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SECOND SERIES: PULMONATA.

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MANUAL  
OF  
CONCHOLOGY

STRUCTURAL AND SYSTEMATIC.

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WITH ILLUSTRATIONS OF THE SPECIES.

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VOL. XX.

CÆCILIOIDES, GLESSULA AND PARTULIDÆ.

INDEX TO VOLS. XVI-XX.

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The description of Orthurethrous snails is continued in this volume, the remaining groups of *Ferussacidæ* and the *Partulidæ* being described. In treating of the latter family, the author has had the advantage of studying the types and other specimens of the late Dr. W. D. Hartman, now forming part of the collection of the Carnegie Museum at Pittsburgh. The conclusions reached in the monograph now published have thus been based upon the material of two large collections. The liberality and courtesy of the Trustees of the Museum and of the Director, Dr. William J. Holland, are here gratefully acknowledged.

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## INTRODUCTION.

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About ten years ago the writer pointed out the existence of three great groups in the monotremate land snails, based upon the structure of the pallial organs: SIGMURETHRA, HETERURETHRA and ORTHURETHRA. The first group includes a very large majority of the land snails now existing, which have been described in volumes I to XVIII of this work. The Heterurethra are chiefly represented by the genus *Succinea*. Finally the group Orthurethra is made up of a series of families which retain primitive pallial structures like the Basommatophora. They are the scattered descendants of snails of long ago—of the first land-snail fauna. With the rise of the Sigmurethra, these primitive snails declined. On the continents they take a minor role, and seem to exist by grace of their insignificance (*Pupillidæ*, *Valloniidæ*, *Ferussacidæ*), though one family, the *Enidæ*, contains snails of moderate size. On the Pacific islands, where the Sigmurethra are represented by only a few low forms, Orthurethra are still dominant. In this island world the *Partulidæ*, *Amastridæ*, *Achatinellidæ* and *Tornatellinidæ* comprise the most conspicuous elements of the snail-fauna.

The following families are now comprised in the group *Orthurethra*:

Valloniidæ (See Vol. VIII, p. 247, and IX, p. 282).  
Holarctic.

Enidæ (*Buliminidæ* of authors). Palearctic, Oriental, African.

Pupillidæ (*Pupidæ* of authors). World-wide.

Partulidæ (this volume, p. 155). Polynesia, Melanesia, Micronesia.

Ferussacidæ (Vol. XVIII, p. 211; this volume, p. 1). Hol-  
arctic, Oriental, African, Neotropical.

Amastriidæ (Vol. XXI). Hawaiian Is.; Juan Fernandez.

Achatinellidæ (Vol. XXI). Hawaiian Islands.

Tornatellinidæ (Vol. XXII). Pacific Islands.

# MANUAL OF CONCHOLOGY.

## Family FERUSSACIDÆ Bgt. (Continued).

### Genus CÆCILIOIDES Herrmannsen.

*Acicula* Risso, Hist. Nat. Eur. Mérid. iv, p. 81, for *A. cburnea* Risso. Not *Acicula* Hartmann, 1821.—Cécilioide, BLAINVILLE, Dict. Sci. Nat. vii, 1817, p. 332, and “ceclionides de M. de Ferussac,” l. c. v, Suppl., p. 129, under *Bulimus acicula*. 1817 (no Latin name given).—*Caccilioides* Fér. HERRMANNSEN, Indicis Generem Malac., i, p. 150, 1846, as equivalent to *Acicula* Risso.—E. A. SMITH, Journ. of Conch. vi, April, 1891, p. 342.—*Cecilioides* Fér. pater., BECK, Verzeichniss einer Sammlung von Landconchylien aus den Dänischen Staaten in Europa, in Amtlicher Bericht ueber die 24ste. Versammlung Deutscher Naturforscher und Aerzte in Kiel, 1847, p. 122, for *C. acicula* Müll.—*Cæcilianella* BOURGUIGNAT, Revue et Mag. de Zoölogie, viii, 1856, p. 378, type *C. acicula* Müll.—P. FAGOT, Historique du genre Cæcilianella, in Bull. de la Soc. Malac. de France, iv, 1887, p. 49.—BERTHIER, a quel auteur attribuer la paternité du genre Cæcilianella? t. c. p. 59.—*Aciculina* WESTERLUND, Fauna der in der Palaäarktischen Region Lebenden Binnenconchylien, iii, 1887, p. 175, first species *C. acicula*.—? *Belonis* HARTMANN, Erd- und Süßwasser Gastropoden der Schweiz, 1841, p. 48 (for “*Belonis acicula*,” mentioned without synonymy, description, or other means of identification.)

The shell is imperforate, very small and slender, very narrowly lanceolate, with obtuse, rounded, smooth apex; smooth, fragile, transparent (weathering to opaque white); aperture usually less than half the total length, piriform; outer lip arching forward in the middle, acute; columella concave, more or less distinctly truncate at base, usually somewhat

calloused. Animal blind, or at least without pigmented eyes. Jaw composed of many narrow plaits. Radula with 11, 1, 11 teeth in *C. acicula*, 18, 1, 18 in *C. gundlachi*, the central tooth much smaller than the laterals, with a tricuspid reflection. Laterals symmetrical, tricuspid. Marginal teeth low, wide, with two low, denticulate cusps. The genitalia, as figured by Lehmann for *C. acicula* (pl. 15, fig. 1) have the duct of the spermatheca very short. An appendix, enlarged at the end, is terminal on the penis. There is also a short accessory organ anteriorly on the penis.

Type *C. acicula* Müll. Distribution, Europe and most tropical and subtropical countries.

An excellent account of *Cæcilioides acicula* has been given by Mr. L. E. Adams, as follows: "*Methods of Progression*.—Usually the shell is dragged along the ground after the animal, though more rarely it is lifted to a horizontal position (pl. 1, fig. 6). On two occasions I observed the animal protrude its head under the shell towards the spire and progress in that direction, forcing the shell along the ground in front of it, apex first, and then lift the shell over its head at an angle of about 45 degrees, and continue its march in that position (fig. 5). The progression is always by slow jerks, and not a continuous glide. I have not observed the shell carried in the position of Jeffrey's figure (British Conchology, Vol. I, pl. 7, fig. 18), though Nilsson says 'the animal sometimes carries its shell erect, but generally drags it along depressed.'

"*Texture and Form of the Animal*.—I was much struck with the extremely flexible and elastic nature of the animal. I have observed one emerge from the shell as it lay flat, on a horizontal surface, and make a complete circle with its head and tail, without moving the shell. It is also remarkable how far the animal will protrude from the shell, and how slender an attachment connects the head and foot with the part within the shell. The end of the tail is often curled up. Along the neck and down the front of the head are two mucus sulcations on either side of the dorsal line (pl. 1, fig. 8). The tail is pointed and sharply carinated; from the dorsal ridge mucus sulcations descend to the lower edge (fig. 7).

“*Eyes and Tentacles.*—Jeffreys’ enlarged figure (Brit. Conch., Vol. I, pl. 7, fig. 19) is not quite accurate. He seems to have taken his description from Nilsson, and it may be doubted whether Jeffreys himself examined the animal with sufficient care. Nilsson had evidently studied the animal, but he was not correct in describing the upper tentacles as ‘not thickened.’ In all the specimens that I have observed the upper tentacles are certainly slightly bulbous when fully or nearly fully extended, though this does not appear when they are only slightly protruded. Nilsson, however, correctly remarks that the apices of the upper tentacles are not ‘marked with a black spot.’ Now Lamarck (to whom Nilsson refers) seems to have been the only one to observe the colorless eyeball, and he did not recognize them as such. Nilsson says (quoting Lamarck) “In this species no eyes indeed are exposed, unless they are white, like the tentacles themselves. These, indeed, are terminated by a convex surface, very smooth, very shiny, surrounded by a slightly impressed ring; which surface doubtless answers to the *eye* of other terrestrial mollusks. But this animal, probably because it lives underground, where it cannot use eyes, appears to us plainly to lack eyes.’ Now I have noticed that these peculiar convex endings with a constricting ring are in fact eyeballs, and also that they are retractile, but whether they have retained the power of sight in spite of their loss of pigment, I am not prepared to say (see fig. 8). As far as my observation goes, the animal is insensible to light, though it will crawl straight away to a heap of moss; the direction, however, may be determined by scent alone. If it is deficient in sight it certainly uses its tentacles to all appearance in the same manner as its more favored brethren. I may mention in this connection that an albino specimen of *Limax maximus*, whose eyeballs were also destitute of pigment, seems to act in a perfectly normal manner. Though my observations on this point (*Journal of Conch.*, Vol. 9, p. 24) tend to show that this species is lacking in sight, I am not aware to what degree of perfection the vision of terrestrial mollusks attains, but I have noticed that *Cyclostoma elegans* and *Helix pomatia* seem sensitive to the approach of a large object.” (Lionel E. Adams in *The Journal of Conchology*, Vol. 9, p. 297.)

*Cæcilioides* is well known to inhabit graves. Gaudry found them in lacrymatories unearthed from Grecian tumuli. Rev. H. Housman records that near Chichester in "an early British burying-ground many skeletons were found. The bones, which lay about three feet below the surface were infested with *A. acicula*" (Journ. of Conch. iii, 1882, p. 317). In Northamptonshire Messrs. Wright and Adams found *Cæcilioides* abundant to a depth of  $4\frac{1}{2}$  ft., in a place where skeletons of men and horses have occasionally been discovered (J. of C. viii, 1897, p. 395). J. W. Horsley reports them similarly from a Saxon cemetery near Witney (J. of C. ix, 164); and in Germany Professor von Martens has recorded the presence of a great number of large fresh specimens in a human skull dug up at Bernburg (Nachrbl. d. Mal. Ges. 1883, p. 60).

Definite information upon the food of *Cæcilioides* is wanting, but they probably feed upon vegetable matter, such as subterranean fungi or possibly fine rootlets.

The European species of *Cæcilioides* have no doubt been multiplied beyond reason, yet without a critical study of the types it is impossible to say how many recognizable races exist. M. Bourguignat and his friends had an agreeable custom of describing "species" from single selected specimens, ignoring connecting forms. Published figures of shells they had never seen occasionally served as a basis for supposed new species; so that in the identification of real shells there is some excuse for passing over much work of these authors with a light heart and careless eye. I have neither the time nor type-material to attempt a critical revision of these forms. It is a work which properly belongs to some European student who will make a study of the local races, of the significance of variations, whether individual or racial, and finally he must study Bourguignat's types. This work demands great application and large series of the shells, unprejudiced by selection or determination. I have been able to do little more than give an account as full as the original sources admit. The American forms are treated more fully, my material being ample, and the literature less overloaded.

The generic name has been variously spelled, but the earliest

valid form is undoubtedly *Cæcilioides*, in reference to the blindness of these tiny subterranean snails. *Aciculina* of Westerland is an absolute synonym of *Cæcilioides*, having for type the same species, *C. acicula*.

*Cæcilioides* occurs in typical species in the Miocene and Pliocene, the following species being known. All were described under the name *Cæcilianella*.

*Cæcilianella grateloupi* Bgt. Rev. et Mag. de Zool. 1856, p. 431, based upon *Bulimus acicula* Grateloup, Actes Soc. Linn. Bord. x, 1838, p. 31, pl. 4, f. 23, 24. St. Paul near Dax.

*Cæcilianella aciculata* Sandberger, Land und Süßwasser Conch. der Vorwelt, p. 595, pl. 29, f. 15. Upper Miocene, Morsingen.

*Cæcilianella polonica* Lomnicki, Verh. k. k. Geol. Reichsanst. Wien, 1885, p. 422. Wycolki.

*C. acicula* and *C. a. irregularis* Sacco have been found in the Pliocene, Villafranchian stage, at Fossano (see Sacco, I Molluschi dei terreni Terziarii del Piemonte e della Liguria, pt. 22, 1897, p. 76).

*C. a. irregularis* Sacco 1885 (t. c., pl. 6, f. 26) is a form with very rapidly descending last whorl, requiring comparison with recent forms.

#### *Sections of Cæcilioides.*

a. Columella distinctly truncate at the base; spire slender. Chiefly Palæarctic species.

b. Columella and parietal wall without conspicuous callosity, a low parietal nodule sometimes developed.

Section *Cæcilioides*, species 1 to 5, 9 to 36.

b<sup>1</sup>. Columella with one or two nodules below the middle.

Section *Terebrella*, species 7, 8.

a<sup>1</sup>. Columella varying from truncate to indistinctly subtruncate at base; spire thick, short; shell very small. Tropical America. Section *Cæcilianopsis*, species 37 to 39.

a<sup>2</sup>. Columella not truncate or very indistinctly so.

b. Columella simple, not conspicuously calloused. Tropical in both hemispheres.

Section *Geostilbia*, species 40 to 47.

b<sup>1</sup>. Columella strongly sigmoid, not truncate at base; a

dentiform callus in the middle of the parietal margin.

Portugal, Madeira? Section *Rhaphidiella*, species 2, 6.

For convenience the species are grouped geographically, under the following heads:

Atlantic Islands, species 1 to 3.

Central Europe, species 4 to 5.

Spain and Portugal, species 4, 6 to 8.

Northern Africa, species 9 to 12.

Italy, Sicily and Malta, species 13 to 21.

Greece, Western Asia, species 22 to 31.

Africa and Arabia, species 32 to 36, 46.

Tropical Asia, East and West Indies, etc., species 37 to 49.

#### Section *Cæcilioides* s. str.

##### *Species of the Atlantic Islands.*

#### 1. *C. SPICULUM* (Benson).

Shell imperforate, subulate-cylindric, very slender, hyaline, polished; spire lengthened, the apex obtuse; suture impressed, margined. Whorls less than 6, slightly convex, the last one-third the length of the shell. Aperture vertical, tapering-piriform, rounded basally; lip slightly obtuse and a little arcuate. Columella deeply, obliquely truncate at base, and calloused at the parietal margin. Length 4, diam. 1, aperture 1.33 mm. (*Bens.*).

Cape Verde Is.: S. Antao (Dohrn), and S. Vicente, near the Duke's Head Mountains (E. L. Layard).

*Achatina spiculum* BENS., Ann. Nat. Hist. xviii, 1856, p. 435. — PFR., Monogr. viii, p. 289. — WOLLASTON, Testacea Atlantica, p. 517.—*Cæcilianella amonitatum* DOHRN, Malak. Bl. xvi, 1869, p. 10.—MORELET, Journ. de Conchyl. 1873, p. 242.

According to Wollaston, this species differs from *C. acicula* by being smaller, narrower, thinner, paler, more highly polished and more transparent; its spire, which has a volution less, is shorter and a little more obtuse at the apex, its suture is less oblique, its columella is relatively somewhat longer and straighter, and more flexuous, and its entire outline is both narrower and more fusiform.



2. *C. EULIMA* (Lowe).

Shell linear, very narrowly cylindrical, very slender, generally very indistinctly curved; spire long subconic-cylindric, the apex obtuse; suture very oblique, distinctly margined. Whorls  $6\frac{1}{2}$ , flat, the middle ones long. Aperture short-obovate, acuminate above, entire and arcuately rounded below, much shorter than the spire; parietal wall uniplicate in the middle, the fold transverse, entering; peristome simple, acute, the margins joined by a somewhat thick callus, the right margin rounded, continued in a regular curve into the basal and columellar margins. Columella curved and slightly twisted, not abruptly truncate, but gradually and easily passing into the basal margin. Length 2.5 to 3, diam. 0.75 lines (*Woll.*).

Madeira: probably in the Funchal district, recent; Porto Santo, very rare, fossil (*Wollaston*).

*Achatina eulima* LOWE, P. Z. S. 1854, p. 201.—WOLLASTON, Testacea Atlantica 1878, p. 244.

“The most important feature which separates the *A. eulima* from the *acicula* consists in the presence of a conspicuous medial plait on its ventral *paries*; but it has other characteristics also which combine to separate it from that species. Thus it is not only longer, more cylindrical, and proportionately still slenderer, with a *tendency* to be obsoletely *bent* (as in the marine genus *Eulima*), but its whorls (particularly the intermediate ones) are altogether more lengthened-out and flattened, and its aperture is relatively a little shorter, as well as broader (and more rounded) posteriorly, the basal margin being more obtusely arcuate, and merging almost without an intervening angle into the columella, which is narrower *gradually* (and is *not* abruptly truncate) behind. The suture is exceedingly oblique, and its surface is of a hyaline white.” (*Wollaston*).

This species apparently belongs to the section *Rhaphidiella* of Maltzan. See species No. 6.

3. *C. NYCTELIA* Bourguignat. Pl. 2, figs. 32, 33.

This shell has the usual acicular shape, clear corneous texture and smooth surface. Whorls  $5\frac{1}{2}$ , very slightly convex, the penultimate and preceding whorls widening more rapidly than

those above on account of the more rapid descent of the last two turns of the suture. The suture is distinctly marginate. The outer lip is strongly convex in profile view, the greatest convexity being below the middle. Columella strongly concave, not heavily calloused, narrowly, subvertically truncate at base. Parietal callus hardly perceptible. Length 4.1, diam. 1.3 mm.

Madeira: Under stones in dry places (Albers); Punta Sao Lourenco. (M. Grabham).

*Glundina acicula* Müll., ALBERS, Malac. Maderensis, 1854, p. 59, pl. 15, f. 17, 18; renamed *Caecilianella nyctelia* BOURGUIGNAT, Rev. et Mag. de Zool. 1856, p. 430, pl. 12, f. 21, 22 (copy from Albers).—*Achatina* n., PFR., Monogr. iv, 626.

This species is distinguished from *C. acicula* by the irregular increase of its whorls, the antepenultimate or penultimate suddenly widening more rapidly than those before, and by the narrow, subvertical truncation of the columella, that of *acicula* being wider and more approaching horizontal. The species of Bourguignat was based solely upon Albers' account; and the latter, in my opinion, applies to this form rather than to the real *C. acicula*. Bourguignat had not actually seen the Madeiran shell.

The Sicilian *C. actoniana*, *rizeana* and *petitiana* are apparently identical specifically with *nyctelia*,—or at all events, there seems to be no difference in the shells. How many other of the "species" are really the same I do not know. Fig. 32 represents an adult shell from Punta Sao Lourenço; fig. 33 a young shell from another locality, length 3.6, diam. 1.1 mm.

Var. *maderensis* n. v. Pl. 2, figs. 34, 35. The shell is composed of 5 nearly flat whorls, the last turn of the suture descending more rapidly. Aperture more than half the total length, lanceolate; columella slightly concave, rather lightly calloused, and somewhat widely truncate at the base. Length 4, diam. 1.25 mm.

Madeira: Suburbs of Funchal, 400 ft. elevation (M. Grabham). Type in coll. A. N. S. P.

*Central European Species.*4. *C. ACICULA* (Müller). Pl. 1, figs. 1, 2, 5-8.

“Shell turreted and slender, transparent, very thin, highly polished and iridescent, ivory-white, with a yellowish tinge on the upper part in fresh specimens (owing to the color of the liver), perfectly smooth and polished when examined with a lens of ordinary power, except a few faint and irregular wrinkles in the lines of growth, but under a microscope exhibiting delicate and close-set spiral striæ. Periphery rounded. Epidermis exceedingly thin and forming a mere film. Whorls  $5\frac{1}{2}$ , not convex, but compressed and drawn out, rapidly increasing in size; the last occupying about one-half of the shell. Spire very obtuse and rounded at the point. Suture moderately deep and oblique, apparently margined on the under side by reason of the upper part of the succeeding whorl being seen through the pellucid shell; mouth oblong, contracted by the penultimate whorl, narrowing above into an acute angle, slightly widened and rounded below, but interrupted by a deep notch at the base of the pillar lip.” Outer lip thin and flexuous. Pillar lip thick and curved. Inner lip consisting of a slight deposit of shelly matter, which is spread on the pillar. Length 0.175, breadth 0.04 inch (*Jeffreys*).

Europe, chiefly in Germany, France and England; Ireland, Spain, Italy. America: introduced in Florida (*W. G. Binney*); Bermuda, near Frascati Hotel (*A. Gulick*); Barbados (*Brown*). S. Africa: *Cradock*, “introduced, apparently not indigenous” (*Melville & Ponsonby*.)

*Buccinum acicula* MÜLLER, *Hist. Verm.* ii, 1774, p. 150.—*Cionella acicula* JEFFREYS, *Trans. Linn. Soc.* xvi, 1830, p. 347.—*Westerlund*, *Fauna* iii, p. 176.—*Achatina acicula* ROSS-MAESSLER *Iconogr.* pt. x, p. 35, f. 658.—PFR., *Monogr.* ii, 274; iii, 506; iv, 623; vi, 240; viii, 294.—JEFFREYS, *British Conchology* i, p. 297, pl. 7, fig. 18-21.—WOLLASTON, *Testac. Atlantica* 1878, p. 243.—*Styloides acicula* FITZ., 1833.—*Cecilioides acicula* BECK, *Amtl. Ber. Deutscher Nat. etc.*, 1847, p. 122.—*Cæcilianella acicula* BOURG., *Revue et mag. de zool.* 1856, p. 382, pl. 18, f. 1-3 (*Amen. Mal.* i, p. 215).—LEHMANN, *Lebenden Schnecken*,

etc., p. 128, pl. 13, f. 43 (teeth and genitalia).—MELVILL and PONSONBY, Proc. Malac. Soc. Land. iii, 184 (in S. Africa).—BINNEY, Manual of American Land Shells, p. 429.—SORDELLI, Atti Soc. Ital. de. Sci. nat. xiii, Milan, 1870, p. 48, pl. 1, f. 22–26 (otocysts, jaw, radula).—*Buccinum terrestre* MONTAGU, Test. Brit. p. 248, pl. 8, f. 3.—*Helix octona* GMELIN, Syst. Nat. 13, p. 3653.—*Achatina alba* BROWN, Illustr. Land and Fresh-water Conchology of G. B. and I., 1845, p. 32 (erroneously quoted as of Turton).—*Achatina pusilla* SCACCHI, Catal. Conch. Reg. Neapolitani, 1836, p. 16.—*Columna miliaris* de CHRISTOFORI et JAN, “Shell fusiform-ovate, imperforate, smooth, glossy, slender, whitish, the last whorl ventricose ( $1\frac{1}{3}$  lines long,  $\frac{1}{2}$  wide), aperture oval, 1 line long,  $\frac{1}{3}$  wide.” Catalogus etc., Mantissa, p. 2, 1832.—*Acicula hyalina* BIELZ, PAULUCCI, Bull. Soc. Malac. Ital. xii, 1886, p. 45 (Italy).—*Stenogyra octona* var. *danica* SCHLESCH Ann. Soc. Roy. Zool. et Malac. Belgique xli, 1906, p. 184.

Gwyn Jeffreys' description of this common species is given. It seems to be a rather variable form, but the limits of variation in this group are little understood. A large proportion of the specimens in collections are from drift debris of rivers, hence forms from various colonies and diverse stations are mingled in unwonted company. Such lots are misleading in the study of variation.

Var. *elongata* Locard. Of a slimmer, more lengthened form.

Var. *ventricosa* Locard. Of the same size (not over 4.5 mm. long), but the shape is a little more ventricose, more swollen at the base (Locard, Conchyliologie Portugaise, in Archives du Mus. d'Hist. Nat. de Lyon, vii, 1899, p. 141).

Var. *festuca* Porro. Whorls only 4; size smaller, alt. 2, diam. 0.5 mm. Como and Varese, Italy. (*Achatina acicula* var. *festuca* Porro, Malacologia terr. e fluv. della Prov. Comasca, Milan, 1838, p. 52.)

Var. *eburnea* (Risso). Pl. 1, fig. 9. Shell very long fusiform, very fragile, glossy, pellucid, ivory-white; spire long, the apex obtuse; whorls 7, regularly increasing, flattened or slightly convex, separated by a deeply impressed suture, the last one-third the total length. Aperture piriform, dilated below; colu-

mella twisted, strongly truncate, not reaching the base; right margin arching forward; margins joined by a callus. Length 6, diam. 1.25 mm. (*Bgt.*).

Southern France: Nice, type loc. (Risso); Italy: Arno river; Pisa (Issel); Po river at Turin (Pollonera).

*Acicula eburnea* Risso, Hist. Nat. Eur. Mérid., 1826, iv, p. 81.—*Cæcilianella e.*, BGT., Etude synon. sur les Mollusques des Alpes Maritimes publiés par A. Risso, p. 43, pl. 1, f. 20–22 (1861), description and figures of the type specimen.—LOCARD, Catal. Gen. des Moll. viv. de France, 1882, p. 136.

Var. *enhalia* Bgt. Pl. 1, fig. 10. Very minute, composed of  $5\frac{1}{2}$  flattened, irregularly increasing whorls, the last over one-third the total length. Right margin of the lip not arching forward; margins of aperture joined by a thin callus which has a more or less obsolete tubercular prominence at the insertion of the outer lip. Length 3.5, diam. 1 mm. Brittany: Around Cancale (Cotes-du-nord), along the cliffs almost at the high tide line. (*Bgt.*, Malac. terr. et fluv. de la Bretagne, 1860, p. 158, pl. 2, f. 14–16.)

Var. *anglica* Bgt. According to Bourguignat, this is distinguished from *acicula* by the larger size,—length 8, diam. 1.5 mm.—the whorls of the spire more convex, the suture deeper, not margined, the aperture rounded, and the columella strongly truncate. England. (*C. anglica* BGT., Rev. et Mag. de Zool. 1856, p. 384, pl. 12, f. 4, 5.)

This "species" is a good example of Bourguignat at his worst. There really was no type specimen of *anglica*; nothing but Reeve's figure in the *Conchologia Iconica* v, pl. 20, f. 111, which Bourguignat described in formal phrase, while his artist redrew it enlarged for his plate. The citation of Reeve is curiously falsified in name of the work, number of the figure and date, almost concealing the real source of all of the information extant upon "*C. anglica.*" Whether the English form has any racial characters or not must be left for English students to decide. I have never seen English examples so large as *anglica* is claimed to be; but the size was probably not carefully measured from the shell, but merely estimated by the eye. Reeve's *Iconica* is very unreliable in all relating to minute shells, though the figures of large species are admirable.

Var. *nodosaria* Boettger. Pl. 1, fig. 16. May be near var. *anglica*, but differs by its far smaller size. With 5 volutions the Caucasus form has relatively wider and distinctly more convex whorls, so that the aperture appears more widely oblong. Length 3.5, diam. 1.12 mm. (*Bttg.*, Jahrb. D. M. Ges. vi, 1879, p. 398, pl. 10, f. 10).

Caucasus: flotsam of the Kura at Borshom.

Var. *merimeana* Bourguignat. Shell lengthened oblong with obtuse apex. Whorls 6, somewhat convex, irregularly increasing, the upper slowly; the rest very rapidly; last two whorls very large, the last almost half the total length, descending at the aperture, rounded at base; suture impressed; outer margin arching forward. Columella short, curved, strongly retracted below, nearly reaching the base. Length 5, diam. 1.5 mm. (*Westerl.*).

France: Cannes.

*Cæcilianella m.*, BGT., Descript. Moll. Alpes Maritimes, 1870, p. 54.—WESTERLUND, Fauna, p. 179. LOCARD, Ann. Soc. d'Agricult., Lyon, 1895, p. 145.

Var. *mauriana* Bourguignat. Shell long pyramidal-lanceolate, slender, with long, produced, acuminate spire with obtuse apex. Whorls 8, scarcely convex, slightly irregularly increasing, the upper slowly, the rest more rapidly; last whorl somewhat more than one-fourth the total length, rounded at the base. Aperture oblique, piriform, acutely angular above, broadly rounded below; outer lip strongly arching forward; columella short, a little truncate, nearly reaching the base. Length 7, diam. 1.75 mm. (*Westerl.*)

France: Cannes, type loc.; Istres, Bouches-du-Rhone (Locard).

*Cæcilianella m.*, BGT., Descript. Moll. Alpes Maritimes, in Mem. Soc. Sci. Nat. de Cannes, i, 1870, p. 54.—WESTERL., Fauna iii, p. 180.—LOCARD, Ann. Soc. d'Agricult. Lyon, 1895, p. 145.

Var. *lactea* Moitessier. Shell lengthened-oblong, glossy, very fragile, glassy, milk-white, smooth; spire long; apex stout, obtuse, as though mamillate. Whorls 6 to 7, slightly convex, very rapidly increasing, the first whorls regularly, the last irregularly; separated by a linear, duplicated suture. Last

whorl large, dilated, not equal to half the length; aperture coarctate, long-piriform, very acute above, rounded below; peristome unexpanded, acute, simple; outer lip arched forward; columella short, strongly curved, abruptly truncate, not reaching the base of the aperture. Length 4 to 5, diam. 1.5 mm. (*Moit.*).

France: drift debris of the Lez and Mosson near Montpellier (*Moit.*).

*Cæcilianella lactea* MOIT., *Revue et Mag. de Zool.*, xix, 1867, p. 371.—*Achatina l.*, PFR., *Monogr.*, viii, p. 295.—*C. lactæa* LOCARD, *Ann. d'Agric. Lyon*, (7), iii, 1895, p. 145.

5. *C. LIESVILLEI* (Bgt.). Pl. 1, figs. 11, 12, 15.

Shell minute, turritate-oblong, slender, polished, diaphanous, whitish, the apex obtuse; whorls 6, a little flattened, separated by a superficial, duplicated suture, the last whorl over one-third the total length. Aperture piriform-oblong; peristome acute, simple, unexpanded, the right margin slightly arching forward; columella straight, slightly truncate, margins joined by a thin callus which bears an obsolete tubercular projection on the convexity of the penult. whorl. Length 4 to 5, diam. 1.5 mm. (*Bgt.*).

France: Commonly distributed, especially northward (*Bgt.*). Sarus river debris at Adana, S.-E. Asia Minor.

*Cæcilianella liesvillei* BGT., *Rev. et Mag. Zoöl.*, 1856, p. 385, pl. 12, f. 6-8; *Amen. Malac.*, i, p. 217, pl. 18, f. 6-8.—PFR., *Monogr.*, iv, 624.—NEVILL, *P. Z. S.*, 1880, p. 135.—*C. a. liesvillei* HESSE, *Jahrb. D. M. Ges.*, ix, 1882, p. 332.—BTTG., *Nachrbl. D. M. Ges.*, vol. 37, 1905, p. 110.

This form is probably distinct from *C. acicula*. It is more slender with smaller aperture, and a rather heavy callus, which forms an entering ridge or nodule below the middle of the parietal margin. While this structure is conspicuous in typical *liesvillei*, yet it varies in development, and is traceable in occasional specimens of *C. acicula*. Dr. Boettger has identified *liesvillei* from debris of the Kura at Borshom, Caucasus. The specimens (pl. 1, fig. 15) differ from typical *acicula* by the obsolete parietal fold in the middle of the base of the last whorl,

and the less curved columella, which is only very obliquely and weakly truncate at the base. Length 5.25, diam. 1.62 mm. (Jahrb. D. M. Ges., vi, 1879, p. 398, pl. 10, f. 9.)

Var. *gemmellariana* (Benoit). Pl. 2, fig. 28, 31. Shell elongate-cylindric, slender, polished, glossy, hyaline, whitish; spire turrited, slightly tapering, the apex mamillate; suture impressed, widely margined, whorls 6, subplanulate, not rapidly increasing, the last cylindric, as long as the spire. Columella subarcuate, at base narrowly and obsoletely truncate. Aperture narrow, oblong-acuminate; peristome simple, unexpanded, acute, the margins joined by a very thin callus, right margin arching forward. Length 4.4, diam. 1.5, aperture 1.66 x 0.75 mm. (*Ben.*)

Sicily: Palermo.

*Achatina g.*, BENOIT, Illustr. Test. estramar. Sicilia, 1862, p. 248, pl. 8, f. 9.—PFR., Monogr. vi, 242.—*Cæcil. g.*, BGT., Rev. et mag. zool. xvi, 212.

Benoit's original figure is copied, fig. 31. I have also illustrated one of several specimens before me, received from Benoit. This shows a form probably not distinguishable from *liesvillei* Bgt., having a slightly contracted-attenuate spire, the whorls distinctly convex, the convexity chiefly close below the suture. There is a conspicuous, spirally entering callous ridge on the parietal wall close to its junction with the columella, but otherwise the parietal and columellar margins form nearly a straight line. As usual, the first whorl increases very fast, the next whorl scarcely widens, and the last  $2\frac{1}{2}$  whorls increase regularly. Length 4.4, diam. 1.3 mm.; whorls  $5\frac{1}{2}$ .

Younger shells agree better with Benoit's description, yet even these show the trace of a callous lamella. I am disposed to place the form in the synonymy of *liesvillei*.

Var. *tiberiana* (Benoit). Vol. xix, pl. 51, fig. 5. Close to *C. gemmellariana* but distinct by the greater size, the upper whorls more slender and delicate, the last whorl much more swollen, and by the greater number of whorls,  $6\frac{1}{2}$ , and the piri-form aperture. (*Ben.*)

Sicily: Palermo.

*Cæcilianella tiberiana* BEN., Nuovo Catalogo delle Conch. terr.



e fluv. della Sicilia, 1881, p. 89; figured in Illustr., etc., pl. 8, f. 7.

Var. *crystallina* (Benoit). Shell turrite, whitish, smooth, translucent, the apex obtuse, spire composed of 5 slightly convex whorls separated by a well-marked suture. Last two whorls forming two-thirds the total length. Lip simple, acute, the margins joined by a callus. Aperture piriform; truncation of the columella strongly marked. Length 5, diam. 2 mm. Sicily: Spadafora, near Messina. (*Cæcil. crystallina* BEN., Catalogo, 1881, p. 90). Related to *C. gemmellariana*.

Var. *hyalina* (E. A. Bielz) Pl. 1, figs. 3, 4. The shell is very long and narrow, composed of fully 6 very slightly convex whorls, the last 4 rapidly increasing, the suture very oblique, but descending much less rapidly near the aperture. Aperture small, piriform. Columellar callus rather thin, but in certain positions its upper edge is barely visible as a slight prominence on the parietal wall. Length 5, diam. 1.25, aperture 1.7 mm.

Transsylvania: Hermannstadt, in a garden; Mediasch; Schlossberge von Vajda Hunyad (*Bielz*).

*Acicula hyalina* BIELZ, Fauna der Land und Süßwasser-Mollusken Siebenbürgens, 1863, p. 84; Second edit., 1867, p. 89 (exclusive of synonymy).

Bielz intended his name to replace that of *acicula*, but he gave a description of the Transylvanian form, which proves to be distinct from *acicula* by its greater elongation. It stands close to *liesvillei*, but is possibly separable by the more delicate columellar callus and the absence of a distinct callus on the parietal wall. The specimen figured was received from Bielz.

Var. *uniplicata* Bourguignat. Pl. 1, figs. 13, 14. Shell minute, turrite-oblong, slender, very fragile, diaphanous-whitish, crystalline, smooth; apex obtuse, mamillate, composed of 6 nearly flat or slightly convex whorls, which increase rapidly and unevenly, and are parted by an impressed, not duplicated, suture; the last whorl half the total length or more. Aperture piriform-oblong; columella uniplicate above, a little twisted, truncate at the base; peristome acute, unexpanded, simple, the right margin arching forward, columellar margin somewhat calloused. Spreading, the margins joined by a thin whitish callus. Length 4, diam. 1.25 mm. (*Bgt.*).

France: on rocks below the village of Bordeau, near Aix-les-Bains.

*Cæcilianella uniplicata* Bgt., Malacologie d'Aix-les-Bains 1864, p. 55, pl. 2. f. 3-5.

The columella "a little concave, ornamented in the upper part with a lamelliform fold, and having a distinct truncation at the base" seems to be the chief characteristic of this form.

Var. *aglena* Bgt. Pl. 1, fig. 18. Shell approaching especially the *C. liesvillei*, but is distinguished by the mamillate summit, non-margined suture, 7 whorls, and especially by the aperture, in which the penultimate whorl has scarcely any convexity, but forms nearly a straight line with the columella. Length 5, diam. 2 mm. Ville-au-Bois-les-Vendeuvre, Aube, France (*Bgt.*, *C. aglena*, Rev. et Mag. Zool., 1857, p. 15, pl. 1, f. 3, 4; *Amen. Malac.*, ii, p. 31, pl. 1, f. 3, 4).

Var. *boettgeri* Hesse. Pl. 1, fig. 17. Differs from the type by the smaller size, more slender shape, angulate columella, whorls more rapidly increasing, the penultimate as high as the upper ones. Length 3, diam. scarcely 1 mm. Tinos, Grecian Archipelago, in flotsam of a small brook. Differs from *liesvillei* by its slimmness and the shape of the columella, which has an angle in the place where there is an obsolete fold in *liesvillei*. (*Hesse*, *Jahrb. D. Malak. Ges.*, ix, 1882, p. 332, pl. 12, fig. 8.)

#### *Forms of Spain and Portugal.*

The Iberian forms have not been figured. In a group where with the closest comparisons of specimens, species are difficult to distinguish, mere descriptions are barely worth the paper they are written on. The student will find all published information below. *C. acicula* and *C. nanodea* are also recorded from the Iberian peninsula.

*C. vandalitiæ* Servain. The whorls increase regularly and rapidly; the suture does not descend much. The last whorl has a regular, median convexity, not inferior, as in *belonidæa*. The spire tapers gradually. The outer lip, instead of descending a little below the columellar extremity, forming an angular part at the base of the aperture as in *belonidæa*, is on the contrary convex and rounded to the columellar border, which is

shorter and more strongly truncate. As the increase of the whorls is regular and the convexity about equal in all there is not the contraction at the left side between the penultimate and last whorls, noticed in *C. belonidæa*. The simple peristome is not thickened within, and is not patulous at the base of the aperture. Length 6, diam. 1.75, aperture 2 x 1 mm.; whorls 7.

Spain: drift debris of the Guadalquivir at Seville.

*Cæcilianella v.*, SERVAIN, Etude ser les Moll. Esp. et Port., 1880, p. 130.—Locard, Ann. Soc. Agricult. Lyon, 1895, p. 146 (drift of the Besançon at Saint-Armour, Jura).

*C. castroiana* Locard. Shell of relatively great size, of a fusiform, long-conic shape; spire very narrow, acuminate, composed of 6 slightly convex whorls, the first three increasing slowly and regularly, the following two much larger, the last whorl greatly developed, rounded at the base, three-sevenths the total length. Suture impressed, with a bordering line below. Summit small, obtuse, rounded. Aperture small, piriform, slightly over two-sevenths the total length, contracted above, well rounded at the base. Peristome simple, unexpanded and acute; right margin arching a little forward, the profile broadly arcuate; columellar border slightly sinuous, truncate, not reaching the base of the shell; the margins joined by a visible callus. Shell thin, quite solid, diaphanous, smooth, whitish. Length 7, diam. 2 mm. (*Loc.*).

Portugal: Faro, Algarve.

*Cæcilianella c.*, LOCARD, Conchyliologie Portugaise, in Archives du Museum d'Histoire Naturelle de Lyon, vii, 1899, p. 141.

Said to be larger, more slender, longer and more conic than *C. acicula*, with less regularly coiled and less convex whorls, duplicated suture, smaller and narrower aperture, etc.

*C. ribeiroi* Servain. This species is remarkable for the oblong-acuminate shape of the spire as far as the two upper whorls, which are cylindrical; for the progressively accelerated increase of the whorls, the suture also more and more steeply descending. The last whorl is regularly long-convex. The aperture is quite excised by the convexity of the penult whorl; columellar margin short, strongly projecting, strongly truncate at the base, obliquely arcuate from left to right, giving the aperture in the

upper part a very distinctly concave contour. Length 5, diam. 1.5, aperture 1.5 x 0.75 mm.; whorls 6.

Spain: drift debris of the Ebre at Saragosse.

*Cæcilianella r.*, SERV., Etude sur les Moll. Esp. et Port. 1880, p. 131.

*C. poupillieri* 'Bgt.' Servain. Shell long, quite oblong-acuminate, of irregular spiral increase: two first whorls minute with nearly horizontal suture, the rest of the whorls well developed, increasing rapidly, and separated by a progressively more and more rapidly descending suture. Whorls 6, slightly convex, lightly flattened, notable the fourth. Outer lip convex. Columellar margin very short, quite projecting, strongly truncate. Peristome simple, acute. Length 6, diam. 2 mm. (*Servain*).

Spain: Grenada and Cordova. Algeria: Algiers, Orleansville; everywhere in drift debris.

*Cæcilianella p.*, Bourg, in sched., SERVAIN, Etude sur les Moll. Espagne et Portugal, 1880, p. 132.—LOCARD, Ann. Soc. d'Agricult. Lyon, 1895, p. 146 (Istres, Bouches-du-Rhone).

*C. belonidæa* Servain. The upper whorls in this species are regularly elongate-convex, with a suture which does not descend much until the beginning of the last whorl, where the descent rapidly increases, the suture descending very obliquely. The last whorl is not regularly convex, but is flattened in the upper part and inflated below. The long-piriform aperture is narrow above, dilated at the base; the outer margin is straight, arcuate in front. The apertural convexity of the penult whorl descends in nearly a straight line to the columella, which is short, straight, indistinctly truncate below. Length 5.5, diam. 1.25, aperture 1.75 x 1 mm.; whorls 5.

Spain: banks of the Rivillas at Badajos.

*Cæcilianella belonidæa* SERV., Etude sur les Mollusques rec. en Espagne et en Portugal, 1880, p. 129.

#### Section *Rhaphidiella* Maltzan.

Differs from the genus *Cæcilianella* Bgt. [*Cæcilioides*] by the club-shaped shell, whorls slowly increasing, columella strongly sigmoid, excised, twisted, the upper margin of the excision with

a dentiform process in the middle of the parietal margin; columella not truncate at the base, passing gradually into the right margin. (*Maltzan*).

The Madeiran *C. eulima* Lowe probably belongs to this group, which seems to be closely related to *C. liesvillei* and its allies.

6. *C. BARBOZE* Maltzan.

Shell very minute, long-club-shaped, the spire cylindrical-turrite, apex rather acute. Whorls 6, slowly increasing, separated by a subimpressed, submarginate suture, the last scarcely one-third the total length. Aperture long-piriform, almost biangular at the base; columella concave, with one tooth above, at the base passing into the right margin almost in a right angle. Length 3, diam. 0.75 mm.; aperture 1 x 0.5 mm. (*Maltzan*).

Portugal: Portimao, Algarve.

*Cæc. barboze* MALTZAN, Nachrichtenblatt d. D. Malak. Ges. xviii, Feb., 1886, p. 26.

Section *Terebrella* Maltzan.

Differs from the genus *Cæcilianella* Bgt. by having the columella nodulose-calloused or one- or two-nodulose below the middle, the upper nodule dentiform, the lower obliquely elongate, distinctly separated from the truncation of the columella by a sinus, disappearing within. Type *C. clessini*. (*Maltzan*).

7. *C. CLESSINI* Maltzan.

Shell elongate-turrite, the spire turrite, apex rather acute, whorls 8, slowly increasing, separated by a margined suture, the last one-third the total length of the shell. Aperture compressed, lanceolate. Columella with one cultriform callus below the middle; at base obliquely and acutely truncate. Length 7, diam. 2.125, aperture 2.5 x 1 mm. (*Maltzan*).

Portugal: Portimao and Tavira, Algarve.

*Cæc. clessini* MALTZ., Nachrichtenblatt d. Deutschen Malak. Ges. xviii, Feb. 1886, p. 27.

8. *C. BINODOSA* Maltzan.

Shell oblong-fusiform, widest in the middle, almost biconic; spire long-conic, the apex obtuse, whorls 5, slowly increasing, separated by a margined suture, the last longer than the spire.

Aperture long-lanceolate, the margins nearly parallel. Columella binodose, the upper nodule dentiform, nearly horizontal, the lower nodule large, obtuse. Truncation of the columella distinct, horizontal. Length 2.62 to 2.75, diam. 1 mm.; aperture 1.62 x 0.5 mm. (*Maltzan*).

Portugal: Portimao, Algarve.

*Cæc. binodosa* MALTZAN, Nachrbl. Feb. 1886, p. 27.

A single larger specimen was taken, of the same shape and formation of the columella, but having only one callus, the lower one. Length 3.5 mm. (*Maltzan*).

Section *Cæciliodes* s. str.

*North African Species, Tunis to Morocco.*

9. *C. BRONDELI* (Bourguignat). Pl. 3, figs. 37, 38.

Shell fusiform-cylindric, acicular, hyaline, very fragile, whitish-corneous, very smooth, apex tapering, obtuse. Whorls 6, flattened, separated by an impressed suture, the last two-fifths the total length. Aperture narrow, lanceolate, rounded at the base; columella arcuate, calloused, narrowly and abruptly truncate at the base, and in the upper part one-lamellate; peristome simple, margins joined by a callus. Length 4, diam. scarcely 1 mm. (*Bgt.*).

Algeria: Mostaganem, under stones.

*Glandina brondeli* BGT, Rev. et Mag. Zoöl., viii, 1856, p. 17, pl. 1, f. 12-14; Amen. Malac., i, p. 144, pl. 10, f. 12-14.—*Achatina brondeli* PFR., Monogr., iv, 625.—*Cæcilianella b.*, BGT., Rev. et Mag. Zoöl., 1856, p. 426.

The columella is very thick, arcuate, and has a quite considerable swelling at the upper part, referred to in the description, somewhat inexactly, as "unilamellate." It is smaller than *C. acicula*, and distinguished from it by the stronger columellar callus, and the small tooth at its upper part, referred to above.

10. *C. RAPHIDIA* Bourguignat. Pl. 3, figs. 39, 40.

Shell pyramidal-oblong, slender, diaphanous, polished, whitish, the apex a little obtuse; whorls 6, slightly convex, separated by a duplicated suture, the last less than one-third the total length. Aperture oblong-rounded, peristome acute, simple, unexpanded; right margin arching forward; columella a little

arcuate, truncate, scarcely reaching to the base, the margins joined by a thin callus, bearing a small projecting tubercle on the convexity of the penult. whorl. Length 4.5, diam. 1.5 mm. (*Bgt.*).

Algeria: Mostaganem, type loc.; also Bone, Philippeville, Algiers, Orleansville, etc., etc.; Tunis in the debris of the Oued Sidi-Aich and of the Medjerda near Ghardimaou.

*Cæcilianella raphidia* BGT., Rev. et Mag. Zoöl., viii, 1856, p. 386, pl. 12, f. 9-11; Amen. Mal., i, p. 218, pl. 18, f. 9-11; Malac. de l'Algerie, ii, p. 115, pl. 8, f. 7-9; Prodr. Mal. Tunisie, p. 127.—PFR., Monogr., iv, 624.

11. *C. NANODEA* Bourguignat. Pl. 3, fig. 36.

Shell dwarfed, obese-fusiform, very slender, polished, whitish; apex obtuse; whorls 5, subplanulate, separated by a distinct suture, the last whorl half the total length. Aperture narrow, oblong-elongate; peristome unexpanded, acute, simple; right margin slightly arched forward; columella rather straight, truncate, not reaching to the base of the aperture; margins joined by a thin callus. Length 2.5, diam. 0.33 mm.

Algeria: Around Bone, type loc.; Tunis in debris of the Medjerda at the bridge of Fondouck.

*Cæcilianella n.*, BGT., Rev. et Mag. Zoöl., viii, 1856, p. 427, pl. 12, f. 12-14; Amen. Malac., i, p. 221, pl. 18, f. 12-14; Malac. Algerie, ii, p. 111, pl. 8, f. 4-6; Prodr. Malac. Tunisie, p. 128.—SERVAIN, Conch. Portugaise, 1899, p. 142.

Distinguished from *C. subsaxana* by the less truncate columella without a callosity, the non-marginate suture, and less forwardly arched outer lip. It has been reported from Faro Algarve, Portugal, by Servain.

12. *C. LETOURNEUXI* Bourguignat. Pl. 3, figs. 43, 44.

Shell minute, elongate-subfusiform, very slender, smooth, hyaline-whitish; spire long lanceolate, obtuse above, the apex very obtuse. Whorls 7, subplanulate, regularly and rapidly increasing, separated by an impressed suture, the last whorl one-third the total length. Aperture minute, oblong, acutely angular above; peristome unexpanded, acute. Columella short,

arcuate, strongly truncate, reaching nearly to the base; outer margin slightly arching forward; margins joined by a thin callus. Length 4.5, diam. 1.25 mm. (*Bgt.*).

Algeria: Vicinity of Algiers in the debris of the Frais-Vallon at the Bab-el-Oued gate, and along the Harrach. Tunis, debris of the Medjerda near Ghardimaou.

*Cæcilianella* L., *BGT.*, Malacologie de l'Algerie ii, 1864, p. 112, pl. 8, f. 10-12; Prodr. Malac. Tunisie, p. 128.

*Species of Italy, Sicily and Malta.*

13. *C. JANI* (de Betta).

Shell conic-ovate with the upper half acutely conic; apex very minute, with rounded summit, whorls 6, scarcely convex, regularly increasing, the last long, convex, very rapidly contracting below, more than double the length of the penultimate, half the total length of the shell. Suture strongly margined. Aperture narrow, long piriform, very narrow above, narrowed at the base, with strongly shortly arcuate basal margin. Outer lip strongly arching forward in the middle. Columella curved, somewhat oblique, strongly excised above, not reaching the base. Length 6 to 6.5, diam. 2 to 2½ mm., aperture 2.5 mm. long. (*Westerlund*).

Northern Italy; southern Tirol; Dalmatia; Greece at Hy-mettos; Malta; Corfu; Sarus river at Adana, in southeastern Asia Minor.

*Achatina jani* de BETTA et MARTINATI, Catal. Moll. Prov. Venete, 1855, p. 59—DE BETTA, *Esame Critico a tre molluschi del genere Glandina*, p. 23, pl. 1, f. 4-6. (Venezia, 1864).—*Ferussacia jani* PFEIFFER, Monogr. iv, 622; vi, 252; viii, 307.—*Cionella* (*Cæcil.*) *jani* WESTERLUND, Fauna iii, p. 178.—*Glandina veneta* Charpentier in coll.; *Achatina veneta* Charp., KUESTER, Neunter Bericht. naturforsch. Ges. Bamberg, 1870, p. 93.—*Cionella jani* HESSE, Jahrb. D. M. Ges. ix, 1882, p. 331 (Hy-mettos, Greece).—*Cæcilianella* (*Aciculina*) *jani* BOETTGER, Nachrbl. D. Mal. Ges. vol. 37, 1905, p. 111 (distribution).

The identity of this species, and its synonymy, have been the subjects of considerable variance. Unfortunately I have not access to de Betta's "Esame Critico" in which he figures the



species. Westerlund's account, which I have used above, seems to have been taken mainly from Kuester's article of 1870, which was the first critical discussion of the species.

Var. *gredleri* Kuester. Shell ovate-fusiform, slender, thin, polished, whitish, the spire rather acute, whorls a little convex, joined by a margined suture, the last more than half the total length. Aperture narrow, lanceolate; peristome unexpanded acute, arching forward. Columella short, slightly arcuate, obliquely truncate, margins joined by a callus. Length 5.5, diam. scarcely 2 mm. (*Acicula gredleri* Kuester, Neunter Ber. Nat. Ges. Bamberg, 1870, p. 94).

"One might say that this species represents a shortened, widened *aciculoides*, just as *veneta* seems to be a derivative of *acicula*. The slender shell is fusiform, but the greatest width is below the middle." The types were found at Trient with *A. veneta* by Professor Gredler. One example was found by Dr. Kuester at Triest.

#### 14. C. ACICULOIDES ('Jan' de Betta). Pl. 2, fig. 25.

Shell minute, fusiform-cylindric, acicular, the apex attenuate, obtuse, hyaline, glossy, white or gray. Whorls nearly flat; suture very narrowly margined; columella arcuate, the base narrowly truncate. Aperture ovate-oblong, lanceolate, very narrow; peristome simple, unexpanded, acute. Length 3.5 to 4, diam. 1 to 1.25 mm.; whorls 6 (*de Betta*, 1852).

Northern Italy: valley of the Non; near Fondo and in the valley of S. Romedio, in crevices of the earth and limestone (*de Betta*); Triest (Kuester).

*Columna aciculoides* CRISTOFORI et JAN. Catalogus, Mantissa p. 2 (1832).—*Achatina aciculoides* Jan, DE BETTA, Malacologia terr. e fluv. della Valle di Non, nel Tirolo Italiano (Verona, 1852), p. 75, fig. III *a, b*; Catalogo del Moll. terr. e fluv. viventi nelle prov. Venete (Verona 1855), p. 57.—KUESTER, Neunter Bericht der naturforschenden Ges. zu Bamberg, 1869–70, p. 91.—*Cionella* (*Cæcil.*) *a.*, WESTERLUND, Fauna, p. 177.

From the notably higher, almost awl-shaped *acicula* this species differs by the entirely different, rather fusiform, cylindrical shape, the much higher last whorl, half the total alt., and

the longer aperture, not so much receding below and less widened. The moderately increasing whorls are somewhat convex, the upper margin noticeably thickened, narrowly bordered. The base of the last whorl is very lightly arcuately tapering. The bend of the columella is indistinct, the truncation at its base oblique. The ends of the peristome are joined by a distinct deposit. Length 5, diam. 1.33 to 1.5 mm. (Küester, 1870).

This species was quite unrecognizably described by Jan, but it was redescribed in 1852 by Edoardo de Betta, from specimens received from Jan. I have translated de Betta's description and reproduced his very poor figure. Küester ably discussed the form in 1870, having specimens received from de Betta, and others collected by himself at Triest.

#### 15. *C. PEDEMONTANA* Pollonera.

Differs from *aciculoides* by the less swollen shell, slightly smaller size, spire a little more acute and higher, aperture narrower and the columellar margin less arcuate. Length 6, diam. 1.75 mm. (Poll.).

Italy: drift debris of the Po at Turin; of the Scrivia at Carbonara.

*Cæcilianella* p. POLL., Atti R. Accad. Sci. di Torino, xx, 1885, p. 693.

#### 16. *C. LAUTA* (Paulucci). Pl. 3, fig. 41, 42.

Shell slender, elongate-lanceolate, glassy-hyaline, whitish, polished, glossy. Spire produced, the apex obtuse. Whorls 6, irregularly and rapidly increasing, the first 4 only a trifle convex, the rest a little convex, separated by a duplicated, impressed suture; last whorl larger, slightly more than one-third the total length, not descending. Aperture oblong, angular above; columella curved, truncate, not reaching the base of the aperture. Peristome unexpanded, the outer margin arching forward, margins joined by a thin callus. Length 4.5, diam. 1.5 mm. (Paul.).

Italy: peak of Ronconali.

*Acicula lauta* PAULUCCI, Bull. Soc. Malac. Italiana, xii, 1886, p. 46, pl. 2, f. 4.

17. *C. ACTONIANA* (Benoit). Pl. 2, figs. 20, 21, 22.

Shell oblong-fusiform, slightly swollen, very thin, very glossy, hyaline, corneous-yellowish. Spire turrite-conic, the apex obtuse, suture deep, indistinctly margined. Whorls 5, convex, very rapidly increasing, the last nearly longer than the spire. Columella a little arcuate, very narrowly truncate at the base. Aperture ovate-oblong; peristome simple, unexpanded, acute; margins joined by a thin callus. Length 4, diam. 1.5, aperture 1.5 x 1 mm. (*Ben.*).

Sicily: Around Palermo (*Benoit*).

*Achatina actoniana* BEN., Illustr. Test. estramar. Sicilia, 1862, p. 244 ("pl. 10, f. 8," unpublished). PFR., Monogr., vi, p. 242.—*Cæcilianella a.*, BENOIT, Catalogo, p. 87.—*Cionella a.*, WESTERLUND, Fauna, iii, p. 172.

Figured from specimens received from Benoit, fig. 20 representing the adult, 4.3 x 1.3 mm., figs. 21, 22 the immature form, 3.7 x 1.2 mm. It is very similar to *C. petitiana*, from which it differs in little but the smaller size, in specimens of apparently equal age. It is practically identical with *C. rizeana*, though the mouth may be a thought narrower, in the specimens compared. The Madeiran *C. nyctelia* is conchologically not distinguishable.

Var. *rizeana* (Benoit). Pl. 2, figs. 26, 27. Shell long-fusiform, thin, polished, glossy, hyaline, whitish-buff. Spire tapering-turrite, the apex mamillate; suture impressed, very narrowly margined. Whorls 6, a trifle convex, the first 4 regularly increasing, the last 2 very rapidly descending, the last two shorter than the spire, two-fifths the total length. Columella subarcuate, abruptly and broadly truncate, not reaching to the base. Aperture oblong-acuminate, rather narrow; peristome simple, unexpanded, acute, the margins joined by a rather thick white callus. Length 4.5, diam. 1.75, aperture 2 x 0.75 mm. (*Ben.*).

Sicily: vicinity of Palermo, type loc.; banks of the Simeto, Plain of Catania (Benoit); Province of Syracuse, in debris of the Anapo (Cafici).

*Achatina rizeana* BEN., Illustr. Test. estramar. Sicilia, 1862, p. 245, pl. 8, f. 10.—*Ferussacia r.*, BGT., Rev. et Mag. de Zoöl.

xvi, 1864, p. 211, no. 48.—PFR., Monogr. vi, p. 253.—*Cæcilianella r.* BENOIT, Catalogo, p. 87.—*Cochlicopa r.*, CAFICI, Il. Nat. Sicil. i, p. 204.

From specimens before me from Benoit, this does not seem to differ materially from *C. petitiana* except in being smaller. I have figured a Benoit shell measuring 4.4 x 1.3 mm. There is no noticeable parietal callus nodule or ridge; the outer lip is very strongly, evenly arched forward; and the last whorl descends very obliquely in the middle of its length.

*Var. petitiana* (Benoit). Pl. 2, figs. 23, 24. Shell elongate-fusiform, thin, polished, glossy, hyaline, whitish. Spire conic-turrite, the apex a little obtuse; suture impressed, narrowly margined. Whorls 6, slightly convex, rapidly increasing, the last nearly flat, longer than the spire. Columella subarcuate, abruptly truncate at the base. Aperture lanceolate, narrow. Peristome simple, unexpanded, acute, the margins joined by a very thin callus. Length 5, diam. 1.66, aperture 2 x 0.75 mm. (*Bcn.*).

Sicily: Mt. Bellocampo and Billiemi near Palermo.

*Achatina petitiana* BEX., Illustr. Test. Estramar. Sicilia 1862, p. 247, pl. 8, f. 8.—PFR., Monogr. vi, 242.—*Cæcilianella p.*, BGT., Rev. et Mag. Zoöl. xvi, 1864, p. 212.—Benoit, Catalogo, p. 88.

Several lots, all from Benoit, are before me. The extremely thin hyaline shell has a conspicuously margined suture. The upper part of the spire is slightly contracted. The first whorl increases in width very rapidly, the next  $1\frac{1}{2}$  increase but little; then the width increases rapidly again, the suture descending more obliquely. Its descent is most oblique in the middle of the last whorl, somewhat less so towards its end. The outer lip arches very strongly forward, the greatest convexity being below the middle. The parietal wall has only a thin callous film. The columella is concave, has a callous edge, and is obliquely but quite distinctly truncate at the base. Length 4.3, diam. 1.3 mm.; whorls 5.

17. *C. STEPHANIANA* (Benoit). Pl. 2, figs. 29, 30.

Shell elongate-fusiform, rather solid, polished, milk-white.

Spire conic-turrite, the apex rather obtuse. Suture somewhat impressed, margined. Whorls 6, convex, the last subovate, tapering at the base, longer than the spire. Columella subvertical, calloused, obliquely truncate, not reaching to the base. Aperture ovate-lanceolate; peristome simple, unexpanded, the margins joined by a rather thick callus, right margin arching forward. Length 6, diam. 2, aperture  $2.6 \times 1$  mm. (*Ben.*)

Sicily: Palermo, type loc. Malta, in Mr. H. Vassallo's garden at C. Attard (Caruana-Gatto). Also in Italy, Monte Argentaro (Paulucci).

*Achatina s.*, BENOIT, Illustr. Test. estramar. Sicilia, 1862, p. 246, pl. 8, f. 11.—PFR., Monogr. vi, 241.—*Cæcilianella s.*, BEN., Catalogo, p. 88.—GATTO, The Mediterranean Naturalist, ii, p. 227, 1892 (Malta).—*Aricula stephaniama* PAULUCCI, Bull. Soc. Malac. Italiana xii, 1886, p. 45.

I have not seen this form, which may differ from *petitiama* by its "calloused" columella.

#### 18. *C. INNOVATA* Gregorio.

Shell very small, thin, translucent, fusiform-subnitiform, narrow. Spire short, composed of 3 whorls; last whorl relatively very large, the aperture equal to the spire in length, in this respect differing from *C. tiberiana* Ben. (*Gregorio*).

Sicily: Scordia Denaro, at the Pagliarelli, near Palermo.

*Cæcilianella innovata* de GREGORIO, Il Naturalista Siciliano, xiv, July-Sept., 1895, p. 206.

Numerous Sicilian forms have also been "described," as follows.

*C. spadaforensis* (Benoit). Shell somewhat solid, fusiform, lucid, smooth, whitish; spire of 6 slightly convex whorls, separated by a superficial suture, which with strong magnification is seen to be encircled with a band; apex very obtuse. Last two whorls more than two-thirds the total length. Columella twisted, but hardly truncate. Aperture narrow, long, acutely angular above; peristome simple, acute, the margins joined by a weak callus. Length 7.5, diam. 3 mm. Spadafora, near Messina, Sicily (*Cæcil. s.*, BENOIT, Catalogo, 1881, p. 91).

*C. maretima* (Benoit). Shell somewhat cylindric, lucid,

whitish. Spire of 5 nearly flat whorls separated by a moderate suture, the apex obtuse; last whorl nearly half the total length; columella strongly twisted but scarcely truncate; aperture narrow, acuminate above: peristome simple, acute, the margins joined by a scarcely visible callus. Length 6, diam. 3 mm. Island of Maretimo, near Sicily. (*Ben.*)

*Cæcilianella maretima* BEN., Catalogo etc., 1881, p. 91.

*C. splendens* (Benoit). A fragile little snail, vitreous, smooth and transparent. Spire composed of 5 slightly swollen whorls separated by a superficial suture, the last a little less than half the total length; apex very obtuse; truncation clear-cut and precise, a little above the base. Aperture piriform, lip acute, the margins joined by a callus. Length 5, diam. 2 mm. Sicily: Mt. S. Martino. (*Cæcil. s.*, BENOIT, Catalogo etc., 1881, p. 91).

*C. montana* (Benoit). Shell elongate-cylindric, very fragile, glassy, transparent, clear, rather obtuse at the apex. Spire of 5 rather flat whorls, the last forming about half the length of the shell. Suture superficial, encircled by a narrow whitish band. Columella truncate at about the level of the base. Aperture narrow, long, most acutely angular above; peristome simple, acute; margins joined by an inconspicuous callus. Length 5, diam. 1.5 mm. (*Ben.*)

Sicily: Mt. Petroso, not far from Palermo.

*Cæcil. montana* BEN., Catalogo, 1881, p. 92.

*C. elegans* (Benoit). Shell minute, slenderly fusiform, bright, transparent, whitish. 5 whorls at the spire regularly increasing, little convex, and separated by a moderately impressed suture, the last half the total length. Right margin very straight, the left very arcuate and truncate above the base. Peristome acute, the margins joined by a scarcely visible callus. Length 5, diam. 2.5 mm. (*Ben.*)

Sicily: country around Palermo.

*C. elegans* BEN., Catalogo etc., 1881, p. 92.

#### 19. *C. GATTOI* (Westerlund).

Shell cylindric-turrite, glossy, diaphanous, white, rather dis-  
tantly costulate-striate. Spire slowly tapering from the middle  
of the shell, turrite-conic, rather obtuse. Whorls  $6\frac{1}{2}$ , a little

convex, the upper three rather narrow, last three rather wide, the penultimate slightly larger than the preceding, half as long as the last at aperture; last whorl long, tapering below. Suture slightly impressed, broadly margined, slightly oblique, sub-horizontal at the aperture. Aperture long, narrow, slowly tapering upward, rounded at base, parietal wall and columella short, at the base truncate, lying nearly in a straight line, outer margin vertical, produced in the middle. Length, 6.5, diam. 2, aperture 3 mm. (*Westerl.*).

Malta: Cape Attard, under stones in Uied Encita.

*Cæcilianella gattoi* WESTERL. in GATTO, *The Mediterranean Naturalist*, ii, p. 227, Aug. 1, 1892.—*Cionella (C.) gattoi* WESTERL., *Nachrichtsblatt d. Deutschen Malak. Ges.*, Dec., 1892, p. 195.

#### 20. C. MELITENSIS Gatto.

Shell sub-subulate, slowly tapering almost to the base, rather obtuse, hyaline, striatulate. Whorls 6, scarcely convex, rather slowly increasing, the penultimate slightly longer than the preceding whorl, and about equal to the last. Suture oblique, margined. Aperture about a third the total length, narrowly ovate, rounded at base, shortly acuminate upward; parietal wall almost straightly descending; columella rather more strongly arcuate, truncate below, not reaching to the base. Outer lip strongly arched forward. Length 3.66 to 4, diam. 1.25 mm. (*Westerl.*).

Malta: in flower-pots, gardens, house yards, etc.

*Cæcilianella melitensis* GATTO, *The Mediterranean Naturalist*, ii, p. 227, Aug., 1892.—*Cionella (Cæcilianella) melitensis* Gatto, *in sc.*, WESTERL., *Nachrbl.*, Dec., 1892, p. 196.

#### 21. C. POLLONERÆ Gatto.

Shell subulate, slowly oblong-tapering to the base, slightly obtuse, hyaline, densely striate. Whorls 7, a trifle convex, the upper two minute, the rest elongate, the penultimate and last equal, a little larger than the antepenultimate whorl. Suture very oblique, margined. Aperture one-fourth the total length, outwardly subvertical, strongly sinuate between the slightly convex parietal wall and the thin, short columella

which is slightly truncate at base; the whole outer lip strongly arched forward. Length 4.25, diam. 1 mm. (*Westerl.*)

Malta: in flower-pots on Dr. Ed. Calleja's terrace; also a house yard in Valletta.

*Cæcilianella polloneræ* GATTO, *The Medit. Naturalist*, ii, p. 227, Aug. 1892.—*Cionella* (*Cæcilianella*) *polloneræ* Gatto in *Sc.*, WESTERL., *Nachrbl.* Dec. 1892, p. 196.

“These three *Cæcilianellas* of the group *Aciculina*, sent for determination by the Count Caruana-Gatto, stand nearest to *C. petitiana*” (*Westerlund*).

*Species of Greece and Western Asia.*

Besides the following, *C. l. boettgeri* and *C. jani* have been recorded.

22. *C. TUMULORUM* Bourguignat. Pl. 3, fig. 45.

Shell minute, conic-fusiform, slender, diaphanous, polished, whitish, the apex tapering, obtuse; whorls 6, flattened, parted by a duplicated superficial suture, the last over one-third the total length. Aperture piriform-dilated-oblong; peristome acute, simple, unexpanded, the right margin arching forward; columella a little twisted and arcuate, abruptly truncate and not reaching the base of the aperture; margins joined by a strong callus which bears an almost obsolete tooth-like callosity on the convexity of the penult. whorl. Length 6 to 6.5, diam. 2 mm. (*Bgt.*).

Greece: Megara, in lacrymatories from ancient tombs (type loc.); Piræus, Athens, Syra, etc. (*Hesse*); Crete, Nauplia, Corfu (*Boettger*). Asia Minor: Samsun; Adalia, in Lycia; Adana, in debris of the Sarus river (*Boettger*).

*Cæcilianella t.*, *BGT.*, *Rev. et Mag. de Zoöl.*, viii, 1856, p. 424, pl. 12, f. 15–17; *Amen. Malac.*, i, p. 219, pl. 18, f. 15–17.—*PFR.*, *Monogr.*, iv, 625.—*HESSE*, *Jahrb. D. M. Ges.*, ix, 1882, 331.—*NAEGELE*, *Nachrbl. D. Mal. Ges.*, 1902, p. 8; 1903, p. 176 (Adana, Ciliciæ, in debris of the Sarus river).—*BOETTGER*, *Nachrbl.*, vol. 37, 1905, p. 111.

“Distinguished easily from *liesvillei* by its more pyramidal shell, larger size, more truncate suture and flatter whorls” (*Bgt.*).



23. *C. SUBSAXANA* (Bourguignat). Pl. 3, fig. 50.

Shell very minute, obese-fusiform, very slender, hyaline, polished, whitish; apex very obtuse, whorls  $4\frac{1}{2}$  to 5, subplanulate, parted by a double suture, the last more than half the total length. Aperture narrow, long; peristome acute, simple, unexpanded; right margin somewhat dilated in the middle; columella arcuate, with a callous deposit, and strongly abruptly truncate, not reaching to the base; margins joined by a callus. Length 2.5, diam. 1 mm. (*Bgt.*).

Greece: Megara, in lacrymatories from ancient tombs (A. Gaudry).

*C. subsaxana* BGT., Rev. et Mag. Zoöl. viii, 1856, p. 426, pl. 12, f. 18-20; Amen. Malac. i. 220, pl. 18, f. 18-20.—Achatina s., Pfr., Monogr. iv, 625.

24. *C. OBTUSATA* (Westerlund).

Shell with the lower half fusiform, the upper cylindric. Whorls 5, the first small, depressed, the second large, strongly convex, globose, wider and slightly shorter than the weakly convex third whorl, which is scarcely shorter than the fourth; the last whorl lengthened, narrowed below, half the total length; suture slightly oblique, simple; aperture narrow; outer margin scarcely produced forward; columella somewhat curved, truncate. Length 3.66, diam. 1 mm. (*Westerl.*).

Caucasus: Poti.

*Cionella* (*Cæcilianella*) *obtusata* WESTERL., Fauna iii, p. 181 (1887).

Two specimens were found with *C. liesvillei*. Even if they are not full-grown, the form is distinguishable from all others by its apex.

25. *C. RADDEI* (Boettger). Pl. 3, figs. 46, 47.

Shell suboblong-fusiform, whitish glassy; spire turritid, the apex obtuse. Whorls  $5\frac{1}{2}$ , here and there substriate, very little convex, the penultimate nearly equal to the height of those above; last whorl not distinctly more swollen than the rest, more convex towards the base, three-sevenths the total length. Aperture drop-shaped; columella arcuate, very obliquely,

abruptly truncate at the base; peristome a little arching forward below the middle. Length  $4\frac{1}{2}$  to 5, diam. 1.5, aperture 2.12 to 2.25 mm. long. (*Bttg.*)

Caucasus: Mamutli, type loc.; Borshom, in flotsam of the Kura. Asia Minor: Sarus river drift at Adana; Samsun (*Bttg.*)

*Cochlicopa (Hohenwartiana) raddei* BTTG., Jahrbücher. d. D. Malak. Ges. vi, 1879, p. 25, pl. 1, f. 8; p. 397.—*Cæcilianella acicula* Müll.? Mousson, Coq. Schlaefli, Vierteljahrsschr. Nat. Ges. Zurich viii, 1863, p. 404.—*Cæcilianella (Aciculina) raddei* BTTG., Nachrbl. D. M. Ges. vol. 37, 1905, p. 112.

This species is comparable to *C. jani* de B., having the sharply truncate columella of that, but it does not reach nearly the size—5.5 to 6.75 mm. long, 2.25 to 2.5 wide. *C. jani* has also a much more ventricose last whorl and distinctly more acute apex. (*Bttg.*)

#### 26. *C. TORTA* (MOUSSON).

Aperture at the base a little compressed; columella incurved, terminating in a twisted thread. This species resembles that of Lombardy in general appearance, so that for the time being it may be regarded as a variety of it, characterized by having the aperture slightly contracted towards the base, and the columella abruptly truncate. The single example, taken at Sayda, is not sufficient to establish well these differences. (*Mousson*).

