in Trochomorphinae.

Genus **BRAZIERIA** Ancey, 1887

Brazieria Ancey, 1887, Conch. Exch. 2:22; type by original designation *Helix velata* Hombron et Jaquinot.

Brazierella, new subgenus, type *B. minuscula,* new species.

Probrazieria, new subgenus, type *B. lutaria,* new species.

Entomostoma, new subgenus, type *B. entomostoma* (Hombron et Jaquinot) from Dublon Islet (BBM. 153311).

At least two of these new subgenera are distinct enough to warrant generic separation but the six species now included in the genus *Brazieria* are certainly more closely related to each other than to anything else. The marginal cusps are truly aculeate and give the radula a decided resemblance to that in most holarctic Zonitidae. In fact, on the basis of radula alone, *Brazieria,* s. s. might easily have been included in the Vitreinae.

Key to Subdivisions and Forms of Brazieria

A. Penial retractor arising from diaphragm and inserting at subapical entrance of epiphallus into penis; vagina absent; principal marginals unicuspid; shell without evident parietal lamella and with criss-cross striae strongest on later whorls..... .....subgenus **Probrazieria, new.**

B. Radular central and laterals tricuspid; shell smaller, subequally dull above and below and with parietal lamella represented by a very low thickening; Truk (Dublon Islet): .....section **Probrazieria,** s. s.: **B. lutaria,** new species.

BB. Radular central and laterals almost unicuspid; shell larger, more glossy below and without trace of parietal lamella; Truk (Dublon Islet): .... section **Entomostoma,** new: **B. entomostoma** (Hombron et Jaquinot).

AA. Penial retractor arising from columellar muscle and inserting on penial apex; shell with large parietal lamella and with criss-cross striae strongest on embryonic whorls;

C. Epiphallus entering through vergic papilla very near penial apex; vagina present; radular central tricuspid and laterals and marginals bicuspid; shell small, thread-carinate and basally dullish with distinct sculpture; Truk (Tol Islet): ....subgenus **Brazierella,** new: **B. minuscula,** new species.

CC. Epiphallus entering far below penial apex; vagina absent; radular central and laterals practically and marginals strictly unicuspid; shell larger, subcarinate to angulate and basally quite polished .....subgenus **Brazieria,** s. s.

D. Shell with distinct growth-threads stopping at supracarinal sulcus;

E. More than twice as broad as high.....**B. velata** (Hombron et Jaquinot).

F. Shell with more irregular and weaker growth-threads and narrower or less distinct peripheral smooth zone; epiphallar entrance partially surrounded by very high hoodlike fold; Truk (Param, Moen, and Tol Islets): ..... typical subspecies.

FF. Shell with more regular and stronger growth-threads and broader, more evident smooth zone; Nomoi (Luganar): ....subspecies **brazieri,** new.

EE. Less than twice as broad as high, with strongest sculpture above; Truk (Tol Islet): subfossil .....**B. obesa,** new species.

DD. Entrance of epiphallus through vergic papilla formed by enlargement of a lower fold; shell with weak and irregular growth-wrinkles dying out at peripheral angle; Truk (Dublon Islet):.....**B. erasa,** new species.

Comparative whorl-sizes in Truk Trochomorphinae

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	6 wh.	Maxima	Index
K. asteriscus	1.44	4.5(6.45)	5.2 (7.50)	6.0 (8.69)	6.8 (9.8)?	.....	5.1	291
H. kondorum	1.95	.....	.....	4.5 (8.79)	5.0 (9.70)	5.5(10.8)	6+	135
B. minuscula	1.15	2.7(3.06)	3.0 (3.41)	3.3 (3.8)?	.....	.....	4¾+	171
B. lutaria	2.35	3.8(8.86)	4.4(10.3)?	5.5(12.9)?	.....	.....	4¼—	199
	2.34	3.8(8.84)	4.5(10.5)?	5.6(13.2)?	.....	.....	4¼—	213
B. entomostoma	2.63	.....	5.3(14.0)	6.3(16.6)	7.4(19.5)	8.7(23.0)?	6—	226
B. velata	1.62	3.4(5.53)	4.0 (6.51)	4.6 (7.46)	5.4 (8.7)?	.....	5¼—	216
Tol	1.61	3.3(5.28)	4.0 (6.47)	4.6 (7.44)	5.4 (8.7)?	.....	5.2+	221
Moen	1.62	3.3(5.42)	3.8 (6.22)	4.4 (7.07)	5.2 (8.4)?	.....	5.1	206
B. v. brazieri	1.61	3.4(5.49)	4.0 (6.37)	4.7 (7.6)?	5.5 (8.9)?	.....	4.8—	218
B. obesa	1.63	3.4(5.56)	4.0 (6.51)	4.5 (7.31)	5.0 (8.09)	5.5 (9.0)?	5.7	177
B. erasa	1.63	.....	4.1 (6.75)	4.8 (7.82)	5.6 (9.16)	.....	5.5+	212
T. approximata	1.79	.....	4.6 (8.19)	5.7(10.15)	6.8(12.1)	7.4(13.2)	6¼	180

Dimensions in Brazieria

	alt.	maj. diam.	min. diam..	alt. ap.	diam. ap.	umbilicus	whs.
B. minuscula							
type	2.13	171 (3.64)	160 (3.42)	51(1.09)	144(1.57)	5.0(0.73)	4¾+
B. lutaria							
type	4.72	199 (9.37)	187 (8.81)	57(2.67)	161(4.30)	6.8(1.38)	4¼—
type lot	4.59	213 (9.78)	191 (8.78)	63(2.90)	160(4.64)	8.0(1.22)	4¼—
B. entomostoma							
H. et J.	.....	(23)	.....	.....	.....	.....	.....
fig.	9.9	232(23)	215(21.3)	67(6.6)	147(9.7)	5.3(4.34)	
BBM. 153311	10.15	226(22.9)	205(20.8)	71(7.25)	138(9.99)	4.8(4.75)	6—
B. velata							
H. et J.	.....	(7)	.....	.....	.....	.....	.....
fig.	3.1	225 (7)	209 (6.5)	68(2.1)	166(3.5)	9.3(0.75)	
BBM. Param	3.72	216 (8.03)	197 (7.34)	64(2.37)	157(3.72)	5.2(1.53)	5¼—
BBM., Tol	3.56	221 (7.88)	205 (7.30)	68(2.42)	140(3.38)	4.5(1.77)	5.2+
BBM., Moen	3.54	206 (7.30)	189 (6.70)	66(2.34)	146(3.42)	7.3(1.00)	5.1
B. v. brazieri							
type	3.26	218 (7.10)	198 (6.45)	74(2.41)	142(3.43)	6.2(1.15)	4.8—
B. obesa							
type	4.89	177 (8.66)	162 (7.94)	53(2.58)	163(4.21)	8.0(1.08)	5.7
B. erasa							
type	4.34	212 (9.19)	197 (8.54)	55(2.37)	170(4.03)	6.1(1.50)	5.5+

Brazieria (Brazierella) minuscula, new species (pl. 65, fig. 10; pl. 59, figs. 14, 15; pl. 48, figs. 1-3).

Caroline Islands: Truk (Tol Islet): BBM. 11499 (155113, dissected), under stones, alt. 1,422 ft., top of Mount Urupot (Y. Kondo! Jan. 4, 1936).

Shell (pl. 65, fig. 10; pl. 59, figs. 14-15) similar to *B. velata* but much smaller, with domical spire, with whorls almost equally convex above and below and with a decided thread-carina, marked off by sharp sulci above and below; tan-color, slightly darker above and for a short distance below carina than on most of base; dullish above and below. Embryonic whorls about 1.7, assuming more irregular but similar criss-cross striae (relatively coarser); suture more impressed. Later whorls with much more regular and actually higher, rounded growth-threads (similarly stopping at carinal sulcus, slightly narrower than their interspaces and 11 per mm. on early 5th) above; base with evident growth-threads and scarcely diminished criss-cross sculpture; suture more impressed and attached just under carina. Aperture somewhat broader, rostrate at 90° to shell-axis; peristome averaging about 10° to shell-axis, less broadly emarginate below carina but more arcuate near center of base, and less expanded but with relatively thicker internal callus below; parietal lamella relatively shorter and so appearing higher, more inclined away from aperture.

Animal also similar but foot pale unicolor. Mantle-lobes pale and left lappets almost touching. Lung with similar but more bands; 6 times as long as base or 2.6 kidney length, which is over 4 times its base. Apical whorls with scalloped black band above. Ovotestis with less alveoli in each group; talon (pl. 48, fig. 1) relatively larger; free oviduct much more elongate, with glandular zone divided into two subequal parts, of which upper has much larger white spots; vagina short but distinct. Prostate with a single row of clavate alveoli (like in many minute species); epiphallus much more sharply demarcated and relatively larger, entering very near penial apex through a large, apically free vergic papilla (PV; pl. 48, fig. 3); penis fusiform, in-

ternally with two long and heavy but low pilasters that connect below vergic papilla, and with a shorter one near base. Atrium shorter. Radula (pl. 48, fig. 2) has oblong, tricuspid central, about 5 bicuspid laterals (without entocone), and 25 marginals, which all have 2 aculeate cusps, a large mesocone and a smaller ectocone; 81 rows counted.

Brazieria (Probrazieria) lutaria, new species (pl. 65, fig. 8; pl. 59, figs. 10, 11; pl. 47, figs. 14, 15).

Caroline Islands: Truk (Dublon Islet): BBM. 11497 (153150), dissected, under stones and logs, alt. 800-950 ft., Mount Tolowan (Y. Kondo! Dec. 18, 1935).

Shell (pl. 65, fig. 8; pl. 59, figs. 10-11) similar to *B. velata* but larger and relatively thinner, with more rapid whorl-increase and with whorls almost equally convex above and below periphery; angle without superior sulcus but broadly and weakly concave below; pale brownish and dullish above and below, tending to accumulate dirt. Embryonic whorls 2.1, soon assuming low but distinct growth-wrinkles and traces of spiral striae but very gradually assuming much weaker criss-cross striae. Later whorls with growth-wrinkles becoming weaker (often only evident near suture) but with criss-cross lines becoming stronger both above and below; suture less sharply but more broadly impressed and not attaching below angle. Aperture broader, angulate at about 90° to shell-axis; peristome 30° to shell-axis, less thickened internally and less markedly concave and expanded below; parietal callus with lamella only represented by a very slight thickening (scarcely noticeable). Umbilicus 6.8 and 8.0 (only 2 shells seen) in major diameter.

Animal similar to *B. entomostoma*; foot (contracted) grayish; tentacles black. Mantle-collar grayish; left mantle-lappets narrowly separated. Lung pale with few small white dots and pearly excrescences. Ovotestis consisting of 5 groups of alveoli; albumen gland shorter and stouter; talon relatively larger, with black pigment; uterus without folds but distended basally by a very large, long ellipsoid, chalky shelled egg. Epiphallus (pl. 47, fig. 15) entering slighty below conical apex of penis, which contains a higher and thinner pilaster and a more ruffled stimulator. Jaw thin, without median lobe. Radula (pl. 47, fig. 14) has squarish, tricuspid central, 8 tricuspid laterals and 33 marginals, of which inner 2 or 3 are bicuspid (as in Gastrodontinae); 101 rows counted.

Brazieria (Entomostoma) entomostoma (Hombron et Jaquinot), (pl. 48, figs. 4-6).

Helyx entomostoma Hombron et Jaquinot, 1841, Ann. Sci. Nat. [2] (Zool.) **16**:63, Hogoleu. *Helix entomostoma* Hombron et Jaquinot, Voy. Pôl Sud, livr. *22*: pl. *7*, figs. *22-25*; Rousseau, **5**:25; Pfeiffer, Monogr. **4**:113 [3:273-**5**:185-**7**:206]; Tryon, Manual 3:*79*, pl. 15, figs. 43-45.

Caroline Islands: Truk [Dublon Islet]. BBM. 153311, dissected (Y. Kondo! Dec. 20, 1935).

Shell similar to *B. lutaria* but far larger, with whorls appearing more flattened above; peripheral carina with broad shallow sulcus above and another below; epidermis brighter chestnut and decidedly more glossy below than above. Embryonic whorls 2.1, somewhat worn, but apparently with similar sculpture. Later whorls also with similar growth-wrinkles (5.6 per mm. on 6th) and criss-cross striae above but more glossed below (approaching base of *B. velata*). Peristome averaging about 40° to shell-axis, emarginate near suture and deeply so below carina (as in *B. velata*); narrowly reflected below. Parietal callus without trace of lamella. Umbilicus encircled by a blunt angulation which is marked off internally by a sulcus.

Animal similar to *B. velata*; often with pearly excrescences; foot brown with pale reticulation. Mantle-collar spotted with brown; left mantle-lappets almost touching. Lung with similar markings and with sparse clumps of chalky-white dots; over twice as long as kidney, which is 2.4 times pericardial length. Apical whorls with chalky-white along blood-vessels. Carrefour with hard white lobe extending above talon. Uterus (pl. 48, fig. 5) transversely folded; free oviduct relatively longer; spermatheca with large bursa, containing a membranous sac (spermatophore?). Penial retractor arising from diaphragm on left side and near base of uterus and inserting around epiphallar entrance; epiphallus slightly better marked, attached by ligament to side of penis, containing numerous wavy longitudinal folds and entering near penial apex through a thickened area (no distinct vergic papilla); penis relatively smaller, long ellipsoid and internally (pl. 48, fig. 4) with a heavy but low pilaster (PP) and a big bipartite stimulator-thickening (PP′). Atrium short. Jaw heavy with weak growth-lines but with distinct longitudinal striae in central area, with very low rounded median lobe. Radula (pl. 48, fig. 6) has broad, practically unicuspid central, 13 or 14 laterals with at most a trace of ectoconal notch, and 69 aculeate marginals; 140 rows counted.

Brazieria (s. s.) velata (Hombron et Jaquinot), (pl. 65, fig. 12; pl. 48, figs. 7-9).

Helyx velata Hombron et Jaquinot, 1841, Ann. Sci. Nat. [2] (Zool.) **16**: 64, Hogoleu. *Helix velata* Hombron et Jaquinot, Voy. Pôl Sud, livr. 22: pl. 6, figs. 29-32; Rousseau, **5**: 20; Pfeiffer, Monogr. **4**: 155 [**3**: 273-**5**: 222-**7**: 260]; Tryon, Manual, 3: 61, pl. 11, figs. 89-91.

Caroline Islands: Truk [Param Islet]. BBM. 155665, dissected, flat, 200 ft. inland, alt. 3 ft. (K. and Y. Kondo and S. Ito! Jan. 7, 1936). (Moen): BBM. 153699, subfossil (pl. 65, fig. 12), approaching *brazieri*; ¼ mile inland, alt. 4-5 ft. (Dec. 27). (Tol): BBM. 155505, with weaker growth-wrinkles and lower spire; Mount Urupot, alt. 1,400 ft. (Jan. 3).

Shell lenticular, with whorls flattened above and convex below periphery, sharply and acutely angulate, subcarinate (sharp sulcus above but not below); umbilicate; light chestnut-brown, dull and opaque above; tan-colored, with circumumbilical band and narrow subperipheral edging darker, rather polished and weakly translucent below. Embryonic whorls 1.8, gradually assuming slightly irregular, protractive and retractive striae that mark off low subquadrate beads; suture overriding. Later whorls developing somewhat irregular, angular or rounded, closely spaced (8-9 per mm. on 5th) growth-threads (weaker and more irregular in 155505 but stronger and more regular in 153699) that extend only to carinal sulcus, but with criss-cross striae becoming weaker (so that granulation almost appears to be spirally arranged) above; base with extremely weak growth-wrinkles and faint, irregular, spiral striae (stronger in 155505); suture narrowly impressed, attached at or even slightly below (most so in 155505) angle and so rendered marginate by carinal sulcus. Aperture narrow, angulate at around 75° to shell-axis; peristome averaging about 20° to shell-axis, slightly arcuate and with weak internal thickening above angle and deeply and broadly excised (concave), narrowly expanded and with heavy internal callus below; columella wall less reflected and thickened; edge of parietal callus built up into high, subvertical, almost rectangular to crescentic (155505) lamella, which is concave away from and slopes very steeply on side towards aperture. Umbilicus steep-sided.

Animal similar to *Trochomorpha typus* but foot pale with irregular brown blotches, that tend to form radiating bars across and above pedal grooves; top of head with pale dorsomedian stripe bordered by broad vague brownish bands; lower pedal grooves meeting behind in an acute angle; sole narrowly rounded, almost pointed posteriad.

Mantle-collar pale; mantle-lobes edged with darker and left ones overlapping. Lung with mantle-glands invading as a whitish, tongue-shaped lobe; with irregularly transverse black bars alternating with colorless areas that contain chalky-white spots; 5 times as long as base or 2.4 kidney length, which is 2.3 times pericardial length. Ovotestis (G; pl. 48, fig. 9) consisting of 11 flattened conoid groups of clavate alveoli, imbedded in basal 2/3 of apical liver lobe; hermaphroditic duct (GD) fairly long; carrefour (X) sacculate. Uterus (UT) with folds in lower end only; free oviduct (UV) long, with extensive, white-spotted, poorly demarcated, glandular zone (UG); spermatheca (S) with long-ellipsoid sac and slender stalk, which enters atrium on male side of penioviducal angle. Vas deferens (D) gradually enlarged into poorly developed, yellowish epiphallus (E), which enters (EP; pl. 48, fig. 8) between apical and middle thirds of penis, through a fork in longest pilaster (PP). Penial retractor (PR, contracted) arising from columellar muscle above posterior edge of diaphragm and a short distance below origins of right and left free retractors; inserting on penial apex. Penis with enlarged apical half containing (pl. 48, fig. 8) two broad thin longitudinal folds (PP′ and PP″), of which one nearest epiphallic entrance (PP′) attaches to a much higher heavy, shining, yellowish, hood-shaped fold (PV) that is thickened by another one on side toward epiphallic pore (EP) and curves below last to join a heavy, but much lower pilaster (PP); basal half slender and containing only a continuation of PP. Atrium (Y) quite long and stout, opening as a vertical slit 2 or 3 times pedal groove interspace behind inferior tentacle. Buccal mass ellipsoid; salivary glands apparently fused above oesophagus. Jaw deep, with fairly sharp growth-lines and longitudinal striae and a prominent, rounded median lobe. Radula (pl. 48, fig. 7) has a squarish, practically unicuspid central, 6 laterals, with ectoconal notch most evident on last, and 19 unicuspid, quite aculeate marginals, of which last is a mere denticle; 92 rows counted.

The form from Param seems to be closest to Hombron et Jaquinot's figure of *B. velata;* their artist has considerably over-accentuated the growth-wrinkles on the base.

Brazieria (s. s.) velata brazieri, new subspecies.

Endodonta velata Pilsbry, 1893, Manual **9**:29, pl. 5, figs. 49-51, Lugunar.

Caroline Islands: Lugunar (= Lukunor or Rukunoru, in Nomoi or Mortlock Group, about 200 miles southeast of Truk?): ANSP. 47730 (John Brazier!).

Shell similar to typical subspecies but attaining less whorls, with considerably stronger and more regular growth-threads (6.4 per mm. on 5th whorl) and with smooth zone just above angle wider (about 0.3 mm.) and more evident.

Brazieria (s. s.) obesa, new species (pl. 60, fig. 15).

Caroline Islands: Truk (Tol Islet): BBM. 155631, subfossil, Netata Village, alt. 30-300 ft. (S. Ito! Jan. 4, 1936).

Shell similar to *B. velata brazieri* but attaining more whorls, with considerably more elevated, fornicate spire, which about equals the also more convex base; chalky white and apparently heavier. Later whorls with growth-threads (7 per mm. on 6th) slightly heavier (although worn) above. Aperture narrower.

Although much larger, *B. obesa* slightly resembles *B. minuscula* from the same islet.

Brazieria (s. s.) erasa, new species (pl. 65, fig. 11; pl. 59, figs. 12, 13; pl. 48, fig. 10).

Caroline Islands: Truk (Dublon Islet): BBM. 11489 (153153, dissected), under stones, alt. 850-900 ft., Mount Tolowan (Y. Kondo! Dec. 18, 1935).

Shell (pl. 65, fig. 11; pl. 59, figs. 12-13) similar to *B. velata* but attaining a larger size; less sharply angulate and without trace of supracarinal sulcus; more glossy above; angle and entire base tan-color. Embryonic whorls polished by wear but with traces of criss-cross striae near suture. Later whorls with much weaker and more irregular growth-wrinkles (6.8 per mm. on late 5th), which die out gradually toward peripheral angle, and with faint criss-cross striae disturbed by spiral injury-grooves above. Peristome averaging about 30° to shell-axis. Parietal lamella heavier.

Animal also similar. Shell-lap pigmented. Lung with less black pigment. Uterus more sacculate. Spermatheca containing membranous sac (spermatophore?) with whitish contents. Interior of swollen apical part of penis (pl. 48, fig. 10) with similar PP″ fold; PP′ fold much larger and more fimbriate, divided into two subequal wings, of which lower expands around epiphallic opening, and attached along apical 2/3 of its length to a narrower, white, shining PV-fold that enlarges at its lower end into a big soft vergic papilla, with the fimbriate epiphallic opening (EP) at its rhomb-shaped apex. Slender part of penis with PP-pilaster breaking into oblique folds before reaching enlarged apical region. Jaw with very low median lobe. Radula has 11 laterals, with just a trace of an ectoconal notch, and 30 marginals; 104 rows counted.

On the basis of the shell alone, I was inclined to call *B. erasa* a subspecies of *B. velata,* but the peculiarities in penial structure were fundamentally identical in two specimens of each species. The divergence in number of radular teeth also seemed too great for the difference in size.

Genus VIDENA H. and A. Adams, 1858

Discus Albers, 1850, Die Heliceen I: 117; type by subsequent designation of Albers-Martens, 1861, 2d ed.: 62, *Helix metcalfei* Pfeiffer, 1845, Proc. Zool. Soc.: 66, from Philippines: Zebu: Sibonga. Not *Discus* Fitzinger (1833).

Videna H. and A. Adams, 1858, Genera Moll. II: 115; type by substitution for *Discus* Albers, *Helix metcalfei* Pfeiffer; same type by subsequent designation of Kobelt, 1880, Illust. Conch.: 226.

Disculus Schaufuss, 1869, Cat. Paetel, ed. 1: 13, substitute for *Discus* Albers; type *Helix metcalfei* Pfeiffer.

Trochomorpha (Albers) Semper, 1873, Reisen 3: 113, pl. 4, fig. 2, anatomy of type species; Wiegmann, 1898, Abhandl. Senckenberg. Naturf. Ges. 24 (3): 431-4, pl. 27, figs. 26-35, anatomy of *Videna timorensis* (Martens) from north Halmahera.

Peleliua, new subgenus, type *Videna pagodula* (Semper) from Peleliu (BBM. 154631).

Periryua, new subgenus, type *Videna oleacina* (Semper) from Peleliu (BBM. 154630).

Key to Palau Subdivisions and Species of Videna

A. Radular central and laterals definitely tricuspid and marginals with broader blades; shell smaller, with relatively stronger growth-threads and very thin pale epidermis, markedly carinate ..... subgenus **Peleliua**, new.

B. Attachment of penial retractor and epiphallic entrance apical; vergic papilla subglobose; radular central and laterals broader, with large side cusps; shell lenticular with subdomical spire ..... **V. pumila**, new species.

BB. Penial retractor and epiphallus more laterad; vergic papilla smaller and more elongate; radular central and laterals longer, with smaller side cusps; shell more elevated (but quite variable in height) and spire with concave outlines..... **V. pagodula** (Semper).

AA. Radular central almost unicuspid, laterals without entocone and marginals with slenderer blades; shell larger, with relatively weaker growth-wrinkles and thicker, amber-colored epidermis ..... subgenus **Videna**, s. s.

C. Attachment of penial retractor and epiphallic entrance almost apical; vergic papilla much broader and open full length; radular central and laterals broader and marginals with mesocone distinctly larger than ectocone; shell more elevated, obtusely angulate with low thread carina and with waxy surface; aperture containing two low, spirally entering, lamellar thickenings, one above and one below periphery ..... section **Periryua**, new: **V. oleacina** (Semper).

CC. Retractor and epiphallus lateral; vergic papilla elongate, with small anterior orifice; radular central and laterals elongate and marginals with subequal cusps; shell lenticular, strongly carinate, and with dullish surface; aperture without lamellar thickenings..... section **Videna**, s. s.: **V. electra** (Semper).

Dimensions in genus Videna

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
V. pumila							
type	4.46	204 (9.08)	195 (8.70)	57(2.54)	143(3.63)	4.4(2.05)	4¾—
V. pagodula							
Semper	5.75	122 (7)	113 (6.5)	.....	.....	.....	7
BBM. 154631	5.30	120 (6.37)	118 (6.26)	28(1.49)	166(2.47)	3.3(1.95)	7.5+
V. oleacina							
Semper	11	136(15)	127(14)	.....	.....	.....	5.5
	9.5	189(18)	179(17)	.....	.....	.....	6
BBM. 154630	9.79	153(15.0)	141(13.8)	48(4.72)	161(7.61)	15.2 (.99)	5¾+
V. electra							
Semper	6.5	262(17)	231(15)	.....	.....	.....	6
	7	243(17)	214(15)	.....	.....	.....	6
BBM. 154690	6.72	225(15.1)	213(14.3)	53(3.54)	190(6.74)	6.0(2.52)	5.7+

Comparative whorl-sizes

	1½	4.5 wh.	5 wh.	5.5 wh.	6 wh.	7 wh.	Index
V. pumila	2.05	4.3 (8.72)	4.8 (9.8)?	.....	.....	.....	204
V. pagodula	1.54	.....	2.5 (3.83)	.....	3.1 (4.77)	3.8 (5.92)	120
V. oleacina	2.45	4.6(11.2)	5.1(12.6)	5.6(13.8)	6.3(15.5)?	.....	153
V. electra	1.92	5.3(10.1)	6.5(12.4)	7.6(14.6)	8.9(17.1)?	.....	225

Videna (Peleliua) pumila, new species (pl. 65, fig. 6; pl. 55, figs. 13, 14; pl. 48, figs. 11-13).

(?) *Trochomorpha swainsoni* (Pfeiffer) Semper, 1873, Reisen 3: 119, Peleliu; not of Pfeiffer.

Palau: Peleliu (= Periryu): BBM. 11494 (154714, dissected), under stones, alt. 20-30 ft., near Asias School (Y. Kondo! April 29, 1936).

Shell (pl. 65, fig. 6; pl. 55, figs. 13-14) lenticular with low subdomical spire, markedly carinate, with thin, practically colorless epidermis, dullish and opaque above and below. Embryonic whorls 1.9, with overriding suture, appearing smoothish, but soon assuming extremely fine, closely spaced, wavy and often anastomosing growth-striae and wrinklets. Later whorls developing coarser, low but sharp, irregularly but quite widely spaced (6.4 per mm. on 5th) major growth-threads, with weak, rather irregular, protractive and retractive striae superimposed on them, above; base with almost equally strong growth-threads but with criss-cross striae much more irregular; suture not much impressed, but attached at edge of or slightly below carina and so rendered marginate by supracarinal sulcus. Aperture rostrate at 90° to shell-axis; peristome over 30° to shell-axis, weakly arcuate and lightly thickened internally above, heavily thickened internally below and markedly arcuate near columella, which is slightly reflected; parietal callus heavy and sometimes noticeably thickened along edge. Umbilicus steep-sided, 4.4 times in shell diameter.

Animal similar to *Trochomorpha typus*; foot pale with few irregular black spots; head with black area behind each pale ommatophore; tail compressed laterally and decidedly angulate above; pedal grooves meeting behind in acute angle; sole longer and narrower, almost pointed posteriad. Mantle-collar with fine black dots; left mantle-lappets separated by a small gap. Lung with mantle-glands invading as an ochraceous lobe; pale, with broken rows of chalky spots along hindgut and around kidney; 4.5 times as long as base or 2.2 times kidney length. Apical whorls seeded with fine white dots that form a reticulum like fine lace. Ovotestis consisting of 11 or 12 subglobular masses in basal 2/3 of apical liver lobe; talon (pl. 48, fig. 12) relatively larger (as usual in small species); carrefour chalky-white; uterus coarsely sacculate, sometimes with chalky deposit in middle third; free oviduct relatively shorter, with yellow-spotted glandular zone. Spermatheca short-stalked with elongate sac, entering apex of a very poorly marked continuation of atrium and a short distance above free oviduct. Vas deferens as wide as prostate for some distance after leaving latter; epiphallus small, sharply demarcated but not much differentiated, entering penial apex through a large, sacculate, subglobose vergic papilla (PV; pl. 48, fig. 11), which is attached along left side of penis. Penial retractor inserting around epiphallus on penial apex; penis proper relatively small, ellipsoid, and internally (pl. 48, fig. 11) with a low double pilaster extending from vergic papilla to a higher, ovoid stimulator-thickening (PP). Atrium apparently with a triangular continuation, which extends up right side of anterior third of penis, but which is demarcated only by its slightly thinner walls; atrium proper moderately long, opening as far behind inferior tentacle as distance between pedal grooves. Jaw with extremely low rounded median lobe. Radula (pl. 48, fig. 13) has squarish, tricuspid central, 12 tricuspid laterals, and 27 rather broad, bicuspid marginals, on which mesocone and ectocone become gradually almost equal in size; 125 rows counted.

V. pumila does bear a distant resemblance to young specimens of the more depressed form of *Trochomorpha swainsoni,* but the citation of Semper's undoubtedly erroneous identification in the synonymy of the former is merely a suspicion.

Videna (Peleliua) pagodula (Semper), (pl. 65, fig. 9; pl. 59, fig. 4; pl. 48, figs. 14-16).

Trochomorpha pagodula Semper, 1873, Reisen 3 (2) : 119. *Helix pagodula* Pfeiffer, Monogr. 7 : 575.

Palau: [Peleliu:]. BBM. 154631, under stones, alt. 50-75 ft., Ngalkol (Y. Kondo! April 21, 1936).

Shell (pl. 65, fig. 9; pl. 59, fig. 4) similar to *V. pumila* but considerably more elevated (although often less so than in shell figured), with subdomical apex but with spire as a whole with markedly concave outlines; with wider, often uptilted carina. Embryonic whorls 2.1, quite polished but with shallow, more widely spaced growth-striae. Later whorls with slightly stronger and more widely spaced major growth-wrinkles but with such weak criss-cross striae that spiral structure of shell shows through them; base more glossy but with quite strong growth-wrinkles and weak wavy spiral striae; suture usually attached below and often considerably under carina. Umbilicus varying in size in opposition to elevation of shell.

Animal also similar, but foot with row of black spots between pedal grooves and with another between ommatophores and otherwise pale. Mantle-collar with fewer black dots. Lung with black spots, often forming short transverse bars and with two rows of chalky ones along hindgut; 6 times as long as base or almost thrice kidney length. Apical whorl very long and attenuate, with row of alternating black and chalky blotches on upper surface. Hermaphroditic duct longer and more convoluted; albumen gland longer; carrefour relatively smaller; uterus more elongate and without chalky area; free oviduct (pl. 48, fig. 16) entering atrium some distance below base of penis. Spermatheca entering near base of penis and farther from free oviduct. Epiphallus longer, not quite so sharply demarcated apically and entering laterally near apex of penis through a relatively smaller, more elongate vergic papilla (PV; pl. 48, fig. 15) Penial retractor inserting down side of penial apex; penis with a small apical caecum containing vergic papilla and internally with large, roughly O-shaped stimulator-thickening. Atrium opening twice pedal groove interspace behind inferior tentacle. Radula (pl. 48, fig. 14) has more elongate central with smaller ectocones, 13 elongate laterals, with smaller side cusps and with entocone largest on 2d and 3d and obsolescent on last two, and 26 marginals with even broader blades; more than 114 rows.

Videna (Periryua) oleacina (Semper), (pl. 55, figs. 9, 10; pl. 49, figs. 1-3).

Trochomorpha oleacina Semper, 1873, Reisen 3 : 118, Nermalck bei Coröre und Peleliu. *Helix oleacina* Pfeiffer, Monogr. 7 : 575; Conch.-Cab. IV: 536, pl. 163, figs. 13-15; Tryon, Manual 3 : 77, pl. 14, figs. 21-23.

Palau: Peleliu: on limestone. BBM. 154630, 154635, on ground, under stones, alt. 50-75 ft., Ngalkol (Y. Kondo! April 21, 1936).

Shell (pl. 55, figs. 9-10) variable in height but less so than Semper's dimensions would indicate; with waxy gloss above and quite polished below. Embryonic whorls 2.3, with growth-striae like *V. pagodula*. Later whorls with weak major (6.4 per mm. on early 6th) and very weak minor growth-wrinkles above and with minor ones obsolescent below. Aperture with a low but broad, rounded, spiral thickening, extending in about ⅛ whorl and dying out toward peristome, above rostral groove, and a distinct but rounded, narrower lamella, about ¼ whorl in length, below, both of which become obsolescent with age; columellar region of peristome heavily thickened internally.

Animal similar to *V. pumila* but foot orange with black spots, which on top of head form one or three dorsomedian stripes and also bands along sides and across between

black tentacles. Mantle-collar paler; mantle-lobes with few black spots. Lung with numerous black and chalky-white spots that tend to form three longitudinal bands; kidney about 4 times as long as its base or 2.3 pericardial length. Top of apical whorls black, with chalky markings like letters S, U, O, etc. Hermaphroditic duct more or less sheathed in black tissue. Free oviduct (pl. 49, fig. 1) with poorly marked glandular zone; spermatheca entering near base of penis. Spermatophore, found in penis, and showing externally as a ridge (SP), with smaller end touching vergic papilla and larger at spermathecal entrance, about 6 times as long as greatest diameter, with extremely thin and flexible but apparently corneous, brownish wall and with a thicker seam down one side. Epiphallus represented only by a short gradual enlargement of vas deferens, connected to penis by ligaments and opening almost apically through a large vergic papilla (PV; pl. 49, fig. 2) that is open full length, although its walls overlap, and is attached along left wall of penis. Penial retractor arising halfway up uterus and inserting almost apically. Penis proper containing a low pilaster, that extends from vergic papilla to flat, subcircular, centrally depressed stimulator-papilla (PP). Atrium opening 4 or 5 times pedal groove interspace behind inferior tentacle. Jaw rather thin, with weak median lobe. Radula (pl. 49, fig. 3) has oblong central with at most one oblique ectoconal notch, 15 laterals with distinct ectoconal notches and 48 elongate, bicuspid marginals, with mesocone noticeably larger than ectocone on all; 144 rows counted.

The lamellar thickenings of the aperture in *V. oleacina* are a very peculiar feature, but the animal evidently is related to the other Palau species included in *Videna.*

Videna (s. s.) electra (Semper), (pl. 59, figs. 1-3; pl. 49, figs. 4-6).

Trochomorpha electra Semper, 1873, Reisen 3: 119, Nermalck bei Coröre und Peleliu. *Helix electra* Pfeiffer, Monogr. 7: 576.

Palau: Peleliu: on limestone. BBM. 154690, dissected, arboreal, alt. 300 ft., Mount Omurbrogol, Ngalkol (Y. Kondo! April 23, 1936).

Shell (pl. 59, figs. 1-3) dull above, with a narrow chestnut band on upper surface of carina but visible through it. Embryonic whorls about 2, with slightly stronger growth-lines than in *V. oleacina,* and crossed by traces of spiral striae. Later whorls with weak growth-wrinkles (major ones 5.1 per mm. on early 5th) but with irregular microscopic granulation above; base with granulation obsolescent and so glossier. Peristome sharp, with slight internal thickening along columellar side.

Animal similar to *V. pumila* but foot pale brownish, slightly darker between pedal grooves, on and around tentacles and in three vague dorsomedian stripes; tail less sharply angulate above. Mantle-collar pale; shell-lap edge with darker. Lung pale with chalky-white dots forming 2 rows along hindgut and broader area over kidney; almost 6 times as long as base or over thrice kidney length, which is 4 times its base or twice pericardial length. Apical whorls with perforate chalky band above. Talon relatively small and more elongate; carrefour broader than long; uterus more elongate, closely folded and brittle with heavy chalky deposit; free oviduct (pl. 49, fig. 4) with glandular zone abruptly swollen apically. Spermatheca actually opening below base of penis proper, which, in specimen figured, appears longer because of spermatophore coiled just below stimulator-thickening with small end in spermathecal orifice. Spermatophore shaped like that of *V. oleacina* but with whitish membranous wall. Epiphallus very poorly differentiated, entering side of apical caecum of penis below middle of elongate vergic papilla (PV; pl. 49, fig. 6) which has small subapical orifice; penial retractor inserting below penial apex. Penis proper relatively smaller; internally (pl. 49, fig. 6) with extremely short pilaster to long stimulator-thickening (PP) and with very weak longitudinal folds

more anteriad. Atrial opening 5 or 6 times pedal groove interspace behind inferior tentacle. Jaw with prominent growth-lines and weak longitudinal striae and with distinct but fairly low lobe. Radula (pl. 49, fig. 5) has more elongate central with at most one ectoconal notch, 13 elongate laterals with small ectocone, and 46 elongate marginals with two subequal cusps; 160 rows counted.

V. electra looks much like the type of the genus, the larger *V. metcalfei,* which (ANSP. 48989) has shallow but distinct spiral striae on its embryonic and neanic whorls and exhibits more tendency for the granulations of its later growth to be arranged in criss-cross lines. Semper's figure of the genitalia shows a somewhat similarly shaped penis, which receives the spermatheca at its base, but the free oviduct seems to go behind the spermathecal stalk and its actual connections are not clear. The Palau species of this genus are also characterized by their laterally compressed foot and their peculiar vergic papilla and stimulator-thickening.

Genus TROCHOMORPHA Albers, 1850

Trochomorpha Albers, 1850, Die Heliceen I: 116; type by subsequent designation of Albers-Martens, 1861, 2d ed.: 60, *Nanina trochiformis* (Férussac) = *T. typus,* new species; Wiegmann, 1893, Weber's Zool. Erg. **2**: 152-160, anatomy; Pilsbry, 1893, Manual **9**: 1; Wiegmann, 1898, Abh. Senckenberg. Naturf. Ges. **24**: 415-419, 427-431, anatomy.

Discus (Albers) Godwin-Austen, 1895, Proc. Malac. Soc. **1**: 285, anatomy.

Nigritella Albers-Martens, 1861: 63; type by original designation, *Helix nigritella* Pfeiffer.

Cotitrochus, new subgenus, type *T. eurydice* (Gould) from Eua (BBM. 87716).

Ludificator, new subgenus, type *T. apia* (Hombron et Jaquinot) from Tutuila (BBM. 84791).

Lauhala, new subgenus, type *T. troilus savaii,* new subspecies.

Lentitrochus, new subgenus, type *T. sanctae-annae* Smith from Owa Raha (BBM. 119236).

Because the shells in the genus *Trochomorpha* usually are large and colored, they have been more thoroughly described by the older workers. This paper will, as a rule, only describe new species in detail.

Key to Subgenera and Sections of Genus Trochomorpha

A. Principal radular marginals bicuspid, usually subequally so; (includes all intralimital species):

B. Penis containing pilasters, one of which sometimes develops a broad flat thickening; Samoa, Futuna, Fiji and Caroline Islands (Ponape, Truk) and westward:..... .....subgenus **Nigritella** Albers-Martens.

C. Penial retractor inserting on penial apex; epiphallus poorly demarcated from vas deferens and entering side of penis; shell of Samoan species glossier, with weaker criss-cross striae;

D. Atrium at least moderate in length; shell peristome narrowly expanded, at least below, and usually becoming more heavily callused; Caroline Islands: Ponape and Truk: .....section **Nigritella,** s. s.

DD. Atrium short; shell peristome not expanded and usually less callused; Samoa, Futuna, Fiji, and westward: .....section **Lauhala,** new[a].

CC. Penial retractor inserting on middle of well-demarcated epiphallus, which enters apex of penis; later whorls of shell finely granulated by sharp criss-cross striae: Samoa: ..... section **Ludificator,** new.

BB. Penis containing large and high, ovoid or fusiform stimulator-papilla, with anterior tip free; penial retractor inserting around base of epiphallus, which enters penis apically; Society Islands and Tonga: .....subgenus **Trochomorpha,** s. s.

E. Epiphallus swollen and sharply demarcated from vas deferens; penial stimulator-papilla with shorter free tip; protoconch with fine spiral striae crossing vaguer retractive and growth-wrinkles; Tonga: .....section **Cotitrochus,** new.

EE. Epiphallus poorly demarcated from vas deferens; penial stimulator-papilla with longer free tip; protoconch pebbled above by sharp anastomosing retractive wrinkles crossing weaker growth ones but without prominent spiral striae; Society Islands: .....section **Trochomorpha,** s. s.

AA. Radular marginals unicuspid although not aculeate; penis and atrium like DD; shell peristome more like D; Solomon Islands: .....subgenus **Lentitrochus*,** new.

Trochomorpha (Nigritella) küsteri (Pfeiffer), (pl. 50, figs. 1-3).

Helix küsteri Pfeiffer, 1845, Zeitschr. Malak. **2**: 153, habitat unknown; Monogr. **1**: 215 [**3**: 167-**4**: 190-**5**: 262 (Carolines:)-**7**: 300], Otaheite; Reeve, Conch. Icon. **7**: pl. 106, fig. 593; Pfeiffer, Conch.-Cab. II: 150, pl. 92, figs. 14-15; Tryon, Manual **3**: 80, pl. 15, figs. 48-49, Ponape.

H. goniomphala "Pfeiffer" Reeve, 1854, Conch. Icon. **7**: pl. 194, fig. 1362, habitat unknown (Cuming!); Pfeiffer, 1855, Proc. Zool. Soc. 1854: 147; Monogr. **4**: 184 [**5**: 255-**7**: 288 (Fiji)]. *T. goniomphala* Pease, Proc. Zool. Soc. 1871: 474, Ponape. *H. goniomphala* Tryon, Manual **3**: 78, pl. 15, fig. 34.

T. kuesteri, variety *fulvizona* and subspecies *goniomphala* (Pfeiffer), *transitans* and *intermedia* (p. 105) Möllendorff, 1900, Jour. Malac. **7**: 104, Ponape (Etscheid, Kubary!).

[Caroline Islands: Ponape:]. ANSP. 1924, 48977 (from Pease). (U. District): BBM. 154250-4 (typical with forms *goniomphala, intermedia* and *fulvizona*), dissected, alt. 200-275 ft., near Roi (Y. Kondo! March 3, 1936); BBM. 154367 forms *goniomphala* and *transitans*), alt. 275-900 ft., Mount Kuporujo (ditto!). (Not): BBM. 153991-3 (forms *kuesteri, intermedia* and *fulvizona*), alt. 1,000-1,500 ft., Mount Tolamain (S. Ito! Feb. 12, 1936). (Kiti): BBM. 153974 (forms *goniomphala* and *transitans*), dissected, alt. 100-150 ft., near Wone Village (Kondo! Feb. 12); BBM. 154054 (forms *kuesteri* and *intermedia*), about 800 ft., Mount Tolotom (Kondo! Feb. 15). (Metalanim):

[a] Local keys are given for the species of: (1) western, northern and central Fiji; (2) Lau Group and Moala in Fiji and Futuna; and (3) Samoa.

BBM. 154137 (*fulvizona* coloration of forms *goniomphala* and *kuesteri*), alt. 300-900 ft. (Ito! Feb. 29).

Shell similar to subspecies *monticola* but considerably smaller, often with higher spire, far weaker carina and less convex base; typically lighter in color but often dark with light carinal zone (form *fulvizona*); usually duller. Later whorls commonly with vaguer criss-cross striae above and below. Peristome usually thicker below and mostly with some indication of a basal nodule internally; with or without notch at base of columella. Umbilicus very variable in size, rarely rimate; encircling cord very strong (*goniomphala*) to completely absent (past typical).

Animal similar to *T. nigritella.* Lung with rows of large black patches along hindgut and smaller black and chalky spots elsewhere to almost colorless (154254); 6 times as long as base or 2.3 kidney length, which is 6 times its base or thrice pericardial length. Uterus (pl. 50, fig. 1) relatively shorter; free oviduct considerably longer; spermatheca more elongate. Penis stouter; right pilaster (PP; pl. 50, fig. 3) very large, filling most of penis and complexly folded; left pilaster only represented as a low fold near apex and another forked one in basal half. Jaw with prominent growth-lines and distinct longitudinal striae, strongest in central area, but with extremely low median lobe. Radula (pl. 50, fig. 2) has oblong central, with ectoconal notches distinct, 13 laterals, of which inner 2 often have entoconal notches, and 46 marginals, usually with shorter cusps; 127 rows counted.

After the description of his "sub-species", Möllendorff wisely remarks: "Unfortunately the collections, made at different localities in the islands, were not always separated, so that it cannot even be determined whether the different forms are local races connected by transitory varieties or whether they occur promiscuously at the same locality. In the latter case they could not be regarded as sub-species, but would appear to be individual variations." Mr. Kondo's lots are very carefully localized, and "the latter case" appears to be the correct one, although, as might be expected, all the lots do not include the entire range of variation.

Key to Species and Subspecies of Section Nigritella, s. s.