Syria: Sayda (Prof. Bellardi).

*Glandina (?) aciculoides* Jan., var. *torta* MOUSS. Mittheilungen der Naturforsch. Ges. in Zurich, iii, No. 103, 1854, p. 395, No. 15.—*Cæcilianella syriaca* BOURGUIGNAT, Rev. et Mag. de Zool., 1856, p. 429, based solely upon Mousson's description.

A form of doubtful status. It was quite unnecessarily re-named by Bourguignat.

#### 27. *C. MICHONIANA* Bourguignat. Pl. 3, figs. 48, 49.

Shell minute, oblong, fragile, glossy, transparent, glassy, smooth. Spire short, tapering-acuminate, the apex a little obtuse. Whorls 6, a little convex, irregularly increasing, the first minute, last large, separated by a somewhat impressed, duplicated suture; last whorl slightly convex, more than half

the total length. Aperture oblong, acutely angular above, somewhat dilated below; columella straight, truncate at the base, the outer lip strongly arched forward, margins joined by a callus. Length 5.5, diam. 2 mm. (*Bgt.*).

Around Jerusalem, under stones, type loc.; Adana Cilicia, in S.-E. Asia Minor.

*Ferussacia michoniana* BGT., Rev. et Mag. Zoöl. xvi, 1864, p. 197, pl. 18, f. 17-20; Moll. nouv., litig., etc., p. 115, pl. 19, f. 17-20.—Pfr., Monogr. vi, 197.—*Cæcilianella* (*Aciculina*) *michoniana* Bgt., BTRG. Nachrbl. d. D. Malak. Ges. vol. 37, 1905, p. 113.

Boettger remarks that this species is an *Aciculina* (= *Cæcilioides*), not a *Hohenworthia*, and is distinguished by its especially regular fusiform shape. Two specimens from Adana measure, alt. 6, diam. 2 mm. and alt. 4, diam. 1.37 mm.

#### 28. C. JUDAICA Mousson.

A little larger [than *tumulorum*]; whorls slightly convex; the the parietal wall not calloused, but the columella slightly thread-margined at the end. Length 7 mm. (*Mousson*, 1861).

*Glandina tumulorum* Bourg. var. *judaica* Mouss., Coq. terr. et fluv. rec. par Mr. le Prof. J. R. Roth dans son dernier voyage en Palestine, 1861, p. 53.—*Ferussacia judaica* BGT., Malac. de l'Algerie ii, p. 33; Rev. et Mag. Zoöl., 1864, p. 211.—*Acicula* (*Cæcilianella*) *judaica* Bgt., MOUSSON, Journ. de Conchyl. xxii, 1874, p. 15.

Differs from *tumulorum* Roth by the feebly convex whorls separated by a margined suture, the last whorl comprising two-fifths of the total length; by the parietal wall being without any callus, the outer margin not divergent, finally by the columella which is obliquely truncate a little way above the base, and bordered with a thread. The largest individuals are 7 mm. long (*Mousson*, 1874).

#### 29. C. MINUTA (Mousson). Pl. 3, figs. 54, 55, 56.

Shell small, cylindrical-subfusiform, fragile, smooth, glossy, subhyaline. Spire accelerate, a little convexly conic, the apex stout, obtuse; suture slightly impressed, simple; whorls  $4\frac{1}{2}$ , more

and more descending, convexly flattened, the last half the total length, elongate, cylindric in the middle, shortly tapering below. Aperture vertical, very narrow; outer margin straightly descending, slightly arching forward, curving into the columella below. Columella long, slightly excavated, abruptly, obliquely truncate below, slightly margined with a delicate thread. Length 4, diam. 1.2 mm.

Mesopotamia: drift debris of the Euphrates (type loc.), and of the Sarus river near Adana, S.-E. Asia Minor.

*Acicula* (*Cæcilianella*) *minuta* MOUSS., Journ. de Conchyl. 1874, p. 39.—*Cæcilianella* (*Aciculina*) *minuta* BOETTGER, Nachrichtenblatt D. Malak. Ges. 1905, p. 112, pl. 2 A, f. 4 a-d.

According to Mousson, there are fewer whorls than in *C. acicula*; the apex is larger and more obtuse, the last whorl is more cylindric, and the remarkably narrow aperture has the free margin descending in a straight line curving towards the end of the columella and without surpassing it. The columella is but slightly concave and is obliquely truncate at the base.

The figures are copied from Boettger, and represent specimens from the drift of the Sarus river, where this species is common. He remarks that the examples vary quite noticeably in size but normally it is 4 to 4.5 mm. long, 1.12 to 1.25 mm. wide. A relative is *C. subsaxana* Bgt., which perhaps may be a young form of the same species.

### 30. *C. PRÆCLARA* Westerlund.

Shell long-cylindric, very slender, very glossy, very smooth, hyaline, glassy, the spire much produced, a little obtuse. Whorls  $6\frac{1}{2}$  to 7, a little convex, the antepenultimate scarcely twice the length of the preceding, the penultimate one-third the total length, flattened dorsally, slowly tapering downwards; suture a little impressed, conspicuously and narrowly margined, deeply descending in the middle and below. Aperture long piriform, acutely angular above, retuse below, parietal margin long, straightish; columella short, a little arcuate, abruptly truncate at the base. Peristome unexpanded, acute, simple, the outer margin strongly arching forward in the middle, receding at base. Length 5 to 5.5, diam. 1 mm. (*Westerl.*)

Turkestan: Totkaul (Kasnakow, in Zoöl. Mus. St. Petersburg).

*Cæcilianella (Aciculina) præclara* WESTERL., Annuaire Mus. Zoöl. Acad. Imp. Sci. St. Petersburg, iii, 1898, p. 176.

31. *C. RETTERI* Rosen.

Shell fusiform, slender, whitish-glassy, pellucid, the apex obtuse; whorls 5, very slightly convex, the penultimate nearly as long as those above it; aperture drop-shaped; columella arcuate; peristome a little protracted below the middle. Length 4.5 to 4.75, diam. 1.25, alt. aperture 1.75 mm. (*Rosen*).

Central Asia: Aman-Kutan.

*Cæcilianella retteri* ROSEN, Nachrbl. d. D. Malak. Ges. vol. 35, Dec. 1903, p. 181.—ROSEN Moskva Izv. Obsc. liub. jest. Dnevn. Zoöl. iii, 3, 1901.

*Species of South and N.-E. Africa and Arabia.*

32. *C. ADVENA* Ancey.

Shell slender, imperforate, tapering-subfusiform, diaphanous, polished, whitish-hyaline. Spire long-subconic, the apex obtuse. Whorls a little more than 5, subconvex, separated by a well impressed and delicately margined suture, flattened in the middle, the first two regularly, lower whorls more rapidly increasing, the suture there being more oblique; last whorl more than one-third the total length of the shell; the sides convex beyond the middle, tapering at the base. Aperture long, piri-form, subvertical, in the middle of the parietal wall distinctly angularly thickened within. Columella below the angle broadly arcuate, obliquely truncate at base. Peristome simple, unexpanded, acute, the outer margin arcuately produced forward, basal margin receding; margins remote, joined by a distinct callus. Length 4.33, diam. 1.25, aperture 1.5 x 0.66 mm. (*Anc.*)

S.-W. Africa: Disappointment Key, Ovampoland ("Luderitzland," or Damara).

*Cæcilianella advena* ANCEY, Le Naturaliste x, 1888, p. 215. "This Cecilianelle resembles some of those known as inhabitants of temperate Europe and North Africa, without being assignable to any of them."

33. *C. OVAMPOENSIS* (Melvill & Ponsonby). Pl. 3, fig. 52.

Shell small, acicular, white, very thin, the apex obtuse. Whorls 4, the last produced; columella truncate at the base. Aperture oblong, the lip simple. Length 3, width 1 mm. (*M. & P.*).

South Africa: Ovampoland (E. L. Layard).

*Cionella ovampoensis* M. & P., Ann. and Mag. Nat. Hist. 6th Ser., ix, p. 91, pl. 6, f. 1 (January, 1892). A very elegant, pure white, four-whorled shell, with very obtuse apex, a little recalling the *Cæcilianella acicula* (Müll.) of Europe and the British Isles.—(*Mel. & Pons.*).

34. *C. MUNZINGERI* (Jickeli). Pl. 3, fig. 53.

Shell imperforate, subulate, thin, glossy, hyaline, whitish, longitudinally striated under the lens. Whorls 8, subinflated, separated by a rather deep oblique suture, the last whorl descending, one-fourth the total length. Aperture oblique, vertically piriform; columella arcuate, very obliquely truncate; lip acute, thin. Length 9.5, diam. 1.75, aperture 2 x 1.33 mm. (*Jick.*).

Abyssinia: Beniamer, banks of the Falkat and in Habab, descending from Nakfa; in the earth at roots of plants. (*Jickeli*). Mt. Abouna Yousef, at 4000 meters elevation (*Raffray*).

*Stenogyra munzingeri* JICK., Malak. Blatter xx, 1872, p. 103.—*Acicula munzingeri* JICK., Fauna der Land und Süßwasser-Mollusken N.-O.-Afrika's, in Nova Acta Acad. Cæs. Leop.-Carol. Germ. Nat. Cur. xxxvii, Dresden 1875, p. 133, pl. 2, f. 3 (teeth and jaw), pl. 5, f. 21 *a, b*, (shell).—*Subulina m.*, Bgt. Malacologie de l'Abyssinie p. 82, pl. 9, f. 65-67.

Bourguignat has referred this species to *Subulina*, whether correctly or not I do not know. His figures of the form taken by Raffray show the sutures much less oblique than in Jickeli's figures.

35. *C. SOLEILLETI* Bourguignat. Pl. 3, fig. 51.

Shell lanceolate-elongate, needle-like, diaphanous, very fragile, whitish, polished; spire very long, a little obtuse at the summit, whorls 6, regularly and rather rapidly increasing, the

first two are scarcely convex, not increasing in diameter, but cylindrical like a pillar; the rest are convex; separated by an impressed suture, last whorl ovate-convex, less than one-third the total length. Aperture very oblique, ovate, angular above, peristome unexpanded, acute; columella short, truncate. Length, 7, diam. 2, aperture 2 x 1 mm. (Bgt.)

East Africa: wooded valley of Bidaro, Choa, southern Ethiopia (*Soleillet*).

*Cæcilianella* s., BGT., Mollusques terrestres et fluviatiles recueillies par M. Paul Soleillet dans son Voyage au Choa (Ethiopie méridionale), Sept. 1885, p. 22, pl. (1), f. 10.

Remarkable for its cylindrical two upper whorls.

36. *C. isseli* (Paladilhe). Pl. 3, fig. 57.

Shell imperforate, subconic-cylindric, glossy, nearly smooth, subpellucid, ivory white (in dead shells); spire tapering upward, the apex rather obtuse; whorls 6, slightly convex as though twisted, rapidly increasing, parted by a narrow, impressed suture, the penultimate whorl large in front, the last whorl a little larger, scarcely one-third the total length, somewhat ascending at the aperture, the free margin a little arcuate. Aperture subpiriform, a little oblique, angular above at the insertion of the lip; peristome unexpanded, fragile, acute; columella short, slightly arcuate, broadly and distinctly truncate at the base; outer margin broad, nearly straight, basal slightly arcuate; margins subparallel, joined by a thin callus. Length 5, diam. 1.5 mm. (*Palad.*).

Aden.

*Cæcilianella isseli* PALAD., Annali Mus. Civ. Genova iii, 1872, p. 22 (probably not the figures).

“By its slim shape, approaching the cylindrical, its more twisted whorls, deeper suture and the appearance of the aperture, *C. isseli* is distinguished from all of its congeners of the Alpic center.”

Paladilhe probably had two species mixed in his lot of *C. isseli*. The description is that of a *Cæcilioides*, possibly identical with Nevill's second species (Handlist Ind. Mus. p. 162), and with *A. balanus* of Hanley and Theobald (Conchologia

Indica, p. 41, pl. 102, f. 10, copied in my fig. 61 of plate 4); while the figure given by Paladilhe, which I have copied, seems to belong to *C. (Geostilbia) balanus*. Further investigation of the *Cæcilioides* of Aden and India is much needed. Whether the observed differences in the columella indicate several species, or are extreme aspects of variation in a single stock, are questions I can throw no light upon.

*Species of tropical Asia, West Indies, etc.*

Tropical countries have a few species of *Cæcilioides* of two groups: (1) the group of *C. iota*, comprising *very minute* species 1.6 to 2.5 mm. long, *markedly cylindric*, with the whorls nearly flat. All are American. (2) the group of *C. gundlachi*, with the shell larger, usually 3 to 5 mm., composed of convex, very obliquely coiled whorls. The columella is only quite obsoletely truncate. These groups are known as *Cæcilianopsis* and *Geostilbia*.

Section CÆCILIANOPSIS Pilsbry.

*Cæcilianopsis* PILS., Nautilus xxi, July, 1907, p. 28, for *C. jod* = *C. consobrina veracruzensis*.

Minute (1.6 to 2.5 mm. long), cylindric-oblong, the spire short, wider than in *Cæcilioides*. Columella varying from abruptly truncate to very obsoletely so. Tropical American. Type *C. consobrina veracruzensis*.

37. *C. IOTA* (C. B. Adams). Pl. 4, figs. 67, 71, 72.

Shell minute, slender, corneous; whorls 4, very wide, smooth; aperture long, very acute above; columella arcuate. Divergence 12 degrees; length of spire .08, total length .135, width .045 inch. (*Ad.*).

Jamaica (C. B. Adams): Bellevue, (Gloyne, in Swift Coll.); Yallahs (Gloyne).

*Achatina iota* C. B. AD., Proc. Bost. Soc. N. H. 1845, p. 13.—PFR., Monogr. ii, 295; iii, 506; iv, 626; vi, 241; viii, 297; Conchyl. Cab. p. 355, pl. 29, f. 18, 19 (bad).—GLOYNE, Journ. de Conchyl. xx, 1872, p. 32.

The type lot at Amherst consists of three specimens. It is a



subcylindric shell, obtuse at both ends, of scarcely four whorls in most examples,  $4\frac{1}{2}$  in the longest. The shell is clear corneous when fresh, showing the internal walls through, but it weathers to milky white. The whorls are only slightly convex, and are separated by a moderately impressed suture, margined below. The suture is at first nearly horizontal, but at the last  $1\frac{1}{2}$  or 2 whorls it descends rapidly, the width of the whorl progressively increasing. The aperture is acuminate above. Outer lip arches very strongly forward. The columella is more or less concave below, and is rather abruptly truncate above the base. Columellar callus usually moderate, but variable in thickness. Under a high power, an extremely minute spiral striation may be seen near the base. Measurements are as follows:

Cotype, Adams coll.: length 1.75, diam. .5 mm.

Bellevue; fig. 72: length 2, length aperture 0.8 mm.

Fig. 71: length 2, diam. 0.6, aperture 0.75 mm.

Fig. 67: length 1.65, diam. 0.5, aperture 0.75 mm.

*C. iota* has been found only in Jamaica. It is readily distinguished from other tropical-American species by its much narrower contour. Exact measurements which I have made of a large number of specimens from several localities show the difference in shape to be constant.

Pfeiffer's figure of this species in the *Conchylien Cabinet* is very poor. It shows no columellar truncation, and hence *C. iota* was classed by Crosse and others in *Geostilbia*. Adams's type specimens, as well as numerous examples before me, have a distinctly truncate columella.

### 38. *C. CONSOBRINA* (Orbigny). Pl. 5, figs. 81, 82.

Shell oblong-fusiform, subcylindric, pellucid, glossy, white; spire of nearly equal diameter to the end, very obtuse. Whorls 5, very slightly convex, the last oblong. Aperture ovate-oblong; columella twisted, truncate. Length 2, diam.  $\frac{2}{3}$  mm. (*Orbigny*).

Cuba: in the interior (Sagra); coffee plantation *Fundador* near Matanzas among dead leaves (Gundlach, type loc. of *A. pygmaea*).

*Achatina consobrina* ORBIGNY, *Historia fisica, politica y natural de la isla de Cuba*, v, Moluscos, p. 89, pl. xi bis, f. 10, 11, 12,

erroneously lettered *A. michaudiana* on plate (1845); French edit. i, p. 170.—*Achatina pygmæa* PFR., Zeitschr. f. Malak. 1847, p. 148; Monogr. ii, 275; iii, 506; iv, 627; vi, 241; Conchyl. Cab. p. 356, pl. 29, f. 22, 23.—*Cæcilianella pygmæa* Pfr. ARANGO, Fauna Malac. Cubana, p. 99.

This species is closely related to *C. iota*, from which it differs by the stouter, more robust figure, specimens of the same length being invariably wider than *iota*. The general shape is slightly tapering cylindrical, very obtuse at the ends. The whorls increase a little more regularly than in *iota*, the last turn of the suture being less oblique, though descending faster than the preceding one. This acceleration of the rate of descent changes the appearance of the shell and the proportionate size of aperture to total length with age, so that the addition of a whorl or even less alters the contour remarkably. The surface is lightly marked with growth-wrinkles and minute engraved spiral lines, visible only under a compound microscope. The columellar truncation is distinct, but rather weak in some examples. Two specimens from a lot taken by Gundlach are figured.

Pl. 5, fig. 82: length 2.4, diam. 0.8 mm.

Pl. 5, fig. 81: length 1.9, diam. 0.7 mm.

The former of these examples corresponds to the type of *A. pygmæa* Pfr.; the latter, a younger shell, agrees with Orbigny's type of *A. consobrina*. In my opinion these two names apply to one and the same species, in slightly different stages of growth. Pfeiffer's description of *A. pygmæa* follows.

"*A. pygmæa* Pfr. Shell cylindrical, smooth, pellucid hyaline, the apex rather obtuse. Whorls 5, rather flattened, separated by an oblique, lightly impressed suture, the last  $\frac{2}{3}$  the total length. Columella nearly straight, forming an angle with the belly of the preceding whorl, subtruncate at the base of the oval-elliptical aperture; peristome acute, the right margin dilated forward. Length 2.25, diam.  $\frac{2}{3}$  mm.; aperture  $\frac{2}{3}$  mm. long." (Pfr.)

Var. *veracruzensis* (Crosse & Fisher). Pl. 5, figs. 76, 77, 78, 79. In this form the microscopic spiral striation is more distinctly developed than in *consobrina*, visible from the suture to the base, the striæ appearing crimped or waved (fig. 79). There is no other difference. Specimens measure:

Pl. 5, fig. 76: length 2.1, diam. 0.75, aperture 0.95 mm. (*Vera Cruz*.)

Pl. 5, fig. 77: length 1.9, diam. 0.75, aperture 0.9 mm. (*Vera Cruz*.)

Pl. 5, fig. 78: length 2.35 mm. (*Tampico*).

Eastern Mexico: on the strand, among debris drifted out of the Antigua river after heavy rains (Strebél); drift debris along the Panuco river, Tampico (A. A. Hinkley).

*Achatina iota* Adams, STREBEL, Beitrag Mex. Land u. Süswasser Conch. ii, 1875, p. 53, pl. 13, f. 50. Not of C. B. Adams.—*Cæcilianella veracruzensis* C. et F., Journ de Conchyl. xxv, 1877, p. 273; Moll. terr. et fluv. Mex., p. 591, pl. 26, f. 4.—MARTENS, Biologia, Moll., p. 324.—*Cæcilioides* (*Cæcilianopsis*) *jod* PILS. Nautilus xxi, p. 28, July, 1907 (Tampico).

The figures represent an older (fig. 76) and a younger (fig. 77) shell, from Vera Cruz, the type locality. Also an old shell (figs. 78, 79) from Tampico, representing the absolutely synonymous form I called *C. jod*.

In recognizing the Mexican specimens as a race distinguishable from the Cuban form, I am probably placing too much dependence upon a slight variation in microscopic sculpture. I merely give the facts observed for what they may be worth.

Var. *minutissima* (Guppy). Pl. 4, fig. 68; pl. 5, figs. 80, 84. "A very minute, glassy, hyaline, smooth, shining, fusiformly cylindrical, shell with 5 whorls, of which the last forms more than half the length of the shell, spire short, with obtuse apex. Aperture elongate-oval, narrow above, wide below; outer lip simple; columella scarcely truncate, passing into a white callus which connects the ends of the peristome. Length 2, diam .75 mm." (*Guppy*).

Trinidad: Amongst dead leaves at Maraccas (Guppy, type loc.). St. Vincent, in dry forest, leeward side, at 1000 ft. (H. H. Smith). Barbados (L. B. Brown).

*Glandina minutissima* GUPPY, Proc. Scient. Asso. Trinidad, 1869, p. 239.—CROSSE, Journ. de Conchyl. 1890, p. 36, pl. 2, f. 1.—*Oleacina* (?) *minutissima* PFR., Monogr. viii, p. 326 (1877).—*Geostilbia minutissima* GUPPY, Journ. of Conch. vii, 1893, p. 211.—*Cæcilioides minutissima* E. A. SMITH, Proc.

Malac. Soc. Lond. i, p. 308 (St. Vincent).—*Cæcilianella m.*, BROWN, J. of Conch. x, 1903, p. 269 (Barbados).

Crosse has very inadequately figured *minutissima*, and I have copied his figure, pl. 5, fig. 80. Figure 84, pl. 5, and fig. 68 of pl. 4, represent what I take to be Guppy's species from Barbados. The general form is as described for *pygmæa*; but the surface is smoother than in Cuban or Mexican shells, spiral lines being scarcely visible under the compound microscope except at the base. The columellar truncation is rather weak. Two specimens measure: Length 2.05, diam. .7 mm., whorls 5. Length 2.15, diam. .8, aperture 9 mm.; whorls 5.

With these specimens were others resembling them except that the columella is very strongly truncate at the base (pl. 5, figs. 83, 85) at all stages of growth. These may represent another species, yet I am unable to satisfactorily separate the series. The two examples figured measure: length 2, diam. .7 mm. (fig. 83); length 2.3, diam. .75 mm., whorls  $5\frac{1}{2}$  (fig. 85).

*Geostilbia mazei* seems to me to be identical with *minutissima*. The original description follows.

*Geostilbia mazei* 'Crosse' Maze. Pl. 5, fig. 75. "Shell imperforate subcylindric, very thin, smooth, crystalline, hyaline unicolorous; spire rather long, the apex somewhat obtuse; suture impressed. Whorls  $4\frac{1}{2}$ , slowly increasing, the last a little shorter than the spire, rounded at the base. Aperture piriform; peristome simple, the margins thin. Length 2.5, diam.  $\frac{2}{3}$  mm. Animal of a yellow color" (*Maze*).

Guadeloupe: Vieux-Fort, southeastern slope of the Morne Houelmont at about 270 meters (E. Marie).

*Geostilbia mazei* Crosse Mss., MAZE, Journ. de Conchyl. xxxi, 1883, p. 7, pl. 1, f. 2.

39. C. BLANDIANA Crosse. Pl. 4, fig. 64.

Shell imperforate, long-fusiform, very thin, polished, very transparent, hyaline. Spire rather long, the apex obtuse, rounded; suture impressed. Whorls  $4\frac{1}{4}$ , a little convex, the last shorter than the spire, rounded at base. Aperture subpiriform; peristome simple, the margins joined by an inconspicuous, very thin callus; columellar margin slightly thickened,

having an appearance of truncation, which does not really exist; hardly reaching to the base; basal margin rounded; outer lip arching forward, subacute. Length 2, diam. 0.66 mm. (*Crosse*).

Brazil: Soure, on the island of Joannes or Juanes, in the mouth of the Amazon, Province of Para.

*Geostilbia blandiana* CROSSE, Journ. de Conchyl. 1880, p. 149 1886, p. 137, pl. 1, f. 4.

The figure of this species, which I have copied, represents the spire as far more tapering than in *C. iota* or *C. consobrina*. Whether this figure is approximately correct or not I am unable to say.

#### Section *Geostilbia* Crosse.

*Geostilbia* CROSSE, Journal de Conchyl. 1867, p. 184, type *G. caledonica* Crosse.

The shell is similar to *Cæcilioides* except in having the columella continuous with the basal lip, being separated therefrom only by a slight sinuation, not an abrupt truncation. Type *G. caledonica*.

The number of valid species of this group is uncertain, but several of them surely stand close to *C. gundlachi*. *C. baldwini*, *C. balanus* and *C. mauritiana* are doubtfully distinct.

40. *C. GUNDLACHI* (Pfeiffer). Pl. 4, figs. 73, 74.

Shell subulate, acicular, glossy, clear-greenish; spire slender, the apex a little acute; suture deep, margined. Whorls 5, rather convex, the last slightly over one-third the total length. Columella slightly arcuate, shortly truncate above the base of the narrow, angularly oval aperture; peristome simple, the margins joined by a thin callus, the right margin arching forward. Length 5, diam. 1.33, aperture 1.75 x .66 mm. (*Pfr.*).

Cuba: Havana, Guanajai and Guantanamo (Gundlach); near Cienfuegos. Jamaica. Haiti: Port-au-Prince and Les Cayes. St. Thomas (Bland). St. Martin. Guadeloupe. Barbados. Demarara (Swift coll.). Princeton, New Jersey (A. D. Brown). St. Helena (Benson).

*Achatina gundlachi* PFR., Zeitschr. f. Malak., 1850, p. 80; Conchyl. Cab., *Bulimus*, p. 358, pl. 29, f. 10, 11; Monogr., iii, 505; iv, 623; vi, 239; viii, 294.—*Geostilbia gundlachi* CROSSE,

Journ. de Conchyl., xxi, 1873, p. 355 (Haiti); 1874, p. 88; 1890, p. 23, 250; 1891, p. 151.—BINNEY and BLAND, Ann. Lyc. N. H. of N. Y., xi, 1875, 152, 185, pl. 13, f. D, G, H, I.—MAZE, Journ. de Conch., 1883, p. 7, pl. 1, f. 1 (Guadeloupe).—CROSSE et FISCHER, Miss. Sci. Mex., Mollusques, i, p. 587, pl. 28, f. 14, 15 (copied from Binney).—*Cæcilianella gundlachi* BINNEY, Ann. N. Y. Acad. Sci., iii, p. 101, pl. 16, f. F, G (jaw), pl. 7, f. F (teeth). ARANGO, Fauna Mal. Cubana, p. 99.—BROWN, Journ. of Conch., x, 270 (Barbados).—*Macrospira aperta* Guild., Swainson, Lardner's Cabinet Cyclopedia, Malacology, 1840, p. 335, figs. 97 e, f (p. 333).—*Geostilbia aperta* E. A. SMITH, Proc. Malac. Soc. Lond., i, 1895, p. 307 (St. Vincent); P. Z. S., 1892, p. 269 (St. Helena).—*Achatina veru* BENSON, Ann. Mag. N. H., xviii, 1856, p. 435.—WOLLASTON, Testacea Atlantica, p. 545.

Pfeiffer's description of this shell is not very good. It tapers regularly to the very obtuse, rounded apex. There are 5 whorls, very obliquely coiled, quite convex, and parted by impressed sutures. The last whorl is evenly convex. The aperture is ovate, effuse at the base; the outer lip arches forward strongly in the middle. The columella is a little concave, and near the base is obsoletely truncate. It has a rather heavy callus in most fully adult shells, which passes up over part of the parietal wall. The color is pale corneous-brown, or sometimes almost clear corneous. There is no spiral striation. Two Cuban examples figured measure: Length 4.2, diam. 1.25 mm. Length 3.85, diam. 1.1, apert 1.3 mm. The figures do not well show the heavy callus upon the columella and lower part of the parietal wall.

This is a somewhat common and widely distributed species, probably to be found throughout the Antilles. It was taken many years ago in Princeton, N. J., no doubt imported with West Indian plants. These specimens were reported as *C. acicula* in Binney's "Manual." It occurred also in St. Helena, though whether it still survives there is unknown.

The New Caledonian *Geostilbia caledonica* is in all probability the same species, a colony having been derived from Guadeloupe or some other Antillean source. At all events I am quite

unable to see any difference in the shell. The original description follows.

*G. caledonica*: Pl. 4, figs. 58, 59, 62.. "Shell imperforate, fusiform-cylindric, thin, polished, diaphanous, clear-corneous. Apex abruptly rounded, very obtuse; suture hair-marginate; whorls 4, slightly convex, the last slowly descending, slightly more than half the total length. Aperture long-piriform; peristome simple, unexpanded, thin, not acute, slightly thickened, the margins joined by a very thin callus; columellar margin having a longitudinal, small, diaphanous, glossy internal lamina giving the appearance of a basal truncation, not reaching the base. Basal margin broadly rounded; right margin arching forward. Length 3.5, diam. 1 mm." (*Crosse*).

New Caledonia: Noumea, common in gardens, living in damp places under dead leaves, old wood and on the ground (*E. Marie*).

*Geostilbia caledonica* CROSSE, Journ. de Conchyl. xv, 1867, p. 186, pl. 7, f. 4; 1894, p. 301 (p. 144 of separate copies, Faune Malac. N. Caléd.)—GASSIES, Faune Conch. Nouvelle-Calédonie ii, 1871, p. 96, pl. 4, f. 4.—PFR. Monogr. vi, p. 244.

Two specimens from Noumea are drawn in figures 58, 59, 62, pl. 4. They measure 3.7 x 1.2 mm., and 3.1 x 1 mm.

*Macrospira aperta* Guilding has never been described. Too poor and dissimilar outline figures were given with this name by Swainson, without locality, dimensions, or any other particulars. In 1892 Mr. E. A. Smith stated that *A. gundlachi* and *veru* were equivalent to *aperta*; and in 1895 he identified *Geostilbia caledonica* Crosse as a synonym of *Megaspira* (*sic*) *aperta*, from the comparison of specimens in the British Museum. In my opinion, *M. aperta* was not sufficiently defined by Swainson to be recognized. Its identity with *C. gundlachi* rests upon Mr. Smith's identification of specimens from Guilding, the locality of which is surmised to be the West Indies, but is not positively known. No description of even these specimens has appeared, and Swainson's figures are extremely crude.

#### 41. C. BALDWINI Ancey.

Shell imperforate, very thin, whitish-hyaline or slightly corneous, diaphanous, glossy, polished; apex large, obtuse; spire

slender, subcylindric but tapering. Whorls  $4\frac{1}{2}$ , regularly increasing, separated by a very oblique, impressed suture margined with a pellucid line; last whorl oblong, larger. Aperture piriform, the right margin arching forward; peristome simple, acute, scarcely thickened, the margins joined by a rather opaque callus. Columella somewhat callous, very slightly truncate above the base. Basal margin rounded. Length 3.75, diam. 1, aperture alt. 1 mm. (*Ancey*).

Hawaiian Is.: Manoa, Oahu (Baldwin).

*Cæcilianella baldwini* ANC., Memoires Société Zoologique de France, v, 1892, p. 718.

Specimens of presumably this species are in the Bishop Museum at Honolulu from the following places: Rocky Hill, Honolulu; Kanaohe, Oahu; Mana, Hawaii. I have no examples at hand, but so far as the description goes there seems to be no difference between this species and *C. gundlachi*.

42. *C. BALANUS* ('Benson' Reeve). Pl. 4, figs. 60, (61?)

Shell cylindrically oblong, somewhat fusiform; whorls 4, smooth, shining; apex obtuse; columella arched, truncated; aperture small. Dull white. (*Reeve*).

Shell almost cylindric-aciculate, smooth, glassy-clear. Spire almost cylindric, slightly tapering above, with an obtuse apex; suture very little impressed. Whorls 4, rapidly increasing, the last forming two-fifths the total length, dilated basally. Columella rather straightly receding, scarcely noticeably truncate at the base of the broadly angular-ovate aperture. Peristome simple, unexpanded, acute. Length 3, diam. hardly 1 mm. (*Pfr.*, from spec. from Benson's collection).

India: Banks of the Jumna near Hameerpore, Bundelkund (type loc.); border of the desert south of Hawee; Agra, on the right bank of the Jumna (Benson); Kattiwari (Hanley). Decan and Sind (Ind. Mus.). Aden (Paladilhe, *C. isseli*).

*Achatina balanus* Benson MSS., REEVE, Conch. Icon., v, pl. 20, f. 109 (March, 1850).—PFR., Monogr., iii, 506; iv, 627; vi, 241; Conchyl. Cab., p. 315, pl. 25, f. 18, 19.—HANLEY and THEOBALD, Conchologia Indica, p. 41, pl. 102. f. 10 (?).—BLANFORD, Journ. Asiatic Soc. Bengal, vol. 44, 1875, pp. 43,



46.—*Cæcilianella* (*Geostilbia*) *balanus* Bens., NEVILL, Handlist Ind. Mus., p. 162.—(?) *Cæcilianella isseli* PALAD., Annali Mus. Civico Genova, iii, 1872, pl. 1, f. 9, 10.—*Acicula i.*, JICKELI, Moll. N.-O. Afr., p. 135.—PFR., Monogr., viii, p. 297.

I have not seen this species, which seems to be rather common in the higher, dry parts of India, and to be known chiefly by river-drift specimens. Pfeiffer's description and the figures of Reeve and Pfeiffer indicate a shell with only weakly-truncate columella, so that one understands why Colonel Beddome should compare *Geostilbia caledonica*, (which he states is identical with Indian specimens from North Canara, see Blanford, *l. c.*). Nevill also refers the species to *Geostilbia*. In his description of *C. isseli*, Paladilhe mentions emphatically its truncate columella; yet his figure seems to represent a *Geostilbia* very close to *balanus*. Blanford has stated that *isseli* is identical with *balanus*; but so far as I can judge from the literature, there are two species involved. Fig. 60 is copied from Reeve's type figure. I have also copied the figure given in *Conchologia Indica*, pl. 4, fig. 61. By its strongly truncate columella, this figure seems to correspond with the description of *C. isseli*.

43. *C. MAURITIANA* (H. Adams). Pl. 4, fig. 69.

Shell imperforate, subulate-cylindric, thin, hyaline, glossy, spire subcylindric, the apex very obtuse, suture impressed. Whorls 5, rather flattened, the last dilated at the base; columella arcuate, slightly truncate. Aperture acuminate-oval; peristome simple, unexpanded, acute. Length 4, diam 1, aperture 1.33 mm. (*H. Ad.*).

Mauritius: Ponce Mt. Malé and Silhouette, Seychelles (G. Nevill).

*Acicula mauritiana* H. AD., P. Z. S. 1868, p. 290, pl. 28, f. 7.—PFR., Monogr. viii, 295.—*Cæcilianella m.*, MARTENS in Möbius, Reise nach Mauritius p. 199.—NEVILL, Handlist moll. Ind. Mus. p. 163.

This does not seem to differ materially from *gundlachi*.

44. *C. COMORENSIS* (Morelet). Pl. 4, fig. 63.

Shell imperforate, turrite, thin, hyaline, smooth; spire long, the apex rounded, obtuse. Whorls 6, plano-convex, subscalar,

with a well-impressed suture, the last whorl one-third the total length. Aperture piriform, the outer margin simple, unexpanded; columellar margin dilated, reflexed, appressed, making an angle with the basal margin. Length 4, diam. 1.25 mm. (*Crosse*).

Comoro Is.: Combani, Mayotte (Marie).

*Geostilbia comorensis* MORELET, Journ. de Conch. 1883, xxxi, p. 196, pl. 8, f. 7.

Differs from *G. mariei* by its more slender shape, with longer spire of two more whorls, and a shorter aperture.

45. *C. MARIEI* (*Crosse*). Pl. 4, figs. 65, 66.

Shell imperforate, subcylindric, thin, polished, diaphanous, hyaline, whitish. Spire rather long, the apex abruptly rounded, very obtuse; suture impressed. Whorls scarcely 4, nearly flat, slightly convex, the last very little descending, shorter than the spire. Aperture regularly elongate-piriform, colored within like the outside. Peristome simple, whitish, the margins joined by a thin callus. Columellar margin somewhat thickened, having an appearance of truncation, hardly reaching to the base; basal margin rounded; outer arched forward, subacute. Length 3, diam. 1 mm. (*Crosse*).

Nossi-be Island: Calempo (E. Marie, type loc.); Mayotte, Comoros (Marie).

*Geostilbia mariei* CROSSE, Journ. de Conchyl. 1880, p. 149; 1881, p. 200, pl. 8, f. 5; 1883, p. 195; in Grandidier's Hist. Madag., Mollusques, pl. 19, f. 8.

This form has a shorter spire and longer aperture than *C. gundlachi*.

46. *C. STUHLMANNI* (Martens). Pl. 4, fig. 70.

Imperforate, elongate, finely and regularly striate, translucent, yellowish-vitreous; 5 whorls, the first globular, smooth, the following rapidly increasing, rather flat, with deep, somewhat step-like suture, which is more oblique between the penult. and last whorls. Aperture rather oblique; outer margin approaching rectilinear, thin, simple; lower margin broadly rounded. Columellar margin thick, white, obliquely truncate

at the base, continued above in a callous layer on the parietal wall. Length 9, diam. 3.66; aperture 4 x 2 mm. (*Martens*).

East Africa: Runssoro, in the bamboo forest at 2600 meters (*Stuhlmann*).

*Geostilbia stuhlmanni* MARTENS, Beschalte Weichthiere Deutsch Ost-Afrika, p. 131, pl. 5, f. 33 (1898).

“Only with some doubt I place this species in the genus *Geostilbia*, for it is not so slender and acicular as the typical species, *G. caledonica*” (*Martens*).

#### 47. C. PHILIPPINENSIS (*Semper*).

Shell subulate, glossy, imperforate; whorls 6, nearly flat, slowly increasing, the last rounded at base; columellar margin straight, subinflexed, thickened. Aperture ovate-oblong, subvertical. Length 6, diam. 1.75, aperture 1.5 x 1 mm. (*Semper*).

Philippines: Guza, Zamboanga, under low plants (*Semper*).

*Cionella philippinensis* SEMP., Reisen in Archipel Phil., Landmoll., p. 139, 1874.—*Geostilbia p.*, MLLDFF., Syst. Verzeichniss, p. 153.—*Glessula philippinensis* COOKE, P. Z. S., 1892, p. 469.

This snail has been erroneously referred by Mr. Cooke to *Glessula*, a genus not known to occur in the Philippine archipelago.

#### 48. C. PHILIPPINICA (*Moellendorff*.) Pl. 15, figs. 6, 7.

Shell small, not rimate, cylindrical-turrite, rather solid, yellowish, polished; spire long-turrited, the apex obtuse. Whorls 4, a little convex; suture impressed, broadly margined, subhorizontal at first, then gradually becoming strongly oblique. Penultimate whorl very high, the last a little higher,  $\frac{2}{5}$  the length of the shell. Aperture vertical, receding at base, narrowly oval; peristome simple, slightly obtuse, the margins joined by a light callus, right margin curving forward in the middle, lower margin rather straightened or biangularly curved, columellar margin reflexed above the rimation; columella vertical, at the base slightly obliquely truncate. Length  $3\frac{5}{8}$ , diam.  $1\frac{1}{8}$  mm.; aperture  $1\frac{3}{8}$  long, scarcely  $\frac{3}{4}$  wide (*Mlldff.*)

Philippines: Monte Licos, Zebu (*Mlldff.*).

*Geostilbia philippinica* Mlldff., Bericht Senck. Nat. Ges. 1890, p. 248, pl. 8, f. 8.

Described from one example. The figures, drawn by Dr. Boettger, show a distinctly truncate columella. This character and the broad sutural margin seem to differ from the following species.

49. *C. MOELLENDORFFI* n. sp. Pl. 15, figs. 4, 5.

The shell is clear corneous, glossy, marked with faint growth-lines and under a high power some faint traces of spiral striation are visible in places. The spire tapers regularly to the obtuse summit. Slightly over 4 whorls, convex and rapidly enlarging. Suture narrowly margined. The aperture is ovate; columella straightened below, not in the least truncate and not calloused. The outer lip is strongly arched forward. Length 4, diam. 1.4, length aperture 1.55 mm.

Philippines: Mananga, Zebu (Quadrans coll.)

The spire tapers much more than in *C. gundlachi*, the last whorl being wider, and the aperture is larger. The sutural margin is narrower than in *C. gundlachi*. In the type lot the columella is not calloused. *C. philippinensis* is a larger shell with proportionally smaller aperture. I have not been able to compare specimens of *C. marici* and *C. balanus*.

#### Genus GLESSULA von Martens.

*Glessula* MARTS. in Albers, Die Heliceen, edit. 2, 1860, p. 254, type *Achatina gemma* Bens.—BEDDOME, Proceedings of the Malacological Society of London, vii, Sept. 1906, pp. 160-172.—*Electra* ALBERS, Die Hel., 1850, p. 194, for *Achatina ceylanica* Pfr. Not *Electra* Lamouroux, 1816, not *Electra* Steph., 1829.

The shell is imperforate ovate-conic or turrite, brown or corneous-brown, glossy and usually without strong sculpture; apex obtuse. Aperture irregularly oval; outer lip unexpanded, acute or blunt; columella short, more or less deeply concave, abruptly truncate at the base.

Sole without distinct median area; no pedal margin; an outer mantle lobe on the left side. Kidney very long, band-like.

Genitalia peculiar (pl. 15, figs. 2); there is a feather-like gland (fig. 3) where the vas deferens enters the penis. The latter contains a short conic, perforated papilla and two of longitudinal folds. The prostate gland of the hermaphrodite duct consists of entirely separated narrow follicles, as in *Achatina*. The spermatheca has a short duct. Uterus containing several large shells with fully 2 whorls.

The jaw is very finely striate, almost smooth. Radula has about 110 teeth in a transverse row. The central tooth is very small, tricuspid; laterals with three cusps; outer marginal teeth very finely 3- or 4-cusped (*G. orophila* from Madras, according to Semper).

Type *G. gemma* Bens. Distribution, Oriental and Ethiopian regions.

*Glessula* was associated with "*Cionella*" (that is, the *Ferussacidæ* as herein understood) by Professor von Martens in 1860. Various other authors, both before and since, have thought the group Achatinoid, belonging to "*Stenogyra*" in the former wide limits of that term. We know too little of its anatomy to give a definite opinion, but the presence of a glandular appendage (appendix or flagellum) at the end of the penis is a feature unlike any *Achatinidæ*. The homology of this appendage is not certain, however. The position of the ureter is unknown. I have been unable to obtain alcoholic material necessary for an investigation of the relations of *Glessula* to *Subulina*, *Homorus*, *Bacillum* and *Pseudoglessula*.

In most (but perhaps not all) species, the lip becomes slightly blunt and smooth in fully adult shells, thereby differing from *Subulina*, which has an acute lip at all stages or growth.

In *G. orophila*, Semper found in the uterus 4 large embryos with shells having fully two whorls, and a small one with a half whorl and very large caudal vesicle. Various other species have been found to be viviparous, while others bring forth globular eggs like those of *Subulina*. Like that genus, also, the *Glessulæ* reproduce before attaining full size.

*Glessula* has been studied mainly by specialists on the Indian fauna. Benson, W. T. Blanford, Beddome and Godwin-Austen have chiefly contributed to the literature. Blanford's

“Contributions to Indian Malacology,” continued through many years of the Journal of the Asiatic Society of Bengal, contain a great mass of information on this genus, as on many others of the Indian fauna. Hanley and Theobald illustrated most of the types of Benson, among others, in their *Conchologia Indica*. Finally, Colonel R. H. Beddome has recently reviewed the genus in his “Notes on Indian and Ceylonese Species of *Glessula*.”

From the purely conchological standpoint we may be said to have an extensive knowledge of *Glessula*, yet various characters of the first importance have been neglected. *The embryonic whorls of the types must all be re-examined and their sculpture described.* Our ignorance of the embryonic sculpture of many forms prevents any natural classification of the species. The surface of the later whorls in all the species should be examined under high power, since some species have a minute sculpture not visible with an ordinary hand lens.

No fossil species of *Glessula* are known to me. A few species of other genera have been referred to *Glessula*.

*Glessula obtusa* and *G. erosa* Blanford are species of *Bacillum* (Vol. xvii, pp. 1, 4).

*Glessula orthoceras* G.-A. is a *Bacillum* (*l. c.*, p. 2).

*Glessula philippinensis* Semper, of Cooke, is a *Cæcilioides* (this vol., p. 49).

No natural classification of the species of *Glessula* can be attempted until the sculpture of the apices of the shells and the anatomy of a number of representative species are studied. I have separated a group of West African forms (species 89 to 92) as a new section, *Neoglessula*. The species are here grouped geographically, as follows:

- I. Ceylon, species 1 to 13, 34, 49, 52.
- II. Peninsular India, species 14 to 58.
- III. Extra-Peninsular India, Indo-China, Yunnan, etc., species 59 to 77.
- IV. Habitat unknown, species 78 to 80.
- V. Sumatra, Java and Borneo, species 81, 82.
- VI. Eastern Africa, species 83 to 86.
- VII. West Africa, species 87 to 92.

## I. SPECIES OF CEYLON.

The Ceylonese *Glessulae* are closely related to those of southern India, and in a few cases seem to be of identical species. Such cases should receive very careful comparison. The following forms, described from Peninsular India, have been identified by reliable authorities from Ceylon.

*G. beddomei* Blanf., No. 34.

*G. sattaraensis* 'H. Ad.' Hanley & Theobald, No. 49.

*G. pusilla* Beddome, No. 52.

1. *G. INORNATA* (Pfeiffer). Pl. 6, figs. 10, 11, 14-17.

Shell turrite-oblong, solid, closely striate; pale tawny, variegated with darker streaks; nearly lusterless, having a woody appearance. Spire turrite, the apex rather obtuse, suture lightly impressed, very closely crenulated. Whorls  $7\frac{1}{2}$ , rather flattened, the last nearly equal to two-fifths the total length, the base slightly compressed and smoother. Columella very deeply arcuate, white-calloused, obliquely, abruptly truncate. Aperture sinuous-semioval, white within. Peristome simple, obtuse, the right margin spreading. Length 28, diam. 11, aperture  $11.5 \times 5$  mm. (*Pfr.*).

Ceylon (*Pfr.*): Kandy (Nevill, Simon); Matelle East and Ma Ellia (Layard). South Canara forests (Beddome).

*Achatina inornata* PFR., P. Z. S. 1851, p. 259; Conchyl. Cab. p. 322, pl. 26, f. 8, 9; and var., pl. 37, f. 1, 2; Monogr. iii, 490.—Hanley & Theob., Conch. Indica, p. 9, pl. 17, f. 2, and var., f. 3.—S. (*G.*) *inornata* NEVILL., Handlist, p. 171.—*Glessula inornata* JOUSSEAUME, Mem. Soc. Zoöl. France vii, 1894, p. 292.—BEDDOME, P. Mal. Soc. vii, 164, with var. *minor*.

The first  $2\frac{1}{2}$  whorls seem to be nearly smooth, but with a finely crenulate suture; then fine, distinct striæ begin, strongest near the suture, weaker below. On the spire these striæ are separated into groups by occasional deeper grooves or larger striæ; and more or less trace of such irregularity may often be traced on the last whorl. Under the compound microscope, the surface is seen to be *very densely covered with minute granules arranged in spiral lines* (pl. 6, fig. 16). These give it a characteristic silky sheen, unlike the smooth species. Specimens before me measure as follows, all being adults with the lip blunt.

Length 29, diam. 13, aperture 12 mm.; whorls 8.

Length 28, diam. 11.5, aperture 11.7 mm.; whorls 8.

Length 24, diam. 11.7, aperture 10.5 mm.; whorls  $7\frac{3}{4}$ .

The color is yellow or olivaceous, with some reddish streaks. The interior is pale lilac or flesh-colored.

This is one of the most distinct species of the genus. Col. Beddome has mentioned a "var. *minor*, length 18 to 20 mm."

Pfeiffer has described and figured a variety which is "more distinctly striate, silky, brownish-tawny" (pl. 6, fig. 17). This form is thought by Col. Beddome to be *G. beddomei* Blanf.

2, *G. LANKANA* Pilsbry, n. sp. Pl. 7, figs. 1, 2, 3.

Shell oblong-turrite, thin but rather solid, yellow or tawny, with some narrow darker or chestnut streaks on the spire. Surface very glossy, finely and deeply striate, the striae unequal, in places being as narrow as the intervals, but occasionally much wider. Under the compound microscope a very faint spiral striation is visible, the spirals being very weakly beaded in places. The first  $2\frac{1}{2}$  whorls are smooth. Spire conic with straight sides and obtuse apex. Suture irregularly crenulate. Aperture vertical, flesh-tinted inside. Outer lip obtuse, forming a regular arch. Columella moderately concave, obliquely truncate at base.

Length 27.2, diam. 11, length apart. 10 mm.; whorls  $8\frac{1}{3}$ .

Length 27, diam. 11.2, length apart. 10.5 mm.; whorls  $8\frac{1}{3}$ .

Ceylon: Matella District (Layard).

Closely related to *G. inornata*, but more glossy and having much less distinct microscopic granulation, as may be seen by comparing fig. 3 with pl. 6, fig. 16. The outlines of the spire are straighter; there are more whorls in the same length, and the aperture is smaller. *G. beddomei* has a more prominent and more deeply truncate columella.

3, *G. PARABILIS* (Benson). Pl. 7, fig. 4.

Shell oblong-ovate, rather solid, glossy, rugose-striate, decussated with most minute, obsolete spiral striae, whitish under a buff-corneous cuticle. Spire long-conic, the apex obtuse, suture lightly impressed, subrenulate. Whorls 6, subplanulate, the last a little convex, scarcely three-sevenths the shell's length.



Aperture triangularly semiovate, whitish inside. Peristome slightly inflexed, the margins joined by a thin callus; right margin sinuous, slightly obtuse, columellar margin very deeply arcuate, strongly truncate obliquely. Length 20, diam. 10, aperture 9 x 5 mm. (*Bens.*).

Ceylon (Layard): Kandy (Nevill); Maturata (Simon).

*Achatina parabilis* BENS., Ann. Mag. N. H. (2), xviii, August, 1856, p. 96.—PFR., Monographia iv, 606.—H. & T., Conch. Indica pl. 35, f. 7.—S. (*G.*) P., NEVILL, Handlist, p. 171.—*G. parabilis* JOUSSEAUME, Mem. Zoöl. Soc. France vii, 1894, p. 294.

This species seems to differ from *inornata* by its glossy surface.

4. *G. CAPILLACEA* (Pfeiffer). Pl. 7, fig. 5.

Shell turrite, thin, hair-striate under the lens, glossy, pellucid, greenish-corneous. Spire elongate, the apex rather obtuse. Whorls  $7\frac{1}{2}$ , convex, the last scarcely one-third the total length, obsoletely angular at the periphery. Aperture slightly oblique, sinuate-oval. Columella arcuate, obliquely truncate. Peristome simple. Length 9, diam. 4 mm., aperture 3 x 2 mm. (*Pfr.*)

Ceylon (Thwaites, in Cuming coll.); Haycock Mt. (Beddome).

*Achatina capillacea* PFR., P. Z. S. 1854, p. 294; Monogr. iv, 614.—H & T., Conch. Ind. 63, pl. 156, f. 3 (fig. of type).

5. *G. NITENS* (Gray). Pl. 6, fig. 1, 2.

“Shell ovate-conic, turrite, hyaline, corneous, smooth, polished, the apex rather obtuse; whorls 8, convex; aperture ovate, peristome thin. Length 0.7, diam. 0.3 inch.” (*Gray*, 1825.)

“Shell turrited, shining, pellucid, horn-color; spire conical; apex blunt; whorls 7 to 8, gradually enlarging, convex. Aperture one-fourth the length of the shell, ovate. Columella sharply curved. Axis  $\frac{5}{8}$ , diam.  $\frac{1}{4}$  of an inch” (*Gray*, 1828).

*Achatina nitens* GRAY, Annals of Philos., n. ser. ix, 1825, p. 415; Spicilegia Zoologica p. 5, pl. 6, f. 18 (1828).—FERUSSAC, Bull. Sci. Nat. 1829, xvi, p. 468.—PFR., Monogr.

ii, 260; Conchyl. Cab. p. 365, pl. 43, f. 10-12.—DESH. in Fér., Hist., p. 165, pl. 134, f. 25-27.—H. & T., Conch. Ind. pl. 17, f. 1.—*Stenogyra* (*G.*) *nitens* NEVILL, *Handlist* p. 171 (Kandy).—*A. panatha* BENS., Ann. Mag. N. H. (3) v, May, 1860, p. 384 (Ellegamme Nalande and Matelle, Ceylon).—H. & T., Conch. Ind. pl. 36, f. 2.—PFR., Monogr. vi, 226.

A typical specimen is drawn in fig. 1, 2 of plate 6. The shell is corneous-yellow, very bright and glossy, nearly smooth. The sides of the spire are very slightly convex; but the whorls are strongly convex, parted by a very *distinctly crenulated suture*. The aperture is small; columella very deeply excavated above. Length 17, diam. 7.8, aperture 6.8 mm.; whorls  $7\frac{1}{2}$ . Nalande, Ceylon.

VAR. PUNCTOGALLANA (Pfeiffer). Pl. 6, figs. 3, 4, 5.

Shell oblong-ovate, slightly striatulate, glabrous, glossy, pellucid, corneous-tawny. Spire pyramidal, the apex obtuse. Whorls  $7\frac{1}{2}$ , convex, the last about two-fifths the total length, base rounded. Columella very deeply arcuate, reaching far forward, abruptly truncate. Aperture vertical, subtriangular-semioval; peristome simple, the right margin regularly arcuate. Length 16, diam. 8, aperture  $7 \times 4$  mm. (*Pfr.*).

Ceylon: Point de Galle (Benson): Matelle district (A. N. S. Coll.): Balapiti (Nevill).

*Achatina ceylanica* REEVE, Conch. Icon. v, pl. 15, f. 59 (not of Pfeiffer).—*A. punctogallana* PFR., Zeitschr. f. Mal. 1852, p. 150; Conchyl. Cab. p. 323, pl. 26, f. 14, 15; Monogr. iii, p. 493.—*Glessula* p., BEDDOME, P. Mal. Soc. vii, 165.

“Differs from *A. ceylanica* by the smoother, more glossy shell, with longer spire, shorter last whorl, and the columella arched forward more” (*Pfr.*). The whorls are *much more convex* in *punctogallana* than Pfeiffer’s description and figures indicate in *ceylanica*. The largest shell before me (fig. 5) measures, length 17.5, diam. 8.4, aperture 7 mm., whorls nearly 8. Others from the Matelle district, received from Layard, are typical in size. Both lots were received as *ceylanica*.

This form differs from *G. nitens* by its stouter, more compact shape.

6. *G. CEYLANICA* (Pfeiffer). Pl. 6, figs. 7, 8.

Shell ovate-oblong, striatulate, silky, thin, tawny-corneous; spire pyramidal, the apex obtuse. Whorls 7, a little convex, the last three-sevenths the total length, inflated. Columella short, arcuate, abruptly truncate. Aperture rather wide, semioval; peristome thin, acute. Length 16, diam. 8, aperture 7.5 x 4 mm. (*Pfr.*).

Ceylon (Templeton); Maturata (Simon); Balapiti and Colombo (Nevill).

*Achatina ceylanica* PFR., Zeitsch. f. Mal. 1845, p. 157; Monog. ii, 258; iii, 493; iv, 607; vi, 223; viii, 279; and in Philippi, Abbild., ii, p. 215, pl. 1, f. 3; Conch. Cab. p. 313, pl. 25, f. 14, 15.—*Glessula c.*, JOUSSEAUME, Mem. Soc. Zool. France vii, 1894, p. 292.—*Stenogyra (G.) c.*, NEVILL, Handlist p. 172.

Closely related *G. nitens*, but the description and figure indicate that the whorls are much less convex in *ceylanica*. Colonel Beddome records specimens of *ceylanica* 30 x 14 mm.; but their specific identity may possibly be doubtful.

7. *G. DESHAYESI* (Pfeiffer). Pl. 6, figs. 6, 12, 13.

Shell turrite-ovate, rather thin, nearly smooth, glossy, corneous-brown; spire long, convex, the apex rather obtuse, suture simple, rather deep. Whorls 7, convex, the last two-fifths the length, rounded at base. Columella somewhat twisted, broadly and obliquely truncate. Aperture slightly oblique, rhombic-semioval; peristome simple, obtuse, the right margin somewhat spreading. Length 11, diam. 5, aperture 4½ x 2½ mm. (*Pfr.*).

Ceylon.

*Achatina deshaysesi* PFR., P. Z. S. 1852, p. 86; Conchyl. Cab. p. 366, pl. 43, f. 13-16; Monogr. iii, 495; iv, 608; vi, 266; viii, 281.—H. & T., Conch. Ind. pl. 102, f. 2.

Smaller than *G. nitens*, and of a richer brown color, but otherwise it is closely related. The whorls are strongly convex and the surface very brilliant. Some of the upper post-embryonic whorls are rather distinctly striate. The suture is much less distinctly crenulated than in *G. nitens*.—nearly

simple. The sides of the spire are slightly convex. Fig. 6 represents a typical example, length 11, diam. 5.2, aperture 4.5 mm., whorls  $6\frac{3}{4}$ . The lip is "finished."

Two specimens, the longest and shortest from another lot of 15, are drawn, pl. 6, figs. 12, 13. Neither has the lip "finished," though no doubt both are nearly mature. They measure as follows.

Length 12.8, diam. 6 mm., whorls  $7\frac{1}{4}$ .

Length 10, diam. 5 mm., whorls  $6\frac{1}{3}$ .

#### 8. *G. PACHYCHEILA* (Benson).

Shell ovate-oblong, striatulate, under a lens decussated with obsolete, close, spiral very fine striæ; glossy, brownish-corneous, translucent; spire lengthened, subconic, apex obtuse, suture lightly impressed. Whorls 6, a trifle convex, the last scarcely two-fifths the total length. Aperture vertical, oblong-ovate; peristome whitish-bordered within; columella exceedingly deeply arcuate, basal margin thickened. Length 11, diam. 5 mm. (*Bens.*).

Ceylon: Heneratgodde (Layard).

*Achatina p.*, BENSON, Ann. and Mag. N. H. (2) xii, August, 1853, p. 94.—PFR., Monogr. iv, 608.—*Glessula p.*, BED-DOME, P. Mal. Soc. vii, 166.

"This little species of a group which has so many representatives in Ceylon, the Nilgherries, and the damp woody mountains of the North-eastern India, with a more slender form than *A. orcas nobis*, is well distinguished from the allied forms by its peculiar sculpture under the lens, and by the internal incrustation of the peristome, a feature which is also observable in the species *A. crassilabris nobis*, from north-eastern India." (*Benson.*)

This species has not been figured. With the same dimensions as *G. deshayesi*, it seems to differ by having the whorls only very little convex, whilst in *deshayesi* they are strongly convex.

#### 8a. Var. *taprobanica* Pils., subsp. n. Pl. 7, fig. 16.

Shell smaller, very pale yellow. Sculpture of fine vertical

grooves, close on the spire but rather widely, unevenly spaced on the last two whorls; no perceptible spiral lines; two whorls at the summit smooth. Aperture small, the outer lip rather thick; columella moderately concave, subvertically and not very deeply truncate at the base.

Length 8.5 to 8.8, diam. 3.2, aperture 3 mm.; whorls  $6\frac{1}{2}$ .

Ceylon: Kandookerre (E. L. Layard).

This form was distributed by Layard as *pachycheilus* Bens. That species has not been figured, but according to the description it differs from this in several respects. *G. colletta* is a more slender, darker species, with a less thickened lip.

9. *G. SERENA* (Benson). Pl. 6, fig. 9.

Shell ovate-pyramidal, rather solid, very highly polished, slightly, obsoletely striate, tawny corneous, pellucid. Spire elongate, subturrite, the apex abruptly obtuse; suture impressed, submarginate, erenulate. Whorls  $6\frac{1}{2}$  to 7, subconvex, convex above near the suture, the last whorl slightly compressed at the base. Aperture vertical, three-sevenths the total length, subtriangular-ovate; peristome unexpanded, rather obtuse; columellar margin very deeply arcuate, whitish-calloused, at the base abruptly and obliquely truncate. Length 20 to 21, diam. 9 to 9.5, aperture  $9 \times 5.5$  mm. (*Bens.*)

Ceylon: Akurambodie, in southern Matelle.

*Achatina serena* BENS., Ann. and Mag. N. H. (3), v, May, 1860, p. 384.—PFR., Monogr. vi, 223.—H. & T., Conch. Ind. pl. 78, f. 8.

This species is very close to *G. nitens*, but the whorls are less convex. It is doubtfully distinct from *G. ceylanica*, but from the figures, that seems to be more straightly conic and smaller.

10. *G. LAYARDI* Pilsbry, n. sp. Pl. 7, figs. 6, 7.

The shell is oblong-turrite, yellow-corneous with profusely scattered whitish dots and spots (produced by disintegration of the surface), paler towards the summit. Surface very glossy, without noticeable microscopic sculpture, but marked with unevenly spaced grooves, which are rather weaker on

the last whorl, and obsolete on the base. The summit is obtuse, rounded, first whorls smooth. Whorls  $6\frac{1}{2}$ , moderately convex. Suture elegantly but somewhat irregularly denticulate. Aperture vertical; outer lip obtuse; columella very short, moderately or deeply concave, subhorizontally and very deeply truncate. Length 14, diam. 6, length of aperture 5.9 mm. Length 13.5, diam. 6.1, length of aperture 5.9 mm.

Ceylon (Layard).

This species differs from *G. ceylanica* by its very much less deeply concave columella. It is a smaller and more slender shell than *G. serena*, which seems to be its nearest ally. The denticulation of the suture is a prominent feature. Though "live" shells, the surface is eroded in places. The whitish flecks probably will not be found on shells from stations where they are less liable to erosion.

#### 11. *G. VERUINA* (Benson).

Shell cylindrical-turrite, very much lengthened, dirty whitish, unevenly striate; the spire gradually tapering above; suture impressed, crenulate; apex obtuse. Whorls  $12\frac{1}{2}$  to 13, narrow, cylindrical, the last scarcely two-elevenths the total length. Aperture vertical, truncate-oval; peristome unexpanded, acute; columella slightly arcuate. Length 25, diam. 5 mm. (*Bens.*)

Ceylon: Narlande and Matelle (Layard).

*Achatina veruina* BENS., Ann. and Mag. N. H. (2) xii, August, 1853, p. 94.—PFR., Monogr. vi, 235.—S. (*G.*) *veruina* NEVILL, Handlist, p. 171.

This rare species has not been figured.

#### 12. *G. COLLETTEÆ* Sykes. Pl. 7, fig. 13.

Shell elongate, thin, smooth, obscurely longitudinally striated, brown or brown-corneous, the apex rather obtuse; suture impressed. Whorls 6 to  $6\frac{1}{2}$ , a little convex, the last half the length of the shell. Aperture nearly vertical, lunate-oval, columellar margin callous, paler, obliquely truncate. Length 8, diam. 2.8 mm. (*Sykes*).

Ceylon: Ambagamuwa (Mrs. Collett).

*Glessula colletta* SYKES, Proc. Malac. Soc. Lond. iii, July, 1898, p. 73, pl. 5, f. 1.

Topotypes before me are rather dark yellowish chestnut colored, with sculpture of impressed vertical grooves. These are rather widely separated on the later whorls, but close above. Nearly two whorls at the summit are smooth. Length 8, diam. 2.9, aperture 2.9 mm. long, whorls  $6\frac{1}{2}$ .

Compared with *G. p. taprobanica*, this is a more slender shell, hence the whorls appear longer, and they are more evenly convex, the suture being less narrowly impressed.

13. *G. SIMONI* Jousseume. Pl. 7, fig. 8.

Shell small, ovate, thin, costulate, glossy, pellucid, fulvous-corneous. Spire conoid, the apex rather obtuse, suture impressed. Whorls 5 to 6, convex, the last half the total length, slightly tapering at the base, rounded. Aperture vertical, semioval; peristome unexpanded, thin, acute; the right margin less arcuate; columella callous, nearly straight, very deeply arcuate, obliquely truncate, at the umbilical region appressed and depressed. Diam. 3 mm., alt. 1.5 mm. (*Jouss.*)

Ceylon: flank of Pedrotalagala at Nuwaraeliya (Simon).

*Glessula simoni* JOUSS., Mémoires de la Société Zoologique de France pour l'année 1894, vii, p. 293, pl. 4, f. 10.

This minute form has about the size of a *Tornatellina*, but seems to be more strongly sculptured than is usual in that genus. The embryonic whorls are smooth, a little darker than the rest of the shell. Four specimens were taken, two of them smaller than the type, which is thought by Jousseume to be immature.

## II. SPECIES OF PENINSULAR INDIA.

14. *G. SHIPLAYI* (Pfeiffer). Pl. 9, fig. 8.

Shell turrite, smoothish, pellucid, glossy, corneous; spire regularly tapering, the apex obtuse; suture substriate; whorls 13, convex, the last slightly more than one-third the total length, rounded, more distinctly striate; columella somewhat straightly running forward, at the base rather widely trun-

cate. Aperture a little oblique, rounded-oval; peristome unexpanded, very thin. Length 25.5, diam. 6.3 mm., aperture 5.5 x 3.25 mm. (*Pfr.*).

Length 36 mm., whorls 14 (*Beddome*).

S. India: Nilgiri Mts (Conway Shiplay, type loc.); Anamallays; Shevaroyes.

*Achatina shiplayi* PFR., Malak. Bl. 1855, p. 169; Novit. Conch. i, p. 82, pl. 22, f. 13, 14; Monogr. iv, 612.—HANL. and THEOB., Conch. Ind. pl. 36, f. 9 (*jur.*).—*Glessula s.*, BEDDOME. P. Mal. Soc. vii, 161.—*Stenogyra (G.) shiplayi* NEVILL., Handlist p. 168, no. 60.

“Full grown specimens were very rarely found by me, though young half- and three-quarter grown ones are most abundant on the Nilgiris. This and some other species certainly breed before the shell attains full size or a hardened peristome, as I have taken eggs from such shells. The peristome differs much in mature specimens, sometimes being very thick and solid, sometimes quite thin, but, even then, firm, and not breaking or becoming jagged at the touch, which is the sign that the shell has not finished its growth. Full-grown examples of *shiplayi* are very like *tenuispira*, but smaller. It also runs *nilgirica* very closely, but the latter has a stronger sculpture, and is broader at the base.” (*Bedd.*)

15. G. HEBES ('Blanford' Pfr.). Pl. 9, fig. 6.

Shell subcylindric-turrite, thin, pale corneous, translucent, polished, striatulate; spire raised, subcylindric in the lower part, the sides convex towards the obtuse apex; suture impressed. Whorls 9 to 10½, convex, regularly increasing, the last short, about one-fourth to one-fifth the total length. Aperture ovate-oblong, a little oblique; peristome thin; columella very arcuate, obliquely truncate in front. Length 17 to 22, diam. 5 mm.: aperture 4 to 4.5 mm. long, 2.3 to 3 mm. wide. (*Blanf.*).

S. India: Deo Ghat, on the south side of Poona (Evizard, type loc.); Shevaroyes; Pulney Hills, and halfway up the Koonoor Pass, Nilgiris (Nevill).

*Achatina hebes* Blanford, PFR., Monogr. Hel. Viv. vi, 1868,



p. 230.—*Glessula hebes* BLANFORD, Journ. As. Soc. Beng. vol. 39, 1870, p. 21, pl. 3, f. 21.—BEDDOME, P. Mal. Soc. Lond. vii, 161.—NEVILL, Handlist, p. 167.

“The nearest ally to this species appears to be *G. tamulica* (W. & H. Blanf.) from near Trichinopoly, which is distinguished by greater diameter in proportion to the length, and a more regularly tapering spire. Intermediate forms may hereafter be found however.

“A specimen from the Shevroy hills near Salem in southern India, sent to me by Major Beddome, only differs from *G. hebes* in being longer and slightly more attenuate towards the apex. It has 13 whorls.” (*Blanf.*)

“Ten specimens received from Blanford and Evizard, collected near Poona, are all young, with quite unformed lip; and all the types of *hebes* in Blanford’s collection, and the specimens in the Natural History Museum and others that I have seen, are the same. If full-grown, or nearly so, it must be a much smaller species than *shiplayi*. It runs the young of that species rather closely, but the apex is generally blunter. Specimens collected by me on the Shevaroyes are referred here by Blanford; they are, however, immature and appear rather to belong to *fairbanki*, if that species is distinct, which I doubt. When collected I took them to be young of *shiplayi*. Until *hebes* and *fairbanki* are found with mature lips, they must, I think, remain doubtful species.

“Hanley’s figure of *hebes* has the tapering apex of young *shiplayi* and is unlike my type of *hebes*.” (*Beddome.*)

16. *G. FAIRBANKI* (Benson). Pl. 9, fig. 7.

Shell subcylindric-turrite, striatulate, obsoletely and very minutely spirally deussate, polished, translucent, buff-corneous, the spire having subconvex sides towards the apex, summit obtuse; suture distinctly impressed; whorls 8, subconvex, short, the last four slowly increasing in diameter; last whorl rounded below, one-fourth the total length; aperture suboblique, ovate, angular above and below, the margins joined by a callus; columella lightly arenate, obliquely truncate; basal and outer margins thin. Length 12, diam. 4, aperture 3 x 2.5 mm. (*Bens.*).

S. India: Mahableshwar Mts. (Rev. S. B. Fairbank).

*Achatina fairbanki* BENS., Ann. and Mag. Nat. Hist. (3), xv, Jan. 1865, p. 14.—PFR., Monogr. vi, 232.—HANLEY & THEOB., Conch. Ind. pl. 18, f. 3.

“The nearest Nilgiri form is *A. corrosula* Pfr. The more cylindrical form below, the sculpture, shorter whorls etc., safely distinguished it” (*Bens.*).

Col. Beddome considers *fairbanki* doubtfully distinct from *G. hebes*. Both were based upon shells not fully mature.

17. *G. VADALICA* (Benson). Pl. 9, fig. 11.

Shell turrite-elongate, striatulate, rather solid, polished, translucent, buff-corneous; spire a little convexly turrite towards the apex; apex rather obtuse; suture impressed. Whorls 11, convex, short, the upper ones rib-striate, last whorl rounded below, scarcely one-fourth the total length. Aperture slightly oblique, elliptical-ovate, margins joined by a callus, columellar margin slightly arcuate, whitish, obliquely truncate, basal and right margins thin. Length 34, diam. 9, aperture 8 x 5 mm. (*Bens.*).

India: Wadale, near Ahmednugger (Fairbank).

*Achatina vadalica* BENS., Ann. Mag. N. H. (3), xv, Jan. 1865, p. 15.—PFR., Monogr. vi, 229.—HANL. and THEOB., Conch. Ind. pl. 35, f. 5.

“The convex sides of the upper part of the spire, the shorter whorls, with the sculpture and polish of the shell, distinguish it as well from the Nilgiri *A. perrotteti* as from the neighbouring *A. notigena*, which has an attenuate spire and costulate sculpture in all the whorls. The Liberian *A. clavus* Pfr., is a broader shell, with longer and wider whorls.” (*Benson.*)

18. *G. TAMULICA* (Blanford). Pl. 9, fig. 12.

“Shell turrite, thin, glossy, corneous, striatulate; spire regularly tapering, the apex obtuse; whorls 10, convex, the last slightly more than one-fourth the total length, rounded; columella strongly arcuate, obliquely truncate. Aperture a little oblique, suboval, peristome simple, thin, the margins joined by a very thin callus. Length 20, diam. 6, aperture 5.8 x 3 mm.” (*Blanf.*).



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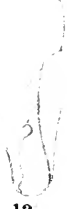
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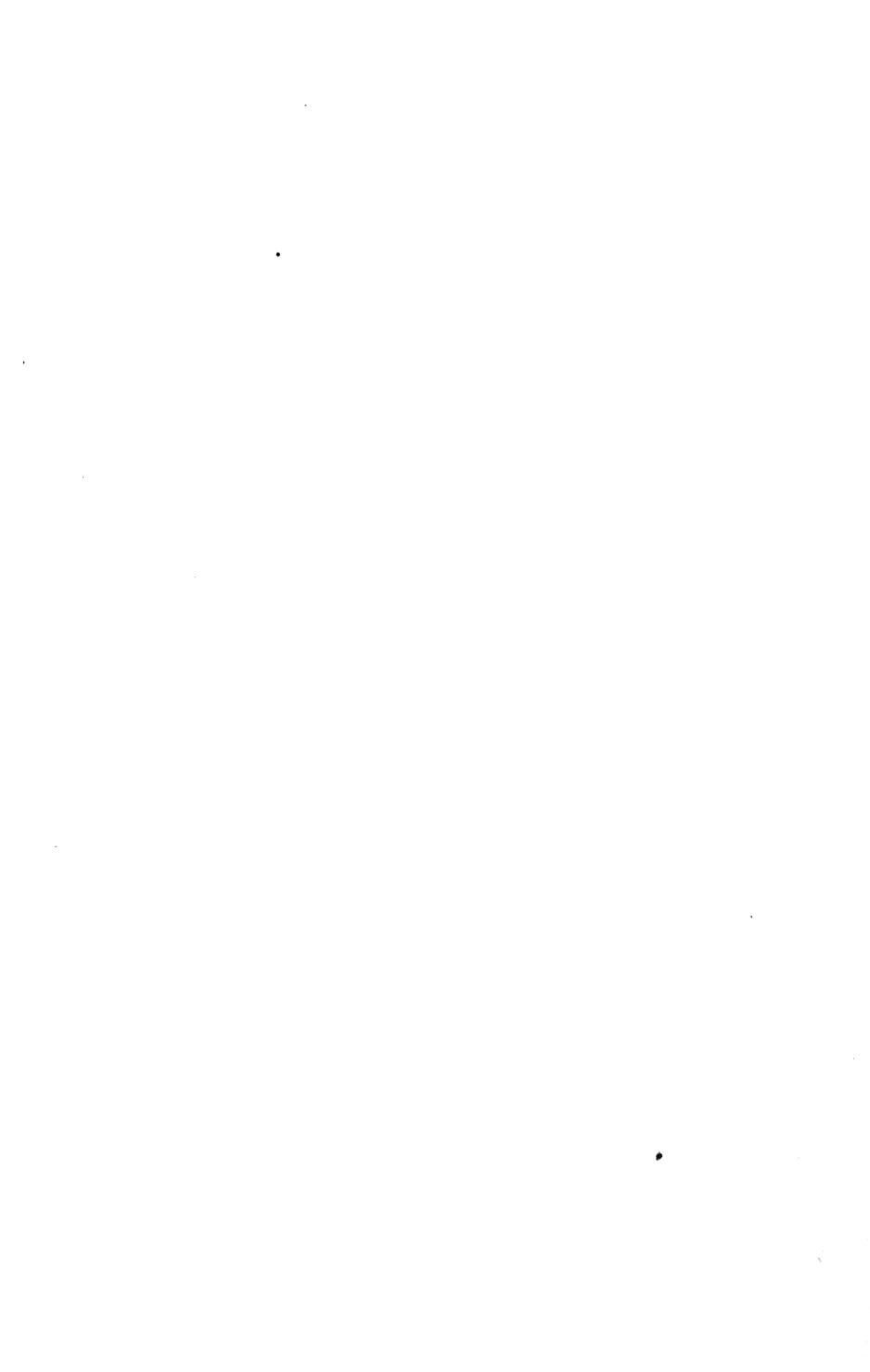
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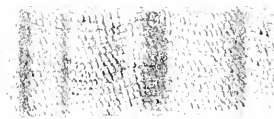
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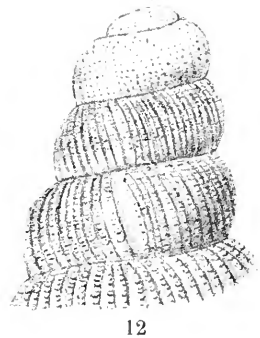


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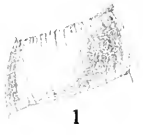
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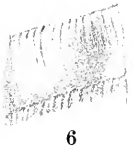
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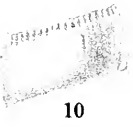
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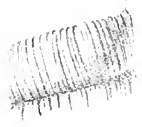
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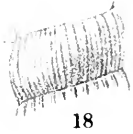
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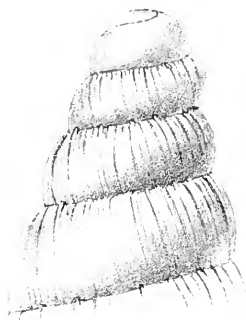
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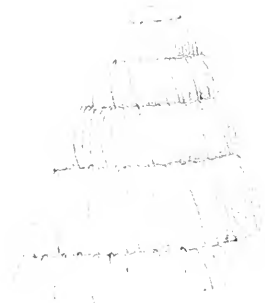
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S. India: Cullagoody, Trichinopoly.

*Achatina tamulica* BLANF., Journ. Asiat. Soc. Beng. vol. 30, 1861, p. 362.—PFR., Monogr. vi, 232.—HANL. and THEOB., Conch. Ind. pl. 17, f. 9.—*Glessula t.*, BEDDOME, P. Mal. Soc. vii, 162.

“Near *A. shiplayi*, but distinguished by the smaller number of whorls, more obtuse apex, etc.” (*Blanf.*). Known from immature specimens with quite fragile lip. Col. Beddome considers that “it is very near *vadalica*, and has all the appearance of being the young of that species.”

19. *G. PERROTTETI* (Pfeiffer). Pl. 9, figs. 9, 10.

Shell elongate-conic, the apex rather obtuse, glossy, corneous, diaphanous; whorls 8, a little convex, the last half the total length, columella deeply incurved, abruptly truncate. Aperture oval, the peristome simple, acute. Length 22, diam. 9, aperture 8 x 4 mm. (*Pfr.*).

S. India: Nilgiris (type loc.) at Neddoowutton (Blanford), and Pulney Hills, about the foot of the mountains (*Beddome*).

*Achatina perrotteti* PFR., Revue Zoologique 1842, p. 305; Symbolæ ii, 59; Monogr. ii, 260; iii, 494; iv, 607; vi, 224; Conchyl. Cab. p. 324, pl. 26, f. 16, 17.—Conch. Indica pl. 35, fig. 6 (?).—REEVE, Conch. Icon. v, pl. 24, f. 102.—*Glandina* ? *p.*, PHILIPPI, Abbild. i, p. 135, pl. 1, f. 12.—*Stenogyra* (*G.*) *p.*, NEVILL, Handlist, p. 168.

Pfeiffer's type seems to be a relatively wide, short form, with the mouth more than one-third the total length. The longer shell figured in Conchologia Indica is probably a different species.

20. *G. LEPTOSPIRA* (Benson). Pl. 12, fig. 2.

Shell oblong-turrite, striatulate, glossy, pale corneous-brown; spire rather narrowly turrite, the apex obtuse, suture rather deep, crenulate. Whorls 9, a little convex, the upper short, more convex, the last less than one-third the total length. Aperture suboblique, elliptical, margins joined by a callus, columellar margin arcuate, obliquely truncate, the right margin thin. Length 16, diam. 6 mm. (*Bens.*)

Someysur Hills (Theobald).

*Achatina l.*, BENS., Ann. and Mag. N. H. (3), xv, Jan. 1865, p. 14.—H. & T., Conch. Ind. pl. 35, f. 2.—PFR., Monogr. vi, 233.—*S. (G.) leptospira* NEVILL, Handlist, p. 171 (Goomesur Hill).

This species was probably based on immature shells. It may prove to be a form of *G. notigena*.

21. *G. NOTIGENA* (Benson). Pl. 12, figs. 3, 4, 9.

Shell long-conic, attenuate above, thin, subcostulate striate, tawny corneous, glossy, pellucid. Spire turrited, attenuate above, the apex obtuse; suture impressed, irregularly crenulate. Whorls 9 to 10, a little convex, the last less than one-third the total length of the shell. Aperture subvertical, narrowly semioval; columella slightly arcuate, subvertical, rather obliquely truncate at the base; peristome unexpanded, thin, the margins joined by a thin callus. Length 20, diam. 7, aperture 6 mm. long, scarcely 4 wide. (*Bens.*)

Mahableswar Ghats (type loc., J. Chesson); Bombay Ghats (W. Theobald). [Cherra Poonjee, Sylhet, teste Beddome].

*Achatina notigena* BENS., Ann. Mag. N. H. (3), v, June, 1860, p. 462.—H. & T., Conch. Ind. pl. 35, f. 8, 9.—PFR., Monogr. vi, 229.—BEDDOME, P. Mal. Soc. Lond. vii, 166.—*Stenogyra (G.) notigera* Blanf., NEVILL, Handlist Ind. Mus. p. 167, no. 40 (Poona and Khandala).

Benson records a variety which is more inflated, ovate-turrite, 22 x 8 mm. No locality for it is mentioned. He writes: "This shell has relations to *A. chessoni* in the attenuation of the spire towards the summit, a feature observable also in the northeastern *A. tenuispira*. It differs in form, size, proportions, etc. In one specimen from Bombay the attenuation of the spire is less conspicuous." Col. Beddome states that the specimens he has seen are in no way separable from *tenuispira*.

The initial half whorl is smooth; then very fine, close, regular vertical striæ appear, continuing to the end of the embryonic shell, which consists of two whorls (fig. 9). After this, the striæ are irregular, coarse ones appearing in groups,



or at somewhat irregular intervals. On the last two or three whorls the striation is still coarser, and chiefly on the upper part of each whorl, the lower part being much smoother. Specimens from Poona before me are more slender than those from Bombay, measuring 21 x 7 mm., with 10½ whorls.

The sculptured embryonic whorls show that this species is not related to *G. tenuispira*. I am much inclined to doubt that the specimens recorded from the Sylhet region are really *notigena*. They are probably *tenuispira*.

22. *G. CORROSULA* (Pfeiffer). Pl. 12, figs. 5, 6.

Shell turrite, rather solid, smoothish, corroded in dots, pale corneous. Spire a little convexly turrite, rather acute; suture shallow subrenulate. Whorls 9, very slightly convex, the last scarcely two-sevenths the total length, rounded at the base. Columella very deeply arcuate, obliquely distinctly truncate. Aperture slightly oblique, sinuate-semioval; peristome simple, thin. Length 15, diam. 4⅓, aperture 4 x 2 mm. (*Pfr.*).

Nilgiris (Ch. Shiplay, in Cuming coll.); Kurnool (Stol.)

*Achatina c.*, PFR., P. Z. S. 1856, p. 35; Novit. Conch. p. 104, pl. 29, f. 9, 10; Monogr. iv, 612.

23. *G. BENSONIANA* (Pfeiffer). Pl. 12, fig. 13, 14.

Shell oblong-turrite, thin, slightly striatulate, glossy, subpellucid, tawny-corneous. Spire somewhat turrite, the apex rather obtuse; suture subimpressed, closely denticulate. Whorls 8½, rather flat, the last slightly more than one-third the total length, tapering at the base; columella slightly arcuate, shortly truncate a little above the base of the semi-oval aperture; peristome simple, acute, the right margin slightly arcuate. Length 18, diam. 6⅓, aperture 6⅓ x 3 mm. (*Pfr.*)

Nilgiris (Perrottet, type loc.); Kotagherry and Ootacamund (Stoliczka).

*Achatina bensoniana* PFR., Zeitschr. f. Malak. 1851, p. 27; Conchyl. Cab. p. 325, pl. 26, f. 12, 13; Monogr. iii, 494.—HANLEY & THEOBALD, Conch. Indica, pl. 102, f. 3.—*Stenogyra*

(*Glessula*) *b.*, G. NEVILL, J. A. S. B., vol. 50, 1881, p. 137, pl. 5, f. 16, 16a.

24. G. PRÆLUSTRIS (Benson). Pl. 9, figs. 15, 16.

Shell ovate-oblong, very thin, fragile, irregularly plicate-striate, glossy, pale buff-corneous; spire pyramidal, the apex obtuse, suture rather deep, subcrenulate; whorls  $8\frac{1}{2}$ , a little convex, slightly swollen above near the sutures, the last whorl more than one-third the total length, subinflated; aperture vertical, semioval, rather wide; columella somewhat straight, slightly curved, base obliquely truncate; peristome unexpanded, acute. Length 33, diam. 17, aperture 15 x 9 mm. (*Bens.*).

S. India: Midnapore, Balasore and Cuttack, Orissa province, in mango topes (*W. Theobald*); common in the Orissa and Ganjam districts, east side of the Madras Presidency (Beddome).

*Achatina praelustris* BENS., Ann. Mag. N. H., June, 1860, v, p. 462.—PFR. Monogr. vi, 221.—HANLEY & THEOB., Conch. Ind. pl. 17, f. 6, and var., f. 7.—*Glessula p.*, BEDDOME, P. Mal. Soc. vii, p. 162.—*Stenogyra (Glessula) praelustris* NEVILL, Handlist, p. 170.

Col. Beddome gives 40 mm. as length of his largest specimen. There is a smaller race (pl. 9, fig. 15) measuring, length 24, diam. 11, aperture 10.5 mm. long; whorls  $7\frac{1}{2}$ . The lip has a smooth, thickened edge.

25. G. CHESSONI (Benson). Pl. 11, fig. 5.

Shell ovate-turrite, attenuate above, roughly plicate-striate, the striae very minutely, closely, obsoletely spirally decussate; tawny-corneous or purplish-brown, translucent, a little glossy; spire turrite, attenuate towards the slightly obtuse apex; suture impressed, crenulate. Whorls  $11\frac{1}{2}$ , a little convex, the last over one-third the length of the shell, a little inflated. Aperture subvertical, semioval, rather wide; columella rather straight, whitish-calloused, at base slightly obliquely truncate; peristome unexpanded, thin. Length 37, diam. 15, aperture 14 x 8 mm. (*Bens.*).

S. India: Mahableshwar Mts. (J. Chesson, type loc.); North Canara forests; near Sireee (Beddome); Igapuri (Stoliczka); Torna and Purandhar (Blanf.).

*Achatina chessoni* BENS., Ann. Mag. N. H. (3), v, June, 1860, p. 462.—PFR., Monogr. vi, 222.—HANL. & THEOB., Conch. Ind. pl. 17, f. 8.—*Glessula c.*, BEDDOME, P. Mal. Soc. vii, 163.—*S. (G.) chessoni* NEVILL, Handlist, p. 167.

There is also a more slender variety 33 x 12 mm. noted by Benson.

26. *G. TORNENSIS* Blanford. Pl. 11, figs. 3, 4.

Shell ovate-oblong, rather thin, smooth, glossy, polished, subobsoletely striatulate, tawny-corneous; spire long-conoid, the sides convex; apex very obtuse; suture impressed, somewhat corrugated above. Whorls 7 to 7½, convex, the last over two-fifths the total length, rounded beneath. Aperture subvertical, oblong-semioval; peristome unexpanded, thin, the margins joined by a thin callus; columella deeply arcuate, whitish, almost vertically truncate in front. Length 25, diam. 14, oblique alt. of aperture 12, width 7 mm. (*Blanf.*).

S. and W. India: Torna Hills, near the town of Poona on the west. (type loc.); Anamullays; Tinnevelly; Travancore Ghats (Beddome).

*Glessula tornensis* BLANF., Journ. A. S. B. vol. 39, 1870, p. 22, pl. 3, f. 22.—BEDDOME, P. Mal. Soc. vii, 163.—*Achatina t.*, Conch. Indica, pl. 78, f. 3.

“In form it is remarkably similar to *G. textilis* W. Blanf., from the Anamallay Hills, but it entirely wants the colored markings of that species” (*Blanf.*). Col. Beddome remarks, “My Travancore specimens were labelled *subtornensis* by Nevill, but I cannot see how they differ. I took a very beautiful, dark chocolate-colored variety on the Calcad Hills in Tinnevelly.” Fig. 4 is the typical form from Torna Hills. A specimen measures, length 26.5, diam. 13.5, aperture 12 mm., with 7¼ whorls. Hanley figures a much more obese form from the same place (fig. 3).

27. *G. TEXTILIS* Blanford. Pl. 11, figs. 6, 7.

“Shell ovate-oblong, rather solid, translucent, striated near

the suture, smooth, polished, dark chestnut with close vertical and horizontal lines of a greyish-yellow color, varying in breadth and resembling the threads of an irregularly woven cloth. Spire elongated, conoidal with convex sides, apex obtuse, sutures impressed. Whorls 7, convex, the last about two-fifths of the entire length, rounded beneath. Aperture vertical, truncately semi-oval, milky within; peristome slightly thickened, white, right margin slightly sinuate towards the base, columella deeply curved, obliquely truncated beneath, margins united by a thin callus. Length 26, diam. 13 mm. Aperture  $10\frac{1}{2}$  mm. long, 7 broad" (Blanf.).

S. India: Anamullay Hills, 6000 ft., type loc. (Blanf.); Pulney Hills (Fairbank); Tinnevely and Travancore Ghats (Beddome).

*Achatina textilis* BLANF., J. A. S. B. xxxv, 1866, p. 41.—Conch. Ind., pl. 17, f. 10.—PFR., Monogr. vi, 220.—*Glessula t.*, BEDDOME, l. c., p. 163.—*S. (G.) textilis* NEVILL, Handlist p. 168.

"This is the only indigenous Indian *Achatina* with which I am acquainted possessing colored markings. In form it approaches some of the Ceylon *Achatina*, and also an undescribed Deccan species" (Blanf.).

"Varies in diameter from 10 to 14 mm. I have specimens from the Tinnevely Ghats in which the textile coloring is reduced to a single narrow band on each of the three lower whorls, or is entirely obsolete" (Beddome).

Besides the numerous reddish lines and bands on a pale-yellow ground, it is sometimes sprinkled with buff dots. A small specimen from the Pulney Hills figured measures, length 21, diam. 9.9, length of aperture 9.8 mm. (fig. 7).

28. G. SENATOR (Hanley). Pl. 11, fig. 8.

Shell subovate-conoid, sometimes narrower, thin, glossy, smooth; chocolate, conspicuously ornamented with a yellowish or pale stripe. Whorls convex, much wider than high ( $6\frac{1}{2}$  in an imperfect example), rapidly increasing, marked below the deeply-impressed suture with a very narrow band and above it with a wide one, which continues on the last

whorl a little above the middle. Spire about half the total length, apex paler, obtuse. Columella short, paler, arcuate, broadly truncate. Length 1 inch (*Hanl.*).

Southern India, Cottyam Hills, collections of Beddome and McAndrew (*Hanley*); Peermede Hills, Travancore (*Beddome*).

*Achatina* (*Glessula*) *senator* HANL., P. Z. S., 1875, p. 606; *Conch. Indica*, pl. 155, f. 4.—*G. s.*, *BEDDOME, l. c.*, p. 163.

Only four specimens are known to me, all from the Cottyam Hills; two are young and rather narrow in proportion to the fine but broken-lipped example I have described, which once belonged to the celebrated Indian conchologist W. Benson" (*Hanley*).

"Only differs from the last two species in its beautiful coloration" (*Beddome*).

29. *G. ISIS* (*Hanley*). Pl. 11, fig. 9.

Shell subcylindric, smooth, thin, very glossy, whitish or pale, sometimes with a narrow tawny band, and encircled by close, very narrow tawny lines; the band generally placed towards the base of the upper whorls and above the middle of the last one. Whorls about 10, convex, gradually increasing, obsolete subrenulated below the deep suture, and all but the last whorl are much wider than high; apex obtuse. Aperture narrow, slightly more than one-fourth the total length. Columella short, arcuate, obliquely twisted-truncate. Length  $1\frac{1}{3}$ , width two-seventh inch [ca. 33 x 7.14 mm.] (*Hanley*).

S. India: Foot of the Pulney Hills (*Fairbank, Beddome*).

*Achatina* (*Glessula*) *isis* HANL. P. Z. S., 1875, p. 606; *Conch. Indica*, p. 62, pl. 155, f. 5.—*PFR.*, *Monogr.*, viii, 616.—*Glessula i*, *BEDDOME, l. c.*, p. 163.

"Much the coloring of *textilis*, but the shell is very different in form, being elongated and narrow" (*Beddome*).

30. *G. SUBPERROTTETI* *Beddome*. Pl. 8, figs. 1, 2.

Shell ovate-turrite, tapering above, very glossy, lightly plicate-striate, fulvous-corneous; spire turrite, attenuate

towards the rather obtuse apex; suture impressed, crenulate. Whorls 9, slightly convex, the last about two-fifths the length of the shell. Aperture semi-oval; columella rather straight, whitish-calloused; peristome unexpanded, thin, the margins joined by a whitish callus. Length 28, diam. 9, aperture 10 x 5 mm. (*Beddome*).

S. India: Travancore Hills above Calcad.

*G. subperrotteti* BEDD., Proc. Malac. Soc., vii, p. 163, pl. 15, f. 1, 1a (Sept., 1906).

“Intermediate between *chessoni* Bens. and *perrotteti* Pfr. The sculpture is much less prominent than in the former.”

31. *G. CANARICA* Beddome. Pl. 8, figs. 7, 8.

Shell turrite-oblong, rather thin; spire oblong, apex obtuse; very glossy, purple-brown, distinctly and closely sub-costulate-striate, under the lens closely decussate; suture impressed; whorls 9, nearly flat, the last two-fifths the total length. Aperture vertical, oblong semi-oval. Peristome thin. Columella deeply arcuate, almost vertically truncate in front. Length 25, diam. 9, aperture 8 x 4 mm. (*Beddome*).

S. India: South Canara Ghats (Kudra Mukh), rare.

*Glessula c.*, BEDDOME, P. Mal. Soc. Lond., vii, 164, pl. 15, f. 4 (Sept., 1906).

“In its blunt oblong spire it resembles the large form of *amentum* as figured by Hanley. It is a beautifully sculptured shell.”

32. *G. ANAMULLICA* (Blanford).

“Shell turrite-ovate, thin, finely striated, horny with high vitreous lustre. Spire turrited, sides convex, apex obtuse, suture impressed. Whorls 8, scarcely convex, the last rounded beneath. Aperture oblique, peristome thin, columella moderately arcuate, obliquely truncated below.”

Length 27, diam. 12, aperture 10 x 6.5 mm. (*Blanf.*).

S. India: Anamullay Hills (Blanf.); Travancore Hills (*Beddome*).

*Achatina anamullica* BLANF., J. A. S. B., vol. 35, 1866, p.

37.—PFR., Monogr., vi, 223.—*Glessula a.*, BEDDOME, *l. c.*, p. 164.

“ Though a good many of this fine, dark chocolate-colored species were taken, none of them had a firm lip, and though eggs were taken from some of them they are probably not full grown. It is not very like any one species, the nearest to it being *perrotteti* ” (*Beddome*).

33. *G. SUBINORNATA* Beddome. Pl. 8, figs. 5, 6.

Shell oblong-turrite, solid, closely striate, decussated with very minute obsolete, spiral striae; tawny, glossy, the apex a little obtuse; suture lightly impressed, very closely crenulate. Whorls 8, rather flattened, the last two-fifths the total length, a little convex; spire long-turrite. Columella arcuate, white-calloused, obliquely abruptly truncate. Aperture triangular-semi-ovate, whitish inside; peristome simple, obtuse,

Length 28, diam. 8, aperture 10 x 5 mm. (*Bedd.*).

S. India: Sispara Ghat, on the Nilgiris.

*G. subinornata* BEDDOME, P. Mal. Soc. Lond., vii, Sept., 1906, p. 164, pl. 15, f. 3, with var. *minor*.

“ Allied to the Ceylonese *inornata* and *parabilis*; smaller and narrower than the former; larger and with a more elongated spire than the latter.”

“ Var. *minor*. Length 21, diam. 7 mm.; aperture 8 mm. long, 4 wide. Brunagherry Hills, Wynad.

“ Of a pale-steel color, otherwise only differing in size from the type. Very near *parabilis*, but with rather longer spire and smaller aperture ” (*Beddome*).

34. *G. BEDDOMEI* (Blanford). Pl. 11, figs. 10, 11.

“ Shell turrite-ovate, solid, finely and closely sub-costulately striated, dark-purplish brown, epidermis in parts having a tendency to assume a dirty cream color, especially in dead specimens. Spire convex below, slightly acuminate above, apex obtuse, rather inclined to the right, suture impressed. Whorls  $7\frac{1}{2}$ -8, convex, the last two-fifths of the entire length, rounded at the base. Aperture nearly vertical, sub-pyriform, milky within; peristome thickened, white, outer

margin rather straight, not arcuate, columella deeply curved, lined with callus, subobliquely and rather broadly truncated at the base."

Length 30, diam. 11.5, aperture 10 x 6 mm. (*Blanf.*).

S. India: Anamullay Hills, 5000-7000 ft. (type loc., Beddome). Ceylon.

*Achatina beddomei* BLANF., J. A. S. B., vol. 35, 1866, p. 41.—H. & T., Conch. Ind., pl. 102, f. 8; 156, f. 4.—*Glessula b.*, BEDDOME, P. Mal. Soc., vii, 165, with var. *pallens*.

"This is a more solid form than any of the Nilgiri species, and it differs from all of them, and also from the solid Ceylonese forms, in its sub-acuminate apex. It is a well-marked species" (*Blanf.*).

"The Ceylon specimens are slightly narrower, but do not otherwise differ" (*Beddome*).

Var. *pallens* Beddome. Only differing from the type in being of a pale-straw color. There are numerous specimens of this in the Nevill collection, purchased by Messrs. Sowerby and Fulton, and a single specimen in the late Dr. Blandford's collection, labeled *G. skinneri*. This is, I believe, *inornata* var. *b* Pfr., Monogr. Hel., iii, p. 490 (*Beddome*).

The figures are copied from *Conchologia Indica*. Fig. 10 is from a native painting, fig. 11 from the type specimen. Hanley remarks that it "differs little from *G. inornata* except in its peaked apex." Whether it has the microscopic sculpture of that species is not known.

35. *G. BOTTAMPOTANA* ('Beddome' Hanley). Pl. 11, fig. 12.

"Length 25.5, diam. 10 mm., whorls 7, of unusually solid substance" (*Nevill*, 1881, specimen from Col. Beddome).

"The decussation in the sculpture is much more prominent than in any other species. Hanley's figure is good, but does not show the sculpture" (*Beddome*).

S.-W. India: Bollampatty Hills, 5-6000 ft., above Palghat.

*Achatina bottampotana* Beddome MSS., HANLEY and THEOBALD, Conch. Indica, p. 63, pl. 156, f. 1 (1874); no description.—*Stenogyra (Glessula) bottampotana* NEVILL, Handlist Ind. Mus., p. 169 (Anamullays).—*S. (G.) bollampattiana*



Beddome, G. NEVILL, J. A. S. B., vol. 50, 1881, p. 139.—*Glessula bolumpattiana* BEDDOME, Proc. Malac. Soc. Lond., vii, Sept., 1906, p. 165.

Since Indian authors do not agree in the orthography of the name, I have followed the original spelling.

36. G. SUBSERENA Beddome. Pl. 8, figs. 13, 14.

Shell ovate-turrite, rather solid, very highly polished, obsoletely striatulate, fulvous-corneous, pellucid. Spire sub-turrite, the apex obtuse; suture impressed, margined, crenulate. Whorls 7, rather flattened, the last scarcely half the total length. Aperture semi-oval; columella deeply arcuate, whitish-calloused, margins joined by a callus, at the base abruptly and obliquely truncate. Length 22, diam. 11, aperture 10 x 5 mm. (*Beddome*).

S. India: Peermede, Travancore; Anamullays.

*Glessula s.*, BEDDOME, P. Mal. Soc. Lond., vii, Sept., 1906, p. 166, pl. 15, f. 7.

“The last whorl is longer and the spire less elevated than in the Ceylonese *serena*, and the whorls, especially the upper ones, are less convex.”

37. G. JEYPORENSIS Beddome. Pl. 8, figs. 11, 12.

Shell oblong-turrite, thin, striatulate, glossy, buff-corneous. Spire sub-turrite, obtuse at the apex. Suture impressed, crenulate. Whorls 8, rather flat, the last nearly two-fifths the total length. Columella very deeply arcuate, truncate at the base. Aperture semi-oval; peristome simple. Length 18, diam. 6, aperture 5 x 3 mm. (*Beddome*).

Jeypore Hills, East coast of the Madras Presidency.

*G. jeyporensis* BEDDOME, P. Mal. Soc. Lond., vii, Sept., 1906, p. 167, pl. 15, f. 6, 6a.

“Allied to *bensoniana*, but with a shorter, blunter spire.”

38. G. JERDONI ('Benson' Reeve). Pl. 12, figs. 16, 17, 18.

Shell oblong-subulate, thin, smoothish, glossy, tawny-corneous; spire turrited, the apex rather obtuse, suture margined; whorls 8, a little convex, the last slightly exceeding one-third

the total length, somewhat tapering towards the base. Columella slightly arcuate, shortly truncate near the base of the subrhombic-semioval aperture: peristome unexpanded, acute, the right margin slightly arcuate. Length 14, diam. 5, aperture  $4\frac{2}{3} \times 2\frac{2}{3}$  mm. (*Pfr.*).

Nilgiris (Jerdon, type loc.); Anamullays; Pulney Hills (Fairbank); Cherra Poonjee (Beddome).

*Achatina jerdoni* Benson MS., REEVE, Conch. Icon., v, March, 1850, pl. 21, fig. 80.—PFR., Monogr., iii, 494; Conchyl. Cab., p. 312, pl. 25, f. 10, 11.—H. & T., Conch. Ind., pl. 78, f. 10.

Pfeiffer's figures and description of a specimen from Benson are reproduced. The specimens recorded from Cherra Poonjee should be very closely compared with those from Southern India; they may prove separable.

39. *G. SINGHURENSIS* W. Blanford. Pl. 10, fig. 5.

Shell pyramidal, turrated, thin, corneous, polished, glossy, smooth, slightly striatulate. Spire long-conic, the apex subacute; suture impressed, minutely corrugated. Whorls 8, convex, the last scarcely one-third the total length, rounded beneath. Aperture nearly vertical, ovate-oblong; peristome obtuse, whitish; columella very deeply arcuate, obliquely truncate in front. Length 12.5, diam. 4.4, aperture  $4 \times 2.5$  mm. (*Blanf.*).

Singhur, near Poona.

*G. singhurensis* BLANF., J. A. S. B., vol. 39, 1870, p. 19, pl. 3, f. 17.—*Achatina s.*, H. & T., Conch. Ind., pl. 78, f. 7.

“ This is allied to the Nilgiri *G. jerdoni* Bens., but the sides of the spire are less convex, the shell being more regularly pyramidal, with a less obtuse apex. In some of the specimens of this species collected alive, but in which the animal had subsequently dried up, I found young shells. It would thus appear to be viviparous. I have observed the same circumstance (the occurrence of young shells inside the old one) in *G. cassiaca* Bs. In other species of this genus I have found small round eggs with a calcareous shell, but these may be hatched, before they are deposited by the parent ” (*Blanf.*).

40. *G. AMENTUM* ('Benson' Reeve). Pl. 10, figs. 1, 2, 3, 4.

Shell turrite-oblong, rather thin, distinctly and closely striate, silky, pellucid, chestnut-corneous. Spire turrite, the apex rather obtuse, suture impressed, whitish, subcrenulate. Whorls 9, a little convex, the last one not one-third the length, rounded at base. Columella a little arcuate, white-calloused, somewhat twisted, obliquely truncate at the base of the sub-rhombic-semioval aperture; peristome simple, unexpanded, the right margin regularly arcuate. Length 22, diam. 7 mm.; oblique length of aperture 7.5, width 4 mm. (*Pfr.*, from spec. in Benson coll.).

Near Calcutta, under a fallen palm, on the Howrah bank of the river, between Bishop's College and the Botanic Gardens (Benson, 1835, type loc.); Valley of the upper Nerbudda (W. Theobald); Orissa and Ganjam (Beddome).

*Achatina amentum* Benson MS., REEVE, Conch. Icon. v., June, 1849, pl. 17, fig. 82.—PFR., Monogr., iii, 499; Conchyl. Cab., p. 311, pl. 25, f. 4, 5.—H. & T., Conch. Indica, pl. 35, f. 3.—BENSON, Ann. Mag., v, 1860, p. 464.—*Glessula a.*, BEDDOME, P. Mal. Soc., vii, 168.

The initial half whorl is smooth, the next two whorls closely, very regularly striate vertically. Then the coarser, post-embryonic sculpture begins (pl. 10, fig. 4). The striation is rather sharp but uneven, and the striæ are strongest at and near the suture, decreasing downwards. It resembles *G. notigena* somewhat, but the early whorls are not attenuated, and there are 2½ embryonic whorls.

Col. Beddome remarks: "I found the smaller variety very abundant on the top of the Myhendra Hill (Ganjam). The larger variety, found near Calcutta and in central India, and well figured by Hanley, is a rare shell. It has a shorter and blunter apex and fewer whorls than *G. vandulica*, but specimens of that species sometimes do duty for it in collections."

41. *G. FACULA* (Benson). Pl. 10, figs. 8, 9.

Shell turrite-ovate, thin, smooth, irregularly striatulate, translucent, glossy, pale tawny-corneous. Spire turrite-conic, the apex obtuse, suture rather deep, irregularly, slightly

crenulate. Whorls  $7\frac{1}{2}$ , somewhat convex, the last scarcely two-fifths the total length, lightly and remotely plicate-striate anteriorly. Aperture subvertical, semi-oval; columella shortly and deeply arcuate, callous, obliquely truncate at base. Peristome unexpanded, thin, margins joined by a thin callus. Length 18, diam. 8, aperture  $7 \times 4.5$  mm. (*Bens.*).

Nilgiris (T. Jerdon, type loc.); Pulney Hills; Nullaymallays; Kurnool; Jeypore Hills, east side of Madras (Beddome).

*Achatina facula* BS., Ann. and Mag. N. H. (3), v, June, 1860, p. 466.—PFR., Monogr., vi, 224.—H. & T., Conch. Ind., pl. 35. f. 1 (not good).—*Glessula f.*, BEDDOME, P. Mal. Soc. Lond., vii, 168.—*Achatina perotteti* REEVE, Conch. Icon., v, pl. 21, f. 102.—*Stenogyra (Glessula) facula* NEVILL, J. A. S. B., vol. 50, 1881, p. 137, pl. 18, 18a (copy from Reeve).

*Cf. G. illustris*, no. 69.

“ Intermediate in form between *A. oreas* and *A. hügelii* Pfr., this shell was, in the *Conchologia Iconica*, confounded with *A. perotteti* Pfr., which proved to be a more elongated form, of which *A. nilagirica* B., fig. 87 of the same plate, is a lengthened variety. Pfeiffer cites fig. 102, with a mark of doubt, under *A. perotteti*, in the third volume of his *Manual*” (*Benson*).

42. *G. BOTELLUS* (Benson). Pl. 10, fig. 6.

Shell oblong, rather solid, smooth, lightly striatulate, under a lens distinctly, closely, spirally, very minutely scratched, polished, tawny-chestnut. Spire ovate-oblong, the apex very obtuse, suture impressed, slightly crenulate. Whorls 7, a little convex, the last slightly wider. Aperture suboblique, semi-oval, whitish within; columella deeply arcuate, whitish-calloused, subvertically truncate at the base. Peristome unexpanded, the margins joined by a thin callus, right margin slightly widened, flat, not thickened. Length 18, diam. 7.5, aperture  $7 \times 3.66$  mm. (*Bens.*).

Nilgiris (T. Jerdon, type loc.); Pykara (Blanford).

*Achatina botellus* BENS., Ann. and Mag. N. H. (3), v, June, 1860, p. 465.—PFR., Monogr., vi, 226.—H. & T., Conch. Ind.,

pl. 35, f. 4.—*Glessula botellus* BEDDOME, P. Mal. Soc. Lond., vii, 168.

Col. Beddome writes: "Nevill labelled my specimens from the foot of the Nilgiris *botellus* var. *convexior*, but I do not see how they differ from the type."

43. *G. OROPHILA* ('Benson' Reeve). Pl. 10, fig. 10.

Shell conically ovate; spire acuminate; sutures impressed; whorls 7, rounded, peculiarly obscurely indented; columella short, deeply arched and truncated; aperture rather small, olive-horn colored. Distinguished by the deeply-arched curvature of the columella, and by the whorls being rather more numerous than is usual in species of this form (Reeve).

Nilgiri Hills (type loc., Jerdon); Anamullay Hills; S. Canara; Golcondah Hills, east side of Madras Presidency (Beddome).

*Achatina orophila* Benson MS., REEVE, Conch. Icon., v, June, 1849, pl. 19, f. 105.—*Stenogyra* (*Glessula*) *orophila* NEVILL, J. A. S. B., 1881, p. 137.—*Glessula o.*, BEDDOME, P. Mal. Soc. Lond., vii, 168.—*Achatina arthurii* BENSON, Ann. Mag. N. H. (3), xiii, March, 1864, p. 209.—H. & T., Conch. Ind., pl. 36, f. 3.—*Cionella* (*Glessula*) *orophila* SEMPER, Reisen im Archipel Phil., Landmoll., p. 133, pl. 12, f. 14-16 (genitalia), pl. 16, f. 18 (central tooth).

Reeve's second locality, Colombo, Ceylon, was probably due to an erroneous identification. Col. Beddome omits the Nilgiris from his list of localities. He writes: "My Golcondah specimens were labelled by H. Nevill *G. subbrevis*, but I cannot see how they differ. Nevill, I think, saw only young examples."

*Achatina arthurii* Benson, from Neher, Mahableswar Hills, is considered a synonym of *orophila* by Col. Beddome. The original figure is copied, pl. 10, fig. 7. "Shell ovate-conic, irregularly plicate-striate, buff-tawny, polished, translucent. Spire ovate-conic, apex obtuse, suture impressed. Whorls  $7\frac{1}{2}$ , a little convex, subcrenulate at the suture. Aperture subvertical, elliptic-ovate, peristome rather thick, parietal cal-

lus whitish; columellar margin obliquely truncate. Length 19, diam. 10, aperture 8 mm." (Benson).

44. *G. OREAS* ('Benson' Reeve). Pl. 10, fig. 11.

Shell oblong-conical; whorls 7, convex, finely margined at the sutures, longitudinally obscurely impressed striate, columella arched, aperture small, brown-horny (Reeve).

Length 14.5, diam. 7.25 mm., whorls 7 (Nevill).

Nilgiris (Jerdon, type loc.), foot of the Koonoor Pass (Nevill); Tinnevely and Travancore Hills; South Canara Ghats; Nallaymallays, Kurnool (Beddome).

*Achatina oreas* Benson MS., REEVE, Conch. Icon., v, pl. 21, fig. 113, March 1850.—*Stenogyra (Glessula) oreas* NEVILL, J. A. S. B., vol. 50, 1881, p. 135.—*Glessula o.*, BEDDOME, P. Mal. Soc. Lond., vii, 169. (Not *A. oreas* Pfr.)

45. *G. PSEUDOREAS* (Nevill), pl. 10, figs. 12, 13.

Shell subturrite-ovate, thin, smooth, slightly shining, brown-corneous; spire turrite-conic, the apex obtuse; suture submarginate, impressed. Whorls 7, a trifle convex, the last about two-fifths the total length, rounded at the base; columella very deeply arcuate, white-calloused, obliquely truncate above the base of the elliptic-semioval aperture; peristome unexpanded, acute, the right margin lightly arcuate. Length 12.5, diam. 5, aperture 5 x 2.5 mm. (Pfr.).

Length 11, diam. scarcely 5 mm., whorls 6 (Nevill).

Nilgiris (type loc., Jerdon, Blanford); S. Canara Ghats; Anamullays; Pulney Hills; Tinnevely Hills (Beddome).

*Achatina oreas* Benson, PFR., Monographia Heliceorum Viventium, iii, 1853, p. 495 (exclusive of reference to Reeve); Conchyl. Cab., p. 312, pl. 25, f. 8, 9. Not *A. oreas* Reeve, 1850.—*Stenogyra (Glessula) pseudoreas* NEVILL, J. A. S. B., vol. 50, 1881, p. 136.—*G. pseudoreas* BEDDOME, Proc. Malac. Soc. Lond., vii, p. 169.

Var. *subdeshayesiana* Nevill. Whorls 6, length 11, diam. 4.25 mm. Type var. from the Anamullays, coll. Col. Beddome; also from the Pulney Hills, coll. Rev. Fairbank (*G. Nevill*).

46. *G. SCRUTILLUS* (Benson). Pl. 10, fig. 17.

Shell oblong, rather solid, smooth, rather remotely striatulate, glossy, tawny-corneous; spire ovate-oblong, apex obtuse, suture impressed; whorls  $5\frac{1}{2}$ , a little convex, the last over one-third the length of the shell. Aperture vertical, ovate-elliptical. Columella deeply arcuate, abruptly and deeply truncate at the base; peristome unexpanded, obtuse, the margins joined by a rather thick callus. Length 6, diam. 2.66, aperture 2.5 mm. (*Bens.*).

Cuttack, Orissa, type loc.; upper valley of the Nerbudda (W. Theobald).

*Achatina scrutillus* BENS., Ann. Mag. N. H. (3), v, June, 1860, p. 463.

This little species may be known at once on comparison with the Bengal *A. gemma*, which is ordinarily of the same size, by its less rapidly-decreasing spire, solidity and color; and from the paler *A. frumentum* Reeve, which is probably only a local variety of *A. gemma*, by the two first-mentioned characters" (*Bens.*).

47. *G. PULLA* Blanford. Pl. 13, figs. 5, 6.

Shell small, turrite, thin, brownish-corneous, a little shining, smooth, striatulate. Spire lengthened subconic, the sides somewhat convex; apex obtuse; suture impressed. Whorls 7 to 8, convex, short, the last about two-sevenths the total length, rounded below. Aperture oblique, subovate; peristome thin; columella arcuate, obliquely truncate below. Length 7, diam. 2.75, aperture  $2 \times 1.5$  mm. (*Blanf.*).

Torna, Bombay Presidency (Evezard).

*Glessula pulla* BLANF., J. A. S. B., 1870, xxxix, p. 21, pl. 3, f. 20.—*Achatina pulla* HANL. and THEOB., Conch. Ind., pl. 78, f. 1.—PFR., Monogr., viii, 288.

"This is allied to *G. fairbanki* Bs., but distinguished by its more conical spire, smaller size and darker color" (*Blanf.*).

48. *G. PAUPERCULA* (Blanford). Pl. 13, fig. 9.

Shell turrite-oblong, rather solid, a little shining, tawny-

corneous, impressed-striate. Spire turrite, the sides slightly convex; apex obtuse; suture submarginate. Whorls 7, a little convex, the last about one-third the total length. Columella deeply arcuate, truncate at the base. Aperture oval-piriform; peristome unexpanded, slightly labiate within, the margins joined by a callus.

Length 9, diam. 3.5, aperture 3 x 2 mm. (*Blanf.*).

Kolamullies, Patchamullies and Shevroys (W. King and R. B. Foote, original lot); Hills in the Salem district; Anamullays; Tinnevely; Travancore Hills; Kurnool Hills (Beddome).

*Achatina paupercula* BLANF., J. A. S. B., vol. 30, 1861, p. 362, pl. 1, f. 16.—H. & T., Conch. Ind., pl. 102, f. 1.—*Glessula p.*, BEDDOME, P. Mal. Soc., vii, 170, with var. *nana*.—[*G.*] *inconspicua* Nevill MS., BEDDOME, l. c.

“The nearest ally to this small species appears to be the Darjiling *A. crassula* B. From this it is mainly distinguished by the shape of the spire which is more convex at the side, by its smaller breadth compared with its length, and by its more marked and slightly marginate sutures.

“*A. paupercula* is probably common upon the Shevroys. All the specimens, however, found by Mr. King at that locality are bleached, two specimens from the Kolamullies alone retaining their original texture” (W. T. & H. F. Blanford).

Var. *nana* Beddome. A shorter, more obtuse form, occurring occasionally with the type form, and very like *sattaraensis*, but shorter (*Beddome*).

49. *G. SATTARAENSIS* ('H. Ad.' H. & T.). Pl. 13, figs. 7, 8.

Shell oblong-turrite, rather solid, smooth, obscurely striate, glossy, brown-corneous. Spire turrite, the apex slightly obtuse; suture impressed, crenulate. Whorls 7, a little convex, the last slightly over three-eighths the total length. Aperture slightly oblique, oval. Columella callous, deeply arcuate, obliquely truncate; peristome unexpanded, obtuse, margined with whitish; margins joined by a thin callus. Length 8.5, diam. 4 mm. (*H. Ad.*).

Western India: Satara, Bombay Presidency (E. L. Layard,



type loc.); Ceylon central provinces; Rambaddy Ghats (Beddome); Nuwara-Eliya (Simon).

*Glessula fusca* H. Ad., P. Z. S., 1868, p. 15, pl. 4, f. 10, 10a (not *Achatina fusca* Pfr.).—*Achatina sattaraensis* H. Adams MS., HANLEY & THEOBALD, Conch. Indica, p. 33, pl. 78, f. 4.—PFR., Monogr., viii, p. 281.

I do not know whether Ceylonese examples have been carefully compared with the types from Satara. A specimen from Saharumpore has been figured by Hanley.

50. *G. SUBJERDONI* Beddome. Pl. 8, figs. 3, 4.

Shell oblong-turrite, thin, lightly striatulate, glossy, subpellucid, tawny-corneous. Spire sub-turrite, a little obtuse at the apex; suture impressed; whorls 7 to 8, a little flattened, the last scarcely four-sevenths the total length, tapering at the base. Columella lightly arcuate, truncate a little way above the base of the aperture. Aperture vertical, semi-oval; peristome simple, a little obtuse. Length 11, diam. 3.5, aperture 2.5 x 2 mm. (*Beddome*).

Jeypore and Golconda Hills, east side of Madras Presidency.

*G. subjerdoni* BEDD., Proc. Malac. Soc. London, vii, Sept., 1906, p. 170, pl. 15, f. 2, 2a.

"A smaller and more slender shell than *jerdoni*, and much larger than *paupercula*, of which it may be a large form."

A specimen evidently near *subjerdoni*, but purchased as *G. jerdoni*, and said to be from the Nilgiris, is figured, pl. 12, fig. 16. Below the suture there are vertical grooves, strong and regular on the shoulder, but rapidly weakening downward. The lip is rather thick and whitish-edged. It is a wider shell than *G. p. taprobanica*, which seems to be closely related. Length 9.2, diam. 3.9, aperture 3.25 mm.; whorls 7.

51. *G. GRACILIS* Beddome. Pl. 8, figs. 17, 18.

Shell small, cylindric-turrite, rather solid, slightly shining, evidently striatulate. Spire long, obtuse at the apex; suture impressed, crenulate. Whorls 8, a little flattened, the last scarcely one-third the total length, the base slightly tapering.

Columella a little oblique, truncate a little way above the base of the aperture. Aperture vertical, semi-oval; peristome whitish within, obtuse. Length 11, diam. 2, aperture 2.5 x 1.5 mm. (*Beddome*).

Nilgiri Hills, type loc.; Jeypore Hills, east coast of Madras.

*G. gracilis* BEDD., Proc. Malac. Soc. Lond., vii, Sept., 1906, p. 170, pl. 15, f. 9, 9a.

“The Jeypore specimens are slightly larger, the whorls rather more convex and slightly angular close to the sutures.”

52. *G. PUSILLA* Beddome. Pl. 8, figs. 9, 10.

Shell turritate-oblong, thin, a little glossy, buff-corneous, lightly striatulate. Spire turritate, obtuse at the apex; suture crenulate. Whorls 6 to 6½, a little convex, the last two-fifths the total length. Columella deeply arcuate, at the base almost vertically truncate. Aperture semi-oval; peristome unexpanded, whitish. Length 5 to 5.5, diam. 1.75 to 2 mm.; aperture 1.5 x 1 mm. (*Bedd.*).

Ceylon, Rambaddy Ghat. South India, Anamullay Hills; Shevaroy; Nilgiris.

*G. pusilla* BEDD., P. Malac. Soc. Lond., vii, Sept., 1906, p. 171, p. 15, f. 5, 5a.

“Much smaller than *colletta*, its nearest ally, with weaker sculpture and paler color.”

53. *G. MULLORUM* (Blanford). Pl. 13, fig. 10.

Shell turritate-oblong, rather solid, pale corneous, diaphanous, rather remotely, lightly striate. Spire turritate, the apex obtuse, suture impressed. Whorls 6, convex, the last about one-third the total length, rounded basally. Columella short, arcuate, slightly callous, obliquely truncate. Aperture nearly semi-circular, vertical; peristome unexpanded, obtuse; margins joined by a thin callus. Length 7.5, diam. scarcely 4, aperture 2.5 x 1.75 mm. (*Blanf.*).

City of Madras (Blanford, Nevill).

*Achatina mullorum* BLANF., J. A. S. B., vol. 30, 1861, p. 362, pl. 1, f. 17.—H. & T., Conch. Ind., pl. 102, f. 5.—PFR., Monogr., vi, 228.

“ This is one of the group of small Indian *Achatinas* comprising *A. gemma* Bens., and *A. scrutillus* B. From these two shells the present species is distinguished by its conical spire with straight and not convex sides, its paler color and sculpture. Both varieties are found abundantly crawling on banks, in a garden at Nungumbankum, a suburb of Madras ” (W. T. & H. F. Blanford).

54. *G. BREVIS* (Pfeiffer). Pl. 13, fig. 13.

Shell conic-ovate, thin, pellucid, tawny-corneous. Spire conic, the apex somewhat obtuse. Whorls 6, moderately convex; distinctly sculptured with striæ descending from the suture and vanishing downward; last whorl a little shorter than the spire, rounded. Columella twisted forward, almost horizontally truncate. Aperture nearly vertical, sinuate-oval; peristome thin. Length 8 to 9, diam. 5 to 5.3, aperture 4.66 x 2.33 mm. (*Pfr.*).

Ahmednuggur (type loc.) and Poona; Jeypore Hills, east side of Madras Presidency (Beddome).

*Achatina brevis* PFR., P. Z. S., 1861, p. 387; Monogr., vi, 227.—H. & T., Conch. Indica, pl. 18, f. 10.—*Glessula brevis* BEDDOME, P. Mal. Soc., vii, p. 171 (*microsculpta* Nevill MS. mentioned).

According to Col. Beddome, “Hanley’s figure is too broad towards the base, and does not show sculpture, which is peculiar.” His Jeypore specimens were named *microsculpta* by Nevill, but they seem not to differ from *brevis*.

55. *G. FILOSA* Blanford. Pl. 13, fig. 14.

Shell subrimate, turrite, thin, corneous, vertically plicastriate, little shining. Spire elevated; apex obtuse, very shortly conic, somewhat mucronate; suture impressed. Whorls 8, convex, the last about one-third the total length, rounded basally. Aperture vertical, lunate-suboval. Peristome unexpanded, thin. Columella arcuate, whitish, lamelliform, thin, obliquely truncate. Length 21, diam. 9; aperture 5 mm. long.

Travancore (type loc.) and Tinnevely Ghats (Beddome).

*Glessula filosa* BLANF., J. A. S. B., vol. 39, 1870, p. 19, pl. 3, f. 16.—BEDDOME, l. c., p. 171.—*Achatina filosa* PFR., Monogr., viii, p. 279.—H. & T., Conch. Ind., pl. 36, f. 10.

“A peculiar form, easily distinguished by its strong sculpture, abrupt, subconical apex, and by the columella standing out from the last whorl, so as to have a groove running along its side” (*Blanf.*).

56. *G. SUBFILOSA* Beddome. Pl. 8, figs. 15, 16.

Shell elongate-turrite, thin, tawny-corneous, distinctly plicate-striate. Spire long, subobtuse at the apex, long-conic. Suture impressed. Whorls 10, rather flat, the last subcarinate, scarcely one-third the total length. Aperture lunata-suboval; peristome thin; columella deeply arcuate, abruptly obliquely truncate. Length 16, diam. 5, aperture 5 x 3 mm. (*Beddome*).

South India: Sirumallay Hills, Dindigul.

*Glessula subfilosa* BEDD., Proc. Malac. Soc. Lond. vii, Sept. 1906, p. 171, pl. 15, f. 8, 8a.

“The prominent sculpture is like that of *filosa*, but it is a very much smaller shell, with a much more elongated apex.”

57. *G. LYRATA* Blanford. Pl. 13, fig. 15.

Shell ovate-turrite, rather solid, corneous, a little shining, vertically costulate-plicate, under the lens decussated with very minute, close spiral lines, often obsolete. Spire pyramidal, the sides slightly convex; apex rather obtuse; suture deep. Whorls  $7\frac{1}{2}$ , convex, obsoletely subangular below the suture, the last a little ascending in front. Aperture vertical, truncate, semioval; peristome obtuse; columella moderately arcuate, obliquely truncate in front. Length 12, diam. 5.5, aperture  $4 \times 2\frac{1}{3}$  mm. (*Blanf.*)

Mahableshwar (type loc.); Khandala, western Ghats (*Blanford*).

*Glessula lyrata* BLANF., J. A. S. B. vol. 39, 1870, p. 20, with var *matheranica*, p. 21, pl. 3, f. 19.—*Achatina lyrata* H. & T., Conch. Indica pl. 18, f. 9.—*S. (G.) lyrata* NEVILL, Handlist, p. 167.

“This shell resembles in form *A. oreas* Bens., but is distinguished from that and all other allied species by its stronger sculpture. Possibly the two varieties should be ranked apart, as there is considerable difference between them. A third form, shorter and more tumid, occurs near Poona. As other intermediate varieties probably exist, I prefer for the present classing all in one species, but it may hereafter be desirable to distinguish them.” (*Blanf.*)

The figure in *Conchologia Indica*, which I have copied, does not agree very well with the description, but it is said to represent the type specimen.

Var. *matheranica* Blanford. Pl. 13, fig. 16.

Smaller, more polished, wanting spiral lines, the sculpture obsolescent on the last whorl. Length 10, diam. 4.5 mm. (*Blanf.*)

Matheran, near Bombay.

58. *G. RUGATA* Blanford. Pl. 7, figs. 11, 12.

Shell turrite, corneous, thin, little shining, vertically closely plicate-striate, the striæ minutely and regularly granulate (under a lens), interstices decussated with close, minute spiral lines, stronger in the upper whorls. Spire long conic; apex obtuse; suture deep. Whorls  $7\frac{1}{2}$ , convex, the last about one-fourth the total length. Aperture oblique, nearly ovate; peristome thin, unexpanded. Columella deeply arcuate, obliquely truncate in front. Length 6, diam. 2, aperture 1.5 x 1 mm. (*Blanf.*)

Singhur Hills near Poona (type loc.), and Poorundhur (var. 7 mm. long), Bombay Presidency.

*Glessula rugata* BLANF., J. A. S. B. vol. 39, 1870, p. 20, pl. 3, f. 18.—*Achatina r.*, PFR., Monogr. viii, p. 293.—H. & T., Conch. Indica pl. 102, f. 7.

The first half whorl seems to be smooth; then granose striæ and spiral lines set in. The lower whorls have beautifully granose plicæ, unlike any other known *Glessula*.

## III. SPECIES OF NON-PENINSULAR INDIA, INDO-CHINA AND YUNNAN.

59. *G. tenuispira* (Benson). Pl. 9, fig. 1, 4.

Shell elongate-turrite, corneous, longitudinally striate, attenuate towards the apex, columnar. Last whorl sometimes ornamented with whitish transverse bands; suture impressed, apex obtuse. Length about 1 inch, width 0.55 inch. Remarkable for the attenuated, columnar form of the terminal whorls of the spire (*Bens.*).

Darjiling; Khasia and Daffa Hills; Pegu; N. Canara (Godwin-Austin, Beddome).

*Achatina tenuispira* BENS., Journ. Asiat. So. Beng. v, 1836, p. 353.—REEVE, Conch. Icon. v, pl. 16, f. 76.—PFR., Monogr. ii, 262; Conchyl. Cab. p. 310, pl. 25, f. 6, 7.—HANL. & THEOB., Conch. Indica, pl. 36, f. 8.—*Glessula t.*, BEDDOME, Proc. Mal. Soc. Lond. vii, 1906, p. 160.—*Achatina pertenuis* W. BLANFORD, Journ. Asiat. Soc. Beng. xxxiv, 1865, p. 79.—H. & T., Conch. Indica, pl. 18, f. 5.—*Glessula p.*, BEDDOME, l. c.—*Stenogyra (G.) pertenuis* NEVILL, Handlist p. 169, no. 68 (Ton-goop, Arakan; Akoutong and Thyetmyo, etc.).—*Glessula baculina* BLANFORD, Journ. Asiat. Soc. Beng. xl, 1871, p. 43, pl. 2, f. 6.—*Achatina b.*, H. & T., Conch. Ind. pl. 78, f. 6.—PFR., Monogr. viii, 291.

“Full grown shells collected in the Teesta Valley near Darjiling, and in N. Canara, measure 44 mm. in length, and have 14 whorls” (*Beddome*). *G. baculina* and *G. pertenuis* are considered to be specifically inseparable from *G. tenuispira* by Col. Beddome, a conclusion supported by the specimens before me. The presence of this trans-Gangetic snail in the North Canara Hills is remarkable, if indeed, the Canara shells are really of the same species.

59a. Var. *baculina* Blanford. Pl. 9, fig. 2.

Shell elongate-turrite, slender, rather thin, obliquely striate, brown or corneous-fulvous, covered with a glossy cuticle. Spire turrite, the apex rather obtuse. Whorls  $1\frac{1}{2}$ , slightly convex, the lower ones subequal; suture impressed, minutely

denticulate. Aperture oblique, ovate-triangular; peristome simple, acute. Columella abruptly arcuate, obliquely produced, vertically truncate at the base. Length 38, diam. 6.5 to 7.5 mm.; aperture 7 x 4 mm. (*Blanf.*)

Khersiong, Himalayas of Sikkim.

"This species appears to have escaped the notice of all previous collectors in Sikkim; it was found in association with its near ally *G. tenuispira* Bens., by Dr. Stoliczka during a recent visit. It is easily distinguished from the latter species by its slenderness, (the diameter being  $\frac{1}{6}$  of the length) and the comparative narrowness of the whorls; moreover by the form of the columella, the lower part of which is bent abruptly almost at right angles with the slope of the inner lip; while in *G. tenuispira*, *G. crosa*, and other allied forms, the curvature is at the utmost obtuse. Specimens, the shell of which has been slightly weathered, show fine spiral markings, but these are not visible unless the shell has become somewhat opaque. The animal is dark leaden grey, somewhat paler at the sides of the foot." (*Blanf.*)

"This is, I believe, only a more slender form of *tenuispira*, as I have specimens intermediate in breadth; as to any difference in the columella, some of my specimens of *tenuispira* have the lower part more bent than in any of the supposed *baculina*" (*Beddome*).

59b. Var. *pertenuis* (Blanford). Pl. 9, fig. 3.

"Shell very slender, turritid, thin, light horny, polished, closely, minutely, and rather irregularly striated. Spire subulate, somewhat acuminate towards the blunt apex; suture impressed, subrenulate. Whorls 11-12, convex, the last about  $\frac{1}{3}$  the length of the spire. Aperture oblique, ovately pyriform, peristome thin, margins united by a thin callus, columella moderately curved, obliquely truncate. Length 20, diam  $4\frac{1}{2}$ . Length of aperture 4 mm. (*Blanf.*)

Tongoop, Arakan. (*Blanf.*)

"Var *major*. Length  $26\frac{1}{2}$  mm.; diam 6; length of aperture 6. Of another specimen length 23 mm.; diam.  $5\frac{2}{3}$ ; length of aperture  $5\frac{1}{4}$ . Pyema Khyoung, Bassein district, Pegu." (*Blanf.*)

A much more slender species than *A. tenuispira* Bens., (a variety of which also abounds in parts of Pegu), though there are signs of a passage. The present appears to replace *A. tenuispira* in Arakan and Bassein. Mr. Benson, to whom I sent a specimen, observes that it is intermediate between *A. tenuispira* and *A. hastula* Bens. (*Blanf.*)

Col. Beddome gives the localities, Assam; Arakan; Garo and Naga Hills; Burma. He remarks that "Blanford's types and all the specimens I have seen of this, are young shells, with fragile, unformed lips. They fit well with young of *tenuispira*. Blanford himself mentions that there are signs of a passage, and it would certainly not be advisable to consider it a good species without seeing specimens with adult lip."

60. *G. NAJA* 'Blanford' n.sp. Pl. 12, fig. 10.

Shell slender, turritate, thin, yellow-corneous, glossy, weekly striatulate, and having vertical grooves at unequal intervals; this sculpture is most evenly developed just below the suture. Under the compound microscope glimpses of excessively weak close spiral granule-lines may be seen in places. Outlines of the spire nearly straight, a trifle contracted near the apex. Whorls  $9\frac{1}{4}$ , moderately convex, separated by a deeply impressed simple suture. Aperture a little oblique; outer lip thin; columella rather long, regularly concave, truncate at the base. Length 19, diam. 6.6, length of aperture 6.5 mm.

Assam.

*Glessula naja* Blanf., in coll. A. N. S. P.—? *Stenogyra* (*Glessula*) n. sp., NEVILL, Handlist Ind. Mus. p. 170, no. 80.

The later whorls are decidedly longer than in *G. tenuispira* and its immediate allies. The specimens were received from Nevill under the name used above; they may possibly be *Glessula* no. 80 of his Handlist, since they seem related to *G. subfusiformis*.

61. *G. NILAGARICA* ('Benson' Reeve). Pl. 9, fig. 5.

Shell pyramidally turritated; whorls 10, convex, very finely



crenulated at the sutures, then striated; columella rather deeply arched; aperture small; brown-horny (*Reeve*).

S. India: Nilgiris (*Jerdon*).

*Achatina nilagarica* Benson MSS., REEVE, Conch. Icon. v, pl. 21, f. 87 (March, 1850).—*A. perotteti* var., PFR., Conchyl. Cab. pl. 25, f. 2, 3.

Mr. G. Nevill has expressed the opinion that the form figured by Reeve, which he had not seen, is distinct from *G. perotteti* (cf. J. A. S. B. 1881, xl. p. 136).

Var. *kurnoolensis* G. Nevill.

Length 30, diam. 9.5 mm., whorls 11. Distinguished from both *St. nilagirica* and *St. perotteti*, not only by its greater size and more numerous whorls, but especially by the (throughout) regular and prominent striation, not crenulate at the suture; from *St. vadalica* Blanford, which it perhaps even more closely resembles, in general aspect at any rate, by the more abruptly tapering apical whorls, more arched columella, &c. Nullaymullay Mountains, Kurnool District, at 2500 ft." (*Nevill*, J. A. S. B. 1881, p. 136).

62. G. HUGELI (*Pfeiffer*). Pl. 9, figs. 13, 14.

Shell ovate-turrite, fragile, longitudinally striate, glossy, pale corneous; spire lengthened, the apex rather obtuse, suture deep. Whorls 10 to 11, rather flat, the last about two-sevenths the total length. Aperture triangularly semioval; columella deeply arcuate, abruptly truncate at the base of the aperture; peristome unexpanded, acute. Length 35, diam. 11.5, aperture 12 x 6 mm. (*Pfr.*).

Kashmir (von Hügel; Hanley).

*Achatina hügelii* PFR., Symbolæ etc., ii, p. 58 (1842); Monogr. ii, 259; viii, 283; Conchyl. Cab. p. 334, pl. 29, f. 2, 3.—REEVE, Conch. Icon. pl. 15, f. 68.—*Glandina ? h.*, PHILIPPI, Abbild u. Beschreib. i, p. 135, *Glandina* pl. 1, f. 8.—HANL. & THEOB. Conch. Ind. pl. 78, f. 2.

The habitat was not given by Pfeiffer, but he states that the shell was taken during Hügel's journey. Hügel traveled in Kashmir, and published an account of that country in four volumes, 1840.

63. *G. BURRAILENSIS* Godwin Austen. Pl. 7, figs. 9, 10.

“Shell turreted, elongate, solid, in fresh state brown and lustrous, finely longitudinally striated; whorls 10, rather flat, suture shallow, apex blunt; aperture subvertical, fusiform, angular above, peristome very thick, paler brown on margin, columella strong. Alt. 1.37, major diam. 0.4 in. (*G.-A.*)

Eastern Burraile Range: Under the Peak of Khunho, the finest specimens; they were also abundant under Japoo at about 7000 ft.” (*G.-A.*)

*G. burrailensis* *G.-A.*, Journ. As. Soc. Beng. vol. 44, 1875, p. 3, pl. 1, f. 6.—*Achatina b.*, PFR., Monogr. viii, 277.

“This species is an extremely elongate, solid form of the *crassilabris* section of *Glessula*, and one of the most distinct.”

64. *G. BUTLERI* Godwin-Austen. Pl. 11, figs. 1, 2.

“Shell elongately turreted, very thin and brittle, tumid, pale corneous, glassy, very minutely striated, apex very blunt, whorls 8, rather rounded, suture deep, body whorl swollen and capacious; aperture vertical, pear-shaped, lip rather thin. Alt. 1.13, major diam. 0.45 inch. (*G.-A.*)

Eastern Burraile Range at 6000 feet; not a common form.

*G. butleri* *G. A.*, J. A. S. B., 1875, vol. 44, p. 4, pl. 1, f. 7.

“I name this shell after Captain J. Butler, Political Agent in the Nágá Hills, with whom I had the pleasure of being associated when mapping that very interesting and beautiful district.” (*G.-Aust.*)

65. *G. PYRAMIS* (Benson). Pl. 12, fig. 1.

Shell oblong-turrite, rather solid, smooth, striatulate, glossy, buff-corneous. Spire turreted with slightly convex sides, the apex rather obtuse, suture impressed. Whorls 8, a little convex, the last one-third the total length, obsoletely plicate in front. Aperture subvertical, elliptic-semioval; columella arcuate, calloused, obliquely truncate at the base; peristome unexpanded, obtuse, white-lipped within. Length 15, diam. 6 mm.; aperture 5 x 2.5 mm. (*Bens.*)

Teria Ghat, Khasia Hills (W. Theobald, type loc.) Pongee, Yunnan (*G. Nevill.*)

*Achatina pyramis* BENS., Ann. and Mag. N. H. (3), v, June, 1860, p. 463.—PFR., Monogr. vi, 226.—HANL. and THEOB., Conch. Ind. pl. 18, f. 6.—*Glessula pyramis* Bens., G. NEVILL, J. A. S. B. vol. 46, 1877, p. 26.

“Allied to the smaller *Ach. crassula* B., from Darjiling, but distinguished from it by its color, smoother sculpture, more convex and numerous. Whorls, by the characters of the peristome, and by the convex and not planate sides of the spire. A large variety of *Ach. crassula*, collected by Mr. W. T. Blanford near Darjiling, is 12 mill. in length by  $5\frac{1}{2}$  in breadth, and like the type, possesses only seven whorls.” (Benson.)

Lieut. Col. Godwin-Austen (J. A. S. Bengal vol. 40, p. 3) regards *illustris*, *pyramis* and *butleri* as varieties of *G. crassilabris*.

The form from Pensee, Yunnan, has been called var. *major* Nevill (Handlist Indian Mus., p. 169, no description).

66. *G. SARISSA* (Benson). Pl. 12, fig. 11.

Shell long-conic, thin, smooth, striatulate, the last whorl (under a lens) closely, obsoletely decussate; very glossy; olive-corneous. Spire long-pyramidal, the apex obtuse, suture impressed. Whorls  $9\frac{1}{2}$ , a little convex, the last over two-sevenths the length of the shell. Aperture subvertical, ovate-elliptical; columella oblique, slightly arcuate, white-calloused, obliquely truncate at base; peristome unexpanded, thin. Length 16, diam. 5.5, aperture  $5 \times 3.5$  mm. (*Bens.*)

Comercolly, Lower Bengal, on the banks of the Ganges (Dr. Th. Cantor, type loc.); Oolooberiah; Moistraka; Jessore District (G. Nevill).

*Achatina sarissa* BENS., Ann. Mag. N. H. (3), v, June, 1860, p. 463.—H. & T., Conch. Ind. pl. 35, f. 10.—PFR., Monogr. vi, 234.—*S. (G.) sarissa* NEVILL, Handlist, p. 170, f. 74.

67. *G. HASTULA* (Benson). Pl. 12, fig. 12.

Shell turrite-subulate, thin, obliquely hair-striate, brownish-corneous, somewhat glossy. Spire subulate, the apex ob-

tuse, suture rather deep; whorls 9, the first convex, the later ones a little convex, the last whorl scarcely two-sevenths the total length. Aperture slightly oblique, ovate-elliptical; margins of the peristome joined by a thin callus, the right margin unexpanded, acute, columellar margin arcuate, calloused, whitish, obliquely truncate at the base. Length 12.5, diam. 3.5, aperture 3.5 mm. (*Bens.*)

Pankabari, Darjiling (W. T. Blanford, type loc); Kumah Hill and near Mai-i, Sandoway district of Arakan (Theob. & Stol.)

*Achatina hastula* BENS., Ann. and Mag. N. H. (3), v, June, 1860, p. 461.—PFR., Monogr. vi, 235.—H. & T., Conch. Ind. pl. 18, f. 4.—*Glessula h.*, THEOB. & STOLICZKA.

“Of a more slender form than the large *A. tenuispira* B., the whorls increasing very gradually, and not attenuate towards the upper part of the spire, as in that species” (*Bens.*).

68. *G. SUBFUSIFORMIS* (Blanford). Pl. 12, fig. 15.

Shell turrite, subfusiform, rather thin, pale olive-corneous, glossy, striatulate, subplicate at the sutures. Spire long-pyramidal, the apex very shortly conic, mucronate; suture impressed, submarginate. Whorls 8, convex, the last somewhat elongate; tapering downwards. Aperture subovate; columella a little arcuate, obliquely truncate in front; peristome obtuse, slightly waved. Length  $17\frac{2}{3}$ , diam.  $5\frac{2}{3}$ , aperture  $6 \times 3$  mm. (*Blanf.*)

Ponsee, Yunnan, 3,300 ft. elevation. Type in Indian Mus.

*Achatina (Glessula) subfusiformis* BLANF., P. Z. S. 1869, p. 449.—PFR., Monogr. viii, p. 285.—*Stenogyra (Glessula) subfusiformis* G. NEVILL, J. A. S. B. 1881, vol. 50, p. 138, pl. 5, f. 13.

“This form may be recognized by its long lower whorl, subattenuate below.” (*Blanf.*). It is the most northerly species of *Glessula* known. Nevill has figured the unique type specimen.

69. *G. ILLUSTRIS* Godwin-Austen. Pl. 11, figs. 13-16.

“Shell elongately oval, greenish horny, finely striated longitudinally; whorls 7, very slightly rounded, suture moderately impressed, the lip thickened, columellar margin slightly curved and strong, apex blunt. Length 0.75 major diam. 0.3; length of aperture 0.3 mm.” (*G.-A.*)

North Cachar Hills: Hengdan Peak, at 7000 feet, in forest; also near Nenglo at 6000 feet and in the Lukah Valley, Jaintia Hills, at 1000 feet.

*Achatina illustris* Godwin-Austen, HANLEY & THEOBALD, Conch. Ind. pl. 102, f. 9.—*Glessula illustris* G.-A., J. A. S. B. 1875, vol. 44, p. 3, pl. 1, f. 5.—*A. illustris* PFR. Monogr. viii, 279.

“This species is an elongate and larger form of *Glessula crassilabris* Bs., of which *G. pyramis* is a closer variety; but its much more elongate form and stronger striation make it a good connecting species with *G. butleri* described further on. The form from the Lukah Valley is a tumid departure from the type figured. Alt. 0.75, major diam. 0.38 inch. Alt. 0.65, major diam. 0.35 inch.”