A. Epiphallar entrance on side of penial apex; atrium moderately long; radular marginals usually with longer cusps; shell without conspicuous hydrophanous patches; Ponape:

B. Radular central and laterals broader; protoconch soon assuming distinct protractive and retractive striae (often eroded); shell imperforate or larger; terrestrial.

C. Shell at least rimate, larger and more depressed or with more subdomical spire; free oviduct with distinct orange glandular zone.....**T. küsteri** (Pfeiffer).

D. Shell smaller, commonly with distinct basal nodule; (U, Not, Kiti and Metalanim): usually at lower altitudes .....typical subspecies.

DD. Shell largest; peristome without basal nodule; (U, Kiti and central): usually at higher elevations .....subspecies **monticola,** new.

CC. Shell imperforate, smaller or with more conoid spire; free oviduct with glandular zone indistinct; (U, Not and Metalanim): ....**T. carolinae,** new species.

BB. Radular central and laterals more elongate; shell gradually assuming criss-cross striae, which are not distinct on protoconch, umbilicate and usually smaller;

E. Penial retractor arising much more anteriad; penis smaller with broader internal pilasters; protoconch irregularly pebbled by fine anastomosing growth-wrinkles; shell with concave base and, when equally elevated, with considerably larger umbilicus and more subdomical spire; mainly terrestrial ..... **T. contigua** (Pease).

F. Shell with more moderate spire and with umbilicus 3.7 times in diameter, tan-unicolor; (central): top of Mount Nanalaut.....subspecies **nanalauti,** new.

FF. Shell with high spire and umbilicus 4.5 to 5.5 times in diameter, typically banded but often dark unicolor; (U, Kiti, Metalanim, and central)..... typical subspecies.

EE. Penial retractor arising from the very near apical cross-wall of diaphragm; penis longer, with narrower internal folds; protoconch soon assuming spiral striae; shell with convex to flat base and, when equally elevated, with smaller umbilicus and more conoid spire; mainly arboreal;

G. Penis more elongate, internally with stimulator-thickening developed in connection with dorsal fold; shell with more ogival spire and with base weakly convex to flat in high forms.....**T. nigritella** (Pfeiffer).

H. Base almost as convex as spire; umbilicus 5.3 times in diameter; (U District): .....subspecies **paucispira,** new.

HH. Base markedly less convex than spire; umbilicus smaller;

I. Spire with more convex outlines; umbilicus intermediate;

J. Spire moderate and base convex; umbilicus 5.5 to 7.5 times in diameter; typically unicolor but usually banded (form *oppressa*); (U and Metalanim): .....typical subspecies.

JJ. Spire fairly high and base weakly convex; umbilicus 7 to 9.5 times in diameter; usually dark unicolor; (Not): Colonia ..... subspecies **fuscata** "Pease" Pilsbry.

II. Spire highest with least convex outlines and base almost flat; umbilicus 11.3 times in diameter; dark unicolor; (Kiti): Mount Tolotom .....subspecies **tolotomi,** new.

GG. Penis shorter, internally with stimulator-thickening associated with right fold; shell with quite high, conoid spire but with convex base; (U and central): above 1,600 ft. on Mountains Kuporujo and Nanalaut ....**T. conoides,** new species.

AA. Epiphallar entrance shortly but distinctly below penial apex; atrium longer and uterus relatively short; radular marginals with short cusps; shell with large hydrophanous patches; protoconch with vague spirals; Truk:....**T. approximata** (Le Guillou).

Dimensions in Section Nigritella from Ponape

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
T. kuesteri							
Pfeiffer	9.5	(18)	(17)	.....	.....	subimperf.	6.5
Reeve fig.	10.9	165(18)	.....	57(6.25)	158 (9.9)	.....	
(goniomphala)	9.5	(20.5)	(19)	.....	.....	narrow	6.5
Reeve fig.	13.8	149(20.5)	.....	51(7.1)	148(10.5)	.....	
BBM. 154250	11.25	173(19.5)	159(17.9)	40(4.53)	225(10.2)	15.3(1.28)	6⅝
T. k. monticola							
type	15.25	174(26.6)	154(23.5)	46(7.06)	191(13.5)	13.9(1.91)	6.5+
T. carolinae							
type	9.72	154(15.0)	143(13.9)	37(3.63)	206 (7.49)	none	6¼+
BBM. 154155	10.3	115(11.9)	111(11.4)	31(3.23)	178 (5.75)	none	6.7—

Dimensions in Section Nigritella from Ponape—Continued

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
T. c. nanalauti							
type	8.23	159(13.1)	156(12.85)	33(2.75)	180 (4.96)	3.7(3.52)	6.3+
T. contigua							
Pease	9	(10)	.....	.....	.....	narrow	6-7
fig.	9.9	101(10)	.....	24(2.4)	196 (4.7)	.....	
ANSP. 48981	9.93	105(10.4)	98 (9.72)	25(2.53)	191 (4.82)	5.5(1.90)	6.8+
BBM. 154272	8.80	127(11.2)	121(10.65)	31(2.73)	174 (4.74)	4.6(2.41)	6.1
T. n. paucispira							
type	6.71	203(13.6)	187(12.55)	49(3.26)	190 (6.19)	5.3(2.56)	5.3
T. nigritella							
Pfeiffer	7.5	(14.5)	(13)	.....	.....	mediocre	5-5.5
fig.	7.5	193(14.5)	172(12.9)	53(4.0)	153 (6.1)	4.6(3.15)	
ANSP. 48982	7.88	180(14.2)	157(12.4)	45(3.56)	185 (6.57)	6.1(2.32)	5.5
BBM. 154144	8.84	157(13.9)	139(12.3)	36(3.22)	201 (6.47)	7.5(1.85)	5¾—
(oppressa)	7	185(13)	.....	.....	.....	.....	.....
ANSP. 48979	7.30	185(13.5)	171(12.5)	40(2.91)	212 (6.17)	6.9(1.95)	5.7—
BBM. 154264	7.98	179(14.3)	163(13.0)	43(3.40)	199 (6.78)	5.6(2.54)	5¾
T. n. fuscata							
type	8.95	135(12.1)	124(11.1)	30(2.64)	217 (5.74)	9.5(1.28)	6.3+
BBM. 155178	9.48	138(13.1)	123(11.7)	32(3.00)	212 (6.35)	7.0(1.87)	6¼
T. n. tolotomi							
type	9.88	117(11.5)	106(10.5)	25(2.45)	219 (5.37)	11.3(1.01)	7
T. conoides							
type	9.80	123(12.0)	110(10.85)	37(3.59)	160 (5.74)	8.7(1.38)	6.8—

Comparative Whorl-sizes in Section Nigritella, s. s.

	1½	4.5 wh.	5 wh.	5.5 wh.	6 wh.	6.5 wh.	Maxima	Index
T. kuesteri	3.02	3.7(11.3)	4.3(12.85)	4.9(14.9)	5.5(16.6)	6.1(18.3)	6⅝	173
T. k. monticola	3.19	4.4(14.0)	5.1(16.2)	6.1(19.4)	7.1(22.6)	8.1(25.9)	6.5+	174
T. carolinae	2.82	.....	4.1(11.5)	4.6(12.85)	4.9(13.95)	.....	6¼—	154
	2.77	3.0 (8.22)	3.3 (9.08)	3.6(10.05)	3.9(10.85)	4.1(11.45)	6.7—	115
T. c. nanalauti	2.01	4.2 (8.46)	4.9 (9.88)	5.6(11.3)	6.1(12.25)	.....	6.3+	159
T. contigua	2.00	.....	3.9 (7.86)	4.3 (8.57)	4.6 (9.12)	4.8 (9.70)	6.8+	105
	2.09	.....	4.4 (9.29)	4.9(10.2)	5.1(10.75)	.....	6.1	127
T. n. paucispira	2.22	4.8(10.65)	5.5(12.3)	6.2(13.8)?	.....	.....	5.3	203
T. nigritella	2.10	5.1(10.65)	5.8(12.25)	6.8(14.2)	.....	.....	5.5	180
	2.27	4.2 (9.59)	5.0(11.25)	5.5(12.45)	.....	.....	5¾—	157
(oppressa)	2.20	4.5 (9.93)	5.1(11.2)	5.7(12.6)	.....	.....	5.7—	185
	2.18	4.5 (9.78)	5.2(11.4)	6.0(13.0)	.....	.....	5¾	179
T. n. fuscata	2.11	3.8 (7.99)	4.4 (9.28)	4.8(10.15)	5.1(10.8)	.....	6.3+	135
	2.23	3.9 (8.68)	4.4 (9.81)	4.9(11.0)	5.2(11.7)	.....	6¼	138
T. n. tolotomi	2.10	.....	3.5 (7.33)	3.9 (8.27)	4.4 (9.24)	4.9(10.25)	7	117
T. conoides	1.95	.....	3.8 (7.41)	4.4 (8.65)	4.9 (9.65)	5.5(10.75)	6.8—	123
T. approximata	1.79	4.6 (8.19)	5.7(10.15)	6.8(12.1)	7.4(13.2)	8.0(14.3)?	6¼	180

Trochomorpha (Nigritella) küsteri monticola, new subspecies (pl. 59, figs. 7-9).

Caroline Islands: Ponape (U District): BBM. 154371, dissected (154372, smaller), on ground, alt. 1,600-1,970 ft., Mount Kuporujo (Y. Kondo! March 3, 1936). (Central): BBM. 154503-6 (and approaching form *fulvizona* of typical *kuesteri*), ground, alt. 1,900-2,500 ft., Mount Nanalaut (Kondo! March 7, 8). (Kiti): BBM. 154056, ground, alt. 800 ft., Mount Tolotom (Kondo! Feb. 15).

Shell similar to *T. carolinae* but much larger and perforate, with lower (typical) or more subdomical spire and more convex base; carina also marked off by sharp sulcus above; epidermis more chestnut, becoming darker on later whorls and often with carina darkest. Later whorls with coarser growth-wrinkles (4.4 per mm. on early 7th) and with more distinct as well as more widely spaced criss-cross striae above; base with fairly prominent, closely spaced growth-wrinkles, which obscure weak but scarcely obsolescent criss-cross striae. Peristome very slightly expanded above, without basal nodule and with slight internal sulcus and marked external expansions at position of circumumbilical cord, above which columella is more steeply inclined and reflected to hide about ¼ of perforation. Umbilicus encircled and reduced by a strong cord, which is demarcated apically by a strong sulcus and often basally by a weak one.

Animal similar to typical subspecies. Mantle-collar with smaller gap between left lappets. Lung invaded by short lobe of yellowish mantle-glands; coloration like darker specimens. Spermathecal sac less elongate. Penis with more prominent vergic lobe on right pilaster, which is deeply double. Radula has central often practically unicuspid, about 17 laterals, with even ectoconal notches weak on inner ones, and 69 marginals, which develop longer cusps (more like in *T. nigritella*); 148 rows counted.

Although the largest specimens of *T. küsteri monticola* look very distinct and actually have bigger whorls, they intergrade with the typical subspecies and possibly represent little more than a giant race, developed in the richer forest of the mountains.

Trochomorpha (Nigritella) carolinae, new species (pl. 65, fig. 5; pl. 59, figs. 5, 6; pl. 49, figs. 18-20).

T. alta (Pease) Möllendorff, 1900, Jour. Malac. 7: 105, Ponape; not *Helix alta* Pease (= *Mendaña rectangula*).

Caroline Islands: Ponape (U District): BBM. 11491 (154278, dissected), ground, alt. 200-275 ft., near Roi (Y. Kondo! March 3, 1936); BBM. 154333, ditto, alt. 500-900 ft. (Not): BBM. 153998, ground, alt. 1,000-1,500 ft., Mount Tolamain (Kondo! Feb. 12.) (Metalanim): BBM. 154155, alt. 300-900 ft. (S. Ito! Feb. 29; one shell, much more elevated).

Shell (pl. 65, fig. 5; pl. 59, figs. 5-6) imperforate, with rounded apex, ogival spire and slightly convex base, sharply and acutely angulate, with carina sulcate below and weakly so above; epidermis heavy, dark (typical) or light chocolate-brown unicolor; weakly glossy above but more so below; heavy and opaque. Embryonic whorls almost 2, assuming fine protractive and retractive striae (often eroded); suture attached at angle. Later whorls flattened above; developing irregularly spaced (9 per mm. on late 6th), low rounded growth-wrinkles but with criss-cross striae becoming weaker above; base with

more closely spaced growth-wrinkles and with criss-cross striae obsolescent; suture attached at or below carinal edge. Aperture low and broad, subrostrate at 100° to shell-axis; peristome almost 40° to shell-axis, arcuate and internally thickened above, heavily thickened, often (typically) with a weak but angular basal nodule and obliquely bevelled internally and scarcely expanded externally below, and almost straight (i.e., very weakly arcuate) near columellar wall, which is gradually reflected and cemented over umbilical region.

Animal similar to *T. nigritella,* but foot with less pigment. Mantle-collar lightly pigmented. Lung with some dark coloration along hindgut, vein and kidney and with small sparse white spots; almost 6 times as long as base; kidney over 5 times as long as base or almost thrice pericardial length. Hermaphroditic duct more convoluted and swollen; talon stouter; uterus relatively shorter; free oviduct (pl. 49, fig. 18) much longer, almost as long as uterus, with glandular zone less prominent; spermatheca with longer stalk. Penial retractor arising from and a short distance below apical wall of diaphragm; right penial pilaster (PP; pl. 49, fig. 20) very heavy, extending full length of penis and also of atrium, splitting near middle of penis to enclose two roughly circular areas (one cut open in figure) and recurving around epiphallic entrance to form a small vergic lobe; dorsal pilaster apparently represented by a much smaller fold in apical third of penis and another in anterior half. Atrium longer, with continuation of dorsal penial pilaster. Jaw with prominent growth-lines and distinct longitudinal striae, especially in central area, and with extremely low rounded median lobe. Radula (pl. 49, fig. 19) has broader central, usually with ectoconal notches, 10 broader laterals, of which innermost rarely has entoconal notch, and 44 marginals; 132 rows counted.

T. carolinae is named in memory of my aunt, Miss Caroline Burrington.

Trochomorpha (Nigritella) contigua nanalauti, new subspecies (pl. 58, figs. 7-9; pl. 49, figs. 10, 11).

Caroline Islands: Ponape (central): BBM. 11489 (154516, dissected), on ground, alt. 1,900-2,500 ft., Mount Nanalaut (Y. Kondo! March 7-8, 1936).

Shell (pl. 58, figs. 7-9) similar to typical *T. nigritella,* but spire, approaching that of variety *fuscata* in height, with more convex outlines; supracarinal sulcus scarcely represented; base concave (i.e., with very broad subcarinal sulcus deeper than convexity of circumfoveolar region); tan-unicolor; slightly duller below. Embryonic whorls around 1.7 (variable), assuming stronger (yet weak) growth-wrinkles and fine anastomosing minor ones (as if criss-cross lines and growth-striae were competing for dominance) which pebble surface above. Later whorls assuming weak major growth-wrinkles (4.1 per mm. on late 6th) and weaker, more irregular criss-cross striae, which are almost as strong below as above. Aperture rostrate at over 120° to shell-axis, more subquadrate; peristome about 40° to shell-axis, arcuate nearer suture above and more gradually expanded below. Umbilicus almost twice as large in shells of similar elevation; subangulate or with a weak cord around periphery.

Animal similar to *T. nigritella,* but foot paler, with brown band between pedal grooves and light brown pebbling on sides of foot and top of head. Mantle-collar with some brown. Lung with irregularly chalky blotches becoming almost confluent anteriad and with black spots that tend to become short transverse bars over hindgut; mantle-glands more deeply invading as whitish tongue; 6.5 times as long as base or over thrice kidney length. Apical whorls with wavy transverse rows of white spots above. Ovotestis with 10 lobes; talon shorter; free oviduct (pl. 49, fig. 10) longer but with relatively short glandular zone; spermatheca ovoid, with longer stalk. Penial retractor arising at level of middle of uterus; penis far smaller and shorter, with right pilaster (PP; pl. 49, fig. 11) heavy and broad in apical half, with dorsal one (PP′) low and limited to anterior half, but with a broad ventral or left pilaster (PP″) that forms a large thickening below middle. Atrium shorter than penis.

Trochomorpha (Nigritella) contigua (Pease).

Helix congrua Pease, 1868, Amer. Jour. Conch. 4: 154, pl. 2, figs. 3-4, Ponape; not Pfeiffer (1858).

T. contigua Pease, 1871, Proc. Zool. Soc.: 457, substitute. *H. contigua* Pfeiffer, Monogr. 7: 289; Tryon, Manual 3: 78, pl. 15, figs. 38-39.

T. nigritella contigua atrofusca, castanea, taeniata, brunnea, fulva and *flava* (all nude quadrinomials) Möllendorff, 1900, Jour. Malac. 7: 107, Ponape.

Caroline Islands: Ponape: ANSP. 48981 (type lot), also 9827 and 48978 (from Pease). (U. District): BBM. 154272, dissected, on ground, alt. 200-275 ft., near Roi (Y. Kondo! March 3, 1936); 154395, ground, alt. 1,600-1,970 ft., Mount Kuporujo (March 3). (Metalanim): BBM. 154152, ground and sometimes on tree trunks, alt. 300-900 ft. (Ito! Feb. 29). (Kiti): BBM. 154061, mainly ground, alt. 800 ft., Mount Tolotom (Kondo! Feb. 15). (Central): BBM. 154511, ground, alt. 1,900-2,500 ft., Mount Nanalaut (Kondo! March 7-8).

Shell similar to subspecies *nanalauti* but with much higher spire, decidedly concave base and with color and pattern very variable (much as in *T. nigritella*). Later whorls with sharper criss-cross striae above and below. Umbilicus smaller, with scarcely a trace of peripheral angulation.

Animal also similar. Lung with almost no chalky-white. Apical whorls with white mostly limited to blood-vessels. Spermatheca with elongate fusiform sac, filled with brittle reddish material. Penial retractor arising between apical and middle thirds of uterus; penis relatively longer, internally with right pilaster reduced to a short high lobe beside epiphallic entrance and an inconspicuous thickening in basal half and with dorsal fold high and extending to near penial apex, so that ventral pilaster connects with it anteriad but is cut off by it from penial apex. Atrium about as long as penis.

Trochomorpha (Nigritella) nigritella paucispira, new subspecies (pl. 65, fig. 4; pl. 58, figs. 2, 3).

Caroline Islands: Ponape (U District): BBM. 11490 (154280, dead shells), alt. 200-275 ft. (also 1,600-1,970 ft.), near Roi (Y. Kondo! March 3, 1936).

Shell similar to typical *T. nigritella* but more depressed, with base almost as convex as spire; coloration similar to form *oppressa* but with broad dark carinal zone bordered above and below by light ones, so that dark basal area is smaller. Peristome even more thickened internally but less expanded below. Umbilicus larger.

Although the differences between *T. nigritella* and variety *paucispira* are not great, the two forms are not known to intergrade.

Trochomorpha (Nigritella) nigritella (Pfeiffer), (pl. 58, fig. 1; pl. 49, figs. 7-9).

Helix nigritella Pfeiffer, 1847, Philippi's Abbild. Beschr. Conch. II (1): 4 [30], *Helix,* pl. 6, fig. 8, Pacific Ocean (Sowerby); Monogr. **1**: 205 [3: 159-4: 184-5: 255-7: 289] islands of Pacific (Cuming!); Reeve,

Conch. Icon. **7**: pl. 101, fig. 561; Pfeiffer, Conch.-Cab. II: 160, pl. 94, figs. 1-2; Pfeiffer, Monogr. **4**: 184, Sandwich Islands (Newcomb!). *Nanina nigritella* Albers-Martens, 1861, Die Heliceen II: 63, Marquesas (sic). *T. nigritella* Pease, 1870, Jour. de Conch. **18**: 400, Ponape. *H. nigritella* Tryon, Manual 3: 78, pl. 15, fig. 35-37.

H. trochiformis "Cuming" Pease, 1864, Proc. Zool. Soc.: 675, probably an erroneous identification (nude and preoccupied). *H. nigritella trochiformis* Pfeiffer, Monogr. 5: 255, Carolines: Puynipet (Hochstetter!).

T. nigritella oppressa Pease, 1870, Jour. de Conch. **18**: 400, Ponape, with *T. trochiformis* Cuming in synonymy; Pfeiffer, Monogr. **7**: 289.

[Caroline Islands: Ponape:]. ANSP. 48982, typical, ANSP. 48979, form *oppressa* (both from Pease). (Metalanim District): BBM. 154142-4 (both forms), dissected, on trunks and branches of trees, 300-900 ft., (S. Ito! Feb. 29, 1936). (U District): form *oppressa;* BBM. 154264, dissected, arboreal, alt. 200-275 ft. (Y. Kondo! March 3); BBM. 154213, same mores, near Roi; 154327, ditto, alt. 500-900 ft.

Shell similar to *T. conoides* but more depressed; spire with more convex outlines and base very much less convex; carina more broadly sulcate below; typically dark brown unicolor, but usually (form *oppressa*; pl. 58, fig. 1) with lower half of upper side and carinal zone on lower side of each whorl yellowish but rarely with dark carina also; duller above and glossier below. Later whorls with sharper growth-wrinkles above and with criss-cross striae more erased below. Peristome about 40° to shell-axis, usually more heavily thickened.

Animal similar to *T. typus*; pedal grooves meeting behind in an acute angle. Mantle-collar quite pale; left mantle-lappets separated by gap about half width of anterior one. Lung somewhat less pigmented and with chalky points sparser except along hindgut and over kidney; 5 times as long as its base or 2.3 kidney length, which is 2.5 pericardial length. Apical whorls moderately dark, with heavy rows of chalky particles along blood-vessels and forming close reticulum over apical liver lobe. Hermaphroditic duct (pl. 49, fig. 8) less swollen; talon larger; carrefour with apparently glandular sac; uterus with apical third forming a gelatinous zone; free oviduct relatively shorter, with conspicuous orange glandular zone, distinctly demarcated apically but vaguely so anteriad; spermatheca with shorter stalk. Penial retractor arising from and a short distance below apical cross-wall of diaphragm just left of uterus and inserting on penial apex; epiphallus even more poorly differentiated, opening (EP; pl. 49, fig. 7) through a large, almost apical pore between penial pilasters; penis proper large, internally with two longitudinal folds, of which right one (PP) is very high in apical half, gradually dies almost out in anterior half but is enlarged again into a transverse lobe at anterior end, and dorsal one (PP') is lowest in apical half but enlarged in third ¼ into a stimulator-thickening and very high in anterior ¼. Atrium moderately long, thin walled. Jaw with very low and small median lobe. Radula (pl. 49, fig. 9) has central, usually with ectoconal notches, 9 or 10 laterals with distinct ectocone, and 69 or 70 marginals, which develop more elongate blades and considerably longer and narrower mesocone and ectocone; 148 rows counted.

Even without the difference in embryonic sculpture, *T. nigritella* and *T. contigua* would be distinct species. Although they may intergrade in height of spire, size of umbilicus or rotundity of base if each characteristic is con-

sidered separately, *T. contigua* has almost twice as large an umbilicus, a much more concave base and a more domical spire when shells of the same stature are compared.

Evidently Pease was convinced that his *fuscata* was the typical form of *T. nigritella* and so named the depressed variety *oppressa.* Actually, the type figure of *T. nigritella* is even lower than Pease's dimensions (or specimens), so that *oppressa* becomes simply a color form.

Trochomorpha (Nigritella) nigritella fuscata "Pease", Pilsbry (pl. 58, figs. 4-6).

Helix fuscata Pease, 1864, Proc. Zool. Soc.: 675, (= "*nigritella* var., teste H. Cuming"; otherwise nude). *T. fuscata* Pilsbry, 1893, Man. Conch. **9**: 6 nude; Pilsbry, 1896, Nautilus **9**: 120, described.

H. fumata "Pease" Paetel, 1889, Cat., ed. 4, **2**: 76, nude (misspelling?).

Caroline Islands: Ponape: ANSP. 1933-4 (from Pease). (Not District): BBM. 155178, dissected, on trunks of hau trees, Colonia and vicinity, alt. 150-200 ft., (Kondo! Feb. 22, 1936).

Shell similar to typical subspecies but more elevated, with base almost flat so that carina is more broadly sulcate below; usually dark unicolor (BBM. material 98 percent so), sometimes so intensely brown as to be almost purplish; duller below. Later whorls with fairly distinct criss-cross striae below. Aperture rostrate at 120° to shell-axis; peristome more markedly arcuate above. Umbilicus smaller.

This variety *fuscata* intergrades with typical *T. nigritella,* but apparently does occur in rather restricted colonies. Because Cuming (in Pease's paper) did not make *H. fuscata* an absolute synonym, the name remained nude and is now available in *Trochomorpha.*

Trochomorpha (Nigritella) nigritella tolotomi, new subspecies (pl. 65, fig. 3; pl. 58, figs. 10, 11).

Caroline Islands: Ponape (Kiti District): BBM. 11493 (154069, dissected), on leaves, branches and trunks of palms and shrubs, alt. 800 ft., Mount Tolotom (Y. Kondo! Feb. 15, 1936).

Shell similar to subspecies *fuscata* but with higher, more conoid spire and flat base (i.e., convexity of base about equalled by concavity of broad subcarinal sulcus); apparently always dark unicolor. Later whorls with more rugged growth-wrinkles (5 per mm. on 7th) above but with somewhat weaker criss-cross striae, often disturbed by bright blisters, below. Peristome almost 50° to shell-axis. Umbilicus narrower.

Animal similar to typical subspecies but often (not always) much darker, with black, white-streaked lung and dark apical whorls. Lung more deeply invaded by mantle-glands; 6.5 times as long as base or thrice kidney length. Free oviduct longer; spermatheca (containing membranous capsule) with longer stalk. Dorsal pilaster of penis more expanded near middle to form a more distinct stimulator-thickening.

T. nigritella tolotomi is not known to intergrade with subspecies *fuscata* and is almost as elevated as the highest specimens of *T. contigua.*

Trochomorpha (Nigritella) conoides, new species (pl. 65, fig. 2; pl. 58, figs. 12, 13; pl. 49, figs. 15-17).

Caroline Islands: Ponape (central): BBM. 11492 (154472-84, dissected), arboreal, alt. 1,900-2,500 ft., Mount Nanalaut (Y. Kondo! March 7, 8, 1936). (U District): BBM. 154397, arboreal, alt. 1,600-1,970 ft., Mount Kuporujo (March 3).

Shell (pl. 65, fig. 2; pl. 58, figs. 12-13) umbilicate, trochiform, with high, almost conoid spire and moderately convex base, sharply angulate and shortly carinate; epidermis greenish-yellow (typical) to olive-brown, commonly (typical) with bright chestnut carinal stripe (narrower below than above) and a usually narrower subsutural one (very broad in 154479); dullish or weakly glossy above and below. Embryonic whorls 2.2, assuming fine shallow spiral wrinklets which cross still weaker, closely spaced minor and very vague major growth-lines above; suture not overriding. Later whorls very weakly convex above, with very low growth-wrinkles (5.6 per mm. on 7th) but gradually assuming criss-cross striae above; base with growth-wrinkles extremely low but with criss-cross striae undiminished; suture attached at end of carina. Aperture quite high, subrostrate at almost 110° to shell-axis; peristome averaging 35° to shell-axis, shallowly emarginate just below suture and then markedly arcuate, internally thickened and slightly expanded toward carina above, and concave, heavily thickened internally and slightly expanded below; columella broadly expanded near attachment but hiding little of narrow umbilicus.

Animal similar to *T. nigritella,* but foot and top of head darker with comparatively light tentacles and pale dorsum of tail; angle between lower pedal grooves shortly attenuate. Mantle-collar pale, edged with dark; anterior left mantle-lappet expanded so as to overlap gap between it and posterior one. Lung powdered with jet-black dots, which tend to run in fine longitudinal lines. Upper side of apical whorls also with a broad chalky band, that is absent over stomach and broken over basal half of apical liver lobe. Ovotestis consisting of 8 or 9 lobes; talon shorter and recurved; uterus relatively less elongate (but animal more contracted); free oviduct (pl. 49, fig. 17) somewhat longer; spermatheca with longer stalk. Penis relatively smaller; right pilaster (PP; pl. 49, fig. 15) a high fold running full length and continued by a lower one in atrium, with a branch anteriad of roughly 0-shaped dorsal stimulator-thickening; ventral pilaster high in anterior half and accentuated again anteriad to form two high short folds. Radula (pl. 49, fig. 16) has central with ectoconal notches, 8 or 9 laterals, of which inner two rarely show entoconal notch, and 52 or 53 marginals, which develop even more elongate cusps; 136 rows counted.

Trochomorpha (Nigritella) approximata (Le Guillou), (pl. 49, figs. 12-14).

Helix approximata Le Guillou, 1842, Revue zool. 1842: 139, in part, Hogoleu and Ternate (Moluccas); Pfeiffer, Monogr. 1:206 [3:160 (Sandwich Islands)-4:185-5:255, 495-7:290]; Reeve, Conch. Icon. 7: pl. 108, fig. 603, Ternate (sic); Pfeiffer, Conch.-Cab. III: 292, pl. 125, figs. 7-8; Tryon, Manual 3:90, pl. 18, figs. 64-65. *T. approximata* Möllendorff, Jour. Malac. 7: 103.

Helix marmorata "Jaquinot" Pfeiffer, 1849, Zeitschr. Malak. 6:75; Caroline Islands; not Férussac (1820).

H. marmorosa Hombron et Jaquinot, 1852 (?), Voy. Pôl Sud, livr. 22: pl. 7, figs. 5-8; Rousseau, 5:22. *H. approximata marmorosa* Pfeiffer, Monogr. 3:160; Tryon, Manual 3:90, pl. 18, figs. 66-67. *T. marmorosa* von Martens, Sitz. Ges. Naturf. Berlin 1880: 146.

Caroline Islands: Truk [Dublon Islet]. BBM. 153137 (Y. Kondo! Dec. 18, 1935).

Shell similar to *T. nigritella* but with lower, more conoid spire and almost flat base; carina with broad shallow sulcus above and below; chestnut-brown, with whitish carina bordered above and below by darker zones, grading into tan-color around umbilicus and with numerous large, irregularly flammulate, hydrophanous blotches; dull above and below. Embryonic whorls assuming fine very weak growth-lines, crossed by vague spiral striae. Later whorls with only a tendency toward criss-cross arrangement of granulations; base with pebbling controlled by more evident (but weak) major and minor growth-wrinkles. Peristome almost 50° to shell-axis, not expanded above and barely so below.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
Le Guillou	11	155(17)	.....	.....	.....	deep	6-7
Pfeiffer	7	(14.5)	(14)	.....	.....	.....	6-7
Reeve fig.	8.05	180(14.5)	.....	52(4.15)	180(7.45)	.....	
(marmorosa)	7	(15)	.....	.....	.....	.....	6
type fig.	9.0	169(15.2)	155(14.0)	41(3.7)	170(6.3)	8.4(1.8)	
BBM. 153137	7.76	180(14.0)	170(13.2)	36(2.76)	239(6.60)	10.1(1.38)	6¼

Animal similar to *T. nigritella* but pale between and below pedal grooves. Left mantle-lappets separated by slightly smaller gap. Lung powdered with chalky particles; slightly shorter. Apical whorls also seeded with white between vessels. Uterus (pl. 49, fig. 13) relatively shorter; free oviduct somewhat longer; spermatheca abruptly swollen at base. Penial retractor arising at level of atrioventricular constriction of heart; epiphallus entering beside right pilaster shortly but distinctly below penial apex; penis shorter, with right pilaster (PP; pl. 49, fig. 12) dying out in anterior half, and with dorsal fold high with a heavy Y-shaped spur that extends apically to between apical and middle thirds. Atrium long and slender, bound to body wall by muscular bands; opening very near upper pedal groove. Jaw with prominent growth-striae and distinct longitudinal lines, especially in central area. Radula (pl. 49, fig. 14) has unicuspid central, 13 laterals, of which inner 3 often lack ectoconal notch, and 68 marginals, on which cusps soon (by 21st tooth) become subequal and are considerably shorter; more than 124 rows.

Le Guillou's original description seems to have confused *T. approximata* with a larger species from the Moluccas (his dimensions), but Truk is the first-named locality and Pfeiffer may be considered as the first reviser, who fixed the name on the present species. In some ways, it seems more or less intermediate between the sections *Nigritella,* s. s. and *Lauhala.*

Trochomorpha accurata Mousson.

T. accurata Mousson, 1870, Jour. de Conch. **18**: 120 [12], pl. 7, fig. 2.
Helix accurata Pfeiffer, Monogr. **7**: 290; Tryon, Manual **3**: 80, pl. 15, fig. 55.

Fiji (west): Viti Levu: Veria (Gräffe!).

No animals or freshly collected shells from western or northern Fiji have been studied. Most of the species will probably be found to belong in the subgenus *Nigritella,* in which I would also include Wiegmann's (1898) dis-

section of *T. lardea* Martens from Halmahera. Although some of the species seem very similar to the Lau forms of the section *Lauhala,* they are, for the present, simply retained in the genus *Trochomorpha.*

Key to Species of Trochomorpha from Western, Northern and Central Fiji

A. Shell with elevated subconoid or rather weakly ogival spire and pale carina;
  B. With highest subconoid spire and violet-greenish with pale apex; Viti Levu: Veria ..... **T. accurata** Mousson.
  BB. With more ogival spire and bright brownish, with pale axial streaks and narrow supracarinal red band; Kandavu and (?) Viti Levu:.... **T. fessonia** (Angas).
AA. Less elevated or with more subdomical spire;
  C. Larger (5 wh. diam. over 12 mm.) with smaller umbilicus when equally elevated and with whorls more flattened above and below;
    D. Irregularly rugose-striate and dark chestnut with light or hydrophanous maculation above; base much paler, glossier and flatter than spire;
      E. Moderately depressed, with fulvous or creamy maculations above and with carina rugose and narrower; Ono: ..... **T. planoconus** "Mousson" Garrett.
      EE. Much depressed, with hydrophanous flammulations above and with carina smoother and broader; Vanua Levu:..... **T. merzianoides** (Garrett).
    DD. Not rugose-striate, with light ground-color and unicolor or spirally banded;
      F. Less depressed and heavier, spirally banded or unicolor;
        G. Solid, with spire more convex than base and with peristome well callused below; later whorls banded and resembling *T. corallina themis* but protoconch more like *T. albo-striata* although with stronger spiral striae;
          H. Shell less depressed and attaining 5¾ whorls; base or spire usually with two narrow reddish bands, of which outer ones invade carinal sulci; Ovalau and Ngau: ..... **T. lüdersi** (Pfeiffer).
          HH. Shell more depressed and attaining 5.5 whorls; base or spire with one broader band well mediad of carina; Taveuni:..... **T. taviuniensis** (Garrett).
        GG. Apparently thinner, with only columellar wall thickened; later whorls unicolor;
          I. Nearer G in form and texture; columella well thickened;
            J. About size of G at 5 whorls; island unknown: ..... **T. latimarginata** (Smith).
            JJ. With more gradual whorl-increases and glossier than G but attaining 5.5 whorls; Viti Levu; Vuni-Vati ..... **T. depresso-striata** Mousson.
          II. Thinner and more depressed; columella weakly thickened; Moala: ..... **T. moalensis,** new species.
      FF. Extremely depressed and thin (like typical *Videna*) with carina darker but edged with white; Kandavu: ..... **T. kantavuensis** Garrett.
  CC. Shell smaller (5 wh. diam. 10 mm. or less), with larger umbilicus when equally elevated and with whorls more convex above and below;
    K. Shell thread-carinate and depressed when young but becoming scarcely angulate and more elevated; umbilicus smaller and not angulate around periphery; Viti Levu: ..... **T. tumulus** (Gould).
    KK. Shell very acutely carinate; umbilicus larger and angulate around periphery; ..... **T. abrochroa** (Crosse).
      L. Very moderately depressed; umbilicus smaller; Viti Levu: banks of Peale River ..... variety **pseudoplanorbis** Mousson.
      LL. Much depressed; umbilicus very large: Viti Levu (Namari) and Kioa: ..... typical variety.

Comparative whorl-sizes in Trochomorpha from Fiji outside Lau Group

	1½	4.5 wh.	5 wh.	5.5 wh.	6 wh.	7 wh.	whs.	Index
T. accurata	.....	.....	.....	.....	.....	(14)	7	116
T. fessonia	.....	.....	.....	.....	(9.5)	.....	6	125
(transarata)	.....	.....	.....	.....	(10.2)	.....	6	143
T. planoconus	.....	.....	.....	.....	.....	(19)	7	164
T. merzianoides	2.62	5.5(14.5)	6.8(17.8)	7.9(20.6)	8.9(23+)?	.....	5.8	232
T. lüdersi	2.18	5.5(12.0)	6.5(14.1)	7.6(16.5)	8.7(19)?	.....	5¾	194
T. taviuniensis	2.13	5.9(12.5)	6.9(14.7)	8.0(17)?	9.0(19)?	.....	5.5—	216
T. latimarginata	.....	.....	(15)	.....	.....	.....	5	214(?)
T. depresso-striata	2.38	4.5(10.7)	5.2(12.4)	5.9(14.0)	6.6(16—)?	.....	5.5	209
T. moalensis	2.33	5.2(12.1)	6.0(14.1)	6.8(16)?	.....	.....	5	244
T. kantavuensis	1.88	5.7(10.8)	7.4(14.0)	9.1(17.1)	10.8(20+)?	.....	5.7	271
T. tumulus	1.90	4.3 (8.2)	4.8 (9.2)	5.5(10.4)	6.1(12—)?	.....	5¾	156
ANSP. 1408	1.87	.....	5.0 (9.3)	5.5(10.2)	6.1(11.5)	.....	6.1	152
T. abrochroa	.....	.....	(10)	.....	.....	.....	5	250(?)

Dimensions in Trochomorpha from western and northern Fiji

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
T. accurata							
Mousson	12	(14)	.....	.....	.....	10 (1.4)	7
fig.	12.1	116(14)	.....	39(4.7)	163(7.65)	.....	
T. fessonia							
Angas	6.4	(9.5)	(9.0)	.....	.....	narrow	6
fig.	7.6	125 (9.5)	.....	42(3.2)	153(4.9)	.....	
(transarata), fig.	7.15	143(10.2)	.....	49(3.5)	161(5.65)	.....	6
T. planoconus							
Garrett	10	(19)	.....	.....	.....	.....	7
Pilsbry, fig.	11.0	164(18)	154(16.9)	42(4.65)	167(7.75)	7.5(2.45)	7
T. merzianoides							
Garrett	9	(22)	.....	.....	.....	.....	6
type	9.77	232(22.7)	214(20.9)	43(4.20)	238(9.99)	6.1(3.70)	5.8
T. lüdersi							
Pfeiffer	7	(19)	(17)	.....	.....	6 (3.2)	5.5
ANSP. 49018	9.43	194(18.3)	175(16.5)	46(4.34)	197(8.55)	6.0(3.06)	5¾
T. taviuniensis							
Garrett	7	(17)	.....	.....	.....	5 (3.4)	5
fig.	8.2	207(17)	.....	51(4.2)	152(6.4)	.....	
ANSP. 49031	7.78	216(16.8)	199(15.5)	51(3.94)	189(7.46)	5.7(2.93)	5.5—
T. latimarginata							
Smith	7	(15)	(14)	.....	.....	6 (2.5)	5
fig.	7.0	214(15)	201(14.1)	57(4.0)	162(6.5)	6.5(2.3)	
T. depresso-striata							
Mousson	.....	.....	.....	.....	.....	.....	.....
ANSP. 49037	6.68	209(14.0)	191(12.8)	51(3.44)	181(6.23)	6.4(2.20)	5.5
T. kantavuensis							
Garrett	7	(20)	.....	.....	.....	.....	6.5
ANSP. 49034	6.67	271(18.1)	250(16.7)	57(3.81)	220(8.37)	5.9(3.08)	5.7
T. tumulus							
Gould	8.9	(10.2)	.....	.....	.....	small	6-7
fig.	6.6	154(10.2)	139 (9.2)	49(3.2)	151(4.9)	6.2(1.64)	
NYSM. 284	7.26	156(11.3)	143(10.4)	42(3.04)	170(5.18)	7.2(1.56)	5¾
ANSP. 1408	7.88	152(12.0)	136(10.7)	43(3.40)	165(5.61)	6.6(1.81)	6.1
T. abrochroa							
Crosse	3	(10)	(9)	.....	.....	large	5
fig.	4.0?	250(10)	229 (9.15)	.....	.....	2.5(4.0)	
(pseudoplanorbis)	6	167(10)	.....	.....	.....	smaller	.....

Trochomorpha fessonia (Angas).

Helix fessonia Angas, 1869, Proc. Zool. Soc.: 626, pl. 48, fig. 7; Pfeiffer, Monogr. **7**: 201; Tryon, Manual **3**: 79, pl. 15, fig. 40.

(?) *T. transarata* Mousson, 1870, Jour. de Conch. **18**: 121 [13], pl. 7, fig. 1, Viti Levu: Veria. *H. transarata* Tryon, Manual **3**: 79, pl. 15, fig. 41. Probably not *H. transarata* Mousson (1865).

Fiji (west): Kandavu: on trees. As Pfeiffer has suggested, Mousson's figure of his second *T. transarata* from Viti Levu looks much like *T. fessonia* but represents a less elevated shell.

Trochomorpha planoconus "Mousson" Garrett.

T. planoconus Garrett, 1887, Proc. Zool. Soc.: 175; Pilsbry, Manual **8**: 132, pl. 57, figs. 4-6.

Fiji (west): Ono: (Garrett!).

Trochomorpha merzianoides (Garrett).

Helix merzianoides Garrett, 1873, Proc. ANSP. **25**: 237, pl. 3, fig. 72. *T. merzianoides* Pilsbry, Manual **8**: 132; **9**: pl. 7, figs. 4-6.

Fiji (north): Vanua (= Vanna) Levu: ANSP. 49033, BBM. 2492 (Garrett!).

Shell rather porcellanous in texture. Embryonic whorls about 2, with sculpture much like those of *T. corallina*. Later whorls with rather weak criss-cross lines and irregularly spaced but often harshly angular growth-wrinkles above; base almost polished.

T. merzianoides and *T. planoconus* seem to form a rather distinct group, with more brittle looking shells and harsher growth-wrinkles than the other Polynesian species.

Trochomorpha lüdersi (Pfeiffer), (pl. 64, figs. 3, 4).

Helix ludersi Pfeiffer, 1855, Proc. Zool. Soc.: 112. *Helix lüdersi* Pfeiffer, 1859, Monogr. **4**: 183 [**5**: 253-**7**: 288]. *T. ludersi* Garrett, Proc. Zool. Soc. 1887: 174, Ngau (= Gnau, Angau).

Fiji (west): Ovalau (Macgillivray!); ANSP. 49018 (from Cuming). Ngau: BBM. 2461, ANSP. 48984 (Garrett!).

Shell with embryonic whorls worn but evidently with sculpture like in *T. taviuniensis*. Later whorls with coarse criss-cross pattern.

T. lüdersi is figured from original material, apparently for the first time.

Trochomorpha taviuniensis (Garrett).

Helix tavinniensis Garrett, 1872, Amer. Jour. Conch. **7**: 223, pl. 19, fig. 10; Pfeiffer, Monogr. **7**: 574; Tryon, Manual **3**: 92, pl. 18, fig. 85.

H. taviuniensis Schmeltz, 1874, Cat. Mus. Godeffroy V: 95. *T. taviuniensis* Garrett, Proc. Zool. Soc. 1887: 174.

Fiji (north): Taveuni: BBM. 2465 (ANSP. 49031, 49032) (Garrett!).

Shell with sculpture of embryonic whorls closest to that on *T. albo-striata* but with stronger spiral striae, which bead growth lines and retractive lines. Later whorls much as in *T. corallina themis.*

T. taviuniensis may be only a subspecies of *T. corallina* but it attains a larger size and has more rapid whorl-increase.

Trochomorpha latimarginata (E. A. Smith).

Helix latimarginata Smith, 1884, Proc. Zool. Soc.: 271, pl. 23, figs. 14, 14b; Tryon, Manual 3: 92, pl. 18, figs. 81-83.

Fiji.

Trochomorpha depresso-striata Mousson, (pl. 64, fig. 1).

T. transarata depresso-striata Mousson, 1870, Jour. de Conch. **18**: 121 [13]; Pfeiffer, Monogr. **7**: 201.

Fiji (west): Viti Levu: Vuni Vatu (Gräffe!); ANSP. 49037 (Godeffroy Exp.!).

Shell pale greenish-horn and practically unicolor although with a suggestion of a brownish zone below carina. Embryonic whorls at first almost smooth (probably worn) but gradually assuming sharp but very shallow criss-cross striae, which continue subequally on later whorls and are visible on base.

T. depresso-striata, which is figured for the first time and probably from original material, is rather similar in whorl-increase to *T. corallina,* but appears somewhat glossier.

Trochomorpha kantavuensis Garrett.

T. kantavuensis Garrett, 1887, Proc. Zool. Soc.: 177; Pilsbry, Manual 8: 127, pl. 20, figs. 25-27.

Fiji (west): Kandavu: ANSP. 49034, 48915; BBM. 2462 (Garrett!).

Shell remarkably thin and depressed. Embryonic whorls soon assuming strong spiral striae, which mark off beads over quite strong growth and retractive wrinklets. Later whorls dullish with strong criss-cross lines above and below. Peristome thin, scarcely callused even on columella.