“I look on all these species as properly varieties, and *G. crassilabris*, very abundant in all the grass country of the Khasi Hills, may be taken as the type; a difference in elevation and condition of habitat, from damp dark forest to hot grassy slopes, having produced modifications of form.” (*Godwin-Austen.*)

Figs. 15, 16, are copied from Godwin-Austen's originals. A typical specimen, length 18.75, diam. 7.8, aperture 7.5 mm., whorls slightly over 7, is shown in figs. 13, 14. *The embryonic whorls are closely and finely striate vertically, as in G. notigena; hence the species has no affinity to G. crassilabris.* It is a much less robust shell than *G. crassilabris*, and less polished; and on the last whorl there are traces of fine spiral striation, as shown in fig. 13. The sculpture of the later whorls is irregular; there seem to be unequally separated grooves, with finer striæ and grooves in the intervals, but quite unequally developed. The suture is crenulate. On the last whorl or two some traces of spiral striæ appear, in places.

The outer lip is a little sinuous, being retracted above; it is moderately thickened or obtuse.

Col. Beddome considers this species identical with *G. facula*.

70. *G. CRASSILABRIS* (Benson). Pl. 10, figs. 14, 15.

“Shell turritic-conic, smooth, corneous, longitudinally striated. Whorls convex, suture excavated; lip thickened within; columella very deeply arcuate; apex obtuse. Length 0.7, diam. 0.3 inch.” (*Benson*).

Length 18, diam. 8, aperture 7.5 x 4 mm., whorls 8 (*Pfr.*).

The shell is ovate-oblong, yellow. The embryonic whorls are smooth, a little over two. Subsequent sculpture consists of rather close grooves, most prominent at the suture, which is rather deeply impressed, though the whorls are only moderately convex. The suture descends a little near the lip. The aperture is rather small, outer lip decidedly obtuse, thickened, its rounded edge bicolored, white and yellow. The outer lip is slightly retracted in the upper part. Length 20.5, diam. 9.5 mm., whorls 6¾ (fig. 15).

Khasia Hills (type loc.); Darjiling, Dafia and Naga Hills; Teria Ghat (Nevill).

*Achatina c.*, BENS., J. A. S. B. v, 1836, p. 353.—PFR., Monogr. ii, 261; iii, 493; iv, 607; vi, 224; Conch. Cab. p. 313, pl. 25, f. 12, 13.—REEVE, Conch. Icon. pl. 21, f. 81.—HANL. & THEOB., Conch. Ind. pl. 36, f. 1.—S. (*G.*) *crassilabris* NEVILL, Handlist, p. 170.

Godwin-Austen (1875) considered *pyramis*, *butleri* and *illustris* as subspecies of *G. crassilabris*. The latter is decidedly more robust than *illustris*, which belong to a different group; *pyramis* and *butleri* are both more elongate shells.

71. *G. OROBIA* (Benson). Pl. 10, fig. 16.

Shell ovate-oblong, rather solid, smooth, lightly striate, sculptured with a few rather widely spaced, deeply impressed striæ; glossy, olive-corneous. Spire convexly pyramidal, the apex obtuse, suture impressed; whorls 6½ to 7½, a little convex, angulated at the shoulder, crenulate, the last over one-third the total length. Aperture vertical, semioval;

columella deeply arcuate, calloused, the base obliquely truncate; peristome unexpanded, rather thick, obtuse. Length 11, diam. 5, aperture 4 x 3 mm. (*Bens.*).

Sinchul and Darjiling (type loc.) at 8500 and 7000 ft. (W. S. Blanford); Naga Hills (Beddome).

*Achatina orobia* BENS., Ann. and Mag. N. H. (3) v, June, 1860, p. 461.—PFR., Monogr. vi, 224.—H. & T., Conch. Ind. pl. 18, f. 7.

“Distinguished from the larger Khasia species, *A. crassilabris*, by its peculiar sculpture, and by the formation of the whorls below the suture” (*Bens.*).

72. G. GEMMA ('Benson' Reeve). Pl. 13, figs. 1, 3.

Shell oblong-conical, rather solid, whorls 6, rounded, smooth, columella arched, abbreviated, aperture nearly round; purple-black, shining (*Reeve*).

Shell ovate-oblong, rather solid, smooth, glossy, pellucid, purplish-corneous. Spire high-conic, the apex rather acute; suture rather deep. Whorls 6, a little convex, the last two-fifths the total length, rounded at the base. Columella arcuate, somewhat calloused, abruptly truncate nearly at the base of the subrhombic-oval aperture; peristome simple, unexpanded, the right and basal margins slightly arcuate. Length 8 to 8.5, diam. 4, aperture 3 x 2 mm. (*Pfr.*).

Lower Bengal, Barrakpore (Benson, type loc.); Rajmahal; Chittagong; plains of Malabar and Beypur (Beddome). Jessore District, Chardbally and Moistraka (Nevill); Chandernagore (Mainwaring); Arakan; Garo Hills (Austen).

*Achatina gemma* BENS. MS., REEVE, Conch. Icon. v, pl. 22, f. 123 (March, 1850).—PFR., Monogr. iii, p. 496; Conchyl. Cab. p. 314, pl. 25, f. 24, 25.—H. & T., Conch. Ind. pl. 36, f. 7.—BENSON, Ann. Mag. v, 1860, p. 464 (large var., 8 x 3.5 mm.)—*Glessula g.*, BEDDOME, P. Mal. Soc. vii, 169.—*S. (G.) gemma* NEVILL, Handlist, p. 170.

Reeve's description and figure (fig. 1) are given above; also Pfeiffer's description of a larger form of the species.

It is dark reddish-brown, and when containing the remains of the soft parts might be termed purplish-brown; very glossy,

very irregularly grooved. The spire tapers regularly (or a little convexly) to the obtuse summit. The outer lip is slightly obtuse, in adults, but scarcely thickened. The figured specimen measures, length 6.5, diam. 3.7, aperture 2.8 mm., with  $5\frac{3}{4}$  whorls. (fig. 3).

Var. *frumentum* (Reeve). Pl. 13, fig. 2.

This approaches very closely to the preceding species [*gemma*]. The whorls are less rounded, less polished, and of a uniform lighter color (*Reeve*).

Chandpore, Bengal (*Bacon*).

*Achatina f.*, REEVE, C. Icon. v, pl. 22, f. 124 (March, 1850).

—DESH. in FÉRUSSAC, Histoire, ii, p. 169, pl. 134, f. 22-24.

Considered to be a variety of *G. gemma* by Benson and Pfeiffer.

73. *G. CRASSULA* ('Benson' Reeve). Pl. 13, fig. 4.

Shell pyramidally conical, whorls 7, flatly convex, longitudinally impressly striated; sutures excavated, columella arched, conspicuously truncated; aperture small. Whitish, covered with an olive horny epidermis (*Reeve*).

Darjiling; Jantia and Naga Hills (*Beddome*), Khasi and Dafia Hills (*G.-Austin*).

*Achatina crassula* Bens. MS., REEVE, Conch. Icon. v, pl. 22, f. 120.—PFR., Monogr. iii, 496; Conchyl. Cab. p. 314, pl. 25, f. 16, 17.—H. & T., Conch. Ind. pl. 36, f. 4.—S. (*G.*) *crassula* NEVILL Handlist, p. 169.

74. *G. BLANFORDIANA* (Nevill). Pl. 13, fig. 11.

“Shell ovately turreted, solid, of a dark brown color, two apical whorls smooth, the others sculptured with raised, coarse, longitudinal, nearly perpendicular striæ, much crowded together and slightly flexuous on the last whorl; spire turreted, with very obtuse apex and excavated suture; whorls six, scarcely convex, the last one rounded at base; aperture vertical, subquadrilateral, with a much thickened white peristome; columella broadly reflected, thickened, white, curved, forming an acute tooth, with a well developed incised notch at its base. Long 7, diam. 3 mm. (*Nevill*).



Ponsee, Yunnan, type loc., and near Bhamo.

*Stenogyra* (*Glessula*) *blanfordiana* G. NEVILL, J. A. S. B. 1877, p. 26; 1881, vol. 50, p. 138, pl. 5, f. 12.

This species closely resembles *Glessula peguensis* Blanford, but is less convex, that is, more slender, and a thicker texture; it can also be easily distinguished by the characteristic, crowded, well-developed, nearly perpendicular, longitudinal striation, varying slightly in direction on each whorl, much as in many species of *Pomatias*. The columella also is peculiar. Type in Indian Museum, Calcutta." (*Nevill.*)

75. *G. PEGUENSIS* (Blanford). Pl. 13, figs. 12.

"Shell oblong-ovate, rather solid, dark reddish brown, horny, marked with distinct and regular impressed lines. Spire convexly conical; apex obtuse; suture impressed, sub-crenulate. Whorls  $6\frac{1}{2}$ , slightly convex; the last ascending a little towards the mouth, and exceeding  $\frac{1}{3}$  of the shell in length. Aperture vertical, truncately semicircular; peristome obtuse, slightly thickened; margins joined by a callus; columella very much curved, projecting forward at the base, subvertically truncated within the peristome. Length 7, diam. 3.5, length of aperture 2.75 mm." (*W. T. Blanf.*)

Irawady Valley, Pegu (Blanford); Kumah Hill and near Mai-i, in the Sandoway district of Arakan (Theobald, type loc.); Thyetmyo (Blanford); near Chittagong (H. Raban).

*Achatina peguensis* BLANF., J. A. S. B. vol. 34, 1865, p. 78.—H. & T., *Conch. Indica*, pl. 102, f. 6.—*Glessula peguensis* THEOBALD & STOLICZKA, J. A. S. B. vol. 41, 1872, p. 334.—*S. (G.) peguensis* NEVILL, Handlist, p. 171.

The specimen figured exceeds Blanford's measurements slightly; length 8.9, diam. 3.9, longest axis of aperture 3 mm., whorls  $6\frac{3}{4}$ . The apex is smooth; the rest of the shell is closely and rather deeply but irregularly striate, and very glossy.

"A pretty little species, darker in color than any of its allies, except perhaps *A. gemma* Bens., and easily distinguished from all, by the columella being more arcuate, also by its more acuminate spire and blunter apex, and its much stronger sculpture." (*Blanf.*)

## 76. G. LATESTRIATA Moellendorff.

Shell rather ventricosely oblong, rather thin, subpellucid, peculiarly sculptured with rather distant impressed striæ, corneous-yellow. Spire moderately long, the sides a little convex, apex somewhat acute. Whorls 7, moderately convex, separated by a well-impressed, subcrenulate suture. Aperture nearly vertical, roundly-rhomboidal; peristome unexpanded, obtuse; columella rather twisted, abruptly truncate. Length 10, diam. 4.5, aperture 3.5 x 2.25 mm. (*Mlldff.*)

Kalow, southern Shan States (Strubell).

*Glessula latestriata* MLLDFF., Nachrichtenblatt d. Deutschen Malak. Ges. vol. 31, p. 166, December, 1899.

## 77. G. PAVIEI L. Morlet. Pl. 12, figs. 7, 8.

Shell imperforate, elongate, subturrite, thin, glossy, translucent, pale corneous, ornamented with radiating striæ. Spire subconic; whorls 8, a little convex, the first obtuse, following separated by a simple suture, a little inflated at the suture, the last whorl moderately inflated, over one-third the total length. Aperture suboval, columella short, very deeply arcuate, twisted and truncate; columellar callus thin; lip regularly arcuate. Length 14, diam. 6, aperture 5 mm. long. (*Morlet*).

Indo-China: Muong-Lai, Laos (Pavie); Lai-Chau, banks of the Black river, Tonkin (Dugast).

*Glessula paviei* L. MORLET, Journ. de Conch. 1892, p. 321, pl. 7, f. 4; Mission Pavie, Indo-Chine iii, p. 359, pl. 19, f. 13 (1904).

Two embryonic whorls are smooth, the last becoming crenulate below the suture. The following whorls are grooved at unequal intervals, the grooves strongest near the upper suture, weakening near the lower. The last whorl has rather close grooves and wrinkles. This sculpture is visible only under a lens. The columella is only moderately concave in specimens I have seen, and is very obliquely truncate. The outer lip is whitish, a little thickened and obtuse, as usual in adult Glessulas. A specimen from Muong-Lai

measures, length 12.7, diam. 6, length of aperture 5 mm.; whorls  $6\frac{3}{4}$  (fig. 7).

Col. Beddome believes *G. paviei* to be a synonym of *G. oreas*. I have been unable to compare specimens of the latter, but I think they will prove distinct.

IV. *Species of unknown habitat.*

78. *G. FUSCA* (Pfeiffer). Pl. 7, figs. 14, 15.

Shell oblong-turrite, thin, very closely hair-striate (and with a few stronger, somewhat varix-like striæ), silky, brown. Spire with slightly curved outlines, the apex obtuse, suture marginate, very delicately denticulate. Whorls 7, convex, the last three-sevenths the total length, rounded at base. Columella white-calloused, lightly arcuate, abruptly shortly truncate; aperture vertical, sinuate-semioval; peristome simple, unexpanded. Length 22, diam. 9, aperture 10 x 4.6 mm. (*Pfr.*).

Habitat unknown (Cuming coll.).

*Achatina fusca* PFR., P. Z. S. 1852, p. 67; Conchyl. Cab. p. 337, pl. 43, f. 8, 9; Monogr. iii, p. 491.

This species should be recognizable by its somewhat unusual sculpture. Known by the original account only. Hanley thinks it near *parabilis* Bens., or perhaps identical.

79. *G. FULGENS* (Pfeiffer.)

Shell oblong-ovate, rather solid, smooth, pellucid, glossy, corneous-tawny. Spire ovate-conic, the apex somewhat obtuse. Whorls 6, slightly convex, striatulate at the narrowly marginate suture, the last whorl about three-sevenths the total length, rounded at base. Columella very much arched, white-calloused, obliquely and rather widely truncate. Aperture vertical, sinuate-elliptical; peristome unexpanded, obtuse. Length 12.5, diam. 5.66, aperture 5.5 x 3 mm. (*Pfr.*)

Habitat unknown (Cuming coll.).

*Achatina fulgens* PFR., Malak. Bl. 1858, v, p. 238; P. Z. S. 1859, p. 27; Monogr. vi, p. 225.—*Glessula fulgens* PFR. Nomencl. Hel. Viv., 1878, p. 330.

An unfigured form, not noticed by other authors.

80. *G. VIRENS* (Pfeiffer).

Shell cylindric-turrite, very thin, lightly striatulate, the striae more distinct at the suture; very glossy, pellucid, greenish-corneous. Spire long, gradually tapering above, the apex rather obtuse; suture suberenuate. Whorls 8, a little convex, the last scarcely one-third the total length, more convex. Columella very much arched, abruptly truncate. Aperture vertical, irregularly oval; peristome simple, unexpanded, the right margin lightly arcuate. Length 18, diam. 8, aperture 6 x 3.5 mm. (*Pfr.*)

Habitat unknown (Cuning coll.).

*Achatina virens* PFR., P. Z. S. 1854, p. 125; Monogr. iv, 609. No other information has been published.

V. *Species of Sumatra, Java and Borneo.*

An undetermined species has been reported from Enganao Island by Henderson, Nautilus xii, 1898, p. 16.

81. *G. SUMATRANA* (Martens). Pl. 14, figs. 4, 5.

Shell subconic-turrite; minutely, subirregularly striatulate, glossy, bright chestnut, the apex paler. Whorls 7 to 8, convex, separated by a rather impressed simple suture, the last whorl gradually tapering at base. Aperture subvertical, emarginate-piriform, three-eighths the total length; columellar margin moderately excavated, spirally twisted, obliquely and distinctly truncate below. Length 13.5, diam. 5, aperture 4.66 x 2.5 mm. (*Marts.*)

Sumatra: in the mountainous interior at Kepahiang (*Marts.*); Padang Pandjang (Rolle).

*Cionella sumatrana* MARTS., Preussische Expedition nach Ost-Asien Landschnecken, p. 372, pl. 22, f. 5 (1867).—*Achatina s.*, PFR., Monogr. vi, 225.—*Glessula s.*, ROLLE, Nachrbl., 1908, p. 68.

“The height of the visible part of the penultimate whorl somewhat exceeds its breadth (diameter), and has the proportion to the last whorl of 1:1½.

“This species is quite like some described by Benson from

the mountainous region of India, and especially stands about midway between *oreas* and *jerdoni*, both from the Nilgiris. A similar species from Java is Hasselt's *Acicula cornea*, figured on his unpublished plate 14, fig. 5, from the mountain Salak." (*Marts.*)

Prof. Boettger states that by the study of Mr. Rolle's specimens of *G. sumatrana*, he sees that *G. javanica* is identical, and the latter name should be withdrawn. Apparently "*javanica*" is an error for *cornea*. The original account follows.

*G. cornea* Boettger. (Pl. 14, fig. 3.) Shell not rimate, subfusiform-turrite, rather solid, very glossy, bright chestnut-brown, the apex not paler. Spire has very slightly convex sides, apex exactly turrited, rather obtuse. Whorls 8, convex, separated by a simple, impressed suture; minutely but very distinctly, somewhat irregularly striate, the striae gathered into groups at the suture and almost rib-like; last whorl slightly tapering basally. Aperture subvertical, emarginate-piriform subeffuse at the base, somewhat lipped with violaceous inside, less than one-third the total length; margins joined by a curved callus, the right margin compressed, nearly straight, columellar margin excavated, oblique, spirally twisted, at the base oblique and distinctly truncate. Length 13, diam. 5, aperture 5.5 x 3 mm. (*Bttg.*)

Java: Gunung Salak, moderately abundant (type loc.); Gunung Gedeh.

*Glessula cornea* BTTG., Bericht Senckenbergische naturforschende Gesellschaft in Frankfurt-am-Main, 1890, p. 148, pl. 5, f. 9, 9a; 1891, p. 244.—*Acicula cornea* Hasselt MS., MARTENS Preuss. Exped. Ostas., Landschn. p. 372, no description.—*Glessula javanica* BOETTGER, Nachrbl. d. D. Malak. Ges. 1908, p. 68, (name only, but said to be identical with *G. sumatrana*).

"This species has already been recorded under the manuscript name *Acicula cornea* Hasselt, from the same locality. It is the sole representative of the genus in Java, and stands nearest to *G. sumatrana* v. *Marts.*, as von Martens has al-

ready noted. *G. sumatrana* is however more tapering at the apex and base, and it has not the strong striation at the suture. Moreover the alt. of the visible part of the penult. whorl in the Javan species is nearly a half less than its breadth (diameter)." (*Bttg.*)

82. *G. WALLACEI* (Pfeiffer). Pl. 14, figs. 1, 2.

Shell ovate-turrite, solid, closely and subregularly striate, silky, blackish-brown. Spire long, nearly straight-sided, the apex obtuse; suture minutely crenulate. Whorls 8, a little convex, the last slightly more than one-third the total length, pale in front, rounded at base. Columella arcuate, callus, obliquely deeply truncate. Aperture vertical, sinuate-oval; peristome unexpanded, obtuse. Length 21 to 22, diam. 9, aperture 8 x 4 mm. (*Pfr.*)

Borneo: Sarawak (Wallace).

*Achatina wallacei* PFR., Malak. Bl. 1855, p. 168; Novit. Conch. p. 82, pl. 22, f. 9, 10; Monogr. iv, 606.

VI. *East African Glessula.*

83. *G. MONTANA* (Martens). Pl. 14, figs. 7, 8.

Shell ovate-oblong, striatulate, glossy; green-buff, marked with isolated brown streaks. Spire turrite, the apex obtuse. Whorls  $6\frac{1}{2}$ , a little convex, separated by a deep crenulated suture. Aperture two-thirds the total length, a little oblique, oblong-piriform, bluish inside. Peristome simple, thin, the columellar margin flexuous, thickened, white, abruptly truncate. Length 14, diam. 6.33, aperture 6 x 4 mm. (*Marts.*)

Eastern Abyssinia: Guno in Begemder, 1200 ft. elevation (Heuglin & Steudner).

*Achatina montana* MARTS., Malak. Bl. xiii, 1866, p. 95.—PFR., Monogr. vi, 228.—*Glessula montana* JICKELI, Nova Acta Vol. 37, 1875, p. 132, pl. 5, f. 19.—*Homorus montanus* Marts., KOBELT, Conchyl. Cab., p. 93.

84. *G. RUNSSORINA* Martens. Pl. 14, figs. 6, 10.

The shell is lengthened ovate, weakly striate, glossy, yellow-

brown;  $5\frac{1}{2}$  to 6 whorls, the first nearly globular, smooth, the second distinctly striate, the rest regularly widening, somewhat convex, with rather impressed and weakly crenate suture; the penult. whorl relatively high, the last whorl lower, elliptical, strongly descending to the aperture, with a few darker growth-arrest streaks, rounded below. Aperture moderately oblique, lanceolate, the outer lip weakly bordered outside, moderately arcuate above and below, in the middle straighter; basal margin rounded; columellar margin strongly arcuate, appressed, white, obliquely truncate below, passing with a distinct callus deposit upon the parietal wall. (*Martens*).

Length 23.5, diam. 9, aperture 10 x 5 mm.

Length 14, diam. 6, aperture 7 x 3 mm.

East Africa: Runssoro at 3100 meters (Stuhlmann, camp III, June 12, '91).

*Glessula runssorina* MARTS., Nachrbl. D. M. Ges. vol. 27, December, 1895, p. 184, Deutsch-Ost-Afrika, Beschalte Weichthiere, p. 114, pl. 5, f. 11, 12, 1898.

"External soft parts black; foot long and narrow behind, flattened above, paler, with two longitudinal furrows, oblique furrows passing outward and backward from them. Sole whitish in the middle, blackish at the edge, but without sharply defined limits." (*Martens*).

#### 85. G. FERUSSACIOIDES Pollonera.

Shell subcylindric-oblong-ovate, clear, pale corneous yellowish, delicately striate. Spire attenuate, the apex obtuse; whorls 7 a little convex, separated by a slightly impressed and narrowly margined suture. Aperture oblong-lunate, acute above; lip simple, thin; columellar margin rather straight, obliquely truncate. Length 18.5, diam. 6.5, aperture 7 x 3.5 mm. (*Poll.*).

East Africa: Eastern slope of Ruwenzori, Valle Mobuku at 2000 meters elevation (Duke of Abruzzi).

*Glessula f.*, POLLONERA, Bolletino Mus. Zool. etc., Torino, xxii, no. 361, p. 3, July, 1907.

86. *G. DEALBERTISI* Pollonera.

Shell oblong-subsubulate, very clear and translucent, amber-greenish, very finely striatulate longitudinally. Spire turrinate, the apex obtuse; whorls 7, a little convex, parted by an impressed suture. Aperture oblong-piriform, acutely angular above, not differently colored within; peristome simple, thin; columellar margin arcuate, obliquely truncate. Length 18, diam. 5.5, aperture 6.5 mm. long. (*Poll.*).

East Africa: Bihunga, Ruwenzori; Valle Mobuku, at about 2500 meters elevation, one example (Luigi, Duke of Abruzzi).

*Glessula De-Albertisi* POLL., Bolletino dei Mus. di Zool. ed Anat. comp. della R. Univ. di Torino, No. 338, vol. xxi, p. 2, October, 1906.

VII. *West African species.*

Two quite distinct groups of *Glessula* are represented in West Africa. The group of *G. lævigata* has substantially the shell-structure of Indian *Glessulæ*. The shell is smooth throughout (species 87, 88). In the group of *G. paritura* the post-embryonic whorls are finely rib-striate (species 89 to 92).

*Group of G. lævigata.*

The central teeth of *G. lævigata* are narrow, not half as wide as the adjacent laterals. There is a well developed but not overhanging cusp. The laterals are quadrate, tricuspid, with overhanging cutting-points on all the cusps. Middle cusp longer than the basal plates. There are about 8 laterals, then one or two transitional teeth, followed by the marginals, also of the tricuspid type (pl. 15, fig. 9). The jaw (pl. 15, fig. 10) is very minutely plaited, serrate on the cutting edge, at least in places.

87. *G. LÆVIGATA* (Pfeiffer). Pl. 14, figs. 9, 11, 12.

Shell turrinate-oblong, rather solid, smooth, buff-waxen; spire elongated, the apex obtuse. Whorls 6, but slightly convex, the last about one-third the total length, rounded beneath, striolate anteriorly. Columella callous, somewhat twisted,



obliquely truncate. Aperture oblique, acuminate-oval, pearly within; peristome simple, acute. Length 17, diam. 6 mm. (*Pfr.*).

Habitat unknown (Cuming coll.). High on the *serra de Pedras de Guinga*, under stones, at an elevation of 3000 ft., district of Pungo-Andongo, Angola (Welwitsch). "For-careach, Senegambia" (A. N. S. Coll.).

*Achatina lævigata* PFR., P. Z. S., 1854, p. 294; Monogr. iv, 607; Novit. Conch. i, p. 32, no. 54, pl. 8, f. 6, 7.—MORELET, Voy. Welwitsch, p. 77.—*Glessula lævigata* PFR., Nomencl. p. 330.—*Homorus l.*, KOBELT, C. Cab. p. 110.

Morelet, who was the first to record a locality for this species, thinks that it must originally have been found nearer the coast, as it is unlikely that any earlier traveler had visited the remote solitudes where Dr. Welwitsch found it.

The whorls are smooth except for weak growth-striae, and are parted by a linear suture which is transparent-margined below. The fifth whorl appears disproportionately wide. The spire tapers rapidly near the obtuse apex, but much more slowly throughout the greater part of its length. The excision at the base of the columella is not very deep. Examples measure:

Length 17.5, diam. 6, aperture 6.2 mm.; whorls  $6\frac{1}{2}$ .

Length 17, diam. 6.3, aperture 6 mm.; whorls  $6\frac{1}{2}$ .

Length 16.5, diam. 5.7, aperture 6 mm.; whorls  $6\frac{1}{2}$ .

#### 88. G. HYALINA (Rang). Pl. 14, fig. 16.

Shell long-oval, smooth, glossy, very thin, transparent and of a pale yellow tint, like horn. The spire is quite elevated and obtuse, composed of 6 slightly rounded whorls, the last one larger than all the others. Aperture oval, rather long, its plane parallel to the axis. The columella has a projecting lobe; its edge is a little reflexed. Right margin unexpanded and thin, simple and continuous with the columella. Length 7 to 9, diam. 3 to 4 mm. (*Rang*).

Liberia: Mesurade, in crevices of rocks at the foot of the cape not far from the sea (*Rang*).

*Helix hyalina* RANG, Ann. Sci. Nat., Zool., xxiv, 1831, p.

40, pl. 3, f. 5.—*Achatina h.*, DESH., in Lam., An. s. Vert. p. 308.—PFR., Monogr. ii, p. 258.

Known to me by the above account only.

*Group of G. paritura* (Section *Neoglessula*, nov.)

Embryonic whorls very minutely and not closely engraved spirally, successively lengthening vertical grooves appearing on the later ones; whorls of the neanic and adult stages closely, regularly rib-striate, base smoother. Viviparous. Type *G. paritura*.

Several species from the northern shores of the Gulf of Guinea form a group having adult sculpture somewhat as in *Pseudoglessula*, but embryonic sculpture of their own. Only one of these is known to me by specimens; the others are still known by the original lots only.

89. *G. PARITURA* (Gould). Pl. 14, figs. 17, 18, 19.

Shell elongate, thin, glossy, pale corneous, longitudinally closely lirate; spire turrite, obtuse at the apex. Whorls 7, convex, the last about half the total length of the shell. Suture deep. Aperture narrow, somewhat ear-shaped. Columella deeply arcuate, involute, forming a basal channel. Length 1, width .35 inch. (*Gld.*).

West Africa: near the sea, Fishtown, Liberia, buried under leaves or in the earth during the dry season; also Cape Palmas.

*Achatina paritura* GLD., Proc. Bost. Soc. Nat. Hist. iii, 1850, p. 196; Otia Conch. p. 208.—PFR., Monogr. iii, 491.—PETIT, Journ. de Conchyl. ii, 1851, p. 269, pl. 8, f. 7.—*Homorus p.*, KOBELT, Conchyl. Cab. p. 92.

This species is viviparous. The summit is semiglobular; first  $1\frac{1}{2}$  whorls smooth in adults, but in young shells they show sparse engraved spiral lines; then vertical grooves appear below the suture, short and widely spaced at first, but gradually lengthening and becoming closer, so that at the end of  $2\frac{1}{2}$  whorls they reach nearly to the suture below, and become so close that the sculpture may be described as rib-

striate, the riblets smooth, rounded, and about equal to the intervals. On the face of the last whorl there are five or six riblets in one millimeter. The riblets weaken or disappear almost abruptly at the periphery of the last whorl, leaving the base and a very narrow band above the suture almost smooth. The columella is formed just as in the Indian *Glessulæ*, being deeply concave, thickened with a white callus, and abruptly, deeply truncate at the base. The shell is translucent whitish under a very thin pale yellow cuticle. A specimen of the ordinary size measures, length 20.3, diam. 8.8, aperture 8.3 mm.; whorls  $6\frac{1}{2}$ .

An embryonic shell, shaken out of an adult, is oval, 4.7 mm. long, with 3 whorls. There is a distinct umbilical slit behind the columellar callus (pl. 14, fig. 19).

90. *G. BRETIGNEREI* Chaper. Pl. 14, fig. 20.

Shell thin, transparent, of a light gray-olive tint; shining, though sculptured with very regular, crowded striæ of growth, well-marked from the end of the second whorl. Spire of 6 or 7 whorls, very regularly conic after the second whorl. Aperture oblique; columella strongly inflexed towards the interior of the aperture. No umbilicus. Length 30, diam. 11 to 12 mm. (*Chaper*).

West Africa: Coffee plantation of Elima, Assinie (type in coll. de l'École des Mines).

*Glessula bretignerei* CHAPER, Bulletin de la Société Zoologique de France, x, 1885, p. 46, pl. 1, f. 6.—*Homorus assiniensis* Chaper, KOBELT, Conchyl. Cab. i, 10te Abth., p. 91, pl. 21, f. 6 (copy from Chaper).

This species differs from *G. paritura* only by its larger size, so far as the published account goes. Kobelt confused the name with that of *Corbula assiniensis*, which occurs on the next page of Chaper's paper.

91. *G. MALAGUETTANA* (Rang). Pl. 14, fig. 15.

Shell elongate, conic, thin, subdiaphanous, very minutely longitudinally striate, brown-buff. Apex obtuse. Aperture oval, the columella arcuate, truncate; lip simple, acute.

Length 15 to 20, diam. 8 to 9 mm. Animal dirty buff, 25 mm. long. (*Rang*).

West Africa: Malaguetta (Liberian) coast, under bushes and in crevices of the rocks (*Rang*).

*Helix malaguettana* RANG, Annales des Sciences Naturelles xxiv, 1831, p. 39, pl. 3, f. 4.—*Achatina m.*, DESH. in Lam., An. s. Vert. viii, p. 307.—PFR., Monogr. ii, 257.—*Subulina malaguettana* BECK, Index, p. 77.

This shell, according to Rang, is long, conic, thin, almost diaphanous, very finely and regularly striate; the very thin cuticle covering it is of a dirty yellowish brown, resembling that of *Subulina striatella*. The summit is obtuse, and its whorls, 6 in number, are quite rounded. The aperture is oval, little oblique. The columella is very concave and truncate in front; the right margin is straight and thin, fragile and acute. Deshayes gives the dimensions 22 x 8 mm. The systematic position is unknown, and it may prove to be a *Pseudoglessula*. The spire is more slender above than in *G. paritura*.

92. *G. SERICINA* (JONAS). Pl. 14, figs. 13, 14.

Shell ovate-turrite, rather thin, longitudinally closely plicate, pellucid, glossy, straw-colored. Spire turrited, the apex very obtuse. Whorls 6 to 6½, convex, the last about three-sevenths the total length, obsoletely angulated in the middle, smooth below the angle. Columella very arcuate, highly and widely truncate, the aperture suboval. Length 17, diam. 7 mm., aperture 7½ mm. long, 4 wide in the middle. (*Pfr.*)

West Africa: Guinea (Jonas).

*Glandina sericina* JONAS, in Phil., Abbild. I, p. 134, pl. 1, f. 11 (July, 1844).—*Achatina s.*, PFR., Monogr. ii, 292; iii, 494; iv, 606; Conchyl. Cab. p. 308, pl. 24, f. 12, 13.—*Homorus (Pseudoglessula) s.*, KOBELT, C. Cab. p. 104.

This snail has a beautiful appearance from its very regular, pretty and strong striation, and its silky luster. (*Jonas*).

## APPENDIX.

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A few corrections of nomenclature and descriptions of obscure forms are inserted here to complete the account of snails described as "*Achatina*."

### OLEACINIDÆ.

SPIRAXIS BLANDIANUS Pils. New name for *Spiraxis blandi* Crosse & Fischer, (Journ. de Conch. 1877, p. 271; Miss. Sci. Mex., Moll., i, p. 616; Manual I, p. 52, XIX, p. 27), not *Spiraxis blandi* (Crosse), described as *Ravenia c.*, Manual XIX, 19, 20.

VARICELLA DISSIMILIS Pilsbry. Vol. XIX, p. 105, pl. 17, f. 10, 11.

New name for *Achatina similis* C. B. Ad. 1850, not *A. similis* Boissy, 1848.

The specimen figured and described (XIX, 105) by me becomes the type of this species.

VARICELLA DISSIMILIS LONGIOR Pils., new name. *V. similis longa* Pils. (Man. Conch. XIX, p. 106), being a homonym of *V. costulata longa* (t. c. p. 68), may be changed to *Varicella dissimilis longior*.

VARICELLA SIMILARIS SLOANEANA Pils.

New name for *V. s. mandevillensis* Pils., (XIX, p. 107), preoccupied on p. 70 of same volume.

STREPTOSTYLA LIMNEIFORMIS CHIAPENSIS Pils. Vol. XIX, p. 159.

New name for *Spiraxis parvula* Pfr. 1856, not of Chitty, 1853.

EUGLANDINA FUSIFORMIS Pfr. *Achatina f.*, Pfr. P. Z. S. 1845, p. 75; Monogr. ii, 292; Man. Conch. XIX, 188, is a homonym of *Achatina lubrica* var. *fusiformis* Picard, 1840. See Vol. XIX, p. 320. The Mexican species should probably stand as *E. binneyana*.

*ACHATINA NYSTIANA* Pfr. Shell fusiform-oblong thin, smoothish, very delicately striatulate, pellucid, glossy, flesh-colored. Spire long, slender, the apex obtuse, suture thread-margined, whorls  $6\frac{1}{2}$ , a little convex, the last about three-sevenths the total length, tapering at base. Columella very lightly arcuate, the base shortly and horizontally truncate. Aperture scarcely oblique, oval-elliptical, peristome simple, thin. Length 47, diam. 12, aperture  $16\frac{1}{2} \times 6$  mm. Habitat unknown, Mus. Cuming (*Pfr.*, P. Z. S. 1855, p. 100; and as *Oleacina n.*, Monogr. iv, 632). Evidently an *Euglandina*.

*GLANDINA CRENULATA* Sow. Ant., Pfeiffer. Shell fusiform ovate, rather solid, reddish-corneous, glossy; spire with the apex obtuse. Whorls  $6\frac{1}{2}$ , a little convex, the last descending, shorter than the spire; suture margined and most minutely crenulate. Aperture dilated below, columella subarcuate, strongly truncate; peristome simple. Length 24, diam. 11, aperture 11 mm. long. Central America. (*Pfr.*, Symbolæ ad Hist. Hel. ii, p. 59, no. 273, 1842, from spec. in coll. Anton, recorded without description in Anton's *Verzeichniss* as *Achatina crenulata* Sow.? p. 44, no. 1595. "*Achatina crenulata* (Sowerby?) Anton," PFR., Monogr. ii, p. 285). Seems to be unknown to monographers of the Mexican fauna. It is not recognizably defined.

### POIRETIA.

A list of species referable to this genus was given in Vol. XIX, pp. xxii-xxv. The preparation of an index of *Achatina* etc. has shown that several names are homonyms and require change, as follows.

*POIRETIA KLEINIANA* Pilsbry, n. n.

New name for *Achatina elegans* Klein, *Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg*, ix, 1853, p. 214, pl. 5, f. 11, not *A. elegans* C. B. Ad. 1849. Cf. Vol. XIX, p. xxiv.

*POIRETIA INFLATA* Reuss, (XIX, p. xxiv). Add the synonym: *Glandina (Achatina) antiqua* KLEIN, *Jahresh. Württemb.* VIII, p. 162, pl. 3, f. 9, 1852.

## POIRETIA ROUISIANA Pilsbry.

New name for *Oleacina teres* Rouis, Sandberger, Land und Süßwasser Conchyl. der Vorwelt, p. 232, pl. 13, f. 26 (1872), not *Oleacina teres* Pfr., Malak. Bl. 1866, p. 140. Eocene, Buxweiler.

## POIRETIA WOODI Pilsbry.

New name for *Bulimus convexus* 'Edwards' S. V. Wood, 1877 (Vol. XIX, p. xxiii), not of Pfeiffer, 1855 (*cf.* vol. XI, p. 216). The generic position of this Oligocene form of the Isle of Wight is uncertain. Photographic figures are reproduced by Taylor, Mon. Brit. Land and Freshwater Moll. ii, p. 29, f. 46, 47.

## POIRETIA MILLERI Pils.

New name for *Glandina ovata* Miller (Vol. XIX, p. xxiii), not *Glandina truncata* var *ovata* Dall.

## ACHATINIDÆ.

## ACHATINA NYIKAENSIS Pils.

New name for *A. fragilis* Smith, 1899, Vol. XVII, p. 63. Not *Achatina fragilis* Deshayes, An. s. Vert. II.

## ARCHACHATINA MARGINATA EDUARDI Pils.

New name for *Achatina marginata* var. *gracilior* Martens (Manual XVII, p. 111), not *Achatina gracilior* C. B. Ad. 1850.

## ARCHACHATINA PURPUREA (Gmel.) Vol. XVII, p. 144.

Add the following synonyms: *Achatina purpurascens* G. FISCHER, Museum Demidoff iii, p. 224 (1807). *Achatina erythrostoma* SWAINSON, Bligh Catal., Appendix p. 14 (1822), based on Martini and Chemnitz, IX, f. 1017, 1018.

HELIX (COCHLITOMA) CANTHERIATA Fér., Prodr. p. 49, no. 340 is a nude name. Férussac refers to the figure of a *Phasianella* as perhaps illustrating it. Habitat unknown.

ACHATINA HYALINA Anton. "Oval-conoidal, 5 convex whorls with deep suture, last whorl two-fifths the total length; transparent, glossy, yellowish-gray, finely striate, imperforate. Aperture long-oval, peristome acute; columella strongly

truncate. Alt.  $2\frac{1}{2}$ , diam.  $1\frac{1}{4}$  lines. Habitat South America'' (*Anton*, Verzeichniss der Conchylien welche sich in der Sammlung von Hermann Eduard Anton befinden, p. 44, no. 1589. Halle, 1839).

Pfeiffer renamed the species *Achatina antoniana*, Monographia Hel. Viv. ii, p. 285 (1848), the original name being preoccupied. It is probably a *Leptinaria*, but it has been recognized by no author since Anton.

BOCAGEIA (PETRIOLA) ANJUANENSIS Pils., n. n.

New name for *Achatina cornea* Morelet 1877, not of Brumati, 1838. Type is the shell described in Man. Conch. XVIII, 189, 190, and illustrated in fig. 23 of plate 57.

*Rumina decollata paiva* Lowe. Vol. XVII, p. 213, 214.

It should be observed that the names *lanceolata*, *cornea*, *maxima*, *flammulata* and *decussata* were already in use in *Bulimus*, hence must be dropped as homonyms in *Rumina*, even if the races denoted are valid, which seems doubtful.

#### FERUSSACIDÆ.

FERUSSACIA TERVERIANA Pils., new name for *Achatina terveri* Bgt. 1859 (Vol. XIX, p. 259, no. 48); not *A. terveri* Boissy, 1848, a species of *Poiretia*.

FERUSSACIA HYPSELIA Pilsbry.

New name for *F. producta* Lowe 1852, not of Reuss, 1849. See Man. Conch. XIX, p. 275. The type of *F. hypselia* is the specimen figured, Vol. XIX, plate 39, figs. 24, 25.

ACHATINA BUCCINULA Grateloup, Actes Soc. Linn. Bordeaux X, 1838, p. 122, pl. 4, f. 25, 26, from Dax, seems to be a Miocene species of *Hohenwartiana*.

#### BULIMULIDÆ.

Genus HEMIBULIMUS Marts., Vol. XII, p. 184.

Mr. E. A. Smith (Proc. Malac. Soc. London VII, p. 313) has called attention to my failure through oversight to include *Achatina dennisoni* Reeve in the Manual. He has also discussed the characters and synonyms of that and other



species of the group *Hemibulimus*, correcting various errors which, by reason of the scarcity of material, had been perpetuated from author to author.

The relation of *Hemibulimus* to *Liguus* is not very close and I now doubt the propriety of including them in one genus. Except in the structure of the columella, *Hemibulimus* is very similar to *Porphyrobaphe*.

1. HEMIBULIMUS EXCISUS (v. Marts.) Vol. XII, p. 185, pl. 36a, figs. 31-34.

Popayan, Colombia, at 2400 meters. Type species of *Hemibulimus*. While evidently related to *dennisoni*, it is probably distinct, at least varietally, as Mr. Smith believes. In Vol. XII I followed Professor von Martens in uniting *excisus* and *magnificus*.

2. HEMIBULIMUS DENNISONI (Reeve). Pl. 40, fig. 1.

“Shell fusiformly ovate, spire rather acuminate, whorls 6, somewhat rudely faintly plicately striated, decussated with fine impressed striæ. Apex somewhat papillary. Columella arched and twisted, attenuately truncated. Pale brown, variegated towards the apex with darker brown, last whorl unspotted, encircled with a pale obscure band, columella pinkish.” (Reeve).

Bogota (J. Dennison, Esq.).

*Achatina dennisoni* REEVE, Conch. Icon. v, pl. 9, f. 32 (March, 1849).—PFR., Monogr. iii, 486.—*Liguus* (*Hemibulimus*) *dennisoni* (Reeve) E. A. SMITH, Proc. Malac. Soc. London vii, 1907, p. 314, 313.—*Achatina magnifica* REEVE, op. cit. pl. 9, f. 33, not of Pfeiffer.—*L. magnificus* (Pfr.) PILSBRY, Man. Con. xii, pl. 36 a, fig. 30 (not the description).

Reeve described and figured a shell from the Dennison collection. The present location of the type is unknown. The figure (copied on pl. 40, fig. 1) shows a pale red-brown shell with decidedly attenuate early whorls, a brown-spotted sub-sutural band, and two other pale bands on the last whorl. The parietal wall is purplish but not black. The aperture is markedly acuminate above. Judging from the description

and figure, the sculpture is not so strong as in the following form; yet it must be remembered that the sculpture is usually minimized in Reeve's figures of *Achatina*.

H. D. CARUS Pils., n. var. Pl. 40, figs. 2, 3, 4, 6.

The shell is elliptic-ovate with a rather slender spire and obtuse apex; solid and strong. Nearly  $2\frac{1}{2}$  smooth, convex whorls form the semiglobose embryonic shell. The next whorl is lightly striate, near its termination the surface becomes minutely plicate and spiral grooves appear; on the next whorl it is closely and finely plicate, the plicæ cut by several (usually 5 to 7) spiral furrows, which appear as if scratched in a plastic surface. On the last whorl the fine plicæ become weaker, irregular, often more or less obsolete towards the end of the whorl; there is more or less indistinct malleation, and some irregularity due to former growth-arrest periods, marked by dusky streaks, of which there may be one to four or more on the last whorl. The aperture is elliptic-pointed, outer lip obtuse, more or less thickened, expanded or effuse towards the base. Columella arched, usually very deeply, but sometimes only moderately, its lower portion colored like the outer lip; base truncate, *parietal callus glossy black*, overlaid with bluish inwardly. Color as follows:

(1) *Ground-tint yellow, fading towards the apex: (a)* brown spots below the suture appearing on the first post-embryonic whorl, becoming broad, more or less fulgurate stripes on the penult. and next earlier whorls; last whorl showing three narrow equidistant bands and an irregular mottling of the yellow ground, elsewhere olive and brown of varying shades; outer lip and lower half of columella edged with vermilion. *(b)* intermediate whorls of the spire marked with narrow, close, wavy brown streaks; antepenult. whorl with some subsutural spots, last whorl without bands, irregularly streaked with dull green on a greenish yellow or light yellow green ground; outer lip and basal half of columella bright ochre.

(2) *Ground-tint reddish. (c)* nearly uniform ochraceous reddish, the red predominating on the earlier whorls; outer

lip dull red, fading to pink in the throat. (*d*) first post-embryonic whorl with subsutural spots, next whorl or two closely streaked with dull red-brown; last whorl of a muddy olivaceous shade, with some darker brown streaks; lip with a narrow red edge and dark submargin.

Length 68, diam. 32 mm.; aperture 37.5 mm.; whorls  $6\frac{1}{4}$ .

Length 65, diam. 34.5 mm.; aperture 38 mm.; whorls 6.

Length 65.5, diam. 31 mm.; aperture 37 mm.; whorls 6.

Length 62, diam. 29.5 mm.; aperture 33 mm.; whorls  $6\frac{1}{3}$ .

Colombia: Quilichao, Cauca Valley, 5,500 ft. elevation.

*Achatina magnifica* REEVE, Conch. Icon. V, pl. 9, f. 33.—

*L. magnificus* Pfr., PILSBRY, Man. Conch. XII, pl. 36a, f. 30.

Not *A. magnifica* Pfr.

This form differs from Reeve's figure of *A. dennisoni* by its intensely black parietal callus, and the shape of the aperture, which is wider, less acuminate above, the outer lip being arcuate and not straightened near the insertion.

Reeve's figure 33, (copied in Manual XII, pl. 36a, fig. 30) represents a form differing from this race only in size, as Mr. E. A. Smith has pointed out. In the Manual I followed Reeve's error in referring to it as an illustration of *Achatina magnifica* Pfr.

### 3. HEMIBULIMUS MAGNIFICUS (Pfr.). Pl. 40, fig. 5.

See Vol. XII, p. 185, where a translation of Pfeiffer's description is given. From the reference-paragraph there given the reference to Reeve's figure should be excluded, and the following added: *Liguus (Hemibulimus) magnificus* (Pfr.), E. A. SMITH, Proc. Malac. Soc. London VII, 1907; p. 314, fig. of type. This species seems to be known only by the original specimen, said to be from Quito. Mr. Smith's figure of this is copied on my plate. The specimens obtained by Lehmann in southern Colombia may have been *H. dennisoni*.

ACHATINA MONILE Swainson. "Shell very finely reticulated, whitish with waved stripes, and transverse bands of chestnut spots; basal volution subventricose; spire produced,

the last two volutions close, and the tip papillary; base nearly entire. Distinct from, though approximating to, *Bulinus zebra* and *undatus*."

(*Swainson*, Catalogue of the rare and valuable shells which formed the celebrated collection of the late Mrs. Bligh, Appendix, p. 14, 1822; *Exotic Conchology*, edit. 2, p. 38, 1841).

This seems to be some such shell as *Oxystyla ferussaci*, or some of the forms represented on plate 17 of vol. XII; yet the "apex papillary" recalls *Pseudotrochus (Perideris)*.

ACHATINA VENTRICOSA G. Fischer, Mus. Demidoff iii, p. 224 (1807)=*Bulinus v.*, Brug. See Vol. VIII, 10.

ACHATINA ANTIQUA Desh., An. s. Vert. Bassin Paris ii, p. 839=*Lacuna*.

ACHATINA DONELLII King. T. subalbida, transversim substriata; anfractus basalis ventricosus.—Long.  $\frac{7}{16}$ , lat.  $\frac{3}{8}$ ". (*King* in Zool. Journ. V. p. 342; Pfr., Monogr. ii, 295.)

Habitat prope Lima.

# INDEX TO VOLUMES XVI, XVII, XVIII, XIX, XX.

## ACHATINIDÆ, OLEACINIDÆ, FERUSSACIDÆ.

The following index comprises the families containing snails formerly described as *Achatina*. All snails described under that generic name, whatever their present systematic place, are included herein, so far as known to me.

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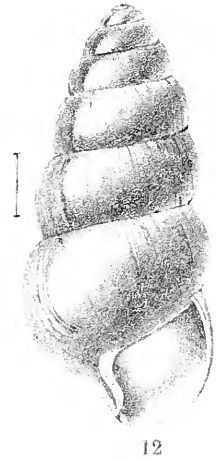


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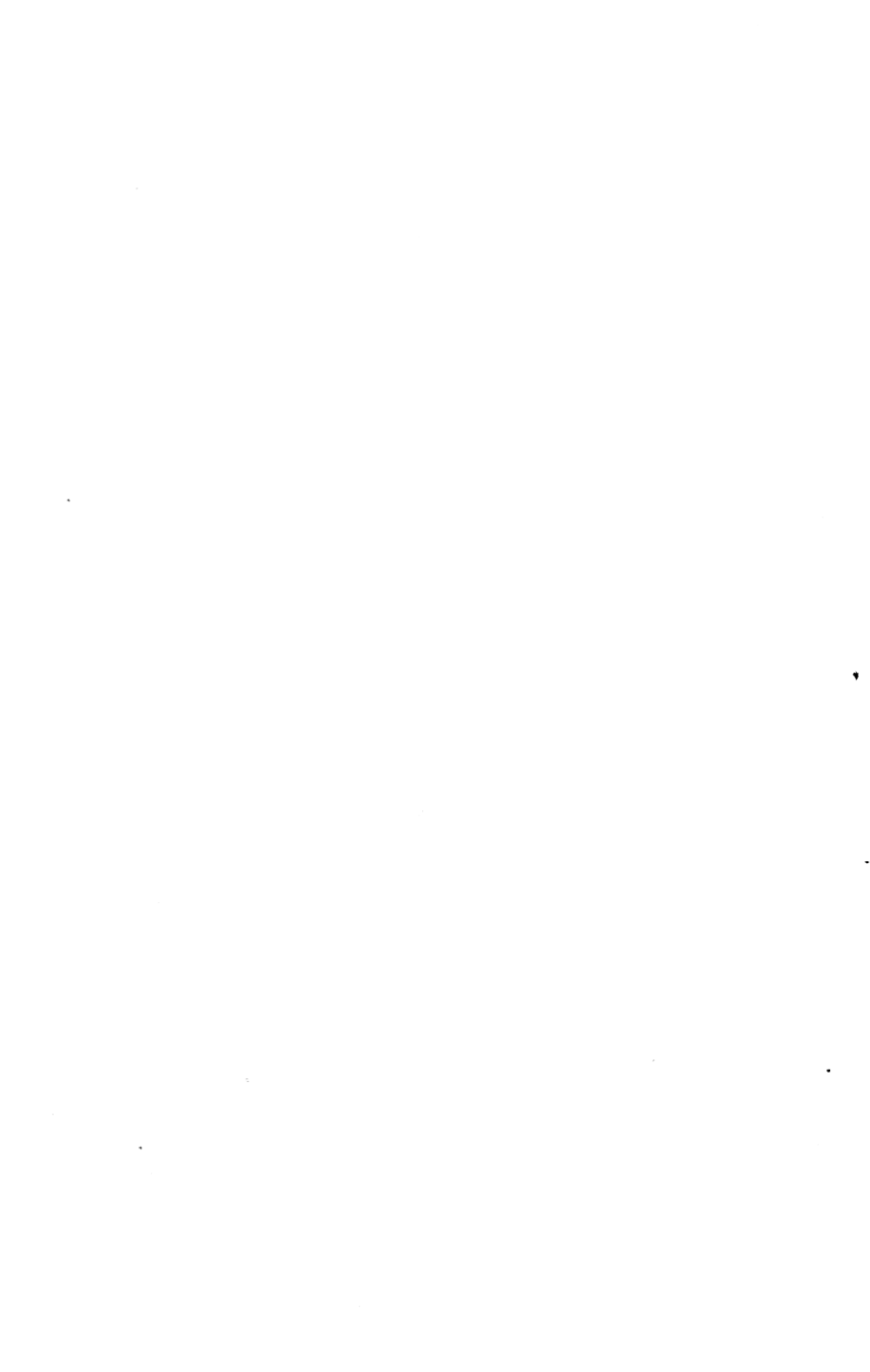
















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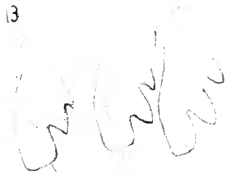
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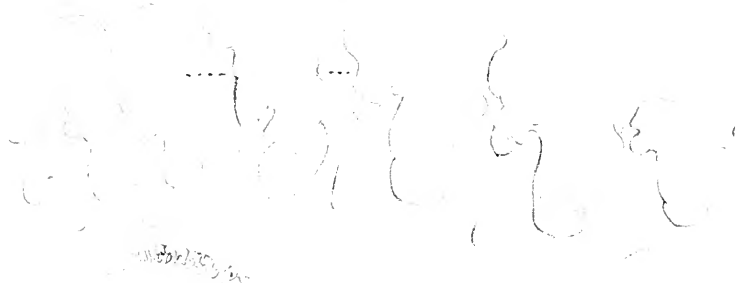
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## Family PARTULIDÆ Pilsbry.

*Partulidæ* PILS., Proc. Acad. Nat. Sci. Phila. 1900, p. 564.

Orthurethra in which the kidney is triangular, equal to the pericardium in length. Genitalia of the haplogonous type, the penis without an appendix. Shell Bulimoid, with the outer lip expanded or reflexed in known forms; the columellar lip reflexed, curving into the basal margin, simple or nodulous; parietal wall often dentate, but the aperture never has entering lamellæ

Jaw very thin, formed of many narrow flat plaits, converging downward towards the middle. Radula broad; the central tooth is not much smaller than the laterals, and has a long middle and small side cusps; lateral teeth with the mesocone long, ectocone well developed, but no entocone; marginal teeth oblique with three cusps directed outward, the inner one largest.

Distribution entirely insular, confined to high islands of the southern and western Pacific. Nearly all the species are arboreal, living on trees and bushes, but some species of Raiatea, Tahaa, Tahiti and perhaps the Caroline Islands, are terrestrial.

This family is co-extensive with the following genus.

## Genus PARTULA Férussac.

*Partula* FÉR., Tableau Systematique de la Famille des Limaçons p. 65, for *P. pudica*, *australis*, *gibba*, *fragilis*, *otaheitana* and *auricula*.—HERRMANNSEN, Indiciis Gen. Malac. ii, p. 204, *P. faba* (*P. australis* Fér.) selected as type.—HARTMAN, Catalogue of the genus *Partula* Fér., 1881; Observations on the genus *Partula*, etc. Bull. Mus. Comp. Zool. ix, p. 171; Catalogue of the genus, Proc. A. N. S. Phila., 1885, p. 206-223.—H. H. SMITH, Annotated Catalogue of shells of the genus *Partula* in the Hartman collection, belonging to the Carnegie Museum, Annals of the Carnegie Museum i, p. 422-485, March, 1903. Bibliography of Hartman's writings on *Partula* on p. 424.

Characters those of the family. Type *P. faba* Martyn.

*Soft anatomy of Partula.*

The first anatomical observations on *Partula* were by Férussac, who discovered that these snails are viviparous. He erroneously states that they have no tentacles, only the eye-pedicles. The next work was by Heynemann, who figured the teeth of *P. lirata*.

The following species of *Partula* were dissected by Dr. C. Semper (Reisen im Archipel Philippinen, Landmollusken, pp. 158, 159): *P. canalis semilineata*, *recluziana*, *lirata* (pl. 17, f. 18, jaw), *hyalina* (pl. 16, f. 21, genitalia), *lineata*, *otaheitana* (pl. xii, fig. 21, genitalia), *vanikorensis* (pl. 17, f. 17, teeth). *P. lineata* was probably not correctly identified.

In 1875 (Proc. Acad. N. S. Phila., p. 244) Mr. W. G. Binney examined the anatomy of numerous Raiatean species: *P. fusca* (pl. 19, f. 9, genitalia), *citrina*, *planilabrum abbreviata*, *umbilicata* (pl. 19, f. 7, genitalia), *bilineata* (pl. 19, f. 10, genitalia), *amanda* (pl. 19, f. 4, teeth), *virginea* (pl. 19, f. 8, genitalia, f. 11, jaw), and *gracilis*, besides several unidentified species. Some of the same information is repeated in Annals of the N. Y. Acad. Sci. iii, p. 127.

I have examined more or less fully *P. rosea*, *P. varia*, *P. arguta* and some unidentified Raiatean species received without the shell.

We have therefore some knowledge of the soft parts in species of the sections *Partula*, *Leptopartula*, *Samoana*, and *Thakombaua*, inhabiting the Society, Samoa and Fiji groups.

Animal externally like that of *Bulimulidæ* or *Helicidæ*; blunt before, the tail long, gradually tapering. There are no pedal furrows, and the sole is undivided. Dorsal grooves weak, but the genital furrow is well developed. Genital pore behind the right tentacle, as usual. The labial processes are rather large. The mantle has very small right and left lobes. The tentacles are as well developed as usual in land snails (pl. 32, fig. 10, *P. canalis*).

Garrett writes: "The examination of the animals of the various species has convinced me that they possess no reliable external features that will aid in their determination.



The coloration in all the species varies from pale cinereous, through all the intermediate shades, to black or dusky slate. The arboreal species are generally lighter colored than the ground species, and have a more expanded creeping-disk. The animals of *P. arguta*, *annectens*, *turgida* and *attenuata*, have the ocular tentacles longer and more slender than the other species, and the exudation of mucus is much more copious and more viscid or tenacious than usual, resembling in that respect the same difference as exists between the typical *Helices* and the arboreal *Naninae*."

The pallial organs are characterized by the short, more or less triangular kidney, with a direct ureter which does not extend to the collar, and opens by a lateral pore. *The pericardium is as long as the kidney.* The surface of the lung shows no visible venation. It is densely peppered with light dots (probably calcareous) arranged in irregular longitudinal lines. In *P. arguta* these light dots are present in spots and stripes (pl. 42, fig. 4), but in other species examined they are equally and densely spread over the whole surface.

In *P. rosea* (pl. 42, fig. 5, x 3) the kidney is very short and strictly triangular. According to Semper, that of *P. canalis* seems to be of the same form. In *P. arguta* (pl. 42, fig. 4) the kidney is relatively larger, and the pericardium lies parallel to its longer axis. The ureter also is longer. In an undetermined Raiatean species (doubtless of the restricted section *Partula*) the kidney approaches the band-like type (pl. 42, fig. 6), yet it is somewhat triangular, and equal to the pericardium in length. This is probably the prevalent shape of kidney, since Semper mentions that all the species examined by him except *canalis* had the kidney, "bandförmig." In most of the subgenera the kidney is unknown.

The alimentary canal is of the usual four-folded type. There is a fusiform crop (pl. 42, fig. 5).

The jaw is very thin and transparent, varying from slightly arcuate to hoofseshoe-shaped, similar to that of *Drymaeus* and *Zaplagius*, formed by the union of many narrow delicate

plates, which converge towards the middle, so that there are short plates where the two series meet (pl. 42, fig. 1 jaw of *P. lirata*, after Semper; fig. 2, central portion of jaw of *P. gracilis* Pse., after Binney).

The number of plates on the two sides is unequal, there being in *lineata* 27.36, in *recluziana* 34.38, in *otahcitana* 40.50 according to Semper.

The radula is broad. The teeth form thrice bent transverse rows, as shown in pl. 15, fig. 11, a half row of teeth of *P. lirata*. The central teeth have the usual quadrate basal plates. In *P. amanda*, *P. rosea*, *P. varia* etc. the length of the basal plate is about twice its width in the middle; the middle cusp is long, reaching to or over the posterior border of the basal plate. Side cusps represented by cutting-points only. The lateral teeth are larger, with the mesocone longer, outer cusp well developed with a strong cutting-point (pl. 43, fig. 1, *P. varia huaheicnensis* Garrett; fig. 2, *P. rosea* Brod.). There are 11 lateral teeth on each side in *P. rosea* and *planilabrum*; 10 in *abbreviata*, *amanda*, *otahcitana*; 8 or 9 in *varia*, *umbilicata*, *virginica*, *bilineata*, *hyalina*, *lineata*, *recluziana*, *canalis*; 5 in *gracilis*. The marginal teeth are peculiar in form, having a long, curved basal plate and 3 cusps, the inner largest, the other two directed outward (pl. 15, fig. 8, 13th to 15th teeth of *P. rosea*). They are numerous, over 120 in *P. virginica*.

The Fijian *P. lirata* differs from the Society Island species examined by Binney and myself by having the central and lateral teeth shorter and wider, the central scarcely longer than wide. There are 7 lateral and over 50 marginal teeth, the latter of typical shape (pl. 15, figs. 11, 12, *P. lirata* after Heynemann).

The radula has been examined in numerous species from the Society, Fiji and Samoan Islands, by Heynemann, Binney, and Semper. I have examined it in *P. rosea* and *varia*.

Genitalia (pl. 43, fig. 5, *P. rosea*).—The penis is well developed. It is more or less distinctly contracted near the distal end, which is swollen. Internally the lower portion is

coarsely wrinkled, the upper portion densely granulose and coarsely plicate. The retractor muscle is terminal. The vas deferens opens below a papilla situated at about the lower third of the granulose portion; it is therefore not terminal on the penis. It is superficially bound to the penis, to the vagina and the basal part of the spermatheca, then free as far as the upper end of the oviduct, where it is again adnate for a short distance. The ovisperm duct is strongly knotted, as usual. The basal part of the spermatheca-duct is much swollen in *P. rosca* and *P. fusca*, the distal end tapering; but in *P. bilineata* (pl. 43, fig. 3, after Binney) *umbilicata*, *virginca*, *otaheitana* and *hyalina* the spermatheca is oblong, obtuse distally, and seated upon a slender duct. In all the species which have been examined the duct is short.

Reproduction seems to be ovo-viviparous. The upper part of the oviduct contains oblong egg-capsules having a calcareous shell, which lower down in the oviduct becomes dissolved or is consumed by the embryo. From one to five eggs or young are found in one individual.

Free muscles:—In *P. rosca* (pl. 43, fig. 4). The pharyngeal retractor is free to its proximal insertion. At about the middle of its length the left ocular and tentacular retractor band joins it, and a little farther out the anterior pedal retractors branch off. The broad posterior pedal retractor (tail retractor or columellar muscle) remains united far forward with the right ocular and tentacular retractor, which gives off a group of small anterior pedal retractor muscles. The right ocular band passes between the male and female branches of the genitalia.

This muscle system differs from that of *Achatinella dolci* chiefly by the union of the right ocular with the tail retractor. In *Achatinella* both ocular bands are free.

#### *Relationships of Partulidæ.*

This family is one of the most sharply defined in the Orthurethra. By its short kidney, about equal to the pericardium, it differs conspicuously from the *Enidæ*,

*Ferussacida*, *Amastrida* and *Achatinellida*, all of which have the kidney very long, far exceeding the pericardium. For comparison I figure the pallial region of *Ena reiniana* (*Buliminus reinianus* Kob.), pl. 42, fig. 3, x 2. In the genitalia, the *Partulida* are remarkable for the absence of an appendix, the penis being simple. This organ is present and highly developed in all the other families. The vas deferens is practically free from the oviduct, its adhesions being merely superficial. This is a somewhat unusual condition, and where found it seems to be associated with viviparous reproduction. The shell is rather characteristic; in form some *Enida* are similar, yet the spirally striate embryonic whorls are unlike that family, and are an invariable feature of *Partulida*, though occasionally this sculpture is lost by wear in adult or old shells. This is not in itself a feature of much importance, yet so far as I know, there is no other Bulimoid snail with an expanded or reflexed lip which has spirally striate embryonic whorls.

From these comparisons it will be seen that the *Partulida* stand somewhat isolated. There is no family of Bulimoid or Achatinoid Orthurethra which can be said to be nearer than any other to the *Partulida*, so far as present information goes.

#### *Hybridism.*

In dealing with Society Island species both Mr. Garrett and Dr. Hartman have called attention to certain specimens of intermediate character which they looked upon as hybrids between species commonly considered to be distinct. Garrett writes as follows: "Hybrids between *P. elongata* and *P. taniata*, and between *P. garretti* and *P. thalia*, are so common where those species come in contact, that I am inclined to believe they possess a certain degree of fertility. I have also detected several hybrids between *P. faba* var. *subangulata*, and *P. virginea*; one between the arboreal *P. imperforata* and the terrestrial *P. lugubris*; two between *P. lineata* var. *strigosa*, and *P. taniata*; about a dozen between the arboreal

*P. faba* and the terrestrial *P. radiata*; a number between *P. faba* and *P. fusca*, and many between the latter and *P. navigatoria*, as well as many between the latter and *P. faba*. I failed to detect hybrids between the Tahitian species, and found none at Huaheine.”

As a general proposition, apparent evidence of hybridism among land snails is so unusual in a state of nature that one is inclined to believe that well-established species very rarely hybridize. In the few species tested experimentally (such as Lang's crosses between *Helix nemoralis* and *hortensis*) the progeny are not abundant and crosses between them are almost sterile. It must be remembered, however, that the Moorean and Raiatean species mentioned as hybridizing by Garrett are very closely related forms, which have for the most part scarcely reached the “specific” stage of differentiation; hence it is not inherently improbable that hybrids occur.

In the case of species between which supposed hybrids are “common,” I would rather explain the intermediate forms occurring on the overlapping confines of the two “pure” races as an undifferentiated remnant of the parent stock which has elsewhere become “specifically” differentiated. Pending experimental evidence to the contrary, this view seems in accordance with what seems to occur in a multitude of other cases, whereas hybridism on an extensive scale is certainly a very rare condition.

#### *Variation in Partula.*

Extended study of variation does not come within the plan of the present work, the purpose of this Manual being the definition of species and their systematic classification. Moreover, the materials for a study of variation—large, unselected series of shells—are not accessible to me; my personal knowledge of them is restricted to museum specimens, which as usually preserved and labelled give little idea of the association of forms or the conditions of their existence. Some general considerations bearing upon variation may however be in order.

Most species of *Partula* are neither more nor less variable than the generality of snails living in exposed situations elsewhere. It is only in the Society Islands that species occur having a variety of well-developed color-patterns. In this respect they resemble many other genera of arboreal snails, such as *Amphidromus*, *Liguus*, *Hemitrochus*, *Polymita*, *Drymaeus* etc., etc. All arboreal snails were derived from terrestrial forms; and almost invariably, with arboreal habits they assume variegated color-patterns. In many cases the colors or patterns seem to be protective (cryptic or warning), but as often they are not so, to our eyes. The color-patterns in arboreal snails seem to be very readily modified, new sports or mutations arising, which are perpetuated, probably in Mendelian ratio, in the parent colonies. This has not yet been tested experimentally in *Partula*; yet from the complex nature of many colonies, in which snails of several distinct color-patterns co-exist and interbreed (being found together in the uterus of a single mother), I have little doubt that pedigree cultures would reveal a Mendelian mixture.

Another common condition among tree-snails is the simplification or absence of pattern, by variation in the "color-factor," whereby patterns characteristic of species or phyla become in part or entirely latent in individuals or races. Cf. the *Pentacniate* snails, *Drymaeus*, *Amphidromus* etc. Some species of *Partula*, such as *P. hyalina*, are apparently albinistic; but in at least a part of these (*P. arguta*) the mantle is variegated, showing through the transparent shell, which in life should vicariously show a pattern.

Probably most "species" of snails and other sedentary animals are in reality more or less complex groups, though in plain-colored forms their composite constitution is not obvious. In some of the plain, ground-living American snails, such as *Omphalina*, the diversity in number of teeth of the radula among different colonies points to this conclusion.

In the Society Islands, where alone the distribution of *Partula* has been studied, most species and races are strictly limited to small areas, a single valley, or several contiguous

valleys. The topographic barriers (ridges unsuitable for Partulæ) are evidently older than the races so isolated, which are the modified descendants of stocks once widely diffused. Diverse mutations soon result in racial differentiation in such isolated colonies, whether the process can be aided by diversity of environment or not. On a small scale this is illustrated by the colonies of *Helix nemoralis* in Burlington, New Jersey, all descended from a single colony planted about 50 years ago, yet now showing incipient racial traits in the several colonies scattered over the town.

Gulick, in his "Evolution, Racial and Habitual" p. 220 has directed attention to the fact that arboreal snails do not have the facility in migrating enjoyed by terrestrial species, and hence are more subject to local differentiation brought about by isolation.

Dr. A. G. Mayer writes: "It is probable that geographical isolation plays a most important part in the formation of new species. If two valleys be adjacent, their snails are closely related each to each, whereas the wider the separation between any two valleys, the more distant the relationship between their snails. The ridges between the valleys, being either barren or covered with vegetation unsuitable to the snails, affords barriers over which the animals must find it more or less difficult to pass. Thus the Partulæ in the Tahitian valleys are isolated very much as are the Achatinellidæ of Oahu in the Hawaiian Islands.

"In Tahiti the snails are most abundant in the valley-bottoms, where they usually occur on the under sides of the leaves of Caladium and Plantain, although in some valleys they are frequently found on Draecena and Turmeric. Although more abundant in the bottom, they extend for some distance up the sides of the valley and appear to be present in most places where the plants which they affect are found. As far as the very limited observation of the writer goes, there appears to be no difference in the character of the snails in different parts of the same valley. The difference between any two adjacent valleys is, however, very marked."

(Mayer, Some Species of *Partula* from Tahiti; a study in variation, in Mem. Mus. Comp. Zool. xxvi, 1902).

### *Fossil Partulidæ.*

No fossil *Partulæ* are known. The ancestors of this family lie buried under the South Pacific. Several Eocene and Oligocene species have been described as *Partulæ*, as follows:

*Partula americana* Heilprin, Trans. Wagner Free Institute of Science i, p. 115, pl. 16, f. 60 (1887) = *Hyperaulax americanus* (Heilprin), Man. Conch. XIV, p. 103. Oligocene, Tampa Silex bed, Florida.

*Partula vicentina* Oppenheim, Denkschriften der Kaiserlichen Akademie der Wissenschaften vol. 57, 1890, p. 125, pl. 2, f. 10-10b. Zeitschrift Deutschen Geol. Gesellschaft, vol. 47, 1895, p. 104. Eocene. Red tuffs of Capitelto, Sta. Catterina above Altissimo, etc.

*Partula dautzenbergi* Cossmann, Annales de la Société Royale Zoologique et Malacologique de Belgique, xli, 1906, p. 280, pl. 8, f. 267bis-1. Sparnacien stage of the Eocene, at Grauves, Paris Basin.

The reference of these forms to *Partula* is purely fanciful. The American species is referable to a genus of *Bulimulidæ*, *Hyperaulax*. Well-preserved specimens have not the characteristic apical sculpture of all known *Partulidæ*. The European Eocene forms offer no character whatever separating them from "*Buliminus*" (*Enidæ*). Their reference to *Partula* rose from the fallacious method of trying to exactly match the fossil shell with some recent species, ignoring the obvious fact that details of contour are constantly changing in the evolution of any group, and offer no features diagnostic of genera in *Bulimini*, *Bulimuli* or *Partulæ*. The Eocene forms in question have not been shown to have the embryonic sculpture of *Partula*.

### *Classification of Partulidæ.*

This family contains the single genus *Partula*. It is quite possible that when the forms of Micronesia, Melanesia etc.



are investigated anatomically, a further generic division may be made. There are two rather dissimilar forms of kidney among the Polynesian species, though at present we do not know enough species anatomically to utilize this fact in taxonomy. By conchological characters nine divisions are indicated, herein called "sections." In all cases these sections are geographically limited to single island-groups, or to several adjacent groups. Five of the nine sections of *Partula* have already been named by Dr. Hartman, who unfortunately used preoccupied names, and in most cases understood the groups in limits different from mine. He also split the typical group of *Partulae* into numerous subgenera which seem to me superfluous. The subgenera herein established are as follows.