T. kantavuensis distinctly resembles typical *Videna* in texture but its protoconch has heavier sculpture.

Trochomorpha tumulus (Gould).

Helix tumulus Gould, 1846, Proc. Boston Soc. N.H. **2**: 175 [22]; Pfeiffer, Monogr. **1**: 85 [**3**: 82-**4**: 111-**5**: 181-**7**: 199]; Gould, Exped. Shells: 62, pl. 4, figs. 53, a, b; Mousson, 1865, Jour. de Conch, **13**: 194 [31], north side of Viti-Lewou (Gräffe!); Tryon, Manual 3: 91, pl. 18, figs. 71-73.

Fiji [(west): Viti Levu]: NYSM. 284 (A-772, Gould types); ANSP. 1408 (A. D. Brown Collection, probably from Gould). ANSP. 48925 (from Schmeltz).

Young shell (ANSP. 48925) depressed and thread-carinate, with large umbilicus; yellowish horn-colored. Embryonic whorls with very fine growth and retractive threads, beautifully beaded by subequal spiral striae, so appearing powdered (like those of *T. tuvuthae*). Neanic whorls with very fine granulations in criss-cross rows. Older shells becoming weakly or scarcely angulate and practically without epidermis.

The NYSM. lot of this species contains two specimens; the dimensions given are for the larger, but probably the smaller one is the type.

Trochomorpha abrochroa (Crosse) and variety **pseudoplanorbis** Mousson.

Helix abrochroa Crosse, 1868, Jour. de Conch. **16**: 176; Jour. de Conch. **18**: 101, pl. 1, fig. 2; Pfeiffer, Monogr. **7**: 207; Tryon, Manual **3**: 91, pl. 18, figs. 74, 75. *T. abrochroa* Garrett, Proc. Zool. Soc. 1887: 174, Fiji (north): Kioa.

T. abrochroa and var. *pseudoplanorbis* Mousson, 1870, Jour. de Conch. **18**: 123 [15], Viti Levu; banks of Peale River.

Fiji (west): Viti Levu: Namori [= Namusi?].

Trochomorpha (Lauhala) moalensis, new species (pl. 64, figs. 7-9; pl. 50, figs. 4, 5).

Fiji (central): Moala: BBM. 11430 (77096-7, dissected), on shrubs and tree trunks, damp ridge, ½ to ¾ mile inland, alt. 1,000-1,400 ft., behind Maloku (Bryan! July 10, 1924).

Shell (pl. 64, figs. 7-9) lenticular, with whorls flattened above and below, with spire considerably more convex than base and with sharp carina demarcated by a sharp sulcus above and a broader more evenly concave one below; whitish-horn unicolor, dull above and little more glossy below, thin and subtranslucent. Embryonic whorls 1.7 to 2, soon assuming fine and shallow but sharp spiral striae, with their interspaces delicately beaded by weak retractive and minor growth-lines, and gradually developing low and rounded but evident major growth-wrinkles; suture lightly impressed and overriding. Later whorls gradually losing spirals, developing weak, anastomosing criss-cross striae and slightly sharper major growth-wrinkles (4.8 per mm. on 5th) above; base with weaker growth-sculpture; suture attached just below edge of carina. Aperture rostrate at 100° to shell-axis; peristome about 40° to shell-axis, thin and evenly convex above, concave and thin below, but with columella weakly thickened internally and gradually reflected. Umbilicus ogival, 5.7 times in shell diameter.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
Type	5.77	244(14.1)	222(12.8)	54(3.13)	201(6.30)	5.7(2.46)	5

Animal similar to *T. troilus* but tail with broad dorsomedian light band. Left mantle-lappets quite close together. Lung with big white blotches along hindgut and small spots elsewhere; twice as long as kidney which is twice pericardial length. Apical whorls with almost continuous chalky deposit. Carrefour (pl. 50, fig. 5) saccate; free oviduct shorter, with gray glandular zone; spermatheca with much shorter stalk. Penial retractor arising near top of uterus; epiphallus shorter and wider, yellow; penis

larger, internally with two full-length pilasters and a shorter one. Atrium with white, apparently glandular exterior, opening even nearer pedal grooves and inferior tentacle. Jaw with low broad median lobe. Radula (pl. 50, fig. 4) has central with distinct ectoconal notches, 9 laterals and 35 marginals, of which 32 are bicuspid and outermost 3 are vestigial; 107 rows counted.

T. moalensis is included in both the key to the species from northern and western Fiji and in that for the Lau Islands.

Trochomorpha (Lauhala?) transarata (Mousson).

Helix transarata Mousson, 1865, Jour. de Conch. **13**: 194 [31]; Pfeiffer, Monogr. **5**: 183 [7: 201]. (?) *T. transarata* Mousson, 1870, Jour. de Conch. **18**: 121 [13], pl. 7, fig. 1, Viti Levu: Veria?

Fiji (north Lau): Vanua Mbalavu (= Balavo): Lomma Lomma (Gräffe!).

This species was described from a single shell "en assez mauvais état" and has not been collected since, although Mousson later figured a specimen from Viti Levu as also *T. transarata.* (See *T. fessonia.*)

Key to Species of Section Lauhala from Moala, Lau Group and Futuna

A. Shell much more elevated, irregularly rugose or plicate-striate and with obtuse conoid spire; Fiji (Lau): Vanua Mbalavu..... **T. transarata** (Mousson).

AA. Shell less elevated;

B. Umbilicus without trace of encircling cord; Fiji (Lau and central):

C. Protoconch with spiral striae strongest; shell most depressed and unicolor or with darker carina;

D. Shell pale unicolor, with more rapid whorl-increase and smaller umbilicus; genital atrium apparently glandular; (central): Moala: ..... **T. moalensis,** new species.

DD. Shell more horn-colored, with more gradual whorl-increase and larger umbilicus; genital atrium short; (Lau):

E. Shell smaller, with base and spire subequally convex; protoconch with evident spiral striae (like D); free oviduct and spermathecal stalk shorter; inner radular laterals usually with entoconal as well as ectoconal notches; Kambara: ..... **T. kambarae,** new species.

EE. Shell larger, with spire more convex than base; protoconch with spirals obscured by heavier granulation; free oviduct and spermathecal stalk longer; inner laterals usually unicuspid; Tuvutha: ..... **T. tuvuthae,** new species.

CC. Protoconch with growth and retractive lines stronger; shell less depressed, with color-zones or with carina paler; (Lau):

F. Protoconch with weak spirals and without sharp protractive striae; shell less depressed, with light ground-color..... **T. corallina** Mousson.

G. Shell with bands obscure and with only edge of carina pale; Malatta and Mango: ..... typical variety.

GG. Shell with sharp darker zones and with pale carina; often but not typically larger; widely distributed..... variety **themis** Garrett.

FF. Protoconch with obsolete spirals and assuming distinct protractive striae on last half-whorl; shell depressed, dark-colored with white carina and capillary varices; Kanathea and (?) Ongea: ..... **T. albostriata** Mousson.

BB. Shell with obscure circumumbilical cord, less depressed than C and smaller than but more like CC; Futuna and Alofi: .....**T. burrowsi,** new species.

Comparative whorl-sizes in Trochomorpha from Moala, Lau, and Futuna

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	Max-ima	Index
T. transarata	.....	.....	.....	(7)	.....	5	140
T. corallina	2.71	3.8(10.2)	4.5(12.2)	5.1(13.7)	5.6(15+)?	5.2	216
T. c. themis	2.72	3.8(10.2)	4.3(11.7)	4.9(13.4)	5.4(15—)?	5⅛	211
Tuvutha	2.65	.....	4.4(11.7)	5.2(13.7)	5.8(15.3)	5.5	198
T. c. themis (big)	3.05	3.9(11.9)	4.5(13.6)	5.1(15+)?	.....	4.8	214
Avea	2.84	3.8(10.9)	4.4(12.6)	5.1(14.5)	5.8(16+)?	5.3	198
Kambara	2.71	4.1(11.0)	4.8(13.0)	5.5(14.9)	6.2(17—)?	5.2	206
T. albostriata	2.58	4.0(10.4)	5.0(12.8)	5.9(15.1)	6.8(17+)?	5¼	235
T. burrowsi	2.33	3.6 (8.4)	4.1 (9.7)	4.7(11)?	.....	4.9	199
Alofi	2.39	3.5 (8.4)	4.2(10.0)	4.8(11.5)	5.3(13—)?	5.2	210
T. tuvuthae	3.16	3.7(11.8)	4.2(13.4)	4.7(15—)?	.....	4.6	263
BBM. 78848	3.03	3.7(11.1)	4.2(13—)?	4.7(14+)?	.....	4.3	253
T. kambarae	2.39	3.4 (8.2)	4.1 (9.7)	4.8(12—)?	.....	4.9	243
BBM. 78686	2.40	3.6 (8.7)	4.3(10.3)	5.0(12)?	.....	4.6	284
T. moalensis	2.33	4.3(10.1)	5.2(12.1)	6.0(14.1)	6.8(16)?	5	244

Dimensions in Trochomorpha from Lau (Fiji), and Futuna

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
T. transarata							
Mousson	5	140 (7)	(6)	.....	.....	.....	6
T. corallina							
Mousson	.....	(13)	.....	.....	.....	.....	.....
BBM. 78926	6.70	216(14.5)	201(13.5)	47(3.14)	208(6.55)	7.4(1.95)	5.2
T. c. themis							
Garrett	6	(14)	.....	.....	.....	.....	5.5
ANSP. 48956	6.48	211(13.7)	194(12.6)	53(3.41)	186(6.34)	7.6(1.80)	5⅛
BBM. 78847 (big form)	7.72	198(15.3)	186(14.4)	46(3.55)	202(7.18)	6.7(2.29)	5.5
BBM. 78994	6.96	214(14.9)	198(13.8)	47(3.27)	219(7.16)	7.6(1.95)	4.8
BBM. 79006	8.08	198(16.0)	183(14.8)	55(4.42)	171(7.55)	7.6(2.10)	5.3
BBM. 78685	7.85	206(16.2)	190(14.9)	49(3.88)	186(7.21)	7.6(2.12)	5.2
T. albostriata							
Mousson	.....	.....	.....	.....	.....	.....	.....
BBM. 78329	7.12	235(16.7)	212(15.1)	51(3.62)	215(7.79)	8.5(1.97)	5¼
T. burrowsi							
Type	5.38	199(10.7)	185 (9.98)	49(2.63)	187(4.92)	7.3(1.47)	4.9
BBM. 115508	5.86	210(12.3)	196(11.5)	49(2.88)	201(5.80)	8.5(1.45)	5.2
T. tuvuthae							
Type	5.16	263(13.6)	248(12.8)	53(2.75)	215(5.91)	5.2(2.59)	4.6
BBM. 78848	4.82	253(12.2)	230(11.1)	52(2.51)	219(5.50)	5.3(2.31)	4.3
T. kambarae							
Type	4.61	243(11.2)	221(10.2)	56(2.59)	179(4.63)	4.7(2.39)	4.9
BBM. 78686	3.73	284(10.6)	263 (9.80)	60(2.22)	201(4.46)	4.7(2.27)	4.6

Trochomorpha (Lauhala) kambarae, new species (pl. 64, figs. 13-15; pl. 50, figs. 8, 9).

Fiji (south Lau): Kambara: BBM. 11428 (78686, 78745 dissected), on leaves of shrubs and tree trunks, damp undulating flat, central wooded basin, ¼ to 1 mile inland, alt. 50-100 ft. (E. H. Bryan, Jr.! Aug. 23, 1924).

Shell (pl. 64, figs. 13-15) similar to *T. moalensis* but with more gradual whorl-increase, with base about as convex as spire and with broader, gradual sulci above and below carina; more intensively horn-colored and commonly with carina slightly darker and more reddish. Embryonic whorls 1.6 to 1.7 with suture overriding only on first. Later whorls with granulation somewhat stronger; more convex above so that suture appears broadly impressed (less noticeable in 78686, and with last whorl slightly twisted upward in type). Aperture more nearly horizontal. Umbilicus smaller.

Animal similar to *T. troilus*. Mantle-collar pale; left mantle-lappets basally separated by a third width of anterior one. Lung black with irregular white markings over more than half of surface near hindgut (smaller in 78745); 4.5 times as long as base or 2.5 kidney length, which is over 4 times its base or under twice pericardial length. Apical whorls with chalky deposit almost continuous. Free oviduct (pl. 50, fig. 9) with yellowish glandular zone; spermatheca with shorter stalk. Epiphallus shorter and stouter, opening between penial pilasters; penis much larger, but with similar interior. Jaw with very low rounded median point. Radula (pl. 50, fig. 8) has central with ectoconal notches usually evident, 8 laterals of which inner 3 usually show entoconal as well as ectoconal notches, and 34 marginals, of which outer 3 or 4 usually develop additional small irregular ectocones; 133 rows counted.

Trochomorpha (Lauhala) tuvuthae, new species (pl. 64, figs. 10 to 12; pl. 50, figs. 6, 7).

Fiji (north Lau): Tuvutha: BBM. 78867 (78848, dissected, 78883), on leaves of shrubs and on tree trunks, damp ridge and flat, wooded interior basin, ½ to 1 mile inland, alt. 150-300 ft. (E. H. Bryan, Jr.! Sept. 10, 1924).

Shell (pl. 64, figs. 10-12) similar to *T. kambarae* but larger with spire more convex than base (more domical than in *T. moalensis*) and with narrower carinal sulci; practically unicolor, somewhat duller and heavier. Embryonic whorls 1.8 to 1.9, with spiral striae slightly the strongest and minor growth-wrinklets the weakest, but with irregular protractive and retractive lines cutting the surface into minute granules that give it a peculiarly powdered appearance. Later whorls with stronger criss-cross sculpture; with slightly more regular growth-wrinkles (5.5 per mm. on early 5th); less convex above (more as in *T. moalensis*). Umbilicus relatively a little smaller.

Animal also similar but foot spotted, with white dorsomedian band on tail. Lung jet black with few squarish white blotches; broken. Free oviduct (pl. 50, fig. 6) longer; spermathecal sac small and stalk much longer (more as in *T. troilus*). Radula (pl. 50, fig. 7) has central usually unicuspid, 8 laterals, of which inner 2 are usually unicuspid and others gradually develop an ectocone, and 33 marginals; more than 103 rows.

Trochomorpha (Lauhala) corallina Mousson, (pl. 64, fig. 2).

Helix lüdersii corallina "Mousson" Schmeltz, 1869, Cat. Mus. Godeffroy IV: 73 (nude), Fiji: Malatta, Vanua Balavu, Oneata; Futuna (sic). *T. lüdersi corallina* Mousson, 1870, Jour. de Conch. **18**: 123 [15]; Pfeiffer, Monogr. **7**: 288. *T. corallina* Garrett, Proc. Zool. Soc. 1887: 176, Vanua Mbalavo, Mango.

Fiji (north Lau): Malatta and island near Mango: on coral rocks (Gräffe). Mango: BBM. 1036, ANSP. 49035-6 (Garrett!); BBM. 78926, dissected, 78928, on shrub leaves and tree trunks, damp forest, limestone ridge, ¼ to ½ mile inland, alt. 250-500 ft., southwest part (R. H. Beck and E. H. Bryan, Jr.! Sept. 17, 1924).

Shell similar to *T. moalensis* but less depressed, with thicker carina; horn-color shading into peripheral rust-colored zone that covers lower half of apical surface and about half of base on 5th whorl, with edge of carina pale; considerably heavier. Embryonic whorls with subequally weak spiral striae and anastomosing retractive and minor growth-lines. Later whorls soon developing considerably sharper and more regular criss-cross striae and more distant major growth-wrinkles (3.8 per mm. on 5th). Peristome internally thickened below and heavily so on columella. Umbilicus smaller with steeper walls.

Animal as in variety *themis*.

Trochomorpha (Lauhala) corallina themis Garrett, (pl. 64, figs. 5, 6; pl. 57, figs. 1, 2; pl. 50, figs. 10, 11).

Helix lüdersii (Pfeiffer) Schmeltz, in part, 1869, Cat. Mus. Godeffroy IV: 73, Fiji: Malatta, Vanua Balavo, Mango. *T. lüdersi* (Pfeiffer) Mousson, 1870, Jour. de Conch. **18**: 122 [14], Vanua Balavo and Oneata.

T. themis Garrett, 1887, Proc. Zool. Soc.: 177.

Fiji (north Lau): Vanua Mbalavu: (Garrett!); ANSP. 48956, 49028 (Garrett!). Tuvutha: BBM. 78847, on shrub leaves and tree trunks, damp ridge and undulating flat, wooded interior basin (E. H. Bryan, Jr.! Sept. 10, 1924). Naiau: BBM. 132845. (South Lau): Yangasa Levu: BBM. 78466 (Bryan!).

Large form (pl. 64, figs. 5, 6; pl. 57, fig. 2). (South Lau): Oneata: BBM. 2477 (Garrett!). Fulanga: BBM. 78449, on shrubs and leaves (Bryan! Aug. 5, 1924). Kambara: BBM. 78685, dissected, on leaves, shrubs and tree trunks (Bryan! Aug. 23). (North Lau): Vanua Mbalavu: BBM. 78994, dissected, on shrubs and tree trunks, north end forest (Bryan! Sept. 20). Katafanga: BBM. 78837 (Bryan! Sept. 9). Avea: BBM. 79006 (Bryan! Sept. 22).

Shell (pl. 57, fig. 1) similar to typical variety but often bigger (large form); color intensified into a more reddish band of varying width just above pale carina or somewhat higher, and into a broader (than one above) zone below carina, and sometimes (78685) with narrow hydrophanous varices. Later whorls with sharper criss-cross striae and often with stronger, closer major growth-wrinkles (4.9 per mm. on 78685).

Animal similar to *T. troilus*. Mantle-collar dark (78994) or pale (78685); left mantle-lappets quite close together. Lung dark (78685) to black (78994) with small scattered white dots, larger near hindgut; 4.6 times as long as base or almost thrice kidney length, which is 4 times its base or twice pericardial length. Apical whorls with chalky deposit almost continuous. Carrefour (pl. 50, fig. 10) saccate; free oviduct with marked grayish glandular zone; spermatheca clavate without distinct stalk. Epiphallus shorter and more swollen; penis much larger, internally with principal pilaster very large

in basal half but forking into two narrower ridges in upper half and with a second short pilaster near base. Atrial opening near pedal grooves and 2 or 3 times their interspace behind inferior tentacle. Jaw with more rounded median point. Radula (pl. 50, fig. 11) has 8 laterals and 34 to 37 marginals, of which outer ones seldom form extra ectocones; 112 rows counted.

The variety *themis* appears typically to be little more than a color variation of *T. corallina,* but the large form diverges considerably.

Trochomorpha (Lauhala) albo-striata Mousson, (pl. 63, figs. 4, 5).

T. subtrochiformis albo-striata Mousson, 1870, Jour. de Conch. **18**: 122 [14]; Pfeiffer, Monogr. **7**: 289.

Fiji (north Lau): Kanathea (= Kanathia): (Gräffe!). (South Lau): Ongea levu: BBM. 78329, animal, on tree trunks and fallen logs, medium damp flat, central forest, to 1 mile inland, alt. 40-50 ft. (E. H. Bryan, Jr.! July 31, 1924). Ongea ndriti: BBM. 78268, on ferns, shrubs and tree trunks, west end (Bryan! July 29).

Shell (BBM. 78329; pl. 63, figs. 4-5) similar to *T. corallina themis* but more depressed, with whorls more flattened above and with broader carina; dark chocolate-brown, slightly intensified toward pale carina and diluted around umbilicus, and with prominent narrow hydrophanous varices. Embryonic whorls assuming stronger (yet weak) retractive and growth lines, with spiral striae almost obsolete, and with protractive striae and stronger major growth-wrinkles appearing on last half whorl; suture soon spreading to edge of carina. Later whorls with still sharper criss-cross striae (more widely spaced than in *T. apia*) above. Umbilicus relatively a little smaller.

Mousson's name is almost nude and the shells to which it was attached came from north Lau. The BBM. specimens from south Lau are very closely related to *T. corallina,* but no definitely intergrading specimens have been seen.

Trochomorpha (Lauhala) burrowsi, new species (pl. 63, figs. 1-3; pl. 50, figs. 12, 13).

(?) *Helix lüdersii corallina* Schmeltz, 1869, Cat. Mus. Godeffroy IV: 73, Futuna. (?) *Trochomorpha corallina* Garrett, 1887, Proc. Zool. Soc.: 176, Futuna.

Futuna: BBM. 11429 (115470, dissected), on dead leaves, ridge, 2 miles inland, alt. about 1,000 ft., (Nuku, Singave), Afili (E. G. Burrows! May 15, 1932).

Alofi: BBM. 115495, 115508, after shower on ferns and shrubs, flat, 150 ft. inland, Alofitai (Burrows! May 15, 20).

Shell (pl. 63, figs. 1-3) similar to *T. corallina* but considerably smaller; carina relatively broader, with upper limiting sulcus more gradual and lower one deeper; approaching variety *themis* in color pattern, but with much less contrast between bands and ground-color. Embryonic whorls with slightly stronger spiral striae and weaker growth and retractive lines (thus somewhat approaching *T. moalensis*). Later whorls with finer growth-wrinkles (6.6 per mm. on early 5th) above; base a little glossier (sculpture more

erased). Peristome slightly less thickened internally below near carina but equally so and also weakly emarginate at base of columella. Umbilicus encircled by a very broad and obscure cord, which is marked off by a sharp sulcus apically; becoming slightly smaller in the larger whorl-sizes (BBM. 115508).

Animal similar to *T. troilus*. Lung with pattern tending to form narrow white transverse bars and broader black ones; 4.5 times as long as base or 2.3 times kidney length, which is less than 4 times its base or twice pericardial length. Mantle over stomach with widely spaced, squarish, white blotches; on apex with white bars. Hermaphroditic duct shorter; talon black; free oviduct (pl. 50, fig. 13) with apparent glandular zone; spermatheca with stouter stalk. Penial retractor also attaching to more swollen epiphallus; penis proper more elongate and internally with right pilaster relatively shorter. Jaw point more eroded. Radula (pl. 50, fig. 12) has 8 laterals, of which inner two sometimes show trace of entoconal angle, and 43 marginals, of which outer 9 usually have extra ectocones; rows not counted.

The specimens of *T. burrowsi* from Alofi are slightly darker in ground-color, so the bands are less distinct, and attain a greater whorl-size, but these differences may well be edaphic rather than racial.

Trochomorpha (Lauhala) troilus (Gould), sensu lato (pl. 50, figs. 14-16).

Helix troilus Gould, 1846, Proc., Boston Soc. N.H. **2**: 176 [23], Samoa; Pfeiffer, Monogr. **1**: 123 [**3**: 158-**4**: 182-**5**: 253-**7**: 288]; Gould, Exped. Shells: 58, at least in part, pl. 4, figs. 55b-55c (fig. b is type), Upolu, Tutuila, Eimeo and Tongatabou. *T. troilus* Semper, Reisen **3**: 114, pl. 12, fig. 11, genitalia. *H. troilus* Tryon, Manual **3**: 92, pl. 18, fig. 90 (type).

Helix navigatorum "Pfeiffer" Reeve, 1854, Conch. Icon. **7**: pl. 187, fig. 1303, Navigator Islands (Cuming!); Pfeiffer, 1855, Proc. Zool. Soc. 1854: 55; Monogr. **4**: 114 [**5**: 185-**7**: 206]; Tryon, Manual **3**: 90, pl. 18, fig. 62.

(?) *H. luteo-cornea* "Pfeiffer" Reeve, 1854: pl. 186, fig. 1287, Navigator Islands (Cuming!); Pfeiffer, 1855: 56; Monogr. **4**: 186 [**5**: 257-**7**: 293]; Tryon, Manual **3**: 90, pl. 18, fig. 63.

Samoa: Upolu: NYSM. 247 (A-734, Gould types); USNM. 5457. BBM. 95707, one example, dissected, "probably Fao mountain" (E. Cristophersen! Aug., 1929); BBM. 75747, on ferns, shrubs and tree-trunks, rain forest, ridge and flat, 6 miles inland, alt. 2,000 ft., Molololelei-Lanutoo (Bryan! April 26, 1924); ANSP. 1403, from A. D. Brown Collection, marked S (probably from Gould), and Cox. Samoa: ANSP. 49024, labeled Smithsonian; ANSP. 49023 (Garrett!) and 49025 (from T. B. Wilson).

Shell similar to subspecies *savaii* but usually becoming larger, very to moderately depressed, whorls flattened above and below (95707), moderately so (type) to quite convex (75747, ANSP. or *T. luteo-cornea*), at least thread-carinate when young with 5th whorl retaining carina narrowly and sharply sulcate above but scarcely so below (94707), remaining thread-carinate (*T. navigatorum*) or becoming moderately (typical)

or scarcely angulate (ANSP. and *T. luteo-cornea*); typically pale yellowish-horn with narrow reddish stripe a short distance above and another an equal distance below angle but often with broader zones variously arranged, to practically dark brownish-horn unicolor; typically (also 95707) glossy above and more so below, with epidermis thin (type and 95707) or heavy and opaque (75747 and ANSP.). Embryonic suture usually narrowly overriding (not so in 75747). Later whorls usually with criss-cross striae even more obsolete, typically (also 95707) with weak growth-wrinkles and often assuming much heavier rounded threads (75747, *T. luteo-cornea* and ANSP.); suture less (type) to more impressed, attached to or falling below angle. Aperture quite evenly rounded to sharply angulate; peristome more evenly concave below.

Animal (BBM. 95707) similar to *T. typus* but foot paler below pedal grooves. Left mantle-lappets so extensive as to overlap slightly. Lung with brilliant black spots surrounded by irregular network of chalky-white; with mantle-glands shallowly but broadly invading; 4 times as long as base or 1.7 kidney length, which is 4.5 times its base or thrice pericardial length. Apical whorls with black spots becoming smaller and chalky deposit more continuous. Talon (pl. 50, fig. 14) relatively larger; albumen gland shorter; carrefour with smaller lateral sac. Free oviduct longer; spermatheca with longer stalk; vagina practically absent. Penial retractor inserting on apex of considerably shorter penis, which receives slender epiphallus laterally, internally (pl. 50, fig. 15) develops two pilasters and lacks a stimulator-papilla. Atrium about half as long as penis. Jaw with relatively narrow but prominent median point. Radula (pl. 50, fig. 16) has central with or without ectoconal notches, 9 laterals with persistent ectocone, and 37 or 38 shorter marginals (more as in *T. apia*), of which last 4 or 5 subdivide the ectocone; 128 rows counted. Central nervous system invested with black fascia.

Of the various forms included in *T. troilus* in the Expedition Shells, the form b (fig. 55b) is the only one which repeats Gould's original (1846) dimensions and so must be the type. This shell appears to be the one in the NYSM. lot with a paper marked "Upolu" stuffed in its aperture; its dimensions are given in my table. The shell in the USNM. seems to be that shown in Gould's figure 55c. Reeve's figure of *T. navigatorum* could be quite closely matched in other specimens of the NYSM. lot. His figure of *T. luteo-cornea* does not look like any specimens I have seen, but Pfeiffer's description also fits some of the shells in the ANSP. lots fairly well.

Because of the paucity of accurately localized material, I do not know whether *T. troilus* is simply an exceedingly variable species or whether it is divisible into a number of local races or perhaps into even distinct species. Unfortunately, the only Upolu specimen that I have dissected is much more carinate than any other shell seen, although it does agree fairly closely with typical *T. troilus* in texture and whorl-increase.

Key to Forms of Genus Trochomorpha from Samoa

A. Shell glossy above; later whorls with weak or obsolescent granulation or criss-cross striae; Samoan species of ..... section **Lauhala**, new.

B. Shell depressed; ..... **T. troilus** (Gould), sensu lato.

C. Shell angulate to carinate on 5th whorl and with more rapid whorl-increase, whorls more flattened above and below, weaker growth-wrinkles and thinner epidermis;

D. Diameter about 19 mm. at 5.5 whorls; Upolu:

E. Distinctly although shortly carinate; epiphallus entering side of penial apex; vagina almost absent ..... BBM. 95707.

EE. Becoming bluntly but distinctly angulate ..... typical form.

DD. Diameter 18.5 mm. at 5 whorls (?); thread-carinate; anatomy and island not known .....**T. navigatorum** (Reeve).

CC. Shell becoming bluntly angulate on 5th whorl, and with less rapid whorl-increase, more evenly rounded whorls, stronger growth-wrinkles and heavier epidermis;

F. Diameter at 5 whorls over 16 mm.; anatomy and island unknown ....**T. luteo-cornea** (Reeve)?

FF. Diameter at 5 whorls about 14 mm.; penis with almost solid caecum above epiphallar entrance; vagina short; Savaii: ....**T. troilus savaii,** new subspecies.

BB. Shell at least moderately elevated and at most subangulate; apparently otherwise similar to CC; Upolu:

G. Moderately elevated, subangulate.....**T. samoa** (Hombron et Jaquinot).

GG. More elevated, scarcely subangulate ..... **T. tuber** Mousson.

AA. Shell dullish above and markedly carinate; later whorls with fine but sharp criss-cross striae ..... section **Ludificator,** new.

H. Depressed to moderately elevated and diameter about 18 mm. at 5.5 whorls; epiphallus sharply demarcated, receiving insertion of penial retractor near its middle and entering penial apex; Upolu, Savaii and Tutuila: ....**T. apia** (Hombron et Jaquinot).

HH. Shell almost as high as broad and diameter about 9 mm. at 5.5 whorls; anatomy unknown; Upolu: .....**T. tentoriolum** (Gould).

Comparative whorl-sizes in Trochomorpha from Samoa

	1½	4 wh.	4.5 wh.	5 wh.	5.5 wh.	6 wh.	Maxima	Index
T. troilus	2.61	.....	5.0(13.1)	6.2(16.1)	7.3(19)?	.....	5.3	178
BBM. 95707	2.56	4.5(11.4)	5.5(14.0)	6.4(16.5)	7.3(19—)?	.....	4.9+	185
T. navigatorum	.....	.....	.....	(18.5)?	.....	.....	5?	176
T. luteo-cornea	.....	.....	.....	(18)?	.....	.....	5?	164
BBM. 75747	3.28	3.3(10.9)	4.1(13.3)	4.8(15.7)	5.5(18)?	.....	5.3	172
T. t. savaii	2.63	3.9(10.3)	4.6(12.1)	5.3(14)?	6.0(16—)?	.....	4.7	199
T. samoa	.....	.....	.....	.....	(18)	.....	5.5	141
T. tuber	.....	.....	.....	.....	(12.5)	.....	5.5	132
T. apia (ANSP.)	2.21	4.5 (9.9)	5.6(12.4)	6.8(15.1)	8.0(18—)?	9.2(20+)?	5.2—	202
BBM. 84791	2.20	.....	5.9(12.9)	7.2(15.9)	8.3(18.2)	9.4(21—)?	5.5+	214
BBM. 75836	2.32	.....	5.5(12.8)	6.7(15.6)	7.9(18.3)	9.1(21)?	5.5	203
T. tentoriolum	2.05	.....	3.5 (7.1)	3.9 (8.1)	4.4 (9.0)	4.9(10)?	5⅞	113

Dimensions in Trochomorpha from Samoa

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
T. troilus							
Gould (form b)	7.6	(19.1)	.....	.....	.....	.....	5.5
fig. 55c	12.2	167(20.3)	.....	62(7.6)	130(9.8)	.....	5-6
NYSM. 247	10.5	178(18.7)	155(16.3)	65(6.78)	135(9.14)	6.6(2.85)	5.3
BBM. 95707	8.00	204(16.3)	185(14.8)	62(4.95)	151(7.47)	5.6(2.91)	4.9+
BBM. 75747	9.90	172(17.0)	160(15.8)	59(5.81)	137(7.98)	6.6(2.57)	5.3
T. t. savaii							
type	6.72	199(13.4)	178(12.0)	70(4.72)	135(6.36)	6.6(2.02)	4.7
T. navigatorum							
Pfeiffer	7.5	(18.5)	(16)	.....	.....	mediocre	5
Reeve fig.	10.5	176(18.5)	.....	67(7.0)	125(8.7)	.....	
T. luteo-cornea							
Pfeiffer	8.5	(18)	(16)	.....	.....	subanguste	5
Reeve fig.	11.0	164(18)	.....	68(7.5)	122(9.1)	.....	
T. samoa							
Hombron et Jaquinot ..		(20)	.....	.....	.....	.....	.....
figs. 28-30	14.2	141(20)	125(17.7)	62(8.8)	106(9.3)	6.5(3.1)	
T. tuber							
Mousson	9.5	(12.5)	.....	.....	.....	9 (1.4)	5.5
fig.	9.5	132(12.5)	.....	48(4.55)	119(5.4)	.....	
T. tentoriolum							
Gould	7.6	(10.2)	.....	.....	.....	.....	6
ANSP. 1935	8.61	113 (9.7)	108 (9.3)	34(2.94)	164(4.82)	9.5(1.02)	5⅞
T. apia							
Rousseau	8	(20)	(18)	.....	.....	.....	5 (?)
fig.	9.9	202(20)	180(17.8)	52(5.1)	173(8.8)	6.7(3.0)	
(subtrochiformis)	....	.....	.....	.....	.....	.....	.....
fig.	10.1	190(19.2)	171(17.3)	52(5.3)	181(9.6)	.....	
ANSP. 77294	8.00	202(16.2)	178(14.2)	47(3.75)	219(8.21)	9.7(1.67)	5.2—
BBM. 84791	8.66	214(18.5)	195(16.9)	49(4.26)	216(9.20)	9.0(2.06)	5.5+
BBM. 75836	9.03	203(18.3)	185(16.7)	48(4.30)	206(8.86)	9.3(1.97)	5.5

Trochomorpha (Lauhala) troilus savaii, new subspecies (pl. 57, figs. 12, 13; pl. 50, figs. 17, 18).

Samoa: Savaii: BBM. 75764, dissected, on ferns and shrubs, damp hillside, 3 to 4 miles inland, alt. 4,100-4,200 ft., between camp and crater of 1905-11 (E. H. Bryan, Jr.! May 8, 1924); BBM. 95757, young, on ferns, shrubs or tree trunks, damp hillside, near Mataulanu Lake (E. Cristophersen! Oct. 2-3, 1929); BBM. 108189, dissected, same mores, over 10 miles inland, alt. 4,300-4,950 ft., above Matavanu Crater (Hume and Cristophersen! Aug., 1931).

Shell (pl. 57, figs. 12-13) depressed, with quite convexly rounded whorls, thread-carinate when young but becoming bluntly and obtusely angulate on 5th whorl; yellowish unicolor on protoconch, but assuming a narrow reddish band above angle and another about an equal distance below on early neanic growth, and with ground-color becoming brownish

horn-color on later growth so that bands are less evident; glossy above and below; thin but with heavy epidermis. Embryonic whorls about 1.8, soon assuming sharp spiral striae which cross weak, anastomosing growth and retractive wrinkles; suture impressed and weakly overriding. Later whorls with spirals becoming weaker but developing very shallow and weak criss-cross striae and low growth-threads (6.3 per mm. on 5th) above; base similar but with more widely spaced, shallow spiral grooves; suture moderately impressed, attached at and later slightly below angle. Aperture weakly angulate at about 90° to shell-axis; peristome 30° to shell-axis, slightly emarginate near suture, then weakly arcuate and thin above, concave and thin below, and very weakly arcuate and internally thickened towards columella, which is gradually reflected so as to reduce umbilicus from 6.6 to above 7.6 times in shell diameter.

Animal similar to typical *T. troilus* but foot pebbled above with dark pigment. Left mantle-lobes quite close together. Lung with similar spots tending to form irregular transverse bars; apical whorls with large but less intense spots. Free oviduct (pl. 50, fig. 18) with glandular zone apparent; spermatheca with shorter stalk; vagina slightly longer. Penis with almost solid apical cone above entrance of epiphallus and internally with right pilaster shorter. Atrium shorter, opening about 1.5 pedal groove interspace above grooves or behind inferior tentacle. Radula (pl. 50, fig. 17) has central and 10 laterals with stronger ectocones, and 49 marginals, of which outer 5 or 6 subdivide ectocone; 115 rows counted.

Trochomorpha (Lauhala) samoa (Hombron et Jaquinot).

Helyx samoa Hombron et Jaquinot, 1841, Ann. Sci. Nat. [2] (Zool.) **16**: 63. *Helix samoa* Hombron et Jaquinot, Voy. Pôl Sud, livr. 22: pl. 4, figs. 28-31; Rousseau, **5**: 11; Pfeiffer, Monogr. **4**: 69 [**3**: 273-**5**: 134-**7**: 136]; Tryon, Manual **3**: 81, pl. 15, figs. 64-66.

Samoa: Upolu (= Opoulou). I have not seen any recently collected specimens that are as elevated as either this species or the next. However, the markedly descending last whorl in the figure of *T. samoa* may indicate deformity and it is the oldest valid name for any of the Oceanesian species of *Trochomorpha.*

Trochomorpha (Lauhala) tuber Mousson.

Trochomorpha tuber Mousson, 1869, Jour. de Conch. **17**: 334 [12], pl. 14, fig. 5. *Helix tuber* Pfeiffer, Monogr. **7**: 278; Tryon, Manual **3**: 81, pl. 15, fig. 63.

Samoa: Upolu (Gräffe!). Samoa: BBM. 1286 (Garrett!).

Trochomorpha (Ludificator) apia (Hombron et Jaquinot), (pl. 63, fig. 7; pl. 57, figs. 14, 15; pl. 50, figs. 19-21).

Helix trochiformis (Férussac) Gould, 1852, Exped. Shells: 61, pl. 4, figs. 58, a-b.

H. apia Hombron et Jaquinot, 1852 (?), Voy. Pôl Sud, livr. 22, pl. 7, figs. 9-13; Rousseau, **5**: 23; Pfeiffer, Monogr. **3**: 273. Not *H. apia* Reeve, 1854, Conch. Icon. **7**: pl. 199, fig. 1402, New Hebrides: Aneityum

(= Annaton): (Macgillivray!); nor Pfeiffer, Monogr. 4: 183 [5:253-7:288]; nor Tryon, Manual 3: 88, pl. 17, figs. 45-46.

H. eurydice (Gould) Mousson, 1865, Jour. de Conch. 13: 170 [7], Upolu and Savaii: Mataatu (Gräffe!).

T. subtrochiformis Mousson, 1869, Jour. de Conch. 17: 335 [13], pl. 14, fig. 6, Upolu and Savaii; Semper, Reisen 3: 113, pl. 12, fig. 12; pl. 16, fig. 3, anatomy. *H. subtrochiformis* Schmeltz, 1869, Cat. Mus. Godeffroy IV: 73, Savaii and Tutuila (Gräffe!); Pfeiffer, Monogr. 7: 289, Dohrn, Conch.-Cab. IV: 565, pl. 167, figs. 24-25; Tryon, Manual 3: 79, pl. 15, figs. 46-47.

Samoa: Upolu: Apia. ANSP. 77294, Apia (C. N. Eliot!). Tutuila: BBM. 84791, dissected, on ferns, shrubs and tree-trunks, damp ridge, alt. 900-1,200 ft., Leone-Aoloau trail (Judd, Dranga, and Cooke! March 23, 1926). Savaii: BBM. 75836, same mores, 2-3 miles inland, alt. 90-300 ft., south of Safune Valley (Bryan! May 1, 1924).

Shell (pl. 63, fig. 7; pl. 57, figs. 14-15) similar to *T. typus* but typically and usually more depressed (very variable in height) with less convex base (in examples of similar elevation); carina with sulcus above it usually deeper than one below; chestnut-brown [paler with median chestnut zone and sometimes with vague supracarinal one in BBM. 75836], usually with hydrophanous varices, above; base paler with poorly demarcated subcarinal zone. Embryonic whorls soon assuming very fine but sharp, spiral striae which cross very low broad growth-wrinkles and faint indications of retractive ones. Later whorls rapidly losing spirals and assuming finer criss-cross striae, which are sharpest on 6th, and weaker growth-wrinkles (4.5 per mm. on early 6th), some of which are usually accompanied by hydrophanous varices, above. Peristome 40° to shell-axis; columella less thickened internally and not emarginate. Umbilicus somewhat larger, more conical and without trace of encircling cord.

Animal also similar. Left mantle-lappets narrowly separated. Lung with weak, equally distributed powdering of chalky-white, which becomes considerably stronger on apical whorls; over 4 times as long as base; kidney almost 4 times length of its base. Talon short, recurved. Free oviduct (pl. 50, fig. 19) with evident glandular zone around most of its length; spermatheca clavate, with yellowish sac poorly demarcated. Penial retractor arising near base of uterus and inserting on middle of epiphallus, which is short but swollen, internally (E; pl. 50, fig. 20) develops anastomosing rugae and is marked off from penis (P) by higher sphincteric fold (EP); penis proper very short, internally with three large pilasters but without stimulator-papilla. Atrium as long as penis proper, opening as far behind inferior tentacle as pedal grooves are separated from each other and half that space above upper groove. Radula (pl. 50, fig. 21) has central usually unicuspid, 8 laterals, of which inner 2 or 3 rarely show ectoconal notch, and 40 shorter marginals with more elevated blades; rows not counted.

Hombron et Jaquinot's *T. apia* was accurately localized and evidently figures 9 to 12 represent the species that was subsequently described by Mousson as *T. subtrochiformis*; their figure 13 represents another color phase. Pfeiffer, who is probably responsible for the identification of the New Hebrides shell with this species, possibly never saw the Samoan *Trochomorpha*

until after Gräffe made his collections, and neither Mousson nor Garrett even mentioned *T. apia* in their discussions of Samoan mollusks.

All the Samoan species of *Trochomorpha* are included in the key under the discussion of *T. troilus*.

Trochomorpha (Ludificator?) tentoriolum (Gould), (pl. 34, fig. 5).

Helix tentoriolum Gould, 1846, Proc. Boston Soc. N.H. 2: 176 [23]; Pfeiffer, Monogr. 1: 119 [3: 112-4: 111-5: 182-7: 201]; Gould, Exped. Shells: 63, pl. 4, fig. 54; Tryon, Manual 3: 79, pl. 15, fig. 32.

Samoa: Upolu: ANSP. 1935 (A. D. Brown Collection, marked S).

This ANSP. specimen, which originally came from the Smithsonian Institution, is slightly smaller than Gould's dimensions for *T. tentoriolum* but is apparently the only example known.

Trochomorpha (Cotitrochus) eurydice (Gould), (pl. 63, fig. 6; pl. 57, figs. 10, 11; pl. 51, figs. 1, 2).

Helix eurydice Gould, 1847, Proc. Boston Soc. N.H. 2: 177 [24]; Pfeiffer, Monogr. 1: 119 [3: 112-4: 111-5: 181-7: 199]; Gould, Exped. Shells: 60, pl. 4, figs. 57, a-b; Tryon, Manual 3: 90, pl. 18, figs. 68-70.

Tonga: Tongatabu: NYSM. 253 (A 743, Gould types); USNM. 5459; ANSP. 48963 (ex auct.). Eua: BBM. 87716-7, dissected, on trees and dead leaves, damp hillside, 2 miles inland, alt. 385 ft., Johanssen plantation (Ladd and Hoffmeister! May 7, 1928). Tonga: BBM. 6891 (Garrett!).

Shell (pl. 63, fig. 6; pl. 57, figs. 10-11) similar to *T. typus* (actually closer to *T. pallens* in form and coloration). Embryonic whorls with fine spiral lines crossing somewhat vaguer retractive lines and growth-wrinkles. Later whorls with weaker growth-wrinkles (4.1 per mm. on early 6th) above, and with more evident, but still wavy, spiral striae below. Aperture rostrate at 105° to shell-axis; peristome 40° to shell-axis; columella not emarginate but with low rounded thickening internally. Umbilicus usually larger, without trace of umbilical cord.

Animal similar to *T. typus*, but foot paler between and below pedal grooves. Mantle-lobes paler; left lappets without gap between them. Lung with heavy reticulation of chalky-white separating brownish black spots (continued on apical whorls); 3.5 times as long as base or 1.6 kidney length, which is thrice its base or over twice pericardial length. Spermatheca (pl. 51, fig. 1) with smaller sac; vagina almost absent. Epiphallus short, sharply demarcated from vas deferens and slightly extending beyond into entrance; internally with coarse yellowish folds. Apical region of penis shorter, demarcated from basal swelling by a constriction; stimulator-papilla relatively higher but with basal end more rounded and not projecting into atrium. Atrial opening slightly higher on foot and 5 to 6 times pedal groove interspace behind inferior tentacle (at 0.3 to 0.4 distance from last to anterior margin of visceral peduncle). Radula (pl. 51, fig. 2) has unicuspid central, 8 laterals, of which 7 are unicuspid, and 40 marginals; 127 rows counted.

The dimensions of one of the NYSM. specimens, given in my table, seem to fit those of Gould for *T. eurydice* most closely. The USNM. shell is too small and is much more depressed, even than the figure.

Trochomorpha (s.s.) typus, new species (pl. 63, figs. 10-12; pl. 51, figs. 10-14).