**MARQUESANA** Pilsbry. Embryonic whorls coarsely pitted along the spirals; post-embryonic whorls with very well developed spiral lines; lip thin but often widely reflexed; colors not bright, a subperipheral band frequently present, but no others; cuticle thin, often deciduous. Type *P. ganymedes*. This group includes all known Marquesan species, no. 1 to 6.

**LEPTOPARTULA** Pils. Shells ovate with short spire, composed of few (4 to 4½) whorls; *very thin and fragile*, subtransparent, pale colored; aperture large, ovate, toothless, lip expanded, not thickened. Type *P. arguta*. Huaheine and Raiatea, Society Is. Species no. 7 and 8.

**PARTULA s. str.** Shell ovate, usually solid and with opaque coloring, often in bands or streaks; lip thickened within, the callus not extending to the upper insertion; parietal wall often toothed. Society, Austral and Hervey Is., species 9-52, and probably Samoan and Tonga Is., species 60-62.

**SAMOANA** Pils. The shell is *very openly umbilicate*, dextral or sinistral, with flatly reflexed lip and no teeth. Type *P. canalis*. Samoan Is., species 53 to 58.

**THAKOMBAUA** Pils. Shell rimate, long-ovate, the later whorls sculptured with coarse spiral cords. A low callous tubercle on the parietal wall far within. Type *P. lirata*, no.

63. Fiji Is. This is the only group having raised spiral sculpture.

MELANESICA Pils. Shell rimate or umbilicate, ovate or pyramidal, thin, corneous, greenish-yellow or pale brown, uniform or obliquely streaked, not banded; aperture simple, the peristome expanded or reflexed. Type *P. turneri*. Melanesia, one species in Samoa. Species no. 59, 64 to 101.

A large group of species simple in form and coloring.

PALAOPARTULA Pils. Long forms with the spire straightly conic, embryonic whorls high, the later ones deeply engraved spirally, saccate below. Umbilical area very ample, deeply perforate; aperture unusually long, toothless, the lip thin and very broadly reflexed. Type *P. thetis*. Pelew Islands. Species 102 to 104.

CAROLINELLA Pils. Perforate, rather solid, opaque and ventricose species of dull or brown coloration, aperture large and toothless. They have the appearance of ground snails. Type *P. guamensis*. Caroline Islands. Species 105 to 107.

MARIANELLA Pils. Shell ovate or inflated, with a small umbilicus, the lip somewhat thickened within, parietal wall plain or bearing a low nodule deep within; colors rather bright. Type *P. gibba*. Marianne Is. Species 109 to 111.

#### *Geographic distribution of the Partulidæ.*

Snails of this family are confined to the high islands of the south and western Pacific. Not one species has ever been found on an atoll or low island. In most island groups all of the Partulæ belong to a single stock, but in a few, notably the Society and Samoan groups, several phyla are represented. Each of the subgenera or sections is confined to a single archipelago, or to several adjacent island-groups; and with the single exception of *P. hyalina*, no species is known to inhabit more than one island-group, while a great majority of the forms live on but one island. The distribution of Partulæ is remarkably consistent, and lends no support to the idea that their dispersal has been due to drifting by ocean currents, or any other "accidental" means of over-sea carri-

age. Their distribution is what would be expected were the present archipelagos remnants of a former continent, now isolated by subsidence. This continent, from the absence of all of the higher families of land snails on the islands remaining, I have conjectured to have been isolated since Palæozoic times, though the final dismemberment of its various components was doubtless much later. (See Pilsbry, *The Genesis of Mid-Pacific Faunas*, Proc. Acad. Nat. Sci. Phila. 1900, p. 568). Such groups as the Society Islands or Fijis may well have existed as rather large land masses as late as middle Tertiary times. Indeed, this hypothesis would seem to be an essential part of any attempt to explain the distribution of land snails in most of the groups of high islands.

The most convenient grouping of species for the purposes of this monograph is by geographic range. The following divisions are used.

- I. Marquesas Islands, species 1 to 6.
- II. Society Islands, species 7 to 50.
- III. Austral and Hervey Islands, species 9, 52.
- IV. Samoan Islands, species 53 to 60.
- V. Fiji Is., Rotuma and Tonga Is., species 61 to 63.
- VI. New Hebrides and Santa Cruz groups, species 64 to 80.
- VII. Solomon Islands, species 81 to 91.
- VIII. New Ireland, New Britain, etc., and Admiralty Is., species 92 to 96.
- IX. Louisiade Archipelago, including Trobriand and Woodlark Is.; New Guinea. Species 97 to 100.
- X. Talauer Is., species 101.
- XI. Pelew Islands, species 102 to 104.
- XII. Caroline Islands, species 105 to 108.
- XIII. Marianne Islands (Guam), species 109 to 111.
- XIV. Snails of other genera described as *Partulæ*.
- XV. Species of uncertain or unknown habitat, species 12, 21, 47, 48, 49, 50, 51, 60, 72, 86, 94.

## Species of the MARQUESAS ISLANDS.

## Section MARQUESANA n. sect.

*Æga* HARTMAN, Catalogue of the Genus *Partula*, 1881, p. 11, type *P. decussatula* (not *Æga* Leach, 1815).—*Latia* Hartm., op. cit. p. 12, type *P. ganymedes* Pfr. (not *Latia* Gray, 1849).

Partulæ having the embryonic shell coarsely pitted along the spirals; post-embryonic whorls with very well developed spiral striation; lip thin but often wide. Colors not bright; the cuticle thin, often deciduous; a subperipheral band frequently present, but no others. Type *P. ganymedes*.

Species of *Partula* are known from five of the nine high islands of the Marquesan group, the others being unknown conchologically. They are distributed as follows:

Nukuhiva: *P. strigata* varieties.

Huapu: *P. strigata* (?), *P. bellula*.

Hivaoa: *P. inflata*, *P. ganymedes*, *P. bellula*, *P. decussatula*.

Tahuata: *P. inflata*.

Fatuhiva: *P. magdalinae*.

The predominance of species on Hivaoa may be due to its being more fully explored. It is the largest island next to Nukuhiva. The proportion of species recorded as common to two islands is remarkable, if indeed it proves to be the fact. It seems likely that further research would greatly augment the brief list of Marquesan *Partulæ*.

*P. spadicea* Reeve, reported from the Marquesas, is a Society Island form.

*Key to Marquesan Partulæ.*

Whorls over 5; peristome broad, white, strongly calloused within; shell opaque.

a. Very obese, the diam. more than  $\frac{2}{3}$  the length; last whorl humped. *P. inflata*, no. 1.

aa. Oblong-conic, the last whorl rounded.

b. Surface partly nude, but having a band of cuticle; length 20-23 mm. *P. ganymedes*, no. 2.

*bb.* Surface covered with a pale greenish cuticle, length about 21.5 mm. *P. recta*, no. 3*b.*

Whorls less than 5; peristome narrower or tinted, not very strongly calloused.

*a.* Aperture less than two-thirds the length of the shell.

*b.* Olive-brown, brown or white, opaque; lip narrow; length 17 to 21 mm. *P. strigata*, no. 3.

*bb.* Pale olive or greenish-yellow, thin, somewhat translucent; length 14 to 17 mm., whorls 4½.

*P. bellula*, no. 4; *P. decussatula*, no. 5.

*aa.* Aperture two-thirds the length of the shell; shell thin, fragile, with a pale yellowish cuticle; length 14 to 15 mm.

*P. magdalinae*, no. 6.

1. *P. INFLATA* Reeve. Pl. 30, figs. 1, 2, 3.

Shell openly umbilicate, globose-conic, rather thin, lusterless or nearly so, varied in color: (1) white, usually with some trace of an olive subperipheral band. (2) white, suffused and obliquely streaked with brown in a broad median belt, abruptly darker below the periphery; spire corneous. (3) reddish or dull chestnut brown, more or less streaked, and sometimes white below the sutures; reverse of the lip and columella white. Of the 2½ embryonic whorls the first half whorl or more is smooth, the rest pitted along the spirals. The rest of the shell is sculptured with very distinct, close waved spiral striae. Spire is straightly conic, suture moderately impressed. Whorls 5½, convex, the last whorl *swollen in the peripheral region* except for the space of a third or fourth of a whorl behind the lip, where it is compressed; this gives a *humped appearance to the back of the shell*. Aperture ovate; lip broad, white, flatly reflexed, thickened within; columella broad, with a deep-seated fold above, visible in oblique view.

Length 23, diam. 17 mm.

Length 21, diam. 16.7 mm.

Marquesas Is.: Taiwata, (Tahuata), on trees at about 1500 ft. elevation; also Dominique or Hivaoa (Garrett).

*Partula inflata* RVE., P. Z. S. 1842, p. 197; Conch. Syst. ii, pl. 175, f. 11, 12; Conch. Icon. pl. 1, f. 3.—PFR., Monogr. iii, p. 452; Conchyl. Cab. p. 267, pl. 64, f. 5, 6.—HARTMAN, Catal. p. 12.—GARRETT, Bull. Soc. Malac. France iv, 1887, p. 25.—*Bulimus thersites* PFR., Symbolæ ad Hist. Hel. ii, p. 52 (1842); Monogr. ii, p. 75.

Remarkable for its gibbous last whorl and broad white lip. The very thin cuticle is more or less wholly lost in most adult shells. The examples described are from the island of Taiwata (= Tahuata); whether those reported from Dominique, the next island of the group, are identical with them in all respects I do not know.

2. P. GANYMEDES (Pfeiffer). Pl. 30, figs. 4, 5, 6, 7.

Shell umbilicate, oblong-conic, thin, minutely, strongly, de-cussated with close growth-lines and extremely close, im-pressed, wavy, spiral lines; dead white under a very fugacious greenish-yellow epidermis. Spire conic, rather acute. Whorls  $5\frac{1}{2}$ , a little convex, the last about as long as the spire, very obsoletely angular in the middle, ornamented with one rather wide chestnut band. Columella straightened. Aper-ture oblong, obliquely truncated above; peristome simple, thin, broadly expanded throughout. Length 23, diam.  $10\frac{1}{2}$ , aper-ture inside  $10\frac{1}{2} \times 5$  mm. (*Pfr.*).

Marquesas Is.: Dominique or Hivaoa, on trees (Garrett).

*Bulimus ganymedes* PFR., P. Z. S. 1846, p. 39; Monogr. ii, p. 72.—*Partula ganymedes* PFR., Monogr. iii, 447; iv, 511; vi, 160.—REEVE, Conch. Icon. vi, pl. 3, f. 16.—HARTMAN Cat. Gen. Partula p. 11, with figure.—GARRETT Bull. Soc. Malac. France, iv, 1887, p. 26.—*Partula fasciata* PEASE, Amer. Journ. of Conch. ii, p. 202, 293.

This species is variable in size, the degree to which the cuticle is lost, and the color of what remains. Specimens of one lot measure:

Length 22, diam. 13, length aperture 12.8 mm.; whorls  $5\frac{1}{2}$ .

Length 20, diam. 11.3, length aperture 11.1 mm.; whorls  $5\frac{1}{2}$ .

In the typical form, the very thin pale green cuticle is

either entirely lost, or only a belt remains at and below the periphery, in adult shells. The upper edge of the subperipheral brown band often shows as a thin line above the sutures of the spire; but frequently a mere brown line replaces the band, and is concealed on the spire (fig. 5).

In another form of the species, the cuticle is removed in a zone below the suture. This zone may be wide or narrow; the remaining portion of the last whorl—usually half to three-fourths—is covered with greenish or dull brown cuticle. These variations seem to be characteristic of different colonies.

The beautifully developed spiral striation is characteristic of all forms. The lip is flatly reflected, thickened at the inner rim, and rather abruptly narrowed near the upper angle. The umbilical crevice is widely open.

### 3. *P. STRIGATA* Pease. Pl. 30, figs. 8, 12.

The shell is openly umbilicate, acutely ovate, rather thin, dingy olive-brown, the latter part of the last whorl light cream-brownish with a few darker oblique streaks, and an orange streak in the angle behind the lip. Sculpture of fine, waved spiral lines. Embryonic shell of  $2\frac{1}{2}$  whorls, coarsely pitted in spiral lines except the smoothish initial half whorl. Whorls  $4\frac{3}{4}$ , convex, the last evenly rounded. The aperture is ovate, oblique, peristome flesh-tinted, flatly reflexed, rather narrow, thickened within except near the upper angle. Length 19, diam. 10.8, aperture 10.8 mm.

Marquesas (Pease). Huapu (Garrett).

*Partula strigata* PEASE, Amer. Journ. of Conch. iv, 1868, p. 155, pl. 12, f. 7; P. Z. S. 1871, p. 473.—PFR., Monogr. viii, p. 202.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 80.

The types, one of which was figured in A. J. C. iv, are before me. The above description and figs. 8 and 12 were drawn from them. Pease gave simply *Marquesas* as the habitat, but Garrett stated that "Pease's shells were collected by a native missionary residing on Woapo." This island lies south of Nukahiva. In his Marquesan catalogue of 1887 Garrett places *strigata* as a synonym of *recta*, without remark.

Whether the specimens were actually taken on Huapu ("Woapo") or not remains uncertain.

Compared with the type lot of Pease's *P. recta*, *P. strigata* is thinner, darker colored, dull brownish instead of pale green, with a narrower flesh-tinted peristome. The two lots seem to be specifically distinct, until studied in connection with a large series from Nukahiva, subsequently obtained, which seem to be partially intermediate.

3a. *P. STRIGATA OBESIOR* Pils. Pl. 30, figs. 11, 14, 15, 16.

A lot of 27 examples from Nukahiva consists of shells which are generally *more globose* than either *recta* or *strigata*, thin, variable in color as follows:

a. White, denuded of cuticle (fig. 14).

b. White, covered with a very thin straw, cream or brown tinted cuticle, the spire often corneous (fig. 15).

c. Rusty brown, having a whitish belt below the suture (fig. 16).

d. Dark brown (fig. 11).

In nearly all of this lot the lip is thin and narrow, as in *strigata*. Specimens measure:

Length 21., diam. 12.8, aperture 11.8 mm., whorls 5.

Length 20.8 diam. 12, aperture 11 mm., whorls 5.

Length 19, diam. 11.8, aperture 11 mm., whorls 5.

Length 18.5, diam. 10.5, aperture 10 mm., whorls  $4\frac{3}{4}$ .

Length 17, diam. 10.5, aperture 10 mm., whorls  $4\frac{2}{3}$ .

A few examples among these shells are typical *recta*. Probably a collector who would keep his shells from different colonies separate would find that there are several races on Nukahiva.

3b. *P. STRIGATA RECTA* Pease. Pl. 30, figs. 9, 10.

The shell is openly umbilicate, acutely long-ovate, solid, the typical form white under a very thin, very pale green cuticle, which is often deciduous on the last half whorl. The spire is straightly conic, whorls  $5\frac{1}{4}$  convex, the last one equably curved from suture to base. The initial half whorl is smooth,



next two whorls of the embryonic shell are rather coarsely pitted in spiral lines, following whorls marked with fine growth-lines and very fine spiral striæ, most distinct at the base. The aperture is oblique, ovate; peristome *broad, white flatly reflexed*, thickened within except near the upper angle. Length 21.5, diam. 12.5, aperture 12 mm.

Marquesas: Nukahiva, abundant on trees.

*P. recta* PSE., Amer. Journ. of Conch. iv, 1868, p. 155, pl. 12, f. 8; P. Z. S. 1871, p. 473.—Hartman, Catal. Gen. Partula p. 12; Proc. A. N. S. Phila. 1885, p. 220.—GARRETT, Bull. Soc. Malac. France, iv, 1887, p. 25.

4. *P. BELLULA* Hartman. Pl. 30, figs. 17, 18, 19.

The shell is rather narrowly umbilicate, ovate-conic, thin, covered with a very pale olive or greenish-yellow cuticle with inconspicuous darker streaks, the embryonic whorls pale flesh-tinted. Surface somewhat shining, with sculpture of fine spiral striæ which are crowded and wavy on the base, but separated by spaces much wider than the impressed lines on the upper part of the last whorl.  $2\frac{1}{2}$  embryonic whorls (fig. 19) have the coarse pitting of other Marquesan species. Spire short, straightly conic; whorls  $4\frac{1}{2}$ , moderately convex, the last inflated, almost equably convex, but the base is especially so. Aperture oblique, ovate; peristome reflected, gray, in fully adult shells having a narrow white callous rim at the inner edge, not extending to the upper termination of the outer lip. Columellar lip dilated.

Length 14.2, diam. 9.7, aperture 8.5 mm., (type).

Length 16, diam. 9.9, aperture 9 mm.

Length 14.5, diam. 9.7, aperture 9 mm.

Marquesas Is.: Huapu I., type loc.; Dominique or Hivaoa Island (Garrett).

*Partula bellula* HARTMAN, Proc. A. N. S. Phila. 1885, p. 203, fig. in text (Sept. 1, 1885).—GARRETT, Bull. Soc. Malac. France iv, 1887, p. 27.

This species is more slender than *P. decussatula*, with a smaller aperture, and the spiral striation is much less crowded

on the upper half of the last whorl. The type specimen (no 4264 Carnegie Mus.) is not completely mature, wanting the narrow callous inner rim of the peristome, but there are several fully adult shells with younger ones in the collection of the Academy, taken by C. D. Voy. An egg shaken from one of them is very shortly oval, 3 x 2.5 mm., matt white, and smooth under an ordinary lens.

5. *P. DECUSSATULA* (Pfeiffer). Pl. 31, figs. 1, 4.

Shell perforate, ovate-conic, thin, very minutely decussated with growth-lines and spiral striæ, slightly shining, fulvous-whitish, diaphanous. Spire short, conic, rather obtuse. Suture moderate. Whorls  $4\frac{1}{2}$ , convex, the last five-ninths the total length, rounded. Columella subplicate, receding. Aperture angularly oval. Peristome simple, thin, the margins converging, right margin with a bell-like expansion, columellar margin reflexed over the perforation. Length 15, diam.  $8\frac{2}{3}$ , aperture 9 x  $6\frac{1}{2}$  mm. (*Pfr.*)

Marquesas Is.: Dominique (Hivaoa), abundant on leaves (Garrett).

*Bulimus decussatulus* PFR., P. Z. S. 1849, p. 131. *Partula decussatula* PFR., Monogr. iii, 453; Conchyl. Cab. p. 274, pl. 65, f. 8, 9.—REEVE, Conch. Icon. pl. 4, f. 23.—HARTMAN, Catal. Gen. Partula p. 11, fig.; Proc. A. N. S. Phila. 1885, p. 217.—GARRETT, Bull. Soc. Malac. France iv, 1887, p. 24.

A thin, inflated species, yellowish-corneous slightly brown tinted towards the summit, with a pale border below the suture denuded of cuticle, and a narrow very faint brown band just below the periphery. This band is sometimes very inconspicuous. Old shells lose much of the cuticle, becoming whitish and opaque. The aperture is ample. The peristome is corneous, thin, well expanded but not thickened within except in quite old shells. Several examples measure:

Length 16.5, diam 10.3, aperture 10 mm., whorls  $4\frac{3}{4}$ .

Length 15.3, diam. 10, aperture 9.9 mm., whorls  $4\frac{3}{4}$ .

Length 15, diam. 9.9, aperture 9.9 mm., whorls  $4\frac{1}{2}$ .

The sculpture of rippled spiral striæ is particularly well developed in this species.

6. *P. MAGDALINÆ* Hartman. Pl. 31, figs. 2, 3.

The shell is rather narrowly umbilicate, globose, with a short, conic spire, thin, fragile; white with some corneous streaks under a very thin pale yellowish cuticle, which seems to be usually deciduous above the periphery on the last whorl. Sculpture of minute, close spiral striæ much as in *P. decussatula*, but weaker above the periphery. Embryonic whorls as in *decussatula*. Spire very short; whorls somewhat convex, the last very much inflated, prominent in the peripheral region, convex beneath. Aperture oblique, ovate; peristome reflexed, gray, thin, just noticeably thickened within.

Length 14.8, diam. 11, aperture 10 mm.

Length 15, diam. 11, aperture 10 mm., whorls  $4\frac{1}{2}$ .

Length 14, diam. 10.3, aperture 9.3 mm., whorls  $4\frac{1}{4}$ .

Marquesas Is.: Santa Magdalena or Fatuhiva Island (Garrett).

*P. magdalena* HARTMAN, Proc. A. N. S. Phila. 1885, p. 203, fig. in text.—GARRETT, Bull. Soc. Malac. France iv, 1887, p. 27.

This very delicate snail is related to *P. decussatula* Pfr., but it is very much more inflated, shorter, with a narrower umbilicus. Of the four examples originally composing the type lot, one has been broken; the example figured by Hartman is also damaged by a hole in front (not shown in my figure of this specimen). Perhaps none of the specimens is quite fully mature, but it is evidently a very thin shell at any stage of growth. Figured from cotypes, no. 4263 Carnegie Museum.

## II. SPECIES OF THE SOCIETY ISLANDS.

The Society Islands are wonderfully rich in Partulas. Both species and individuals are developed in profusion, and differentiation of form and color has been carried further than in any other island group, though there has been no great structural divergence. Probably all of the Society species are referable to two stocks, herein regarded as "sections." These sections may be defined thus:

- I. Shell ovate, with short spire, composed of 4 to  $4\frac{1}{2}$  whorls, very thin, fragile and subtranslucent; color pale and

simple; aperture ample, peristome expanded, not thickened. Section *Leptopartula*, species 7 and 8.

- II. Shell composed of more than  $4\frac{1}{2}$  whorls, usually solid, with opaque coloring, but sometimes white; lip thickened within. Section *Partula*, species 9 to 50.

Up to this time we owe our knowledge of the distribution and variation of Society Island Partulæ to Andrew Garrett, whose residence at Tahiti gave him unusual facilities for their study. In the following account I have quoted largely from his writings and except in a few cases, have accepted his estimate of the rank of the several species and races. In a case like this, where races in all degrees of differentiation abound, the rank to be assigned to any given race is, in the last resort, a matter of opinion. The criterion of intergradation is often difficult of application, as where the racial divergence is expressed chiefly in slightly different tendencies of variation. In Raiatea and Tahaa especially, there seems to be a good deal of intergradation between the races and so-called species.

Section LEPTOPARTULA n. sect.

*Echo* HARTMAN, Cat. Gen. Partula, 1881, p. 11; not of Selys, 1853.

The shell is ovate with short spire, and composed of few (4 to  $4\frac{1}{2}$ ) whorls; very thin, fragile and somewhat transparent, pale; aperture large, ovate; lip expanded, not thickened. Type *P. arguta*.

Two species, the most fragile of the genus, compose this section, which is confined to Huabeine and Raiatea.

7. *P. ARGUTA* (Pease). Pl. 24, figs. 14, 15.

The shell is narrowly but deeply perforate, short, ovate, *extremely thin*, fragile, *corneous* usually with a faint buff tint, and imperfectly *transparent*. Surface rather glossy, marked with weak growth-lines and microscopic incised spiral striæ which are weak on the last whorl but distinct and close on the spire. The spire is very short, conic; whorls 4, convex, the last evenly convex, globose. The aperture is somewhat

oblique, more than half the total length, broadly ovate. The peristome is *thin* and expanded throughout, whitish-corneous. Outer lip equably arched, basal margin more strongly arcuate. Columellar margin reflexed and dilated above. Columella concave, bending towards the right above. Parietal film hardly perceptible.

Length 13, diam. 8.1, length of aperture 7.7 mm.

Length 12, diam. 8, length of aperture 7.5 mm.

Huaheine: "The metropolis of this very fragile species is in the upper portion of a mountain ravine, on the west coast of Huaheine, where it is rather common on the leaves of low shrubs and ferns. It occurs much more rarely in a neighboring valley south of its specific center. Mr. Pease's habitat 'Tahiti,' as given in his list of Polynesian land shells, is decidedly wrong." (*Garrett*).

*Bulimus argutus* PEASE, Proc. Zool. Soc., 1864, p. 670; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 46.—*Partula arguta* SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—MARTENS and LANGK., Don. Bismarkianum, 1871, p. 55, pl. 3, fig. 7.—HARTMAN, Cat. Part., p. 11 (with woodcut); Obs. Gen. Part., Bull. Mus. Com. Zool., ix, p. 179.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 62, pl. 3, f. 57.

Though referred by Pease to the genus *Bulimus*, it is, nevertheless, a true *Partula*. "The animal, which is viviparous, has very long, slender, ocular tentacles, long lance-pointed foot, and that portion of the animal occupying the whorls of the translucent shells is beautifully maculated with black and white spots on grayish yellow ground. The shell, which is very uniform in all its specific characters, may be readily distinguished by its very thin pellucid texture, ovate form, abbreviated spire, turgid body-whorl, uniform pale yellowish horn-color, thin, slightly expanded lip and large simple aperture." (*Garrett*).

Pease gave the following description. Specimens received from him are before me. "B. testa ovata, tenuissima pellucida, membranacea, nitida, anguste umbilicata; anfr. iv, convexis, ultimo ventricosos, suturis impressis; apertura

ampla, ovata; labro simplici, reflexo; pallide straminea. Long. 13, diam  $8\frac{1}{2}$  mill."

8. *P. TURGIDA* Pease. Pl. 24, fig. 16.

The shell is shortly, openly rimate, not perforate, short, obliquely ovate, *extremely thin, fragile*, corneous, faintly tinted with pale brown, slightly transparent. The surface is glossy, marked with growth-lines and minute, close, spiral striae. Spire very short, conic; suture marked with a fine white line. Whorls  $4\frac{1}{2}$ , convex, the last very large, evenly swollen. Aperture oblique, broadly ovate, *two-thirds* the length of the shell. Peristome thin, narrowly expanded, the columellar margin dilated and flattened above. Length 17, diam. 11.6, length of aperture 11.5 mm.

Raiatea: though widely diffused it is excessively rare. (*Garrett*).

*Bulimus turgidus* PEASE, Proc. Zool. Soc., 1864, p. 670; 1871, 473.—PFEIFFER, Mon. Hel., vi, p. 12.—*Partula turgida* HARTMAN, Cat. Part., p. 12; Obs. Gen. Part., Bull. Mus. Com. Zool., ix, p. 188. GARRETT, Journ. A. N. S. P. ix, 1884, p. 56, pl. 3, f. 74.

This delicate shell is larger and more opaque than *P. arguta*, and differs in the non-perforating umbilical fissure. Garrett remarks that "Like *P. clara* and *P. annectens*, it appears to be gradually becoming extinct."

#### Section PARTULA s. str.

*Partula* FÉR., Tabl. Syst. p. 65 (1821).—HERRMANNSEN, Indicis Gen. Malac. ii, p. 204, type *P. faba*.—*Nenia* HARTMAN, Cat. Genus Partula, 1881, p. 7, type *P. auriculata* Brod.; not *Nenia*, H. & A. Adams.—*Astræa* HARTMAN, t. c. p. 7, type *P. dentifera* Pfr.; not *Astræa* Gmelin.—*Clytia* HARTMAN, t. c. p. 8, type *P. umbilicata* Pse.; not *Clytia* Lam.—*Ibia* HARTM., t. c. p. 8, type *P. lutea* Less.; not *Ibia* Leach, 1817.—*Oenone* HARTMAN, t. c. p. 9, type *P. hebe* Pfr.; not *Oenone* Savigny.—*Helena* HARTM., t. c. p. 9, type *P. otaheitanana*.—*Pasithea* HARTM., t. c. p. 10, type *P. spadicea* Rve.;

not of Lamarek.—*Matuta* HARTMAN, t. c. p. 14, type *P. rosea* Brod.; not *Matuta* Fabricius.

The typical group of *Partula* is restricted to the Society and Hervey Islands. Each island has its minor type of shell, except Moorea and Tahaa, which have Tahitian and Raiatean types respectively; but the entire series is so closely interrelated that the named subgeneric divisions proposed by Dr. Hartman cannot be sustained.

A small group of white, translucent species includes  
No. 9, *P. hyalina* Brod. Tahiti, Hervey and Austral  
Islands.

No. 16, *P. clara* Pse. Tahiti.

No. 17, *P. attenuata* Pse. Tahiti and Raiatea.

No. 44, *P. annectens* Pse. Huaheine.

These forms may have some exceptional means of distribution, or they may be conservative stocks, which have altered little since the original radiation over the mountain ranges which are now islands. They approach the simply colored southwestern forms of *Partula*, such as those of the Solomon Islands, in appearance, and seem to be little-changed members of an old stock.

The species are here treated in geographic order, as follows:

1. Tahiti, species 9 to 17.
2. Moorea, species 18 to 21.
3. Raiatea and Tahaa, species 22 to 41, 8.
4. Huaheine, species 42 to 44, 7.
5. Borabora, species 45.
6. Species of uncertain habitat, species 46 to 50.

### 1. *Partulae* of Tahiti.

“On Tahiti, the largest island in the group, we find eight species only, six of which are endemic. One (*P. clara*), which has a limited range, appears to be gradually becoming extinct. Four species (*P. filosa*, *nodosa*, *producta* and *stolida*) are each restricted to a single valley. All the above species are well-defined, and exhibit but little variation. On the contrary, *P. otaheitana*, which has its centre of distribution

in Fautaua valley, has spread all round the island, and is subject to so much variation that no less than fourteen species have been proposed for the different forms. Two species (*P. hyalina* and *attenuata*) are common to other islands; the former is found in the Austral and on one of the Cook's group; the latter occurs on Raiatea, but does not inhabit the two intermediate islands. It is a noteworthy fact that, notwithstanding both species have spread nearly all round Tahiti, yet they have not developed a single varietal feature, but, on the contrary, are remarkably uniform in all their specific characters.

"Here we have three species ranging round the island, and all subject to the same conditions of life, yet two have not shown the slightest tendency to depart from the typical forms, and the other, which is very variable in its metropolis, has developed many local varieties. The above facts, which are common to other species, seem to suggest that physical conditions are not the primary cause of variations, but that it is the operation of some unknown law." (Garrett).

Numerous forms of Tahiti and Moorea are sinistral. The species of all the other islands are invariably dextral. Sinistral *Partulae* also occur in the Samoan group.

9. *P. HYALINA* Broderip. Pl. 24, figs. 10, 11, 12, 13.

The shell is perforate, acutely long-ovate, thin but rather strong, corneous-white or bluish-white throughout. The spire is straightly conic, apex acute. Whorls 5, weakly convex, the last convex, becoming somewhat compressed laterally in the last half, base convex. Sculpture of fine growth-lines decussated by minute, close spiral incised lines. The aperture is very oblique, ovate. Peristome rather broadly reflexed, strongly thickened within, the columellar margin weakly nodose.

Length 15, diam. 9, aperture 9 mm.

Length 16, diam.  $9\frac{1}{2}$ , aperture 9 mm.

Society Islands: Tahiti, throughout the island in small numbers (Garrett). Austral Is.: Tubuai (Garrett), and



Rurutu or Oheteroa (type loc.; Cuming). Cooks or Hervey Is.: Mangaia (Garrett); Rarotonga (C. D. Voy).

*Partula hyalina* BROD., P. Z. S. 1832, p. 32.—REEVE, Conch. Syst. ii, pl. 175, f. 1, 2; Conch. Icon. pl. 3, f. 14.—PFR. Monogr. iii, 451; Conchyl. Cab. p. 271, pl. 64, f. 19, 20.—GARRETT, Proc. A. N. S. Phila. 1879, p. 18 (Austral Is.); Journ. A. N. S. Phila. ix, 1884, p. 65.—MAYER, Mem. Mus. Comp. Zool. xxvi, no. 2, p. 122, figs. 1, 2, 1a-1c (1902).—*Bulinus hyalinus* SOWB. Conch. Illustr. f. 9.—*Bulinus hyalinus* PFR. Monogr. ii, p. 67.

Quite distinct by its milk-white color, and the very oblique aperture, contracted in adult shells by a strong inner rib of the lip. It might form a separate subgenus.

The distribution of this snail on several widely separated groups is remarkable. Such distribution is unparalleled by any land snail of its size in Polynesia. I have not seen specimens from Mangaia or Rurutu, but those collected by Voy at Rarotonga seem indistinguishable from Tahitian examples. It seems possible that it has been distributed by human agency, since it is not likely that a snail of this size could be carried far over sea by hurricanes, as the minute forms (*Tornatellina*, *Pupida* etc.) no doubt have been. Still another hypothesis: *P. hyalina* may be an ancient and conservative stock, which has survived from the time when these mountain islands formed the sierras of a larger land mass.

10. *P. COMPRESSA* 'Pfr.' Reeve. Pl. 41, figs. 19, 20, 21.

"Shell acuminate oblong, rather thick, obliquely produced towards the base, rather largely, compressed umbilicate. Whorls convex, obliquely striated, very slightly spirally lineated; last whorl rotundately angulated at the base. Aperture oblong, lip reflected in a slanting direction, a little contracted in the upper part. Dark chestnut brown, lip and interior of the aperture livid purple." (Reeve).

"Shell deeply rimate, ovate-conic, rather solid, under the lens very minutely decussate; chestnut colored. Spire conic, rather obtuse; suture marked with a white line. Whorls 5,

nearly flat, the last as long as the spire, narrowed and compressed at the base. Columella subnodose. Aperture oblong, narrowed by the calloused lip; peristome brownish violaceous, broadly expanded, a little reflexed. Length 22, diam. 10, aperture with peristome 12 x 8 mm." (*Pfr.*)

Society Islands (Cuming coll.).

*Partula compressa* PFR., REEVE, Conch. Icon. pl. 4, f. 20 (May, 1850).—PFR., Monogr. iii, 447.—Cf. GARRETT, Journ. A. N. S. Phila. ix, 112.—*Bulimus compressus* PFR., Zeitschr. f. Malak. 1850, p. 75 (July, 1850).—*P. stolidus* GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 70, pl. 3, f. 58.

The descriptions of Reeve and of Pfeiffer are given above. The type specimen is represented by fig. 21, copied from Reeve who described the species in advance of Pfeiffer. The figure measures about 24 mm. long. The last whorl is dark chestnut colored.

Three specimens received as *P. compressa* from Mr. Cuming in 1862 are before me, two being figured, pl. 41, figs. 19, 20. The shell is glossy, with very fine and rather weak spiral striation. The color in one shell is white under a yellow cuticle, closely streaked with olive-yellow, the streaks forming an ill-defined median belt. The other specimens are very finely, closely but irregularly streaked with brown, on a yellow ground on the last whorl, giving a rather bright reddish or yellowish brown appearance, while the spire is dull or liver brown, the apex dull purplish-brown. The last whorl is *very conspicuously compressed laterally*, flat there in the last half-whorl. The aperture is diagonal, the base thrown out from the middle, in the type figure and in the yellow shell before me (fig. 19), but in a smaller shell it is normal in shape. The lip is reflexed, heavily thickened within. The interior is white.

Length 21, diam. 11½, aperture 12 mm., whorls 5⅓.

Length 19½, diam. 10½, aperture 10.2 mm., whorls 5⅓.

These specimens agree perfectly with one received from Andrew Garrett as *P. stolidus*, and which he figured in Journ. A. N. S. Phila. ix, p. 70, pl. 3, fig. 58. I have drawn this

shell somewhat enlarged on pl. 25, fig. 7. It has some resemblance to *P. affinis*, but the last whorl is *far more compressed laterally* than in *affinis*. The spire is reddish-brown, becoming darker towards the apex, which is blackish-purple. The last whorl is olivaceous-chestnut, closely streaked with yellow. *The last half of the last whorl is strongly compressed at the side, with a very convex, "saccate" base.* The umbilical crease is rather ample. The rather narrowly reflexed lip is fleshy-tinted, thin-edged, having a strong internal thickening. No parietal tooth. Sculpture consists of very fine and close spiral striæ crossing the growth-wrinkles, and continuing to the lip. This shell measures, length 19, diam. 11, length of aperture 10 mm. Garrett writes: "I took a few examples of this ground species about two miles up Papenoo valley, on the northeast coast of Tahiti. They were all found lurking among the roots of ferns."

The identity of the original *P. stolidus* of Pease is doubtful. There is little in the description to exclude it from *P. compressa*, yet the statement that it is "dentate" probably indicates that what Pease originally had was a form closer to *P. affinis* (no. 11b.)

11. *P. OTAHEITANA* (Bruguere). Pl. 26, figs. 13-15; pl. 28, fig. 13.

"This species is fluviatile and was discovered during the same voyage as the preceding [Captain Cook's], in the brooks of the island Otahiti. The shell is sinistral, oblong, oval, very thick, not more than 10 or 11 lines in length by about 6 in diameter. It is composed of 5 whorls, united exteriorly, and as much swollen as those of the *austral Bulimus*, but coiled in a direction contrary to that of most shells; that is to say, the right side of its animal is towards the left. The spire is conic and terminates in a pointed summit. The sutures resemble those of the preceding species [*P. faba*]. The aperture is semi-oval, oblique, rounded at the base, only a third longer than wide, and shorter by a line than half the shell. Outer lip arcuate, much reflexed and recurved to

the exterior, flat and projecting outside. The inner [parietal] lip is very thin and furnished with a tooth in the middle, only found in old shells, the young having an inconspicuous callus in its place. The columella is simple, outwardly covering an umbilicus resembling that of *Bulimus australis*. The whole shell is brown outside, or the color of roasted coffee; the lips are whitish and the cavity sooty. It is not common." (*Brug.*).

Society Is.: Tahiti (Cook, Garrett *et al.*).

*Bulimus otahaitanus* BRUGUIÈRE, Encyc. Méth., i, p. 347 (1792).—PFEIFFER, Mon. Hel., ii, p. 71, in part; Conchyl. Cab. pl. 14, f. 5, 6.—*Helix perversa*, etc., CHEMNITZ, ix, p. 108, pl. 112, figs. 950, 951.—*Helix otahaitana* DILLWYN, Desc. Cat. Shells, ii, p. 935.—WOOD, Ind. Test., pl. 34, fig. 110.—*Partula otahaitana* FERUSSAC, Prod., p. 66.—REEVE, Conch. Syst., ii, pl. 175, fig. 16; Conch. Icon., pl. 3, fig. 13b.—PFEIFFER, Mon. Hel. Viv. iii, p. 448.—HARTMAN, Cat. Part., pp. 9, 10, with woodcut; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 184.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 46.—*Partulus otahaitanus* BECK, Ind. Moll., p. 58.—*Bulimus (Partula) isabellinus* PFEIFFER, Proc. Zool. Soc., 1846, p. 39; Mon. Hel., ii, p. 70.—*Partula isabellina* REEVE, Conch. Icon., sp. 10, pl. 2, fig. 8b.—PFEIFFER, Mon. Hel., iii, p. 448.—*Bulimus amabilis* PFEIFFER, Proc. Zool. Soc., 1846, p. 38; Mon. Hel., ii, p. 71.—*Partula amabilis* REEVE, Conch. Icon., sp. 8, pl. 2, figs. 8a, 10.—PFEIFFER, Mon. Hel., iii, p. 448.—PEASE, Proc. Zool. Soc., 1871, p. 473.—*Partula rubescens* REEVE, Conch. Icon., pl. 3, fig. 12.—PFEIFFER, Mon. Hel., iii, p. 446.—PEASE, Proc. Zool. Soc., 1871, p. 473.—*Partula reeveana* PFEIFFER, Proc. Zool. Soc., 1852, p. 137; Mon. Hel., iii, p. 447; Conch. Cab., *Bulimus*, pl. 65, figs. 10, 11.—*Partula tahaitana* GOULD, Expl. Exped. Shells, pl. 84, fig. 91.—PEASE, Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeffroy, v, p. 92.—*Partula lignaria* PEASE, Proc. Zool. Soc., 1864, p. 671; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 160.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—*Partula rufa* CARPENTER (not of Lesson), Proc. Zool. Soc., 1864, p.

675.—HARTMAN, Cat. Part., p. 10.—*Partula affinis* PEASE, Amer. Jour. Conch., iii, 1867, p. 224; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 204.—*P. affinis* var. *dubia* Pse. MS., GARRETT, t. c. p. 49.—*Partula sinistrorsa* PEASE, MS. in Coll. Pease, 1863.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 209.—GLOYNE, Quart. Jour. Conch., i, p. 337.—*Partula sinistralis* PEASE, MS. in coll. Pease, 1863.—PFEIFFER, Mon. Hel., viii, p. 209.—GARRETT, t. c., p. 49.—*Partula crassa* PEASE, MS., GARRETT, J. A. N. S. P., ix, 1884, p. 49.—*Partula brevicula* PEASE, MS., GARRETT, t. c., p. 49.—*Partula perversa* PEASE, MS., H. H. SMITH, Ann. Carnegie Mus., i, p. 442, no. 4188.

Bruguier's account is given above, since it seems to indicate a darker, more elongate shell than that generally accepted as typical *otaheitana*.

"The metropolis of the typical *otaheitana* is about two miles up Fautaua valley, on the northwest part of Tahiti, where it is very abundant on the trunks and foliage of trees and bushes. The above-mentioned valley being close to the principal harbor which was frequented by the early navigators, it was undoubtedly where Bruguier's type was obtained.

"The Fautaua shells, which are very variable in size, shape, and color, are never ornamented by spiral bands, and about one-third of the specimens are sinistral. The parietal tooth is nearly always present in the adults, and the peristome, though usually white, is frequently pinky flesh-color. The prevailing colors are straw-yellow, reddish fulvous, light chestnut, frequently with the spire more or less tinted with reddish and often with longitudinal strigations. The spire is more or less produced, and the aperture varies some in size and shape.

"The shape of the shell varies from abbreviate-ovate to elongate-ovate, as the following measurements will show:

Length 21, diam. 10 mm. Dextral specimen.

Length 16, diam. 10 mm. Dextral specimen.

Length 20, diam. 10 mm. Sinistral specimen.

Length 16, diam. 9 mm. Sinistral specimen." (*Garrett*).

The following form has been referred to *otaheitana* as a synonym by *Garrett* and *Hartman*. "*Bulimus isabellinus* Pfr. Shell subperforate, oblong-conic, solid, striatulate, isabelline. Spire conic, rather acute. Whorls 5, a little convex, the upper sculptured with impressed, very delicate spiral lines, the last, a little shorter than the spire, base rounded in front. Columella white, plicate-gibbous. Aperture oblong-oval, narrowed by a dentiform callus deep within on the belly of the penultimate whorl. Peristome callous, white, broadly expanded, a little reflexed, the columellar margin dilated, sinuous-reflexed. Length 22, diam. 10, aperture inside 9 mm. long,  $4\frac{1}{2}$  wide. Habitat unknown, Mus. Cuming." (*Pfr.*) *Reeve's* figure is copied, pl. 26, fig. 16.

*P. laevigata* Pfr. is doubtless a Society Island shell, probably a form of *P. otaheitana*. The description follows:

*P. laevigata* Pfeiffer. — "Shell deeply rimate, ovate-conic, solid, smooth, (slightly striatulate under the lens), glossy, buff. Spire conic, rather obtuse; suture moderate. Whorls 5, a little convex, the last about equal to the spire, more swollen next the suture, rounded at base. Columella inwardly nodose-plicate above the middle. Aperture slightly oblique, oblong, obstructed by a deeply placed tubercle on the penultimate whorl; peristome thick, white, spreading throughout, the columellar margin dilated and adnate above. Length 20, diam. 10 mm.; aperture with peristome 11 mm. long, 4 wide inside. Habitat unknown (Cuming coll.)." (*Pfr.*).

*Partula laevigata* PFR., P. Z. S. 1856, p. 334; Monogr. iv, p. 511.

11a. *P. o. LIGNARIA* Pse (pl. 25, figs. 1, 2, 3, 4.) "In a valley about two miles west of Fautaua, there exists in abundance the variety (?) *lignaria*, Pease, which, though described as dextral, is nevertheless very frequently sinistral. Though not attaining quite so large a size as the Fautaua shells, it differs none in shape, but is usually darker colored and

more strigated, as well as exhibiting one to three transverse reddish chestnut bands. The lip is always white, and the parietal tooth is very seldom absent. The inosculation with *otahcitana* is so complete that it cannot be even separated as a well-marked variety." It was thus described: *Partula lignaria* Pease in Proc. Zool. Soc. 1864, p. 671. "P. t. ovata, solidiuscula, dextrorsa, anguste umbilicata, sub lente minutissime transversim striata, irregulariter longitudinaliter striata; anfr. 5, plano-convexis, sutura impressa; apertura rotundato-ovata, edentata, labro rotundatim incrassato; castaneo-fusco irregulariter longitudinaliter strigata, interdum omnino rufo-fusca. Long. 18, diam. 10 mill."

"Var. *b.* Fascia unica nigro-fusca cingulata, seu omnino flavide fusca."

Garrett's note on this imperfectly differentiated race is given above. The figures are from shells collected by him, showing several color-patterns. In certain examples a more or less conspicuous nodule appears on the face of the columella near its insertion, fig. 4, much as in *P. auriculata* and *nodosa*.

Dr. Mayer found *lignaria* streaked without spiral bands, and also with one dark peripheral band in Tipærui valley. All were dextral. In a few there is an additional subsutural band.

In Hamuta and Piræ Valleys, a form with sutural, peripheral and umbilical bands was found, constituting 3 to 4 per cent of the *Partula* taken. It occurred with streaked *lignaria*. In Piræ, all are sinistral; in Hamuta (between Piræ and Tipærui) both dextral and sinistral individuals were found.

11b. *P. o. AFFINIS* Pease. Pl. 25, figs. 5, 6, 9.

"Shell elongately ovate, rather solid, compressly umbilicate, dextral, finely, roughly and irregularly striated longitudinally, transversely very minutely striate, suture impressed, sometimes faintly marginated; lip narrowly thickened, occasionally connected with the columella by a thin

callosity; columella dentate. Color light or dark chestnut brown, sometimes striped with darker or wholly of a straw color.

“*Var.* encircled with three dark reddish brown bands, on middle of last whorl, at the umbilicus, and just beneath the suture.

“*Observations:* The above species is allied to *P. otaheitana*. It is, however, smaller and less elongate.” (*Pease*).

Garrett writes: “*Pease's affinis*, which cannot be separated from some of the small abbreviated forms of *otaheitana*, occurs in greater or less abundance in all the valleys from Haona as far as the southeast end of Taiarapu peninsula, and round the opposite coast as far as Papiéri on the southwest of Tahiti proper. In Papinoo I discovered a large colony of *affinis*, many of which had the pinky flesh-colored lip and sinistral form of *otaheitana*. Far up in the same valley, though common, none but dextral forms were found, and out of thousands taken in the other valleys, not one sinistral example occurred to my notice.

Three examples of *affinis*, received from Pease, and representing the three color-forms mentioned by him, are figured, pl. 25, figs. 5, 6, 9. All the examples of this lot have the parietal wall dentate. The sculpture of spiral lines is very fine and close, but on the last whorl it is more or less obsolete, especially so in the middle of each whorl.

In a lot of five examples received from Garrett, one has a small parietal tooth, the others none. All are obscurely streaked with chestnut on a yellow ground, the spire brown. The sculpture of the latter part of the last whorl below the suture, of one of this lot, is drawn in pl. 25, fig. 8. In some other individuals, the spiral lines are subobsolete, as in typical *affinis*.

11c. *P. o. DUBIA* ‘Pse.’ Garrett. Pl. 25, figs. 10, 11.

“In a valley several miles from Papinoo I found a small colony of *affinis* which were marked by three transverse reddish chestnut bands like *lignaria*. And most singular, no



other banded specimens of *affinis* occurred to my notice in any other part of the island. This is the variety *dubia* Pse., by Carpenter erroneously referred to *varia*." [Pl. 25, fig. 10, 11]. The var. *dubia* was not defined by Pease, but only mentioned as a form of *varia*, in P. Z. S. 1864, p. 675. Its first published definition was in Garrett's note, quoted above. Examples of *dubia* from Pease are figured (pl. 25, figs. 10, 11). The smallest *dubia* seen are only 15 mm. long.

11c. *P. O. AMABILIS* Pfeiffer. Pl. 26, figs. 1, 2.

"Shell sinistral, subperforate, ovate-turrite, rather solid, striatulate, glossy, citrine, the acute apex reddish, suture white-edged. Whorls 5, the upper flat, the rest convex, the last shorter than the spire. Columella nearly simple, slightly plicate. Aperture oblong-semioval. Peristome somewhat thickened, white, expanded and reflexed, the columellar margin wide, flat, spreading. Length 23, diam.  $11\frac{1}{2}$ , aperture inside  $9\frac{1}{2}$  mm. long, 5 wide. A variety is somewhat smaller, ornamented with wide blackish-chestnut bands, the peristome livid-brown." (*Pfr.*).

"To the eastward between Fautana and Papinoo valley, a distance of about eight miles, there are three valleys, all inhabited by Pfeiffer's *amabilis*, a sinistral form which has not a single feature to distinguish it from some of the large turreted Fautana shells. In the first valley, Pfeiffer's species, though not abundant, were very fine specimens. The next valley, known as Pirai, (the metropolis of the small dextral *P. filosa*, which occupies the lower part of the valley), is, in the upper part, which trends towards the headquarters of *otaheitana*, inhabited by the sinistral *amabilis*. A few immature examples were found which were banded like *lignaria*. The only dextral *Partula* taken in the two valleys were *filosa*, *attenuata* and *hyalina*.

"In the next valley, called Haona, I found the dextral *P. affinis* abundant, and took a few of *amabilis*.

"Both Dr. Pfeiffer and Reeve described the latter species from specimens in the Cumingian collection, and both quote

Anaa, a low coral island, as its habitat. Having resided about five months on that island, and searched all parts for shells, I did not find a single *Partula* there, or on any other low coral island. Though neither Pfeiffer nor Reeve allude to a parietal tooth, it is very frequently present." (*Garrett*).

11d. *P. o. RUBESCENS* Reeve. Pl. 26, figs. 3, 4, 5, 6.

"Shell acuminate oblong, rather thick, sinistral, compressly umbilicated; whorls 6, smooth, somewhat rounded, lip and columella broadly reflected. Pink. red-brown towards the apex." (*Reeve*).

*P. rubescens* REEVE, Conch. Icon. pl. 3, f. 12 (April, 1850). —PFR., Conchyl. Cab. p. 271, pl. 64, f. 21, 22; Monogr. iii, 446.—*Partula turricula* PEASE, olim, H. H. SMITH, Ann. Carnegie Mus. i, 442, not of Pease 1872.

Fig. 4 is a copy of Reeve's. The examples before me are the form sent out as *turricula* by Pease. They are all sinistral, elongate, glossy, varying from chestnut-tinted yellow to pale yellow with light green streaks on the last two whorls, those preceding rose-tinted, the shade deepening to the apex. The lip is white in the paler shells, rose-tinted in the darker. Measurements vary from length 22, diam. 12.1, aperture 10.9 mm., to 19, 11, 9.8 mm. just three-fourths of the adult shells seen have a parietal tooth. Garrett writes: "Reeve's *rubescens* is abundant in Papinoo, and occurs sparingly in all the valleys as far as the southeast end of the island. Like *amabilis* it cannot be separated from the sinistral turreted *otaheitana*, inhabiting Fautana. It is always sinistral, never banded, and, though usually of a reddish tint, is frequently straw-yellow or fulvous, with or without a reddish or pinky apex. The lip is white or pinky flesh-color. Though described as edentate, some have a small parietal tooth. Reeve gave no locality, and Pfeiffer erroneously cites the Marquesas as its habitat."

11e. *P. o. SINISTRORSA* 'Pse.' Garrett. Pl. 26, figs. 7, 8, 9, 10.

"Pease's *sinistrorsa* is confined to the south coast of Tahiti proper, where it exists in the greatest profusion in all the

valleys and lowland forests for a distance of ten or twelve miles. In the valley which is the limit of the range of the dextral *affinis* I took several specimens of the sinistral *sinistrorsa*. The latter is invariably reversed, dentate or edentate, fulvous with three more or less diffused reddish chestnut bands. Reeve figures the same shell on Plate 3, fig. 13a, as *otaheitana*. Bandless varieties are frequent, and vary from straw-yellow to fulvous or light chestnut, frequently strigated and the lip white. The latter varieties differ none from the true *otaheitana* of Fautaua.

“It is worthy of remark that in that part of the district of Papieri, occupied by *sinistrorsa*, is also the headquarters of the terrestrial *P. producta*, a dextral species, which is always edentate, and exhibits the fasciation of the former.

“After passing to the westward of the range of the typical *sinistrorsa*, which presents the same features for a distance of ten or twelve miles, it suddenly exhibits a tendency to a change in its becoming more stunted, more solid, always dentated, and the bands, one to three, are sharply defined on a pale ground. It is the *sinistralis* of Pease, MS., and occupies two valleys.

“In the next large valley, called Faahuaite, on the southwest coast, we find Pease’s *crassa* (MS.), which is also a sinistral shell, always dentated, solid, more tightly coiled than *sinistrorsa*, and the body-whorl is more flattened. It is rarely marked by a single narrow submedian chestnut band. In the same valley, but more inland, occurs a smaller form, which is, I suppose, the *P. brevicula*, Pse., MS. [see pl. 26, f. 12, specimens from Dr. Hartman].

“The following valley, named Punaavia, is the metropolis of the beautiful *P. nodosa*, which also exhibits three bands. Far above the restricted range of the latter, where the valley turns towards the head of Fautaua, the home of the typical *otaheitana*, I took a few examples of a *Partula*, similar to, but larger than *crassa*. The next valley is the habitat of *lignaria*.” (Garrett).

Specimens of *sinistrorsa* received from Pease and Garrett

are figured. There is also a bandless form, dark chestnut colored with darker and lighter oblique streaks, which may be called variety *confluens* (pl. 26, fig. 11).

12. *P. STENOSTOMA* Pfeiffer. Pl. 27, figs. 12, 13.

Shell umbilicate, dextral, oblong-conic rather solid, closely striolate, glossy; fulvous clouded with brown and brightly three-banded with chestnut. Spire long-conic, rather acute; suture lightly impressed, whitish. Whorls  $5\frac{1}{2}$ , but a trifle convex, the last shorter than the spire, somewhat compressedly rounded at the base. Columella running forward obliquely, slightly plicate above. Aperture a little oblique, narrow, truncate-oblong, narrowed by a deeply placed, tooth-like callus on the penultimate whorl. Peristome callous, white, expanded and slightly reflexed throughout, the right margin sinuated above. Length 22, diam.  $10\frac{1}{2}$ , aperture with peristome 11 mm. long, 5 wide inside (*Pfr.*).

Habitat unknown (Cuming coll.)

*Partula stenostoma* PFR., P. Z. S. 1855, p. 97; Novit. Conch. p. 61, pl. 17, f. 16, 17; Monogr. iv, 507. Cf. GARRETT, JOURN. A. N. S. Phila. ix, p. 52.

In my copy of Pfeiffer's figure (pl. 27, fig. 13) the small parietal tooth was omitted by oversight. It is very indistinctly drawn in the original figure, and should resemble that of fig. 9 of the same plate.

*P. stenostoma* was not identified by Mr. Garrett. The positions of the bands cause me to think it related to *affinis* Pse., and *dubia* Garr., but it differs from these and other forms of *P. otaheitanus* by the narrow shape of the aperture. Dr. Hartman has referred *stenostoma* to *P. vexillum* Pse.; and it has a certain resemblance to the Raiatean *P. planilabrum* and *P. vittata*.

13. *P. PRODUCTA* Pease. Pl. 27, figs. 1, 2, 3.

The shell is dextral, long-ovate, deeply rimate, rather solid, moderately glossy; yellow or brownish-yellow with three dark chestnut bands, a pale sutural band above the upper one, the middle band widest, the lower one defining a light umbili-

cal patch; whorls of the spire showing two dark bands on a light or flesh-colored ground, apex dark. The surface shows *no spiral lines*, or only faint traces of them. Whorls  $5\frac{1}{2}$ , moderately convex, the last well rounded peripherally and beneath. The aperture is nearly vertical, dark within; peristome narrowly expanded and reflexed, moderately thickened within, white or flesh-tinted. The parietal wall is typically toothless, but sometimes it bears a tubercular white tooth.

Length 20, diam. 10.7, aperture 10 mm.

Length 19, diam. 10.2, aperture 10 mm.

Length 21, diam. 11.2, aperture 10.8 mm.

Length 18.8, diam. 10, aperture 9.8 mm.

Tahiti: "This species only occurred to my notice in one valley, on the southwest coast of Tahiti, where it is abundant, lurking beneath decaying leaves and under heaps of loose stones." (Garrett).

*Partula producta* PEASE, Proc. Zool. Soc., 1864, p. 671; 1871, p. 473.—PFEIFFER, Mon. Hel. Viv., vi, p. 156.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—HARTMAN, Cat. Partula, p. 10; Obs. Gen. Partula, Bull. Mus. Comp. Zool., ix, p. 185.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 66, pl. 3, f. 51.

This terrestrial form was found by Garrett to be invariably dextral. It is not so glossy as *P. otaheitana sinistrorsa* Pse., but otherwise there is not much difference. *P. producta* however has somewhat diverse variations; the dark bands become confluent in some individuals by darkening of the ground color, leaving the last whorl chestnut with (usually) a pale sutural band and umbilical patch. Garrett also records a mutation uniform pale fulvous or tawny with a darker apex. Description and figs. 1, 2, 3 from examples received from Pease.

14. *P. NODOSA* Pfeiffer. Pl. 25, figs. 12, 13, 16, 17.

Shell perforate, conic-ovate, rather solid, obsoletely decussate; chestnut-colored, ornamented with a wide white band at the suture, and often some other pale bands. Spire conic,

acute. Whorls  $5\frac{1}{2}$ , a little flattened, the last about as long as the spire. Columella plicate above, deep within, then nodulose. Aperture subvertical, oblong, narrow; peristome outwardly scarcely expanded; inwardly provided with an acutely projecting white callus, contracting the aperture; margins subparallel, the right margin a little straightened. Length 16, diam. 8, aperture 6 mm. long inside, 4 wide. (*Pfr.*).

Tahiti: "This beautiful arboreal species is restricted to a limited area about two miles up Punaavia valley on the west coast of Tahiti. I first discovered the location in 1861, and gathered about three hundred examples. On a subsequent visit, nine years later, I secured over eight hundred specimens. It is *entirely* confined to the south side of the stream which flows through the valley, and circumscribed in a narrow area about three-fourths of a mile in length." (*Garrett*).

*Partula nodosa* PFEIFFER, Proc. Zool. Soc., 1851, p. 262; Mon. Hel., iii, p. 449; iv, 512; vi, 160; Conchyl. Cab. p. 266, pl. 64, f. 1, 2.—Pease, Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—HARTMAN, Cat. Part., p. 10; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 184, 188, 195.—GARRETT, J. A. N. S. ix, 1884, p. 65.—*Partula trilineata* PEASE, Amer. Jour. Conch., 1866, p. 195; 1867, p. 81, pl. 1, fig. 1.—PFR., Monogr. viii, p. 195.—*Partula nodosa* var. *trilineata* PEASE, Proc. Zool. Soc., 1871, p. 473.—*Partula nodosa* var. *sinistralis* MAYER, Some species of *Partula* from Tahiti in Mem. Mus. Comp. Zool. xxvi, no. 2, Jan. 1902, p. 127, figs. 14, 15, 14a, 15a.

*P. nodosa* stands near *P. suturalis* of Moorea, which doubtless arose from the same ancestral stock. In Tahiti it has no little resemblance to certain forms of *P. lignaria*, especially those with many streaks and a single dark belt, many of which show a more or less developed nodule on the columella, such as is characteristic of *P. nodosa*.

The typical *P. nodosa*, pl. 25, figs. 12, 13, was the dark reddish-brown or chestnut-brown shell, with a wide cream-white band below the suture on the last one or two whorls.

There is usually more or less pale streaking of the dark ground on the last whorl; the reverse of the lip and the border of the umbilicus are also pale. Several examples seen, one of them received from Dr. Pfeiffer. All are dextral. Judging by the lots before me, this form occurs in the same colonies with the following color phases.

Color-form *TRILINEATA* Pease. Pl. 25, figs. 14, 15. "Cream color or yellowish horn-color, the spire usually reddish-brown, last whorl striped irregularly with brown, and encircled by three dark reddish-brown lines or bands; suture margined with white" (*Pse*). In the typical lot of *trilineata* received from Pease the spire is fleshy brown in two examples (typical coloration); clear corneous in two; and the other two have some whitish and faint brown markings on a fleshy-corneous ground. Four of the shells are 3-banded, like fig. 14, 15, one has only a wide chestnut belt, and is conspicuously streaked with brown, and the sixth is a typical *nodosa* in color.

A lot from Garrett consists of (1) ordinary dark *P. nodosa*; (2) one sinistral shell (fig. 16) with normal *trilineata* color-pattern. Garrett states "about one in two hundred is sinistral"; and (3) pale shells with the spire corneous, last  $1\frac{1}{2}$  whorls cream-colored with a profusion of corneous and corneous-brown streaks which do not reach to the suture; aperture typical (pl. 25, fig. 17, color-form *pallidior*).

14a. P. N. LÆVA, n. n. Pl. 25, figs. 18, 19.

"The shell is blunt in shape and the spire is short; the lip is quite thick, and is usually provided with a well-developed tooth upon the columellar side, and there is also a tooth upon the wall of the aperture. The surface of the shell is smooth and slightly polished, and there are no deep longitudinal furrows. About 57 per cent of these snails are well represented by fig. 18. The ground color is a light horny-yellow streaked longitudinally with darker brown, in addition to which there are two dark-brown whorl-stripes and a white whorl-stripe adjacent to the suture of the spire. In about 43 per cent the dark-brown whorl-stripes are either absent or very faint,

and the ground color of the shell varies from light horny-yellow to rich brown. A snail of this type is fairly well represented in fig. 19, a dark-brown individual being drawn. Ninety-seven per cent of the adult snails of type 18 and 91 per cent of type 19 are sinistral; while of the young, 100 per cent from type 18 and 90 per cent from type 19 are sinistral. In the case of the snails of type 19, twenty-six sinistral adults gave forty-six sinistral and one dextral young; while two dextral adults gave four dextral and no sinistral young. Among the snails of type 18, only one of the dextral adults contained young and this one gave a single sinistral offspring. Twenty-six whorl-striped adults of the type of fig. 18 gave forty-two young, of which 76 per cent display whorl-stripes, while 24 per cent are plain colored. On the other hand, twenty-eight adults of type 19, which are either unstriped or with very faint whorl-stripes, gave forty-one young of which 61.5 per cent are marked with whorl-stripes and 38.5 per cent are plain colored. It is very evident that the striped and unstriped forms intergrade.

“Of the one hundred adults found in the valley, 94 per cent are sinistral, while of the eighty-eight young taken from them, 94.5 per cent are sinistral. This condition appears, therefore, to be stable from one generation to another.” (Mayer).

Maruapoo valley, on the western side of Tahiti about 7 miles south of Tipærui valley.

This form is said to constitute 99 per cent of the snail fauna of the valley, *P. hyalina* forming the remainder. Figures and description from Dr. Mayer. The name *sinistralis* being preoccupied, I have substituted *lava*.

15. *P. FILOSA* Pfeiffer. Pl. 27, figs. 4, 5.

Shell perforate, conic-ovate, solid, sculptured with close impressed spiral lines, hardly shining; chestnut-colored, ornamented with ashen hair-lines. Spire conic, rather obtuse. Whorls 5, flattened, the last as long as the spire, more convex, columella slightly plicate above. Aperture a little ob-



lique, subtriangular-semioval; peristome a little expanded, provided with a thick prominent callus within. Length 16, diam.  $8\frac{1}{2}$ , aperture with peristome  $8\frac{1}{2}$  mm. long,  $6\frac{1}{2}$  wide (*Pfr.*).

Tahiti: "Restricted to the lower portion of Piræ valley, on the northwest coast of Tahiti, where it is abundant on foliage." (*Garrett*).

*Partula filosa* PFEIFFER, Proc. Zool. Soc., 1851, p. 262; Mon. Hel., iii, p. 450; Conchyl. Cab. ed. 2d. Bul., p. 267, pl. 64, figs. 3, 4.—HARTMAN, Cat. Part., p. 10; Obs. Gen. Partula, Bull. Mus. C. Zool., ix, pp. 182, 183, 196.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 64, pl. 3, f. 81.—MAYER, Mem. Mus. Comp. Zool. xxvi, no. 2, p. 126, figs. 9, 10.—*Partula lincolata* PEASE, Amer. Jour. Coneh., 1867, p. 224; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 206.

*P. filosa* is quite distinct from other Tahitian snails, but is very closely related to the Moorean *P. nucleola* Psc. It is a small, ovate, solid and compactly coiled shell, dull or with but little gloss, and either reddish-brown with darker purplish summit, or dull yellow with the summit roseate; in either case being irregularly marked with many backwardly sloping longitudinal whitish lines. Under the lens these lines appear ragged, and are seen to be due to the loss of cuticle along some of the lines of growth. All the post-embryonic whorls have this peculiarity. The spiral striation is well developed throughout. All of the thirty examples seen have a parietal tooth, but in some it is quite small. The peristome is white, moderately expanded but strongly thickened within. There is often the low indication of a tubercle on the columella. No banded or sinistral examples have been found.

16. *P. CLARA* Pease. Pl. 24, figs. 7, 8, 9.

The shell is openly perforate, oblong-ovate, thin, sometimes imperfectly translucent, pale yellowish corneous or very pale chestnut, often variegated with darker obliquely axial streaks; suture with an opaque-white margin. Surface somewhat shin-

ing, with sculpture of fine growth-lines and minute, crowded, waved spiral striæ. Whorls  $4\frac{3}{4}$ , moderately convex; the last half of the last whorl is noticeably compressed below the periphery, the base being strongly convex. Aperture ovate, slightly oblique, usually pale brownish or fleshy inside. Peristome white, reflexed, thickened within except near the upper and columellar insertions. Columellar margin dilated above. Parietal callus very thin.

Length 15.5, diam. 9.1, length aperture 8.1 mm.

Length 15.2, diam. 8.7, length aperture 8.7 mm.

Length 17, diam. 9.7, length aperture 9.7 mm.

Society Islands: Upper portions of the valleys of the southwestern part of Tahiti, a rare species, found on foliage. (*Garrett*).

*Partula clara* PEASE, Proc. Zool. Soc., 1864, p. 671; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 159.—HARTMAN, Cat. Partula, p. 11; Obs. Gen. Partula, Bull. Mus. Comp. Zool., p. 181, vol. ix.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 56, pl. 3, f. 75.

This leaf-dweller is said by Garrett to be rare and in his opinion approaching extinction. It has the figure of *P. annectens* of Huaheine, but is much less delicate. *P. attenuata* of Raiatea and Tahiti, is an allied species of much more slender contour.

Specimens from Pease and Garrett before one are either nearly uniform in tint, or streaked obliquely with chestnut. Pease in his original account has described a "var., encircled with a single line, or two or three." Garrett describes it as "corneous, sometimes with darker stripes, and more rarely with one or two transverse chestnut bands." In being variegated, *P. clara* is clearly less modified from the ancestral stock than *P. attenuata* and *annectens*.

#### 17. *P. ATTENUATA* Pease. Pl. 24, figs. 1, 2, 3, 4.

The shell is openly perforate, slender, long-ovate, thin, slightly pellucid pale yellowish-corneous, sometimes with a faint reddish tint towards the apex; the suture transparent-

margined, or margined with a white line. Surface lustrous, faintly marked with growth lines and minute, crowded, finely rippled spiral striæ throughout. Whorls 5, but slightly convex, the last one compressed below the periphery, and strongly convex, somewhat swollen, at the base. (This is well shown in fig. 2). The aperture is nearly vertical, more than half the total length. Peristome broadly reflexed, the basal and outer margins thickened within except near the upper end of the lip, which is thin and merely a little expanded. Columellar margin dilated and bifurcate above. Parietal callus a transparent film.

Length 16, diam. 8, length aperture 9 mm.

Length 17, diam. 8.6, length aperture 9.5 mm.

Length 17.8, diam. 8.5, length aperture 9.9 mm.

Society Islands: "Upper portions of all the central valleys on both the east and west sides of Raiatea. It is more abundant in Toloa and Hapai valleys than elsewhere. Owing to its peculiar habit of living on the foliage near the tops of trees, it easily escapes observation. It occurs more rarely at Tahiti, where it has, also, a wide range, and is confined to the upper portions of the valleys." (*Garrett*).

*Partula attenuata* PEASE, Proc. Zool. Soc., 1864, p. 672; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 156.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—HARTMAN, Cat. Part., p. 11; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 179.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 70.—*Partula gracilis* PEASE, Amer. Jour. Conch., ii, 1866, p. 197; 1867, p. 81, pl. 1, fig. 3.—BINNEY, Proc. Acad. Nat. Sci. Phil., 1875, pp. 244, 247, pl. 19, fig. 6 (part of jaw).—PEASE, Proc. Zool. Soc., 1871, p. 473.—PFR., Monogr. viii, 198.—*Partula carteretensis* REEVE (not of Quoy and Gaimard), Conch. Leon., sp. 13, pl. 4, fig. 13.—SCHMELTZ, Cat. Mus. Godeff., iv, p. 72.

This snail is closely related to *P. annectens* of Huaheine, having in common with that the color, texture and sculpture, and especially the peculiar shape of the last whorl, which is compressed below the middle, then swollen around the umbilical region in both species. It differs from *annectens* by its

more slender shape, heavier substance, and wider lip, which is calloused within. *P. clara* also is an allied species of broader contour, but with an aperture much like that of *attenuata*.

In a lot of three specimens sent many years ago by Pease, the suture has a grayish margin; but in all other shells seen, the margin is white, by loss of the cuticle, or by its becoming permeated with air. Normally the lip-edge and parietal callus are thin, but in one very old shell before me, both are considerably thickened.

Pease described this species twice, evidently from the same examples. He seems to have forgotten the description of 1864. It is an error other prolific authors have committed.

“When we take into consideration its peculiar habit of concealment in the tops of trees, and its range restricted to the more elevated portions of the valleys, so contrary to the habits of other species, it is really remarkable to find it inhabiting two remote islands, especially as all the other species have a very limited range. It does not occur at Tahaa, which is only four miles from Raiatea, and enclosed in the same encircling reef. It is no less singular to note its absence from Huaheine and Moorea, though at the former island we find the closely allied *P. annectens*.” (Garrett).

## 2. *Moorean Partula*.

Four species and numerous subspecies are peculiar to Moorea, which is separated from Tahiti by a channel only eight miles wide. All show clear traces of a common ancestry with Tahitian forms, though since the separation of the islands there has been specific divergence. The affinities of the snails are as follows:

<i>Tahiti.</i>	<i>Moorea.</i>
<i>P. otaheitana</i>	<i>P. mooreana</i>
<i>P. nodosa</i>	<i>P. suturalis</i>
<i>P. filosa</i>	<i>P. taniata</i> group.

18. *P. MOOREANA* Hartman. Pl. 29, figs. 17-20.

The shell is sinistral, deeply but shortly rimate, rather thin;

dilute yellow, fleshy-corneous or soiled white, the first whorl almost always brown; rarely the last whorl is streaked with buff (fig. 19), or has three pale brown spiral bands (fig. 17). Surface shining, rather densely marked with spiral striæ throughout. Spire straightly conic; whorls 5, only very slightly convex, the last compressed laterally, convex below. The aperture is quite oblique, peristome is well reflexed, strongly thickened within, much narrower in its upper third. Columellar margin dilated at the insertion. There is usually a rather thick but transparent parietal callus and a well-developed parietal tooth. Length 18.5, diam. 11, length of aperture 10 mm.

Moorea: Vaianai valley, on the southeast coast.

*Partula mooreana* HARTMAN, Proc. Acad. Nat. Sci. Phila., 1880, p. 229; Cat. Part., p. 10; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 184.—GARRETT, Terrestrial Mollusca inhabiting the Society Islands, Journ. A. N. S. P. ix, 1884, p. 59, pl. 3, f. 55.