Helix trochiformis Férussac, 1821, Tabl. Limaçons: 49 [45], nude, "L'ile de France"; Pfeiffer, 1842, Symbolae II: 40, "Taheiti" (Cuming!); Monogr. 1: 206 [3: 159-4: 184-5: 255-7: 289]; Conch.-Cab. II: 97, pl. 13, figs. 7-8; Reeve, Conch. Icon. 7: pl. 108, fig. 606. *T. trochiformis* Garrett, 1884, Jour. ANSP. 9: 24, on trunks of trees, Raiatea and Tahaa. *H. trochiformis* Tryon, Manual 3: 79, pl. 15, fig. 42. *T. trochiformis* Pilsbry, Manual 9: 1, pl. 7, figs. 8-9. Not *Helix trochiformis* Montagu, 1803, Test. Brit.: 427, xxiii, 601.

Helix circumdata Anton, 1839, Verz.: 40, "Tahieli and Opana"; Pfeiffer, 1842, Symbolae II: 40, in synonymy of *H. trochiformis*; not Férussac (1820).

Society Islands: Raiatea: BBM. 11431 (139416-20, dissected), damp hillside, alt. 200-800 ft., north side of Faaroa Bay (Mang. Exped.! Oct. 6, 1934). Tahaa: BBM. 139835, on ferns, shrubs and tree-trunks, alt. 400-900 ft., valley south east of Mount Pu Rauti (Mang. Exped.! Oct. 11).

Shell (pl. 63, figs. 10-12) umbilicate, trochiform with subconoid to subdomical spire and weakly convex base; carinate, with broad but deep sulcus above and again below angle; tan-color to brownish, with broad dark chestnut supracarinal and basal bands and with white carina; dull above and glossy below. Embryonic whorls 1.5 to 1.7, soon assuming somewhat irregularly pebbled surface, due to anatomosing retractive wrinkles crossing weaker growth ones; sometimes with vague indications of spiral lines; suture narrowly overriding. Later whorls with protractive and retractive striae, quite prominent on neanic growth but becoming vague later, crossing weak major growth-wrinkles (2.6 per mm. on 6th) above; base with criss-cross striae erased but with vague broken spiral lines; suture attached at and later just below carina. Aperture rostrate at about 105° to shell-axis; peristome about 35° to shell-axis, weakly arcuate and thin above, and concave below, at first thin but becoming gradually and broadly thickened internally towards columella (more so in 139835), which is emarginate opposite circumumbilical cord. Umbilicus open, surrounded by a very low and broadly rounded cord, which is usually demarcated by a shallow sulcus apically.

Animal with dark foot; tail rounded above, without dorsomedian groove, caudal "horn" or mucous foss; upper pedal groove weak and lower one ending short of broadly rounded tip of tail; sole quite broad, undivided although with median zone paler, rounded posteriad. Mantle-collar pigmented; shell-laps heavy but not expanded nor developing lobes; mantle-lobes low; anterior left mantle-lappet separated by about ¾ of its breadth from very low posterior one. Lung with mantle-glands invading anterior end as a rounded mass; with considerable, evenly distributed, dark pigment and superficially clouded with chalky-white points which tend to form denser stripes along hindgut and pulmonary vein; without distinct minor venation; 5.5 as long as base or over twice length of ligulate kidney, which is 5 times as long as its base or twice pericardial length; ureter complete. Apical whorls with some dark pigment and with network of chalky-white.

Ovotestis (G; pl. 51, fig. 12) consisting of about 8 groups of clavate alveoli, imbedded in basal 0.8 of apical lobe of liver; hermaphroditic duct (GD) quite long and swollen and convoluted in basal half; talon (GT) small and clavate, black with white tip; albumen gland (GG) large; carrefour (X) saccate. Uterus (UT) transversely folded. Free oviduct (UV) fairly long, attached to right wall of haemocoele by 5 muscular

bands that pass over spermathecal stalk; internally with 7 or 8 fine longitudinal folds at either end but with 5 coarse crenulated ones in middle third (corresponds to glandular zone); externally without glandular zone evident. Spermatheca of short type, with fusiform sac (S) attached by ligament (SR) to prostate and with slightly longer stalk; sometimes containing ellipsoid, membranous sacs (spermatophores?); vagina (V) short. Penial retractor (PR) arising from diaphragm on left side near middle of uterus but continued by muscle fibers to near posterior cross-wall of lung; inserting around base of epiphallus but with small band to side of penis. Prostate (DG) almost as long as and attached to uterus; vas deferens (D) caught into penioviducal angle by right ommatophoral retractor, internally (pl. 51, fig. 10) developing 7 flat longitudinal folds and demarcated from epiphallus by a low thickening. Penis without separate sheath, but connecting to epiphallus by two bands of muscle; epiphallus (E) longer than penis, containing (pl. 51, fig. 10) three long and one short, yellow pilasters and demarcated from penis by an internal sphincteric fold (EP); penis proper (P) internally developing two heavy pilasters in its apical two-thirds and a large lanceolate, rugose stimulator-papilla (PP and pl. 51, fig. 11), which is continuous with one of the pilasters and of which the free end projects into the atrium. Atrium (Y) short, opening as far above upper pedal groove as upper is from lower and thrice that distance (i.e., shortly) behind base of inferior tentacle.

Retractor system gives off buccal muscle almost immediately, then left free (lateral) retractor, which sends band to buccal retractor, and shortly afterward the right free muscle, which does not insert directly on the genitalia. Each free retractor is connected by fibers with tail fan and gives off almost immediately a tentacular muscle, which divides near middle of its total length into a slender ommatophoral retractor and a large muscle to inferior tentacle, jaw and lower lip. Right ommatophoral muscle passing between penis and oviduct.

Salivary glands lanceolate, about as long as short buccal mass, with ducts 1.5 as long; right one considerably more anteriad and contiguous to but not fused with left one above oesophagus. Jaw heavy, with strong growth-striae, weak longitudinal ones and a very low, broadly rounded, median lobe. Radula (pl. 51, fig. 13) has central with heavy lanceolate blade that may or may not develop one or two very weak ectoconal notches, 10 longer laterals, which lack entocone but gradually develop an ectoconal notch (rarely present on first), and 61 marginals, of which 59 are bicuspid, with ectocone and mesocone becoming subequal, and last two are mere denticles; 135 rows counted.

Central nervous system (pl. 51, fig. 14) similar to that of *Dendrotrochus ponapensis*. Right cerebral ganglion gives off a relatively smaller ommatophoral nerve (TE), a very small nuchal proper (not shown in figure), a quite large penial nerve (P), accompanied by muscular tissue, from base of frontal (NF), and, inside the ganglion's large retractor muscle, a small buccal retractor nerve (BR). Left pleural and pedal connectives shorter than right ones. Right parietal ganglion somewhat more distinct from relatively larger abdominal one. Tentacular nerves similar (not shown in figure). Right lateral pedal nerve with relatively much smaller penial branch (P), so that enervation of penis mainly arises from cerebral ganglion, but with a large branch (just below penial in figure) to female genitalia. Ventral pedal nerves larger and more numerous; 3 anteroventrals, 4-5 medioventrals and one large bifurcate posteroventral observed. Otocysts small, near middle of dorsal surface of each pedal ganglion.

T. typus is the type species of the genus *Trochomorpha*. Because of the confusion of locality in the original description of the preoccupied *Helix trochiformis* Pfeiffer (1842), I am founding this new name on the BBM. material. Anton's name, also preoccupied, would be quite unrecognizable without Pfeiffer's synonymic citation.

Comparative whorl-sizes in Trochomorpha from Society, Tonga, Solomon Islands

	1½	4.5 wh.	5 wh.	5.5 wh.	6 wh.	6.5 wh.	Maxima	Index
T. typus	2.26	.....	5.0(11.4)	5.8(13.0)	6.6(14.9)	7.2(16.3)	6.6	149
paratype	2.35	.....	4.7(11.1)	5.3(12.5)	5.8(13.6)	6.3(15—)?	6¼	133
Tahaa	2.45	.....	4.6(11.3)	5.3(12.9)	6.1(15.0)	6.8(16.7)	6.5	142
(trochiformis)	.....	.....	.....	.....	(16)	.....	6(?)	.....
T. swainsoni	.....	.....	(16)	.....	.....	.....	5(?)	217
ANSP. 48961	2.50	4.5(11.2)	5.3(13.2)	6.1(15+)?	.....	.....	5⅛	269
BBM. 139379	2.25	5.0(11.2)	6.0(13.6)	7.0(16—)?	8.0(18)?	.....	5.3+	248
T. assimilis	.....	.....	.....	.....	(15)	.....	6(?)	205
ANSP. 48964	1.89	.....	6.1(11.6)	7.2(13.7)	8.5(16.0)	.....	6.1	223
BBM. 139135	1.84	.....	5.9(10.8)	6.9(12.7)	7.9(14.5)	8.9(16+)?	6.1	202
BBM. 139134	1.86	.....	5.1 (9.5)	5.9(10.9)	6.7(12.4)	7.5(14)?	6.2	154
T. pallens	.....	.....	.....	.....	(16)	.....	6	171
ANSP. 48970	2.06	5.2(10.7)	6.2(12.7)	7.0(14.5)	8.1(17—)?	.....	5.9	188
BBM. 86804	2.10	4.6 (9.8)	5.4(11.3)	6.1(12.9)	6.9(15—)?	.....	5¾	178
BBM. 86805	2.10	5.1(10.7)	6.1(12.9)	7.1(14.9)	8.1(17)?	.....	5.5	185
T. cressida	.....	.....	(17.8)	.....	.....	.....	5(?)	197
(vahine)	.....	.....	.....	.....	.....	.....	....	211
ANSP. 1951	2.44	5.5(13.4)	6.6(16.2)	7.6(19—)?	.....	.....	5.2+	240
BBM. 137012	2.38	5.8(13.8)	6.8(16+)?	.....	.....	.....	4.9	220
BBM. 137014	2.38	5.8(13.8)	6.8(16+)?	.....	.....	.....	4¾	253
T. eurydice	2.35	4.6(10.8)	5.4(12.6)	6.3(14.7)	7.1(17—)	.....	5¾	189
ANSP. 48963	2.38	5.0(12.0)	5.7(13.6)	6.4(15+)?	.....	.....	5⅜	185
BBM. 87716	2.60	4.5(11.8)	5.3(13.9)	6.1(15.9)	6.9(18—)?	.....	5.5+	182
T. sanctaeannae	.....	.....	(17)	.....	.....	.....	5	224
BBM. 119236	2.46	5.6(13.8)	6.7(16.4)	7.8(19+)?	.....	.....	5¼	221

Key to Species of Section Trochomorpha, s.s.

A. Shell with more gradual whorl-increase (evident when equally elevated shells are compared, Leeward Group:

B. Fundamentally larger; Raiatea and Tahaa:

C. Usually less than 1.5 times as broad as high, with weak broadly rounded circumumbilical cord; lung darkish, powdered with white....**T. typus,** new species.

CC. Usually more than twice as broad as high, usually lighter in color, with narrower and paler bands and without trace of circumumbilical cord; lung with bolder pattern of transverse black and white bars.....**T. swainsoni** (Pfeiffer).

BB. Fundamentally smaller; usually more like CC in coloration of shell and animal and without circumumbilical cord; Huahine: .....**T. assimilis** Garrett.

AA. Shell with more rapid whorl-increase; Windward Islands: Tahiti and Moorea:

D. Intermediate in elevation between C and CC, but with whorl-increase appearing as rapid as in CC; usually with less intensive shell-coloration than C but with similar circumumbilical cord and lung pattern: Tahiti and Moorea: .....**T. pallens** Pease.

DD. About as depressed as CC but with much more rapid whorl-increase, without circumumbilical cord, glossier than other Society Islands species and sometimes pale unicolor; lung blacker with white dots; Tahiti: .....**T. cressida** (Gould).

Dimensions in Trochomorpha from Society Islands and Tonga

	alt.	maj. diam.	min. diam	alt. ap.	diam. ap.	umbilicus	whs.
T. typus							
type	11.1	149(16.5)	143(15.9)	36(4.02)	208(8.37)	12.1(1.37)	6.6
paratype	10.6	133(14.1)	128(13.6)	36(3.84)	179(6.87)	.....	6¼
Tahaa	11.8	142(16.7)	136(16.0)	40(4.68)	179(8.37)	.....	6.5
T. swainsoni							
Pfeiffer	5	(16)	.....	.....	.....	mediocre	5
Reeve fig.	7.4	217(16)	.....	63(4.6)	171(7.9)	.....	
(depressiformis)	2	(7)	.....	.....	.....	broad	3.5
(peasiana, type)	1.73	260 (4.9)	249 (4.3)	80(1.38)	142(1.96)	3.2(1.53)	2⅞
(scuta, ANSP. 48961)	5.25	269(14.1)	242(12.7)	56(2.95)	217(6.41)	5.4(2.61)	5⅛
BBM. 139379	6.09	248(15.1)	226(13.8)	57(3.48)	201(7.00)	5.4(2.81)	5.3+
T. assimilis							
Garrett	7	(15)	.....	.....	.....	moderate	6—
fig.	7.3	205(15)	.....	53(3.9)	172(6.7)	.....	
ANSP. 48964	7.40	223(16.5)	203(15.0)	44(3.28)	238(7.79)	6.3(2.62)	6.1
BBM. 139135	7.54	202(15.2)	180(13.6)	42(3.13)	220(6.88)	6.9(2.19)	6.1
BBM. 139134	8.44	154(13.0)	147(12.4)	35(2.96)	205(6.08)	10.2(1.28)	6.2
T. pallens							
Pease	11	164(18)	.....	.....	.....	.....	.....
fig. Garrett	9.35	171(16)	.....	47(4.4)	153(6.75)	.....	6
ANSP. 48970	8.79	188(16.5)	171(15.0)	44(3.87)	201(7.79)	7.4(2.24)	5.9
BBM. 86804	7.68	178(13.7)	168(12.9)	41(3.17)	191(6.06)	6.8(2.00)	5¾
BBM. 86805	8.07	185(14.9)	171(13.8)	49(3.97)	177(7.04)	8.5(1.75)	5.5
T. cressida							
Gould	6.35	(17.8)	.....	.....	.....	.....	5
fig.	9.05	197(17.8)	175(15.8)	57(5.2)	163(8.4)	4.9(3.61)	
(vahine, fig.)	.....	211	198	.....	.....	5.6	.....
ANSP. 1951	7.12	240(17.1)	223(15.9)	56(4.00)	190(7.59)	5.6(3.03)	5.2+
BBM. 137012	6.95	220(15.3)	204(14.2)	65(4.55)	151(6.86)	6.0(2.54)	4.9
BBM. 137014	6.00	253(15.2)	230(13.8)	72(4.32)	161(6.97)	.....	4¾
T. eurydice							
Gould	7.0	(16.5)	.....	.....	.....	.....	5-6
fig.	8.9	185(16.5)	172(15.3)	51(4.6)	172(7.8)	4.5(3.7)	
NYSM. 253	8.62	189(16.3)	172(14.8)	44(3.76)	204(7.67)	9.1(1.79)	5¾
BBM. 87716	8.80	182(16.0)	165(14.5)	44(3.88)	178(6.91)	5.7(2.81)	5.5+

Trochomorpha (s.s.) swainsoni (Pfeiffer), (pl. 57, figs. 4-6; pl. 51, figs. 6, 7).

Helix swainsoni Pfeiffer, 1846, Proc. Zool. Soc.: 28, under stones, "Tahiti" (Tucker); Monogr. 1:122 [3:157-4:182-5:250-7:286]; Reeve, Conch. Icon. 7: pl. 108, fig. 607. *T. swainsoni* Garrett, 1884, Jour. ANSP. 9: 26, ground species and weak climber, Raiatea and Tahaa. *H. swainsoni* Tryon, Manual 3:91, pl. 18, fig. 80.

H. vahine "Jaquinot" Pfeiffer, 1849, Zeitschr. Malak. 6:75, in synonymy of *H. swainsoni.*

H. depressiformis Pease, 1864, Proc. Zool. Soc.: 670, juvenile, Central Pacific Islands.

H. scuta "Pease" Garrett, 1884: 26, in synonymy.

H. lenta "Pease" Garrett, 1884: 27; not Solander in Brander (1766).

Planamastra peasiana Hyatt and Pilsbry, 1911, Manual **21**: 130, pl. 25, figs. 8-10, juvenile, "Hawaiian Islands" (from Pease).

Society Islands: [Raiatea]. ANSP. 48961, "*H. scuta* Pease, MSS." (Garrett!); ANSP. 1984, type of *P. peasiana* (A. D. Brown Collection, from Pease). BBM. 139379, dissected, on logs, ferns, shrubs, tree-trunks and dead leaves, damp hillside, north side of Faaroa Bay (Mang. Exped.! Oct. 6, 1934).

Animal similar to *T. typus* but foot paler, almost white on tail, which is somewhat more abruptly rounded; surface sometimes with pearl-like excrescences. Gap between left mantle-lappets about ¼ width of anterior one. Lung with black spots and intervening chalky-white areas that tend to form 2 bands either side of hindgut. Apical whorls black with irregular transverse blotches of white. Genitalia (pl. 51, fig. 7) similar. Jaw with quite prominent, evenly rounded median lobe. Radula (pl. 51, fig. 6) has central with more persistent ectocones, 8 laterals with stronger ectocone, and 53 marginals; rows not counted.

Reeve's figure of *T. swainsoni* seems to represent a deformed shell. Pfeiffer's dimensions as well as his inclusion of *Helix vahine* "Jaquinot" (the first use of the name) in the synonymy appear to indicate *Trochomorpha cressida* rather than the present species. Nevertheless, I am accepting Garrett's identification of the Raiatea species with Pfeiffer's name. According to Garrett, hybrids between *T. swainsoni* and *T. typus* occur, and one lot in the ANSP. seems to contain intergrading shells.

Trochomorpha (s.s.) assimilis Garrett, (pl. 57, fig. 3; pl. 51, fig. 8).

T. assimilis Garrett, 1884, Jour. ANSP. **9**: 27, pl. 3, fig. 44. *H. assimilis* Tryon, Manual **3**: 92, pl. 18, fig. 84. *T. assimilis* Pilsbry, Manual **9**: 1, pl. 8, figs. 9-12, anatomy.

(?) *Nanina cressida* (Gould) W. G. Binney, 1884, Ann. N. Y. Acad. Sci. **3**: 85, pl. 17, fig. Q, Huahine (Garrett!), radula.

Society Islands: Huahine: ANSP. 48964 (BBM. 1890), on trunks of trees (Garrett!). BBM. 139134-5, dissected, on shrubs and tree-trunks, alt. 1,200-1,700 ft., northwest of Fare (Mang. Exped.! Sept. 30, 1934).

Animal similar to *T. typus*. Gap between left mantle-lappets half width of anterior one. Lung and apical whorls with white-spotted, transverse bars, extending as far as peripheral carina and separated by larger areas of chalky-white. Spermatheca (pl. 51, fig. 8) with more elongate stalk. Insertion of penial retractor more posteriad; apical region of penis slender and more sharply demarcated from basal swelling containing stimulator, which is recurved. Radula has 9 laterals and 48 marginals; 128 rows counted.

Trochomorpha (s.s.) pallens Pease, (pl. 51, fig. 9).

T. trochiformis pallens Pease, 1870, Jour. de Conch. **18**: 399, Taïti and Moorea; Pfeiffer, Monogr. **7**: 289. *T. pallens* Garrett, 1884, Jour.

ANSP. **9**: 25, pl. 3, fig. 43, on trunks of trees. *Helix pallens* Tryon, Manual **3**: 91, pl. 18, fig. 79.

Society Islands: Tahiti: (Garrett!). BBM. 86804-5, dissected, on ferns, shrubs and tree-trunks, 1-6 miles inland, alt. 100-1,000 ft., right hand side of Vaita Valley, Tautira District, Taiarapu (MacDaniels! June 27, 1927). Society Islands: ANSP. 48970, "types, Jour. A.N.S. IX" (Garrett!).

Animal similar to *T. typus*. Spermathecal stalk slightly longer; epiphallus a little better demarcated from vas deferens. Radula (pl. 51, fig. 9) has 9 laterals with more persistent ectocone (more as in *T. swainsoni*) and 63 marginals; 149 rows counted.

Trochomorpha (s.s.) cressida (Gould), (pl. 57, figs. 7 to 9; pl. 52, fig. 1).

Helix cressida Gould, 1846, Proc. Boston Soc. N.H. **2**: 176 [23], Samoa and Tahiti; Pfeiffer, Monogr. **1**: 123 [**3**: 114-**4**: 115-**5**: 188-**7**: 208]; Gould, Exped. Shells: 57, pl. 4, figs. 56, a-c. *T. cressida* Garrett, 1884, Jour. ANSP. **9**: 25, valleys on northwest side of Tahiti. *H. cressida* Tryon, Manual **3**: 91, pl. 18, figs. 76-78.

Helix vahine Hombron et Jaquinot, 1852 (?), Voy. Pôl. Sud, Astrolabe, livr. *22*: pl. *7*, figs. 1-4; [Pfeiffer, Monogr. **3**: 157]. Not *H. vahine* Pfeiffer (1849)?

H. exclusa (Férussac) Rousseau, 1854, Voy. Pôl. Sud **5**: 24, in part.

Society Islands: Tahiti: ANSP. 1951 (A. D. Brown Collection, marked S); USNM. 5458. BBM. 137012-4, dissected, damp ridge, alt. 5,600-6,300 ft., Aorai Trail (Mang. Exped.! Sept. 15, 1934); BBM. 136342, damp hillside, alt. over 750 ft., Fautaua Valley (Mang. Exped.! May 9). Samoa (sic): ANSP. 49026, labeled Smithsonian Inst.

Animal similar to *T. typus*. Gap between left mantle-lappets about ¼ width of anterior one. Top of lung jet black with broken reticulation and small dots of chalky-white, which forms continuous reticulum on apical whorls. Middle zone of free oviduct (pl. 52, fig. 1) paler than end zones; spermatheca with longer stalk. Apical region of penis relatively longer and slenderer. Radula has 11 laterals with weak ectoconal notch and 54 marginals; 144 rows counted.

ANSP. 1951 (pl. 57, fig. 9) seems to fit Gould's original dimensions of *T. cressida* closely enough; the USNM. shell is far too small, but may be the basis for the figure in the Expedition Shells, which, however, badly exaggerates the height. The single broken specimen in ANSP. 49026, although labeled Samoa, is evidently also this species and perhaps is one of the specimens on which Gould based his undoubtedly erroneous first locality.

Trochomorpha (Lentitrochus) sanctae-annae E. A. Smith*, (pl. 63, figs. 8, 9; pl. 51, figs. 3-5).

T. sanctae annae Smith, 1885, Proc. Zool. Soc.: 594, pl. 36, figs. 7-7b. *Helix sanctae annae* Tryon, Manual 3: 89, pl. 18, figs. 56-58.

Solomon Islands (east): Owa Raha (= Santa Anna): on trunks of coconut palms (Guppy!). BBM. 119236, dissected (Crocker Expedition!).

Shell (pl. 63, figs. 8-9) depressed trochiform, with low ogival spiral and very weakly convex base, carinate with broad sulcus above angle considerably deeper than one below; yellowish to light tan unicolor, or with carina bordered above and below by vague darker zones; dullish above and below. Embryonic whorls soon assuming quite sharp but shallow spiral lines which cross weak, quite widely spaced growth-lines; suture impressed and narrowly overriding. Later whorls with criss-cross striae fairly evident on neanic and vaguer on later growth and with weak major growth-wrinkles (3.8 per mm. on late 5th) above; base granulate with vague criss-cross sculpture; suture dropping to just below carina. Aperture carinate at 100° to shell-axis; peristome 40° to shell-axis, evenly and weakly arcuate, internally thickened and very slightly expanded near carina above; concave (but very weakly arcuate toward columella), well thickened and shortly but distinctly expanded below. Umbilicus 6 to 7 times in shell diameter, showing evenly rounded whorls and well impressed suture.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
Smith	7	(17)	(15)	.....	.....	.....	5
fig.	7.6	224(17)	204(15.5)	57(4.3)	163(7.0)	6.8(2.5)	
BBM. 119236	7.91	221(17.5)	207(16.4)	46(3.64)	208(7.56)	5.9(2.97)	5¼

Animal similar to *T. troilus* but coloration more brownish (bleached); pedal grooves meeting behind in an acute angle, from which a small foss-like slit runs caudad; sole more narrowly rounded. Left mantle-lobes quite close together. Lung with chalky-white and some brownish behind mantle-collar and with broad white bands on both sides of hindgut; with mantle-glands quite deeply invading; almost 5 times as long as base or 2.3 kidney length, which is over 4 times its base or twice pericardial length. Talon (pl. 51, fig. 5) bifurcate; albumen gland larger; carrefour somewhat sacculate. Uterus with broad collar of white gelatinous material near its apex; spermatheca with shorter duct. Epiphallus shorter; penis proper more elongate (usually not constricted as in one figured) and internally (pl. 51, fig. 4) with a heavy pilaster running entire length, a smaller one and vague bosses in apical half and several short folds near base. Atrial opening just above pedal grooves and 2 or 3 times their interspace behind inferior tentacle. Jaw with low, broadly rounded median lobe. Radula (pl. 51, fig. 3) with all teeth unicuspid, of which 10 broader ones might be called laterals and 36 marginals; 109 rows counted.

According to Wiegmann (1893), a similar radula is found in *Trochomorpha costulata* von Martens.

Genus BERTIA Ancey*, 1887

Bertia Ancey, 1887, Conchologist's Exchange 1: 53; type by original designation *Nanina cambodgiensis* = *Helix cambojiensis* Reeve, 1860, Ann. Mag. Nat. Hist. III, 6: 455, from French Indo-China: Cambodia (Mouhout!).

(?) *Ryssota* (Albers) Godwin-Austen, 1891, Proc. Zool. Soc.: 27, pl. 6, figs. 1-8a; (?) *Rhysota* Wiegmann, 1898, Abh. Senckenberg. Naturf. Ges. 24

(3) : 291-298, pl. 21, figs. 1-7; (?) *Ryssota* Laidlaw, 1932, Proc. Malac. Soc. **20** (2) : 94; dissections of *B? brookei* (Adams and Reeve) from Borneo.

(?) *Exrhysota,* new subgenus, type *Rhysota brookei* Wiegmann (1898), from Borneo.

The anatomy of the type species of *Bertia* is unknown but the dissections of *B? brookei* apparently represent a species of Trochomorphinae; in any case, the Borneo species is certainly not congeneric with *Ryssota,* although it is the animal that caused Laidlaw and probably Thiele to refer the Philippine group to this subfamily. The new subgenus *Exrhysota,* founded on Wiegmann's dissections, has a shell with broadly plicate undulations above and with its columella peculiarly produced so as to almost cover the perforation, while *Bertia,* s.s. has a much smoother shell with a regularly expanded columella; both are sinistral.

The three dissections agree that *B? brookei* lacks a caudal foss and that its epiphallus is not well developed. Wiegmann states that the penis is enervated from the cerebral ganglion. The presence of shell-lobes is denied by Wiegmann and Laidlaw. Apparently, Laidlaw agrees with Godwin-Austen on the length of the spermatheca.

Incidentally, *"Eurybasis" lychnia* (Benson) Laidlaw (1932: 93, fig. 9) is apparently another member of this subfamily, despite the resemblance of its shell to that of the true *Eurybasis* (Sesarinae).

VITRININAE

Semper (1873) described *Vitrinopsis, Vitrinoidea,* and *Vitrinoconus,* from the Philippines, as genera of this subfamily, but his anatomical accounts, especially of the last group, are too brief and superficial for complete conviction. *Otoconcha* Hutton (1884), from New Zealand, has also been included with them, but actually belongs in the superfamily Arionacea (Endodontidae, etc.).

Genus VITRINA Draparnaud, 1801

Vitrina Draparnaud, 1801, Tableaux: 33, 98; type fixed by Opinion 119, International Commission of Zoölogical Nomenclature, as *Helix pellucida* Müller, 1774, Hist. Verm. II: 15, from Denmark; Hesse, 1923, Arch. Mollusk. **55**: 1-25, 81-115, 130-145, anatomy and systematics; Baker, 1929, Nautilus **42**: 137-139, nomenclature.

As in the nearctic region, only *Vitrina,* s.s. is represented in the Hawaiian islands.

Vitrina (s.s.) tenella (Gould).

(?) *V. tenella* Gould, 1847, Proc. Boston Soc. N. H. **2**: 181 [26], Kauai; Pfeiffer, Monogr. **2**: 509 [**3**: 6-**4**: 797-**5**: 20-**7**: 25]; Gould, Exped.

Shells: 11, pl. 1, fig. 10, a-c. *Helicarion tenellus* Tryon, Manual 1: 171, pl. 38, figs. 59-60. (!) *V. tenella* Cooke, 1921, Occ. Papers BBM. 7: 268, figs. 4 (anatomy); pl. 24, figs. 2 (shell).

Hawaii: [east Maui]: USNM. 20874. (Makawao): BBM. 76532, above Von Tempsky's, alt. 6,000 ft., Kula (Cooke! May 27, 1924). Hawaii (North Hilo): BBM. 11444, dissected, on ground, slopes of Puu Huluhulu, alt. 6,700 ft., near Humuula (Baker! Aug. 10, 1935). (Hamakua): BBM. 75488, Mauna Kea, alt. 9,500 ft., above Kukaiau (M. C. Neal! May 14, 1923).

The USNM. lot contains a broken shell of *V. tenella,* which is probably that figured in the Expedition Shells and is the only authentic specimen seen. I am rather dubious of its identity with Gould's original description, but accept it as the type, especially since I would not dare describe the Hawaiian species as distinct from *V. alaskana* Dall, from the western United States, either on the basis of its shell or its animal. From collections made on Haleakala, I believe that the Hawaiian animals still retain their usual habits and become sexually mature in the fall. Because of its mores and habitat, *V. tenella* is probably not an example of human introduction, although it is commonly associated, on both Maui and Hawaii, with European Limacidae.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	1½	2.5 wh.	3 wh.	whs.
Gould	2.31	(8.47)	.....	.....	.....	.....	.....	(8.47)	3
fig.	.....	138	105	81	104	.....	.....	.....	
BBM. 76532	3.48	161(5.59)	128(4.45)	80(2.80)	120(3.35)	1.37	2.9(3.96)	4.5(6.1)?	2.9
BBM. 75488	3.82	169(6.45)	132(5.02)	82(3.15)	125(3.94)	1.42	2.8(3.99)	4.5(6.45)	3

VITREINAE

The name Vitreinae was used by Thiele (1931). The subfamily includes the palearctic *Vitrea* Fitzinger (1833), the Mexican *Pycnogyra* Strebel und Pfeffer (1880), and *Pristiloma* Ancey (1887), which apparently occurs on both sides of the Pacific.

Genus HAWAIIA Gude, 1911

Hawaiia Gude, 1911, Proc. Malac. Soc. 9: 272; type by original designation *Helix kawaiensis* Pfeiffer.

Pseudovitrea Baker, 1928, Proc. ANSP. 80: 25; type by original designation *Helix minuscula* Binney from Michigan.

Hawaiia minuscula (A. Binney), (pl. 61, figs. 13-15).

Helix minuscula Binney, 1840, Jour. Boston Soc. N.H. 3: 435, Ohio and Vermont; Pfeiffer, Monogr. 1: 114 [3: 90-4: 83-5: 147-7: 154].

(Zonites) Hyalinia minuscula Tryon, Manual **2**: 202, pl. 60, figs. 58-63. *Pseudovitrea minuscula* Baker, 1928, Proc. ANSP. **80**: 25, pl. 5, figs. 1-4, anatomy; 1929, Proc. ANSP. **81**: 261-263, pl. 10, figs. 1-12, varieties.

Helix kawaiensis "Pfeiffer" Reeve, 1854, Conch. Icon. **7**: pl. 182, fig. 1256, Kawai (= Kauai); Pfeiffer, 1855, Proc. Zool. Soc. 1854: 52; Monogr. **4**: 84 [**5**: 147-**7**: 148]. *(Zonites) Hyalinia kawaiensis* Tryon, Manual **2**: 170, pl. 52, fig. 5. *Hawaiia kawaiensis* Baker, 1930, Occ. Papers Mus. Zool. Univ. Mich., **220**: 34, anatomy (BBM. 76132).

United States: Ohio: ANSP. 74416.

Hawaii: Molokai: BBM. 76132 (ANSP. 153476), dissected (1930), Halawa (Cooke! Dec. 31, 1923). Kauai, Oahu, east Maui: BBM.

Tuamotu: Pitcairn: BBM.

Society Islands: Tahiti: BBM.

Shell depressed turbinate, with subcylindric whorls and broadly umbilicate; whitish, with very thin, weakly corneous epidermis; almost polished above and more so below; subtranslucent to nearly opaque. Embryonic whorls 1.6 to 1.7, rather polished at first but soon assuming fairly sharp but shallow spiral striae crossing very weak minor growth-wrinkles (both often more or less eradicated in old shells); suture distinctly impressed. Later whorls (often irregular and usually at last descending) with somewhat sharper but wavy spiral striae which cross low rounded irregularly developed minor and major growth-wrinkles (25 per mm. on 4th); base with growth sculpture weaker so that weakened spirals are more apparent; suture well impressed, scarcely overriding and finally descending slightly below periphery. Aperture subcircular, peristome sharp and simple, almost 25° to shell-axis, mediocrely arcuate above and concave below; columella scarcely reflected and hiding little of large umbilicus, which shows rounded whorls and deep suture.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
ANSP. 153476	1.30	174(2.26)	164(2.13)	58(0.75)	105(0.79)	2.8(0.81)	4+

Whorl-sizes

	1½	3 wh.	3.5 wh.	4 wh.	4.5 wh.
ANSP. 153476	0.61	2.5(1.52)	3.1(1.89)	3.6(2.22)	4.1(2.5)?

This apparently nearctic species has been widely disseminated by commerce and will probably attain an extensive distribution on the islands of the Pacific.

GASTRODONTINAE

The name of this subfamily was used by me (1928). It includes the nearctic genera *Gastrodonta* Albers (1850) and *Poecilozonites* Boettger (1884).

Genus **STRIATURA** Morse, 1864

Striatura Morse, 1864, Syn. Fluv. Terr. Moll. Maine: 1; type (only vested species) *S. milium* = *Helix milium* Morse, 1859, Proc. Boston Soc. N. H. **7**: 28, from Maine, U.S.A.; Baker, 1928, Proc. ANSP. **80**: 35, pl. 7, figs. 8-12, anatomy from northern Michigan and additional synonymy.

Pseudohyalina Morse, 1864: 1; type by subsequent designation of Kobelt, 1880, Illust. Conch.: 223, *Hyalina* = *Helix exigua* Stimpson, 1850, Proc. Boston Soc. N. H. **3**: 175, Mass., U.S.A.; Baker, 1928: 33, pl. 7, figs. 1-4, anatomy of *S. exigua*; Baker, 1930, Occ. Papers Mus. Zool. Univ. Mich., **220**: 38, pl. 11, figs. 2-5, anatomy of *S. meridionalis* and *S. pugetensis*.

Only the very distinct subgenus *Pseudohyalina* is represented within the limits of these studies.

Key to Species of Subgenus Pseudohyalina

A. Shell with oblique riblets low and little more conspicuous than growth-wrinkles, with which they appear to anastomose;

B. With more than 30 riblets per mm. (near end of 3d whorl), more elevated; Nearctic and Hawaii: Kauai:

C. Larger, with about 40 riblets per mm.; umbilicus 3.2 times in diameter; western North America and Hawaii: Kauai: ..... **S. pugetensis** (Dall).

CC. Smaller, with about 35 riblets per mm.; umbilicus 2.8 or less times in diameter (constricted by descending last whorl); southeastern United States to Mexico: ..... **S. meridionalis** (Pilsbry and Ferriss).

BB. With less riblets per mm., and with diameter about twice altitude; Hawaiian islands: Oahu to Hawaii:

D. With most rapid whorl-increase, becoming larger than C, and with about 25 riblets per mm.; umbilicus 2.9 times in diameter; Hawaii: ..... **S. meniscus** (Ancey).

DD. Most depressed, about size of CC, but with 15-17 riblets per mm.; umbilicus 2.3 to 2.4 times in diameter; Maui to Oahu ..... **S. discus**, new species.

AA. Shell with riblets high thin cuticular and most widely spaced (9-10 per mm.); whorls largest with 4th markedly descending; umbilicus about 2.6 times in diameter; northeastern North America: ..... **S. exigua** (Stimpson).

Dimensions in Subgenus Pseudohyalina

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
S. pugetensis							
Dall	0.5	(1.5)	(1.2)	.....	.....	.....	3-3¼
BBM. 11432	0.985	173(1.70)	152(1.50)	70(0.685)	91(0.62)	3.2(0.525)	3
BBM. 11028	0.945	168(1.59)	148(1.40)	68(0.64)	90(0.605)	3.2(0.495)	2⅞
S. meridionalis							
Mexico	0.98	169(1.66)	155(1.52)	62(0.605)	100(0.605)	2.8(0.57)	3¼—
S. meniscus							
Ancey	0.5	(1.7)	(1.3)	.....	.....	.....	3.5
BBM. 11434	1.035	190(1.97)	167(1.73)	72(0.74)	101(0.75)	2.9(0.675)	3⅛+
S. discus							
type	1.025	198(2.03)	178(1.82)	68(0.70)	92(0.665)	2.4(0.84)	3⅝+
BBM. 20345	0.89	212(1.89)	183(1.63)	72(0.645)	90(0.58)	2.3(0.825)	3.5—
BBM. 35511	0.89	213(1.90)	191(1.70)	75(0.67)	100(0.67)	2.4(0.78)	3.4
S. exigua							
Michigan	1.30	172(2.24)	164(2.13)	62(0.805)	95(0.765)	2.6(0.875)	3.5

Comparative Whorl-sizes

	1½	2.5 wh.	3 wh.	3.5 wh.	Maxima	Index
S. pugetensis	0.685	1.9(1.33)	2.5(1.70)	3.1(2.1)?	3	173
BBM. 11028	0.68	1.8(1.27)	2.5(1.7)?	.....	2⅞	168
S. meridionalis	0.635	1.9(1.20)	2.4(1.54)	3.0(1.9)?	3¼—	169
S. meniscus	0.69	2.0(1.38)	2.7(1.83)	3.3(2.3)?	3⅛+	190
S. discus	0.63	1.8(1.15)	2.4(1.52)	3.0(1.90)	3⅝+	198
BBM. 20345	0.625	.....	2.5(1.54)	3.1(1.9)?	3.5—	212
BBM. 35511	0.62	1.9(1.17)	2.5(1.58)	3.2(2.0)?	3.4	213
S. exigua	0.73	.....	2.5(1.83)	3.1(2.24)	3.5	172

Striatura (Pseudohyalina) pugetensis (Dall), (pl. 60, figs. 1-3).

Patulastra? pugetensis Dall, 1895, Nautilus **8**: 130; Pilsbry, 1895, Naut. **9**: 17, radula. *Zonitoides pugetensis* Dall, 1902, Proc. U.S. Nat. Mus. **24**: 500, pl. 27, figs. 10, 12. *S. pugetensis* Baker, 1930, Occ. Papers Mus. Zool. Univ. Mich. **220**: 38, pl. 11, fig. 3, anatomy.

United States: Washington: under leaves, Seattle. BBM. 11432, near outlet of Lake Crescent, Clallam County (Baker! Aug. 22, 1929).

Hawaiian islands: Kauai (Waimea): BBM. 11028, Waiakoali (Cooke!). (Koloa): BBM. 20592, high in first valley south of gap, Kipu (Cooke! March 7, 1910).

Shell similar to *S. meniscus* but more elevated, with smaller umbilicus; duller and considerably more brownish in tinge. Later whorls above with oblique threadlets (around 40 per mm. on late third) about as broad as their interspaces and largely obscuring growth-wrinklets and spiral ridgelets; base with less evident spirals even on sides of umbilicus.

The two small specimens from Kauai show no tangible characters to distinguish them from examples from the Pacific coast of the United States.

Striatura (Pseudohyalina) meniscus (Ancey), (pl. 60, figs. 4-6).

Pseudohyalina meniscus Ancey, 1904, Jour. Malac. **11**: 65.

Hawaiian islands: Hawaii (Hamakua): BBM. 18876, subfossil, Palihoou-kapapa, alt. 4,000 ft. (Thaanum!); BBM. 18877 (Thaanum!). BBM. 36645, later collection. (North Hilo): BBM. 11434, dissected, fairly common under stones, in damp rotten fern debris, alt. 6,700 ft., southeast of Kalaeeha, near Humuula (Baker! Aug. 6, 1935). (North Kona): BBM. 89943, dissected, on ground on moss just above uppermost gate, Stillman trail, alt. 6,000-7,000 ft., Hualalai (O. Oswald! Feb. 25, 1928).

Shell (pl. 60, figs. 4-6) similar to *S. discus* but with more rapid whorl-increase and so developing larger whorls, with smaller umbilicus and usually more depressed; duller and more golden in color. Embryonic whorls more convex above; apex appearing more protuberant. Later whorls above with more closely spaced (about 25 per mm. on early 4th and becoming more crowded toward peristome) and heavier oblique threadlets; suture

more abruptly impressed. Umbilicus appearing considerably smaller because of more rotund whorls and deeper suture.

Peculiarly enough, *S. meniscus* from Hawaii is more or less intermediate between the Kauai species and *S. discus* and, in fact, resembles *S. pugetensis* more closely.

Striatura (Pseudohyalina) discus, new species (pl. 60, figs. 7-9).

Hawaiian islands: east Maui (Makawao): BBM. 38479, on ground, Ainaho, half way down slope, top of Keanae Gap, Haleakala Crater (Cooke! May 26, 1915). (Hana): BBM. 38514, near Kaupo Gap, Palikou (ditto!). Lanai: BBM. 34710, subfossil, western end (Forbes!).

Depressed form. Molokai (east): BBM. 20345, Division Hill, Waikolu (Cooke! Jan. 3, 1910). Oahu (Honolulu, Koolau Range): BBM. 35511, deep in moss of dead kukui tree, above waterfall, Glen Ada, Nuuanu (Cooke! Dec. 28, 1913).

Shell depressed, broadly umbilicate, with well rounded whorls appearing slightly flattened inside umbilicus; light greenish corneous, dull but of vitreous texture and actually quite transparent. Embryonic whorls discoid or at first even slightly immersed, about 1.1, rapidly assuming sharply cut although rather low spiral ridgelets (16 or 17 visible at end of first), which are separated by rounded grooves and tend to be very weakly and irregularly beaded by the inconspicuous growth-wrinklets; second whorl with neanic sculpture becoming superimposed; suture deeply impressed but overriding. Later whorls above with low widely spaced (about 25 per mm. on 4th) threads that are more oblique than the weaker, closely spaced growth-wrinklets, which disturb and even appear to anastomose with them, and with irregular, broken, more or less spiral wrinklets that may be quite distinct in the interspaces between the protractive threads but often change direction or are broken where they cross the last; base with protractive threads gradually dying out below periphery and not reaching nadir of whorl so that spiral sculpture becomes more evident and regular; suture deeply impressed, attached at or near periphery. Aperture subcircular, evenly rounded; peristome simple and sharp, arcuate above periphery and convex below, averaging about 25° to shell-axis; columella very shortly reflected near attachment. Umbilicus obdomical, with well impressed suture.

The Molokai and Oahu specimens are not much more depressed than examples of same whorl-size from Maui, and such differences are difficult to evaluate in these shells, which appear to be irregularly coiled because they are apt slightly to change the slant of the whorls at the more prominent growth or injury varices. In addition, very few fresh shells have been collected.

Genus ZONITOIDES Lehmann, 1862

Zonitoides Lehmann, 1862, Malak. Bl. 9: 111; type (only species) *Helix nitida* Müller, 1774, Hist. Verm. II: 32, from Denmark.

Zonitellus Baker, 1928, Proc. ANSP. 80: 37; type by original designation *Helix arboreus* Say from northern Michigan.

Zonitoides (Zonitellus) arboreus (Say), (pl. 61, figs. 10-12).

Helix arboreus Say, 1817, Nich. Encycl., pl. 4, fig. 4, United States; Pfeiffer, Monogr. 1:95 [3:88-4:81-5:146-7:153]. *(Zonites) Hyalinia arborea* Tryon, Manual 2:161, pl. 51, figs. 9-17. *Z. arboreus* Baker, 1928, Proc. ANSP. 80:39, pl. 8, figs. 6-8 (fig. 9 erroneous), and 1929, Proc. ANSP. 81:255, pl. 8, fig. 7, anatomy from northern Michigan.

United States: under bark of decaying trees very common [probably from near Philadelphia].

Hawaii: Hawaii (Puna): BBM. 88159, dissected, wet place, alt. 3,700-3,800 ft., upper Olaa forest (June 19, 1928). Kau: BBM.

Shell umbilicate, depressed, barely angulate when young and soon becoming evenly rounded, with moderate whorl-increase; bright corneous [rarely albino (pale greenish) in the U. S.], with fairly thick epidermis, quite polished above and becoming more so below; transparent when young but becoming translucent. Embryonic whorls 1.3 to 1.4, almost smooth but gradually assuming extremely fine and faint spiral and growth striae; suture impressed but well overriding. Later whorls developing fine, regularly spaced, spiral striae and wrinklets, which cross weak, irregularly spaced (about 10 per mm. near end of 4th), low, rounded growth-wrinkles above; base with considerably weaker growth and slightly shallower spiral sculptures; suture fairly well impressed but overriding and moderately marginate. Aperture evenly rounded; peristome thin, weakly arcuate near suture, 30° to shell-axis; columella scarcely reflected. Umbilicus funicular, with rapid whorl-increase; major diameter 5.5 and minor 8.3 times in diameter of shell.

Dimensions

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
Say	2.5	(5.0)	.....	.....	.....	.....	4
BBM. 88159	2.77	182(5.05)	167(4.62)	61(1.70)	132(2.24)	5.5(0.92)	4.3

The anatomy of Hawaiian animals is the same as in those from the United States. *Z. arboreus* appears to be native over the entire nearctic region and extends into the tropics; it is often abundant in acid situations. It was undoubtedly introduced by commerce into Hawaii and may appear on other islands of the Pacific.

The comparative whorl-sizes for this species are included in the table for the genus *Retinella* (p. 330).

ZONITINAE

The name Zonitinae was used by Binney and Bland (1869) and Zonitidae by Moerch (1864). The palearctic genera are *Zonites* Montfort* (1810) [including *Aegopis* Fitzinger (1833)] and *Oxychilus* Fitzinger* (1833); the soft parts of *Birulana* Lindholm* (1922) and *Helicophana* Westerlund*

(1886) are unknown. The nearctic genera are *Mesomphix* Rafinesque* (1819) [actually not vested until Férussac (1822); including *Omphalina* Rafinesque (1831) and *Patulopsis* Strebel und Pfeffer (1880)], *Vitrinizonites* W. G. Binney* (1879), *Paravitrea* Pilsbry* (1898) and my *Pilsbryna** (1929).

Genus **RETINELLA** Fischer, 1877

Retinella "Shuttleworth" Fischer, 1877, Not. Malac. Berne **2**: 5; type by subsequent designation of Kobelt, 1880, Illust. Conch.: 223, *Hyalina olivetorum* = *Helix olivetorum* Gmelin, 1790, Syst. Nat. XIII: 3639, from Europe; Baker, 1930, Proc. ANSP. **82**: 193-219, anatomy and additional synonymy.

(?) *Hawaiia* Gude, 1911, Proc. Malac. Soc., erratum for **9**: 272, type by invalid subsequent designation *"Helix hawaiiensis* Ancey."

Nesovitrea Cooke, 1921, Occ. Papers BBM. **7**: 271; type by original designation *Vitrea pauxillus* (Gould), from Maui (anatomy).

Perpolita "Pilsbry" Baker, 1928, Proc. ANSP. **80**: 15; type by original designation *Helix hammonis* Baker = *H. electrina* Gould, 1841, Invert. Mass.: 183, from Massachusetts (anatomy from northern Michigan).

Unfortunately, our anatomical knowledge of the palearctic *Retinella,* s.s. is very limited. From what is known, the holarctic and Hawaiian *Nesovitrea* appears to be the most distinct and primitive subgenus, but *Retinella,* s.s. and the nearctic *Glyphyalinia* von Martens (1892) may be divergent derivatives. Since they are already named, two sections of *Nesovitrea* are utilized, but their differences are not very great, and I must confess that the term *Perpolita* was quite superfluous.

Key to Hawaiian and related species of subgenus Nesovitrea

A. Epiphallus poorly developed; spermathecal sac long, sausage-shaped and flabby; centrals and laterals of radula large, squarish and tricuspid; shell with quite uniform, rounded growth-wrinkles (major series weakly developed); suture with less oblique (usually narrower) bevel; sutural spiral (as viewed apically) relatively wide; holarctic and Hawaii: Molokai to Hawaii: ..... subgenus **Nesovitrea** Cooke.

B. Penis with internal, suckerlike thickenings subapical, above lateral insertion of retractor; shell depressed, quite hyaline (whitish), with fine but sharp spiral striae; Hawaii: ..... section **Nesovitrea,** s.s.

C. Shell with more gradual whorl-increase; umbilicus around 3.6 times in major diameter; Molokai: ..... **R. molokaiensis** (Sykes).

CC. Shell with more rapid whorl-increase; umbilicus 4.8 to 5.9 times in major diameter;

D. Smaller; Maui and Lanai: ..... **R. pauxilla** (Gould).

DD. Decidedly larger; Hawaii: ..... **R. hawaiiensis** (Ancey).

BB. Penis with suckerlike thickenings below more nearly apical insertion of retractor; shell more elevated or corneous; mainland: section **Perpolita** Baker.*

E. Shell depressed, with sharp spirals (like B) but corneous and smaller; umbilicus about 4 times in maj. diam.; whorl-increase intermediate between C and CC; penis with suckerlike thickenings above middle of its length; Mexico:..... .....**R. subhyalina** (Pfeiffer)*

EE. Shell more elevated so whorl-increase slightly more rapid than in CC; umbilicus funicular (like CC); holarctic:

F. Shell at 3.5 whorls about size of C; spiral striae usually fairly sharp;
G. Hyaline with obsolescent spirals (typical) or weakly corneous with sharper spirals (subsp. *occidentalis* Baker); penis with suckerlike thickenings below middle of length; nearctic: .....**R. binneyana** (Morse)*.

GG. Shell corneous, with stronger growth-lines and quite sharp spirals; palearctic: .....**R. hammonis** (Ström)*.

FF. Shell about size of DD; spiral striae almost completely obsolete; penis with suckerlike thickenings above middle of its length; nearctic: ....**R. electrina** (Gould)*.

Dimensions in Subgenus Nesovitrea

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
R. pauxilla							
Gould	.....	(4.4)	.....	.....	.....	perforate	4—
fig.	2.07	212(4.4)	188(3.90)	85(1.76)	107(1.89)	3.6(1.22)	
NYSM. 243	2.45	203(4.98)	174(4.27)	78(1.92)	117(2.25)	5.9(0.85)	3.7
(baldwini)	2.1	(5)	(4.17)	.....	.....	7.5(0.67)	4
BBM. 38733	2.41	210(5.07)	183(4.41)	78(1.89)	113(2.13)	4.7(1.09)	3¾
BBM. 20995	2.39	211(5.05)	181(4.32)	80(1.91)	123(2.34)	5.3(0.95)	3¾
(lanaiensis)	1.2	267(3.2)	(3)	.....	.....	6.4(0.5)	.....
fig.	1.72	186(3.2)	165(2.84)	83(1.42)	92(1.31)	3.9(0.8)	
BBM. 34213	2.30	228(5.25)	200(4.60)	83(1.91)	118(2.26)	5.0(1.06)	3¾—
R. molokaiensis							
Sykes	2	230(4.6)	(4)	.....	.....	4.6(1)	4¼
fig.	2.35	196(4.6)	175(4.12)	84(1.97)	96(1.89)	3.7(1.25)	
BBM. 24624	2.27	234(5.32)	200(4.55)	84(1.91)	112(2.13)	3.6(1.47)	4.2—
R. hawaiiensis							
Ancey	2.2	197(4.33)	(3.66)	.....	.....	.....	.....
fig.	2.21	196(4.33)	166(3.66)	67(1.49)	109(1.62)	5.1(0.85)	.....
BBM. 44137	3.99	200(7.98)	175(7.00)	74(2.96)	118(3.48)	4.8(1.67)	4.1
BBM. 44168	3.01	204(6.13)	176(5.30)	81(2.43)	111(2.70)	5.4(1.13)	3.5
R. subhyalina							
Mexico	1.80	223(4.02)	188(3.39)	76(1.37)	121(1.65)	3.9(1.03)	3¾—
R. binneyana							
ANSP. 667	1.97	190(3.77)	162(3.20)	76(1.49)	100(1.49)	5.0(0.75)	3.5
R. b. occidentalis							
ANSP. 150605	1.93	185(3.57)	158(3.05)	75(1.45)	108(1.56)	5.1(0.70)	3.5—
R. hammonis							
ANSP. 9830	1.97	187(3.68)	161(3.18)	73(1.43)	106(1.52)	4.5(0.82)	3.5—
R. electrina							
ANSP. 51	2.63	183(4.80)	168(4.41)	63(1.65)	109(1.80)	4.4(1.09)	3.8

Retinella (Nesovitrea) pauxilla (Gould), (pl. 61, figs. 1-3; pl. 52, fig. 4).

Helix pusillus Gould, 1846, Proc. Boston Soc. N. H. **2**: 171 [19]; Pfeiffer, Monogr. **1**: 97. Not Lowe (1831), etc.

H. pauxillus Gould, 1852, Exped. Shells: 40 [243], pl. 3, fig. 46, a-c; Pfeiffer, Monogr. 3:90 [4:88-5:152-7:161]. *Nanina pauxillus* Tryon, Manual 2:123, pl. 41, figs. 51-53. *Nesovitrea pauxillus* Cooke, 1921, Occ. Papers BBM. 7:272, fig. 5 (anatomy), p. 24, fig. 1 (shell).

Hyalinia baldwini Ancey, 1889, Bull. Soc. Malac. France 6:192, west Maui; Sykes, 1899, Proc. Malac. Soc. 3:275, pl. 13, figs. 1-3.

Vitrea lanaiensis Sykes, 1897, Proc. Malac. Soc. 2:298, Lanai: mountains behind Koele (Perkins!); Fauna Hawaii. II: 278, pl. 11, figs. 43-44.

Hawaii: Maui [probably east]: NYSM. 243 (A-781, Gould types), in mountains; USNM. 20964. East Maui (Makawao): BBM. 38733, Ukulele (Cooke! June 7, 1915). West Maui: BBM. 18870 (type of *H. baldwini*), "top of W. Maui" (Baldwin!). (Lahaina): BBM. 20995, dissected, high above camp, Maunahooma (Cooke! May 19, 1910); BBM. 21041, ditto, still higher (May 20).

Lanai: BBM. 34213, dissected, eastern end above base camp, Capt. Sowle's house (Forbes! June 1, 1913).

Comparative whorl-sizes in genus Retinella

	1½	3 wh.	3.5 wh.	4 wh.	4.5 wh.	Maxima	Index
R. pauxilla	1.15	2.9(3.32)	3.8(4.42)	4.7(5.4)?	.....	3.7	203
BBM. 38733	1.16	2.9(3.41)	3.8(4.46)	4.7(5.4)?	5.6(6.5)?	3¾	210
BBM. 20995	1.20	2.8(3.35)	3.6(4.35)	4.4(5.3)?	.....	3¾	211
BBM. 34213	1.18	3.0(3.55)	3.9(4.60)	4.8(5.7)?	.....	3¾—	228
R. molokaiensis	1.12	.....	3.3(3.74)	4.2(4.75)	5.1(5.7)?	4.2—	234
R. hawaiiensis	1.53	.....	3.9(5.92)	4.9(7.57)	5.9(9.0)?	4.1	200
BBM. 44168	1.45	3.2(4.59)	4.2(6.13)	5.2(7.5)?	.....	3.5	204
R. subhyalina	0.99	2.7(2.70)	3.5(3.47)	4.3(4.3)?	.....	3¾—	223
R. binneyana	0.96	3.0(2.90)	3.9(3.77)	4.8(4.6)?	.....	3.5	190
R. b. occidentalis	0.99	2.8(2.78)	3.7(3.7)?	4.6(4.6)?	.....	3.5—	185
R. hammonis	0.99	2.9(2.89)	3.8(3.8)?	4.7(4.6)?	.....	3.5—	187
R. electrina	1.10	2.9(3.15)	3.8(4.17)	4.7(5.2)?	.....	3.8	183
Z. arboreus	1.27	.....	2.9(3.74)	3.5(4.49)	4.1(5.2)?	4.3	182

Shell (pl. 61, figs. 1-3) depressed, umbilicate, with rounded periphery and quite rapid whorl-increase; greenish white with very weak corneous tinge, moderately polished above and more so below, thin and transparent. Embryonic whorls 1.5 or over, assuming widely spaced growth-sulci and very weak, superficial, minute spiral striae. Later whorls with closely spaced growth-sulci and wrinkles (about 25 per mm. on 4th) and weak, superficial but distinct spiral striae above; base with much weaker growth-wrinkles; suture weakly impressed, overriding and widely margined. Aperture subcircular; peristome weakly and very shortly arcuate near suture, averaging 20° to shell-axis; columella simple. Umbilicus funicular but showing rounded whorls.

Animal similar to *R. electrina* and as described by Cooke (1921). Epiphallus scarcely represented; penis proper internally (pl. 52, fig. 4) with longitudinal folds, and with two sucker-like thickenings above lateral insertion of penial retractor. Penial nerve from

pedal ganglion. Radula has 3 tricuspid laterals (Cooke found 4) and 25-29 unicuspid marginals; 58 rows counted.

The USNM. lot contains one shell of *R. pauxilla* that is broken at its apex and aperture and is considerably smaller than Gould's dimensions. NYSM. 243 probably contains Gould's type although the specimen measured is a little larger. NYSM. 240 (A-784) is not this species.

Retinella (Nesovitrea) molokaiensis (Sykes), (pl. 61, figs. 4-6; pl. 52, figs. 5, 6).

Vitrea molokaiensis Sykes, 1897, Proc. Malac. Soc. **2**: 298; Fauna Hawaii. II: 278, pl. 11, figs. 45-46.

Hawaii: Molokai (east): forest above Pelekunu (Perkins!). BBM. 24624, dissected, *ieie* clump, west of flat, above narrow ridge and end of Waihanau (Cooke! Aug. 18, 1912).

Shell (pl. 61, figs. 4-6) similar to *R. pauxilla* but more depressed, with more gradual whorl-increase and with larger umbilicus. Base especially with slightly sharper growth-wrinkles. Peristome slightly more vertical. Umbilicus more obdomical.

Animal also similar. Penis (pl. 52, fig. 6) similar. Radula (pl. 52, fig. 5) has 3 shorter and broader laterals and 22 marginals.

Retinella (Nesovitrea) hawaiiensis (Ancey), (pl. 61, figs. 7-9; pl. 52, figs. 2, 3).

Vitrea hawaiiensis Ancey, 1904, Proc. Malac. Soc. **6**: 120, pl. 7, figs. 8-8b.
(?) *Helix hawaiiensis* (Ancey) Gude, 1911, Proc. Malac. Soc., erratum for **9**: 272?

Hawaiian islands: Hawaii (Puna): BBM. 18871, Olaa (Thaanum!). BBM. 11490, dissected, among wet leaves on ground, bottom of crater in Puu Huluhulu, about 5 miles southeast of Volcano House, alt. 3,400 ft. (Cooke and Baker! Aug. 12, 1935). (South Kona): BBM. 44137, dissected, Waialohi, Kapua (A. Gouveia! Aug. 20, 1917). (Kau): BBM. 44168, alt. 7,000 ft., northwest of Papa II boundary, Kahuku (Gouveia! Aug. 22, 1917); BBM. 39337, *kipuka* in 1823 flow, alt. 7,000 ft., level of Keawewai (Forbes! June 28, 1915).

Shell (pl. 61, figs. 7-9) similar to *R. pauxilla* but considerably larger throughout and somewhat more polished. Later whorls with lower and more irregular growth-wrinkles and still weaker spiral striae above.

Animal also similar. Sole tripartite. Left mantle-lappets well separated. Lung twice as long as its base or 1.5 times kidney length which is twice its base or 1.5 pericardial length. Talon (GT; pl. 52, fig. 2) short ovoid; carrefour (X) small. Free oviduct short; spermatheca with long thin-walled sac and short stalk; vagina with vague glandular zone. Epiphallus little more prominent. Penial retractor inserting somewhat lower on penis, which has similar folds and circular thickenings. Radula (pl. 52, fig. 3) has 4 tricuspid laterals and 24 marginals; 56 rows counted.

Genus GODWINIA Sykes, 1900

Godwinia Sykes, 1900, Fauna Hawaii. II: 277; type (only species included with certainty) *Vitrina caperata* Gould.

Omphalops new subgenus; type *G. newcombi* (Reeve), from Halemanu (BBM. 47813).

The genus *Godwinia,* although very distinct from any of the continental groups, seems to be most closely related to the Mexican *Patulopsis* Strebel und Pfeffer [see Baker, 1930, Occ. Pap. Mus. Zool. Univ. Mich. 220: 31-34, pl. 10]. The genitalia in both groups have practically no epiphallic development of the vas deferens, but the penis internally exhibits a pseudo-epiphallic chamber, marked off by a heavy fold (also V-shaped in *Omphalinella*). In addition, the sculpture of the shell in the Kauai genus and that in the typical species of *Patulopsis* are rather similar.

Key to Subgenera and Species of Genus Godwinia

A. Vas prong of penis subterminal, almost equal in size to penial caecum and also receiving insertion of bifurcate retractor; radular laterals with distinct entocones; embryonic whorls of shell with only traces of rugae and later ones with more regular growth-threads and becoming evenly rounded; (Waimea): ..... subgenus **Omphalops,** new; **G. newcombi** (Reeve).

AA. Vas prong of penis subbasal and smaller than penial caecum, which alone receives insertion of undivided retractor; radular laterals with weak entoconal notches; embryonic whorls with coarse rugae and later ones with more irregular growth-threads and more angulate ..... subgenus **Godwinia,** s. s.

B. Shell becoming weakly angulate, with lower growth-threads, which are usually disturbed by protractive, oblique, sinuous and anastomosing sulci; vas prong of penis distinct; (northern Lihue to Waimea): ..... **G. caperata** (Gould).

BB. Shell more angulate, with stronger growth-threads but with protractive sulci becoming obsolete; vas prong of penis vestigial; (Lihue-Koloa boundary): ..... **G. haupuensis** Cooke.

Dimensions in Genus Godwinia

	alt.	maj. diam.	min. diam.	alt. ap.	diam. ap.	umbilicus	whs.
G. newcombi							
Pfeiffer	6	(11)	(9)	.....	.....	min. perf.	3.5
Reeve fig.	7.41	149(11)	.....	77(5.70)	115(6.56)	.....	
BBM. 47813	5.25	169 (8.86)	147(7.44)	75(3.92)	126(4.93)	24(0.33)	3.2
	4.65	168 (7.80)	144(6.71)	81(3.76)	117(4.41)	27(0.33)	3
G. caperata							
Gould	5.08	(11.4)	.....	.....	.....	arcte perf.	3.5
fig.	7.30	156(11.4)	132(9.61)	78(5.70)	117(6.68)	.....	
Cooke	8.0	154(12.3)	.....	.....	.....	.....	3.5
BBM. 82199	6.51	153 (9.98)	130(8.43)	73(4.78)	112(5.37)	24(0.41)	3.3
BBM. 48696	5.37	191(10.26)	153(8.21)	79(4.22)	141(5.96)	24(0.43)	3.2
G. haupuensis							
Cooke	5.1	165 (8.4)	129(6.6)	80(4.1)	134(5.5)	narrow	3.5
BBM. 81455	5.14	170 (8.74)	140(7.20)	72(3.71)	132(4.88)	27(0.32)	3.2

Comparative Whorl-sizes

	1½	2.5 wh.	3 wh.	3.5 wh.	Maxima	Index
G. newcombi	2.16	2.6(5.62)	3.6(7.73)	4.6 (9.9)?	3.2	169
	2.17	2.6(5.71)	3.6(7.80)	4.6(10.0)?	3	168
G. caperata	2.01	2.7(5.33)	4.0(7.96)	5.3(10.7)?	3.3	153
	2.00	2.7(5.44)	4.3(8.57)	5.7(11.4)?	3.2	191
G. haupuensis	1.83	2.8(5.11)	4.2(7.65)	5.6(10.2)?	3.2	170

Godwinia (Omphalops) newcombi ("Pfeiffer" Reeve), (pl. 62, figs. 10, 11; pl. 52, figs. 8-10).

Helix newcombi Reeve, 1854, Conch. Icon. **7**: pl. 189, fig. 1321, Oahu (Newcombe!); Pfeiffer, 1855, Proc. Zool. Soc. 1854: 51; Monogr. **4**: 57 [**5**: 113-**7**: 119].

Hawaiian islands: [Kauai:] (Newcombe!). (Waimea): BBM. 48120 (compared to original lot by Cooke), Halemanu; BBM. 47813, dissected, Kunalohiuluhulu, Halemanu (Thaanum! July 14, 1919); BBM. 44287, near and above Halemanu (Forbes! July 8, 1918).

Shell (pl. 62, figs. 10-11) thin, vitriniform, perforate, becoming bluntly angulate on early 3d whorl and usually evenly rounded before 4th; tan-color, dullish and almost opaque above but decidedly glossy below. Embryonic whorls over 1.4, rapidly becoming decussated by shallow growth-sulci and slightly stronger spiral grooves (about 30 visible at end of first); without or with only traces of major rugosities; suture weakly impressed, widely overriding and margined. Later whorls with spirals gradually becoming weaker, but with quite regular although low growth-wrinkles (13-14 per mm. on 3d) above; base with much shallower growth-sulci; suture moderately impressed but overriding and margined. Aperture large, evenly rounded; peristome sharp, arcuate above and averaging almost 30° to shell-axis; columella shortly expanded near attachment but hiding less than half of funicular perforation, of which major diameter goes 24-27 and minor about 11 times in major diameter of shell.

Animal similar to *G. caperata,* with a middorsal white line on head. Lung with hindgut, kidney and mantle-collar bordered by black pigment and with some connecting bands. Middle whorls with black spots, which diminish toward apex. Vagina (pl. 52, fig. 8) slenderer. Penis with two, almost subequal branches; vas prong containing a smallish vergic papilla. Penial retractor bifurcating to insert on both vas prong and penial caecum. Radula (pl. 52, figs. 9-10) has 5 laterals, of which inner 4 are distinctly tricuspid, and 21 aculeate marginals; 62 rows counted.

Reeve's description of *G. newcombi* appears to be prior to Pfeiffer's. Its identification with the present species is largely based on Cooke's examination of type material in the British Museum.

Godwinia (s. s.) caperata (Gould), (pl. 52, fig. 7).

Vitrina caperata Gould, 1847, Proc. Boston Soc. N. H. **2**: 181 [26]; Pfeiffer, Monogr. **2**: 509 [**3**: 6-**4**: 797-**5**: 20-**7**: 25] Gould, Exped. Shells: 10, pl. 1, figs. 9, a. *Helicarion caperatus* Tryon, Manual **1**: 171, pl. 38, figs. 61-63. *G. caperata* Sykes (?), Fauna Hawaii, II: 277, pl.

12, figs. 6-12, anatomy (?) by Godwin-Austen; Cooke, 1921, Occ. Papers BBM. 7 (12): 264, figs. 1, 2 (anatomy), pl. 24, fig. 4 (shell).

Hawaii: Kauai [(Lihue)]: USNM. 5409, [Wailua Valley]. BBM. 81299, dissected, on ground, steep slope about ⅛ mile below intake, south branch of North Fork of Wailua River (Cooke and Mrs. Dranga! Oct. 28, 1925); BBM. 81269, on ground and shrubs during rain, along trail from tunnel outlet to top of ridge, North Fork of Wailua River (Ditto! Oct. 27). (Waimea): BBM. 48696, dissected, on ground, along Nualolo trail, near top of divide, Halemanu (Cooke! Aug. 28, 1919). (Hanalei): BBM. 86442, Kalalau.

Shell similar to *G. newcombi* but early 3d whorl usually with rounded peripheral cord, marked off by a visible to deep sulcus above; 4th whorl becoming bluntly and weakly angulate; duller above and less glossy below. Embryonic whorls developing, in addition to similar fine sculpture, about 15 coarse and distinct but low, arcuate growth-rugae on last whorl. Later whorls with somewhat coarser (about 11 per mm. on 3d) and more irregular growth-wrinkles above, and with irregular but very variable, anastomosing, impressed sulci, which are so markedly protractive as to be almost spiral and which resemble grooves due to injuries, above and below.

Animal as in Cooke's description (1921); mucous foss often elevated in preserved specimens to form an ovoid boss. Mantle-collar white with black around anus; shell-lobes absent; mantle-lobes large and left one undivided. Lung with networks of black and white; columellar margin extremely short. Apical whorls with chalky-white along blood-vessels. Talon (pl. 52, fig. 7) ovoid; free oviduct rather short; spermatheca of short type but with fairly long stalk; vagina very short with glandular zone vague. Vas deferens not expanded to form epiphallus, which is apparently represented by region above V-folds in penis; penial retractor arising from diaphragm and inserting on apex of large, apparently glandular penial (or epiphallic) caecum (PC); penis internally divided by V-shaped folds into a pseudo-epiphallic region, which includes the penial caecum, and penis proper, which contains longitudinal folds; atrium very short, opening near center of visceral stalk. Right ommatophoral retractor free from genitalia. Radula has 6 or 7 laterals, with entoconal notch weak even on first, and 29-34 unicuspid, aculeate marginals. Penial nerve from right pedal ganglion.

As will be noted from the dimensions, the shells included in *G. caperata* vary considerably in form and more detailed studies might show that several races or even species may be represented on Kauai. However, large fresh shells appear to be quite rare and some of the differences may be due to drying or warping.

Godwinia (s. s.) haupuensis Cooke.

G. haupuensis Cooke, 1921, Occ. Papers BBM. 7 (12): 267, fig. 3 (anatomy), pl. 24, fig. 2 (shell).

Hawaii: Kauai (Lihue): BBM. 58469 (17831), dissected by Cooke, northern slope of Mount Haupu. BBM. 81455, dissected, top of peak, Haupu (Cooke and Mrs. Dranga! Oct. 31, 1925).

Shell similar to *G. caperata* but apparently not attaining such large whorl-sizes; less bluntly angulate; still duller, with a more golden tinge. Embryonic whorls with narrower but more angular major growth-rugae. Later whorls with higher, finer growth-

threads (14.5 per mm. on 3d) above and much less evident spiral sculpture above and below; protractive sulci becoming obsolescent on later growth.

Animal as described by Cooke (1921). Vas deferens opening through a small conical vergic papilla but vas prong scarcely represented; V-folds and longitudinal ones of penis proper bigger and stronger than in *G. caperata*.

INCERTAE SEDIS

"Helix" lardyi "Charpentier" Pfeiffer.

H. lardyi Pfeiffer, 1853, Zeitschr. Malak. **10**: 145, Opara (Austral Islands: Rapa); Monogr. **4**: 50 [**5**: 107-**7**: 113].

Shell scarcely perforate, depressed, thin, very lightly striate, shining, pellucid, corneous white, spire very low conoid; apex small; suture deep; whorls 6, convex, narrow; last whorl well rounded, not descending; aperture little oblique, lunate; peristome simple, not expanded, arcuate towards periphery above; columella very shortly reflected at perforation. [Translated from Pfeiffer.]

Dimensions

	alt.	maj. diam.	min. diam.	whs.
H. lardyi Pfeiffer	5.5	(9)	(8)	6
N. margarita Albers	4.5	(8.5)	(7)	4

The perforations and dimensions of this and the next species apparently exclude them from any known Polynesian genus, although they may possibly be Euconulinae from Micronesia or the adjacent mainland. The localities given are almost certainly incorrect.

"Nanina" margarita "Beck" Albers.

Microcystis margarita "Beck" Moerch, 1852, Cat. Conch. Yoldi: 2, nude. *Nanina margarita* Albers, 1860, Die Helic., ed. **2**: 50, Pitcairn Island (p. 49). *Helix margarita* Pfeiffer, Monogr. **5**: 106 [**3**: 272-**4**: 324-**7**: 113].

Shell very narrowly perforated, orbiculate-depressed, scarcely striate, shining, pellucid, pallid yellowish; spire little elevated, convex; suture distinct, flatly marginate; whorls 4, the last large, rounded, not descending and with a lightly impressed foveola in its base; aperture scarcely oblique, rounded lunate; peristome simple sharp, with arcuate margin; columella thickened and fornicately reflected. [Translated from Albers.]

"Nanina" firmostyla Mousson.

Nanina firmostyla Mousson, 1865, Jour. de Conch. **13**: 167 [4], pl. 14, fig. 7. *Helix firmostyla* Pfeiffer, Monogr. **5**: 70 [**7**: 82]. *N. firmostyla* Mousson, Jour. de Conch. **19**: 7 [3], Futuna and Fiji (north Lau): Thikombia-i-lau; Tryon, Manual **2**: 125, pl. 41, fig. 62. *Zonites fir-*

mostyla Schmeltz, Cat. Mus. Godeffroy V: 90, Samoa. *Microcystis firmostyla* Garrett, Proc. Zool. Soc. 1887: 170, throughout Tonga.

Uea (= Nukuiona): (Gräffe!).

Shell minute, covered perforate, depressed-convex, smoothish, very shining, darkish corneous; spire obtusely depressed-conic, regular; apex obtuse, rather small; suture submarginate, scarcely impressed. Whorls 5.5, gradually increasing, rather convex; last not descending, rounded and weakly convex below. Aperture vertical, lunate-circular. Peristome not expanded, sharp, incomplete, regularly curved; columella somewhat expanded and thickened towards insertion.

Dimensions

	alt.	maj. diam.	min. diam.	whs.
Mousson	2	150(3)	125(2.5)	5.5

The dimensions and general form of this species approach those of *Liardetia samoensis,* but the whorls of its spire are less rounded, its suture is considerably more superficial, and its surface more shining. The last whorl is not in the least angulate and is also more convex below. The columella bears a weak callus but no lamella or nodule.

The above descriptions of *"Nanina" firmostyla* are free translations of those of Mousson; I have seen no authentic specimens. It is probably either a *Liardetia* or a *Coneuplecta,* and, in fact, may be founded on exceptionally large specimens of *L. samoensis.*

CORRECTIONS TO PARTS 1 AND 2

PART 1 (see page 190)

Page 12. Last line of key. Change "Pfeiffer" to Pfeffer.
Page 35. Third line from bottom. Change semicolon after "elevations]" to period.
Page 38. Line 11. Change semicolon after "elevations]" to period.
Page 42. Line 11. Change space after "[Uahuka]" to period.
Page 60. Line 14. Change comma after "Bay]" to period.
Page 88. Line 9 (not counting table). Change colon after "Vavau" to period.

PART 2

Page 129. Both headings *P. (P.) hartmani.*
Page 174. Line 8. Delete first "fulvo".
Page 198. Plate 34, fig. 3. Change 94384 to 92384.
Plates 37 and 38. Change to 38 and 37. [Already corrected on most copies.]

EXPLANATION OF PLATES

For this Bulletin, Mr. E. R. Tinkham made all the figures of shells, (plates 53-65) with exception of plate 55, figure 15; plate 60, figures 1-15; and plate 61, figures 10-15. As in the other papers of this series, unless otherwise

stated, scales for wash figures of shells (plates 62-65) represent 2 millimeters; those for ink figures of shells, animals, mantle-collars, pallial complexes, genitalia and nervous systems represent 1 mm.; those for outlines and lines of radular transverse rows (T) 0.1 mm.; and those of individual radular teeth 10 microns (0.01 mm.). The following symbols are used throughout the paper:

A: anus or anal nerve. AC: acoustic nerve.

B: lateral buccal nerve. BA: anterior buccal nerve. BC: buccal connective. BR: buccal retractor or nerve.

C: caudal or columellar nerve. CF: caudal foss. CH: caudal horn. CS: middorsal sulcus or groove.

D: vas deferens. DE: junction of vas deferens and epiphallus. DG: prostatic gland. DS: seminal duct (prostatic part).

E: epiphallus. EF. epiphallic flagellum or apical calc-sac. EP: junction of epiphallus and penis proper. ER: epiphallic retractor-caecum.

F: foot. FA: anterolateral pedal nerve. FG: pedal gland (opening). FL: mediolateral or lateral pedal nerve. FP: posterolateral pedal nerve. FS: pedal grooves.

G: gonad (ovotestis). GD: hermaphroditic duct. GG: albumen gland. GT: talon.

H: heart or pericardium. HG: hindgut. HK: renopericardial pore. HV: principal pulmonary vein.

I: intestinal nerve.

J: jaw (mouth). JN: labial nerve.

K: kidney. KD: ureter. KO: renal orifice. KX: external ureteric opening.

L: left shell-lap. LD: right shell-lap. LK: urinary chamber. LL: left shell-lobe. LP: pneumostome. LR: right shell-lobe. LU: umbilical shell-lobe.

M: left pallial nerve. MA: anterior left mantle-lappet. MC: mantle-collar. MG: mantle glands. ML: left mantle lobe. MP: posterior left mantle-lappet. MR: right mantle-lappet. MW: attachment of mantle-collar to visceral stalk and diaphragm.

N: nuchal nerve (upper labial). NF: frontal nerve. NM: right pallial nerve. NN: nuchal nerve proper. NS: subcerebral nerve.

O: oesophageal nerve. OA: anterior oesophageal nerve. OP: posterior oesophageal nerve.

P: penis or penial nerve. PA: penial appendix (apical). PC: penial caecum or lobe (apical). PD: penial dart, stimulator or their sacs. PE: epiphallic branch of penis. PG: penial dart glands. PL: penial lobe or diverticulum (lateral or basal). PP: penial stimulator papilla or pilaster. PR: penial retractor. PS: penial sheath. PV: verge or penial papilla through which epiphallus opens.

R: radular central tooth. RN: odontophoral nerve.

S: spermatheca. SP: spermatophore. SR: spermathecal ligament. SS: spermathecal stalk.

T: right half of radular transverse row (outline or line); also tentacle. TE: ommatophore or its nerves. TR: tentacular retractors or their nerves. TV: inferior tentacle or its nerve.

U: oviduct as a whole. UE: embryos. UG: glandular sheath on free oviduct. UT: uterus. UO: eggs. UV: free oviduct. UZ: post-uterine oviduct.

V: vagina. VA: anteroventral pedal nerve. VG: vaginal gland. VL: medioventral pedal nerve. VP: posteroventral pedal nerve. VS: visceral stalk or peduncle.

WB: dart (on atrium or on female side). WD: duct of dart-gland. WG: dart-gland. WP: dart-papilla. WS: dart-sac.

X: carrefour. XL: lobe or sac of carrefour.

Y: atrium. YD: atrial stimulator. YG: atrial gland. YL: atrial lobe or diverticulum. YO: atrial opening. YP: penial prepuce (atrial outgrowth). YV: atrial vagina (common to SS and WS).

Z: liver.

PLATE 43. EUCONULINAE

Figs. 1-3. *Euconulus (Nesoconulus) subtilissimus* (Gould), BBM. 21021: 1. Dissected genitalia (ovotestis, most of its duct and penial sheath omitted). 2. Radula; central with first lateral, 11th with 12th, and 27th teeth; also (T) outline of right half of one transverse row, with widths of central and of blocks of 11 teeth indicated. 3. Jaw.

Fig. 4. *Euconulus (Nesoconulus) thaanumi* (Ancey), BBM. 53685: lower quarter of dissected genitalia.

Fig. 5. *Euconulus (Nesoconulus) gaetanoi vivens,* new subspecies, BBM. 39321: Penis and ends of female genitalia (same scale as fig. 4).

Figs. 6, 7. *Euconulus (Pellucidomus) lubricella* (Ancey), BBM. 92910: 6. Dissected genitalia (ovotestis omitted). 7. Radula; central with first lateral, 14th and 26th teeth.

Figs. 8, 9. *Euconulus (Monoconulus) conoides,* new species, BBM. 145273: 8. Dissected genitalia (ovotestis and most of albumen gland omitted). 9. Radula; central with first lateral and 18th teeth.

Figs. 10-12. *Kororia palaensis* (Semper), BBM. 89839 (figs. 10-11) and 153870 (fig. 12): 10. Dissected genitalia with penial sheath opened (organs above diaphragm omitted). 11. Radula; central with first lateral, 8th to 10th, 27th and 91st teeth; also (T) line of half row with widths of central and blocks of 8 teeth indicated. 12. Mantle-collar with shell-lobes turned outwards and left mantle-lappets and tip of right one inwards.

Figs. 13-15. *Palaua straminea* (Semper), BBM. 89891: 13. Dissected genitalia (ovotestis and penial sheath omitted). 14. Mantle-collar as in fig. 12 (scale as in fig. 13). 15. Radula; central with first lateral, 13th with 14th, 38th and 45th teeth; also (T) outline of half row with widths of central and blocks of 8 teeth indicated.

PLATE 44. EUCONULINAE, SESARINAE

Figs. 1, 2. *Discoconulus* species, near *D. sinapidium* (Reinhardt), BBM. 155177: 1. Dissected genitalia (ovotestis and most of its duct omitted). 2. Radula; central with first lateral and 11th teeth.

Figs. 3, 4. *Habroconus (Cocoslens) pallidus,* new species, ANSP. 170394: 3. Dissected genitalia (ovotestis and penial sheath omitted). 4. Radula; central with first lateral, 8th with 9th, 16th with 17th and 83d with 84th teeth; also (T) outline of half row with widths of central and blocks of 8 teeth indicated.

Figs. 5, 6. *Habroconus (Cocosconus) hopkinsi* (Dall), ANSP. 170396: 5. Radula; central with first lateral, 8th with 9th and 15th with 16th teeth; also (T) line of half row with widths of central and blocks of 9 teeth indicated. 6. Dissected genitalia (ovotestis and penial sheath omitted).

Fig. 7. *Habroconus (Pseudoguppya) pacificus* (Pfeiffer), ANSP. 170395: Penis (sheath omitted) and ends of female genitalia.

Figs. 8, 9. *Coneuplecta (Durgellina) calculosa* (Gould), BBM. 95961: 8. Dissected genitalia (ovotestis omitted and penial sheath outlined). 9. Radula; central with first to third, 44th with 45th, and 136th teeth; also (T) line of half row with widths of blocks of 10 teeth indicated.

Figs. 10, 11. *Coneuplecta (Sitalina) microconus* (Mousson), BBM. 77014: 10. Radula; central with only lateral and 22d teeth (same scale as fig. 9). 11. Penis and ends of female genitalia (penial sheath outlined).

Figs. 12, 13. *Coneuplecta (s. s.) turrita palauensis,* new subspecies, BBM. 154727: 12. Dissected genitalia (ovotestis omitted and penial sheath outlined). 13. Radula; central and first marginal teeth.

Figs. 14, 15. *Orpiella (Halozonites) cookensis* (Gude), BBM. 87993: 14. Dissected genitalia (ovotestis and most of its duct omitted; penial sheath shown in outline). 15. Radula; central with first lateral, 5th with 6th, and 25th teeth; also (T) outline of half row with widths of central and blocks of 5 teeth indicated.

PLATE 45. SESARINAE

Figs. 1-3. *Orpiella (Irenella) nouleti tawalekae,* new subspecies, BBM. 94726: 1. Dissected genitalia (penial sheath opened and pinned out). 2. Interior of opened penis, showing stimulator-papilla (PP). 3. Radula; central with first lateral and 20th teeth; also (T) line of half row with widths of central and blocks of 13 teeth indicated.

Figs. 4-6. *Orpiella (Fijia) macgillivrayi* (Gude), BBM. 77040: 4. Penis (sheath opened) and ends of female genitalia. 5. Radula; central with 1st lateral, 29th and 41st teeth; also (T) line of half row with widths of central and blocks of 9 teeth indicated. 6. Broken spermatophore.

Figs. 7-9. *Orpiella (Owaraha) solidiuscula* (Smith), BBM. 119238: 7. Spermatophore. 8. Penis (sheath opened) and ends of female organs (uterus immature). 9. Radula; central with first lateral, 20th and 40th teeth; also (T) outline of half row with widths of central and blocks of 14 teeth indicated.

Figs. 10-12. *Orpiella (Eufretum) similis* (Semper), BBM. 77021: 10. Spermatophore. 11. Detail (A-A) of spermatophore. 12. Penis (thin part of penial sheath around penis opened) and ends of female organs.

Figs. 13, 14. *Orpiella (Eufretum) richardi* (Gude), variety from Ovalau. BBM. 79140: 13. Dissected genitalia (ovotestis omitted and penial sheath opened). 14. Radula; central with first lateral, 16th and 81st teeth; also (T) line of half row with widths of central and blocks of 12 teeth indicated.

Figs. 15, 16. *Orpiella (s. s.) fragillima* (Mousson), BBM. 79143: 15. Radula; central with first lateral, 29th and 49th teeth. 16. Penis and ends of female organs (as in fig. 12).

PLATE 46. SESARINAE, HELICARIONINAE

Figs. 1, 2. *Dendrotrochus (s. s.) cleryi* (Récluz), ANSP. 151452: 1. Penis, with upper wall cut away to expose penial papilla (PV) and its spathe, and ends of female genitalia. 2. Radula; central with first lateral, and 20th teeth; also (T) outline of half row with widths of central and inner 3 blocks of 11 teeth indicated.

Figs. 3-7. *Dendrotrochus (Ponapea) ponapensis,* new species, BBM. 154204: 3. Interior of penis, opened lengthwise and pinned out. 4. Radula; central with first lateral, 20th and 197th teeth; also (T) line of half row (same scale and blocks as in fig. 2-T). 5. Dissected genitalia (ovotestis omitted). 6. Spermatophore, from spermatheca (same scale as fig. 5). 7. Central nervous system (with pleuro-abdominal ring pulled to left side) and roots of principal nerves.

Figs. 8-10. *Ryssota (Trukrhysa) pachystoma* (Hombron et Jaquinot), BBM. 155660: 8. Dissected genitalia (ovotestis omitted; scale = 5 mm.). 9. Detail of interior of penis (scale = 1 mm.). 10. Diagrammatic longitudinal section of one papilla from penis.

Figs. 11-13. *Ryssota (Trukrhysa) pachystoma dubloni,* new subspecies, BBM. 153591: 11. Spermatophore from spermatheca (same scale as fig. 8). 12. More magnified detail of spermatophore (A-A). 13. Radula; central with first lateral, 38th with 39th, 50th and 138th teeth; also (T) line of half row with widths of central, lateral (38 teeth) and marginal fields indicated.

Figs. 14-17. *Ryssota (s. s.) otahietana* (Férussac), ANSP. 44092: 14. Details of spermatophore, near base of its tail (scale = 1 mm.). 15. Ditto, near middle of its tail. 16. Radula; central with first lateral, 38th, 45th and 95th teeth; also (T) line of half row (same scale and blocks as fig. 13-T, but 34 laterals). 17. Penis and accessories with sheath opened lengthwise and pinned out (scale = 5 mm.).

Fig. 18. *Helicarion (Sitalarion) planospira* (Pfeiffer), ANSP. 151450: Radula; central with first lateral, 10th, 20th and 258th teeth; also (T) line of half row with widths of central, lateral (11 teeth) and marginal fields indicated.

PLATE 47. HELICARIONINAE, DYAKIINAE, TROCHOMORPHINAE

Figs. 1-3. *Epiglypta howinsulae* (Cox), ANSP. 63208: 1. Penis (with upper half of its wall and sheath cut away to show lumen) and ends of female organs. 2. Mantle-collar with shell-lobes deflected outwards and left mantle-lappets and tip of right lobe turned inwards. 3. Radula; central with first lateral, 37th with 38th, and 111th teeth; also (T) line of half row with widths of central and blocks of 25 teeth indicated.

Figs. 4, 5. *Helicarion (s. s.) leucospira* (Pfeiffer), ANSP. 63315: 4, Radula; central with first lateral, and 27th teeth. 5. Penis (sheath shown in outline) and ends of female organs.

Figs. 6, 7. *Dyakia (Quantula) striata* (Gray), BBM. 92345: 6. Penis and ends of female organs, with dart-gland (WG) dissected out of its sheath. 7. Dart-sac opened lengthwise and pinned out.

Figs. 8-10. *Kondoa asteriscus,* new species, BBM. 153067: 8. Dissected genitalia (ovotestis omitted). 9. Penis proper, opened lengthwise and pinned out to show interior. 10. Radula; central with first lateral, 24th and 38th teeth; also (T) outline of half row with widths of central and blocks of 11 teeth indicated.

Figs. 11-13. *Hogolua kondorum,* new species, BBM. 153787: 11. Dissected genitalia (ovotestis omitted). 12. Radula; central with first lateral, 12th, 22d, 29th and 36th teeth; also (T) outline of half row with widths of central and blocks of 12 teeth indicated. 13. Penis, as in fig. 9.

Figs. 14, 15. *Brazieria (Probrazieria) lutaria,* new species, BBM. 153150: 14. Radula; central with first lateral, 8th with 9th, 14th and 40th teeth; also (T) outline of half row with widths of central and blocks of 8 teeth indicated. 15. Penis and ends of female genitalia.

PLATE 48. TROCHOMORPHINAE

Figs. 1-3. *Brazieria (Brazierella) minuscula,* new species, BBM. 155133: 1. Dissected genitalia (ovotestis omitted). 2. Radula; central with first lateral, 5th, 10th, 20th and 28th teeth; also (T) outline of half row with widths of central and blocks of 5 teeth indicated. 3. Penis proper, opened lengthwise and pinned out to show interior.

Figs. 4-6. *Brazieria (Entomostoma) entomostoma* (Hombron et Jaquinot), BBM. 153311: 4. Penis, as in fig. 3. 5. Penis and ends of female organs. 6. Radula; central with first lateral, and 23d teeth.

Figs. 7-9. *Brazieria (s. s.) velata* (Hombron et Jaquinot), BBM. 155665: 7. Radula; central with first lateral, 6th, 12th, 24th and 25th teeth; also (T) outline of half row with widths of central and blocks of 6 teeth indicated. 8. Apical two-thirds of penis proper, as in fig. 3. 9. Dissected genitalia.