*P. mooreana* "may be characterized by its elongate-ovate form, rather thin texture, constant parietal tooth, planulate-conical spire, which equals half the length of the shell, pale luteous color, with darker apex. It is *always* sinistral, and the white expanded lip is rather thin and moderately incrasated. A variety with three narrow pale brown revolving bands is not infrequent.

"It is closely related to some of the sinistral forms of varieties of *P. otaheitana*, particularly with Pease's *P. crassa*, which, though of the same shape, is more solid, rougher, and the fine crowded spiral incised lines which extend over the whole surface of the former are nearly obsolete on the latter." (*Garrett*).

19. *P. SUTURALIS* Pfeiffer. Pl. 27, figs. 10, 11; pl. 28, figs. 1 to 6, 8.

Shell narrowly perforate, oblong-conic, thin, distinctly striate spirally; fulvous-buff irregularly painted with chestnut streaks. Spire convexly conic, acute; suture margined

with a white thread. Whorls  $5\frac{1}{2}$ , slightly convex, the last slightly shorter than the spire, somewhat swollen above, tapering towards the base. Columella nearly simple, almost vertical. Aperture slightly oblique, truncate-oblong; peristome white, thin, the right margin narrowly expanded, sinuated above, columellar margin dilated, reflexed. Length 19, diam. 9, aperture with peristome 10 mm. long,  $4\frac{1}{3}$  wide inside (*Pfr.*).

Moorea.

*Partula suturalis* PFR., P. Z. S. 1855, p. 98; Novit. Conch. i. p. 62, pl. 17, f. 18, 19; Monographia iv, 508.—HARTMAN, Catalogue of Partula p. 10.—SMITH, Ann. Carnegie Mus. i, p. 446.—*Partula lineata* LESSON, REEVE, Conch. Icon. vi, pl. 2, f. 7.—GARRETT, Journ. Acad. Nat. Sci. Phila. ix, 1884, p. 50, pl. 3, f. 83, and of some other authors; not *P. lineata* Lesson.—*Partula alternata* (Pease, MS.) H. H. SMITH, Ann. Carnegie Mus. i, p. 447 (March, 1903).—*Partula vexillum* PEASE, Amer. Jour. Conch., 1866, p. 198; 1867, p. 81, pl. 1, fig. 8; Proc. Zool. Soc., 1871, p. 473.—PFEIFFER, Mon. Hel., viii, p. 196.—*Partula nodosa* CARPENTER (not of Pfeiffer), Proc. Zool. Soc., 1864, p. 675 (= *alternata*).

The original figures of this species are copied, pl. 27, figs. 10, 11. It was described from the Cuming collection, the habitat being unknown. Dr. Hartman seems to have first recognized it in the common Moorean shell under consideration. Garrett subsequently (1884) discussed the species at great length.

Figures 5, 6, 8 of plate 28 represent the typical form of the species. The shell is rather solid when adult, compact in shape. The lip is snow-white, thickened within, columella vertical, swollen or inflated just below the insertion. There is generally *no parietal tooth*, but when developed it is a low callous node or pad, not often a distinct tooth, as in *vexillum*. The first  $2\frac{1}{2}$  whorls are isabella-colored; the darker obliquely longitudinal stripes appear at first rather faint and widely spaced on the isabelline ground, but on the last whorl the ground becomes opaque, more or less café-au-lait tinted or

sometimes nearly white, and the stripes are brown-corneous or even, unequal and unevenly spaced. The sculpture consists of spiral incised striæ which are rather widely spaced, and typically are distinct on the last whorl.

This type of shell is further modified by the development of spiral bands; sometimes only one, at the periphery, the base of the shell often chestnut-colored, and again two bands, one above, the other below the periphery (pl. 28, fig. 8; pl. 27, fig. 6). Specimens with oblique streaks only, with one and with two bands, occur together in Garrett's sendings, and apparently are mingled in the same colonies. The spiral striation is usually subobsolete on the upper part of the last whorl in these shells, which are what Pease named in MS. and Smith described as *P. alternata*. The preceding forms are what Garrett alludes to as found in Oahumi valley. Comparing this race with *vexillum*, he writes: "The Oahumi shells are usually a trifle smaller, not so frequently dentated, and are much more conspicuously strigated than the Vaianai shells. The spiral bands, of which there are one or two, seldom three, on the body-whorl, are very frequently interrupted, which, with the conspicuous strigations, gives the shell a somewhat tessellated appearance. All the color-varieties alluded to in my remarks on the Vaianai shells are also found in Oahumi, but the uniform dark-colored ones are more frequent, besides one of a uniform white color, not decorticated, of which I took three examples.

"So far as I can ascertain, there has been no figure published of Pfeiffer's *strigosa*. He gives the Admiralty Islands as its habitat. There are *no* species of the type he describes found in the western Pacific. It is undoubtedly a Society Islands species, and I fully agree with Dr. Hartman in referring it to the shells under consideration."

Further Oahumi color-forms are represented in pl. 28, figs. 1, 2, 3, 4, the lot from Garrett. They are chestnut with light streaks and a white suture, the spire flesh-colored (fig. 3), the same with a pale girdle (fig. 2), or line (fig. 1), at the periphery, or there may be two white zones, one below the suture, the other in the middle of the basal slope (fig. 4).

*P. strigosa* Pfr. is probably, as Garrett and Hartman have held, a form of *suturalis*. It was described as follows: "Shell perforate, oblong-conic, rather solid, very obsolete decussate, subopaque; whitish, ornamented with irregular fulvous and rufous streaks. Spire conic, the apex acute. Whorls 5, nearly flat, the last slightly shorter than the spire, somewhat tapering at the base, rounded. Columella somewhat twisted above, subnodose at base. Aperture slightly oblique, truncate-oval, generally contracted by a nodiform parietal callus. Peristome white, callous, subequally spreading throughout. Length 17 to 18, diam. 9 mm., aperture with peristome  $8\frac{1}{2}$  x  $6\frac{1}{2}$  mm., inside  $3\frac{1}{2}$  mm. wide. Admiralty Is." (*P. strigosa* PFR., P. Z. S. 1856, p. 384).

19a. *P. SUTURALIS VEXILLUM* Pease. Pl. 27, fig. 9; pl. 28, figs. 9-12.

The shell is typically dextral, more lengthened than the preceding, less compact, and somewhat thinner. On a corneous-buff ground it is obliquely streaked with opaque buff on the last whorl, and begirt with two chestnut bands, the upper one ascending on the penult. whorl. *Parietal tooth well-developed*. Spiral striation wanting or extremely weak on the last whorl. Sutural white line inconspicuous or even wanting. Length 21, diam.  $11\frac{1}{2}$ , length of aperture 11 mm. Description and fig. 9 are from one of Pease's original lot. Other shells are somewhat smaller, length 18 mm., and the oblique streaks may be less distinct.

Many examples were collected by Andrew Garrett, who found it variable. Some shells are dark chestnut with a white sutural line (fig. 10); others are like Pease's original lot, or have a third band, around the umbilicus (fig. 11); while some shells are finely streaked brown and buff, without any bands (fig. 12). Garrett writes as follows: "This beautiful arboreal species is found in great profusion in Vaianai valley, on the southeast coast of Moorea, where it occurs in company with *P. mooreana* and *P. elongata*. It also exists in considerable numbers in a small valley about two miles to the westward, associated with *P. taniata* and *elongata*."



“I first discovered this species in 1861, and obtained several hundred specimens, *all* collected on the eastern side of the stream that flows through the valley of Vaianai. They were *all* dextral, and were so described by Pease, under the name of *vexillum*. On a second visit, in 1875, I took over 2000 examples, *all* gathered on the *western* side of the stream, and was surprised to find many sinistral forms among them [pl. 28, fig. 9]. At the same time I found about a dozen specimens, *all* sinistral, in a large semicircular valley on the opposite side of the island. They were probably stragglers from Vaianai.

“It is noteworthy that no reversed *Partulæ* were found in any other part of the island except on the western side of the stream in Vaianai, and the above-mentioned stragglers taken on the opposite coast. The same side of the stream is also the home of the sinistral *P. mooreana*.”

20. *P. TÆNIATA* (Mörch). Pl. 28, figs. 15, 16; pl. 29; figs. 8, 12, 13.

Shell rimate, conic, pellucid, transversely irregularly plicate, longitudinally very closely waved-striate, under a lurid cuticle, the last whorl encircled with two distant, white, brown-bordered bands; suture appressed, whorls 5, a little convex, the last about as long as the spire, obsoletely angular above and below; fold of the columella compressed, twisted. Peristome white, broadly expanded, reflexed. Length 18, diam. 8, aperture inside  $8 \times 4\frac{1}{2}$  mm. (*Mch.*).

Society Is.: Moorea.

*Bulimus (Partulus) tæniatus* MOERCH, Catalogus Conchylionum quæ reliquit C. P. Kierulf, etc., 1850, p. 29, pl. 1, fig. 5.—*Partula tæniata* PFEIFFER, Mon. Hel., iii, p. 451.—CARPENTER, Proc. Zool. Soc., 1864, p. 675.—HARTMAN, Obs. Gen. Part. Bull. Mus. Comp. Zool., ix, p. 188 (part).—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 72.—*Partula striolata* PEASE, Amer. Jour. Conch., 1866, p. 197; 1867, p. 81, pl. 1, fig. 4; Proc. Zool. Soc., 1871, p. 473.—PFEIFFER, Mon. Hel. viii, p. 203.—*Partula simulans* PEASE, Amer. Jour. Conch.,

1866, p. 202; 1867, p. 81, pl. 1, fig. 11.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 206.—*Partula decussatula* CARPENTER (not of Pfeiffer), Proc. Zool. Soc., 1864, p. 675.—*P. peraffinis* Pse. MS., according to Hartman.

The typical form is tawny brown with two widely separated white bands as shown in figures 15, 16 of pl. 28. There are also often some pale oblique streaks. The shape, as Garrett writes, "varies from abbreviate-ovate to elongate-ovate, more or less solid, scarcely shining, smooth or wrinkled with incremental striæ, and the spiral incised lines are very fine, and crowded on all the whorls. The spire is more or less produced half the length of the shell, sometimes shorter or a trifle longer. The last whorl is frequently compressed in the back and right side, which gives it a faintly biangular appearance. The peristome is more or less expanded, sometimes considerably so, moderately thick, slanting and labiated within. Columellar lip more or less tortuous, abruptly receding above, which gives it a nodulous appearance. About one in a hundred exhibits the parietal tooth. The color is also variable: white, straw-yellow, lemon-yellow, light orange, corneous, fulvous, various shades of brown, sometimes with darker strigations, and frequently spirally banded. The most common style of fasciation consists of from one to four narrow, more or less broken, fulvous or fulvous-brown bands on the body-whorl. Fulvous-brown examples, with two or three pale bands, are not so common. The last appears to be Mörch's type, which he incorrectly assigns to the Viti Islands."

"The metropolis of this truly protean species is in a very large semicircular valley on the north coast of Moorea, where it occurs in prodigious numbers on the foliage of bushes. In the western part of the same valley, where it exhibits less variation, it gradually intergrades with the form which has been distributed under the name of *nucleola* Pease, which has its headquarters in a small, but isolated, valley about two miles west of Opunohu.

“On the southwest part of the island we find *taniata* tolerably abundant in three valleys, and, like the shells in the western part of Opunohu, it is subject to much less variation than obtains in the eastern part of the same valley. The shells from the southwest coast were described by Pease under the name of *P. simulans* [pl. 29, figs. 8, 12, 13].

“In the third or more eastern valley, where they come in contact with *P. elongata* and *lineata*, hybrids between the former and *taniata* are so numerous that any one collecting in that valley only would, without hesitation, pronounce them one and the same species.

“From this point to a distance of several miles, the valleys are inhabited by *lineata*, *mooreana*, *elongata* and *lineata* var. *strigosa*, only. But after passing Oahumi, the home of the latter variety, we again find *taniata*, but nearly as variable as the eastern Opunohu shells, and mixed with the form known as *striolata*, Pse., with which it intergrades. Here I found several unmistakable hybrids between *strigosa* and *taniata*. All the valleys between this latter location and the one nearest to Opunohu are inhabited by the typical form *striolata*, which scarcely differs from *nucicola*, except in being smoother and more variegated with stripes. In a large valley adjacent to Opunohu, we find these shells by thousands; they differ in being beautifully striped like *strigosa*. Here, again, it insensibly graduates into the typical *taniata*. Whether the inosculation takes place through hybrids or not is a difficult question to decide. In looking over a large collection from the eastern part of Opunohu, I find some of the small forms are not dissimilar to the typical *striolata*, which has suggested the propriety of following Dr. Hartman in consolidating the three forms.” (*Garrett*).

*P. taniata spadicea* Reeve. Pl. 41, fig. 18.

“Shell perforate, conic-oblong, thin, very minutely decussate, diaphanous, brown-corneous streaked with paler. Spire long-conic, rather obtuse; suture margined. Whorls 5 to  $5\frac{1}{2}$ , a little convex, the last equal to the spire or a little

shorter. Columella obliquely subpubescent above. Aperture slightly oblique, oblong-oval; peristome thin, white, broadly expanded throughout, the right margin spreading. Length 18, diam. 8, aperture with peristome 10 x 6½ mm. Marquesas Is. (Cuming coll.)." (*Pfr.*).

*Partula spadicea* REEVE, Conch. Icon. vi, pl. 4, f. 24 (May, 1850).—*PFR.*, Monogr. iii, 451; Conchyl. Cab. p. 273, pl. 64, f. 31, 32.—*Cf.* GARRETT, Journ. A. N. S. Phila. ix, 1884, foot of p. 73.

An example of *P. spadicea* received from Mr. Cuming in 1862 is smaller than Reeve's figure, but resembles it in otherwise. Though labeled "Marquesas" it is apparently a form of *P. elongata* Pease, or very closely related to that species. Dr. Hartman has referred *spadicea* to *P. taniata*; and the figure certainly has a close resemblance to *P. simulans* Pse., a form of *taniata*.

*P. simulans* Pease, based on shells which are "plain reddish-brown yellowish or horn-color" or with "three interrupted transverse bands" belongs apparently to *taniata*. Pl. 28, fig. 14 represents the cotype originally supplied by Pease for pl. 1, fig. 11 of the Am. Journ. Conch. It is not fully mature, and is corneous with indistinct brown streaks. It is this form which seems to be identical with *P. spadicea* Rve. Pl. 29, figs. 8, 12 are uniform white and brown-banded examples also supplied by Pease at the time of original publication. The banded examples have two submedian and one umbilical band, on a corneous-whitish ground. Some of these shells scarcely differ from *P. t. nucleola*.

*P. striolata* Pease, seems to be identical with *taniata* except in coloration; it is dull tawny-brown with a few whitish oblique streaks. The columellar tubercle is very weak, not prominent as in *nucleola*. Fig. 8, pl. 27, is drawn from a cotype received from Pease.

Whitish-corneous, solid shells, striped closely with brown or chestnut, chiefly on the last whorl (pl. 28, fig. 7) have been distributed by Garrett as *striolata*. They are probably closer to the following form and to *nucleola*.

Another race, tangent from *nucleola*, is figured, pl. 27, fig. 7. The dark brown shell is profusely striped on the last  $1\frac{1}{2}$  whorls with cream-white. The columellar denticle is small and prominent.

*P. TÆNIATA NUCLEOLA* 'Pease' Garrett. Pl. 29, figs. 14, 15, 16.

A small, compact, ovate-conic race. The surface is densely and distinctly striate spirally, but little shining, corneous-whitish, corneous-brown with wide indistinct darker and paler streaks, yellowish-brown or chestnut brown. The short spire is straightly conic; whorls about  $4\frac{3}{4}$ , the last full below, rounded or somewhat flattened on the back. The columella bears a small but rather acute tubercle in the middle, at the lower end of the axial expansion. There is no parietal tooth, but sometimes the very slight indication of one may be seen.

Length 15, diam. 9, aperture 8.4 mm.

Length 16, diam. 8.2, aperture 8 mm.

Length 14, diam. 9, aperture 8 mm.

This form is probably more primitive than the typical *tæniata*. It stands very close to *P. filosa* of Tahiti. The two are apparently of common origin. According to Garrett, *nucleola* intergrades with *tæniata*, yet it appears to be as distinct as *clongata* is. The largest examples measure 18 x 10, apert.  $9\frac{1}{2}$  mm. It lives in a small valley about two miles west of Opunohu.

*Partula nucleola* Pease MS., GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 72 (a form of *tæniata*).—*Partula corneola* HARTMAN, Proc. A. N. S. Phila. 1886, p. 32, pl. 2, f. 6 (April 6, 1886).

Form *corneola* Hartman, pl. 41, figs. 15, 17. A form of *nucleola* has been described as a distinct species under the name *P. corneola*. It is similar to *P. t. nucleola* in most respects. The surface is dilute brown with some faint whitish-corneous streaks; surface very beautifully engraved spirally, the lines close and somewhat waved. There are rather *coarse longitudinal wrinkles* on the back of the last whorl, readily

appreciable in a basal view, as they cause the periphery to be irregular. The lip is like that of *nucleola*. There is a small nodule above the middle of the columella, and a small but *well-developed callous nodule or tooth on the parietal wall*, deep within and near the columella.

Length 18, diam. 10, aperture 9 mm., whorls  $5\frac{1}{4}$  (*type*).

Length 17, diam. 9.9, aperture 9 mm.; whorls  $5\frac{1}{4}$  (A. N. S.).  
Moorea (Mr. Geale).

The larger of the two shells in Dr. Hartman's collection (no. 4242 Carnegie Museum) may be considered the type of this form or race, if it be found racially separable from *nucleola*. The chief difference is the possession of a parietal tooth by *cornicola*, which is wanting or only weakly developed in *nucleola*. The back of the last whorl is also somewhat more roughened in *cornicola*. The smaller of the two specimens mentioned in the original account of "*cornicola*" is identical with *nucleola*.

Fig. 15 represents the type; fig. 17 is a back view of an example in coll. Acad. Nat. Sciences, showing the wrinkles and the longitudinal streaking of the last whorl.

I suspect that *P. concinna* Pse. was based on a specimen of *nucleola*.

*P. T. ELONGATA* Pease. Pl. 29, figs. 1 to 7, 9 to 11.

"Shell elongate, slender, turreted, thin, transparent, shining, transversely very finely striated, somewhat roughened longitudinally, narrowly umbilicate; whorls  $5\frac{1}{2}$ , flatly convex, suture somewhat impressed, very rarely marginated; aperture oblong oval, somewhat oblique, edentate, one-half the length of the shell; lip evenly and somewhat roundly reflected. Horn color or pale rose, striped longitudinally, or wholly straw color. Var. encircled by three chestnut bands, more or less interrupted." (*Pease*).

"The headquarters of this arboreal species is in Vaianai valley on the southeast coast of Moorea, where it is abundant, associated with *P. lineata* (= *suturalis*) and *P. mooreana*. It occurs, also, but in less numbers, in a valley to the west-

ward, where it is found in company with *lineata* and *taniata*. The same valley, which is about two miles from Vaianai, is the limit of the range of the latter species on that part of the island, and hybrids between it and *elongata* are rather common, the same as between *garrettii* and *thalia* at Raiatea. To the eastward of Vaianai it ranges throughout the small valleys for a distance of several miles, as far as Oahumi, the specific centre of *strigosa*." (Garrett).

*Partula elongata* PEASE, Amer. Jour. Conch., 1866, p. 196; 1867, p. 81, Pl. 1, fig. 2; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., iv, p. 72.—PFEIFFER, Mon. Hel., viii, p. 196.—GARRETT, J. A. N. S. Phila. ix, 1884, p. 68.—*Partula lineata* CARPENTER (not of LESSON), Proc. Zool. Soc., 1864, p. 676.—*Partula taniata* HARTMAN (not of Mörech), Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 188 (part).—*P. gracilior* Pease label in A. N. S., HARTMAN, Bull. Mus. Comp. Zool. ix, p. 183 (as syn. of *gracilis*).

This form seems to intergrade perfectly with *P. taniata*, of which I would think it a subspecies, so far as I can judge without detailed study of the colonies in the field. However, Garrett writes "I cannot agree with Dr. Hartman in uniting this species with *taniata*. It is only through hybrids between the two species that the inosculation takes place. Examples taken in any of the valleys not inhabited by *taniata* prove at once its distinction."

The type lot received from Pease contains three shells measuring

Length 18.5, diam. 9, aperture 9.3 mm., 5 whorls.

Length 17.2, diam. 8.8, aperture 9.2 mm.,  $4\frac{3}{4}$  whorls.

Length 16, diam. 8.1, aperture 8.9 mm.,  $4\frac{3}{4}$  whorls.

One shell is corneous-brown with inconspicuous narrow darker streaks, another is corneous-white with white streaks on the last whorl, while the third (fig. 6, and A. J. Conch. iii, pl. 1, f. 2) is dilute brown with indistinct, wide whitish corneous streaks. All have the dense, minute spiral sculpture of *taniata* and its allies. The whorls are not very convex, last one more or less flattened below the periphery, very con-

vex at base. The lip is narrowly reflexed, a little thickened within. There is no noticeable callous nodule on the columella, and no parietal tooth.

Other lots show a wide range of variation in form and color, apparently showing considerable local differentiation. In one lot from Garrett (pl. 29, figs. 1, 2, 3, 4, 5) there are several color-forms: tawny shells with narrow browner streaks (fig. 5); greenish white (fig. 1); pale brown or whitish with 4 interrupted bands (figs. 2-4). Another lot consists of yellow or yellowish-corneous shells, very indistinctly streaked (fig. 11). Still other forms (figs. 9, 10) approach closely to typical *P. taniata* in color, having two widely separated whitish bands on a tawny-brown ground.

21. *P. ERHELII* Morelet. Pl. 27, figs. 15, 16.

Shell slightly umbilicate, acutely ovate, thin, diaphanous, decussate under the lens, covered with a grayish-tawny, in the last whorl yellow epidermis. Spire conic acute. Whorls 5, a little convex, the last longer than the spire, angular in front. Aperture ample, very oblique, oval. Columella lightly arcuate; peristome narrowly expanded, white-lipped, margin acute, roseate, outwardly scarlet-tinted. Length 16, diam. 8, length of aperture 9, width  $5\frac{1}{2}$  mm. (*Morelet*).

Society Is.: Moorea (*Morelet*).

*Partula erhelii* MORELET, Journ. de Conchyl. iv, 1853, p. 371, pl. 12, f. 7, 8.—PFR., Monogr. iv, 509; vi, 157.

A thin little shell, writes M. Morelet, diaphanous, finely striate in both directions, recognizable by the obliquity of the aperture, the plane of which is inclined backward, as well as by the angular shape of the last whorl. The peristome is dilated, reddish at the edge, thickened by a white callus which is sharply limited towards the inside. The slightly curved columellar margin is applied over the umbilical region so as to almost wholly mask the opening.

Dr. Hartman referred this form to *P. taniata*, but the features noticed in Morelet's remarks, translated above, hardly warrant such a disposition of it. The lip-color and



the angle on the front differentiate *P. erhelii* from otherwise similar known Moorean forms. M. Morelet states that it was brought from Tahiti by M. Erhel, a young surgeon of the marine service who died in Senegal.

### 3. *Species of Raiatea and Tahaa.*

The Partulæ of these two islands are so intimately related that they must be treated together. The separation of the islands by a shallow lagoon about two miles wide, has evidently been a quite recent event. Both islands are enclosed in the same encircling reef.

The extrinsic relations of the Partulæ are with Tahitian forms. With the exceptions of *P. turgida* (no. 8) and *P. attenuata* (no. 17) already described, all Raiatean species may credibly be assumed to have descended from a single ancestral stock which was also the common parent of the *otaheitana* group. Subsequent events were as follows. (1) Three chief branches of this stock arose: the *faba* group, the *dentifera* group and the *hebe* group. (2) Each of these stocks spread over the available area, and (3) by local differentiation gave rise to numerous races, which are still doubtless spreading and becoming further modified. This tertiary geographic radiation and racial differentiation was also accompanied by an adaptive radiation whereby several arboreal forms gave rise to terrestrial species. As the result of these events we find most available stations occupied by two to four species, each representing one of the three stocks derived from differentiation (1), and from the adaptation to terrestrial conditions.

The comparative simplicity of the distributional conditions indicates that the evolution cycle outlined above has not been of great duration. By analogy with known cases, differentiation (1) probably took place in Pliocene time.

Most Partulæ known to be terrestrial are from Raiatea and Tahaa. The terrestrial habit is no doubt a readaptation of arboreal ancestors. The coloration approximates to the dull tints of ground snails.

*Group of Partula dentifera.*

These arboreal snails of Raiatea and Tahaa are characterized by the usually light yellow color of the shell, the summit white, yellow, pink, or purple-tipped; lip white, thickened within, more or less strongly toothed within the outer lip and excised above the tooth. Columella and parietal wall often toothed. The species are closely related to some of the *faba* group.

*a.* Shell denuded of cuticle, openly umbilicate; aperture rounded-oval, with two or three strong teeth.

*P. callifera*, no. 22.

*aa.* Cuticle present; aperture ovate.

*b.* Lip heavy, keeled on the face, with a heavy tooth above; no columellar or parietal teeth.

*P. dentifera*, no. 24.

*bb.* Lip thinner, its face not keeled, tooth smaller.

*c.* No parietal tooth, but having a columellar tooth; umbilicate, greenish-yellow, length 23 mm.

*P. citrina*, no. 25.

*cc.* Parietal tooth usually developed; nearly or quite imperforate; length 17 to 21 mm.

*P. imperforata*, no. 26.

Properly speaking, this group consists of only three species: *P. callifera* of Haamoia valley, Raiatea; *P. solidula* of unknown locality, and *P. dentifera*, of which *formosa*, *citrina*, *imperforata* and *virginica* are scarcely more than subspecies, spread over Raiatea and part of Tahaa. *P. imperforata raiatensis* and *virginica* are apparently the least modified survivors of the original stock.

22. *P. CALLIFERA* Pfeiffer. Pl. 20, figs. 1, 2, 3.

Shell umbilicate, ovate-conic, solid, nearly smooth (under the lens punctate-striate), whitish. Spire a little convexly conic, rather obtuse. Suture light. Whorls 5, a little convex, the last a little longer than the spire, inflated. Columella subvertical, bearing a tubercle above, folded within. Aperture slightly oblique, sinuous-oblong, contracted by a deeply

placed parietal tooth. Peristome thickened, dilated, the margins joined by a callus, the right margin bearing an oblong callus within, above the middle. Length 19, diam. 11, aperture with peristome  $11\frac{1}{2}$  mm. long, 4 wide inside. (*Pfr.*).

Raiatea: restricted to the higher portion of Haamoā valley, on the east of Raiatea, where it is not uncommon on foliage. (*Garrett*).

*Partula callifera* PFEIFFER, Proc. Zool. Soc., 1856, p. 333; Mon. Hel., iv, p. 511.—CARPENTER, Proc. Zool. Soc., 1864, p. 675.—PEASE, Proc. Zool. Soc., 1871, p. 473.—HARTMAN, Cat. Part., p. 8; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 180.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 60, pl. 3, f. 82.—*Partula megastoma* PEASE, MS., SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—*Partula callistoma* SCHMELTZ, l. c., p. 207; vi, p. 81.

A beautiful and very distinct species, totally lacking cuticle in adult shells, and hence having a dull surface and cream-white color; the early whorls generally yellow, sometimes white. The last whorl is quite inflated, the aperture rounded-oval, usually three-toothed: there is a strong parietal tooth, a wider one above the middle of the outer lip, and a smaller denticle, or sometimes only an indistinct callous nodule, on the columella. The lip is generally thickened on the face, which is usually carinated. The size varies from length 17, diam. 11 mm., to length 21, diam.  $12\frac{1}{2}$  mm. Fig. 3 represents one of the specimens sent by Mr. Pease as *megastoma*.

23. *P. SOLIDULA* Reeve. Pl. 20, fig. 12.

“Shell acuminate ovate, rather gibbous, compressly umbilicated, solid, whorls flatly convex, obliquely irregularly striated, minutely sculptured with spiral impressed lines, aperture auriculate, the lip and columella being broadly callously reflected; straw-color, sometimes reddish at the apex.

“A solid subtransparent shell, having the character and substance of *P. otaheitana* with the form and coloring of *P. gibba*; excepting that the whorls are not crowned with

the white sutural band which is constant in that species." (Rvc.).

Society Islands (Mus. Cuming).

*Partula solidula* RVE., Conch. Icon. vi, pl. 4, f. 22, May, 1850.—?? PFR., Conchyl. Cab. p. 269, pl. 64, f. 15, 16; pl. 65, f. 12, 13; Monogr. iii, 452.

This may be identical with one of the described forms of *P. dentifera* or *imperforata*, such as *virginica*, or more likely *raiateensis*; but perhaps representing another race of the same stock, not rediscovered by Mr. Garrett. Pfeiffer's figures evidently do not apply to exactly the same form. Hartman expressed the idea that *solidula* is a large form of *P. lutea*. Garrett compares *solidula* to *compacta* Pse., from which it differs by the parietal tooth. Description and figure from Reeve.

24. *P. DENTIFERA* Pfeiffer. Pl. 20, figs. 4, 9.

The shell is narrowly umbilicate, ovate-conic, solid, nearly smooth, somewhat shining, pale straw colored. Spire conic, the apex rather acute, suture margined. Whorls  $5\frac{1}{2}$ , the upper ones flat, the penultimate more convex, the last slightly shorter than the spire, convex, impressed in the middle anteriorly. Columella subvertical, slightly folded. Aperture slightly oblique, narrow, obversely ear-shaped. Peristome white, strongly thickened, built forward; its margins subparallel, the right margin deeply curved above, and bearing a strong, acute, tooth-like tubercle in the middle. Length  $21\frac{1}{2}$ , diam. 10, aperture 11 mm. (Pfr.).

Raiatea: The specific centre of the type of this species is in the large valley of Vairahi, on the east coast of Raiatea, where it occurs in vast numbers on foliage in company with the typical *P. hebe*. It has not spread at all to the southward, but a variety occurs in an adjacent valley on the other side. (Garrett).

*Partula dentifera* PFEIFFER, Proc. Zool. Soc., 1852, p. 85; Mon. Hel., iii, p. 447; Conchyl. Cab. p. 264, pl. 44, f. 14, 15.—PEASE, Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus.

Godeff., v, p. 207.—HARTMAN, Cat. Part., p. 8, with woodcut; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 181, 183, 194 (excl. *raiatensis*).—GARRETT, Journ. A. N. S. P. ix, 1884, p. 68, pl. 3, f. 84.—*Partula decorticata* PEASE, MS. Coll. Pease, 1863.—*Partula labiata* PEASE, MS. Coll. Pease, 1863.—SCHMELTZ, Cat. Mus. Godeff., v, pp. 92, 207.—PFEIFFER, Mon. Hel., viii, p. 209.

It may be distinguished by its elongate-conical form, straw-yellow color, rather shining surface, chink-like perforation, and small oblong obauriform white aperture. The *peristome* is ivory-white, heavily calloused, the face angularly ridged, strongly labiated within, and armed slightly above the middle with a very prominent tooth, above which the lip is strongly contracted, forming a conspicuous sinus. A very rare variety occurs of a ruddy brown color, purple-black apex, and flesh-colored peristome. Examples with a white sutural line are not infrequent and most shells are a little paler below the suture; otherwise it is *never* ornamented with bands; even the most perfect specimens *always* have the cuticle more or less decorticated behind the peristome, which suggested the provisional name *decorticata*. The above notes, slightly modified from Garrett, apply to the typical *P. dentifera* from Vairahi valley, of which *P. labiata* Pease (fig. 9) is an exact synonym. In this form a parietal tooth is never developed. The color varies commonly from straw to light greenish yellow. The figured shell (fig. 9) measures, length 21, diam. 11, aperture 12 mm. but it is sometimes as small as 19 mm. long.

Garrett states that north of Vairahi valley, *P. dentifera* "has migrated into a small adjacent valley, where it is much less abundant, and differs from the type in about half of the specimens having a prominent parietal tooth (which is *always* absent in examples inhabiting Vairahi); otherwise the shells are not dissimilar." Examples of this dentate race are figured pl. 20, figs. 7, 8. It certainly approaches close to *P. imperforata raiatensis*.

*P. dentifera* is never banded, and the apex, though often yellow, is never rose-colored, as it often is in *P. imperforata*.

24a. *P. D. FORMOSA* 'Pease' Garrett. Pl. 20, figs. 5, 6.

“Shell large, imperforated, solid, elongate-ovate, striated, shining, pale yellowish white, straw-yellow or fulvous; spire conical, with nearly flat outlines, spirally striated with fine, crowded, incised lines, half the length of the shell, and frequently tinged with rose-red; suture slightly impressed, margined with a rugose, white line; whorls five and a half, flattened, the last one large, convex; aperture oblong, subvertical, obauriform; peristome white, rather widely expanded, declivous, external margin angularly ridged, inner margin strongly labiated, acutely dentate, and contracted above the denticle; parietal region thinly glazed, edentate; columellar lip closely appressed over the umbilical region. Length 25, diam. 13 mm. (*Garrett*).

The metropolis of this very distinct species is in Fatimu, or on the southwest part of Raiatea. It occurs in vast numbers on bushes on the lowlands near the seashore, becoming more scarce inland, where it is found associated with *P. hebe*, var. *bella*. It ranges north as far as Vaiau valley, becoming less and less abundant as the distance increases from its specific centre. (*Garrett*).

*Partula formosa* PEASE in coll.—HARTMAN, Cat. Part., p. 8; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 182, 191 (no description).—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 60, pl. 3, f. 49.

“Its large size, edentate parietal region, sharp labial tooth and closed umbilicus will readily distinguish it. It is never ornamented with bands.” The columella is slightly sinuous, but has no distinct tooth or nodule such as is present in *P. imperforata*. It differs from *P. dentifera* by its larger size and, imperforate axis *and in its distribution*. Fig. 5 represents Garrett's type specimen, no. 59453 A. N. S. P. Others received from him are smaller, length 22, diam. 11.5 mm., and length 21.5, diam. 12.5 mm.

25. *P. CITRINA* Pease. Pl. 20, figs. 10, 11.

The shell is narrowly perforate, ovate-conic, rather solid,

straw-colored with faintly darker or greenish streaks, the spire paler or whitish, apex yellow or reddish tinted. Whorls  $5\frac{1}{2}$ , but slightly convex, separated by a minutely roughened, white-edged suture; last whorl paler or white behind the outer lip. Aperture somewhat oblique, auriform, the lip well expanded, white, flattened or sloping inward, having a rather strong callous ledge within, which terminates upward in a wide tubercle, above which it is narrow and excavated. Columella vertical, very little dilated at the insertion, where it is somewhat guttered, an oblong callous nodule below the gutter. Parietal callus thin and transparent, not toothed. Length 23, diam. 12.5 mm.

Raiatea: "restricted to a single valley called Uparu, on the west coast of Raiatea; arboreal. I found it abundant in a limited area in the upper portion of the valley. A few stragglers occurred lower down in company with *faba* and *garrettii*." (Garrett).

*Partula citrina* PEASE, Amer. Jour. Conch., 1866, p. 195; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., vi, p. 81.—PFEIFFER, Mon. Hel., viii, p. 200.—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 64, pl. 3, f. 52.—*Partula faba* var. CARPENTER, Proc. Zool. Soc., 1864, p. 675.—HARTMAN, Cat. Part., p. 6; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 180, 195.

This species stands very close to *P. dentifera* and *P. imperforata*. It differs from *dentifera* by the flattened or inwardly sloping lip, which is not keeled on the face, by the less prominent tubercle within the outer lip, and by the more emphatic nodule on the columella. Compared with *P. imperforata*, it differs by the absence of a parietal tooth, the usually lighter color, larger size and slightly open umbilicus, all being inconstant characters. Garrett writes as follows: "Though considered by some authors to be a variety of *P. faba*, I am, nevertheless, fully convinced of its specific value. When I first discovered it in 1861, I took but few examples, in consequence of not penetrating far enough into the valley to find its headquarters. A more extended research in 1873

revealed its specific centre, and I took about eight hundred specimens in various stages of growth, and many of the adults were in a gravid condition.

“It has been suggested that it may be a hybrid between *faba* and some other species. I only noticed *faba* and *garrettii* in the lower part of the valley, and *not* in the upper portion, which is the principal haunt of *citrina*. Its uniform straw-yellow color, more slender form, smaller perforation, more reflected columella, and more decided labial tooth, and profounder emargination, will distinguish it from the very variable *faba*.

“My largest examples are 25 mill. in length and 12 in diameter. It is *always* of a straw-yellow color, rarely with faint longitudinal darker strigations, and is either lemon-yellow or light red at the apex. It is *never* spirally banded, and the parietal wall is invariably edentate. The oblong white aperture is, including the peristome, half the length of the shell. The ivory-white lip is broadly expanded, planulate, declivous, strongly labiated, slightly dentate and distinctly emarginate above. The slightly gibbous columella is reflected over the small compressed perforation.”

26. *P. IMPERFORATA* ‘Pease’ Garrett. Pl. 20, figs. 13, 14, 15.

Shell imperforated or very narrowly compressly umbilicated, solid, oblong-conic, somewhat shining, with rather smooth, irregular, incremental striae and closely set delicate spiral incised lines, which are more or less evanescent on the body-whorl. Color, pale straw-yellow, luteous, or fulvous, often with a brownish apex. Spire conical, with subplanulate outlines, about half the length of the shell; suture sometimes margined by a rugose white line; whorls 5-5½, flatly convex, the last one convex, or convexly rounded. Aperture subvertical, oblong, obauriform, white, sides nearly parallel; parietal wall with a more or less developed tubercular tooth; peristome white, thick, moderately expanded, its face concave, heavily labiated within, strongly contracted above, forming a rather profound sinus, and generally subdentate next to the emargination; columellar lip subnodose.



Length 21, diam. 12 mm.

Var. *a*. Uniform chestnut-brown; rare.

Var. *b*. Base and sutural band chestnut-brown; somewhat rare.

Var. *c*. With a broad, median, chestnut-brown band; rather rare.

This species is restricted to Toloa and Hapai valleys on the west coast of Raiatea, where it is abundant on foliage (*Garrett*).

*Partula imperforata* Pease MS., GARRETT, JOURN. Acad. Nat. Sci. Phila. ix, 1884, p. 54, pl. 3, f. 53.—*Partula raiatensis* GARRETT (as var. of *imperforata*), t. c. pp. 54, 55.—*Partula recta* Pease MSS., 1863, not *P. recta* Pease, 1868.

“Like all the species, they differ some in size, shape, and some have the spire more abbreviated than others. The type, which inhabits Hapai valley, is nearly always imperforated and may be distinguished from the imperforate *formosa* by its smaller size, gibbous columella and parietal tooth. Carpenter confused it with *dentifera*, an allied species confined to the opposite side of the island” (*Garrett*).

Garrett's description, slightly modified, is given above. His figured cotype and two others of the same lot are illustrated, pl. 20, figs. 13-15. The length varies commonly from 19 to 21 mm., diam. usually 11 mm. It differs from *P. dentifera* by the smaller tooth in the outer lip, by having a more or less distinct oblong callus lump on the columella near its insertion, and a small parietal tooth (sometimes absent); the face of the lip is less thickened than in *dentifera*. It is a less evolved race than *dentifera*.

Typical *imperforata* is confined to Hapai valley. The valley Toloa is inhabited by a weakly individualized local race which has been called *raiatensis* Garrett (pl. 20, figs. 16, 17) and *recta* Pse. (in coll. 1863) not *P. recta* Pse. 1868. Garrett writes: “After a careful study of about 2000 specimens of the two species, I have annexed the Toloa with the Hapai shell. The only difference between the two is that *raiatensis* is usually lighter-colored, seldom imperforate, and the apex is

much more frequently rose-red. It is, I think, more nearly related to the dentated *virginica*, inhabiting the neighboring island, than to *dentifera*." This conclusion is fully supported by the series before me, received from Pease, Garrett and others.

26a. P. I. VIRGINEA 'Pse.' Garrett. Pl. 20, figs. 18, 19.

"Shell compressly umbilicated, solid, oblong-conic, somewhat shining, yellowish corneous or light fulvous brown; spire convexly conical, half the length of the shell; suture margined by a whitish line; whorls 5-5½, slightly convex; aperture subvertical, oblong, obauriform, rounded below and much contracted by the strongly labiated peristome; parietal wall with a white tubercular tooth which is rarely absent; peristome white, sometimes tinged with carnelian, widely expanded, subplanulate, slightly contracted above, and the margins frequently nearly united by a ridge of callus; columellar lip vertical, more or less distinctly nodose. Length 18, diam. 9 mm." (*Garrett*).

"Form *a*. Uniform chestnut-brown. Not uncommon.

"Form *b*. Yellowish corneous, with a basal and sutural chestnut-brown band. Very rare." (*Garrett*).

Raiatea: The specific centre is in Vaipiti valley, on the west coast of Tahaa, where it occurs in the greatest profusion on the foliage of shrubs. It has extended its range to the northward as far as Murifanna on the north coast, which latter is the limit of the western range of *P. umbilicata*. (*Garrett*).

*Partula virginica* PEASE, MS.—BINNEY, Proc. Acad. Nat. Sci. Phil., 1875, pp. 245, 247, pl. 19, fig. 8 (anatomy).—SCHMELTZ, Cat. Mus. Godeff., vi, p. 81.—HARTMAN, Cat. Part., p. 8; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 189.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 61, pl. 3, f. 54.—*Partula solidula* var., CARPENTER, Proc. Zool. Soc., 1864, p. 675.—PEASE, Proc. Zool. Soc., 1871, p. 473; not of Reeve.

This form is practically identical with the *raiatensis* form

of *imperfurata*. Although I give Garrett's description above, I am convinced that no study of descriptions or of the type specimens, which I have before me, would enable one to separate a series of the two forms if mixed. The distinction is based chiefly on geographic distribution but also to some extent on the *diverse variations* of the two forms. Pale specimens of *virginica* usually have the apex purple-tipped (not pink, as in *raiateensis*); but the darker shells have the embryonic whorls white. The only closely related or similar shell on Tahaa is *P. planilabrum*, which belongs to the *faba* series.

The figures are from Garrett's type lot, no. 59474 A. N. S. P.

*Group of P. hebe.*

In this group of rather small forms the spiral striæ are usually somewhat better developed than in most other Raiatean species. The relations of the main forms may be expressed diagrammatically, thus:



27. *P. HEBE* Pfeiffer. Pl. 21, figs. 1, 2, 3.

Shell perforate, globose-conic, thin, under the lens most minutely decussate, hyaline. Spire short, conic, acute. Whorls  $4\frac{1}{2}$ , flat, the last longer than the spire, globose. Columella short, subplicate; aperture wide, almost semicircular, having a deep-seated tooth-like callus on the belly of the penult whorl. Peristome white-calloused within, narrowly expanded throughout. Length 16, diam. 9, aperture  $7 \times 5\frac{1}{2}$  mm. inside. (*Pfr.*).

Raiatea: "The specific centre of the type of this small white species is in the large valley of Faalooa, on the eastern coast of Raiatea, where it is found in great profusion on the foliage of bushes. From this central point it has migrated

to the northward, where it is found, though less abundant, in an adjacent valley, associated with the typical *P. dentifera*. About two miles to the southward, on the same side of the island, in a large valley called Opoa, is found in large numbers the pretty variety *bella* Pse., which has passed over a range of wooded hills into a large valley on the south coast, where it occurs in limited numbers in company with *P. formosa*. In another valley, some distance to the northward, on the west coast, we find another variety, *ventricosa*, Garr.”

*Bulimus hebe* PFEIFFER, Proc. Zool. Soc., 1846, p. 39; Mon. Hel., ii, p. 68; Conchyl. Cab., p. 268, pl. 64, figs. 7, 8. *Partula hebe* REEVE, Conch. Icon., sp. 25, pl. 4, fig. 25.—PFEIFFER, Mon. Hel., iii, p. 453.—PEASE, Proc. Zool. Soc., 1871, p. 473.—PAETEL, Cat. Conch., p. 104.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—HARTMAN, Cat. Part., p. 9 (with woodcut); Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 183, 193.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 53.—*Partula globosa* PEASE, MS. (Mus. Pease, 1863).—GLOYNE, Quar. Jour. Conch., i, p. 338.—SCHMELTZ, Cat. Mus. Godeff., v, p. 207.—*Partula ventricosa* GARRETT, J. A. N. S. P., ix, 54.—*Partula hebe* var. *bella* PEASE, Proc. Zool. Soc., 1871, p. 473, name only.—HARTMAN, Bull. M. C. Z., ix, p. 193.

Typical *P. hebe* (pl. 21, fig. 1) has the shell covered with a very thin white more or less shining cuticle, upon which delicate spiral lines may be seen under the lens. Most examples have lost their cuticle and have a matte white surface (figs. 2, 3). The size and proportions vary but little, the usual size being, length 15, diam. 10.2 to 11, length aperture 8.2 to 8.8 mm.

The outer lip is rather narrow in the typical form; in the heavy, denuded examples it is wide and heavily thickened within, generally showing a trace of the tooth or tubercle above the middle which is so prominent in the related *faba* group. It is often thickened on the face and convex or carinate there. The columella in oblique view in the aperture, is very wide.

This charming snail has several close relatives among the dull ground-living species, such as *P. crassilabris* etc.

*P. HEBE BELLA* 'Pse.' Hartman (pl. 21, figs. 4, 8) has the spire orange rose colored, usually darker towards the apex. The surface is glossy, covered with a very thin yellow cuticle which is usually deciduous in part, or is entirely lost, when the whole surface is lusterless. The shell is often more solid than typical *P. hebe*. This form was named *P. globosa* and *P. h. bella* by Pease many years ago, but it was in no manner described until Dr. Hartman reported on Pease's duplicates.

I am unable to find much cause for recognizing var. *ventricosa* Garrett, 1884 (pl. 21, figs. 6, 7). It "is usually a little smaller than the type, not decorticated, and is more variable in color, but never banded. The ground color varies from whitish to fulvous, rarely with a reddish spire, but more frequently with the apex of a purple-brown." (*Garrett*). The cuticle is decidedly thicker than in other forms of *hebe*; it peels off in an area behind the lip, but is elsewhere persistent. The parietal tooth is smaller than in other forms of *hebe*. Figured from examples received from Garrett. This form is probably what Dr. Hartman refers to as "*P. ventrosa* Pse." (*t. c.*, p. 193). It approaches *P. crassilabris*, a ground species, but differs by its much larger parietal tooth, etc.

28. *P. CRASSILABRIS* Pease. Pl. 21, figs. 5, 9, 10.

The shell is umbilicate, short, ovate-conic, moderately thick. Surface rather dull, lightly marked with growth-lines and usually showing engraved spiral lines distinctly on all the whorls; brown or corneous-brown, the base darker, spire or apex usually purplish-brown; periphery frequently (and typically) encircled with a yellow belt or line. The conic spire has straight sides; whorls  $4\frac{3}{4}$ , only slightly convex, the last rotund. The aperture is small, rounded-ovate, dark flesh-colored inside. Peristome expanded, thick in adult shells, thickened within, its face convex, white, or brownish towards the outer edge. Outer lip is a little narrower above, but not dentate; at the insertion it gives off a short parietal

callus. The columellar margin has no callous tubercle or node, but in oblique view is seen to be very broad. It is angularly bent at the insertion. Parietal wall covered with a thin, transparent callus, bearing a small white tooth far within.

Length 14.5, diam. 10 mm.

Length 15.3, diam. 9.3 mm.

Length 15 to 16, diam. 10 mm.

Raiatea: The metropolis of this species is in Hapai valley, on the west coast of Raiatea, the home of *P. imperforata* and *lugubris*. It is very abundant, lurking beneath decaying vegetation and found associated with the typical form of *P. lugubris*. It has not spread any to the northward, but to the southward it has migrated into two small ravines. (*Garrett*).

*Partula crassilabris* PEASE, Amer. Jour. Conch., 1866, p. 199; 1871, p. 81, pl. 1, fig. 6; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 207.—PFEIFFER, Mon. Hel., viii, p. 208.—HARTMAN, Cat. Part., p. 9; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 181, 192 (excl. *rustica*).—GARRETT, Journ. A. N. S. P., ix, 1884, p. 66.—*Partula otaheitana* REEVE, Conch. Icon., pl. 2, fig. 11c, not of Bruguière.—*Partula hebe* var., CARPENTER, Proc. Zool. Soc., 1864, p. 675.

This small ground-snail is very closely related to *P. hebe*. It differs from that by the dull brown color, smaller parietal tooth (which indeed is sometimes wanting), the less expanded lip, and persistent cuticle. The description and fig. 10 are from Pease's type lot, no. 59477 A. N. S. P. The color is variable.

- a. Yellowish chestnut, the base darker, summit purplish, a pale brown peripheral line (fig. 5).
- b. Chestnut, the spire darker, purplish; often a white hair-line at suture (fig. 9).
- c. Light brown or brownish-corneous, summit darker, periphery indistinctly marked with a light or a dark band.
- d. Greenish-corneous, lip pure white. An albino.

29. *P. RUSTICA* Pease. Pl. 19, figs. 12, 15 to 18.

The shell is rather openly umbilicate, obesely ovate-conic, somewhat thin. Surface rather dull, lightly marked with growth-lines and spiral engraved lines, which are generally subobsolete on the last whorl except near suture and base; chestnut-brown, sometimes having a pale belt, or pale brownish-corneous, the summit or spire purplish-brown. Spire conic with straight outlines; whorls  $4\frac{1}{2}$ , slightly convex, the last rotund. The umbilicus has a more or less distinct spiral groove or excavation within. Aperture subvertical, ovate, dark flesh-colored within; peristome narrowly expanded, thickened within, noticeably narrower near the upper insertion. Columellar margin *sinuated or weakly nodose* within; in oblique view less wide than *P. crassilabris*. Parietal wall covered with a transparent callus which is rather thick at the edge, and often bears a very small tooth far within.

Length 16.7 to 17.7, diam. 11 mm.

Length 16, diam. 10 mm.

Raiatea: The metropolis of this species is in a large valley called Toloa, on the west coast of Raiatea, where it occurs in great abundance beneath decaying vegetation. It has migrated to the southward into two small adjacent valleys, but does not extend its range so far as Hapai, the next large valley, and the home of the allied *P. crassilabris*. (*Garrett*).

*Partula rustica* PEASE, AMER. JOUR. CONCH., 1866, p. 199; 1867, p. 81, pl. 1, fig. 5; PROC. ZOO. SOC., 1871, p. 473.—SCHMELTZ, CAT. MUS. GODEFF., v, p. 207.—PFEIFFER, MON. HEL., viii, p. 205.—GARRETT, JOURN. A. N. S. PHILA., ix, 1884, p. 77.—*Partula crassilabris* GLOYNE (not of Pease), QUAR. JOUR. CONCH., i, p. 338.—HARTMAN, CAT. PART., p. 9; OBS. GEN. PART., BULL. MUS. COMP. ZOO., ix, p. 187 (part).—*Partula pinguis* GARRETT, l. c. p. 77.

Described from Pease's type lot, no. 59480 A. N. S. P. Garrett writes as follows: "It is larger, less globose, the aperture more oblong, than *P. crassilabris* with which it has been confounded. Its chief character consists in the colu-

mellar region being, as it were, pressed in towards the aperture, nodulous on the inner margin, and subangulated at the base. The parietal tooth is less developed and absent more frequently than in *crassilabris*. The coloration is the same in the two species. Like the majority of the ground species, it varies in a greater or less degree in shape and size. Some forms almost exactly simulate *P. garretti*, not only in the outline of the shell, but in the peculiar shape of the aperture as modified by the columella being pressed inwardly. Occasionally examples occur which are so much abbreviated that they resemble *P. crassilabris*, but may readily be separated by the dissimilarity in the columellar region.

“My *P. pinguis*, of which I have seen only a dozen examples, was found under decaying leaves in the mountain ravines, at the head of Vaioara valley. It certainly equals *rustica*.” (*Garrett*).

30. *P. GARRETTI* Pease. Pl. 21, figs. 15 to 19.

The shell is minutely rimate or imperforate, oblong-ovate, solid and strong, slightly shining, lightly marked with growth-striae and minute engraved spiral lines, which are usually more or less obsolete on the last whorl; yellowish, the spire either paler, apex white, or spire pink-tinted with the apex purplish flesh colored. Suture very lightly impressed, edged with a white line. Whorls 5, very slightly convex. Aperture is oblique, white within. Peristome very narrowly expanded, thick, the face convex or keeled, pure white; internal rib strong. Columella vertical, sinuous, bearing a strong tubercle or node above the middle, its junction with the basal margin angulated. Parietal wall covered with a smooth, transparent callus, not toothed within.

Length 16, diam. 9 mm.

Length 14, diam. 9 mm.

Length 15, diam. 8.5 mm.

Raiatea: “The specific centre is Vaioara, on the west coast of Raiatea, where it exists in prodigious numbers on bushes. It has spread north and south of its metropolis, and in the



former direction has slightly overlapped the southern range of *P. thalia*, and hybrids between the two species are quite common. To the southward it ranges about one mile, where it extends a short distance up a valley which is the home of *P. citrina*." (Garrett).

*Partula garretti* PEASE, Proc. Zool. Soc., 1864, p. 672; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 158.—SCHMELTZ, Cat. Mus. Godeff., v, p. 207.—HARTMAN, Cat. Part., p. 10; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 182.—GARRETT, Journ. A. N. S. P., ix, 1884, p. 56, pl. 3, f. 48.—*Partula gonocheila* SCHMELTZ (not of Pfeiffer), Cat. Mus. Godeff., v, p. 92.

Differs from the related *P. thalia* and *P. rustica* by its less inflated form, extremely narrow or closed umbilicus, less expanded lip and strongly developed columellar sinuosity. Garrett remarks that "Its principal characters are its small size, contracted aperture, rounded or angulated peristome and nodulous columella, which latter is, as it were, pushed in towards the aperture. The parietal region is very rarely toothed. It is whitish or pale yellowish horn-color, rarely fulvous or light brown, and sometimes the apex is purple-brown. A variety with a brown base and sutural band is not infrequent."

Fig. 15 represents one of Pease's original lot. Fig. 19 is somewhat intermediate between *garretti* and *rustica*. It has the columella and almost closed umbilicus of *garretti*, but a somewhat fuller shape and a minute parietal tooth.

### 31. *P. UMBILICATA* Pease. Pl. 21, figs. 11, 12, 13, 14.

The shell is *globosely* ovate, solid, rather dull *openly umbilicate*, roundly angulate at the umbilicus, very delicately striated spirally. Whorls  $4\frac{1}{2}$ , convex, the last swollen. Aperture rounded-oval, toothed. Lip internally thickened, obliquely flat. The columella has a somewhat tooth-like callus, and is angular at the base. Color, yellowish or brownish horn-color, faintly streaked with darker, the apex generally reddish-brown or dark purple; seldom wholly dark chest-

nut-brown; occasionally with a broad yellowish horn-color band; very rarely yellowish horn-color with a chestnut band.

Length 18, diam. 12.5 mm. (*Pease*).

Tahaa: The metropolis of this well-defined species is in a large valley called Haamene, on the east coast of Tahaa, where they are found in prodigious numbers on the foliage of low bushes. It has not spread any to the southward, but, on the other hand, ranges in considerable numbers through all the valleys, except Faa-apa, the home of *bilineata*, as far as Murifanna on the northwest coast, where it is found associated with *P. virginea*. (*Garrett*).

*Partula umbilicata* PEASE, Amer. Jour. Conch., ii, 1866, p. 200; 1867, p. 81, pl. 1, fig. 7; Proc. Zool. Soc., 1871, p. 474.—BINNEY, Proc. Acad. Nat. Sci. Phil., 1875, pp. 245, 247, pl. 19, fig. 7 (anatomy).—SCHMELTZ, Cat. Mus. Godeff., iv, p. 71.—PFEIFFER, Mon. Hel., viii, p. 207.—HARTMAN, Cat. Part., p. 8 (with woodcut); Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 188.—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 61.

*P. umbilicata* unites characters of the *auriculata* and the *rustica* groups in some degree, though nearer *rustica*, of which it might be called a very large and obese edition. The outer lip is a little narrower in its upper fourth than in *P. thalia*, and there is a distinct callus, often dentiform, superposed upon the columella. The parietal tooth varies from small to well developed, and seems to be invariably present. There is often an indistinct appearance of several angles in the outline of the outer lip, which is moderately expanded, and cream-white behind, white on the face. The whole surface generally shows spiral striæ. Umbilicus much wider than in *P. thalia*. The last whorl is typically well inflated, but I have seen specimens with a strong peripheral angle, from retention of a juvenile character in the adult stage.

Color various; the commonest pattern before me is chestnut, fading to yellowish-white below the last suture, gradually shading to purplish-black at the apex; but sometimes the whole shell is straw-color. In fig. 11 it shows one of the common color-patterns of the *faba* group. Figs. 13, 14 rep-

resent two of the type lot, received from Pease, no. 59452 A. N. S. P.

32. *P. THALIA* Garrett. Pl. 19, figs. 10-11, 13.

“Shell compressly perforated, solid, ovate-conic, somewhat shining, lines of growth rather smooth, and revolving incised lines very fine and crowded; whitish or yellowish horn-color, with or without a purple-black apex; spire rather short, conical, with plano-convex outlines, half the length of the shell; suture slightly impressed; whorls five, flatly convex, the last one large, subglobose. Aperture subvertical, shortly subauriform; parietal region more or less glazed, and armed with a white tubercular tooth; peristome white, moderately expanded, thick, angularly ridged, strongly incrassated within, sinuous above, and the margins frequently joined by a ridge of callus. The columella is frequently slightly gibbous or nodulous in the inner margin. Length 17, diam. 11 mm.

“Var. *a.* Fulvous brown, with or without purple-black apex. Rather rare.

“Var. *b.* With brown base and sutural band. Not common.” (*Garrett*).

Raiatea: “The specific centre of this very abundant arboreal species is in Huaru valley, on the west coast of Raiatea. It has spread along the well-wooded lowlands about two miles north and one mile south of its metropolis, slightly overlapping the northern range of *P. garrettii*.” (*Garrett*).

*Partula abbreviata* PEASE, MS. (not of Mousson) coll. Pease, 1863.—*Partula auriculata* var., CARPENTER, Proc. Zool. Soc., 1864, p. 675.—*Partula peaseana* GARRETT, MS. (not *peasei*, Cox).—*Partula thalia* GARRETT, HARTMAN, Cat. Part., p. 7; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 188, 191, 192 (name only).—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 69, pl. 3, f. 46.

“It is smaller, smoother, more shining, much less variable in color, and the aperture is less auriform than *P. auriculata*.” The smaller *P. garrettii* is probably its nearest ally, but that is a narrower species with more oblique aperture,

more strongly tuberculate columella, and usually no parietal tooth. *P. thalia* seems to be a quite distinct species. I have seen a large number besides Garrett's type lot (figs. 10, 11), mostly labeled "*P. abbreviata* Pse.," a preoccupied name.

*Group of P. faba.*

33. *P. RADIATA* 'Pease' Garrett. Pl. 18, figs. 5, 6, 7.

"Shell rimately perforated, moderately thick, not shining, surface roughened by unusually coarse, rude incremental striæ, and the spire marked by more or less distinct crowded spiral incised lines; color whitish or pale luteous horn-color, with longitudinal, irregular, narrow darker stripes; spire conical, with planulate outlines, half the length of the shell; apex subacute, concolored, white, or light brown; suture linearly impressed, sometimes whitish; whorls 5-5½, flatly convex, last one large, convex, sometimes obsoletely angulated in front and generally a little compressed behind the outer lip. Aperture subvertical, oblong, obauriform, sides parallel; parietal region more or less glazed, and, with few exceptions, furnished with a white tubercular tooth; peristome whitish, frequently margined with pale purplish brown, rather thin, considerably expanded, concave, very obliquely slanting, strongly and acutely labiated on the inner margin, which is more or less distinctly toothed and sinuous above; columellar lip subnodose. Length 21, major diam. 10 mm." (*Garrett*).

"Var. *a.* Uniform chestnut-brown. Frequent.

"Var. *b.* With a chestnut-brown base and sutural band. Not uncommon.

"Var. *c.* With a median brown or chestnut-brown band. Somewhat rare." (*Garrett*).

Raiatea: "The metropolis of this species is in Hamoa valley, on the east coast of Raiatea, the home of *callifera* and *compacta*. It is quite common beneath decaying vegetation and among piles of loose stones. It has not spread any to the northward, but occurs in limited numbers in all the valleys south as far as Vairahi, the headquarters of *P. dentifera*." (*Garrett*).

*Partula radiata* PEASE, MS. 1863.—HARTMAN, Cat. Part., p. 7; Obs. Gen. Part., Bull. Mus. Com. Zool., ix, pp. 185, 196 in part, (1881).—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 74, pl. 3. f. 45.—ANCEY, Il Nat. Siciliano iii, p. 344 (Sept. 1884); Nautilus iii, 1889, pl. 1, f. 17.—*Partula compressa* CARPENTER, Proc. Zool. Soc., 1864, p. 675.—PEASE, Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 207 not *P. compressa* Pfr., 1850.—*Partula microstoma* PEASE, MS.—HARTMAN, Bull. M. C. Z., ix, p. 184, as syn. of *vittata*.—GARRETT, t. c. p. 74, as a form of *radiata*.—SMITH, Ann. Carnegie Mus., i, pp. 429, 472 (1902).

A dull, streaked species, with "key-hole" aperture, the outer lip having a prominent tooth projecting inward, above which it is very narrow. The parietal tubercle is variable, but usually present. Apex may be either white or blackish-brown. Length 20 to 22, diam. 11. Length 21, diam 11.5 mm. It was first described by Garrett, in 1884, although Hartman had given a brief descriptive note in 1882 (Bull. M. C. Z., ix, 185, 196). It was widely distributed by Pease, and in consequence of an ill-judged identification by Cuming and Carpenter, has generally been known in collections as "*P. compressa* Pfr." Garrett's type, no. 59409 A. N. S. P. is figured, fig. 5. Others from Pease (fig. 6), Hartman and others are before me. *P. radiata* stands very close to *P. fusca approximata* of the southern part of Raiatea, but it is duller, with a larger lip-tooth and generally it has a parietal tooth. In the several forms of *P. fusca*, the parietal tooth, when present, is not so large as in *radiata*.

A form which Pease called *P. microstoma* (in his collection, 1863), and which inhabits Vairahi valley, "though very frequently found adhering to the lower portion of the trunks of trees and shrubs, can scarcely be separated from *radiata*, which is strictly terrestrial in habit. Dr. Hartman unites it with *P. vittata*. It appears to me more nearly related to *radiata* than the latter, which is smoother, and the columellar lip is flat and simple." (*Garrett*).

Fig. 14, of pl. 27 represents a specimen of *microstoma*

received from Hartman. It measures, length 23.7, diam. 13, aperture 12.2 mm., has the shape of *radiata*, but the tooth within the outer lip is less developed. There is no parietal tooth. The base of the last whorl and a band below the suture, ascending the spire are chestnut, leaving a rather wide pale buff zone. The surface is not quite so dull as in *radiata*. Whether this form is identical with Garrett's Vairahi *microstoma* remains uncertain. The discussion between Hartman and Garrett about the identity of Pease's *microstoma* is academic, since Pease never described the form. It was first described (by accident, and quite unrecognizably) from Hartman's collection, by H. H. Smith, as cited above.

According to Garrett, specimens which he regards as hybrids between *P. radiata* and *P. faba* are of common occurrence.

34. *P. LUGUBRIS* Pease. Pl. 19, figs. 1 to 7.

The shell is moderately or *narrowly* umbilicate, ovate, *thin*, rather dull, finely marked with growth-lines which are more or less distinctly decussated by the spiral lines. Spire straightly conic. Whorls slightly more than 5, moderately convex. Aperture ovate, the lip only slightly or narrowly expanded, a little thickened within, usually flesh-colored, thinner near the upper insertion. Columella dilated above, *not calloused or nodulous*. Parietal wall covered with a very thin transparent glaze, *toothless*. Coloration various:

a. Pale honey yellow or corneous, darkening to brown at the apex, lip white.

b. Similar, but with a narrow brown periferal band.

c. Reddish-chestnut throughout, of dark or light shade.

d. Chestnut, with a narrow or wide median light band.

Length 19.5, diam 11 mm. (Specimen from Pease).

Length 18, diam. 10.2 mm. (Specimen from Pease).

Length 17.2, diam. 9.8 mm.

Hapai valley, on the west coast of Raiatea; also the adjacent Vaiau valley, where the form *ovalis* is found. Terrestrial.

*Partula lugubris* PEASE, Proc. Zool. Soc., 1864, p. 672; 1871, p. 473.—PFEIFFER, Mon. Hel., vi, p. 158.—SCHMELTZ,

Cat. Mus. Godeff., v, p. 207.—GARRETT, Jour. A. N. S. P., ix, 1884, p. 77, pl. 3, f. 47.—*Partula ovalis* PEASE, Amer. Jour. Conch., 1866, p. 194; Proc. Zool. 1871, p. 473.—PFEIFFER, Mon. Hel., viii, p. 205.

This is a very thin member of the *faba* group, deficient in lip callus and teeth, smaller and more lightly built than *P. fusca*, which is also a ground snail.

The race described by Pease as *P. ovalis* (pl. 19, fig. 7) differs from *lugubris* only by being a little larger, more solid, with a stronger lip-callus. It replaces *lugubris* in Vaiau valley, the typical *lugubris* being confined to Hapai valley. It approaches very near to *P. vittata*, which is a larger form with longer spire and a small parietal tooth. The *ovalis* form is usually dark chestnut with a yellowish belt, but sometimes is of a uniform chestnut hue.

Mr. Garrett writes: "My largest Vaiau specimens are 20½ mm. long, and 11 mm. in diameter. The smallest adult from Hapai is 16 by 8 mm. I have found hybrids between *lugubris* and *imperfurata*, the latter a strictly arboreal species.

"Dr. Hartman, overlooking the fact that *lugubris*, *ovalis*, *protea* and *fusca* inhabit widely separated valleys, has suggested that the three former may be the juvenile and adolescent forms of the adult *fusca*. The habitats of the two former species are about two miles apart, and five miles south of the location of *fusca*. *P. protea*, which = *fusca*, is confined to the opposite side of the island, and is separated from the latter by an almost inaccessible mountain."

### 35. *P. FABA* (MartyN). Pl. 16, figs. 1 to 8.

The shell is dextral, openly perforate, obliquely ovate-conic, rather solid, weakly striate obliquely, with close spiral striation on the early whorls, almost obsolete on the last. Spire straightly conic, of nearly 6 moderately convex whorls. Aperture a little more than half as long as the shell, white or flesh-colored inside. Peristome very broad, reflexed and thickened within, white or flesh-tinted, flattened, the upper third of the outer lip narrow. Columella vertical, its internal thicken-

ing terminating in a stout callous nodule near the insertion. Parietal callus thin and transparent, not toothed.

Typical color yellow, fading to whitish on the spire, the entire base and a band below the suture chestnut or chocolate brown.

Length 25.5, diam. 14, length aperture 14 mm.

Length 25, diam. 15, length aperture 14.5 mm.

Raiatea, throughout the island, on the trunks and foliage of trees and bushes, very abundant, the metropolis of the typical form at Utuloa.

*Limax faba* MARTYN, Universal Conchologist ii, pl. 67, two middle figures (1784). Chenu's Bibl. Conch. ii, p. 24, pl. 24, f. 2a.—*Helix faba* GMEL. Syst. Nat. 1791, p. 3625.—*Bulimus faba* LAM. and of PFR., Monogr. ii, 73.—*Partula faba* SOWB. in Zool. Beechey's Voy., p. 144, pl. 38, f. 4.—REEVE, Conch. Syst. ii, pl. 175, f. 13, 14; Conch. Icon. pl. 1, f. 5.—PFR. Monogr. iii, 446; iv, 511; vi, 159; viii, 199; Conchyl. Cab. p. 263, pl. 22, f. 10.—DESH., in Fér., Histoire, p. 125, pl. 158, f. 7-10, 15, 16.—PEASE, Journ. de Conchyl. xviii, 1870, p. 400 with var. *subangulata*, p. 401; P. Z. S. 1871, p. 458 (var. *subangulata*).—HARTMAN, Catal. Partula p. 6, woodcut; Obs. Part., Bull. M. C. Z. ix, p. 182.—GARRETT, Journ. A. N. S. P. ix, 1887, p. 57, with var. *subangulata*, p. 58, pl. 3, f. 79; *amanda*, p. 58, pl. 3, f. 78; and *dubia*, p. 58, pl. 3, f. 80.—SMITH, Annals of the Carnegie Mus. I, p. 426, no. 4093-4108.—*Partula biangulata* Pse. MS. and *P. propinqua* Pse. MS. according to Hartman.—*Voluta fasciata* DILLWYN, Descr. Catal. i, p. 502.—*Bulimus australis* BRUG., Encycl. Méth. i, p. 347.—*Partula australis* GRATELOUP Soc. Bord. xi, 424, pl. 2, f. 5.—*Partulus australis* BECK, Index p. 57.—*Bulimus inconstans* Mühlf., ANTON, Verzeichniss p. 40, no. 1474 ("chestnut brown, the peristome light brown, stronger [than *faba*], aperture narrower. Nuahame").—*Bulimus tricolor* Mühlf., ANTON, l. c., no. 1474 ("yellowish-green banded with brown").—*Partula brunnea* PEASE MS., HARTMAN, Bull. M. C. Z., ix, 180 "a dark elongated variety of *P. faba*."—*Partula pallida* Pease MS., HARTMAN, Bull. M. C. Z., ix, 195 " =



elongated specimens of *P. faba*."—*Partula biangula* Pease MS., HARTMAN, Bull. M. C. Z. ix, 180, as synonym of *faba*. No description.

*P. faba* was first obtained when Captain Cook visited Raiatea in 1769. Andrew Garrett writes as follows:

"The type varies from straw-yellow to brownish yellow or fulvous, with a broad basal and narrow sutural chestnut-brown band. The most common bandless variety is of the normal color varied with longitudinal darker strigations. A variety of a uniform, whitish horn-color, as well as one of a uniform chestnut-brown, sometimes approaching black, is not infrequent. The lip is white, and the apex frequently tinted with purple-black.

They vary considerably in shape, as the following measurements will prove:

Length 25, diam. 14 mill.

Length 25, diam. 12 mill.

The average dimension is 25 by 13 mill. Out of about 6000 examples I found but one possessing the parietal tooth. Hybrids between this species and *radiata*, *fusca* and *navigatoria* are not uncommon."

Fig. 1 is a copy of Martyn's type figure. Fig. 2 is a more streaked example of the typical form. Deep brown (fig. 3), and greenish-yellow (fig. 4), examples are also drawn. Figs. 5 to 8 are from a series collected by C. D. Voy, presumably in one colony, the several color-forms being connected by intermediate stages.

*P. subangulata*, *amanda*, *navigatoria* and *fusca* might be ranked as subspecies of *faba* without going far wrong.

### 36. *P. SUBANGULATA* Pease. Pl. 16, figs. 14, 15, 16.

Shell smoother, more glossy and thinner than *P. faba*; chestnut-colored with darker streaks and a yellow band below the suture; early whorls purplish-black or brown-tinted; the peristome dark flesh colored, often with white spots. Varies commonly to chestnut with streaks but no light band, and to light yellow or olive-yellow with chestnut streaks and white

spire. A variety with a narrow subsutural and subbasal band of a dark chestnut color on a pale greenish yellow ground is not uncommon.

Tahaa, at the southern end in several valleys (Garrett).