Fig. 10. *Brazieria (s. s.) erasa,* new species, BBM. 153153: Apical half of penis proper, as in fig. 3.

Figs. 11-13. *Videna (Peleliua) pumila,* new species, BBM. 154714: 11. Penis, as in fig. 3. 12. Dissected genitalia (ovotestis omitted). 13. Radula; central with first lateral, 6th and 20th teeth.

Figs. 14-16. *Videna (Peleliua) pagodula* (Semper), BBM. 154631: 14. Radula; central with first lateral, 20th and 36th teeth; also (T) outline of half row, with widths of central and blocks of 13 teeth indicated. 15. Penis proper as in fig. 3. 16. Penis and ends of female organs.

PLATE 49. TROCHOMORPHINAE

Figs. 1-3. *Videna (Periryua) oleacina* (Semper), BBM. 154630: 1. Penis, containing spermatophore (SP), and ends of female organs. 2. Penis proper, opened lengthwise and pinned out to show interior. 3. Radula; central with first lateral, 20th, 43d and 60th teeth; also (T) line of half row with widths of central and blocks of 15 teeth indicated.

Figs. 4-6. *Videna (s. s.) electra* (Semper), BBM. 154690: 4. Penis, swollen basally (SP) by spermatophore, and ends of female organs. 5. Radula; central with first lateral, 21st, 29th and 54th teeth; also (T) line of half row with widths of central and blocks of 13 teeth indicated. 6. Penis proper, as in fig. 2, with lumen of vergic papilla (PV) and entrance of epiphallus (EP) shown by broken lines.

Figs. 7-9. *Trochomorpha (Nigritella) nigritella* (Pfeiffer), BBM. 154264: 7. Penis proper, as in fig. 2. 8. Dissected genitalia (ovotestis omitted). 9. Radula: central with first lateral, 9th, 24th and 57th teeth.

Figs. 10, 11. *Trochomorpha (Nigritella) contigua nanalauti,* new subspecies, BBM. 154516: 10. Penis and ends of female organs. 11. Penis proper, as in fig. 2.

Figs. 12-14. *Trochomorpha (Nigritella) approximata* (Le Guillou), BBM. 153137: 12. Penis proper, as in fig. 2. 13. Dissected genitalia (ovotestis and most of its duct omitted). 14. Radula; central with first lateral, 15th and 48th teeth.

Figs. 15-17. *Trochomorpha (Nigritella) conoides,* new species, BBM. 154472: 15. Penis proper, as in fig. 2. 16. Radula; central with first lateral, and 36th teeth; also (T) line of half row with widths of central and blocks of 9 teeth indicated. 17. Penis and ends of female organs.

Figs. 18-20. *Trochomorpha (Nigritella) carolinae,* new species, BBM. 154333: 18. Penis and ends of female organs. 19. Radula; central with first lateral, and 23d teeth. 20. Penis proper, as in fig. 2.

Plate 50. Trochomorpha

Figs. 1-3. *Trochomorpha (Nigritella) küsteri* (Pfeiffer): 1. Dissected genitalia (ovotestis omitted); BBM. 154254. 2. Radula, BBM. 153974; central with first lateral and 45th teeth; also (T) line of half row with widths of central and blocks of 13 teeth indicated. 3. Penis proper, BBM. 154254; opened lengthwise and pinned out to show interior.

Figs. 4, 5. *Trochomorpha (Lauhala) moalensis,* new species, BBM. 77097: 4. Radula; central with first lateral, and 20th teeth; also (T) line of half row with widths of central and blocks of 9 teeth indicated. 5. Dissected genitalia (ovotestis omitted).

Figs. 6, 7. *Trochomorpha (Lauhala) tuvuthae,* new species, BBM. 78848: 6. Penis and ends of female organs (same scale as fig. 5). 7. Radula; central with first lateral, and 20th teeth.

Figs. 8, 9. *Trochomorpha (Lauhala) kambarae,* new species, BBM. 78745: 8. Radula; central with first lateral. 9. Penis and ends of female organs.

Figs. 10, 11. *Trochomorpha (Lauhala) corallina themis* Garrett, BBM. 78994: 10. Dissected genitalia (ovotestis omitted). 11. Radula; central with first lateral, and 20th teeth; also (T) line of half row with widths of central and blocks of 8 teeth indicated.

Figs. 12, 13. *Trochomorpha (Lauhala) burrowsi,* new species, BBM. 115470: 12. Radula; central with first lateral, 20th and 48th teeth. 13. Penis and ends of female organs.

Figs. 14-16. *Trochomorpha (Lauhala) troilus* (Gould), BBM. 95707: 14. Dissected genitalia (ovotestis omitted). 15. Penis proper, as in fig. 3. 16. Radula: centrals with first laterals of two rows, 9th, 20th and 45th teeth; also (T) outline of half row with widths of central and blocks of 9 teeth indicated.

Figs. 17, 18. *Trochomorpha (Lauhala) troilus savaii,* new subspecies, BBM. 75764: 17. Radula; central with first lateral, and 30th teeth. 18. Penis and ends of female organs.

Figs. 19-21. *Trochomorpha (Ludificator) apia* (Hombron et Jaquinot), BBM. 84791: 19. Penis and ends of female genitalia. 20. Atrium, penis and epiphallus as in fig. 3. 21. Radula; central with first lateral, 9th and 22d teeth; also (T) line of half row with widths of central and blocks of 8 teeth indicated.

Plate 51. Trochomorpha

Figs. 1, 2. *Trochomorpha (Cotitrochus) eurydice* (Gould), BBM. 87716: 1. Penis and ends of female organs. 2. Radula; central with first lateral, 8th and 20th teeth.

Figs. 3-5. *Trochomorpha (Lentitrochus) sanctae-annae* Smith, BBM. 119236: 3. Radula; central with first lateral, 11th, 20th and 42d teeth; also (T) outline of half row with widths of central and blocks of 10 teeth indicated. 4. Penis proper, opened lengthwise and pinned out to show interior. 5. Dissected genitalia (ovotestis and most of its duct omitted).

Figs. 6, 7. *Trochomorpha (s. s.) swainsoni* (Pfeiffer), BBM. 139379: 6. Radula; central with first lateral, 20th and 51st teeth. 7. Penis and ends of female organs.

Fig. 8. *Trochomorpha (s. s.) assimilis* Garrett, BBM. 139134: Penis (retractor partly omitted) and ends of female genitalia.

Fig. 9. *Trochomorpha (s. s.) pallens* Pease, BBM. 86804: Radula; central with first lateral (same scale as fig. 13).

Figs. 10-14. *Trochomorpha (s. s.) typus,* new species, BBM. 139416: 10. Penis proper, atrium, epiphallus and end of vas deferens, as in fig. 4. 11. Lateral view of penial stimulator on section of penial wall. 12. Dissected genitalia. 13. Radula; centrals and first laterals of two rows, 11th, 20th, 51st and 68th teeth; also (T) outline of half row with widths of central and blocks of 10 teeth indicated. 14. Central nervous system (with pleuro-abdominal ring pulled to left side) and roots of principal nerves.

Plate 52. Trochomorphinae, Zonitinae

Fig. 1. *Trochomorpha (s. s.) cressida* (Gould), BBM. 137012: Penis (most of retractor omitted) and ends of female genitalia.

Figs. 2, 3. *Retinella (Nesovitrea) hawaiiensis* (Ancey), BBM. 44137: 2. Dissected genitalia (ovotestis and most of its duct omitted). 3. Radula; central with first lateral, 4th with 5th, and 11th teeth; also (T) outline of half row with width of central and blocks of 4 teeth indicated.

Fig. 4. *Retinella (Nesovitrea) pauxilla* (Gould), BBM. 20995: Penis proper shown in diagrammatic optical section, from mount in glycerin jelly.

Figs. 5, 6. *Retinella (Nesovitrea) molokaiensis* (Sykes), BBM. 24624: 5. Radula; central with first lateral (same scale as fig. 3). 6. Penis proper (same scale as fig. 4) with retractor and end of epiphallus.

Fig. 7. *Godwinia (s. s.) caperata* (Gould), BBM. 81299: Dissected genitalia (ovotestis omitted).

Figs. 8-10. *Godwinia (Omphalops) newcombi* (Reeve), BBM. 47813: 8. Dissected genitalia (ovotestis omitted). 9-10. Radula; central with first lateral, 5th with 6th, and 15th teeth; also (T) outline of half row with widths of central and blocks of 5 teeth indicated.

Plate 53. Euconulinae

Figs. 1-4. *Euconulus (Nesoconulus) subtilissimus* (Gould): 1-3. BBM. 11286, frontal, apical and basal outlines of a typical shell. 4. BBM. 38476, frontal outline of a higher shell.

Figs. 5, 6. *Euconulus (Nesoconulus) subtilissimus kaunakakai,* new subspecies, BBM. 11445: Basal and apical outlines of type shell.

Figs. 7, 8. *Euconulus (Monoconulus) conoides,* new species, BBM. 11291: Apical (same scale as fig. 4) and basal outlines of type shell.

Figs. 9, 10. *Euconulus (Nesoconulus) gaetanoi vivens,* new subspecies, BBM. 11285: Apical (same scale as fig. 6) and basal outlines of type shell.

Figs. 11, 12. *Euconulus (Chetosyna) thurstoni,* new species, BBM. 59168: Apical and basal outlines of type shell.

Figs. 13-15. *Kororia palaensis* (Semper), BBM. 89839: Apical, frontal and basal outlines of a shell from Palau: Koror.

Plate 54. Palaua

Figs. 1-3. *Palaua straminea* (Semper), BBM. 89891: Frontal, apical and basal outlines of a shell from Palau: Angaur.

Figs. 4-6. *Palaua wilsoni* (Semper), BBM. 154618: Basal, frontal and apical outlines of a shell from Palau: Peleliu.

Figs. 7-9. *Palaua minor* (Semper), BBM. 154919: Apical, basal and frontal outlines of a shell from Palau: Babelthuap.

Figs. 10-12. *Palaua babelthuapi,* new species, BBM. 11486: Basal, frontal and apical outlines of type shell.

Figs. 13-15. *Palaua margaritacea* (Semper), BBM. 154830: Frontal (same scale as fig. 14), apical and basal outlines of a shell from Palau: Koror.

Plate 55. Euconulinae, Sesarinae, Trochomorphinae

Figs. 1-3. *Palaua ngarduaisi,* new species, BBM. 11487: Frontal, apical and basal outlines of type shell.

Figs. 4, 5. *Coneuplecta (Durgellina) calculosa* (Gould), BBM. 95961: Apical and basal outlines of a shell from Marquesas: Nukuhiva.

Fig. 6. *Coneuplecta (Sitalina) microconus* (Mousson), BBM. 78558: Frontal outlines of a shell from Fiji: Namuka-i-Lau.

Figs. 7, 8. *Coneuplecta (s. s.) turrita palauensis,* new subspecies, BBM. 11488: Basal and apical outlines of type shell.

Figs. 9, 10. *Videna (Periryua) oleacina* (Semper), BBM. 154630: Frontal and basal outlines of a shell from Palau: Peleliu.

Figs. 11, 12. *Dendrotrochus (Ponapea) ponapensis,* new species, BBM. 154051: Basal and apical outlines of type shell.

Figs. 13, 14. *Videna (Peleliua) pumila,* new species, BBM. 11494: Apical and basal outlines of type shell.

Fig. 15. *Ryssota (Trukrhysa) pachystoma dubloni,* new subspecies, BBM. 11488: Frontal outline of type shell.

Plate 56. Orpiella

Figs. 1-3. *Orpiella (Halozonites) cookensis* (Gude), BBM. 87993: Frontal (same scale as fig. 5), apical and basal outlines of a shell from Fiji: Vatuleile.

Figs. 4-6. *Orpiella (Halozonites?) proxima,* new species, BBM. 11424: Basal, frontal and apical outlines of type shell.

Figs. 7-9. *Orpiella (Halozonites?) schmeltziana* (Garrett), ANSP. 49192: Apical, basal and frontal outlines of shell from type lot.

Figs. 10-12. *Orpiella (s. s.) fragillima* (Mousson), BBM. 79143: Frontal, apical and basal outlines of a shell from Fiji: Ovalau.

Figs. 13-15. *Orpiella (Eufretum) similis* (Semper), BBM. 77021: Basal, frontal and apical outlines of a small shell from Fiji: Viti Levu.

Plate 57. Trochomorpha

Figs. 1, 2. *Trochomorpha (Lauhala) corallina themis* Garrett: 1. BBM. 78847, frontal outlines of a typical shell from Fiji. Tuvutha. 2. BBM. 78685, frontal outlines of a larger shell from Fiji: Kambara.

Fig. 3. *Trochomorpha (s. s.) assimilis* Garrett, BBM. 139134: Frontal outlines of an exceptionally elevated shell (same scale as fig. 2).

Figs. 4-6. *Trochomorpha (s. s.) swainsoni* (Pfeiffer), BBM. 139379: Apical, basal and frontal (same scale as fig. 2) outlines of a shell from Raiatea.

Figs. 7-9. *Trochomorpha (s. s.) cressida* (Gould): 7-8. BBM. 137012, frontal and apical outlines of a shell from Tahiti. 9. ANSP. 1951, frontal outlines of a shell, probably from Gould.

Figs. 10, 11. *Trochomorpha (Cotitrochus) eurydice* (Gould), BBM. 87716: Apical (same scale as fig. 7) and basal outlines of a shell from Tonga: Eua.

Figs. 12, 13. *Trochomorpha (Lauhala) troilus savaii,* new subspecies, BBM. 75764: Apical and frontal outlines of type shell.

Figs. 14, 15. *Trochomorpha (Ludificator) apia* (Hombron et Jaquinot), BBM. 84791: Apical and basal outlines of a shell from Samoa: Tutuila.

Plate 58. Trochomorphinae

Fig. 1. *Trochomorpha (Nigritella) nigritella* (Pfeiffer), form *oppressa* Pease, ANSP. 48979: Frontal outlines of a shell from Pease.

Figs. 2, 3. *Trochomorpha (Nigritella) nigritella paucispira,* new subspecies, BBM. 11490: Apical and basal outlines of type shell.

Figs. 4-6. *Trochomorpha (Nigritella) nigritella fuscata* "Pease", Pilsbry, ANSP. 1933: Apical frontal and basal outlines of type shell.

Figs. 7-9. *Trochomorpha (Nigritella) contigua nanalauti,* new subspecies, BBM. 11489: Apical, basal and frontal outlines of type shell.

Figs. 10, 11. *Trochomorpha (Nigritella) nigritella tolotomi,* new subspecies, BBM. 11493: Apical (same scale as fig. 5) and basal outlines of type shell.

Figs. 12, 13. *Trochomorpha (Nigritella) conoides,* new species, BBM. 11492: Apical (same scale as fig. 9) and basal outlines of type shell.

Figs. 14, 15. *Hogolua kondorum,* new species, BBM. 11495: Basal and apical outlines of type shell.

Plate 59. Trochomorphinae

Figs. 1-3. *Videna (s. s.) electra* (Semper), BBM. 154690: Frontal, apical and basal outlines of a shell from Palau: Peleliu.

Fig. 4. *Videna (Peleliua) pagodula* (Semper), BBM. 154631: Basal outlines of a shell from Palau: Peleliu.

Figs. 5, 6. *Trochomorpha (Nigritella) carolinae,* new species, BBM. 11491: Basal and apical outlines of type shell.

Figs. 7-9. *Trochomorpha (Nigritella) küsteri monticola,* new subspecies, BBM. 154371: Apical, basal and frontal outlines of type shell.

Figs. 10, 11. *Brazieria (Probrazieria) lutaria,* new species, BBM. 11497: Apical and basal outlines of type shell.

Figs. 12, 13. *Brazieria (s. s.) erasa,* new species, BBM. 11489: Apical and basal outlines of type shell.

Figs. 14, 15. *Brazieria (Brazierella) minuscula,* new species, BBM. 11499: Apical and basal outlines of type shell.

Plate 60. Euconulinae, Trochomorphinae, Gastrodontinae

Figs. 1-3. *Striatura (Pseudohyalina) pugetensis* (Dall), BBM. 11028: Frontal (with sculpture shown on first half of last whorl), apical (with 5 riblets shown) and basal outlines of shell from Hawaii: Kauai.

Figs. 4-6. *Striatura (Pseudohyalina) meniscus* (Ancey), BBM. 11434: Basal (sculpture shown near aperture), frontal (as in fig. 1) and apical (as in fig. 2) outlines of a shell from Humuula.

Figs. 7-9. *Striatura (Pseudohyalina) discus,* new species, BBM. 38479: Apical (3 riblets shown), basal and frontal (like in fig. 1; same scale as fig. 5) outlines of type shell.

Figs. 10-12. *Habroconus (Cocoslens) pallidus,* new species, ANSP. 170394: frontal, apical and basal outlines of type shell.

Fig. 13. *Habroconus (Pseudoguppya) pacificus* (Pfeiffer), ANSP. 84695: frontal outlines of "cotype of *Guppya fultoni*".

Fig. 14. *Discoconulus* species, near *D. sinapidium* (Reinhardt), BBM. 155177: frontal outlines of a shell from Caroline Islands: Ponape.

Fig. 15. *Brazieria (s. s.) obesa,* new species, BBM. 155631: Frontal outlines of type shell with 4 riblets shown.

Plate 61. Vitreinae, Gastrodontinae, Zonitinae

Figs. 1-3. *Retinella (Nesovitrea) pauxilla* (Gould), BBM. 38733: Apical, frontal (same scale as fig. 5) and basal outlines of a typical shell.

Figs. 4-6. *Retinella (Nesovitrea) molokaiensis* (Sykes), BBM. 24624: Apical, frontal and basal outlines of a shell.

Figs. 7-9. *Retinella (Nesovitrea) hawaiiensis* (Ancey), BBM. 44168: Apical, frontal and basal outlines of a large shell.

Figs. 10-12. *Zonitoides (Zonitellus) arboreus* (Say), BBM. 88159: Apical, frontal and basal outlines of a shell from Hawaiian islands: Hawaii.

Figs. 13-15. *Hawaiia minuscula* (Binney), ANSP. 153476: Apical, frontal and basal outlines of shell from Hawaiian islands: Molokai.

Plate 62. Microcystinae, Euconulinae, Zonitinae

Figs. 1, 2. *Philonesia (s. s.) glypha,* new species, BBM. 11354: Apical and frontal views of type shell (described in Part 2).

Fig. 3. *Euconulus (Nesoconulus) subtilissimus kaunakakai,* new subspecies, BBM. 11445: Frontal view of type shell.

Figs. 4, 5. *Philonesia (Aa) waiheensis,* new species, BBM. 11368: Apical and frontal views of type shell (described in Part 2).

Fig. 6. *Euconulus (Pellucidomus) lubricella* (Ancey), BBM. 11288: Frontal view of a shell.

Figs. 7, 8. *Philonesia (Mauka) welchi,* new species, BBM. 11355: Apical and frontal views of type shell (described in Part 2).

Fig. 9. *Euconulus (Nesoconulus) gaetanoi vivens,* new subspecies, BBM. 11285: Frontal view of type shell.

Figs. 10, 11. *Godwinia (Omphalops) newcombi* (Reeve), BBM. 47813: Apical and frontal views of a shell.

Fig. 12. *Euconulus (Chetosyna) thurstoni,* new species, BBM. 59168: Frontal view of type shell.

Fig. 13. *Coneuplecta (Durgellina) calculosa* (Gould), BBM. 95961: Frontal view of a shell from Marquesas: Nukuhiva.

Fig. 14. *Coneuplecta (s. s.) turrita palauensis,* new subspecies, BBM. 11488: Frontal view of type shell.

Fig. 15. *Euconulus (Monoconulus) conoides,* new species, BBM. 11291: Frontal view of type shell.

Plate 63. Sesarinae, Trochomorphinae

Figs. 1-3. *Trochomorpha (Lauhala) burrowsi,* new species, BBM. 11429: Apical, frontal and basal views of type shell.

Figs. 4, 5. *Trochomorpha (Lauhala) albo-striata* Mousson, BBM. 78329: Apical and frontal views of a shell from Fiji: Ongea levu.

Fig. 6. *Trochomorpha (Cotitrochus) eurydice* (Gould), BBM. 87716: Frontal view of a shell from Tonga: Eua.

Fig. 7. *Trochomorpha (Ludificator) apia* (Hombron et Jaquinot), BBM. 84791: Frontal view of a shell from Samoa: Tutuila.

Figs. 8, 9. *Trochomorpha (Lentitrochus) sanctae-annae* Smith, BBM. 119236: Frontal and basal views of a shell from Solomon Islands: Owa Raha.

Figs. 10-12. *Trochomorpha (s. s.) typus,* new species, BBM. 11431: Apical, frontal and basal views of type shell.

Figs. 13, 14. *Orpiella (Irenella) nouleti tawalekae,* new subspecies, BBM. 11425: Frontal and apical views of type shell.

Fig. 15. *Orpiella (Owaraha) solidiuscula* (Smith), BBM. 119238: Frontal view of a shell from Solomon Islands: Owa Raha.

Plate 64. Trochomorpha

Fig. 1. *Trochomorpha depresso-striata* Mousson, ANSP. 49037: Frontal view of a shell, probably from type lot.

Fig. 2. *Trochomorpha (Lauhala) corallina* Mousson, BBM. 78926: Frontal view of a shell from Fiji: Mango.

Figs. 3, 4. *Trochomorpha lüdersi* (Pfeiffer), ANSP. 49018: Frontal and apical views of a shell, probably from type material.

Figs. 5, 6. *Trochomorpha (Lauhala) corallina themis* Garrett, BBM. 78685: Basal and apical views of a shell from Fiji: Kambara.

Figs. 7-9. *Trochomorpha (Lauhala) moalensis,* new species, BBM. 11430: Apical, frontal and basal views of type shell.

Figs. 10-12. *Trochomorpha (Lauhala) tuvuthae,* new species, BBM. 78867: Apical, frontal and basal views of type shell.

Figs. 13-15. *Trochomorpha (Lauhala) kambarae,* new species, BBM. 11428: Apical frontal and basal views of type shell.

Plate 65. Sesarinae, Trochomorphinae

Fig. 1. *Dendrotrochus (Ponapea) ponapensis,* new species, BBM. 154051: Frontal view of type shell.

Fig. 2. *Trochomorpha (Nigritella) conoides,* new species, BBM. 11492: Frontal view of type shell.

Fig. 3. *Trochomorpha (Nigritella) nigritella tolotomi,* new subspecies, BBM. 11493: Frontal view of type shell.

Fig. 4. *Trochomorpha (Nigritella) nigritella paucispira,* new subspecies, BBM. 11490: Frontal view of type shell.

Fig. 5. *Trochomorpha (Nigritella) carolinae,* new species, BBM. 11491: Frontal view of type shell.

Fig. 6. *Videna (Peleliua) pumila,* new species, BBM. 11494: Frontal view of type shell.

Fig. 7. *Hogolua kondorum,* new species, BBM. 11495: Frontal view of type shell.

Fig. 8. *Brazieria (Probrazieria) lutaria,* new species, BBM. 11497: Frontal view of type shell.

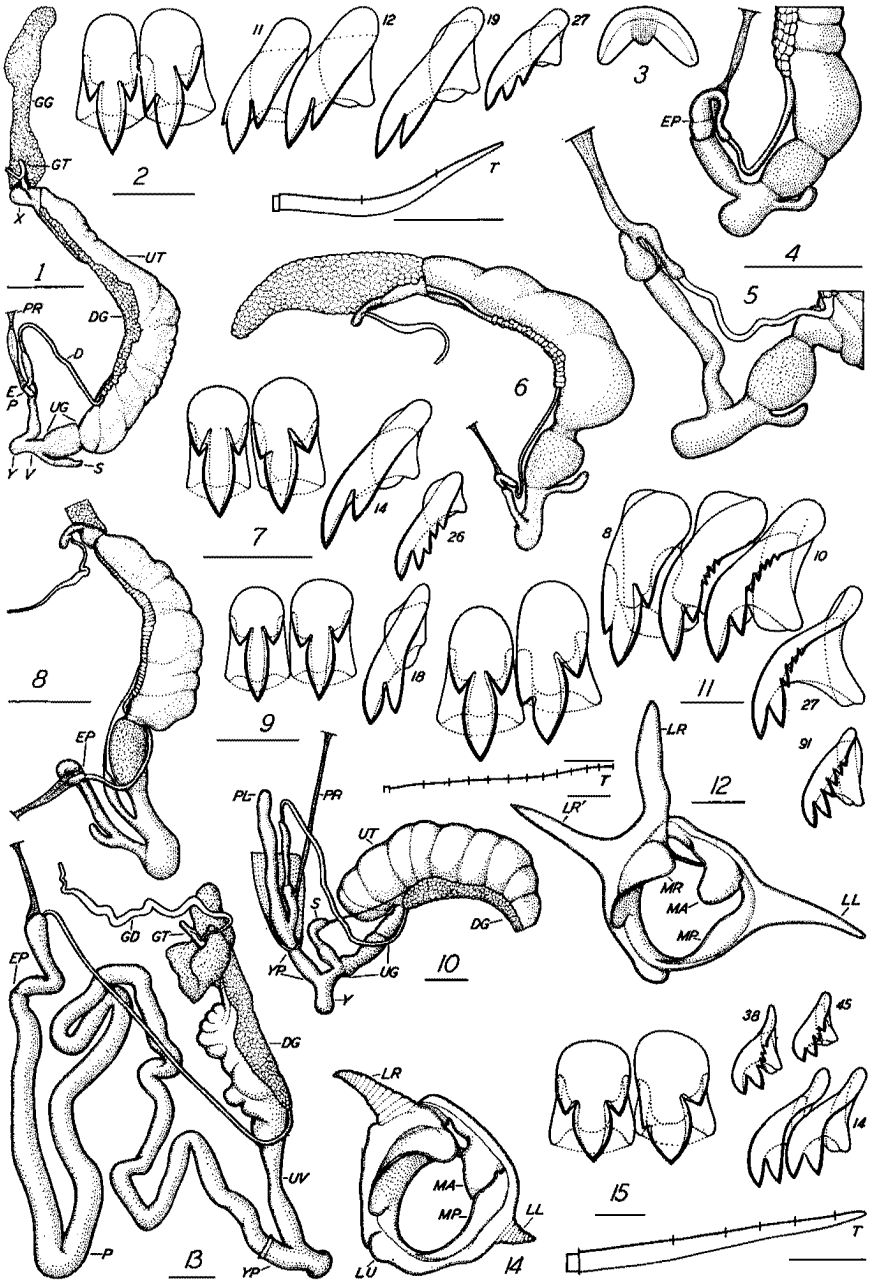
Fig. 9. *Videna (Peleliua) pagodula* (Semper), BBM. 154631: Frontal view of a shell from Palau: Peleliu.

Fig. 10. *Brazieria (Brazierella) minuscula,* new species, BBM. 11499: Frontal view of type shell.

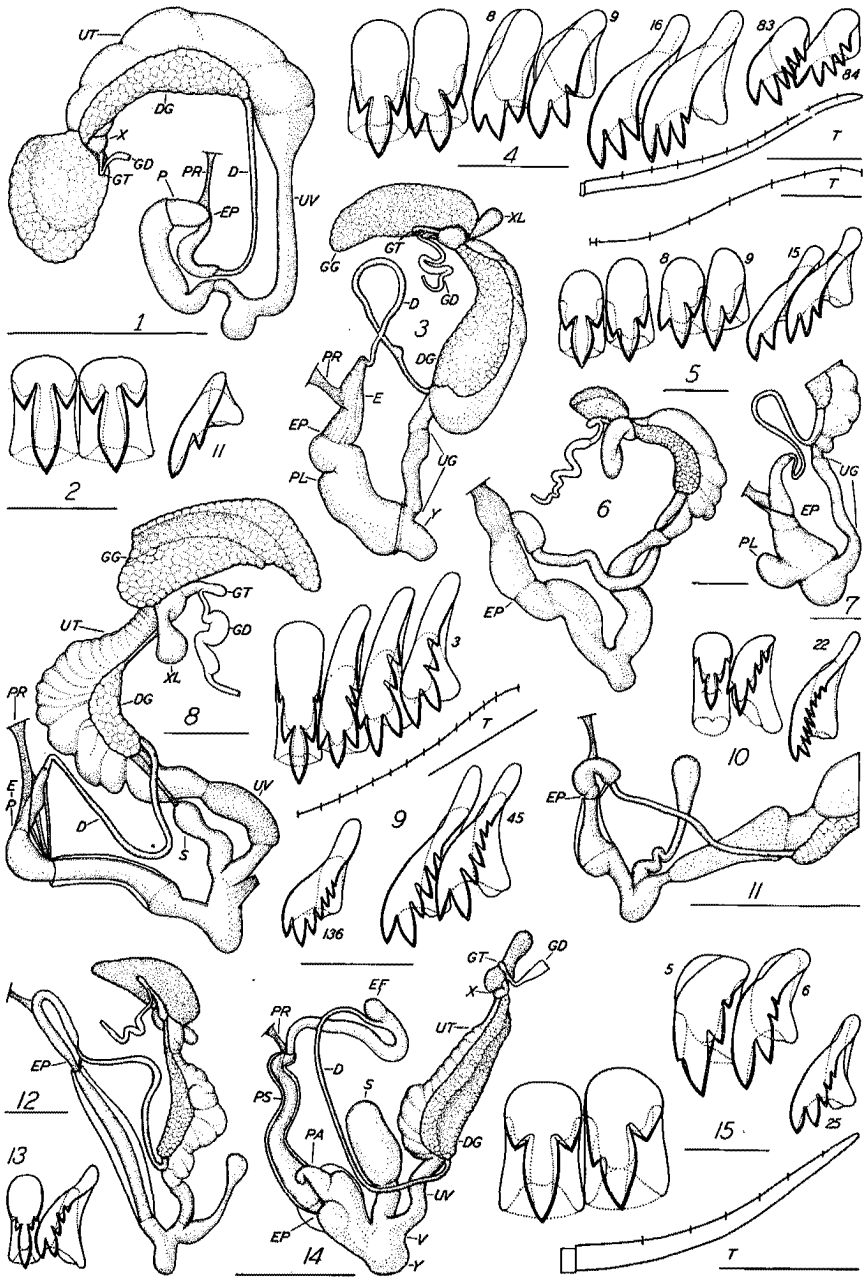
Fig. 11. *Brazieria (s. s.) erasa,* new species, BBM. 11489: Frontal view of type shell.

Fig. 12. *Brazieria (s. s.) velata* (Hombron et Jaquinot), variety, BBM. 153699: Frontal view of a shell from Moen, approaching subspecies *brazieri.*

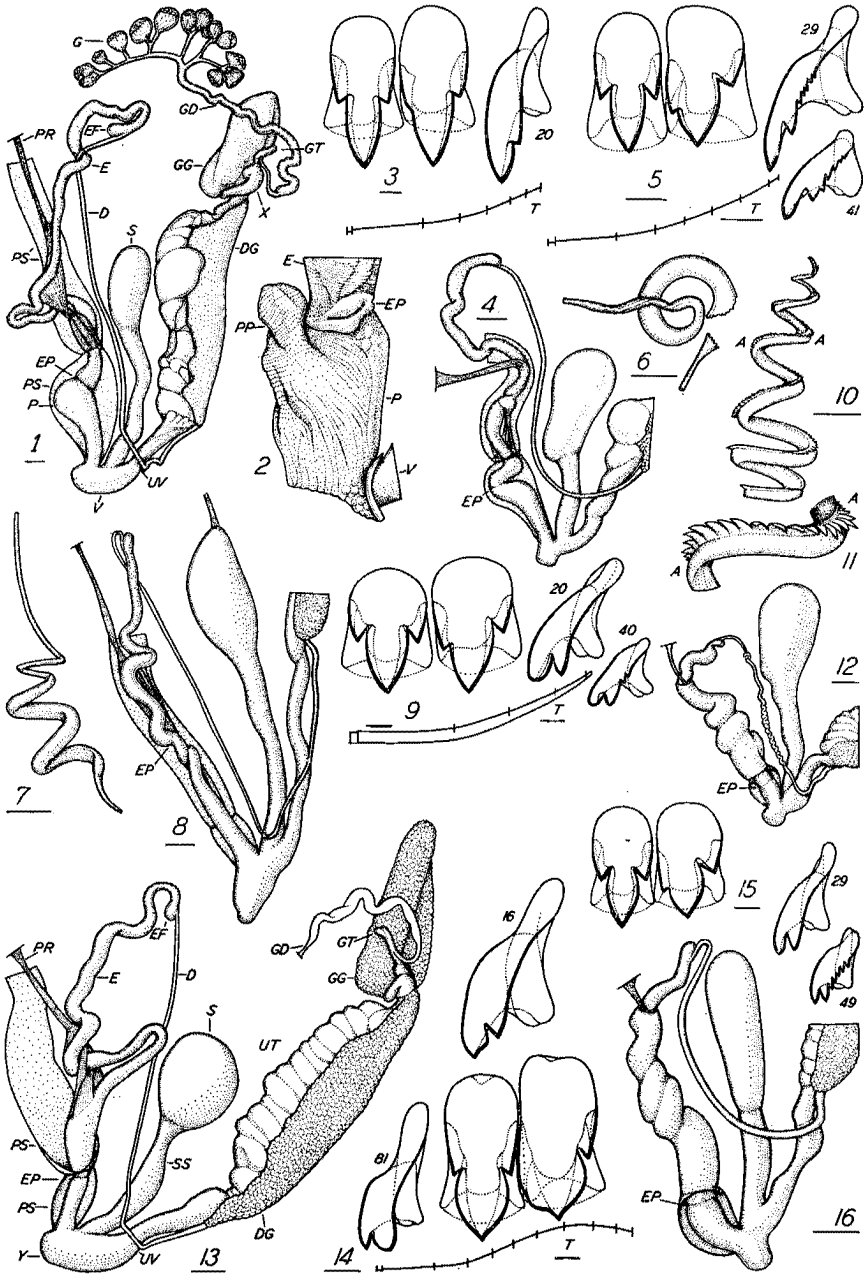
Figs. 13-15. *Kondoa asteriscus,* new species, BBM. 11496: Apical, frontal and basal views of type shell.



EUCONULINAE



EUCONULINAE, SESARINAE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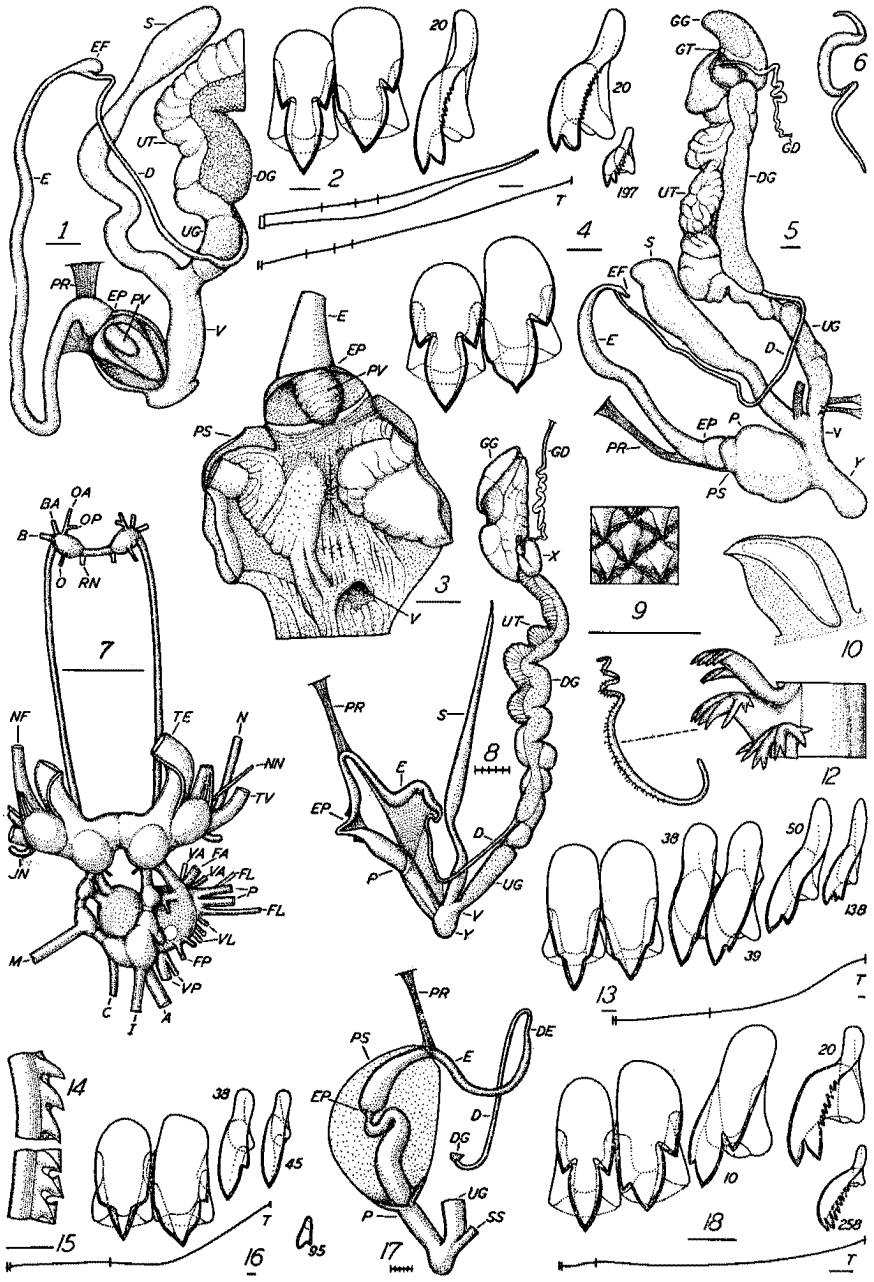
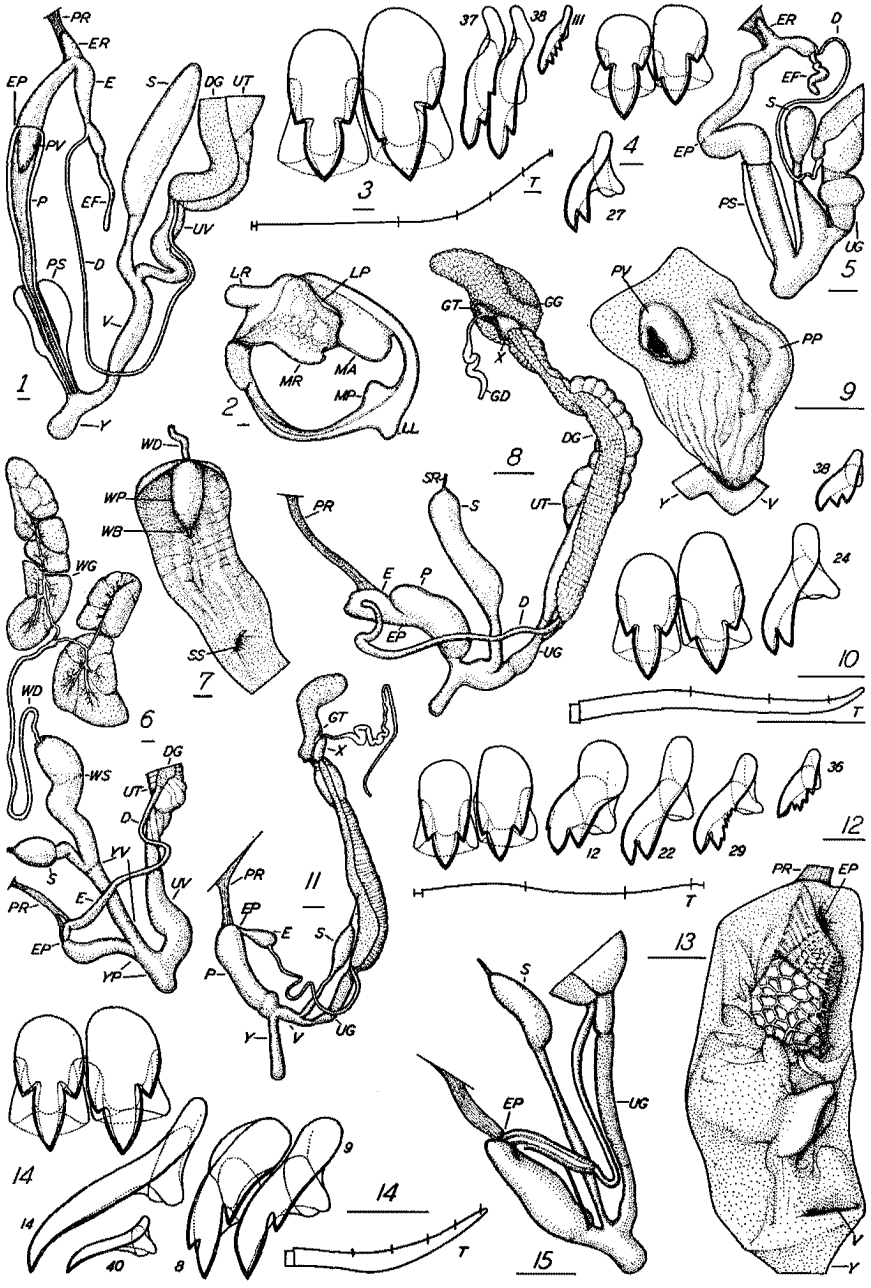
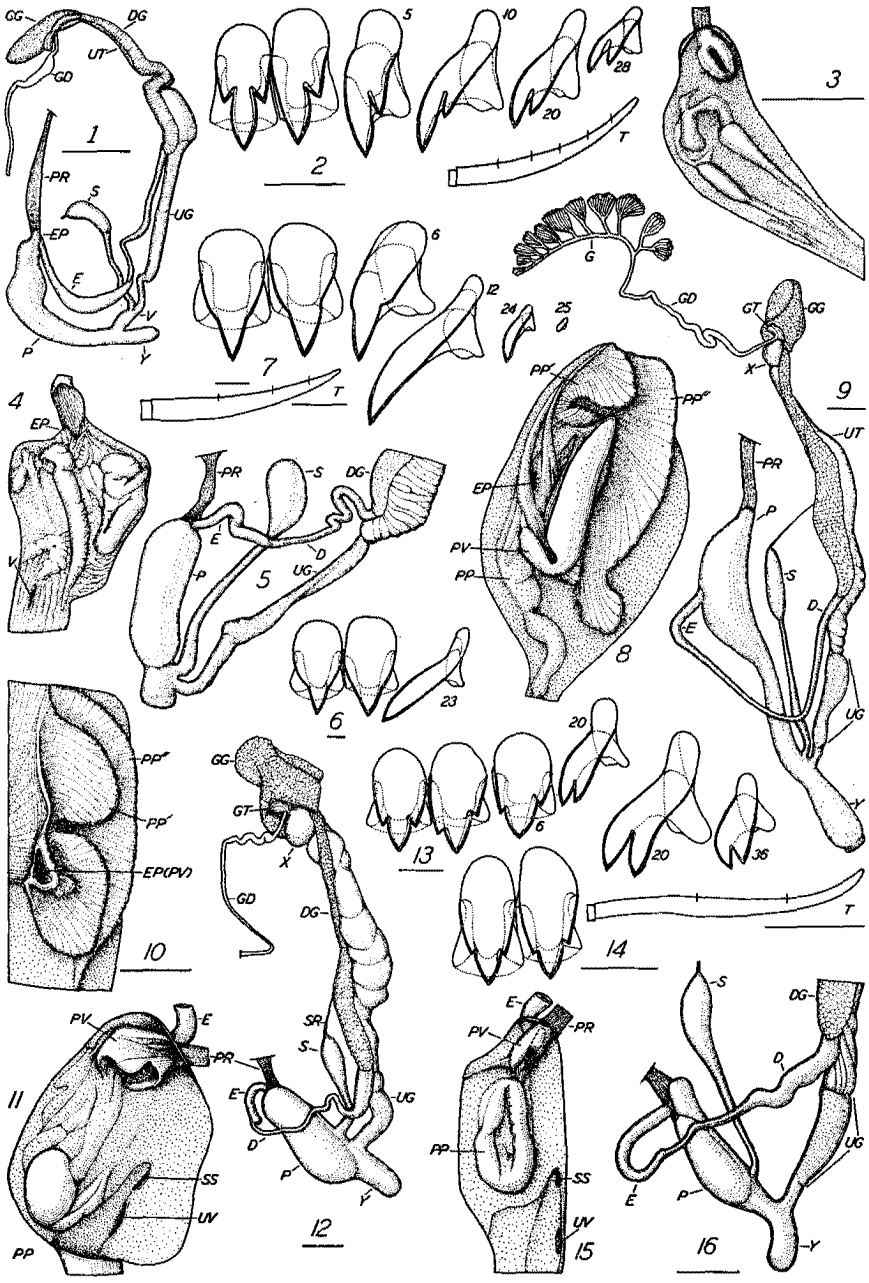
SESARINAE