*Partula faba* var. *subangulata* PEASE, Jour. de Conch., 1870, p. 401; Proc. Zool. Soc., 1871, pp. 458, 473.—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 58, pl. 3, f. 79.—*Partula ventricosa* PEASE MS., HARTMAN, Bull. M. C. Z. ix, p. 189, Tahaa. No description.—*Partula amanda* GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 58, pl. 3, f. 78.—*Partula dubia* GARRETT MS., HARTMAN, Bull. M. C. Zool. ix, 181, 191.—GARRETT, t. c., p. 58.—*P. marginata* GARRETT MS., HARTMAN, Bull. M. C. Zool. ix, p. 184; undescribed; “= *P. faba* var., Tahaa.”—*Partula propinqua* PEASE MS., HARTMAN, t. c. p. 185, “Tahaa” no description.

The pale subsutural band gives the shoulder an appearance of angulation, which does not really exist. While the Tahaan forms of the *faba* type differ but little from Raiatean *faba*, yet their variation-forms are somewhat diverse, and the minor differences noted above seem fairly constant. I have therefore thought it best, in view of the minute specific subdivision of Raiatean Partulae, to give *subangulata* specific rank.

36a. P. S. AMANDA Garrett. Pl. 17, figs. 1, 2, 3.

The shell is like *subangulata* in shape, but it occasionally has a small tooth on the parietal wall. The usual color is pale yellow or greenish yellow, almost white towards the summit, or more or less suffused with fulvous, with a white or flesh-tinted lip. “A beautiful variety occurs which has a wide median reddish chestnut band (fig. 1). A more common variety is found with two narrow reddish chestnut bands” (fig. 2); the summit in these is purple-black. “Chestnut-brown varieties are not uncommon. The rarest variety is fasciated the same as the typical *faba*.” (Garrett).

Tahaa, occurring in greatest profusion in the northeastern part, but spread all over the island except in the area of *subangulata* (Garrett).

A subsvariety of *amanda* has been called var. *dubia* Garrett (pl. 17, figs. 4, 8) but that name was already in use for a Tahitian form of the *otaheitana* group. It is yellow with a white spire, white lip, and invariably has a parietal tooth. Some specimens have a chestnut umbilical area, or are somewhat suffused and streaked with fulvous, and the apex is pinkish brown. This form is found in some valleys on the north coast.

37. *P. NAVIGATORIA* (Pfeiffer). Pl. 16, figs. 9 to 13.

Shell perforate, dextral, oblong-ovate, solid, obsoletely granulose-striate, rather shining; fulvous, marked with close darker lines. Spire conic, rather acute, suture light, white-edged. Whorls 5, nearly flat, the last longer than the spire. Aperture oblong, narrow, whitish within, provided with a small callous [parietal] tooth deep on the ventral side of the penult whorl. Peristome somewhat thickened, strongly white-lipped within, the margins parallel, right margin narrowly expanded, somewhat toothed in the middle, columellar margin dilated, flat, reflexed. Length 23, diam. 11, aperture 13 x 8 mm. Type in Mus. Cuming. (*Pfr.*).

Lower portion of Vaioara valley, on the west coast of Raiatea and spread along the lowland forests south as far as Uparu valley; very abundant, associated with *P. fusca*; usually lurking beneath decaying vegetation, but sometimes taken on the trunks of trees. (*Garrett*).

*Bulimus navigatorius* PFR., P. Z. S., 1849, p. 131.—*Partula navigatoria* PFR., Monogr. iii, 449.—REEVE, Conch. Icon. vi, 1850, pl. 4, f. 21.—GARRETT, Journ. A. N. S. P. ix, p. 76.—*Partula variabilis* PEASE, Amer. Journ. of Conch. ii, 1866, p. 203; iii, 1867, p. 8, pl. 1, f. 12-14; P. Z. S. 1871, p. 473.—PFR., Monogr. viii, 201.

This form differs from *P. faba* chiefly by having the last two whorls less convex than usual in that species, and the aperture is narrower, more contracted. Moreover it lives for the most part on the ground, and has its own patterns of coloring, which however do not differ much from the patterns

of *faba* and *fusca*. Garrett writes that "hybrids between this species and *fusca* and *faba* are very frequent."

The typical coloration of *navigatoria* (fig. 9, copied from Reeve) and the synonymous *variabilis* is yellow, profusely streaked with chestnut, the spire often pinkish. This is the normal or usual form. Other patterns are:

Uniform yellow. Not common.

Uniform dark chestnut, or with pale apex. Not common.

The last form, greenish yellow, the base and a subsutural band chestnut, is not uncommon; it resembles typical *P. faba* in pattern.

"The parietal tooth mentioned by Pfeiffer, but not alluded to by Reeve or Pease, is not constant, but exists in about two-fifths of the adults. The former author's 'medio subdentato,' likewise not mentioned by the latter two writers, is simply the lower angle of the small labial sinus.

"In shape it varies from ovate to oblong-ovate, as the following two measurements will show: Length 25, diam. 13 mm.; length 20, diam. 13 mm." (*Garrett*).

38. *P. FUSCA* Pease. Pl. 17, figs. 5, 6, 7.

"Shell umbilicated, solid, varying from an abbreviate-ovate to oblong-ovate, roughly striated by irregular lines of growth, and the usual fine spiral incised lines become evanescent on the body-whorl; spire convexly conical, less than half the length of the shell; suture linearly impressed, frequently margined by a thread-like white line; whorls 5-6, more or less flatly convex, last one large, convex, rounded or turgid, sometimes slightly angled just above the aperture; base more openly umbilicated than usual in the ground species; aperture subvertical, oblong, sides nearly parallel; parietal region more or less glazed with callus, and sometimes dentate; peristome rather broadly expanded, moderately thick, slanting, flat or concave, strongly incrassated within and sinuous above; columellar lip depressed, receding or transversely grooved above. Color very variable: whitish corneous, straw-yellow, fulvous, light or dark chestnut, sometimes brown-

black, and frequently strigated. Yellowish horn-colored examples with the base and the sutural band chestnut, are not uncommon. The lip, though usually white, is frequently margined with purple-brown. Length 20, diam. 11 mm.

“The above is about the average dimensions. My largest example is 24 by 13½ and the smallest adult 17 by 10 mm. Sometimes, though rarely, the spire equals half the length of the shell. Very old examples have a more or less nodulous columella and a more or less distinct denticle on the outer lip.” (*Garrett*).

*Partula fusca* PEASE, Amer. Jour. Conch., 1866, p. 193; Proc. Zool. Soc., 1871, p. 473.—BINNEY, Proc. Acad. Nat. Sci. Phil., 1875, pp. 245, 247, pl. 19, fig. 9 (anatomy).—PFEIFFER, Mon. Hel., viii, p. 205.—SCHMELTZ, Cat. Mus. Godeff., vi, p. 81.—HARTMAN, Cat. Part., p. 6; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 182 (excl. *ovalis* and *lugubris*).—GARRETT, Journ. A. N. S. Phila. ix, p. 71, pl. 3, f. 50.—*Partula protea* PEASE, MS. coll. Pease, 1863.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 209.

Raiatea: The metropolis of this very variable ground species is in Vaioara valley, on the west coast of Raiatea, the headquarters of *P. garrettii* and *navigatoria*. It has not migrated any to the southward, but to the northward it occurs sparingly far up in Huaru valley. On the opposite side of the island it is found in Tepua valley, and I took a few in a small ravine more to the southward. The Tepua shell, which is the *protea* Pse., differs none from his *fusca*. (*Garrett*).

“Hybrids between *protea* and the arboreal *P. faba* are not uncommon, and are usually found adhering to the lower parts of the trunks of trees.

“In Vaioara, hybrids between *fusca* and *navigatoria*, and between the two former and *faba*, are so frequent as to be very embarrassing in the separation of the three species collected in that valley. Like the Tepua hybrids, all those between the two ground species and the arboreal *faba* live on the lower parts of the trunks of trees.” (*Garrett*).

Illustrated from specimens received from Garrett. Others from Pease are before me. This snail lives under cover on the ground, and the shell is less glossy than *navigatoria* or *fabu* which differ from *fusca* and *vittata* chiefly by their arboreal habits and brighter shells. The lip is usually expanded more than in *vittata*, which replaces *fusca* on the southwest. *P. fusca* occasionally has a small parietal tooth, but in *vittata* the tooth is almost invariable in fully adult shells.

38a. *P. F. VITTATA* Pease. Pl. 17, fig. 16.

The shape of the typical *vittata* is oblong-conic, more or less compressedly umbilicated, and the spire, which equals half the length of the shell, has straight outlines. The last whorl is not angular in front of the aperture. The ample, oblong aperture is considerably contracted by the intrusion of white callus on the inner margin of the peristome, and the sides are nearly parallel. The peristome is rather thin, widely expanded and usually stained with brownish purple. The white callus does not extend to the upper end of the lip, leaving a shallow sinus. The columella is flattened, *not calloused* or nodose, and reflected over the umbilicus. The color is whitish, yellowish corneous, fulvous or horn-color, frequently with the basal third of the body and a sutural band chestnut-color. Sometimes the apex is black or purple-black. The parietal tooth, though small, is constant, but so far within that it is hardly visible in a front view.

Length 23, diam. 13 mm. (fig. 16).

Length 24, diam. 12 mm. (*Pease*).

Length 25, diam. 11 mm. (*Garrett*, maximum size).

Society Islands: Restricted to the higher portions of Toloa valley, on the west coast of Raiatea, not uncommon under decaying vegetation. (*Garrett*).

*Partula vittata* PEASE, Amer. Jour. Conch., 1866, p. 194; Proc. Zool. Soc., 1871, p. 473.—PFEIFFER, Mon. Hel., viii, p. 200.—HARTMAN, Cat. Part., p. 7; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 169 (excl. *microstoma*).—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 75, pl. 3, f. 56.—*Partula approxi-*

*mata* PEASE, MS., SCHMELTZ, Cat. Mus. Godeff., v, p. 207.—GLOYNE, Quar. Jour. Conch., i, p. 338.—HARTMAN, Cat. Part., p. 7; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 179, 195 (no description).—GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 75.

Doubtfully distinguishable from *P. fusca*. The figure is drawn from the shell already figured by Garrett, who collected the type lot. He states that "no examples were discovered in Hapai or Vaian, the headquarters of *lugubris* and *ovalis*, which two valleys are between Toloa and the small ones inhabited by *approximata*."

38b. P. F. APPROXIMATA 'Pease' Garrett. Pl. 17, figs. 13, 14, 15.

This is a race subsidiary to *vittata* characterized by its inferior size, *smaller umbilicus*, which is frequently impervious, smaller aperture, and less expanded lip. The parietal tooth is very seldom developed. The banding is similar in the two forms, but occurs rarely in *approximata*, which differs also in being generally a lighter or darker chestnut-color, though both have similar horn-colored varieties, with brown streaks. The last whorl is usually angular in front, as in var. *terrestris*.

Occurs in greater or less profusion in several small valleys on the southwest part of Raiatea.

Cotypes from Garrett are figured.

38c. P. F. TERRESTRIS 'Pse.' Garrett. Pl. 17, figs. 9, 10, 11.

The shell is moderately umbilicate, thin, with only a trace of spiral striæ on the last whorl. It is (1) corneous with yellowish streaks, (2) chestnut colored, or (3) chestnut with an equatorial yellow zone. The apex is usually pale, but sometimes purple. *The last whorl is rather acutely angular immediately in front of the upper termination of the outer lip; or if not, an angle may be traced above the suture, near the aperture; the immature stage being strongly angular.* The aperture is *rather narrow, with a distinct prominence at the upper end of the lip-callus.* Lip moderately expanded,

white or pale. Columella concave, with no callus or nodule. A very small parietal tooth is usually present.

*Partula terrestris* Pease MS., GARRETT, Journ. A. N. S. P., ix, 1884, p. 75.—*P. castanea* Pse. MS., GARRETT, t. c. p. 76.

Differs from *P. vittata* chiefly by the distinct angulation of the body in front of the aperture. Cotypes in coll. A. N. S. P., no. 59450. Garrett writes:

“In the valleys on the southern part of the island ( Raiatea ), we find a gradual change from the typical *P. approximata* into the form known as *P. terrestris* Pease, which latter connects the former with *vittata*. The range of *terrestris* terminates at Opoa valley, on the southeast coast.

“At Faalooa, on the east coast, there exists a form, *P. castanea* Pease, which is intermediate between *terrestris* and *vittata*. It is usually chestnut-colored, constantly toothed on the parietal wall, and the fasciation is the same as in the other varieties. It has not spread any to the northward of Faalooa, but occurs more sparingly in a small valley between Faalooa and Opoa.” (*Garrett*). A specimen of *castanea* received from Pease is figured (pl. 17, fig. 12). It is absolutely identical with *terrestris*.

### 39. *P. PLANILABRUM* Pease. Pl. 18, figs. 1, 2, 3, 4.

Shell long-ovate, solid, umbilicate; whorls 5, plano-convex; aperture oblong-oval, somewhat ear-shaped, toothed. Lip oblique and broadly flattened, thickened within, projecting outwardly, having a toothed callus. Columella straight, angular at the base. Chestnut-colored, pale at the suture, sometimes encircled with a broad yellowish-brown band. Length 22, diam. 12 mm. (*Pse.*).

East coast of Tahaa.

*Partula planilabrum* PEASE, Proc. Zool. Soc., 1864, p. 672; 1871, p. 473. — PFEIFFER, Mon. Hel., vi, p. 156. — BINNEY, Proc. Acad. Nat. Sci. Phil., 1865, pp. 245, 247.—SCHMELTZ, Cat. Mus. Godeff., vi, p. 81.—HARTMAN, Cat. Part., p. 7; Obs. Gen. Part. Bull. Mus. Comp. Zool., ix, pp. 185, 188, 190. —GARRETT, Journ. A. N. S. Phila., ix, 1884, p. 63, pl. 3, f. 77.



—*Partula suturalis* PEASE, P. Z. S. 1864, p. 675, nude name, (not of Pfeiffer).

The callous rim and "tooth" within the outer lip are more strongly developed than in *P. faba*, *fusca* and their immediate allies. There is an oblong callous lump on the face of the columella, more or less visible in different examples. The white border below the suture is an important feature of the species, very rarely wanting. *P. planilabrum* is larger and more elongated than *P. bilineata*, and the surface is not so smooth and shining. The structure of the peristome is similar in the two shells, but the aperture is more elongate in *planilabrum*. The parietal tooth is constant in adults but varies in size. The following color-forms are found.

Pl. 18, figs. 2, 3. The type is deep chestnut-brown, gradually fading into yellowish corneous towards the sutural line; the whitish lip is frequently tinged with violet.

Pl. 18, fig. 4. Fulvous yellow, with the basal half of the body-whorl and a revolving band below the whitish subsutural border, deep chestnut-brown. Not infrequent.

Pl. 18, fig. 1. Pale corneous or light fulvous with indistinct oblique streaks. Rare.

Numerous specimens from Pease and Garrett show it to be rather constant in form, but some shells show an angle on the last whorl, in front of the aperture. Garrett writes: "The metropolis of this species is Haamene valley, on the east coast of Tahaa, where it is common, and, though usually lurking beneath decaying vegetation, is sometimes found adhering to the trunks of the wild banana. It is found, though less abundant, in a valley north of its specific centre, but does not occur in the intermediate valley Faa-apa, the home of *bilineata*."

#### 40. *P. BILINEATA* Pease. Pl. 19, figs. 8, 14.

The shell is rather openly umbilicate, ovate-conic, solid, *smooth and glossy*, marked lightly with growth-lines. Spire almost straightly conic, the apex frequently dark. The suture is margined with a white line. Ground-color whitish-corneous,

pale yellow or brownish yellow, typically with a narrow brown band revolving a short distance below the suture, and a wider one just below the periphery; but sometimes the whole base is dark chestnut, or the whole shell may be dark except for a light equatorial girdle or zone. The aperture is nearly white inside, lip broad, white, well expanded and strongly thickened within. The columellar lip bears on its inner face a low nodule, sometimes hardly noticeable. The parietal tooth is deeply placed and well developed.

Length  $20\frac{1}{2}$ , diam. 13 mm. (fig. 8).

Length 18, diam. 12 mm. (Pease).

Tahaa, confined to Faa-apa valley on the east coast, where it occurs in abundance on the trunks of a species of wild banana and at the roots of ferns. (Garrett).

*Partula bilineata* PEASE, Amer. Jour. Conch., ii, 1866, p. 201; 1867, p. 81, pl. 1, fig. 10; Proc. Zool. Soc., 1871, p. 473. —BINNEY, Proc. Acad. Nat. Sci. Phila., 1875, pp. 245, 247, pl. 19, fig. 10 (anatomy). —PFEIFFER, Mon. Hel., viii, p. 195. —SCHMELTZ, Cat. Mus. Godeff., vi, p. 81. —HARTMAN, Cat. Part., p. 8; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 180, 196. —GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 62.

*P. planilabrum* is more lengthened and less glossy than *bilineata*, and the two have not the same cycles of color-forms. *P. umbilicata* is a still more shortened and globose form. These three species of Tahaa are slight modifications of the ancestral Raiatean *P. auriculata* stock. Fig. 14 represents Pease's type specimen. Garrett writes of *P. bilineata*: "It is readily distinguished by its smooth, glossy surface, ovate-conic form, yellowish horn-color, and two revolving chestnut-brown bands, the upper one narrow and subsutural. The subacute apex is sometimes purple-brown and the suture is margined by a narrow, rugose, whitish line. The constant parietal tooth is prominent and the broad white peristome is slightly emarginate above, strongly labiate within, and widely expanded.

Var. *a*. With a single broad median chestnut-brown band. Not common.

Var. *b.* Chestnut-brown with a yellowish horn-colored sutural band. Very rare.

Var. *c.* Uniform yellowish horn-color. Very rare.

They are all remarkably uniform in shape and size."

41. *P. auriculata* Broderip. Pl. 18, figs. 8 to 12.

"Shell perforate, ovate-pyramidal, chestnut colored; whorls 6, somewhat swollen, longitudinally striated. Aperture white, ear-shaped, the lip flat and thick; a white tooth on the internal face of the last whorl. Length  $\frac{3}{4}$ , diam.  $\frac{1}{2}$  inch. A variety is yellowish with the outer margin of the aperture somewhat roseate.

"The thick, flattened lips forming the aperture of this species are so disposed as to give the mouth, in many individuals, the appearance of a key-hole, while in others it is ear-shaped." (*Brod.*)

Raiatea, in the lower half of Hamoa valley, on the east coast near the north end of the island; it has spread northward in two small valleys (Garrett, for *P. compacta*); Utuloa, north end of Raiatea, in great profusion, with *P. faba* (Garrett, for *P. auriculata*); arboreal.

*Partula auriculata* BRODERIP, Proc. Zool. Soc., 1832, p. 125.—REEVE, Conch. Syst., ii, pl. 175, figs. 7, 8.—PEASE, Amer. Jour. Conch., 1866, p. 201.—SCHMELTZ, Cat. Mus. Godeff., iv, p. 71.—HARTMAN, Cat. Part., p. 7, with woodcut; Obs. Gen. Part., Bull. Mus. Comp. Zool. ix, pp. 180, 186, 192.—GARRETT, Journ. A. N. S. P. ix, 1884, p. 58.—? *Partula tahulana* ANTON, Verz. Conch., p. 40 (1839), nude name; (quoted *tabulana* by Garrett).—*Partulus auriculatus* BECK, Ind. Moll., p. 58.—*Bulimus auriculatus* PFEIFFER, Symb., i, p. 80; ii, p. 111.—*Bulimus otaheitanus* PFEIFFER, Mon. Hel., ii, p. 71 (part).—*Partula otaheitana* REEVE (not of Brugière), Conch. Ieon., pl. 2, fig. 11a, b.—*Partula robusta* PEASE (MS. coll. Pease, 1863), SMITH, Annals Carnegie Mus. i, p. 436, no. 4140, 4141.—*Partula tahitana* SCHMELTZ (not of Gould), Cat. Mus. Godeff., v, p. 92.—PEASE, Proc. Zool. Soc., 1871, p. 473.—? ? *Partula maura* Muhl. ANTON, Verz.

zeichniss p. 40 (nude name).—*Partula compacta* PEASE, Amer. Jour. Conch., 1866, p. 200; 1867, p. 81, pl. 1, fig. 9; Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—PFEIFFER, Mon. Hel., viii, p. 207.—HARTMAN, Cat. Part., p. 7; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 181, 192.—GARRETT, Journ. A. N. S. P. ix, 1884, p. 55.—*Partula solidula* Pse. MS., H. H. SMITH, Annals Carnegie Mus. i, p. 436, no. 4142.

This arboreal species is obese, solid, not very glossy, with a moderate or quite narrow umbilicus. The lip is not very broadly expanded, but is strongly thickened within, white, flat, often more or less dentate, and is conspicuously excised above. The columella is oblique, broad, and bears a moderate or heavy callus which is notched at the insertion above. The parietal tooth is well developed.

Length 20, diam. 13.5 mm.

Length 21, diam. 13.3 mm.

*P. auriculata* has been united by many authors with the totally different *P. otahaitana* of Tahiti. The erroneous locality "Huaheine" was given by Cuming, who collected the types. As Pease and Garrett have already remarked, *P. auriculata* was evidently based upon several forms of this group, but the emphasis laid by Broderip upon the flat lip indicates that the form described as *P. compacta* by Pease is practically typical *auriculata*. Reeve's *Conchologia Iconica*, *Partula* plate 2, figure 11b may be considered the type of *P. auriculata*. I have figured similar shells, pl. 18, figs. 10, 11. The color is usually light brownish yellow, but it varies to light chestnut in the lots before me. Fig. 9, copied from Reeve's figure of one of the original lot, is unlike the *compacta* I have seen in being banded. Pease's type of *compacta*, now before me, is a typical *auriculata* in development of the apertural callosities. In many individuals the "teeth" are less developed, as in fig. 8.

41a. *P. A. ROBUSTA* Pease. Pl. 18, figs. 13 to 16.

The shell is somewhat smaller than the largest *P. auriculata*,

more *compactly ovate*, very solid, the lip very little expanded and *very much thickened on the convex face*, though less broad than in *auriculata*, and with less prominent internal callosities, hence the aperture is more open. The parietal tooth is smaller than in *auriculata*, and often almost disappears. The lip is generally *brown-edged*, and often a raised callus connects the ends. The columellar lip is seen, in profile view, to be very thick, and the umbilical crevice is narrow. Color-patterns as follows:

- a. Last  $1\frac{1}{2}$  or 2 whorls corneous, copiously streaked obliquely with chestnut; the next earlier whorl rich chestnut, deepening to purple-black towards and at the summit. This is the typical coloration.
- b. Yellowish, with some faint brownish streaks, apex pale. Approaches *auriculata* in form.
- c. Dark chestnut throughout, with more or less distinct paler oblique streaks on the last whorl.
- d. Chestnut colored with a broad corneous or yellowish zone above the middle of the last whorl. This pattern also occurs in *auriculata*.

Length 19.5, diam. 11.5, aperture 11 mm. (fig. 14).

Length 17.5, diam. 11, aperture 10 mm.

*P. robusta* has not before been figured, but descriptive notes were published by Smith in his catalogue of the Hartman collection. Types no. 59444 A. N. S. P.

#### 4. *Species of Huaheine.*

Huaheine possesses four species all endemic. Two (*P. arguta* and *annectens*) are restricted to two valleys, and the latter, like *P. clara*, appears to be gradually becoming extinct. Both species are remarkably uniform in all their specific characters, and are related to forms of Tahiti and Raiatea. On the contrary, the other two species (*P. rosca* and *varia*) have spread nearly all over the island, and are subject to considerable variation. Neither is closely related to other Society Island species, but a form scarcely distinguishable from *varia* occurs at Rarotonga. It is worthy of remark that

dentated species, which are so common in all the islands except Borabora, do not occur on Huaheine.

The structure of the kidney raises a doubt as to the systematic position of *P. rosea* and *varia*. They may belong in or near the section *Samoana* rather than to *Partula s. str.*

42. *P. VARIA* Broderip. Pl. 23, figs. 1 to 12.

Shell openly perforate, ovate-pyramidal, thin, glossy, composed of nearly 5 convex whorls, the last rounded periferally, or slightly subangular in front; *very convex or saccate at the base*. Surface with sculpture of fine growth-striae and minute spiral lines, which are more or less obsolete on the last whorl. Aperture vertical, white or purplish-brown within, the lip reflexed, evenly thickened within, white or purple-brown. Length 17, diam. 11 mm.

Huaheine: "The metropolis of the typical *P. varia* is in two valleys on the west coast of Huaheine, where they are very abundant on foliage, but it is generally distributed throughout all parts of the island." (*Garrett*).

*Partula varia* BRODERIP, Proc. Zool. Soc., 1832, p. 125.—REEVE, Conch. Syst., ii, pl. 75, figs. 5, 6; Conch. Icon., pl. 3, figs. 17 a. b. c.—PFEIFFER, Mon. Hel., iii, p. 448.—PEASE, Proc. Zool. Soc., 1871, p. 473, with var. *glutinosa*, *pulchra*, *simplex*.—SCHMELTZ, Cat. Mus. Godeff, v, p. 92.—HARTMAN, Cat. Part., p. 14; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, pp. 189, 191 (excl. *strigata*).—*Bulimus varius* PFEIFFER, Symb., i, p. 86; ii, p. 124.—*Bulimus roseus* var. *b. minor* PFEIFFER, Mon. Hel., ii, p. 70.—*Partula glutinosa* PFEIFFER, Proc. Zool. Soc., 1852, p. 85; Mon. Hel., iii, p. 448; Conchyl. Cab. p. 265, pl. 44, f. 16, 17 (*in insulis Salomonis*).—*Partula mucida* PFEIFFER, Proc. Zool. Soc., 1855, p. 98; Mon. Hel., iv, p. 513 (*in insulis Pacificis*).—*Partula pulchra* PEASE, MS. SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—*Partula huahainensis* GARRETT, as syn. of *varia*, t. c. 1884, p. 78, 79.—*Partula bicolor* GARRETT, Journ. A. N. S. P. ix, 1884, p. 79 (not of Pease).—*Partula adusta* GARRETT, MS., undescribed.—*Partula perplexa* Pease, MS., H. H. SMITH, Ann. Carnegie Mus. i, p. 463, no. 4277.

This common Huaheine species is smaller and more glossy than *P. rosea*, and differs in its range of color-variation. According to Andrew Garrett, the type form "is very variable in coloration, and considerably so in size and shape. The smallest form, which = *P. pulchra* Pse., gradually merges into the type, and is restricted to the larger of the two valleys called Hamene. The type which equals my *huaheincensis* and *adusta*, is usually corneous, luteous, more frequently fulvous, rarely white, and the most abundant variety is dark chestnut, sometimes nearly black with a pale apex and dark or pale lip (fig. 1). Deep chestnut-colored examples, with a wide or narrow central pale band, are not uncommon (fig. 2). The form with an obscure central fulvous band on a pale ground, is rather common (figs. 6, 7).

"In the higher portion of Hamene may be found a large form (*bicolor* Garr., not of Pease) which is either uniform straw-yellow, or greenish yellow, with or without a dark chestnut spire. It differs from the typical *varia* in being larger, more robust, the whorls more inflated and the aperture wider. Specimens from Garrett are figured, pl. 23, figs. 4 and 8.

"In a valley named Faahiti, on the northern part of the island, we find in the greatest profusion, associated with *P. rosea cognata* Pse., a form shaped like '*bicolor*,' but smaller and more variable in color than the typical *varia*. The most common variety is light yellowish, sometimes strigated, the lip, and sometimes the base, stained with burnt-brown or violet-brown. Nearly half of the specimens are uniform fulvous brown, or chestnut-brown approaching black. The variety with central pale band is also very frequent, as well as the one of a uniform whitish or luteous with white lip. The pale variety with chestnut spire is somewhat rare, besides one with a dark spire and two narrow bands on the body-whorl. A lot of these shells sent to the 'Museum Godeffroy,' were by Prof. Mousson referred to Morelet's *P. simplaria*, and have been freely distributed under that name. Morelet cites 'Tahiti' as the habitat of his species. His 'apice obtuso rosaceo' and 'sutura albo marginata' do not occur in these

shells, nor any of the varieties of *varia*” hence the name *simplaria* should not be applied to them. Specimens of various color-patterns are figured, pl. 23, figs. 9, 10.

The form called *P. glutinosa* Pfr. is straw colored or pale fulvous, the lip white with a purplish-brown border. It was originally described as from the Solomon Islands. Fig. 11 is a copy of the original figure. A specimen received from Cuming is drawn in fig. 15. “*P. perplexa* Pse. MS.” of H. H. Smith is the same.

*P. mucida* Pfr. was based on the uniform chestnut colored form of *varia*. A figure of the type specimen in the British Museum is given, pl. 41, fig. 13.

#### 43. *P. ROSEA* Broderip. Plate 22.

The shell is openly perforate, rather thin, ovate-pyramidal, moderately glossy; under a lens it is seen to be marked with fine growth-lines and close, waved, distinctly engraved spiral lines. Whorls 5, very slightly convex, the last generally angular at the periphery, in front of the aperture. The aperture is ovate, slightly oblique; outer lip well expanded, thin-edged, strengthened with a narrow callous rim within, gradually tapering to the upper end. Columella thin, dilated above. Parietal film transparent, toothless.

Length 22, diam. 13 mm.

Length 23, diam. 13 to 15 mm.

The typical color (pl. 22, figs. 1, 2) is uniform rose, including the interior and lip; but in many examples the embryonic whorls are paler or yellowish with a pink sutural line.

Huaheine: “The headquarters of this beautiful and well-known arboreal species is in a large forest at the head of Hawai bay on the west side of Huaheine. From this region, where they are very numerous, they have spread over many parts of the island. They differ but little in shape in the different localities, except in Faahiti on the north coast, where they (the *P. cognata* Pease) are smaller, less angulated on the last whorl, and in the total absence of the uniform dark purple-brown and rose-colored varieties which are so com-



mon elsewhere. The most numerous variety of the *cognata* form is straw-yellow with the sutural line tinted with rose or purple rose. A rose or purple-brown variety with a central yellow band is found in no other part of the island." (*Garrett*).

*Partula rosca* BRODERIP, Proc. Zool. Soc., 1832, p. 125.—REEVE, Conch. Syst., ii, pl. 175, figs. 9, 10; Conch. Icon., pl. 1, figs. 1a, b, c.—PFEIFFER, Mon. Hel., iii, p. 448; iv, 509; vi, 157; Conchyl. Cab., p. 272, pl. 64, f. 23-28.—PEASE, Proc. Zool. Soc., 1871, p. 473.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—HARTMAN, Cat. Part., p. 14 (with woodcut); Obs. Gen. Part., Bull. Mus. Com. Zool., ix, pp. 186, 191 (excl. *simplaria*).—GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 67.—H. H. SMITH, Ann. Carnegie Mus. i, p. 461, with *cognata* and *estaliana*, p. 462.—*Partulus roseus* BECK, Ind. Moll., p. 57.—*Bulinus roseus* PFEIFFER, Mon. Hel., ii, p. 70, exclusive of var. *b*.—*Partula purpurascens* PFEIFFER, Proc. Zool. Soc., 1856, p. 333; Mon. Hel., iv, p. 511.—*Partula cognata* PEASE, MS., SCHMELTZ, Cat. Mus. Godeff., v, p. 92.—GLOYNE, Quar. Jour. Conch., i, p. 338.—GARRETT t. c. p. 68.

Besides the common typical rose-colored form (figs. 1, 2), the following color-patterns occur. From Garrett's remarks it appears that several of the patterns occur together, so that they seem ordinarily to have no racial status. The somewhat smaller form *cognata* seems to have incipient racial features.

2, form *purpurascens* Pfr. Dull purple, the aperture and lip violet, common (fig. 3).

3, form *bipartita*. Upper surface rose (fig. 4) or purple (fig. 5) base pale yellow, the lip white. "Frequent in the metropolis of the species but very rare elsewhere" (*Garrett*).

4, form *bicolorata*. Spire rose or purple, fading at the end of penultimate whorl to straw yellow or corneous on the last whorl; apex whitish; mouth and lip white (figs. 6, 7). Common.

5, form *straminea*. Straw-yellow or yellowish-corneous, the apex or whole spire corneous-white; aperture and lip

white (figs. 8, 9). According to Garrett this form is very abundant.

6, form *zonata*. Yellow, with the base and a narrow or rather wide sutural band brown, purple-brown or rose-color, mouth bicolored. Common (fig. 10, 11). Varies in size from 24 x 13.5 to 21.5 x 12.5 mm.

7, form *cognata* 'Pse.' Garrett. Often smaller, length 19.5 to 23 mm., yellow with the suture tinted with rose or purplish; aperture white (pl. 22, figs. 12, 17; pl. 33, fig. 3), "Very common in Faahiti valley, but rare elsewhere" (Garrett). This small form varies to light yellow with pallid spire, and to yellow with purple or roseate spire, like form *bicolorata*; or it may have the color of form no. 6.

8, form *estalliana* 'Garrett' Smith. Shell small, thin, whitish-corneous or yellowish, with the base and a band below the suture rose or dull purple, leaving the lighter tint in a broad zone or band. Occurs in Faahiti valley only (figs. 13, 14).

This form varies to yellow or corneous-yellow shells, with the spire corneous or more or less purple-tinted, lip whitish or with a purplish tint (figs. 15, 16).

Broderip's original description of *P. rosea* follows: "Shell ovate-pyramidal, roseate; whorls 6, longitudinally substriate, subdecussate with very close lines, the last largest; epidermis thin. Length  $\frac{7}{8}$ , diam.  $\frac{1}{2}$  inch.

"Var. *a*, purple-brown. Var. *b*, whitish, sutures and base of the last whorl roseate, epidermis yellow." (Brod.).

44. *P. ANNECTENS* (Pease). Pl. 24, figs. 5, 6.

The shell is perforate, oblong-ovate, *very thin, pellucid*, slightly yellowish corneous, sometimes with a pale ruddy tint at the apex, the suture bordered with an opaque white line. Surface lustrous, showing fine growth-lines, and very close, minutely crimped, spiral striæ throughout. Whorls  $4\frac{1}{2}$ , convex, the last one compressed or somewhat flattened below the periphery, therefore unusually convex close to the perforation. The aperture is quite oblique, ovate; peristome thin, re-

flexed throughout, white, the columellar margin dilated and bifurcate above. Parietal wall covered with a scarcely noticeable film.

Length 13, diam. 7.25 mm.; aperture 7.8 mm.

Length 14, diam. 7 mm.; aperture 7.8 mm.

Huaheine: "This delicate arboreal species is excessively rare, and has only occurred to my notice in two valleys on the west coast of Huaheine." (*Garrett*).

*Bulimus annectens* PEASE, Proc. Zool. Soc., 1864, p. 671.—PFEIFFER, Mon. Hel., vi, p. 48.—*Partula annectens* PEASE, Proc. Zool. Soc., 1871, p. 473.—HARTMAN, Cat. Part., p. 12; Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 179.—GARRETT, Journ. A. N. S. P. ix, 1884, p. 66, pl. 3, f. 70.

"It is more fragile and less slender than *P. attenuata*, the nearest allied form. The spire is less than half the length of the shell, and the suture is margined by a white line. The dull whitish peristome is widely expanded. The aperture is never dentate, and the yellow-corneous shell is faintly tinged with greenish.

"The animal varies from pale luteous-yellow to light brownish yellow. The soft parts, as seen through the transparent shell, are mottled with slate-colored spots. The foot is about the same length as the shell, and the ocular peduncles are very long and slender." (*Garrett*).

### 5. *Species of Borabora.*

45. *P. LUTEA* Lesson. Pl. 23, figs. 16, 17, 18, 19.

This species resembles the preceding [*P. lineata*], but it is distinguished by having the peristome less thick, by the umbilicus, of which the crevice is obliterated. Its altitude is 8 lines by 5 in diameter. Its spire is more swollen than in the preceding. The shell is thinner, and entirely corneous yellow. The Yellow Partula lives on the island of Borabora (*Lesson*).

Society Is.: Borabora (Lesson, Garrett, Voy); widely diffused throughout the island, on the trunks and foliage of trees and bushes. (*Garrett*).

*Partula lutea* LESSON, Voy. autour du Monde La Coquille, Zoologie, ii, pt. 1 (1831), p. 325.—PFEIFFER, Mon. Hel., iii, p. 453.—PEASE, Proc. Zool. Soc., 1871, p. 473.—HARTMAN, Cat. Part., p. 8 (with woodcut); Obs. Gen. Part., Bull. Mus. Comp. Zool., ix, p. 184, part.—GARRETT, J. A. N. S. Phila. ix, 1884, p. 53.—*Bulimus luteus* DESHAYES, in Fér., Moll., ii, p. 123, pl. 158, figs. 17, 18.—PFEIFFER, Mon. Hel., ii, p. 229.—*Partula solidula* Rve., PFR., Monogr. iii, p. 452; Conchyl. Cab., *Bulimus*, pl. 64, f. 15, 16; pl. 65, f. 12, 13.—SCHMELTZ, Cat. Mus. Godeff., v, p. 92 (not of Reeve).—*Partula lilacina* PFEIFFER, Proc. Zool. Soc., 1856, p. 334.

This is a rather solid, obscely ovate-conic shell, with straightly conic, acute spire and rather glossy surface. The spiral striation is generally weak in the median part of the last whorl, more distinct above and below. The first two whorls are flattened and slope steeply, giving the apex a more acutely conic shape than usual. Whorls 5, the post-embryonic ones rather convex, *last whorl inflated*. The aperture is somewhat oblique; outer lip reflexed and thickened within, white. Columellar margin only very little dilated at its insertion, near which it is thickened by a callous deposit on the inner margin of its face. The parietal wall is covered with a transparent callus, which near the lip-ends is thickened and white. There is no parietal tooth. *The umbilicus is reduced to a very narrow, short chink*. The color is variable:

1. Uniform pale yellow.
2. Pale yellow with brownish apex.
3. Isabelline, the first 2½ whorls purple-brown or blackish violet.
4. Purple-brown, covered on the last whorl with a yellow cuticle, which is thin and transparent on the spire, the suture white (*lilacina* Pfr.).

The size and shape vary. Lesson's type was evidently near the small extreme in size. Shells from a lot collected by C. D. Voy, color-forms 2, 3, 4, measured:

Length 19, diam. 11, aperture 10.1 mm.

Length 18.8, diam. 11, aperture 10.5 mm.

Length 18, diam. 11.5, aperture, 10.8 mm.

Others are more ventricose:

Length 19.8, diam. 12.2, aperture 11.5 mm.

Length 17.2, diam. 11, aperture 10 mm.

Length 17.4, diam. 11, aperture  $9\frac{1}{2}$  mm.

According to Garrett, "notwithstanding its wide range over the island, it has not developed a single local variety. In fact it exhibits less variation than some of the species at the other islands which are restricted to single valleys."

Dr. Hartman and Andrew Garrett are agreed that *Partula lilacina* Pfr. is a color-phase of *P. lutea*. A figure of the type specimen in the British Museum is given, pl. 41, fig. 14.

6. *Species of unknown habitats, probably from the Society Is.*

The following will probably prove to be forms of some of the species already known from the Society Islands; but their status can only be determined by examination of the type specimens.

#### 46. *P. STOLIDA* Pease.

"Shell elongate, ovate, dextral, rather dull, umbilicate, very finely roughened longitudinally and indistinctly under the lens striated transversely; whorls 5, convex; suture impressed; aperture elongately oval, rather small, not one-half the length of the shell, dentate, rarely edentate; lip somewhat roundly thickened, chestnut or olivaceous, obscurely and very finely striped longitudinally. Length 20, diam.  $10\frac{1}{2}$  mm. Tahitian archipelago. Terrestrial." (Pease).

*Partula stolidia* PEASE, Amer. Jour. Conch., 1866, p. 198; Proc. Zool. Soc., 1871, p. 473. — PFEIFFER, Mon. Hel. Viv. viii, p. 195.

Garrett, in his work of 1884, identified specimens of *P. compressa* as *stolidia*; but they cannot be made to agree with Pease's description. Pease himself, in 1871, gives the locality *Raiatea*; yet his testimony is of doubtful value. Perhaps

*P. stolida* will prove, if the type specimen can be found, to be a form of the *otaheitana* series from Tahiti.

47. *P. NITENS* Pfeiffer.

Shell subperforate, come-ovate, swollen, rather thin; longitudinally very delicately striate; glossy, diaphanous; tawny-brown, above obsoletely, at the base broadly banded with buff. Spire come, rather acute. Suture lightly impressed, whitish. Whorls 5, a trifle convex, the last about equal to the spire, rounded at the base. Aperture slightly oblique, acuminate-oval; peristome white, the right margin somewhat spreading above, moderately expanded; columellar margin dilated, spreading somewhat over the perforation. Length 17, diam. 10 mm.; aperture with peristome 10 mm. long,  $4\frac{1}{3}$  wide inside. (*Pfr.*).

Habitat unknown (Cuming coll.).

*Partula nitens* PFR., P. Z. S. 1854, p. 293; Monogr. iv, 513.

48. *P. PACIFICA* Pfeiffer.

Shell compressed-umbilicate, oblong-conic, rather thin, under a lens very minutely striated spirally, slightly shining, straw colored radiated with white and tawny lines. Spire conic, the apex acute; suture deep, submarginate. Whorls  $5\frac{1}{2}$ , convex, the last a little shorter than the spire, somewhat tapering basally. Columella receding above, vaulted over the umbilicus. Aperture slightly oblique, truncate-oblong; peristome white, spreading and reflexed. Length 22, diam. 10 mm.; aperture  $9 \times 4\frac{1}{2}$  mm. inside (*Pfr.*).

Islands of the Pacific Ocean (Cuming coll.).

*Partula pacifica* PFR., Proc. Zool. Soc. 1854, p. 154; Monogr. iv, 509.

“Very closely related to *P. radiolata*, but differing in size, the acute spire, convex whorls etc.” (*Pfr.*). Dr. Hartman has considered *pacifica* a variety of *P. otaheitana*.

49. *P. SIMPLARIA* Morelet. Pl. 23, figs. 13, 14.

Shell perforate, ovate-conic, rather ventricose, yellowish-fulvous, thin, striolate, and delicately decussate towards the

apex; spire conic, the apex obtuse, roseate. Whorls  $5\frac{1}{2}$ , a little convex, the last slightly more than half the total length; suture white-margined. Aperture subvertical, ovate, the throat whitish; peristome thin, narrowly expanded, pale flesh colored, the columellar margin dilated, overhanging. Length 19, diam. 10, aperture  $10 \times 8$  mm. (*Morelet*).

Tabiti (*Morelet*).

*Partula simplaria* MOREL., Journ. de Conchyl. 1853, p. 370, pl. 11, f. 13, 14.—PFR., Monogr. iv, 512.

This *Partula* is distinguished from *P. varia* by its swollen shape, obtuse summit, wider, less oblique and more rounded aperture, and finally the less thickened, less dilated peristome (*Morelet*).

This form has not been rediscovered, and its locality is uncertain. It stands near *P. assimilis*; and by some authors has been considered a form of *P. rosea* or *P. varia*.

#### 50. *P. DIMINUTA* C. B. ADAMS.

“Shell rather thick, ovate-conic; translucent, horn-colored, sometimes reddish, with a thin shining brownish horn-colored epidermis, which is much interrupted by transverse stripes; with the tip white, with unequal, irregular, rather coarse transverse striæ, and numerous excessively minute impressed spiral lines; apex subacute; spire rather short, with the outlines slightly curvilinear; whorls five, a little convex, with a moderately impressed suture; last whorl moderately oblique: aperture rather small, subovate, with a tubercle on the middle of the intruding part of the last whorl: lip much thickened, but narrow, with a regularly rounded surface: umbilicus small.” (*Ad.*)

Length .63, greatest breadth .36, length aperture .23 inch, mean divergence  $58^\circ$ .

Length .525, greatest breadth .28, length of aperture .21 inch, mean divergence  $60^\circ$ .

Habitat unknown (Mus. Amherst College).

*Partula diminuta* C. B. ADAMS, Annals of the Lyceum of Natural History of N. Y., v, p. 41 (1851); Contrib. to Conch. no. 8, p. 125.

“This species resembles a variety (*P. auriculata* Brod.) of *P. otahcitana* Brug., but is more slender as well as smaller.” (*Ad.*). Possibly a form of *P. otahcitana*.

51. *P. OBESA* Pease. Pl. 41, fig. 22.

“Shell umbilicate, abbreviate, conically ovate, rather thin, light, transversely very finely, closely and undulately striated; whorls  $4\frac{1}{2}$ , the last very large, comprising nearly three-fourths the length of the shell, somewhat inflated and produced obliquely, rounded at base, spire short, conical, rather acute; aperture oblique, ovate; lip widely flatly expanded, white on both its outer and inner sides; columella slightly expanded above; greenish yellow, encircled with a broad white band beneath the suture.

Length 20, diam. 14 mm.

Habitat unknown.

*Partula obesa* PSE., American Journal of Conchology iii, p. 222, pl. 15, f. 12 (Jan. 2, 1868).

The figure does not agree well with Pease's measurements.

“We have no locality for the above species. It appears to approach the Marquesan type, and *may* be allied to *lilacina* Pfr. It is covered with a thin epidermis, which, when worn off, would probably leave the shell without color, as is the case with *ganymedes*, Pfr. We have but a single specimen.” (*Pease.*)

### III. PARTULÆ OF THE AUSTRAL AND HERVEY GROUPS.

The few species of these groups are very closely related to those of the Society Islands, and no doubt are of common derivation.

In the Austral Group, *Partula hyalina* (see p. 180) is found on Tubuai and Rurutu (Oheteroa). No other *Partula* is known from the group. One island, Rurutu, has been somewhat carefully explored for land shells (see Garrett, Proc. A. N. S. Phila. 1879, pp. 17-30).

In the Hervey or Cook's Group, *P. hyalina* has been found on Mangaia and Rarotonga. *P. assimilis* Pse., a form very close to *P. varia* of Huaheine, occurs on Rarotonga. Pease



has stated that the Raiatean *P. hebe* is found on Mangaia (Journ. de Conchyl. 1870, p. 401) but his records occasionally prove erroneous, and this one seems doubtful.

52. *P. ASSIMILIS* Pease. Pl. 41, figs. 5, 9.

The shell is narrowly umbilicate, ovate-conic, rather thin; corneous or faintly yellowish-corneous, nearly uniform, but under a lens it appears to be very indistinctly marked with pale brown streaks; the early whorls are sometimes pale brown.  $2\frac{1}{3}$  embryonic whorls with the usual subpunctate spiral lines, succeeding whorls finely weakly striate spirally, convex. The last whorl is quite convex, *very indistinctly* marked with more or less effaced spiral lines, or they may be almost wholly absent. Aperture slightly oblique, white or flesh-tinted within. Peristome white or flesh-colored, reflexed and somewhat thickened within. Columellar lip dilated above.

Length 18.3, diam. 10.5, aperture 10 mm.; whorls 5.

Length 17.2, diam. 10, aperture 9.3 mm.; whorls  $4\frac{1}{2}$ .

“Length 17, diam. 9 mm.” (*Pse.*).

Hervey Is.: Rarotonga (Pease).

*Partula assimilis* Pse., Amer. Journ. of Conch. iii, p. 230, pl. 15, f. 28, 29.—Journ. de Conchyl. 1870, p. 401, with var. *virgulata* Pse.—PFR., Monogr. viii, p. 197.—*Cf.* GARRETT, Journ. A. N. S. Phila. ix, 1884, p. 80.—*Partula cookiana* ‘Mouss.,’ Schmeltz, Museum Godeffroy Catalog v, 1874, p. 92 (name only).

This species closely resembles the pale, yellowish form of *P. varia* of Huahaie, but differs by the thinner, less conic shell, with the spire more swollen, apex more obtuse and the lip is less thickened within.

Pease has described a “var. *virgulata*, shell generally shorter than the typical form, longitudinally streaked with light red; alt. 15, diam 9 mm. Rarotonga.”

Two specimens out of the Pease duplicates, from a series received from Dr. Hartman, have the summit purplish, like the form of *P. varia* figured on pl. 23, fig. 4, yet I do not feel certain that they are really from Rarotonga.

## IV. PARTULÆ OF THE SAMOAN ISLANDS.

The Samoan Partulæ are still very imperfectly known, species having been collected only on Upolu and Tutuila. Nothing is known of the species of the largest island, Savii, if any exist there, or of several smaller islands of the group.

The known forms belong to four groups, quite diverse in texture and coloration, but two of them are alike in having the umbilicus unusually open.

## Key to Samoan species.

- a. Umbilicus or rimation very broadly open.
  - b. Shell covered with a greenish-yellow or chestnut enticle; whorls 5 to 5½.
    - c. Last whorl spirally striate throughout.
      - d. Dextral.
        - e. Length 21, diam. 14 mm.  
*P. abbreviata*, no. 56.
        - ee. Length 22 x 13 to 25 x 14 mm.  
*P. stevensoniana*, no. 55.
      - dd. Sinistral; greenish-yellow with pale spire.  
*P. conica*, no. 54.
    - cc. Later whorls without spiral striæ except at the base of the last whorl; spire dark-colored.
      - d. Last whorl swollen at base; umbilicus ample.  
*P. canalis*, no. 53.
      - dd. Last whorl tapering downward; umbilicus narrower.  
*P. c. biconica*, no. 53a.
  - bb. Shell mottled or streaked with opaque white or buff on a corneous gray or brown ground, or maculate with gray or brown on a pale ground; whorls 4 to 4½.
    - c. Last whorl very wide, not striate spirally; umbilicus deep.  
*P. expansa*, no. 58.
    - cc. Last whorl spirally striate; shell oblong-conic, rimate.
      - d. Aperture smaller.  
*P. zebrina*, no. 57.
      - dd. Aperture larger.  
*P. z. reclusiana*, no. 57a.

aa. Umbilical cavity small or moderate.

b. Aperture about half the length; shell oblong-acuminate, the last whorl very indistinctly streaked with greenish-yellow; 24 x 13 mm., aperture 12.9 mm. *P. brazieri*, no. 59.

bb. Aperture more than half the length; shell ovate-conic, the last whorl greenish-yellow, spire brownish; 17 x 9 to 18 x 10.3 mm., aperture 10 mm.

*P. gonochila*, no. 60.

Section SAMOANA n. sect.

*Evadne* HARTMAN, Catal. Genus Partula, 1881, p. 12, type "*E. bulimoides*" = *P. canalis* MOUSS. (preoc.)

The shell is very openly rimate or umbilicate, dextral or sinistral, with flatly reflexed lip and no parietal tooth. Arboreal. Type *P. canalis*.

The type species has a short, triangular kidney, according to Semper. The group may be related to the Partulæ of Huaheine, which have a similar kidney.

*Group of P. canalis.*

53. *P. CANALIS* MOUSSON. Pl. 32, figs. 6, 7, 8, 10.

Shell sinistral, umbilicate, elongate-conic, rather thin, striatulate, not decussate, slightly shining, brownish. Spire conic, regular; apex subacute, violaceous, suture bordered with a white line, simple. Whorls 5½, nearly flat, the last large, equal to five-fourths the spire, long, more convex at the umbilicus, a little ascending in front. Aperture subvertical, ovate-oblong, subeffuse below. Peristome white, flatly reflexed, moderately expanded, margins subparallel, columellar margin long, somewhat folded and impressed in a canal above. Alt. 29, diam. 14 mm. (*Mouss.*).

Samoa Is.: Upolu (Graeffe, Garrett); Apia (C. N. E. Eliot).

*Partula canalis* MOUSS., Journ. de Conchyl. 1865, p. 172; 1869, p. 337 (with var *semilineata*, p. 338).—PFR. Monogr. vi, p. 155.—GARRETT, Proc. A. N. S. Phila. 1887, p. 134.—*Partula conica* brown variety, GOULD, U. S. Expl. Exped.,

Moll., p. 82, pl. 6, f. 88.—*Evadne bulimoides* Less., HARTMAN, Cat. Gen. Partula, 1881, p. 12, 13, fig.; not of Lesson.

This species differs from *P. conica* by its longer, more slender spire, absence of spiral striae except on the embryonic whorls and base, the darker tint, etc. It is said to be invariably sinistral, and restricted to the island Upolu.

The color is greenish-yellow with more or less chestnut suffusion, sometimes darker in narrow streaks. The spire is darker, reddish brown; suture margined with a white line, narrower than in *P. conica*. The peristome is flesh-tinted, not so broad as that of *P. conica*, and the columella is guttered at its junction with the body. The umbilicus is ample, as in *P. conica*. Figs. 6 and 7 were drawn from one of the original lot collected by Schmeltz. Specimens measure as follows.

Length 28, diam. 17, aperture 16 mm.;  $5\frac{1}{2}$  whorls.

Length 27, diam. 16.5, aperture 16.3 mm.;  $5\frac{1}{2}$  whorls.

Length 28.3, diam. 16.8, aperture 15 mm.;  $5\frac{3}{4}$  whorls.

Length 25.8, diam. 15.8, aperture 14.7 mm.;  $5\frac{1}{2}$  whorls.

A single specimen before me (pl. 32, fig. 8) has a much shorter spire than *canalis*, not attenuated as that is. The color is dark chestnut, the spire dull dark purple. It is spirally striate below the periphery. Length 23, diam. 15, aperture 13.3 mm.; whorls slightly over 5. Upolu. This may represent a distinct subspecies.

53a. Var. BICONICA Pils., n. v. Pl. 31, figs. 6, 7.

Some specimens collected by the United States Exploring Expedition differ from *canalis* by having the last whorl more swollen above the periphery, tapering to the base, and therefore distinctly conic; the umbilicus is much narrower, and the plane of the peristome is more oblique.

Length 28.8, diam. 18, aperture 17.5 mm.;  $5\frac{1}{2}$  whorls.

Length 28, diam. 18, aperture 16.9 mm.;  $5\frac{1}{2}$  whorls.

53b. Var. SEMILINEATA Mousson. A little smaller, the last whorl wavy-lineolate at the base. Color varying from pale to dark corneous. Tutuila (*Mousson*).

54. *P. CONICA* Gould. Pl. 32, figs. 1, 2, 3, 5; pl. 31, fig. 8.

The shell is sinistral, openly umbilicate, conic, with rather slender spire; white under the thin yellow cuticle, the earlier whorls and a subsutural margin being white. The surface is glossy. Whorls  $5\frac{1}{3}$ , the first half-whorl smooth, following  $2\frac{1}{2}$  whorls spirally engraved (fig. 8); on the following whorls the spire striæ are almost wanting, but they reappear on the last whorl, which is very closely sculptured throughout with fine wavy spirals, stronger towards the base. The whorls are moderately convex, the last whorl rather swollen peripherally and very convex at the base. The aperture is ovate, rather oblique; peristome white, flatly, rather widely reflexed, dilated at the columellar insertion and somewhat excavated or grooved at its junction with the base. Parietal callus very thin, transparent.

Length 25.5, diam. 16.5, aperture 15 mm. (figs. 1-3).

Length 24.5, diam. 16.5, aperture 15 mm. (fig. 5).

Samoa Is.: Tutuila; (Upolu?).

*Partula conica* GOULD, Proc. Boston Soc. N. II. ii, 1848, p. 196; Expedition Shells, in Otia Conchologica, p. 33; U. S. Expl. Exped. Mollusca, p. 81, atlas pl. 6, f. 88a.—PFR., Monogr. iii, 445; iv, 507; vi, 155; Novit. Conch. i, p. 120, pl. 34, f. 8, 9.—MOUSSON, Journ. de Conchyl. 1865, p. 171, no. 11.

In his descriptions of this species, Gould considered the large, more or less chestnut colored and smoother form later described as *P. canalis* to be a form of *conica*, and he also, by implication, included the dextral form, his words "*interdum sinistrorsa*" indicating that he had seen dextral examples. It is obvious that Gould considered the sinistral form to be typical from his selection of sinistral examples for figuring, and from his comparison "*resembling Bulimus lavus* in form"; yet his description is composite, the number of whorls referring especially to the larger brown form (*canalis*) and the description of sculpture to the striate form here considered to be the true *conica*. Garrett's restriction of *P. conica* to the dextral form was not allowable under the existing conditions.

One of Gould's figures is copied, fig. 1. Other figures drawn from the same type specimen are given (figs. 2, 3, no. 2687 A. N. S. P.). The whitish spiral lines on this shell are apparently pathologic.

This species is distinguished from *P. canalis* by the white spire of fewer whorls ( $5\frac{1}{4}$  to  $5\frac{1}{3}$ ), the more developed striation of the last whorl and the comparatively larger aperture. In some examples, such as that shown in fig. 5, the spiral striation of the last whorl is hardly visible above the middle.

Gould's second locality for this species, "Raraka," is a low island (atoll) of the Paumotu group, where it is practically certain that no *Partula* lives.

"*Partula conica* Gld. (*upolensis* Mss.)" SCHMELTZ Catalog II der zum Verkauf stehenden Doubletten aus den naturhistorischen Expeditionen der Herren Joh. Ces. Godeffroy & Sohn in Hamburg, p. 25, no. 1379 (March, 1865), is an undescribed form, about which very little is known. Garrett placed *upolensis* in the synonymy of *P. conica*, but he seems to have had *P. stevensoniana*. A specimen purchased from the Godeffroys as *P. upolensis* (no. 59845 A. N. S. P.) as from Samoa, is nothing else than *P. rosea cognata*! This shell is figured, pl. 33, fig. 3.

55. *P. STEVENSONIANA* n. sp. Pl. 32, figs. 4, 9, 11; pl. 31, fig. 12.

The shell is openly umbilicate, ovate-conic, rather thin, whitish under a greenish-yellow cuticle, pale corneous or brown on the spire, suture edged with a white line. The embryonic whorls, except the first half-whorl, are deeply and very closely sculptured with engraved punctate spirals (pl. 31, fig. 12); following whorls and upper half of last whorl have rather widely spaced spiral lines, and the basal half of the last whorl is densely marked with wavy spirals. Spire short, conic, regular. Whorls  $5\frac{1}{4}$ , convex, the last equally convex except near the aperture where it is a little produced outwardly towards the base. Aperture ample, flesh colored within, but slightly oblique. Peristome reflexed, ivory white, dilated and a little impressed at the columellar insertion.

Length 25, diam. 14, aperture 14.1 mm.

Length 23, diam. 13.5, aperture 14 mm.

Length 22, diam. 13, aperture 13 mm.

Samoa Is.: Apia, Upolu (Sir Charles Eliot), cotypes no. 77306 A. N. S. P.

*Partula conica* GARRETT, Proc. A. N. S. Phila. 1887, p. 134. —? *Partula upolensis* MOUSSON, Schmelz, according to GARRETT, Proc. A. N. S. Phila. 1887, p. 134, in synonymy of *P. conica* Gld.—? *P. cepolensis* MOUSS., SCHAUFUSS, Paetel Catal. p. 83, nude name.

This is a more lengthened shell than *P. abbreviata*.

56. *P. ABBREVIATA* MOUSSON. Pl. 32, figs. 15, 16.

Shell rimate-umbilicate, ovate, thin, striate, closely sculptured throughout with minute wavy lines, pale corneous. Spire convexly-conic, obtuse and worn bare at the summit; suture little impressed, white, generally with a denuded line. Whorls 5 to 5½, rapidly increasing, a little convex, the last whorl inflated, rounded, a little ascending, rather swollen basally. Aperture subvertical, (15 degrees with the axis), large, two-thirds the total length. Peristome acute, widely and flatly reflexed, white, the margins remote, joined by a scarcely visible callus; right margin forming a long arch, columellar margin widely reflexed, slightly impressed at the insertion; columella somewhat folded deep within. Length 21, diam. 14 mm. (*Mouss.*).

Samoa Is.: Tutuila.

*Partula abbreviata* MOUSS., Journ. de Conchyl. 1869, p. 339, pl. 14, f. 7.

This form seems to be known by the original lot only. It stands close to *P. canalis* and *P. conica*, having spiral sculpture like the latter, and coloration more like *canalis*. The cuticle is readily deciduous on the summit and in a band along the suture. The compact, subglobose shape distinguishes it from allied species. It is shorter and wider than *P. stevensoniana*, and the aperture is larger.

*Group of P. zebrina.*

57. *P. ZEBRINA* Gould. Pl. 31, figs. 10, 11, 14, 15.

The shell is openly rimate and perforate, rather thin, oblong-conic, scarcely shining, *closely and finely striate spirally throughout*; marked with spots, flecks or stripes of opaque buff on a corneous or brown ground, or with corneous or brown on a buff ground. Spire convexly conic, the summit obtuse, whorls  $4\frac{1}{2}$ , convex, the second disproportionately large, last whorl convex, swollen basally. Aperture subvertical. Peristome flatly reflexed, white, thickened within with a *strong callous rib* which ascends on the columellar margin, often forming a vertical ridge near the dilated upper end.

Length 20, diam. 12.3, aperture 12 mm.;  $4\frac{1}{2}$  whorls.

Length 19, diam. 12.5, aperture 12 mm.;  $4\frac{1}{2}$  whorls.

Length 18.5, diam. 10.7, aperture 11 mm.;  $4\frac{1}{3}$  whorls.

Length 21, diam. 12, aperture 12.25 mm.,  $4\frac{1}{2}$  whorls (*tryoni*).

Samoa Is.: Tutuila (U. S. Expl. Exped.; Schmeltz).

*Partula zebrina* GOULD, Proc. Boston Soc. N. H. ii, 1848, p. 196; Expedition Shells, p. 33; U. S. Expl. Exped., Moll., p. 82, pl. 6, f. 89.—PFR., Monogr. iii, 450.—*Partulus actor* ALBERS, Die Heliceen, 1850, p. 187.—*Partula actor* Alb., PFR., Monogr. iii, 450; Conchyl. Cab. p. 266, pl. 48, f. 13, 14.—GARRETT, Proc. A. N. S. Phila. 1887, p. 133.—*Partula tryoni* HARTMAN, Proc. A. N. S. Phila. 1885, p. 204, fig. in text.

This species is related to *P. expansa*, but differs by its narrower, less deeply penetrating umbilicus, longer spire, and especially by the *spiral striation* of the last whorl, which was described by Gould (see fig. 11, drawn from below the suture just back of the outer lip).

The opaque buff markings appear mostly as oblique streaks along the lines of growth, but they often tend to become transformed into spirally descending stripes, especially on the last half whorl, approaching the condition of the further evolved *P. expansa*. Often the cream tint predominates over the corneous or brown markings, which remain as streaks or spots.



*Partula tryoni* Hartman (pl. 31, fig. 5) is a *zebrina* in which the cream-white markings are reduced to mere flecks. While this color-pattern may possibly be characteristic of a local race, it is surely nothing but a form of *P. zebrina*. I have figured the type specimen (no. 4261 Carnegie Mus.). It was erroneously supposed to be from the Solomon Islands.

*Partula actor* Albers differs in no respect from *zebrina*. The type figure is copied, pl. 31, fig. 10.

57a. Var. *recluziana* Petit. Pl. 31, figs. 9, 13, 16.

“Shell rimate-perforate, ovate-conic, buff-brown ornamented with irregular whitish, sometimes zigzag spots. Spire short, obtuse; whorls 4, a little convex, the last longer than the spire. Aperture oblong-oval; lip expanded, white. Length 20 mm.”

Samoa Is.: Tutuila (Schmeltz).

*Partula recluziana* PETIT de la SAUSSAYE, Journ. de Conchyl. i, 1850, p. 170, pl. 7, f. 5.—cf. MOUSSON, J. de C. 1869, p. 339.

This form differs from *P. zebrina* by its larger last whorl and shorter spire. Whether it is a true race or merely a phase of individual variation I have not the means of deciding. Fig. 9 is copied from that of Petit. Figs. 13, 16 represent specimens before me, measuring

Length 19.9, diam. 12.2, aperture 13, whorls  $4\frac{1}{4}$ .

Length 18, diam. 12.5, aperture 11.8, whorls 4.

In fig. 16 the white spots and stripes follow the direction of growth-lines, and stand on a corneous-brown ground. In fig. 13 the flecks and spots are mainly lengthened in a spiral direction, but arranged in oblique series; the ground being very dark brown. The whole shell is marked with spiral lines, as in *P. zebrina*.

58. *P. EXPANSA* Pease. Pl. 32, figs. 12, 13, 14.

The shell is broadly and deeply umbilicate, obliquely ovate, rather thin, lusterless; gray, marked with opaque white bands or spots, which descend spirally and obliquely forward. Spire

very short, conic; whorls 4 or slightly more, convex, the first  $2\frac{1}{2}$  composing the embryonic shell are uniform gray, the first half whorl smooth, the rest very closely marked with engraved spiral lines, which rapidly disappear on the next whorl. About the middle of the penultimate whorl some white spots appear in the gray surface, the first ones being arranged along growth-lines; they rapidly change to spirally lengthened spots and belts which may be either continuous or interrupted on the last whorl. The last whorl is lightly marked with growth-lines but has *no spiral striae*. It is inflated and very convex at the base. Aperture lateral, diagonal. Peristome broadly and flatly reflexed, white, thickened within.

Length 18, diam. 14, aperture 13 mm.

Length 19, diam. 15, aperture 13.5 mm.

Samoa Is.: Upolu, on foliage (Garrett). ? Tutuila (Brazier).

*Partula expansa* PSE., Amer. Journ. of Conch. vii, 1872, p. 26, pl. 9, f. 3.—PFR., Monogr. viii, p. 203.—GARRETT, Proc. A. N. S. Phila. 1887, p. 133.—*P. extensa* PEASE, P. Z. S. 1871, p. 473 (name only; error for *expansa*).—*P. zebrina* Gld., MOUSSON, Journ. de Conchyl. 1865, p. 173; 1869, p. 339.

Readily distinguished by its broad and deeply penetrating umbilicus, very short spire, the absence of spiral striation on the last whorl, etc. The locality Tutuila, originally given by Pease on Brazier's authority, is apparently erroneous. It has been taken by Garrett and Schmeltz on Upolu. Pease's type specimen (drawn in my figure 14) is not fully mature, the expansion and thickening of the lip being incomplete. The pattern of opaque white stripes is interrupted, leaving snowy dots and streaks over part of the surface.

#### *Group of P. brazieri.*

The following species seems to be very intimately related to the group of *P. caledonica*, and belongs to the section *Melanesica*—forms inhabiting the New Hebrides and neighboring groups. It has the same pyramidal shape, indistinct

strigation and subperipheral band, etc. We have no sufficient ground for doubting the evidence of an experienced collector that *P. brazieri* inhabits the Samoan Islands; yet up to this time no other naturalist has encountered it there.

59. *P. BRAZIERI* Pease. Pl. 33, figs. 1, 2.

The shell is dextral oblong-acuminate, openly and deeply rimate, rather thin, glossy, whitish, having a very thin eutiele which on the last whorl is indistinctly streaked with very pale greenish-yellow, this color strongest in an indistinct belt below the periphery, and on the base. After the first half whorl the embryonic shell (fig. 2) is sculptured with close, punctate spiral striae; post-embryonic whorls sculptured with engraved spiral lines, which are rather widely spaced, and on the last half of the last whorl are obsolete above periphery. Spire conic, rather slender above. Embryonic shell of  $2\frac{1}{2}$  flat whorls; following whorls convex, the last whorl convex above, very full basally. Aperture slightly oblique, white within. Peristome narrowly reflexed, thickened within, white, tapering towards the upper termination, where it is continued in a small triangular callus filling the angle of the aperture. Columellar lip dilated inwards, a trifle grooved along its junction with the body; its outer edge continued a short distance upward on the parietal wall. Parietal callus transparent. Length 24, diam. 13.1, length of aperture 12.9 mm.; whorls  $5\frac{1}{2}$ .

Samoan Islands: Tutuila (Brazier).

*Partula brazieri* PSE., Amer. Journ. of Conch. vii. 1872, p. 27, pl. 9, f. 5. Cf. GARRETT, Proc. A. N. S. Phila. 1887, p. 135, and HARTMAN, Nautilus xi, 44.

Described and figured from the unique type, no. 59846 A. N. S. P. Garrett and Hartman have expressed doubts as to the locality assigned by Pease on the authority of Brazier. The shell is so similar to species of the New Hebrides that it seems possible that it was obtained in that group. Trading schooners from Sydney usually touched at numerous islands, exchanging their cargoes of rum, cloth, guns and trinkets for

copra, and the shells brought from various places might easily become mixed.

*Group of P. gonochila.*

The relations of *P. gonochila* and *P. subgonochila* to other *Partulæ* are uncertain.

60. *P. GONOKHILA* (Pfeiffer). Pl. 41, figs. 6, 7, 8, 10.

Shell subperforate, ovate-conic, thin, delicately and closely decussate, diaphanous, green. Spire conic, rather acute; whorls 5, slightly convex, the last convex, longer than the spire. Columella obsoletely plicate above. Aperture oblong, obliquely truncate above; peristome broadly, angularly expanded, a little reflexed, thin, white inside, the margins remote. Length 17, diam. 9, aperture with peristome 10 x 7 mm. (*Pfr.*).

Habitat unknown (coll. Dunker). Navigator (Samoa) Is. (*Pfr.*; coll. Acad. Phila.).

*Bulimus gonochilus* PFR., Zeitschr. f. Malak. 1847, p. 82; Monogr. ii, 69.—*Partula gonochila* PFR., Monogr. iii, 448; iv, 512; vi, 160; Conchyl. Cab. p. 274, pl. 64, f. 33, 34.—? *Partula gonochila* REEVE, Conch. Icon. 6, pl. 4, f. 19 (May, 1850).

Pfeiffer's description and figures (pl. 41, figs. 7, 8) are copied. The specimen drawn in figs. 6, 10, is slightly less swollen than Pfeiffer's, measuring, length 18, diam. 10.3, aperture 10 x 7 mm., whorls 5. The last whorl is whitish under a very thin pale greenish yellow cuticle. The spire is red-brown, darkest at the apex; on the penultimate whorl it becomes paler in the middle, a darker shade continuing as a border above and below the suture as far as the lip. The growth-striae are fine and distinct. Engraved spiral lines are fine and close, strongest on the last whorl. The whorls including the last are evenly convex; base convex, shortly rimate and deeply perforate. The lip is reflexed, opaque white behind the reflection. It is strengthened by a very strong, narrow white callous rib within. This rib diminishes gradually above, and extends upward on the colu-

mellar margin two-thirds of the distance to the insertion, terminating rather abruptly near the lower end of the oblique, straight columellar fold.

The habitat of this species is not known, even the group assigned (Samoan) being uncertain.

#### V. SPECIES OF THE FIJI IS., ROTUMA, AND THE TONGA IS.

##### *Tonga Is. species.*

#### 61. *P. SUBGONCHILA* MOUSSON. Pl. 41, figs. 11, 12.

Shell perforate, ovate-conic, finely, widely decussate, striatulate, greenish. Spire convexly-conic, regular, the summit rather obtuse; suture not impressed, submarginate. Whorls  $4\frac{1}{2}$ , slightly convex, the last moderately convex, not as long as the spire, not ascending in front. Aperture rather small, subvertical (making an angle of 5 degrees with the axis), oblong, obliquely truncate above. Peristome expanded, angularly reflexed, whitish, somewhat labiate within, the margins not approaching; right margin curved in a long arch above; columellar margin vertical, wide, spreading, not folded within. Length 16, diam. 9.6 mm. (*Mouss.*).

Tonga Is.: Futuna or Fotuna, in the Horne group, and Vavau (Dr. Ed. Graeffe).

*Partula subgonochila* MOUSS., Journ. de Conchyl. xix, 1871, p. 14, pl. 3, f. 4.

This species resembles *P. varia* to some extent, but the spire is less produced. Two lots from the Hartman collection are before me: No. 4284 Carnegie Mus. is from "Fortuna, Friendly Is.," coll. by Brazier (apparently Futuna, the type locality). The shell is thin, pale greenish yellow on the last whorl or two, fading to whitish above near the suture, the spire whitish. The spiral striæ are rather close and very distinct, and on the last whorl the peripheral angle is so indistinctly indicated, that the contour remains rounded. The summit is quite obtuse. The lip is white. The largest of four measures, length 17, diam. 10, aperture 9 mm., whorls  $4\frac{3}{4}$ . The smallest is 16 mm. long.