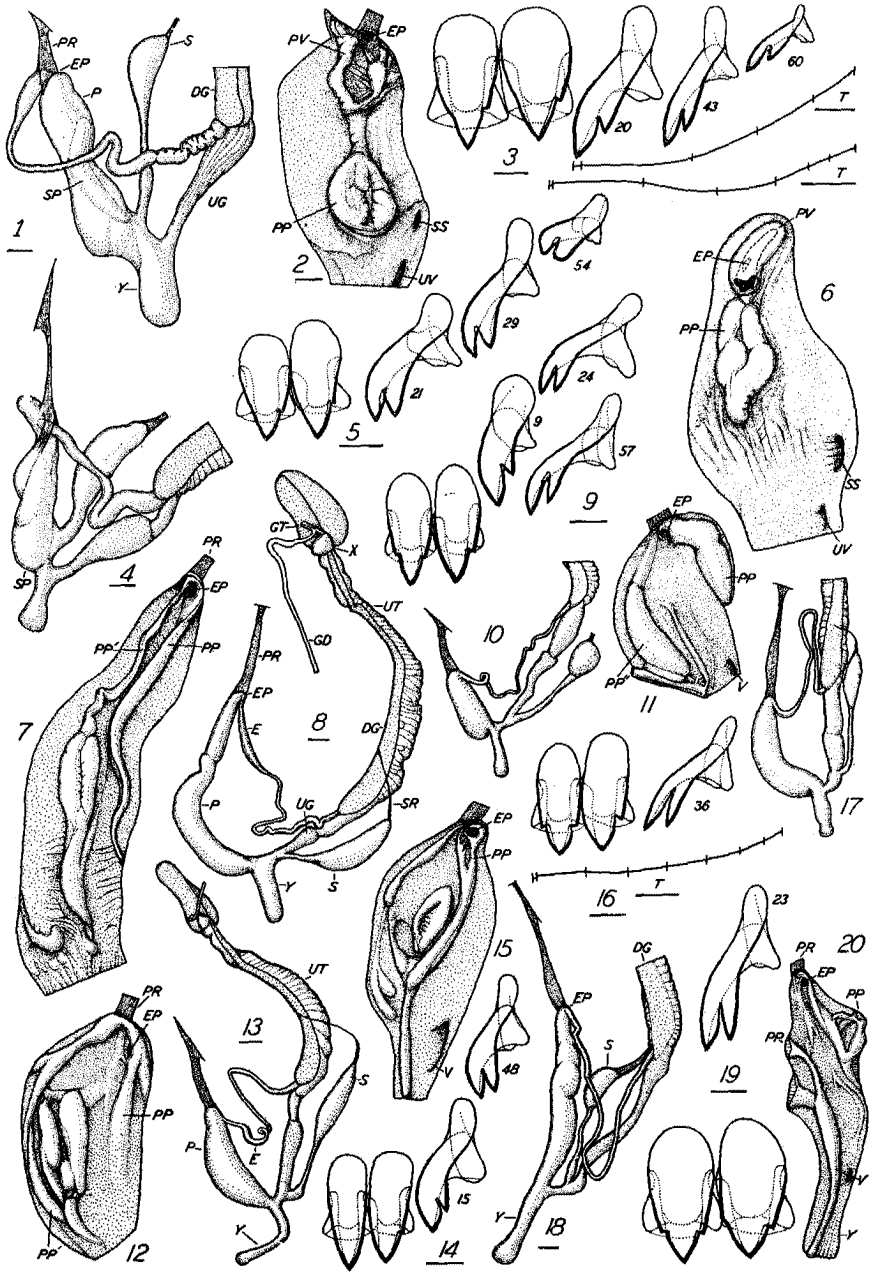
SESARINAE, HELICARIONINAE



HELICARIONINAE, DYAKIINAE, TROCHOMORPHINAE



TROCHOMORPHINAE



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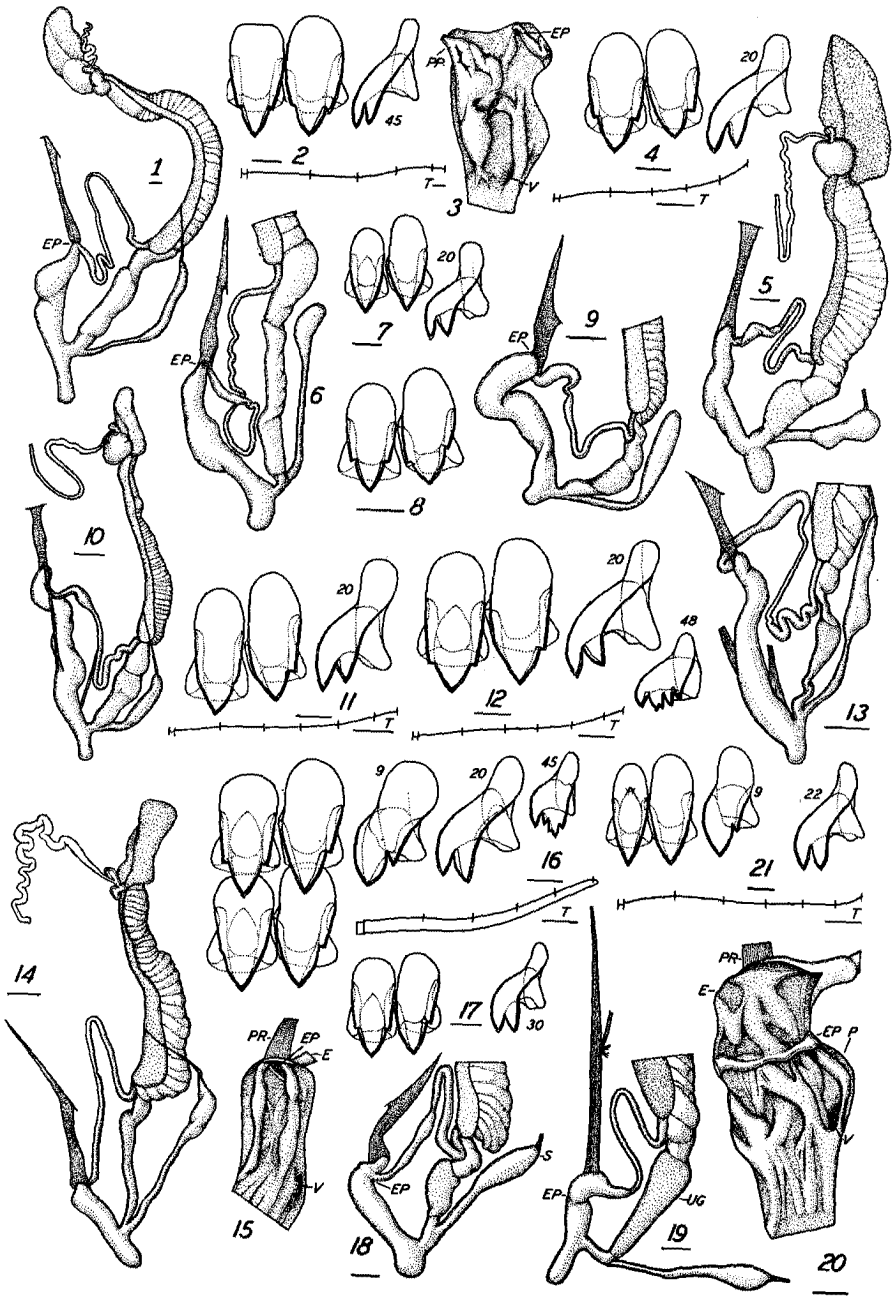

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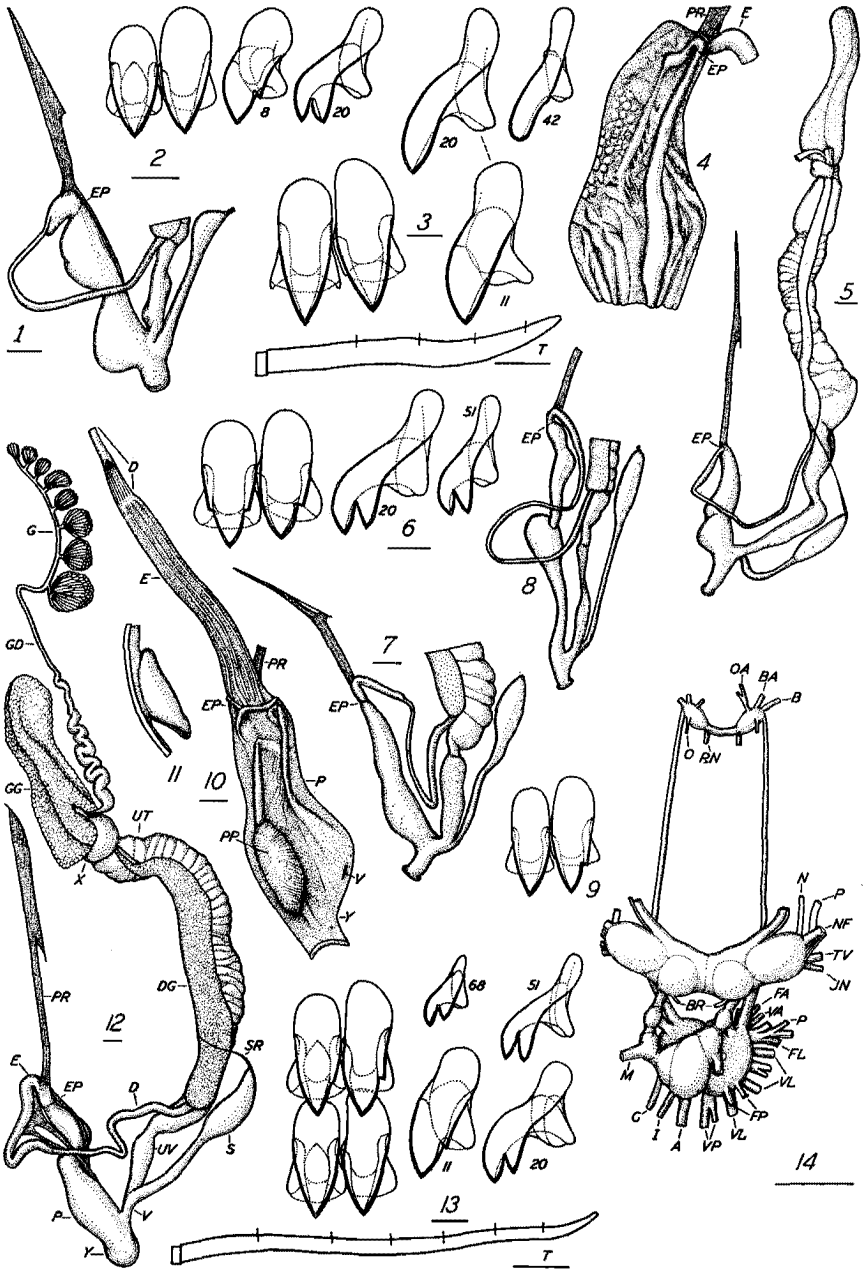

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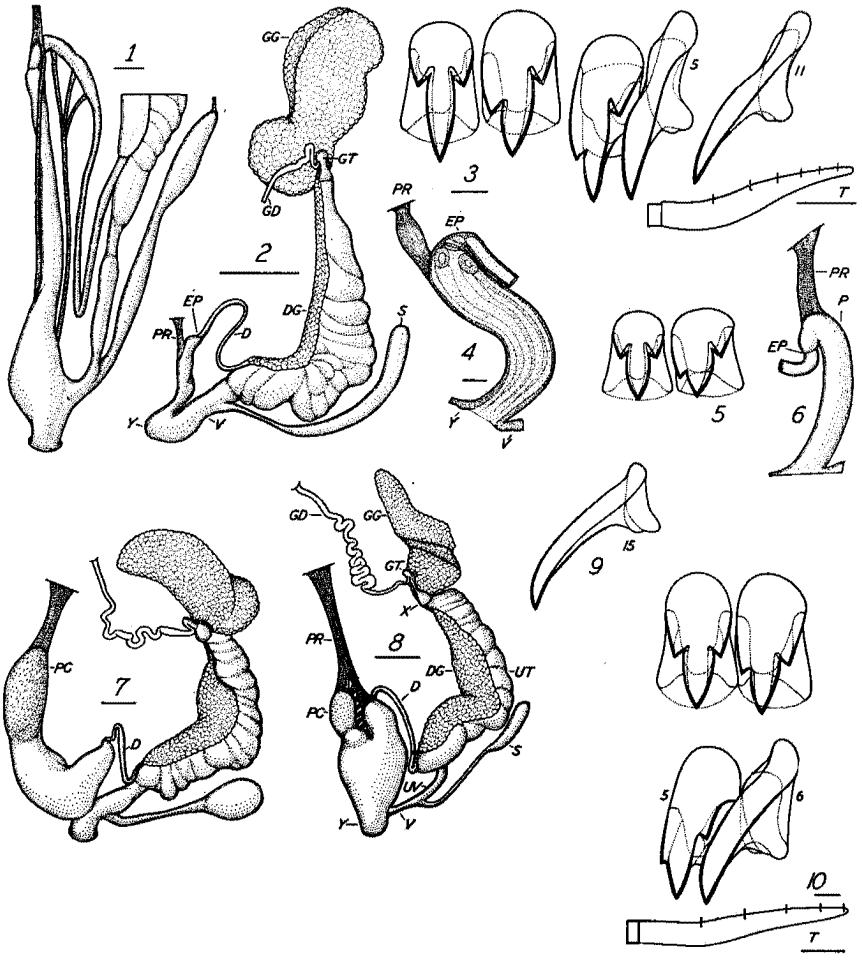
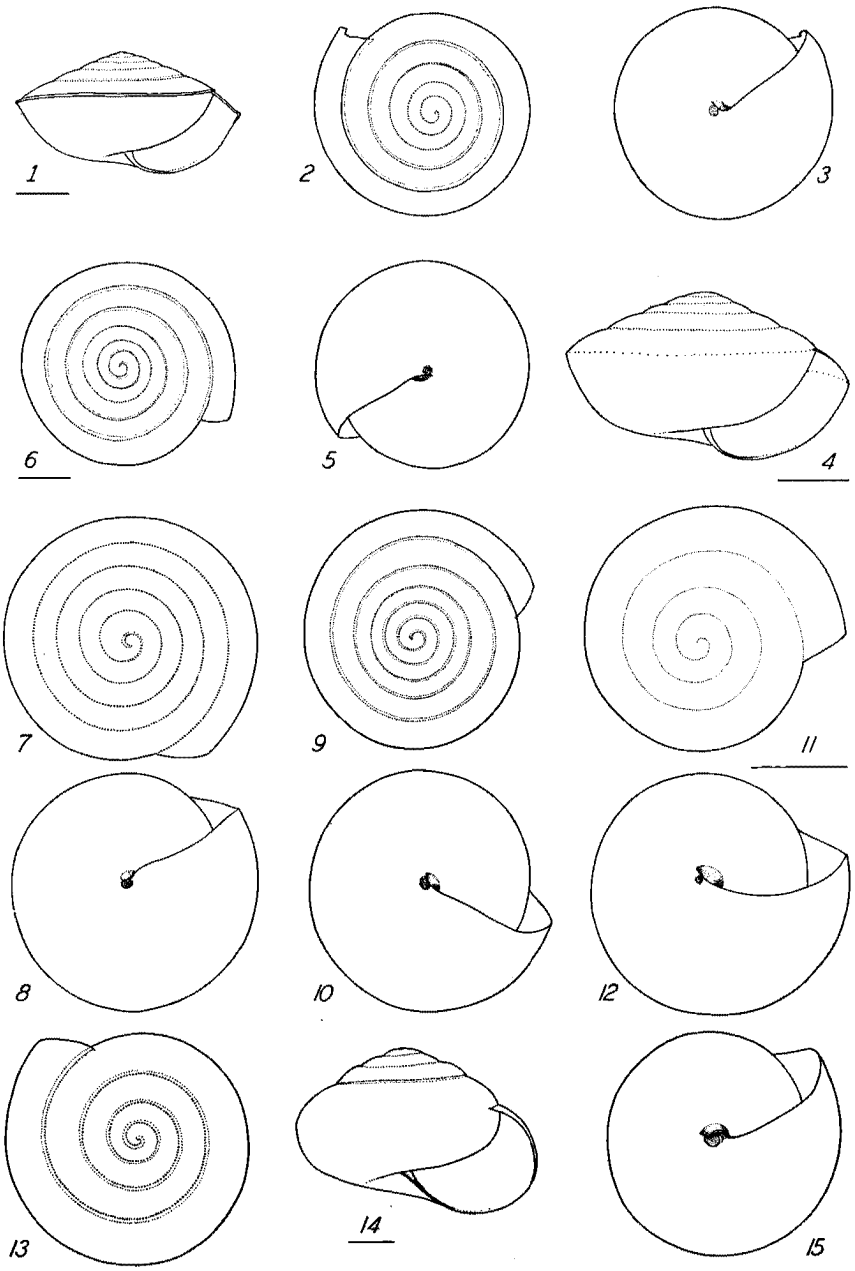
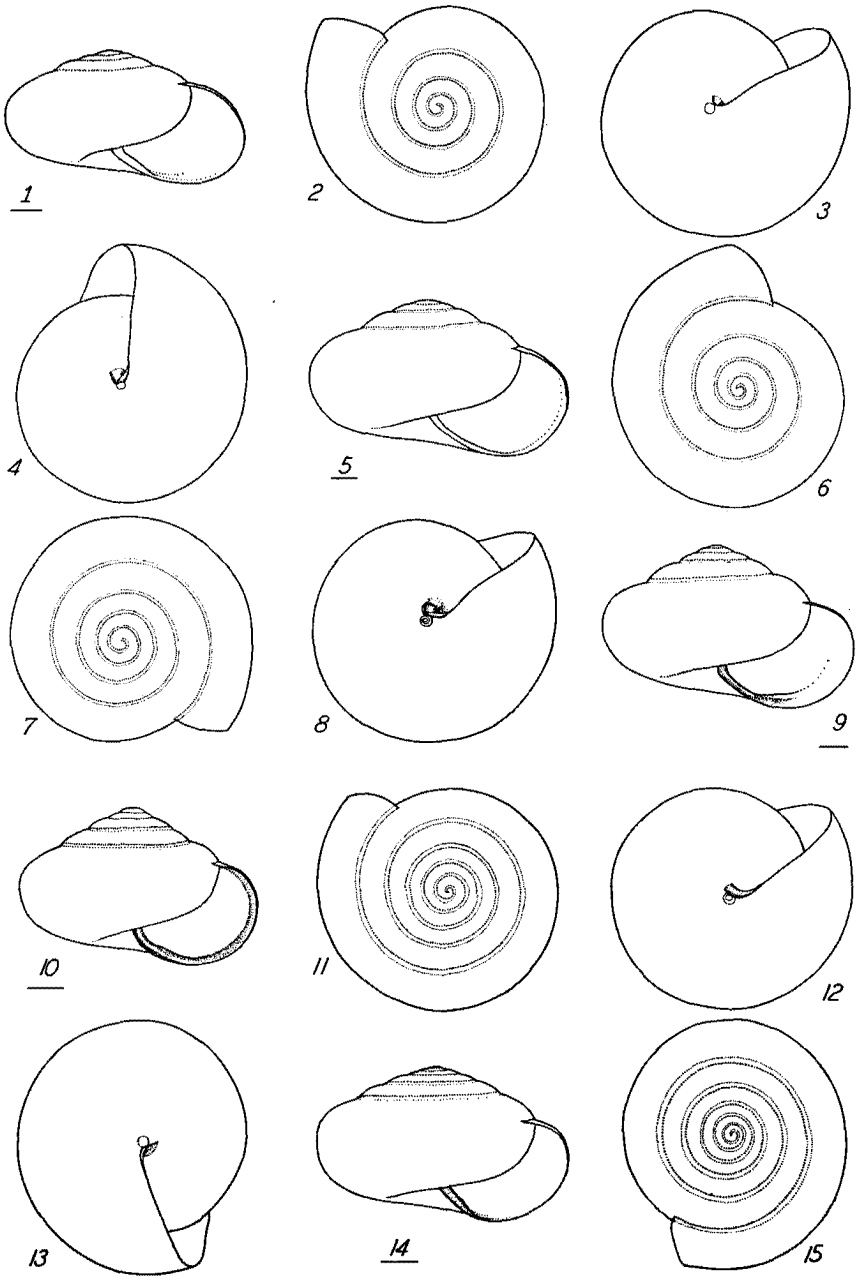


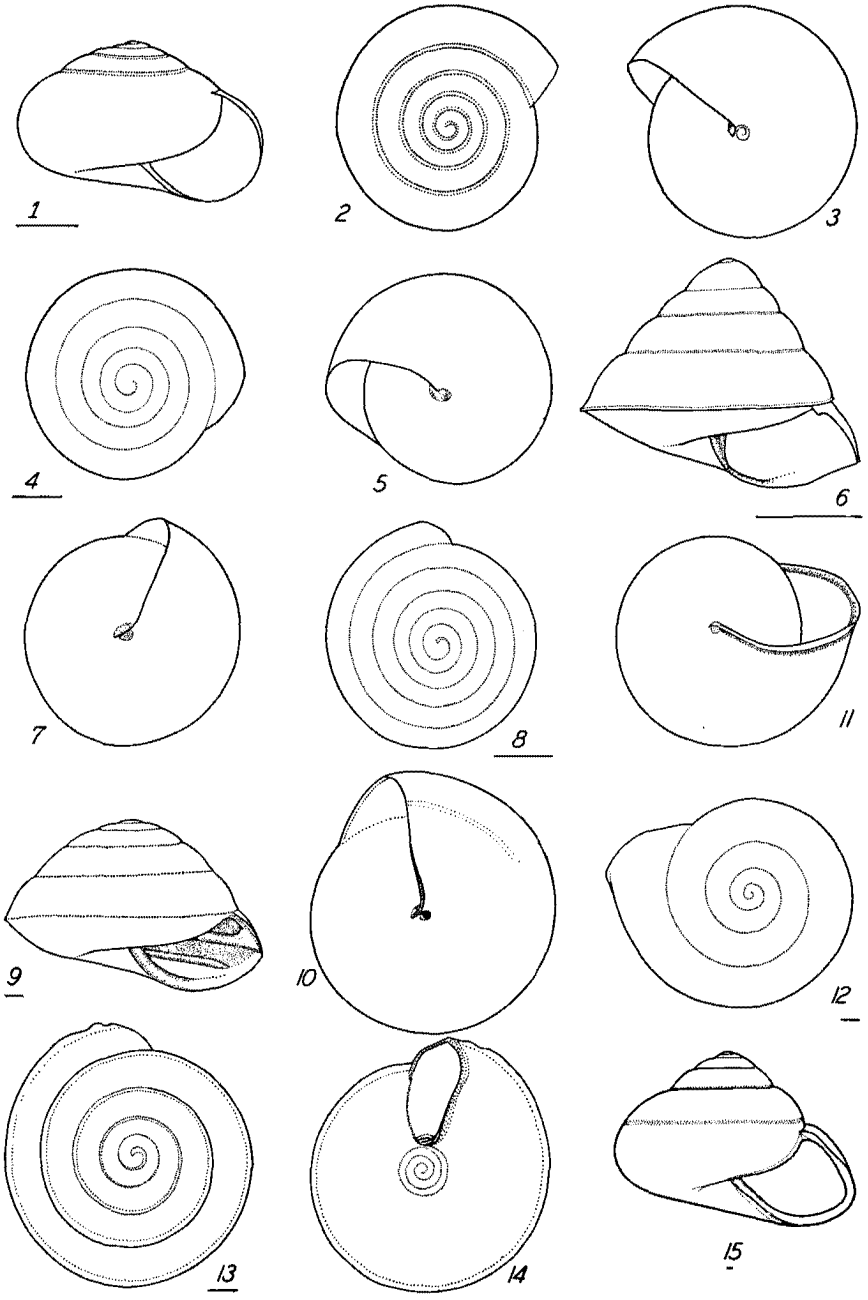
TROCHOMORPHINAE, ZONITINAE



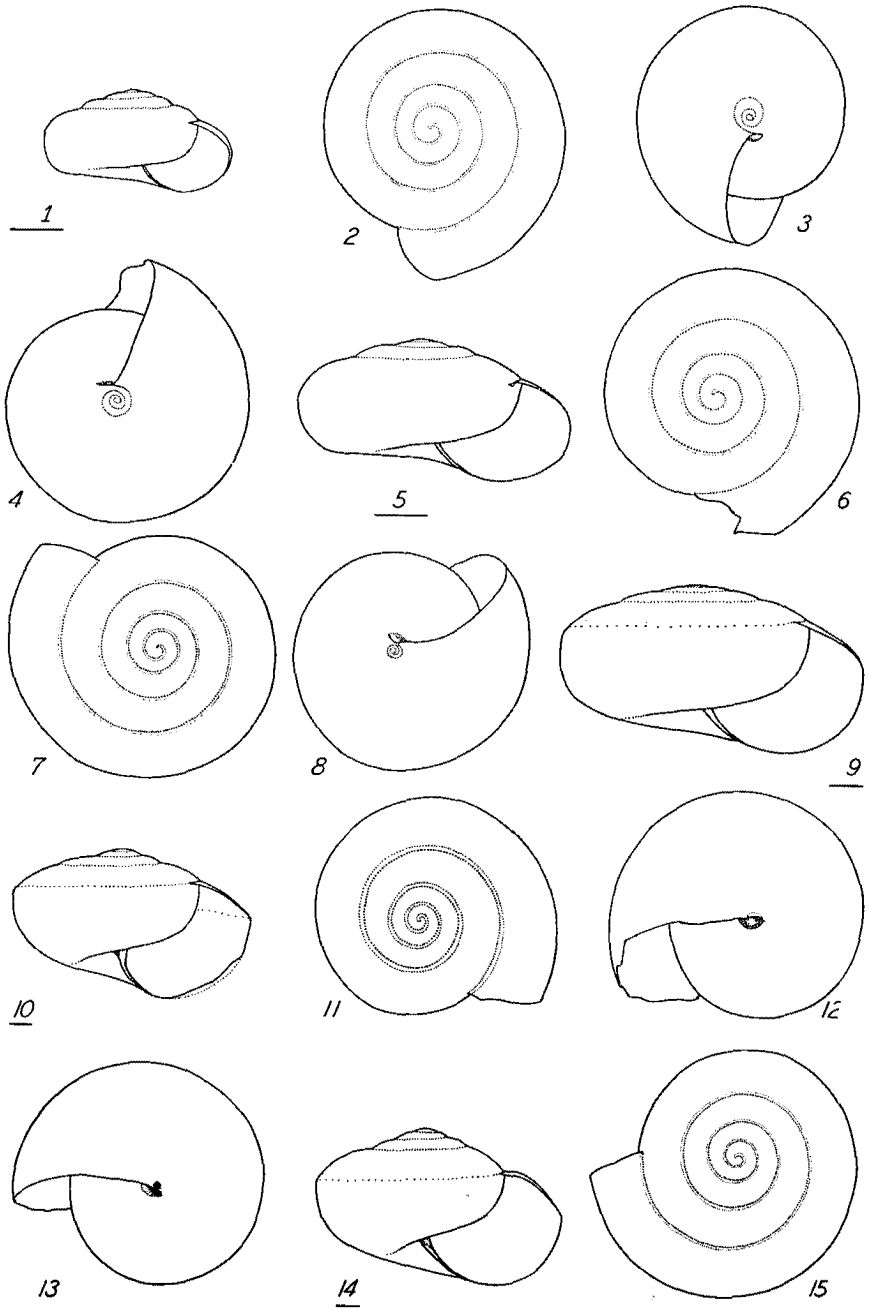
EUCONULINAE



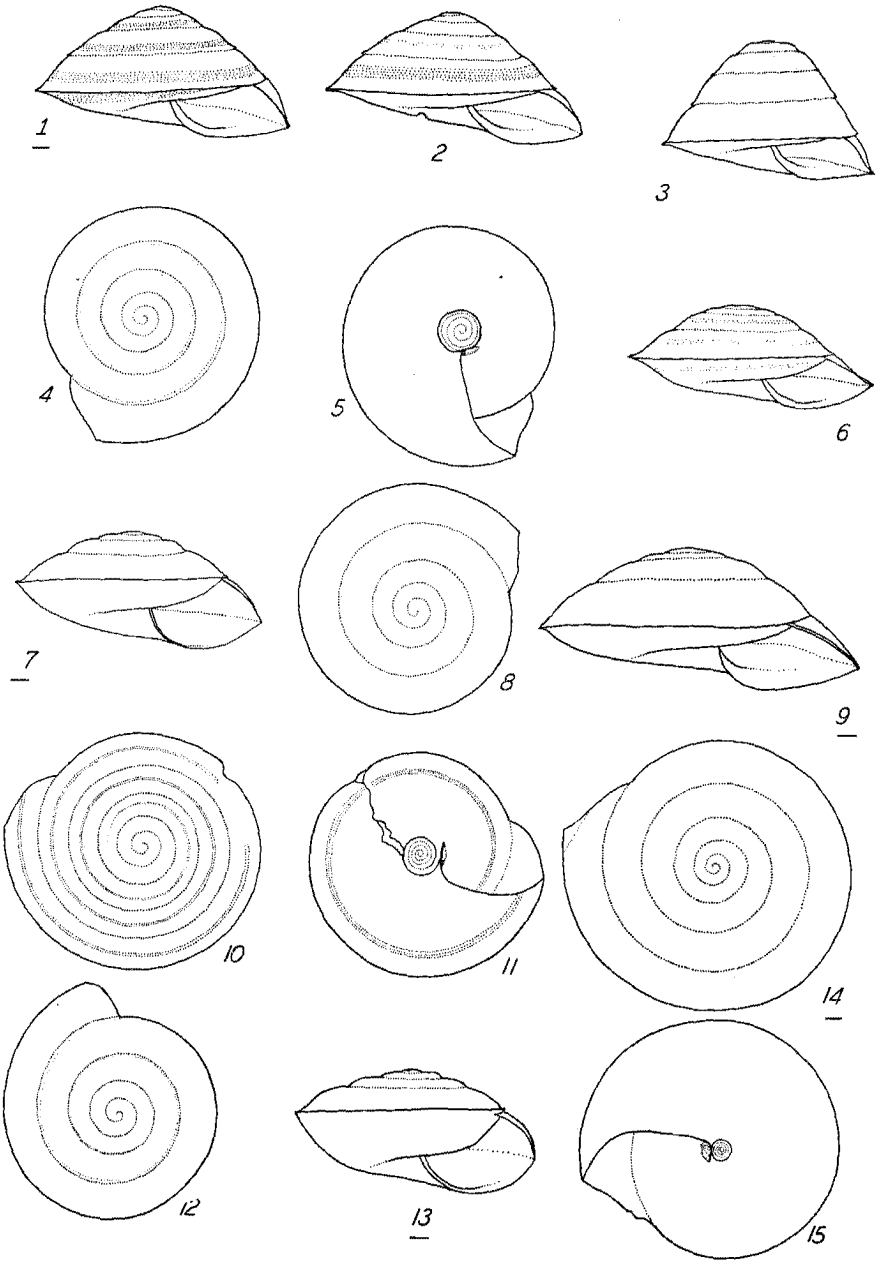
PALAUA



EUCONULINAE, SESARINAE, TROCHOMORPHINAE



ORPIELLA



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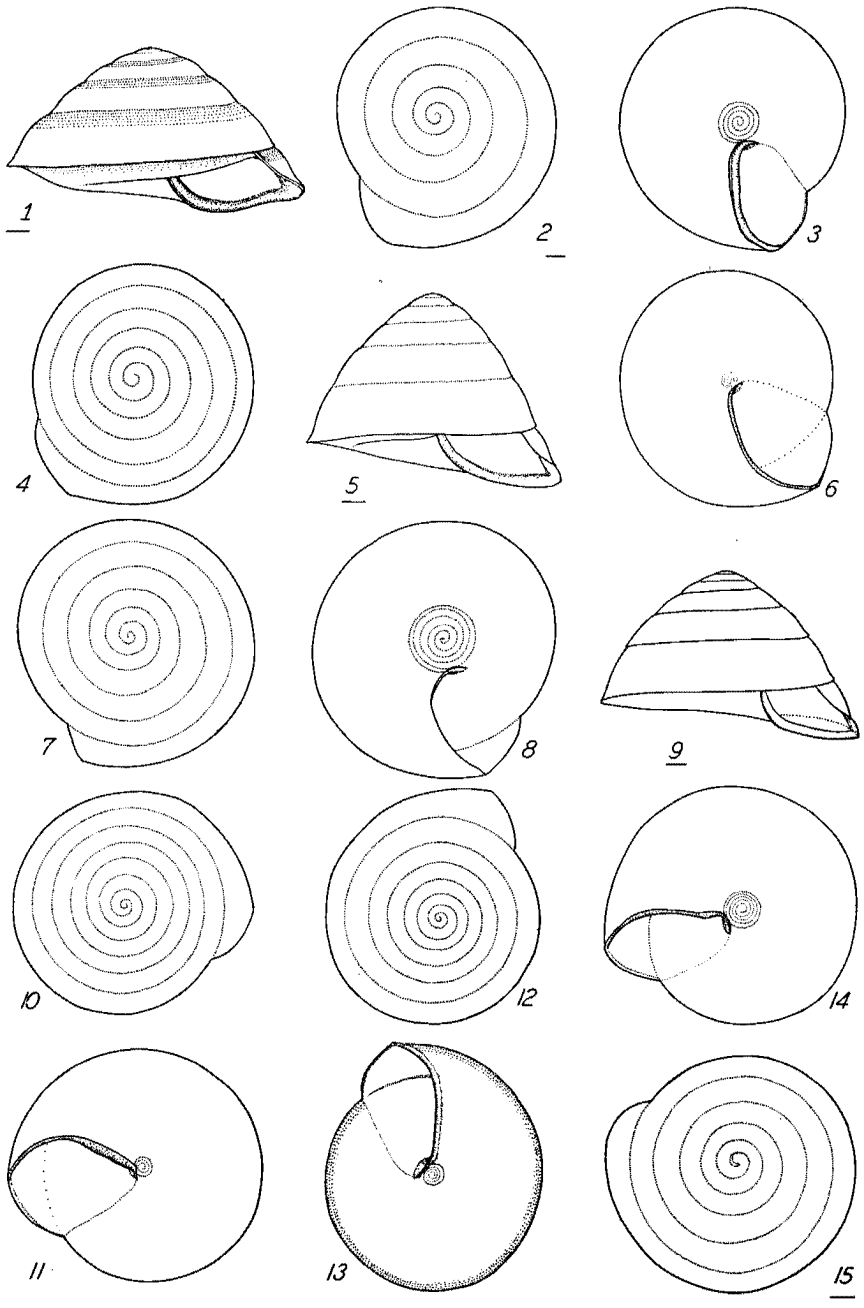

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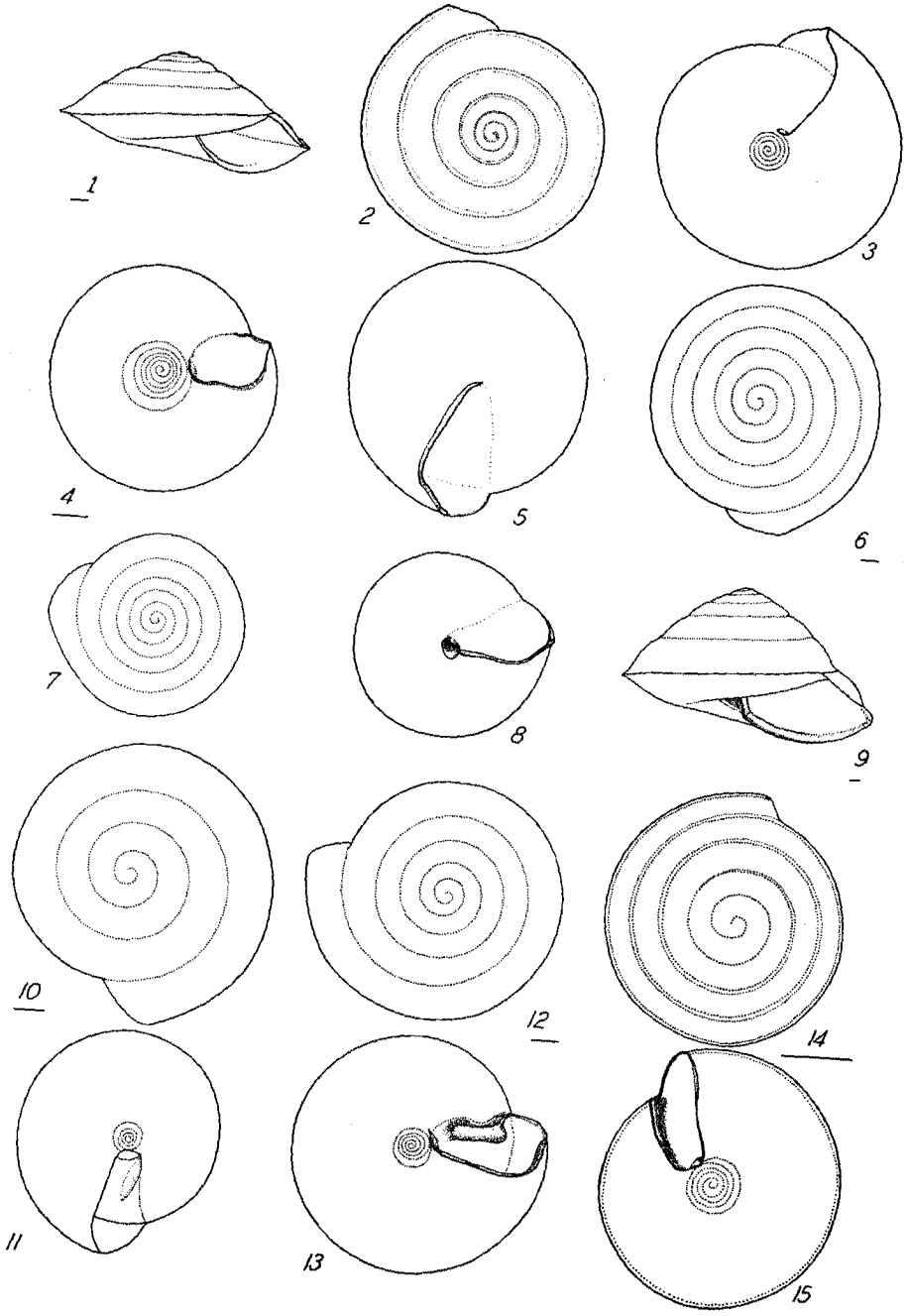

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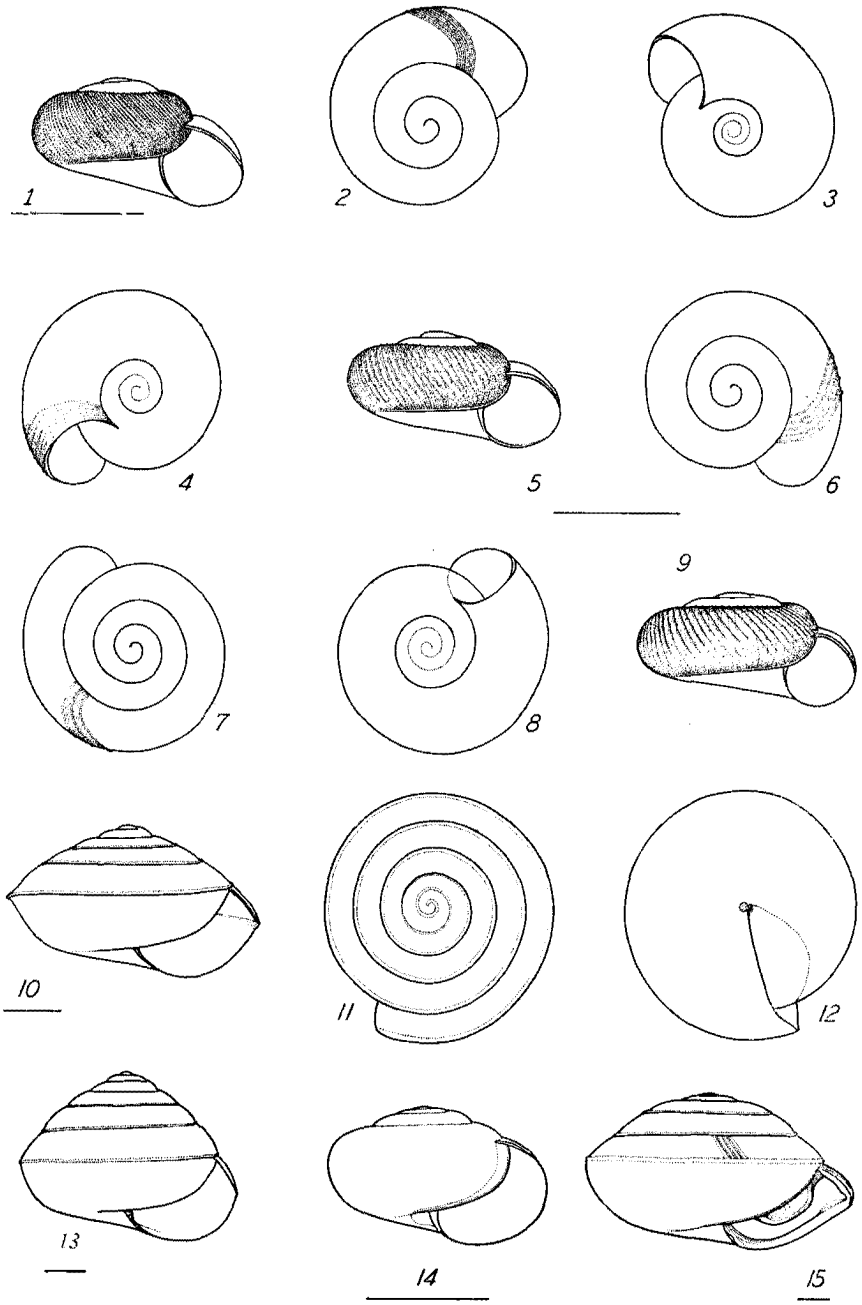
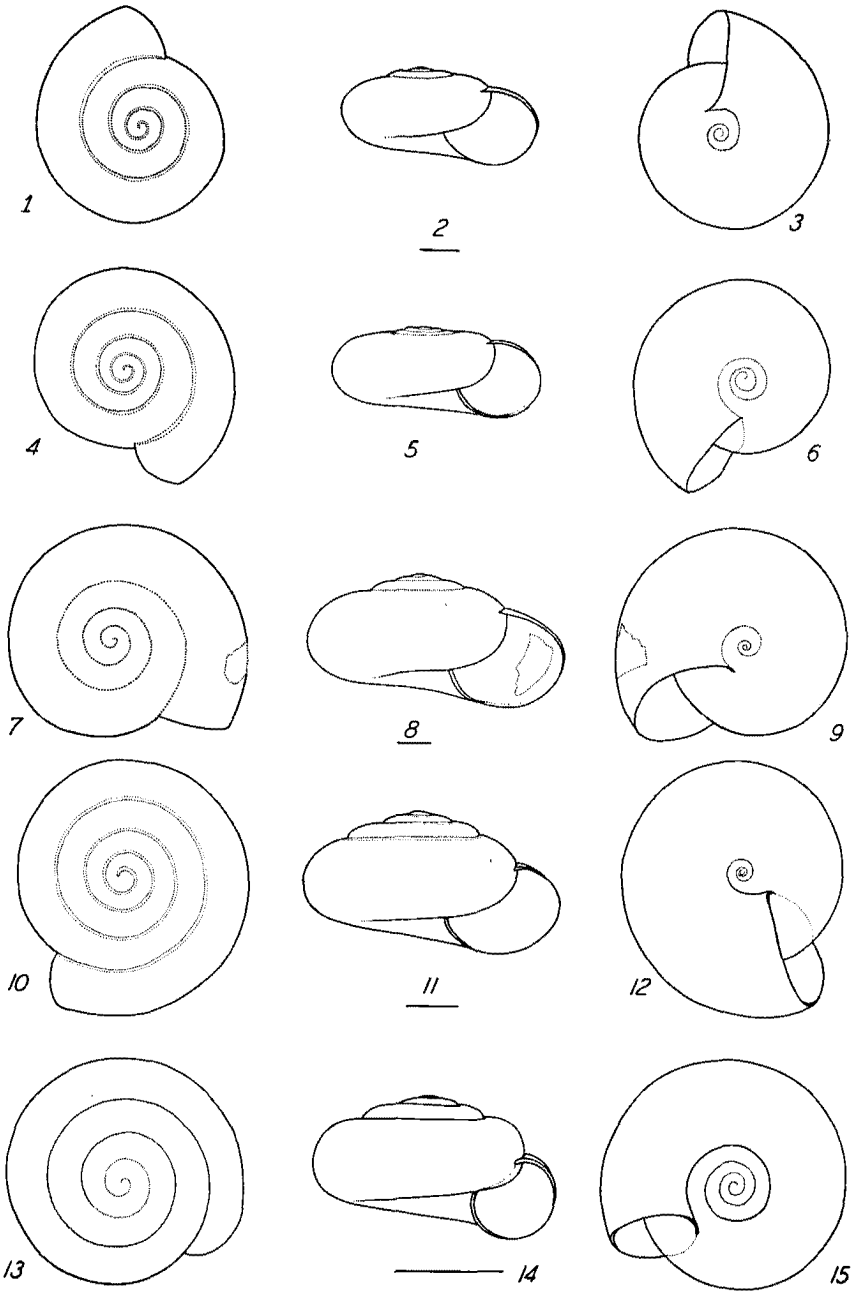
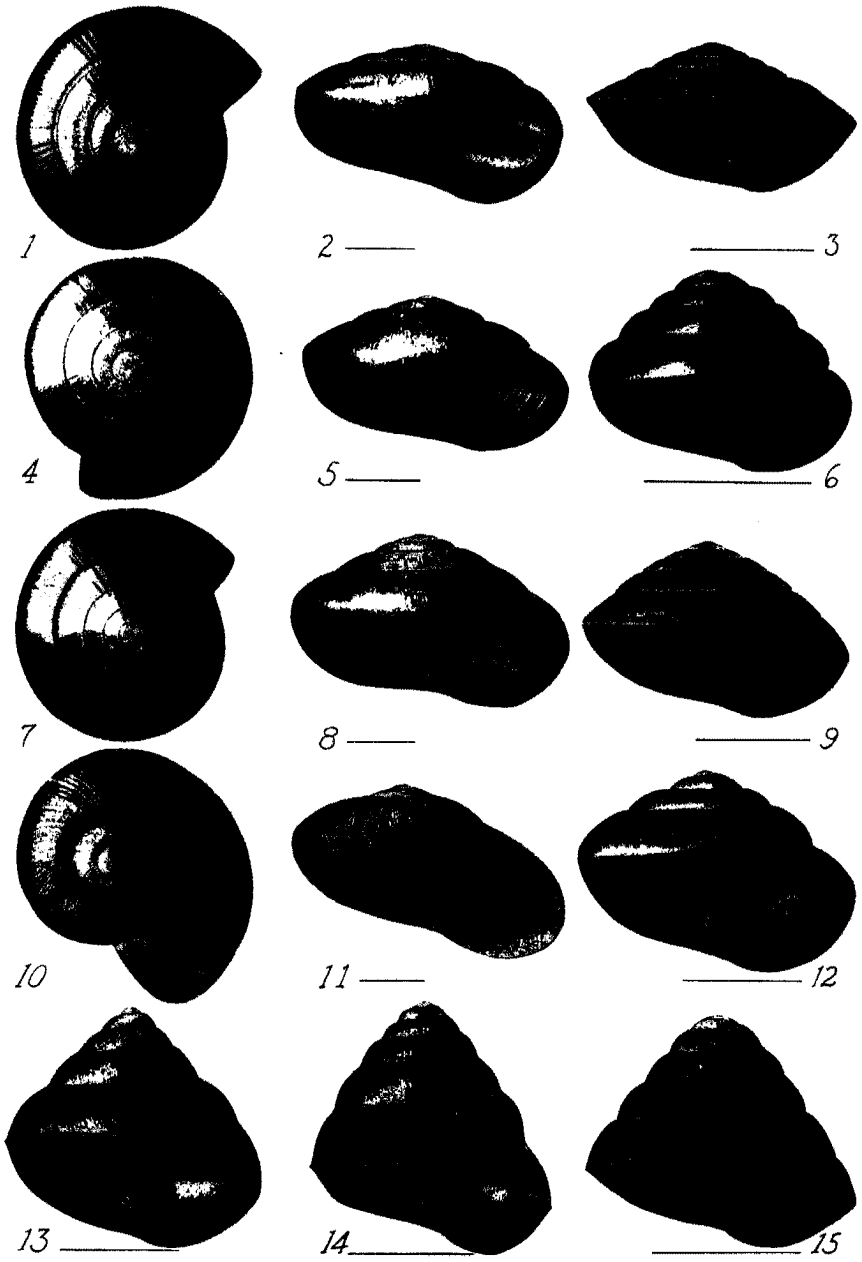


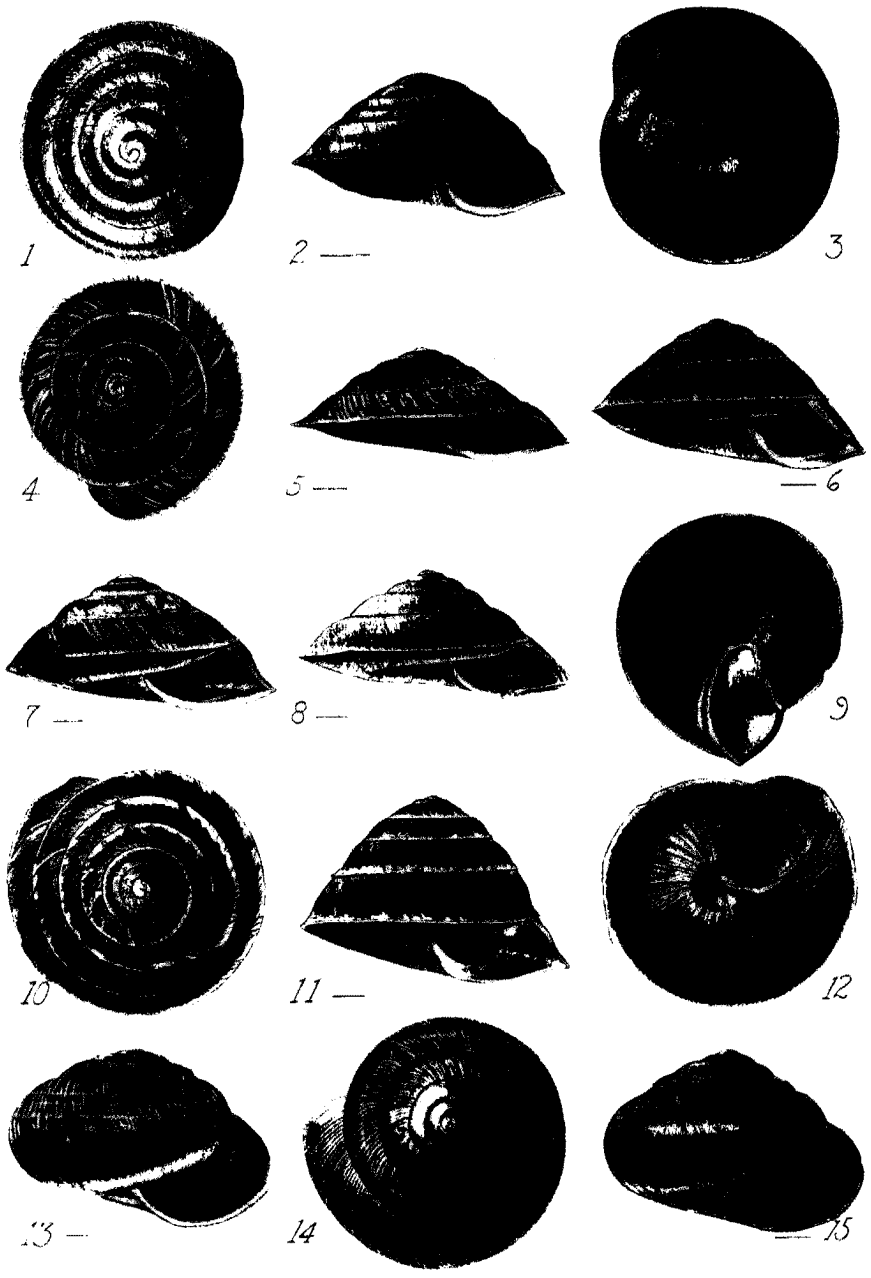
EUCONULINAE, TROCHOMORPHINAE, GASTRODONTINAE



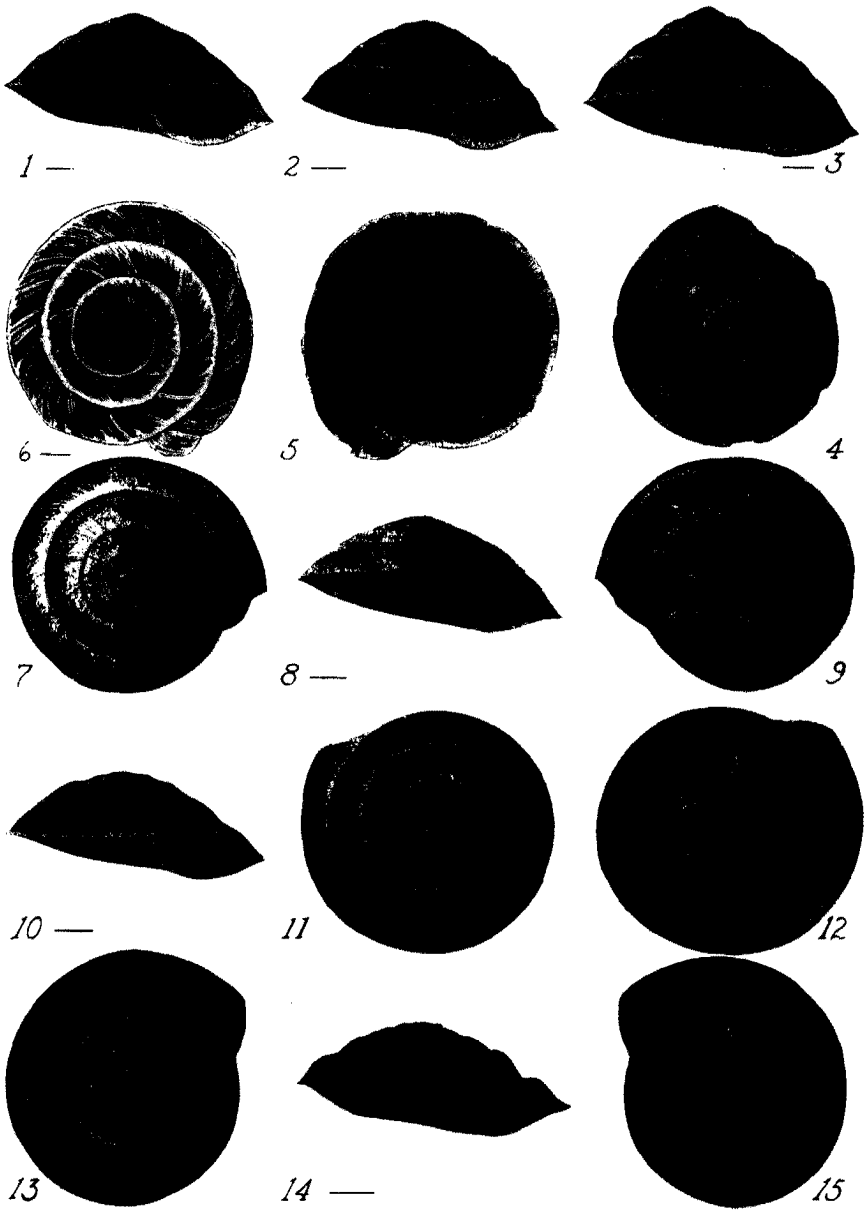
VITREINAE, GASTRODONTINAE, ZONITINAE



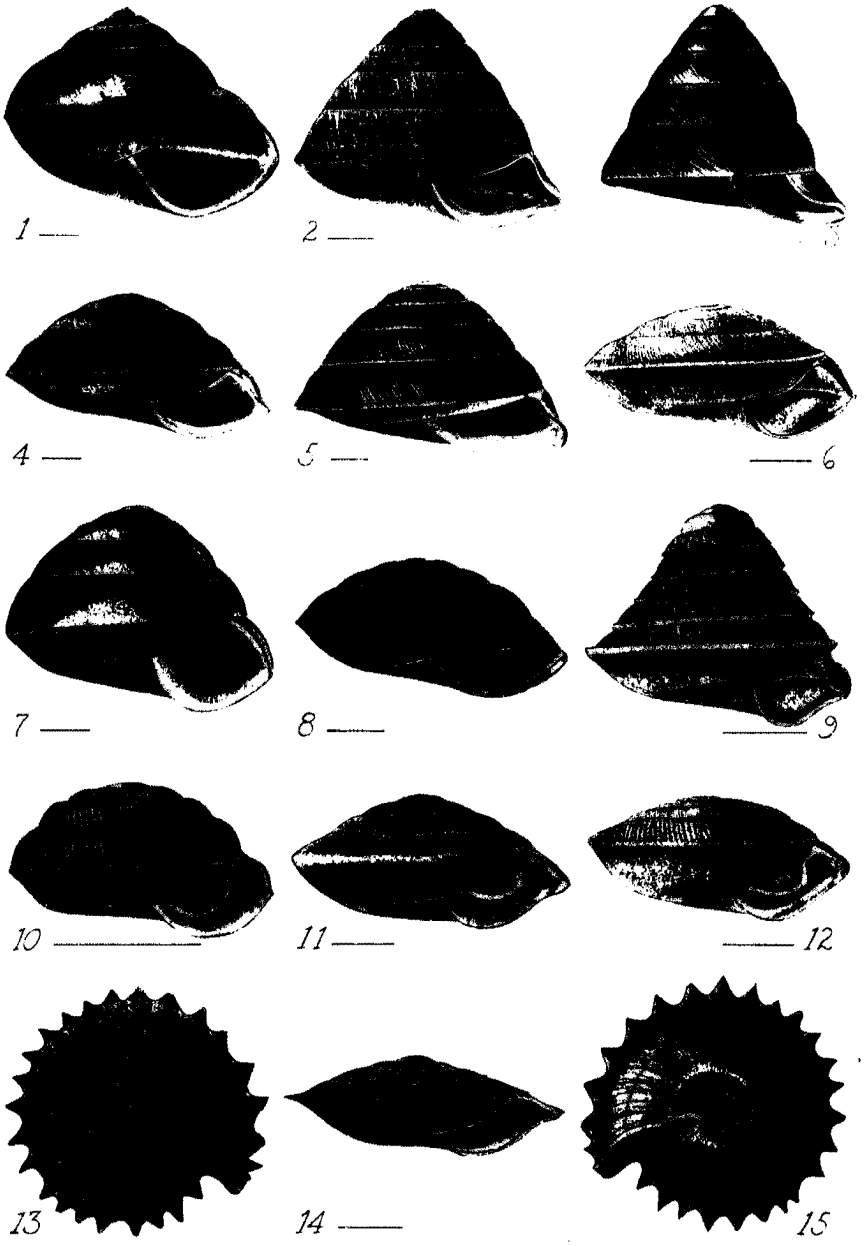
MICROCYSTINAE, EUCONULINAE, ZONITINAE



SESARINAE, TROCHOMORPHINAE



TROCHOMORPHA



SESARINAE, TROCHOMORPHINAE

Zonitid Snails from Pacific Islands—Part 4

4. DISTRIBUTION AND INDEXES

DISTRIBUTION

In this brief discussion of the zoögeographic relationships of Helicarionidae and Zonitidae, Pacific area or region will be used for the island groups included in the systematic studies and outlined in the introduction to Part 1. This practically coincides with Sclater and Sclater's Hawaiian and Polynesian "sub-regions" (The Geography of Mammals, 1899), with omission, due mainly to lack of material, of the New Hebrides and New Caledonia. The terms Austral, Malayan, Maorian, and Papuan will be utilized to indicate the areas covered by their subregions of the same names.

In tables 1 to 8, the islands or island groups are represented by vertical columns and the genera or sections by horizontal rows. The figures give the numbers of species. Asterisks (*) preceding figures indicate that no endemic species are present, except in the columns of totals, in which they precede the numbers of species which are not restricted to single islands (in parentheses).

Any zoögeographic discussion of these zonitids must take into consideration the probability that they are the most advanced families of terrestrial mollusks which have endemic species in most parts of the Pacific region. Because they probably did not originate as far back in geologic time as did the more primitive Orthurethra, they may not present very valid evidence in regard to the former land connections which have been inferred for this area. Nevertheless, their endemicity is quite high; 12 (35 percent) of the 32 genera and 253 (95 percent) of the 266 species are not known to range beyond the limits of the area studied.

On the basis of distribution, the Pacific zonitids divide themselves immediately into four groups: 1, the species which have evidently been disseminated by human agencies; 2, the groups which range or are related to the eastward; 3, those with Malayan or Papuan affinities; and 4, the largely endemic Microcystinae.

In the first group, the genera *Discoconulus, Dyakia, Hawaiia,* and *Zonitoides* (table 1) and the type subgenus of *Liardetia* (table 3) have no endemic species on the islands of the Pacific. To these may be added *Coneuplecta,* even though *C. microconus* is not known to occur outside, and probably also *Kororia* and *Kusaiea,* which are only known with certainty from the Caroline Islands. In addition, *Liardetia discordiae, Diastole conula* and some of the smaller species of *Lamprocystis,* notably *L. ensifera* and *L. excrescens,* have

Table 1. Distribution of genera

Genera	Eastward	Hawaii	Marquesas	Tuamotu	E. Society	W. Society	Rapa	Other Austral	Cook	Tonga	Samoa	Futuna	Lau	Other Fiji	Carolines	Palau	Marianas	Westward	Pacific Is.
Liardetia	....	....	*2	*1	9	4	....	*1	*2	?	*1	*1	*1	*1	*3	....	*3	x	14(*7)
Puka	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	—	1
Cookeana	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	—	2
Kusaiea	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	?	1(*1)
Diastole	....	....	....	1	2	*1	....	2	*1	2	4	1	2	....	....	....	....	x	13(*5)
Microcystis	....	....	....	....	....	....	3	7	1	....	....	....	....	....	....	....	....	—	11
Lamprocystis	....	....	....	....	....	1	*1	3	3	4	4	*1	6	3	....	....	4	x	23(*13)
Mendaña	....	....	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	15(*2)
Philonesia	....	40	13	4	....	....	2	....	....	....	....	....	....	....	....	....	....	—	59(*5)
Kaala	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	1
Hiona	....	13	2	2	7	2	1	....	....	....	....	....	....	....	....	....	....	—	27(*3)
Euconulus	x	6	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	—	7(*1)
Kororia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*1	*1	....	x	1(*1)
Discoconulus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*1	....	....	x	1(*1)
Palaua	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	x	6(*3)
Coneuplecta	....	....	*1	....	*1	....	....	....	*1	*1	*1	*1	*1	*2	....	*1	....	x	3(*3)
Orpiella	....	....	....	....	....	....	....	....	*?	....	....	....	*1	19	....	....	....	x	19(*8)
Parmella	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	?	1
Dendrotrochus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	x	1
Ryssota	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	x	1
Dyakia	....	....	....	....	....	....	....	....	....	....	....	....	....	*1	....	....	....	x	1(*1)
Kondoa	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	—	1
Hogolua	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	—	1
Brazieria	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	—	6(*1)
Videna	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	x	4(*2)
Trochomorpha	....	....	....	....	2	3	....	....	....	1	5	1	5	12	6	....	....	x	35(*11)
Vitrina	x	*1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	1(*1)
Hawaiia	x	*1	....	*1	*1	....	....	....	....	....	....	....	....	....	....	....	....	x	1(*1)
Striatura	x	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	3(*2)
Zonitoides	x	*1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	x	1(*1)
Retinella	x	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	3(*1)
Godwinia	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	3
Totals 32		72	33	9	23	12	7	15	8	8	15	5	16	39	22	12	7		266(*74)
Endemic 12		68	30	7	18	9	6	12	3	5	11	2	11	33	17	10	4		253(*61)

apparently been disseminated with culture from island to island. These ruderal snails form practically all the zonitoid fauna of the lower coral atolls; the endemic species, on the other hand, are almost all limited to the higher, volcanic islands. The only striking exceptions to this last rule are the Henderson Island *Diastole glaucina,* which may be only a local mutation of *D. conula,* and the very dubious *Philonesia (?) pertenuis* (Gould), which was described as if from Makatea.

Table 2. Distribution of sections of genera ranging or related eastward

	Eastward	Kauai	Oahu	Molokai-Maui	Hawaii	Marquesas	Tuamotu	East Society	Totals	
EUCONULUS										
Euconulops	x									
Monoconulus	....	....	....	....	....	....	....	1	1	
Nesoconulus	....									
Nesoconulus	....	....	....	1	3	....	....	....	4	(*1)
Chetosyna	....	....	....	....	1	....	....	....	1	
Pellucidomus	....	....	....	....	1	....	....	....	1	
VITRINA	x	....	....	*1	*1	....	....	....	1	(*1)
HAWAIIA	x	*1	*1	*1	....	....	*1	*1	1	(*1) introduced
STRIATURA										
Pseudohyalina	x	*1	*1	*1	1	....	....	....	3	(*2)
ZONITOIDES	x	....	....	....	*1	....	....	....	1	(*1) introduced
RETINELLA										
Nesovitrea	x									
Nesovitrea	....	....	....	2	1	....	....	....	3	(*1)
GODWINIA	....	3	....	....	....	....	....	....	3	
TOTALS	....	5	2	6	9	....	1	2	19	(*7)
Endemic	....	3	0	3	7	....	0	1	14	(*2)

The genera ranging or related to the eastward (table 2) are limited to the Hawaiian islands, with the remarkable exception of the Tahitian *Euconulus conoides.* The single species of *Vitrina,* a holarctic group, is not distinguishable, so far as I can judge, from the form in western North America. *Stria-*

tura, mainly nearctic, has developed at least two endemic species. *Retinella,* also holarctic, has evolved three strictly Hawaiian species, which constitute a poorly marked section, *Nesovitrea,* sensu stricto. *Euconulus,* a third holarctic genus, is represented by the very distinct autochthonic subgenus *Nesoconulus,* which itself has produced a remarkable amount of differentiation, at least in the shells of its three sections. Finally, *Godwinia* is a decidedly divergent genus, although it appears to be related to the Mexican group *Patulopsis* of the nearctic *Mesomphix.* With the exception of the three in *Godwinia,* all the species that are limited to a single island occur either in Hawaii or in the Molokai-Lanai-Maui complex, which, since it is broken by straits with depths of less than 270 feet, assuredly formed one land mass during the lowered strand-lines of the glacial period.

These data hardly seem explicable by the postulation of past land connections. In the first place, the predominance of the species on the southeastern islands seems to indicate that the present distribution is largely determined by ecologic rather than by strictly zoögeographic factors. The mountains of Kauai and Oahu attain elevations of little over 5,000 feet above sea-level, while Haleakala on Maui and the two higher volcanoes of Hawaii reach altitudes of 10,000 to almost 14,000 feet and approximate arctic-alpine conditions. Although these Hawaiian snails, like *Striatura ferrea,* a boreal species that ranges into the southern Appalachian mountains, may be found, at least temporarily, at lower altitudes, they do not occur at any great distance from those elevations which present their optimum environment. Evidently, the holarctic and nearctic genera were slowly adjusted, and probably never have become thoroughly adjusted, to the subtropical conditions of the lowlands and are still restricted to ranges that contain areas which approach the climates of their original homes. In addition, the amounts of divergence and speciation on the Hawaiian islands differ greatly in the various genera. When compared to the evolution in the same groups on the mainland, this seems to indicate a similar disparity in the time factor; in other words, their arrivals at the islands may not be synchronized. For this reason, several different "land-bridges" or, at least, considerable intermittance in land connections would be required. Finally, the presence of certain elements of the American fauna and the absence of others, for example *Pristiloma* and *Discus,* seem fortuitous and adventitious.

The most probable method, by which the accidental introduction of these land snails might be accomplished, would appear to be their rare transport by birds. As is known, certain of the latter, such as the golden plover, do annually migrate through Hawaii to islands in the south central Pacific and might occasionally transfer eggs, juveniles, or even adults. The discovery of *Euconulus conoides* on Tahiti gives some slight additional evidence in favor

Table 3. Distribution of sections of Helicarionidae ranging or related westward

	Marquesas	East Society	West Society	Cook	Tonga	Samoa	Futuna	Lau	Central Fiji	North Fiji	West Fiji	Kusaie	Ponape	Truk	Palau	Marianas	Westward	Totals
LIARDETIA																		
Liardetia																		
Liardetia	*1	*1	*1	*1	*?	*1	*1	*1	*?	*?	*1	....	*2	*1	....	*2	x	3(*3)
Belopygmeus	....	....	....	....	....	....	....	....	....	....	....	*1	*?	*1	....	*1	x	1(*1)
KUSAIEA	....	....	....	....	....	....	....	....	....	....	....	*1	*?	*1	....	....	?	1(*1)
KORORIA	....	....	....	....	....	....	....	....	....	....	....	*1	*1	*1	*1	....	x	1(*1)
DISCOCONULUS	....	....	....	....	....	....	....	....	....	....	....	....	*1	....	....	....	x	1(*1)
PALAUA	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	?	6(*3)
CONEUPLECTA																		
Durgellina	*1	*1	*?	*1	*?	*?	*?	*?	*?	*1	*1	....	....	....	....	....	x	1(*1)
Sitalina	....	....	....	....	*1	*1	*1	*1	*1	*1	*1	....	....	....	....	....	x	1(*1)
Coneuplecta	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*1	....	x	1(*1)
ORPIELLA																	x	
Halozonites	....	....	....	*?	....	....	....	*1	*1	?	3	....	....	....	....	....	?	3(*1)
Fijia	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	?	2
Irenella	....	....	....	....	....	....	....	....	....	3	3	....	....	....	....	....	?	6(*3)
Orpiella																	x	
Orpiella	....	....	....	....	....	....	....	....	....	1	3	....	....	....	....	....	?	4(*3)
Eufretum	....	....	....	....	....	....	....	....	....	3	2	....	....	....	....	....	?	5(*1)
DENDROTROCHUS																	x	
Ponapea	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	?	1
RYSSOTA																	x	
Trukrhysa	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	?	1
DYAKIA																		
Quantula	....	....	....	....	....	....	....	....	....	....	*1	....	....	....	....	....	x	1(*1)

of a north and south direction of carriage, even if the Tahitian snail does appear to be more or less intermediate between mainland and Hawaiian members of the genus. If this hypothesis be true, the original ancestors of these interesting additions to the Pacific fauna would have come from the vicinity of Bering Strait, as agrees with their evident holarctic and nearctic affinities.

A note on the fauna of Cocos Island may not be out of place here. *Habroconus* is purely neotropical. *Ochrodermella* (Naut. 48:84, 1935) is somewhat closely related to the Curaçao genus *Neosubulina. Nesopupa* seems to crop up on oceanic islands in various parts of the world and the section *Cocopupa* also has affinities to the neotropical *Bothriopupa* (Man. Conch. 28:207, 1935). Despite all that has been written to the contrary, the land mollusks of Cocos are not definitely Polynesian, might well have been derived from the nearby continent, and, since they are all small species, probably arrived by accidental means.

Quite unlike those of Hawaii, the groups ranging or related to the westward (tables 3 and 4) all belong to the more primitive subfamilies: Euconulinae (*Palaua* and *Kororia*), Sesarinae (*Orpiella, Dendrotrochus* and *Ryssota*), or Trochomorphinae. The autochthonous species of the first two (both Helicarionidae, table 3) are limited to the peripheral islands of the western Pacific, which all lack endemic species of the intrinsically Pacific Microcystinae (except *Lamprocystis kioaensis,* which is very closely related to the widespread *L. excrescens*). *Orpiella* undeniably exhibits a considerable degree of differentiation in northern and western Fiji, but any estimate of the amount of evolution which the genus may have undergone in Fiji would be mere speculation, until the obviously related Papuan species are more thoroughly known. The occurrence and restriction of a single species of the Papuan genus *Dendrotrochus* on and to one of the Caroline Islands (Ponape), and of the Malayan *Ryssota* to another (Truk), seem to present a highly fortuitous and sporadic pattern of distribution. *Palaua* is probably Malayan and the six species in Palau are distinguished from each other by only slight morphologic differences. What I have identified as *Videna* (table 4), the only other zonitoid genus with species endemic to Palau, is certainly Papuan and probably also Malayan.

The most primitive members of the Trochomorphinae (table 4) appear to be *Kondoa* and *Hogolua,* genera peculiar to Truk. With *Brazieria* and a single species of *Trochomorpha* in addition, this small group of islets has a strikingly greater amount of generic differentiation than in any other equal area within the range of this subfamily. Beyond Truk, only *Trochomorpha* is found, but it has traveled, in general from west to east, as far as Tahiti. Although the distances between islands in the southern Pacific are far

Table 4. Distribution of sections of Zonitidae ranging or related westward

	Marquesas	East Society	West Society	Cook	Tonga	Samoa	Futuna	Lau	Central Fiji	North Fiji	West Fiji	Kusaie	Ponape	Truk	Palau	Marianas	Westward	Totals
KONDOA	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
HOGOLUA	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
BRAZIERIA																		
Brazierella	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Probrazieria																		
Probrazieria	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Entomostoma	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Brazieria	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	3(*1)
VIDENA																		
Peleliua	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2
Videna																		
Periryua	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1(*1)
Videna	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	x	1(*1)
TROCHOMORPHA																		
Nigritella																	x	
Nigritella	....	....	....	....	....	....	....	....	....	....	....	....	5	1	....	....	?	6
Lauhala	....	....	....	....	....	3	1	5	1	2?	9?	....	....	....	....	....	?	21(*6)
Ludificator	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2(*1)
Trochomorpha																		
Cotitrochus	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1(*1)
Trochomorpha	....	2	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5(*3)
TOTALS																		
Helicarionidae	2	2	1	2	1	2	1	3	3	9	16	3	5	5	8	3	....	39(*22)
Zonitidae	....	2	3	....	1	5	1	5	1	2	9	....	5	9	4	....	....	47(*14)
Totals	2	4	4	2	2	7	2	8	4	11	25	3	10	14	12	3	....	86(*36)
Endemic	0	2	3	0	1	5	1	5	2	9	20	0	6	10	10	0	....	74(*24)

shorter than that between North America and Hawaii, the direction of this distribution increases the complexity of its explanation. However, the differentiation inside this genus has been slight and, even if speciation has been considerable, some forms are found on more than one island in Fiji, Tonga, Samoa, and the Society Islands. The subgenus *Nigritella* apparently has a member at the extreme western edge of the Papuan area and certainly occurs on Truk, on Ponape and from Fiji to Samoa. The type subgenus of *Trochomorpha* seems to be restricted to Tonga and the Society Islands.

The Microcystinae are the most characteristic subfamily of zonitid snails on Pacific islands and may have originated within this region. Although the greatest number of described species (almost a third of the total) is known from the Hawaiian islands, the maximum divergences, based on the numbers of genera with endemic species, are found in the Austral Islands (with 6) and the Society Islands (with 5). In *Liardetia* (table 5), which seems to be the most primitive genus, all the species which are restricted to single islands occur in the Society Islands. Of the other two genera of Liardetiae, *Pukaloa*

Table 5. Distribution of sections of Liardetiae

	Marquesas	Tuamotu	E. Society	W. Society	Tubuai-Raivavae	Rurutu	Cook	Samoa	Fiji	Carolines	Palau	Marianas	Westward	Totals
LIARDETIA														
Oceanesia														
Dasyconus	....	....	4	1	....	....	....	....	....	....	....	....	....	5(*2)
Oceanesia	*1	*1	3	*1	....	*1	*1	....	....	....	....	....	....	3(*1)
Belonesia	....	....	....	1	....	....	....	....	....	....	....	....	....	1
Nesoreus	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Liardetia														
Liardetia	*1	*?	*1	*1	....	....	*1	*1	*1	*2	....	*2	x	3(*3)
Belopygmeus	....	....	....	....	....	....	....	....	....	*1	....	*1	x	1(*1)
PUKALOA	....	....	....	1	....	....	....	....	....	....	....	....	....	1
COOKEANA	....	....	....	....	2	....	....	....	....	....	....	....	....	2
KUSAIEA	....	....	....	....	....	....	....	....	....	1	....	....	?	1(*1)
TOTALS	2	1	9	5	2	1	2	1	1	4	....	3	....	18(*8)
Endemic	0	0	7	3	2	0	0	0	0	1?	....	0	....	13(*3)

is found on Raiatea, in the same group, and *Cookeana* only on Tubuai, in the Austral Islands. These data seem to indicate that the center of dispersal for the Microcystinae was in the south central Pacific.

The direction from which the ancestral forms of this subfamily entered the Pacific region is open to question. The closest relative of *Liardetia* outside the Microcystinae appears to be the American genus *Guppya,* which is also ovoviviparous. On the other hand, the type subgenus of *Liardetia* ranges into Asia and becomes richer in species toward the western limits of its distribution. The problem is complicated by the presence of quite closely related species of Euconulinae around the Pacific in almost all directions except toward the south.

The Philonesiae (tables 6 and 7) are a quite closely knit group, with considerable sectional but very weak generic differentiation. Although over 50 percent of the known species are Hawaiian, this may be partly due to the more intensive collecting there. *Mendaña* (table 6), which appears to be the most generalized genus, is strictly Marquesan. From Hawaii, the group extends somewhat east of south about 50° of latitude to Rapa, while the greatest width of its range is about 20° of longitude. The long axis of this distributional area roughly corresponds with the north-south direction, by which the nearctic genera of Hawaii and Tahiti seem to have entered the region, and at least suggests that bird transport may also have been a factor in the dissemination of these Microcystinae.

The three species (table 6) of *Philonesia* (subgenus *Pitcairnia*) on the higher islands of Tuamotu (Pitcairn and Mangareva) are more or less intermediate between *Mendaña* and the other groups, especially the subgenus *Kipua* from Kauai. The two species of *Philonesia* on Rapa have much in common with the type subgenus, but seem, on the whole, closest to the Marquesan subgenus *Nesarion.* Although the species of *Philonesia* are generally restricted to a single island, the subgenus sensu stricto is found in the Hawaiian islands (mainly Oahu) and the Marquesas; similarly, the subgenus *Neutra,* perhaps the most primitive in the genus *Hiona,* is shared by Oahu and Uapou. Although *Philonesia* is apparently absent from the Society Islands and well developed in the Marquesas, the opposite is true of the genus *Hiona* (table 7). With the exception of the subgenus *Neutra,* the only Marquesan record of *Hiona (H. callifera)* is very dubious, and the greatest divergence in the genus is between the Hawaiian and Society Island divisions.

Inside the Hawaiian islands, if Molokai, Lanai, Kahoolawe and Maui together be considered as a single, quite recently divided island, each of the species of Philonesiae (tables 6 and 7) is restricted to one of the four high island masses, with the exception of the arboreal *P. turgida diducta,* which seems to have reached them all. Kauai has the most isolated fauna, which

includes the subgenera *Kipua* and *Hionarion* and the section *Nesocyclus*. Oahu apparently has the richest assemblage, but has also been most thoroughly collected; it supports the genus *Kaala,* the sections *Neutra,* s.s. and *Hiona,* s.s. and also two of the sections, *Mauka* and *Piena,* and almost all the species of the subgenus *Philonesia,* s.s. However, small species of the type section of the last group appear on Kauai, Lanai, Maui and Hawaii, and a larger one, *P. perlucens,* has been developed on Maui. With the exception

Table 6. Distribution of sections of Mendaña and Philonesia

	Kauai	Waianae Mts.	Koolau Range	Molokai	Lanai	West Maui	East Maui	Hawaii	Fatuhiva	Hivaoa-Tahuata	Uapou	Uahuka	Nukuhiva	Tuamotu	Rapa	Totals
MENDAÑA																
Mendaña																
Mendaña	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2
Tahuatoa	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	3(*1)
Macrorbis	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2
Uanuka	....	....	....	....	....	....	....	....	....	....	1	2	2	....	....	5
Fatuoa	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	3(*1)
PHILONESIA																
Pitcairnia	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	3
Kipua	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Waihoua	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Philonesia																
Philonesia	1	4	11	....	1	2	*1	1	....	....	....	....	....	....	....	18
Mauka	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	3
Oafatua	....	....	....	....	....	....	....	....	1	4	1	1	....	....	....	7(*1)
Piena	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	3
Nukupiena	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2
Aa																
Haleakala	*1	*1	*1	2	2	3	2	*1	....	....	....	....	....	....	....	6(*3)
Hiloaa	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	2
Aa	....	....	....	2	....	1	....	2	....	....	....	....	....	....	....	5
Nesarion																
Uafatua	....	....	....	....	....	....	....	....	1	....	1	1	....	....	....	3
Nesarion	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1(*1)
Rapafila	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2
Uncertain	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1

of *P. turgida diducta,* the subgenus *Aa* is limited to the two southeastern island complexes, as is also the section *Hionella.* The fossil subgenus *Waihoua* has been collected only on the island of Hawaii. This pattern of distribution does not exactly correspond to what might be expected on a basis of former land connections, since the depth of ocean between Hawaii Island and the Maui-Molokai complex (about 7,000 ft.) is much greater than that between the latter and Oahu (about 2,000 ft.).

In the Marquesas Islands, if Hivaoa and Tahuata be regarded as a single unit, as they appear to be faunally, all the Philonesiae (tables 6 and 7) are again endemic to one of the five large masses from which data are available. Nukuhiva and Hivaoa apparently represent distinct centers of dispersal, although the type subgenera of *Mendaña* and *Philonesia* are found on both. Nukuhiva seems the most isolated, with the sections *Mendaña,* s.s., *Macrorbis,* and *Nukupiena* restricted to it, but shares the subgenus *Uanuka* with Uapou

Table 7. Distribution of sections of Kaala and Hiona

	Kauai	Waianae Mts.	Koolau Range	Molokai	Lanai	West Maui	East Maui	Hawaii	Fatuhiva	Hivaoa-Tahuata	Uapou	Uahuka	Nukuhiva	Tuamotu	E. Society	W. Society	Rapa	Totals
KAALA	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
HIONA																		
Neutra																		
Uapuneutra	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Neutra	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Insulorbis																		
Insulorbis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	4
Minororbis	....	....	....	....	....	....	....	....	?	?	?	?	?	1?	4	1	....	7(*1)
Opara	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Aukena	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Hiona																		
Hionella	....	....	....	2	*1	*1	....	1	....	....	....	....	....	....	....	....	....	3(*1)
Hiona	....	2	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Nesocyclus	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Hionarion	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
TOTALS																		
Philonesiae	10	10	19	6	4	7	3	8	3	10	4	4	8	6	7	2	3	102(*9)
Endemic	9	24		4	2	6		7	3	10	4	4	8	6	7	2	3	100(*7)

and Uahuka. Hivaoa (with Tahuata) has the autochthonous sections *Nesarion,* s.s. and *Tahuatoa,* but the subgenus *Nesarion* also occurs on Uapou, Uahuka and Fatuhiva and the subgenus *Fatuoa* on Fatuhiva. Thus Hivaoa alone is seemingly responsible for the fauna of Fatuhiva but both centers have contributed toward the faunas of Uahuka and Uapou and the last island has the peculiar section *Uapuneutra* all to itself.

The distribution of the Microcystes (table 8) roughly resembles that of the Trochomorphinae (table 4) with the substitution of the Marianas for the Carolines, but has apparently proceeded in the opposite direction, that is, from east to west. *Diastole,* which is perhaps the least specialized genus, seems to be best developed in Samoa but ranges from Henderson Island in Tuamotu to the Lau Islands of Fiji and probably has representatives or related groups in the Kermadecs and on Norfolk Island. Almost 40 percent of the Polynesian species are found on more than one island and *D. conula,* at least, seems to have been disseminated by man.

Microcystis (table 8), one of the most distinct genera in the subfamily, ranges from Rapa through Raivavae to Tubuai in the Austral Islands and then seemingly jumps Rurutu and Rimatara to turn up again on Mangaia in the Cook Islands. The very divergent subgenus *Facorhina* is absent from Rapa. All the species of *Microcystis,* which includes some of the largest and heaviest shells in the subfamily, are confined to single islands.

With the exception of the species of *Liardetia* which have evidently been carried by man, *Lamprocystis* (table 8) has the widest range of any genus of the Microcystinae, but over half of the Pacific species occur on more than one island. *Avarua,* which I consider the most primitive subgenus, inhabits the eastern end of the generic range, with all the rather large species strictly endemic to Raiatea, Rurutu or Rarotonga. The genus appears to attain its maximum development in the Lau Islands of Fiji, but many of the smaller species of that area range over several islands or even groups. Although most of the Malayan, Papuan, and Australian forms that have been relegated to this genus (or *Microcystis*) are obviously either Euconulinae or Helicarionini, the presence of the very distinct subgenus *Guamia* in the Marianas Islands suggests the probable existence of at least Malayan members.

As has been emphasized in the systematic discussions, the Microcystinae seem to form a very closely related group with considerable sectional but relatively slight generic differentiation. While, in general, their distribution and relationships conform with the theory of evolutionary divergence, certain remarkable convergences almost look as if some of the branches of their subfamily tree had inosculated and produced stocks of double origin. For example, some species of both *Philonesia* and *Hiona* develop a left shell lobe in the Hawaiian islands, although this structure is not produced in any of

Table 8. Distribution of sections of Microcystes

	Tuamotu	East Society	West Society	Rapa	Raivavae-Tubuai	Rurutu	Cook	Tonga	Samoa	Futuna	Lau	Central Fiji	North Fiji	West Fiji	Marianas	Westward	Totals
DIASTOLE																	
Diastole																	
Diastole	1	2	*1	....	*1	*2	*1	1	1	1	....	....	....	....	....	?	7(*2)
Trochonanita	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	3(*1)
Euanana	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Laua	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	?	2(*2)
MICROCYSTIS																	
Microcystis																	
Microcystis	....	....	....	3	1	....	....	....	....	....	....	....	....	....	....	....	4
Leurocystis	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Facorhina																	
Facorhina	....	....	....	....	3	....	1	....	....	....	....	....	....	....	....	....	4
Cnesticystis	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
LAMPROCYSTIS																	
Avarua																	
Raiatea	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Manureva	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Avarua	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	2
Lamprocystis																	
Naiaua	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Kerakystis	....	....	....	*1	....	2	....	....	1	....	....	....	....	....	....	....	3(*2)
Lamprocystis	....	....	....	....	....	....	*1	*2	3	*1	5	?	1	*1	1	x	9(*8)
Tongacystis	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	2(*1)
Moala	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1
Guamia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	?	3(*2)
TOTALS	1	2	2	4	8	5	5	6	8	2	8	1	1	1	4	....	47(*18)
Endemic	1	1	1	3	7	2	3	4	5	1	6	1	1	0	4	....	40(*11)

the other Microcystinae except *Kusaiea frivola* and *Lamprocystis moalana.* Again, the epiphallus in the species of *Hiona* (subgenus *Insulorbis*) from the Society Islands considerably resembles that in the species of *Lamprocystis* (subgenus *Avarua*) from the Society and Cook Islands and that in the genus *Microcystis* from the Cook and Austral Islands. While the production of a new line by the hybridization of such divergent animal stems seems to have happened rarely, if ever, in nature, it might be most apt to occur if members of related island groups were accidentally brought together. Because the forms on each island are geographically segregated, divergence may result from lack of interbreeding but does not require functional inability to produce such crosses.

The evaluation of the more strictly ecologic effects is beyond the scope of the present studies. My own field experiences have been limited to three of the Hawaiian islands consisting in brief excursions, of which the longest was a trip up Mauna Kea (island of Hawaii), conducted by the Hawaiian Academy of Sciences. Nevertheless, even these have convinced me that Crampton (Carnegie Inst. Wash., Pub. **410**: 26, 1932) has greatly underestimated the importance of environmental factors, as has already been suggested by Welch (Bernice P. Bishop Mus., Bull. **152**: 150, 1938).

Since none of these islands lies far outside the tropics and all have oceanic climates, temperature differences due to latitude are almost negligible, but those of altitude may be considerable and attain their maximum on the island of Hawaii. In general, the absolute humidity is high, but, under the influence of the mountains, which often become extremely precipitous, the rainfall frequently differs markedly within short distances. The lowlands, especially on the leeward sides of the higher islands, may approach semi-desert conditions, but the highlands, at least on their windward slopes, usually produce dense cloud forests. The crown of Mauna Kea (about 13,800 feet high) extends far above this cloud-zone, seems much more arid than at similar altitudes in the Rocky Mountains, and almost completely lacks vegetation or snails. Usually, calcareous rocks are only present on the lowlands; and the soils of the higher parts are largely derived from basaltic lavas. Near the equator, hurricanes may be very destructive, especially in proximity to the sea; these might be among the principal reasons for the usual absence of endemic species on the lower islands, although coincidently they may rarely assist in dispersal.

CONCLUSIONS

1. The Zonitidae and Helicarionidae are the most highly evolved pulmonate mollusks that have endemic members in most parts of the Pacific area and their immigrations have probably been relatively recent.

2. With the exceptions of the oviparous Sesarinae and Trochomorphinae,

they are all small species, or, like *Microcystis* and *Mendaña,* may well have been derived from minute ancestors and developed size within their present ranges.

3. Perhaps for these reasons, their distribution does not seem to offer very definite evidence for (or against) a former Pacific continent or extensive land-connections in the area, but does seem to be mainly explicable on the hypothesis of adventitious dissemination.

4. Also, when contrasted with related mainland groups, the Pacific island zonitids appear to be characterized by a great amount of minor divergence in proportion to the total land area which they inhabit (probably little larger than Switzerland and smaller than West Virginia) but by a slight degree of profound differentiation in comparison with the extent of their range (greater than on any of the continents).

GEOGRAPHIC INDEX

In this index to parts 1 to 3, the extralimital regions and some adjacent subregions are also included, but are preceded by asterisks (*). Similarly, the pages that record species which are probably absent (i.e., have been erroneously recorded) from the cited localities are also so accompanied.

SYSTEMATIC INDEX

In this index to parts 1-3, asterisks (*) precede extralimital species and groups, and are also utilized for pages where extraneous (often incorrect) usages are cited. Generic, subgeneric, and sectional names are not distinguished, so a genus may be followed by three page references, of which the second and third indicate the keys for the type subgenus and section. Subspecific terms and synonyms are treated like specific ones and are followed by (1) the authority (unless new) and (2) the adopted generic name for the correct or restricted usage.