No. 4285 Carnegie Mus., four specimens labelled "Tutuila." Smaller than the preceding, the spiral striation not so strong on the last whorl, lip flesh-tinted. Length  $14\frac{1}{2}$ , diam. 9, aperture  $8\frac{1}{4}$  mm., whorls  $4\frac{1}{2}$

*P. gonochila* Pfr. is no doubt closely related to *subgonochila*. In both the spiral striation of the embryonic whorls is very fine and distinct, and the pitting is conspicuous. *P. gonochila* is a more solid shell, darker colored, with the lip more thickened within, and the upper part of the spire more narrowly conic.

*Rotuma species.*

62. *P. LEEFEI* (E. A. Smith).

"Shell dextral, small, ovate, umbilicate, yellow-olivaceous, pale below the suture and towards the apex; spire moderately produced, rounded at the apex. Whorls 5, a little convex, closely sculptured with delicate growth lines and very fine spiral striae, more or less obsolete on the last whorl; last whorl hardly descending in front. Aperture ovate, brownish inside, about half the total length; peristome white, expanded and reflexed, slightly thickened. Length 14, diam. 9 mm.; aperture  $6 \times 3\frac{1}{2}$  mm. inside" (*Smith*).

Rotuma Island (R. B. Leefe).

*Partula lefeei* SMITH, Annals and Magazine of Natural History (6) xx, 520 (Dec., 1897).

"A small species, distinguished by its style of coloration and general form."

Rotuma lies between the Fiji and Ellice Is., about 300 miles N. N.-W. of the former. Its size is about  $8 \times 2$  miles, with a height of 800 ft.

*Fiji species*: Section THAKOMBAUA, n. sect.

The single Fijian *Partula*, *P. lirata*, is very distinct by the coarse spiral sculpture of the post-embryonic whorls and the tubercular callus or tooth on the parietal wall near the columella.

*P. lirata* has no near relatives among known forms, and for

it the section *Thakombaua* is here instituted. It is somewhat remarkable that in Fiji no Partulas are known from the islands inhabited by *Placostylus*. The same is true of the New Caledonian group; but in the New Hebrides and Solomon Islands both genera exist.

63. P. LIRATA MOUSSON. Pl. 34, figs. 15, 16, 17, 18.

The shell is long ovate-conic, rather thin, rimate; white, pale yellowish, pale brown or rather dark liver brown with narrow paler streaks. Surface lusterless. The embryonic shell consists of nearly 3 whorls, the initial half whorl smooth, following half whorl very subtly punctate-striate spirally, spirals on the next whorl fewer, rather separated, and mainly on the upper part; third whorl with very weak spirals, which at the beginning of the post-embryonic shell become distinct but low cords. These increase in prominence to the last whorl, where there are 8-12 strong spiral cords above the periphery, with small, unequal cords in most of the intervals, and on the base are many smaller unequal cords and threads. These spiral cords extend to the lip-edge, which is erenulated in all but old specimens. The last whorl is somewhat compressed laterally and convex at the base. Aperture ovate, oblique, colored within like the outside. Peristome narrowly expanded, thickened within; columella dilated above. Parietal wall covered with a distinct but transparent callus, which bears a white callous tubercle far within near the root of the columella.

Length 18.2, diam. 9.8, aperture 9.5 mm.; whorls  $5\frac{1}{2}$ .

“ Length 21, diam. 10 mm.; whorls  $5\frac{1}{2}$  ” (*Mouss.*).

Fiji (Viti) Islands, only in the Eastern group: Lommalouma, Vanua Balavo I.; Kanathia I.; Oneata I. (Dr. E. Graeffe). Lanthala I., Vanua Balavo and Taviuni, on foliage near the sea-shore (Garrett), Maugo or Mago (Layard).

*Partula lirata* MOUSSON, Journ. de Conchyl. xiii, 1865, p. 196; xviii, 1870, p. 126.—CROSSE, J. de C. xiii, 1865, p. 432, pl. 14, f. 4.—HEYNEMANN, Malak. Blätter xiv, 1867, p. 148, pl. 1, f. 1 (teeth).—GARRETT, P. Z. S. 1887, p. 187.—H. H. SMITH, Ann. Carnegie Mus. i, p. 451, no. 4236.

The single Fijian *Partula* has been found only on the small islands of the "eastern group," the genus being unknown on the large islands, where *Placostylus* abounds. The rarity of *Partula* in this archipelago is at present inexplicable. The single species is one of the most distinct of the genus.

Mr. Layard stated in a letter to Dr. Hartman that he did not find the species on Taviuni or Lomma-lomma, in six weeks collecting on the former and a day or two at the latter place.

#### Section MELANESICA n. sect.

*Sterope* HARTMAN, Catal. genus *Partula*, 1881, p. 14, type *P. carteriensis* Q. et G.; not of Goodsir 1845, or Hagen, 1850.

*Partulae* of simple form and coloring, corneous, yellow or brown, uniform or obliquely streaked, not banded; aperture not obstructed by teeth; the peristome either thin or thickened within. Suture often bordered above by a thread, which continues indistinctly on the last whorl as a low welt or group of closer striae. Type *P. turneri*.

This group includes all of the species of the New Hebrides, Solomon Is., New Ireland, New Britain, New Guinea, and other adjacent islands, as well as one Samoan form, *P. brazieri*.

#### VI. NEW HEBRIDES AND SANTA CRUZ ISLANDS.

The Santa Cruz group, Banks and Torres Islands and New Hebrides form a group trending from N. W. to S. E. through about 10 degrees of latitude. The southern islands, Eromanga, Aneiteum, are not remote from the Loyalty Islands which lie on a parallel fold, and have no *Partulae*. The northern or Santa Cruz end of the group approaches the Solomon Islands. The fauna is only imperfectly known, but seems to be somewhat related to that of the Solomon Islands, though much poorer and more primitive by lacking *Papuina*, *Chloritis*, etc. Many of the islands are high and wooded.

#### *Group of P. turneri.*

Ovate-conic or pyramidal, openly and deeply rimate-umbili-



cate shells, with narrow-streaked cuticle and markedly swollen, saccate base.

64. *P. TURNERI* Pfeiffer. Pl. 33, figs. 5, 6.

Shell deeply rimate-umbilicate, ovate-conic, rather solid, under the lens spirally wavy-striate, glossy, pale buff rayed with darker streaks. Spire conic, rather acute. Whorls 5, convex, the last slightly shorter than the spire, subcompressed at the base. Columella simple, slightly arcuate. Aperture a little oblique, oblong, peristome white, glossy, rather widely expanded throughout, the margins converging, columellar margin spreading. Length 22 to 23, diam. 11 to 12 aperture with perist. 12 x 8.5 mm. (*Pfr.*).

New Hebrides: Eromanga (Turner).

*Partula turneri* PFR., P. Z. S. 1860, p. 40; Malak. Bl. 1861, p. 16; Monogr. vi, 159.

In the *Monographia* Pfeiffer mentions a var. *b*, "a little more ventricose, rayed with isabelline and whitish."

Figs. 5, 6, represents a specimen received from Cuming. This typical form of *P. turneri* has very pale narrow yellowish-green streaks on a white, faintly lemon tinted ground. There is a very inconspicuous band below the periphery. The base is markedly full, sack-like. The spiral lines are rather widely spaced and become very faint on the last half of the last whorl, except at the base. The figured example measures, length 23.5, diam. 13.3, length of aperture 12.5, width 8.9 mm.; whorls 5½. Another of the same lot is smaller, length 23, aperture 12 x 8.5 mm.

Var. *perstrigata* nov. Pl. 33, fig. 4.

The shell is pale buff or whitish, copiously marked with narrow chestnut or pale chestnut streaks; form, size and sculpture as in *turneri*.

One of the lots of this form, received from Dr. Hartman and said to have been collected by Geale, is marked "Tanna, New Hebrides." The type lot, no. 59848 A. N. S. P., was received from Cuming as "*P. turneri* var., New Caledonia",—an evident error. The variety closely resembles *P. caledonica* in color, but it is much more robust. *Cf. P. macgillivrayi*.

65. *P. MACGILLIVRAYI* Pfeiffer. Pl. 33, fig. 15, 16.

Shell broadly and compressed umbilicate, conic, rather thin, striatulate and under a lens closely sculptured with spiral striæ; whitish with yellowish streaks and marked with obsolete bands. Spire long-conic, rather acute. Whorls 5, slightly convex, the last about equal to the spire, somewhat ascending in front, sack-like at the base. Columella slightly arcuate, lightly folded deep within. Aperture slightly oblique, truncate-oblong; peristome white, thin, equally, sub-rectangularly expanded. Length 23, diam. 11, aperture with peristome 12.5 x 9.3 mm. (*Pfr.*).

New Hebrides (Macgillivray).

*Partula macgillivrayi* PFR., P. Z. S. 1855, p. 97; Monogr. iv, 508; Novit. Conch. i, p. 61, pl. 17, f. 14, 15.

This species is known to me only by Pfeiffer's description and figures, which indicate a shell very similar to the brown-streaked variety of *P. turneri*.

66. *P. CALEDONICA* Pfeiffer. Pl. 33, figs. 12, 13, 14.

Shell deeply and compressed-umbilicate, rather solid, oblong-conic, irregularly striate, pale flesh colored irregularly radiated with close brownish streaks. Spire conic, acute. Whorls 5½, a little convex, the middle ones distinctly striate spirally, last whorl shorter than the spire, ascending in front, impressed in the middle and sack-like at the base. Columella subpubescent deep within. Aperture a little oblique, oblong. Peristome white, rather widely expanded throughout, the margins converging, right margin somewhat sinuous. Length 22 to 22½, diam. 10 mm.; aperture with peristome 11 mm. long, 7 wide; inside 4¾ wide above the middle (*Pfr.*).

New Hebrides: Havannah Harbor, Sandwich (Vate or Efate) Island, type loc.; also reported from Vanua Lavu, Banks Islands (John Brazier).

*Partula caledonica* PFR., P. Z. S. 1861, p. 389; Monogr. vi, 157. — BRAZIER, P. Z. S. 1871, p. 585. — *Partula pfeifferi* CROSSE, Journ. de Conchyl. 1871, p. 184; 1894, p. 172 (based on Pfeiffer's description). — *Partula artensis* Montrouzier, Cox, on label in coll. A. N. S. P.

A slender shell resembling *P. turneri* in coloration. The spiral lines are distinct and rather widely spaced on the penultimate whorl and obsolete on the last whorl except in the base. There is a faint band below the periphery, as in the allied species. The apical whorls are shaped like those of *P. brazieri*, figured on plate 33, fig. 2. Specimens measure:

Length 21.8, diam. 12, aperture 11 mm.; whorls  $5\frac{1}{2}$ .

Length 20, diam. 10.5, aperture 10.9 mm.

67. *P. NEMATORAPHE* Pilsbry, n. sp. Pl. 35, figs. 1, 2, 3.

The shell is ovate-conic, rather thin, white under a thin, pale, yellowish green cuticle, which is darkest at the base, fading upward to corneous-whitish on the upper whorls, the last whorl having narrow streaks of a darker shade at irregular intervals. Surface glossy. Embryonic shell of fully  $2\frac{1}{2}$  whorls is very minutely punctate-striate spirally; following whorls are more convex, with rather distinct oblique growth-striae but only very faint and fine traces of spiral lines, except on the last whorl, which is distinctly striate spirally on the base and somewhat malleate behind the outer lip. The last whorl is full, rather swollen above the periphery, then tapers to the narrow, very convex base. The umbilical chink is deep and ample. Whorls nearly  $5\frac{1}{2}$ , separated by a well-impressed suture, which in the last two whorls is bordered above by a low cord defined by a groove. This margin is covered by the ascent of the last whorl near the aperture, but may be traced faintly on the last whorl, though it is there very indistinct. The aperture is vertical, white within. Outer lip narrowly reflexed, white, thickened within. Columellar margin broadly dilated above. The lip-callus extends somewhat more than half way up to the insertion, where it terminates in a small but distinct nodule. Parietal callus thin, transparent.

Length 21.7, diam. 12.5, aperture 12 x 9 mm.

Length 21, diam. 12, aperture 11 x 8.3 mm.

Habitat unknown. The types were obtained from Geale

as "*P. alabastrina* Pfr., Fiji Is." but the shell has wholly the appearance of the New Hebrides *Partula*. Two cotypes no. 4293 Carnegie Museum.

*Partula alabastrina* Pfr., H. H. SMITH, Annals of the Carnegie Museum, i, p. 468, no. 4293.

This species was thought by Dr. Hartman to be *P. alabastrina*, but Pfeiffer's description of that shell does not apply well to these specimens in several respects. Fig. 3 represents the suture just behind the aperture, showing the end of the suprasutural cord.

68. *P. EXIMIA* Hartman. Pl. 33, fig. 11.

The shell is very deeply rimate-perforate, pyramidal. The unique type is a "dead" shell, denuded of cuticle, grayish white, but the color is preserved on the parietal wall, indicating a very pale buff ground marked with narrow brownish-yellow streaks; the coloration perhaps intermediate between that of typical *P. turneri* and *P. caledonica*. The apical whorls resemble those of *P. brazieri*, though the second may be slightly more convex. Subsequent whorls are quite convex, and traces of fine, rather spaced spiral striation, just as in *P. caledonica*, may be seen on the penultimate and next earlier whorls, the last whorl being without spirals except around the umbilicus. Oblique growth-wrinkles are rather distinct. The last whorl is compressed laterally and very convex at the base. Aperture only half the total length, slightly oblique; peristome white, expanded, well thickened within; having the usual deeply placed fold at the root of the columella. Length 23, diam. 11.7, length of aperture 11.5 mm., width 7.8 mm.; whorls  $5\frac{1}{2}$ .

New Hebrides: Aneiteum (Layard).

*Partula eximia* HARTMAN, Proc. A. N. S. Phila. 1886, p. 35, pl. 2, f. 14. (April 6, 1886).

This species stands very close to *P. caledonica*, from which it differs by the slightly more lengthened spire, and perhaps the paler, less brown color. Hartman, in 1896, wrote me that he considered *eximia* a synonym of *macgillvrayi*, having

compared it with a Cumingian specimen of *macgillivrayi* in the Newcomb collection (see Nautilus XI, 1897, p. 44). According to the measurements given by Pfeiffer, *macgillivrayi* has a larger aperture. The unique type of *P. eximia* is figured and described.

69. *P. EBURNEA* Hartman. Pl. 33, fig. 8.

“Shell dextral, ovate, very elongate, solid. Spire half the length; whorls  $5\frac{1}{2}$ , oblique striae coarse, spiral striae obsolete, aperture a wide oval, more or less oblique; umbilicus compressed. Columella wide above, lip reflected, white and flat, margins of the peritreme connected by callus. Color ivory-white. In fresh examples sometimes the whole shell is tinged with pale rose. Length 26, diameter 13, length of aperture 11, diameter 6 mm.” (*Hartman*).

Habitat unknown.

*Partula eburnea* HARTM., Proc. A. N. S. Phila. 1886, p. 33, pl. 2, f. 10.—H. H. SMITH, Ann. Carnegie Mus. i, pp. 467, 475.

“Captain Brazier sent me two examples of this shell, given him by a friend; it is larger and more solid than *pfeifferi* Crosse.” (*Hartm.*)

Dr. Hartman's description is given above and a photograph of his type is copied. The type and another example were returned to Mr. John Brazier of Sydney, N. S. Wales. On the photograph of *eburnea* presented to the Academy Dr. Hartman marked “= *macgillivrayi* Pfr.”

70. *P. PYRAMIS* Hartman. Pl. 33, fig. 7.

The shell is deeply rimate-umbilicate, rather thin, ovate-pyramidal, white under a very thin whitish cuticle which is indistinctly marked with narrow yellowish-green streaks on the last whorl. Spire slender, long. Embryonic whorls conic and but slightly convex, much as in *P. brazieri*. Subsequent whorls convex, the *penultimate and last whorls very strongly convex*. The later part of the last whorl is flattened laterally; base very full, sack-like. Spiral lines well spaced on the penultimate whorl, wanting on the last except at the base.

Aperture subvertical, white inside; peristome white, rather narrowly reflexed, thickened within, the columella dilated above as usual. Parietal callus thin and transparent except at the ends, where it bears short, callous pads joining the lip-ends.

Length 23.3, diam. 13, aperture 12 mm.; whorls  $5\frac{1}{3}$ .

Length 24.5, diam. 13, aperture 12.2 mm.; whorls  $5\frac{1}{2}$ .

New Hebrides: Efate (Vate) Island (type loc.); Renée River and Terebu, Espiritu Santo (J. J. Walker).

*Partula pyramis* HARTMAN Proc. A. N. S. Phila. 1886, p. 34, pl. 2, f. 12.—SYKES, Proc. Malac. Soc. Lond. v, p. 198.

In coloring, this species is like *P. turneri* except that it has no band below the periphery; but it is a much more slender shell with a deeper suture. It stands very close to *P. eximia*, but differs by the more swollen last whorl and consequently wider aperture, and by the greener color. Described and figured from two cotypes in Hartman collection, no. 4305 Carnegie Museum.

71. *P. ALBESCENS* Hartman. Pl. 33, figs. 9, 10.

“Shell dextral, ovate elongate, spire acute, regularly tapering, equal to one-half the length, whorls 5, rounded. Suture impressed, body whorl somewhat inflated, spiral striæ numerous, regular and very fine, umbilicus open, aperture ovate, oblique, peritreme connected by a thin callus, columella wide at base, lip white, expanded, and concave, color a clear white and translucent. Length 25, diam. 13, length of aperture 8, diam. apt. 5 mm.” (*Hartm.*)

New Hebrides: Aura Island, Malo Pass, Espiritu Santo group, and Sitova Island, (E. L. Layard).

*Partula albescens* HARTM., Proc. A. N. S. Phila. 1888, p. 251, pl. 13, f. 4.—SMITH, Ann. Carnegie Mus. i, p. 467, no. 4290.

Dr. Hartman's description and a copy of his figure (fig. 9) are given. The specimens before me from Sitova Island (fig. 10) are smaller, with a narrower lip than the Aura Island type. The apex is like that of *P. brazieri*; later whorls are

engraved with distinct spiral lines which are somewhat separated on the penultimate whorl and front of the last one, but on the latter half of the last whorl the spiral striæ are close, with deeper lines at short intervals. The later whorls are strongly convex, but the last becomes compressed laterally, towards the aperture, and is sack-like below. The umbilical chink is deep and wide. The color is a slightly bluish milky white, without markings. Length 21.8, diam. 12.2, length of aperture 11.2 mm.; whorls  $5\frac{1}{3}$ .

While it is closely related to *P. caledonica*, *macgillivrayi*, *eximia* etc., this species is distinct by the absence of color streaks and the persistence of spiral striæ over the whole last whorl.

I have been unable to find an Aura Island in the New Hebrides. Probably Arag is intended. Sitova is also unknown to me.

## 72. *P. TURRICULA* Pease.

Shell elongate, turriculate, solid, sinistral, rimate-perforate, glossy, smooth, delicately marked with growth-lines; buff, indistinctly rayed with darker streaks. Spire turriculate, rather acute. Whorls  $5\frac{1}{2}$ , plano-convex, the last shorter than the spire, obliquely produced. Columella vertical, heavily calloused, broadly dilated above, especially over the umbilicus, transversely subsulcate. Aperture oblique, oblong, obliquely truncate behind. Peristome white, calloused, expanded and reflexed, slightly sinuated posteriorly. Length 20, diam. 10 mm. (*Pease*).

New Hebrides (?).

*Partula turricula* PSE., Amer. Journ. of Conch. vii, 1871, p. 196.

“The habitat of the above species is doubtful. From its approaching *P. macgillivrayi*, Pfr., and *caledonica*, Pfr., inhabiting the New Hebrides, and having lately received specimens from Dr. Jas. C. Cox, with other species from that group of islands, there is little doubt but that locality is the correct one. It differs from the species mentioned above in being

smaller, more slender, 'sinistral,' smooth, without any trace of transverse striae, and last whorl produced." (*Pease*).

*Group of P. auraniana.*

73. *P. AURANIANA* Hartman. Pl. 34, figs. 7, 8, 9, 10.

The shell is deeply rimate, rather thin but solid, ovate-conic. The last two whorls are whitish (probably denuded of cuticle) below the suture, elsewhere covered with a thin greenish yellow cuticle with some inconspicuous darker streaks. The spire lacks cuticle and is very pale brownish, almost white. Apex obtuse; embryonic whorls slightly convex, punctate-striate, not so high as in *P. fraterna*. Subsequent whorls more convex, sculptured with distinct, regular engraved spirals, which are somewhat weaker and more widely spaced on the upper part of the last whorl, closer and deeper on the base. Last whorl is strongly convex, its last half however being perceptibly compressed laterally; base very convex. The aperture is but slightly oblique, symmetrically ovate, faintly flesh-tinted within. Peristome white, moderately reflexed, thickened within. Columellar margin dilated above

Length 18.8, diam. 11, aperture 10 mm.; whorls 5.

Length 18.25, diam. 11, aperture 10 mm.; whorls  $4\frac{3}{4}$ .

Length 18, diam. 10.9, aperture 10 mm.; whorls  $4\frac{2}{3}$ .

Length 17.5, diam. 11, aperture 10 mm.; whorls  $4\frac{2}{3}$ .

New Hebrides: Aura (? Arag) Island, in the Malo Pass, Santo Espirito group (Layard, type loc.); Lo and Hiu islets of the Torres group (Walker).

*Partula auraniana* HARTM., Proc. A. N. S. Phila. 1888, p. 250, pl. 13, f. 1.—SYKES, Proc. Malac. Soc. Lond. v, 198.

This is said to be a common species. It differs from *P. fraterna* chiefly by the better developed spiral striation, lower embryonic whorls and shorter spire; yet it is not improbable that intermediate forms occur.

An embryo of  $2\frac{1}{2}$  whorls, 4.9 mm. long, is figured, pl. 34, fig. 8. The first half whorl is pale brown and smooth, following whorls are densely punctate-striate above. The peri-



phery of the last whorl is angular, base with no spiral striae. The columella is long, vertical, rather heavily calloused, tapering and somewhat excised below, not unlike the columella in some forms of *Obeliscus*. The axis is perforated.

Mr. Sykes states that the specimens from Lo Island collected by Mr. J. J. Walker are a local race.

74. *P. FRATERNA* Hartman. Pl. 34, fig. 4.

The shell is rather widely and deeply rimate, solid, ovate-conic. Last whorl whitish below the suture, elsewhere covered with a faintly green tinted yellow entele which is indistinctly streaked with brighter yellow; the spire brown, becoming darker towards the apex; suture well impressed, marked with a whitish line. Apex obtuse, the top more rounded and the sides less straightened than in *P. caledonica*, *brazieri* etc.; embryonic whorls punctate-striate, convex; subsequent whorls convex, engraved with rather delicate spirals, almost obsolete on the upper part of the last whorl, but distinct though delicate on the base. The last whorl is a little flattened laterally behind the aperture, convex and somewhat sack-like basally. Aperture fleshy within, ovate, hardly oblique. Peristome rather narrowly expanded and reflexed, thickened within, tapering at the upper end. Columellar margin broadly reflexed, dilated and biramose above. Parietal callus thin, transparent, thickened at its junctions with the lip ends.

Length 20.2, diam. 11.8, aperture 10.9 mm.; whorls  $5\frac{1}{3}$ .

New Hebrides: Aura (? Arag) Island (Layard, type loc.); Ravenga, Vanua Lavu; Lakona, Gaua (J. J. Walker).

*Partula fraterna* HARTM., Proc. A. N. S. Phila. 1888, p. 250, pl. 13, f. 2 (Oct. 23, 1888).—SYKES, Proc. Malac. Soc. Lond. v, 198.

This rather stout, opaque species has some resemblance to *P. carnicolor*, but differs by its shorter form, wider umbilical fissure and the much more convex base. The embryonic whorls are more convex than in the group of *P. turneri*, and the apex is more obtuse. It is closely related to *P. auriana*

but differs by the longer spire of decidedly over five whorls, while *auraniana* has barely five or fewer. The spiral striation is not nearly so well developed in *fraterna*, and the second whorl is higher.

A second example in the type lot is 19 mm. long, but not quite fully mature. Description and figure are from the type, no. 4294 Carnegie Museum.

75. *P. CARNICOLOR* Hartman. Pl. 34, figs. 1, 2, 3.

The shell is oblong-conic, moderately solid, rather narrowly umbilicate; fleshy-brown under a very thin yellowish-corneous cuticle with narrow darker greenish-yellow streaks (the cuticle mostly wanting in the two adult cotypes, which were "dead" shells). Spire straightly conic. Embryonic shell rather large, conic, densely punctate-striate spirally, bicolored, the lower part of each whorl brown, darker than the upper. Subsequent whorls convex, marked with growth-lines but without spirals except at the base, which is very closely marked with wavy spiral striae. Last whorl is evenly convex throughout, tapering basally. Aperture ovate, oblique, flesh-tinted inside. Peristome narrowly expanded and reflexed, white on both face and reverse, well thickened within; columellar margin dilated above, *distinctly grooved at its junction with the whorl*.

Length 23.9, diam. 11.3, aperture 11.9 mm.; whorls  $5\frac{1}{2}$ .

Length 21, diam. 11.2, aperture 11 mm.; whorls  $5\frac{1}{3}$ .

New Hebrides: Aura (? Arag) Island.

*Partula carnicolor* HARTM., Proc. A. N. S. Phila. 1888, p. 250, pl. 13, f. 3.

The symmetrically ovate aperture, tapering base of the last whorl and sober coloring distinguish this species. The type lot, no. 4289 Carnegie Mus., consists of two adult shells, both of which I have figured, and two immature ones.

76. *P. PROXIMA* Hartman. Pl. 34, figs. 12, 13.

"Shell dextral, thin, ovate; very elongate, spire half the length; whorls  $5\frac{1}{2}$ , surface smooth, oblique lines of growth fine; spiral striae obsolete, aperture ovate, oblique, umbilicus

compressed; columella wide above, and slightly nodose, lip white and slightly concave, margins of the peritreme connected by a thin callus, color white. Length 23, width 10; length of aperture 12, width 6 mm." (*Hartman*).

New Hebrides: Vanua Lavu, Banks group (*Brazier*).

*Partula proxima* HARTMAN, Proc. A. N. S. Phila. 1886, p. 34, pl. 2, f. 11.

"Capt *Brazier* sent me two examples (weatherbeaten) collected at the above island by himself in 1865; it has the outline of *cburnea nobis*, but is a smaller, thinner and more slender shell." (*Hartm.*)

The specimens of this species were returned to Mr. *Brazier* or Dr. *Cox* (see H. H. *Smith*, Annals of the Carnegie Museum I, p. 467). My figures are drawn from photographs of the two examples mentioned above, fig. 13 representing Dr. *Hartman's* figured type.

77. P. MINOR *Hartman*. Pl. 34, figs. 5, 6, 14.

The shell is oblong-conic, with a rather narrow and compressed but deep umbilicus; white under a very thin pale yellow cuticle, the spire light brown or white; suture indistinctly white-bordered. Spire conic, the apex obtuse;  $2\frac{1}{2}$  embryonic whorls are convex, very delicately punctate-striate spirally. Following whorls convex, with sculpture of growth-lines and extremely delicate engraved spirals, which are indistinct and rather widely spaced except on the base where they are closer and more distinct. The last whorl is somewhat compressed laterally and very convex at the base which is rather narrow and sack-like. The aperture is symmetrically ovate, rather oblique. Peristome narrowly reflexed, thickened within, white. Parietal callus rather short and heavy.

Length 16.5, diam. 9, aperture 9 mm.; whorls  $5\frac{1}{4}$  (type).

Length 14.25, diam. 8.25, aperture 8 mm.; whorls 5.

New Hebrides: Eromanga (*Turner*, through Dr. *Cox*).

*Partula minor* HARTM., Proc. A. N. S. Phila. 1886, p. 31, pl. 2, f. 5.

The two cotypes from Dr. Hartman's collection, no. 4243 Carnegie Museum, are figured. The cuticle of the smaller example is corneous with hardly any yellow tint. It is deciduous in spiral bands, not much remaining on the last whorl and none on the spire. The other example has a yellower, more persistent cuticle.

78. *P. CONCINNA* Pease. Pl. 36, figs. 9, 12.

Shell compressed-umbilicate, conic-ovate, rather thin, closely and distinctly striate spirally, pale fulvous or whitish rayed with darker streaks, the apex generally rufous. Spire rather acute, short, conic. Whorls 5, a little convex, the last as long as the spire; suture generally submarginate. Columella nearly vertical, nodose, dilated above; aperture expanded, slightly reflexed. Length 15, diam. 9.5 mm. (*Pse.*).

New Hebrides: Tanna Island (Cox).

*Partula concinna* PEASE, Amer. Journ. of Conch. vii, 1871, p. 196.—HARTMAN, Proc. A. N. S. Phila. 1886, p. 35, pl. 2, f. 16.

“The above is of the type of *P. repanda* Pfr. inhabiting the same group of islands. It is smaller than that species, more abbreviate in shape, thinner, distinctly striate, columella nodose, and of a different color.” (*Pse.*).

The figures are from a specimen in the Hartman collection (no. 4244 Carnegie Mus.). It measures 13 mm. long, 8 wide, aperture 7.3 mm. long, and has  $4\frac{1}{2}$  whorls. It is bluish white, the spire pale brown. The columellar nodule, mentioned by Pease, may be seen in fig. 9, under a lens. While smaller than Pease's type, I think the specimen is probably identified correctly.

I suspect that *P. concinna* was based on a stray example of *P. taniata nucleola*. The description certainly favors that theory, and the Hartman example figured seems hardly separable from that Moorean shell.

79. *P. REPANDA* Pfeiffer. Pl. 34, fig. 11.

Shell compressed-umbilicate, ovate-conic, rather solid, under the lens most minutely striate spirally, slightly shining,

pale buff, sometimes roseate towards the apex. Spire conic, rather acute; whorls 5, moderately convex, the last a little longer than the spire, somewhat impressed in the middle in front, the base sack-like. Columella subvertical, somewhat folded above. Aperture a little oblique, oblong; peristome whitish, expanded, calloused within; the right margin spreading, subdentate within above the middle. Length 17, diam. 9, aperture with peristome 9.5 x 7 mm. (*Pfr.*).

New Hebrides (Cuning coll.).

*Partula repanda* PFR., P. Z. S. 1855, p. 98; Monogr. iv, 512.

The figure is from a drawing by Mr. E. A. Smith of one of the type lot in the British Museum. It represents a pale fleshy example, an accompanying note stating that others are pale yellow.

80. *P. VANICORENSIS* (Quoy & Gaimard). Pl. 35, figs. 15, 16, 17.

“Shell ovate-conic, perforate, solid, longitudinally and transversely striate, fulvous. Aperture oval; peristome wide, reflexed and white; whorls 5 or 6.

“All the individuals of the division of Partulas are remarkable for the generally short aperture, the wide and strongly reflexed peristome and especially for the very delicate intersecting longitudinal and transverse striæ.

“This new species is solid, long, regularly ovoid. The aperture is ovate, a little contracted, with the peristome much expanded but only a little thickened within, tending to become entire. The columellar margin is dilated, callous at the base, partly covering the umbilicus which is oval and not deep. The spire is pointed, whorls wide, oblique, rounded, the last whorl, a little swollen, is larger than the others taken together. The suture is linear. The color of the shell is fawn, becoming more or less brown. The individuals of a pale tint are marked, principally on the last whorl, with longitudinal bands of a darker shade of fawn. The peristome is white or violaceous. Length 10, diam. 4½ lines.

“The young shell is globose, swollen, more strongly striate transversely, and has a strongly marked double keel.

“The animal has no peculiarities of form and is colored like the shell, a uniform yellowish fawn.” (*Q. & G.*)

Santa Cruz group: Vanikoro, not very common; found under the leaves of trees at the abandoned village of Ocili (*Astrolabe*).

*Helix vanicorensis* Q. et G., Voyage de l’Astrolabe, Zoologie ii, p. 116. Atlas pl. 9, f. 12-17 (1832).—*Bulimus v.*, DESHAYES, Anim. s. Vert. viii, p. 282.—PFR., Monogr. ii, p. 71.—*Partulus v.*, BECK, Index Moll. p. 57.—*Partula vanikorensis* PFR., Monogr. iii, 446.

This species is probably related to *P. auraniana* and its allies. It has been erroneously placed in the synonymy of *P. otahcitana* by Garrett (Journ. Acad. N. S. Phila. ix, p. 47).

#### VII. SPECIES OF THE SOLOMON ISLANDS.

The Solomon Island Partulæ are corneous or pale yellowish or greenish corneous forms, plain and simple in shape and coloring.

##### 81. *P. FLEXUOSA* Hartman. Pl. 35, figs. 4, 5, 13.

The shell is long ovate, moderately strong, white under a thin cuticle which is gray on the spire and base, yellowish-brown in the middle part of the last whorl, where there are very faint traces of spiral lighter and darker bands. The spire is rather long, whorls convex; suture well impressed. Just above the suture may be seen an inconspicuous ridge or angle—the periphery of the penultimate whorl. The embryonic sculpture is worn; subsequent whorls have very even and regular spiral striation, which may be slightly weaker on the upper part of the last whorl. Last whorl is convex at first, on the last half becoming flattened laterally; very convex, sack-like, at the base. The umbilical fissure is short but deep. Aperture slightly oblique, ovate, small, white inside. Peristome well expanded, thickened within, white, columellar margin dilated above, and slightly grooved where it joins the preceding whorl. Parietal callus transparent.

Length 19.7, diam. 10.2, aperture 10 x 7 mm.; whorls 5¼.

Length 19, diam. 10, aperture 9.7 x 6.8 mm.

Solomon Islands: St. George's and Eddystone Islands.

*Partula flexuosa* HARTMAN, Proc. A. N. S. Phila. 1885, p. 204, fig. in text.

Two of the three cotypes in coll. Hartman (Carnegie Museum no. 4238) are figured. I fail to get Hartman's meaning in calling the shell "flexuose." It is very closely related to the following species. Fig. 13 shows a portion of the last whorl a short distance behind the aperture.

82. *P. HASTULA* Hartman. Pl. 35, figs. 6, 7, 8.

Shell similar to *P. flexuosa*, ovate-fusiform, thin, covered with a thin cuticle, pale yellow on the last whorl, grayish-corneous on the spire; rather openly but deeply umbilicate; sculptured throughout with impressed spiral lines. Whorls moderately convex, parted by impressed sutures which are usually margined above more or less distinctly. Last whorl is laterally flattened and saccate at the base. Aperture longer than in *P. flexuosa*; outer lip thin, reflexed, thickened within except near the posterior termination.

Length 19.7, diam. 9.8, aperture 10.7 x 6.7 mm.; whorls 5.

Length 20, diam. 9.25, aperture 10 x 6.7 mm.; whorls 5 $\frac{1}{3}$ .

Length 18.7, diam. 9.5, aperture 10 x 6.5 mm.; whorls 5 $\frac{1}{4}$ .

Solomon Is.: Simbo or Eddystone Island (Brazier).

*Partula hastula* HARTMAN, Proc. A. N. S. Phila. 1886, p. 33, pl. 2, f. 9.—SMITH, Ann. Carnegie Mus. i, p. 453, no. 4239.

This form stands extremely close to *P. flexuosa*, but it has a longer aperture and somewhat thinner shell. The umbilicus is also a little more open in *hastula*. I hardly think the two specifically distinct. Figures and description from the cotypes, no. 4239 Carnegie Mus.

Dr. Hartman at first gave the locality as "Erromango Island, Solomon Is.," an error for Eromanga, New Hebrides; but on the back of the label he has written "Simbo, Eddystone Isl."

83. *P. INCURVA* Hartman. Pl. 35, figs. 9, 10.

The shell is long ovate-conic, openly and deeply umbili-

cate, thin, pale gray-buff, slightly shining. Embryonic whorls are very minutely sculptured with spiral puncture-lines, the junction with the after-growth not distinct; whorls somewhat convex, separated by a well-impressed suture, which is narrowly bordered above, the border defined by an impressed line; last whorl is strongly compressed laterally, saccate at base, and a little concave just below the suture. Post-embryonic sculpture of strongly developed spiral striæ and irregular growth-lines (very similar to that of *P. regularis*, fig. 11); behind the outer lip the surface is opaque and often of a brighter yellow tint. Aperture ovate, hardly oblique, bluish white within. Peristome reflexed, thickened within except near the upper angle where it is thin. Columellar margin oblique, dilated above. Parietal callus thin.

Length 18, diam. 9.5, aperture 9 mm.; whorls  $5\frac{1}{3}$ .

Length 17, diam. 8.6, aperture 8 mm.; whorls  $5\frac{1}{3}$ .

Solomon Islands: Rubiana (Brazier).

*Partula incurvum* HARTMAN, Proc. A. N. S. Phila. 1886. p. 31, pl. 2, f. 3.

By its strong spiral sculpture this species is close to *P. regularis*, but it is more lengthened than that, with less convex whorls, the last one more flattened laterally and more sack-like below. *P. hastula* resembles *incurva*, but it is far less strongly sculptured. Description and figures from the type, no. 4240 Carnegie Museum.

84. *P. REGULARIS* Hartman. Pl. 35, figs. 11, 14.

The shell is ovate-conic, rather thin, nearly lusterless, of a pale gray-buff tint. Sculpture of close, strongly developed spiral striæ as wide as their intervals, (pl. 35, fig. 11, last whorl behind aperture x 25). Spire conic, the whorl rather convex; last half of the last whorl is a little compressed laterally, and the base is very convex; umbilicus deep, rather open. Aperture oval, bluish-white within; peristome thin, reflexed, thickened within except near the upper end.

Length 17, diam. 9.8, aperture 9 mm.; whorls  $5\frac{1}{3}$ .

Length 16.9, diam. 9.5, aperture 9 mm.; whorls 5.



Solomon Islands: "Savu, Galeria Is. (Capt. Brazier)" [? Savo, near Guadalcanar I.].

*Partula regularis* HARTM., Proc. A. N. S. Phila. 1886, p. 31, pl. 2, f. 4.

This species resembles *P. flexuosa* in shape and convexity of the whorls, but differs in being more strongly sculptured spirally. In sculpture it recalls *P. incurva*, but that is more lengthened, the last whorl more compressed and more saecate.

85. *P. PERLUCENS* Hartman. Pl. 35, fig. 12.

"Shell dextral, oblong, ovate, very thin and pellucid; whorls 5, well rounded, body-whorl somewhat inflated, spire more than half the length. Suture well impressed, spiral striae numerous and fine, umbilicus compressed, aperture oblique, round oval, lip white, concave and moderately reflected. Color a very pale green. Length 18 mm., diam. 9 mm.; length of aperture 9 mm., diameter 4 mm." (*Hartm.*)

Solomon Islands: Ugi or Golfe I., arboreal. (Brazier).

*Partula perlucens* HARTM., Proc. A. N. S. Phila. 1886, p. 31, pl. 2, f. 2.—SMITH, Ann. Carnegie Mus. i, p. 457.

"Compared with *P. similis* it is a larger, thinner and more inflated shell. Capt. Brazier sent me two examples; the smaller measured: length 14, diam. 8 mm." (*Hartman*). The types were probably returned to Brazier. I copy the original figure and description.

86. *P. HOLLANDIANA* n. sp. Pl. 37, figs. 8, 9, 10.

The shell is ovate-conic; moderately thin; deeply and rather narrowly rimate; isabelline with many unequal chestnut lines and streaks in the direction of growth-striae, and a narrow, weakly-marked band of the same at the periphery. Surface rather dull, with sculpture of weak growth-wrinkles and close, slightly rippled, deeply engraved spiral lines; at the peripheral band there is a group of finer spiral lines. Whorls  $4\frac{3}{4}$ , convex, parted by a simple suture, which on the last half of the last whorl has a rather wide margin below, defined by an impressed line. The last whorl is rather

convex, but tapers slightly toward the base. The aperture is slightly oblique, bluish-white inside. Peristome white; outer lip narrowly reflexed, thickened within, except at the strongly curved posterior part, where it is thin. Columellar margin dilated, biramose above, having a low weak nodule just below the middle, at the termination of the internal callus.

Length 17, diam. 9.5, aperture 9.3 x 6 mm.

Habitat unknown (no. 4237 coll. Carnegie Mus.).

“*Partula lacvigata* Pfr.,” II. H. SMITH, Ann. Carnegie Mus. i, p. 452, no. 4237.

In shape and sculpture this species resembles *Partula regularis*, but it differs by the very distinctly margined suture, the less approaching terminations of the lip, the better developed callus within the lip, and the coloration, which seems to be quite characteristic. It will probably be found to be a species of the Solomon Island or the New Hebrides.

This species was in the Hartman collection under the name “*P. lacvigata* Pfr.,” but on the label Dr. Hartman expressed the opinion that it was not that species. It has little in common with *lacvigata*, which evidently belongs to a wholly different group. Named in honor of Dr. J. W. Holland, Director of the Carnegie Museum.

#### 87. *P. ALABASTRINA* Pfeiffer.

Shell compressed-umbilicate, oblong-conic, thin, very lightly striatulate, slightly shining, buff-alabastrine. Spire conic the apex rather obtuse. Whorls  $5\frac{1}{2}$ , convex, the last slightly longer than the spire, tapering towards the base, sub-compressed. Aperture a little oblique, obliquely truncate-oblong. Columella somewhat straightly receding. Peristome white, the margins joined by a very thin callus, right margin broadly expanded, columellar margin extremely broad, spreading. Length 23, diam. 11 mm.; aperture with peristome  $13\frac{1}{2}$  x 9 mm., inside 9 x  $4\frac{1}{2}$  mm. (*Pfr.*)

Solomon Is. (Mus. Cuming).

*Partula alabastrina* PFR., P. Z. S. 1856, p. 390; Monogr. iv, 509.

This species has not been figured. Hartman's statement that it occurs on the Fiji Islands was based upon an erroneous identification.

*Group of P. micans.*

Small, ovate, thin forms, with corneous, pellucid cuticle and usually very distinct spiral striae; whorls 5 or less.

88. *P. MICANS* Pfeiffer. Pl. 36, figs. 10, 11, 13, 14.

Shell deeply rimate, subperforate, ovate-conic, thin, distinctly deccussated with close growth-striae and spiral lines, diaphanous, slightly glossy, pale corneous; spire conic, rather acute, the suture deep. Whorls nearly 5, convex, the last as long as the spire, rounded at base. Columella lightly arcuate. Aperture slightly oblique, oblong-oval; peristome whitish, expanded, acute, the margins converging, columellar margin dilated, spreading. Length 15, diam. 8, aperture with peristome  $8\frac{1}{2} \times 6$  mm. (*Pfr.*).

Solomon Islands (Cuming coll.): Shortland Island (Sowerby and Fulton).

*Partula micans* PFR., P. Z. S. 1852, p. 138; Monographia iii, 451; Conchyl. Cab., p. 276, pl. 66, f. 12, 13.

The shell is larger than *P. pellucida*, with a half whorl more.

Pfeiffer's figures of the type are copied, pl. 36, figs. 10, 11.

Specimens from Shortland I. are figured, pl. 36, figs. 13, 14, for comparison with *P. similis* and other related forms. The spire is shorter than that of *P. similis*, with not quite 5 whorls, the last one convex, shaped about as in *similis*, being much less compressed laterally than *P. coxi*. The lip is only very slightly thickened within,—much less than in *coxi*, *similis* etc. The spiral striation is weaker on the last whorl than in the allied species. Color very pale honey yellow, slightly transparent. The suture is marked with a whitish line. Sometimes a margining thread may be seen above it on the last whorl, but in other shells this is concealed. The last half whorl is impressed just below the suture, forming a sort of margination there.

Length  $15\frac{1}{2}$ , diam.  $8\frac{2}{3}$ , aperture  $8 \times 5\frac{2}{3}$  mm.

89. *P. CINEREA* Albers.

Shell rimate-perforate, small, conic-pyramidal, striolate and very delicately decussated with spiral lines, ash-colored. Whorls 5, rather flat, the last somewhat swollen, compressed basally. Spire short, conic. Columella lightly arcuate. Aperture a little oblique, oblong-ovate. Peristome white, narrowly expanded, the margins joined by a thin callus, right margin arcuate, columellar margin dilated above, reflexed, spreading. Length 15, diam. 8, aperture 7 x 4 mm. (*Pfr.*).

Solomon Islands (coll. Albers).

*Partula cinerea* ALBERS, Malak. Blätter iv, 1857, p. 98.—  
PFR., Monogr. iv, 510.

This unfigured species is probably a form of, or very closely related to *P. micans*, which has a slightly larger aperture, but no other difference so far as the description shows.

90. *P. COXI* 'Angas' Hartman. Pl. 36, figs. 1, 2, 3, 4.

The shell is oblong-conic, openly rimate and perforate, thin, pale yellowish-corneous throughout, imperfectly transparent, not glossy. Spire conic, the apex slightly obtuse; whorls  $4\frac{1}{2}$  to  $4\frac{3}{4}$ , all convex;  $2\frac{1}{2}$  embryonic whorls sculptured with punctured engraved spirals, following whorls marked with growth-lines and fine engraved spirals, which continue strongly and evenly developed on the last whorl, which is especially convex above the periphery and at the base, and somewhat tapering between. The aperture varies from moderately to very slightly oblique, ovate; outer and basal lip narrowly reflexed, slightly thickened within except at the posterior curve of the outer lip where it is thin; on the columellar side the thickening extends about half way up to the insertion. The columellar lip is dilated and two-branched above.

Length 14, diam. 8, aperture 7.8 x 5.2 mm.

Length 13, diam. 7, aperture 7 mm.

Solomon Islands: Ysabel (Brazier).

*Partula coxi* Angas, Cox, Dr. James C. Cox's Exchange List

of Land and Marine Shells from Australia and the adjacent islands, 1868, p. 46, no. 152, name only.—HARTMAN Proc. A. N. S. Phila. 1885, p. 217; 1886, p. 32, pl. 2, f. 7.—*P. gracilior* Pease in coll. according to Dr. Cox's label.

This shell stands near *P. pellucida* Hartm. but differs by its longer, less obtuse spire.

Up to the beginning of the last whorl the shell is biconic, acutely angular or carinate at the periphery, the angle bearing a projecting cord wider than the other intervals of the spiral sculpture. The axis is perforate at all stages of growth.

*P. micans* has the last whorl less compressed laterally, and the lip is much less thickened within.

91. *P. PELLUCIDA* Pease. Pl. 36, figs. 5, 6.

Shell oblong-ovate, narrowly perforate, thin, pellucid, granulose by the intersection of longitudinal and transverse striae. Spire conic. Suture impressed, margined. Whorls  $4\frac{1}{2}$ , plano-convex, the last hardly one-half the length of the shell. Aperture vertical, ovate. Peristome somewhat thickened, white, slightly expanded. Columella slightly dilated above, nearly straight. Whitish-corneous. Length 12, diam.  $6\frac{1}{2}$  mm.; aperture  $5 \times 3\frac{1}{2}$  mm. (*Pease*).

Solomon Is.: Guadalcanar (John Brazier).

*Partula pellucida* PSE., P. Z. S. 1871, p. 457.—PFR. Monogr. viii, 199.—HARTMAN, Proc. A. N. S. P. 1886, p. 35, pl. 2, f. 17.

“It is the nearest allied to *P. minuta* Pfr. It differs in being more slender, thinner, the spire elongate, the aperture smaller, the surface more distinctly granulose and the suture marginate” (*Pease*).

One adult and two young examples in the Hartman collection, no. 4246 Carnegie Museum, are stated on the label to have been compared with “Brazier's type example.” They are labelled “Ysabel, Solomon Is. (coll. Cox).” The adult shell is figured (fig. 6). It is white under a very thin, clear corneous cuticle which is partly worn off in ragged streaks. The surface is rather coarsely sculptured with close wavy

spirals, the intervals as wide as the striæ; embryonic sculpture indistinct, being worn. Whorls  $4\frac{1}{4}$ , convex, the latter part of the last whorl somewhat flattened laterally and slightly concave just below the suture, which is whitish. Aperture slightly oblique, oval; peristome continuous, the outer lip slightly expanded, thickened within except near the posterior angle; parietal callus heavy for so small a shell, its edge distinctly raised. Umbilical chink short but deep. Length 11, diam. 6.9, aperture including peristome  $6 \times 4$  mm.

Another specimen (pl. 36, fig. 5) from Dr. Cox, (no. 59873 A. N. S. P.), measures, length 11, diam. 6.7, aperture 6.5 mm. long. It is similar but has the corneous cuticle entire and the parietal callus weak in the middle. There is a narrow slightly prominent though hardly raised girdle at the periphery, where the cuticle is more persistent, and this is visible above the suture for a short distance behind the aperture. This structure is so weak that it might readily be overlooked, but it is visible in both of the examples seen. The aperture is decidedly oblique in this shell.

This species has a shorter spire than the preceding forms and is a little smaller, otherwise they seem to be closely related.

#### VIII. BISMARK ARCHIPELAGO (New Ireland, New Britain etc.), and ADMIRALTY IS.

The species of these islands are closely related to those of the Solomon group, and belong to the same section.

92. *P. CARTERIENSIS* (Quoy & Gaimard). Pl. 36, figs. 15, 16, 17, 18.

“Shell elongate, apex acute, perforate, transversely and longitudinally striate, fulvous. Aperture oval, inflected, peristome wide, reflexed. Whorls 5, the last ventricose, larger than the rest.

“This species is more lengthened and especially more acute than the preceding [*P. vanicorensis*]; the whorls of the spire are well spaced and separated by a quite deep suture; the last whorl, a little larger than the others together, is still but

little inflated. The aperture is produced obliquely towards the right, and is ovate; peristome wide, but little thickened and white. The columellar margin is dilated at its base and the umbilicus forms an oblique chink. The shell, very finely striated in both directions, is of a uniform yellowish color. Length 9, diam.  $3\frac{1}{2}$  lines'' (*Q. et G.*).

New Ireland: Port Carteret (Astrolabe). New Hanover, Nordhafen, under stones (Gazelle exped.).

*Helix carteriensis* Q. et G., Voyage de l'Astrolabe, Zoologie ii, p. 117, pl. 9, f. 10, 11 (1832).—*Bulimus c.*, DESH., Anim. s. Vert. viii, p. 283.—*Partula c.*, PFR., Monogr. iii, 460.—v. MARTENS, Monatsberichte der K. Preuss. Akad. Wissensch. Berlin, 1877, p. 279.—Not *Partula carteretensis* REEVE, Conch. Icon. vi, pl. 4, f. 13 (1850)—*P. attenuata*.—? *Sterope carteriensis* HARTMAN, Catal. genus Partula Fér., 1881, p. 14, figure.

A slender, acute pale species, of which I give the original description and figures (pl. 36, figs. 17, 18). These, if accurately drawn, indicate a shell with longer spire than any I have seen. Port Carteret examples before me received from Cuming (pl. 36, figs. 15, 16) are nearly white with the spire pale flesh-colored. The surface is glossy, with sculpture of growth-wrinkles and *extremely fine and close* engraved spirals. Above the periphery of the last whorl these spiral lines become faint, more or less obsolete. The apex is rather pointed. The last half of the last whorl is compressed laterally, the base saccate. The aperture is vertical, ovate; the lip narrowly reflexed and thickened within, thin near the posterior angle, the outer margin slightly sinuous. The umbilical chink is rather small.

Length  $17\frac{1}{2}$ , diam.  $8\frac{1}{2}$ , aperture  $9 \times 6$  mm.; whorls 5.

Length 16, diam.  $8\frac{2}{3}$ , aperture  $8\frac{2}{3} \times 6$  mm.; whorls  $4\frac{1}{2}$ .

It differs from *P. coxi*, *kubaryi* etc. by the more delicate, more minute and crowded spiral lines of the penultimate whorl and base.

93. *P. KUBARYI* Hartman. Pl. 36, figs. 7, 8.

The shell is ovate-conic, rather thin, openly rimate and

narrowly, deeply, umbilicate; pale grayish yellow, but slightly shining. Whorls 5, all moderately convex;  $2\frac{1}{2}$  embryonic whorls are sculptured with delicate punctate spiral lines as usual; following whorls have fine incised spiral lines throughout, strongest on the last whorl. The suture is impressed, and at its last turn is bordered above; this border is narrow, and continued as a slightly differentiated belt on the last whorl, in front of the aperture. The last whorl is somewhat compressed laterally and full at the base. The aperture is slightly oblique, ovate, flesh-tinted inside; lip white, narrowly reflexed, thickened within except at the upper curve where it is thin. Columella dilated above. Length 14.8, diam. 8, aperture  $7.2 \times 5$  mm.

Bismarck Archipelago: Karakaut, New Britain (Kubary).

*Partula kubaryi* HARTM., Proc. A. N. S. Phila. 1890, p. 284, pl. 3, f. 3 (Oct. 21, 1890).

This species stands close to *P. coxi*, but it is larger, slightly more solid, and more conic in shape, the last whorl being broader.

94. *P. OBLITERATA* Pilsbry, n. sp. Pl. 37, figs. 11, 12.

The shell is ovate with conic spire; shortly rimate and perforate; moderately strong; pale yellowish with indistinct darker, slightly greenish yellow streaks, the apical whorls faintly brown; somewhat glossy. Whorls 5, the embryonic  $2\frac{1}{2}$  puncture-striate, the rest marked with distinct, irregular growth-wrinkles and faint spiral lines, weak and rather indistinct on the last whorl. Last whorl rather convex. Aperture ovate, whitish within; outer lip narrowly reflexed, white, rather strongly thickened within except at the posterior curve of the lip, at its other termination, on the columella, the end of the callus is not noticeable. Length 16, diam. 9, aperture  $8\frac{1}{2}$  mm.

New Ireland?

This species stands near *P. kubaryi*, having almost the same contour, but it differs by the very weak spiral striation. *P. micans* has a thinner lip and much more distinct sculpture. This species is known to me by a set of three examples re-



ceived from S. Hanley as *P. grisea*, and one from Dr. Hartman labeled "P. carterensis, Carteret I., New Ireland, F. Geale."

95. *P. MINUTA* Pfeiffer. Pl. 41, fig. 16.

Shell perforate, globose-conic, thin, striatulate and spirally striate, subgranulose, pale fulvous, diaphanous. Spire short, conic, rather obtuse. Whorls 4, convex, the last globose, forming three-fifths the total length. Columella nearly simple, slightly receding. Aperture a little oblique, oval; peristome thin, white, the margins approaching, right margin very strongly arched above, expanded; columellar margin wider, spreading. Length  $10\frac{1}{2}$ , diam. 7 mm.; aperture with peristome  $7 \times 5\frac{1}{3}$  mm. (*Pfr.*).

Admiralty Islands (Cuming coll.).

*Partula minuta* PFR., Proc. Zool. Soc. Lond. 1856, p. 384; Malak. Bl. 1856, p. 244; Monogr. iv, 514.

Figured from the type specimen in the British Museum. It is a very small and globose species.

96. *P. HARTMANNI* E. A. Smith. Pl. 37, figs. 5, 6, 7.

"Shell elongate, conical, thin, semipellucid, white, narrowly umbilicated. Whorls  $5\frac{1}{2}$ , slightly convex, sculptured with minute microscopic spiral striæ and fine oblique lines of growth, which give the upper edge of the whorls a slightly puckered appearance; last whorl long, a little contracted behind the aperture, and marginate beneath the suture near the lip. Aperture almost perpendicular, somewhat ear-shaped, dirty whitish within, together with the peristome equalling rather less than half the total length of the shell. Lip somewhat flattened and expanded. Columellar margin reflexed, not twisted or tubercular; outer margin above well bent over towards the columella, with which it is united by a thin callus. Length  $16\frac{1}{3}$  mm., diam. 7; aperture 8 long,  $5\frac{1}{2}$  broad. (*E. A. Smith*).

Admiralty Is.: Wild Island and Pigeon Island (Challenger Exped.).

*Partula hartmanni* E. A. SMITH, P. Z. S. 1884, p. 265, pl. 22, f. 7.

“*P. elongata* Pease, and *P. gracilis* of the same author, from the Tahiti group, closely resemble this species. The former is rather larger and broader, not so strongly spirally striated, and more or less striped with pale brown. The latter has a longer aperture, rather more convex apical whorls, and a peculiar bulging at the lower part of the body-whorl. *P. minuta*, Pfr., also from the Admiralty Islands, is similarly sculptured, but of a totally distinct form.” (*E. A. Smith*).

Mr. Smith's description and figure (fig. 7) are copied. One of the specimens from Wild Island before me is smaller, length  $14\frac{1}{2}$ , diam. 7, aperture 7.2 mm., with 5 whorls. The aperture of this example is quite oblique (pl. 37, fig. 6). In a larger specimen the aperture is almost vertical. The peripheral cord common to other species of the group is visible above the suture, which is also very distinctly marginate below, on the last half whorl. Spiral striation is very distinctly developed throughout.

IX. LOUISIADE ARCHIPELAGO, including Trobriand and Woodlark Is.; NEW GUINEA and adjacent islets.

97. *P. SIMILARIS* Hartman. Pl. 37, figs. 13, 14, 15.

“Shell dextral, oblong-ovate, thin and translucent; whorls 5, convex, spire half the length, oblique lines fine and decussated by coarse spiral striæ, umbilicus compressed; aperture rounded ovate; lip white. Color yellowish white, with the apex very pale rose. Length 17 mm., diameter 9 mm.; length of aperture 6 mm., diameter 4 mm.” (*Hartman*).

Louisiade group: Woodlark Island (Brazier; Kowald and Belford).

*Partula similaris* HARTM., Proc. A. N. S. Phila. 1886, p. 30, pl. 2, f. 1.—HEDLEY, Proc. Linn. Soc. N. S. Wales vi, p. 97 (1892).—*P. woodlarkiana* HARTM., t. c., p. 33, pl. 2, f. 8.—HEDLEY, t. c., p. 98.

“For size and contour this shell is near *P. carteriensis*, Pfr.; it is thinner and less solid, with a more rounded aperture, and concave lip.” (*Hartm.*)

Equally with Mr. Hedley (*l. c.*) I am unable to grasp any

specific distinction between *P. similaris* and *P. woodlarkiana*. The type specimens of both were returned to Australia by Dr. Hartman. I have copied a photograph of the type of *P. similaris* in fig. 13. Specimens from the Trobriand Is. are also figured, pl. 37, figs. 14, 15.<sup>3</sup> The shell is somewhat transparent grayish yellow, flesh-tinted near the apex. The surface is very distinctly and beautifully decussate, the deeply engraved spiral lines being made wavy by the fine, rather distinct growth-striae. The last whorl is convex, narrowly umbilicate, and sometimes margined below the suture on its last half. A narrow margining thread may be seen in places above the suture. The suture itself is edged throughout with a fine white line. The callous thickening within the lip thins out rather gradually above, not abruptly as in many related species, but it stops abruptly about half way up the columellar margin. At the columellar insertion there is a slight groove.

Length 18, diam. 10, aperture 9.4 x 6.7 mm.; whorls 5.

Length 16.8, diam. 9.2, aperture 9 mm.; whorls 5.

*P. woodlarkiana* Hartman appears to have a somewhat larger aperture than *similaris*, but it is otherwise very like. A photograph of the type is copied in my figure 16, of plate 37. The original description follows:

“Shell dextral, ovate, thin and translucent; body-whorl inflated; whorls 5, rounded, suture impressed, lines of growth decussated by numerous waved spiral striae, spire short, columella slightly arcuate, wide and smooth, compressly umbilicate, aperture round ovate, lip concave, white and moderately reflected; color yellowish, apex very pale rose. Length 19, diameter 11, length of aperture 9, diameter 6 mm. Woodlark Island (*Hartm.*).

98. *P. OCCIDENTALIS* Hedley. Pl. 37, fig. 4.

“Shell dextral, ovate elongate, thin and translucent; color (?); whorls 5, rounded, last a little flattened below the suture; sculpture: everywhere encircled by close sharply impressed spiral lines, which are decussated by oblique irregular lines

of growth, at the intersection the former are sometimes distorted by the latter; spire slender, elongate, a quarter of total length; apex dome-shaped; half of the first whorl embryonic; suture impressed; umbilicus small, deep, compressed; aperture roundly ovate, scarcely oblique, lip moderately reflected and expanded, margins of the peristome connected by a thick callus. Length 19, breadth 10, length of aperture 9, breadth 6 mm.; length 17, breadth 10, length of aperture 9, breadth 7 mm.

“On the ground under bushes upon Samarai Island I collected two dead shells of this species. Type in Queensland Museum.” (Hedley.)

*Partula occidentalis* HEDLEY, Proc. Linn. Soc. N. S. Wales, VI, 1891, p. 98, pl. 12, f. 31 (1892).

“The two *Partulae* described by Lesson have, as Tapparone remarks, a doubtful claim to Papuan soil, and, omitting these, the above species is the first described from New Guinea proper.” (Hedley.)

Samarai is a small island lying off the eastern extremity of New Guinea.

99. *P. GRISEA* Lesson. Pl. 37, figs. 1, 2, 3.

This species is more lengthened and thinner than any other known to me. The penultimate whorl is longer than in the species already mentioned [*P. otaheitana*, *rufa*, *lineata*, *lutea*]. The last whorl, finally, is but little dilated, little swollen. The aperture is directed to the right. It is higher than wide, with the peristome thick, a little dilated in front of the umbilical chink. The surface of the shell is very finely striate longitudinally and transversely, hence covered with a fine and granulose network. The aperture is white. All the rest is uniform light gray. Length 8, diam.  $3\frac{1}{2}$  lines (Lesson).

New Guinea (Lesson).

*Partula grisea* LESSON, Voyage autour du Monde, La Coquille, ii, pl. 1, p. 325, pl. 13, f. 11.—PFR., Monogr. iii, 450.—ALBERS, Malak. Bl. iv, 1857, p. 99, new diagnosis.—

*Bulimus griscus* PFR., Symbolæ ad Hist. Hel. i, p. 82; ii, p. 115; Monogr. ii, p. 68.

It is not certain that Albers had the same form which Lesson described. *P. occidentalis* Hedley is evidently a near relative of *grisca*, but so far as I know, the "Coquille" reached New Guinea only in the west.

#### 100. *P. BULIMOIDES* LESSON.

This *Partula* is the largest species known to us. It is 10 lines long and 7 in diameter. The shell is thick, solid, with the mouth on the right side, large and oval, provided with a thick flange, the umbilicus very open back of the columellar plate adnate to the peristome. The spire is short, conic, obtuse at the apex, the whorls parted by a quite deep suture. Last whorl large, ventricose, very finely striate lengthwise. The shell is whitish, but covered with a bright fawn epidermis. The peristome is simple in the young. (*Lesson*).

New Guinea (Voy. Coquille).

*Partula bulimoides* LESS., Voy. autour du Monde de La Coquille, Zool., p. 326.

An unfigured species, not recognized since its description. So far as I know the *Coquille* landed only at Port Dorey (near Mt. Arfak and the N.-W. cape of Geelvink Bay), and probably this shell came from there. The visit was in July-August, 1824. Hartman, at one time, identified *P. canalis* as *P. bulimoides*. From Lesson's description, the shell must be very different from other species of the southwestern Pacific.

### X. TALAUER ISLANDS.

The single species from this group is the westernmost species of the genus.

#### 101. *P. NEWCOMBIANA* Hartman. Pl. 43, fig. 6.

"Shell dextral, ovate, rather thin; spire acute, half the length; whorls 5, rounded; suture deeply impressed; body-whorl somewhat inflated; oblique lines of growth fine and crossed by numerous waved spiral striæ, compressly umbili-

cate; aperture very oblique, rounded, ovate; lip white, moderately reflected and concave; the outer margin partaking of the color of the epidermis; columella wide above; margins of the peristome connected by a thin vitreous deposit; a broad, flat, pillar tooth far within the aperture. Color light fawn, with dark brown oblique striæ, apex dark brown. Length 17, diam. 11.5 mm.; aperture, length 7, width 4 mm." (*Hartman*).

Salibabu, one of the Talauer Is., between Gilolo and Mindanao.

*Partula newcombianum* HARTM., Proc. A. N. S. Phila. 1886, p. 34, pl. 2, f. 13.—*Partula newceniliarum* HARTMAN, Nautilus xi, p. 44 (typographical error).

Dr. Hartman has recorded the loss of the type of this species by shipwreck on its return voyage to Mr. Garrett at Tahiti. The figure is a copy of his.

"I received this shell from Mr. Layard, through Mr. A. Garrett. In outline and general appearance it resembles some varieties of *P. varia*. I have named it in honor of Dr. Wesley Newcomb, one of our oldest American conchologists, well known for his writings on the allied genus *Achatinella* of the Sandwich Islands." (*Hartm.*)

#### XI. PELEW ISLAND SPECIES. Section PALAOPARTULA n. sect.

Straightly conic forms with high embryonic whorls and very deeply engraved later whorls, the last compressed laterally and sack-like below, with a *very ample umbilical area* and deep perforation. The aperture is unusually long, and the *peristome is thin and very broadly reflexed*. Type *P. thetis*.

The three closely related forms from Pelelu (Piliu) stand apart from all other Partulas. They have some appearance of being a branch from the Melanesian group. The coloring, the slight differentiation of a peripheral belt (marked with finer spiral striæ), and the high apical whorls, recall species of the New Hebrides and Solomon Islands.

#### 102. *P. LEUCOTHOE* O. Semper. Pl. 38, fig. 1.

Shell openly and compressedly umbilicate, conic-pyramidal,

very thin, white, subhyaline, irregularly subsulcate and sculptured with very dense, somewhat rippled spiral lines. Spire pyramidal, rather acute, suture marked with a white line and substriolate. Whorls  $5\frac{1}{2}$ , nearly flat, the last a little larger, somewhat ascending in front. Columella deep, slightly arcuate. Aperture oblique, oblong, subcompressed, the margins subparallel; peristome white, thin, equally and broadly expanded. Length 22, diam. 12, aperture 12 mm. long, 4 wide inside. (*Semp.*).

Pelew Is.: Pelelu (Dr. C. Semp.).

*P. leucothoe* O. SEMP., Journ. de Conchyl. 1865, p. 417, pl. 12, f. 5.

Differs from *P. calypso* by the strong obliquity of the aperture, finer sculpture and shape of the shell.

103. *P. CALYPSO* O. Semp. Pl. 38, fig. 2.

Shell broadly and compressed umbilicate, high-turritid, thin, whitish, roseate towards the apex, longitudinally somewhat wrinkled, encircled with wavy spiral lines; suture somewhat thread-like, striolate; spire raised, acute; whorls 6, nearly flat, the last a little longer than the spire, somewhat ascending in front. Columella nearly straight. Aperture slightly oblique, oblong; peristome white, broadly expanded, especially over the umbilicus, the right lip subnodose within. Length 31, diam. 14, aperture with peristome 17 mm. long, 5 mm. wide inside (*O. Semp.*).

Pelew Is.: Pelelu (Dr. C. Semp.).

*P. calypso* O. SEMP., Journ. de Conchyl. 1865, p. 418, pl. 12, f. 7.

104. *P. THETIS* O. Semp. Pl. 38, figs. 3, 4, 5, 6.

Shell openly and compressed umbilicate, conic-pyramidal, brown, blackish towards the apex, remotely and lightly wrinkled and encircled with somewhat roughened and beautifully waved spiral lines. Spire conic, the apex pointed but mamillate. Whorls  $5\frac{1}{2}$ , a little convex, the suture somewhat thread-like, striolate; last whorl convex, regularly rounded, somewhat ascending in front. Columella somewhat arcuate.

Aperture oblong-rounded, nearly vertical; peristome buff, brownish, broadly expanded throughout, right lip nodose within. Length 30, diam. 16, aperture with peristome 17 mm. long, 5 mm. wide inside.

The following varieties occur: *b.* more elevated, the last whorl less convex, *g.* suture more striolate, *d.* color paler, yellowish-fawn (fig. 4). (*O. Semper*).

Pelew Islands: Pelelu. (C. Semper).

*P. thetis* SEMP., t. c., p. 419, pl. 12, f. 6.

This third species, according to Semper, is not quite so thin as the other two. The aperture is a little rounder, and the summit is mamillate, a feature totally wanting in the two other species.

A specimen before me, figs. 5, 6, no. 4272 Carnegie Mus., is distinctly streaked with greenish-corneous and whitish on the last whorl, growing ruddy on the spire. The apical whorls are very high, much as in *P. brazieri* (pl. 33, fig. 2). The rest of the whorls are very distinctly and beautifully sculptured with close, deeply engraved spiral lines. The lip is thin throughout, not perceptibly thickened within, and tapers rapidly from the upper third to the insertion. The columella is straight and vertical. Length 30, diam. 15, aperture 16.2 x 10 mm., including peristome; 6 whorls.

## XII. CAROLINE ISLAND SPECIES.

### Section CAROLINELLA n. sect.

Rather solid, opaque, ventricose shells, with the aperture large and simple, umbilical area small; general shape Bulimoid. Type *P. guamensis* Pfr.

This Caroline Island group consists of rather large Partulas with a quite distinct aspect. They look like ground snails. *P. gonochila* and *P. lutea* have much the same form, but are smaller shells. *P. lineata* is a small, banded species of quite different type.

105. *P. GUAMENSIS* (Pfeiffer). Pl. 38, figs. 7 to 14.

Shell rimate-perforate, ovate-conic, rather solid, very deli-



cately decussate, chestnut-colored. Spire rather short, obtuse. Whorls 5, convex, the last swollen, longer than the spire. Columella nearly straight. Aperture ample, semi-oval, bluish inside; peristome white within, the margins remote, right margin expanded, columellar margin broadly reflexed, spreading. Length 26, diam. 15 mm.; aperture 14 x 8 mm. inside. (*Pfr.*).

Caroline Islands: Ponape, in the ruins of Nanmatal (Finsch); in the hills (Etscheid, Kubary).

*Bulimus guamensis* PFR., in Philippi, *Abbild. a. Beschreib. neuer Conch.* ii, p. 113, *Bulimus*, pl. 4, f. 9 (August, 1846); *Monogr.* ii, 73.—*Partula guamensis* PFR., *Monogr.* iii, 446.—REEVE, *Conch. Icon.* vi, pl. 1, f. 4 (1849).—DESH., in Fér., *Histoire* p. 124, pl. 158, f. 3-6.—*Partula rufa* LESS., v. MARTENS, *Conchologische Mittheilungen* 1881, i, p. 95, pl. 17, f. 12-16.—[*Partula*] *ponapensis* HARTMAN, *Proc. Acad. Nat. Sci. Phila.*, 1885, p. 221, substitute for *guamensis* Pfr.—*Partula rufa* subsp. *montana* v. MOELLENDORFF, *The Journal of Malacology* vii, p. 112 (March 24, 1900), substitute for *guamensis* Pfr.—*Partula brumalis* REEVE, *Conch. Icon.* vi, pl. 1, f. 2 (May, 1849).

A large, bulimoid species having much the appearance of a small *Borus*. Pfeiffer's type, figured in Philippi's *Abbildungen* (copied in my fig. 9), is the rather obese form further illustrated by figs. 7 and 8. The embryonic shell is very densely striate spirally but is usually worn in adult shells. The rest of the whorls have distinct spiral striæ, which in the typical form are deeply engraved throughout, but on some examples they become rather weak on the last whorl. The ample aperture is dull purplish inside in some examples, white in others. The white lip is reflexed, and a little thickened within. The chestnut color of the shell is sometimes varied by a faintly darker line at the periphery. Examples measure:

Length 27, diam. 18.3, aperture 16 x 11.8 mm.; whorls 5 $\frac{1}{3}$ .

Length 27, diam. 17, aperture 15.5 x 11 mm.; whorls 5 $\frac{1}{2}$ .

Length 28, diam. 17, aperture 15 x 12 mm.; whorls 5 $\frac{1}{2}$ .

The form called *brumalis* by Reeve (pl. 38, fig. 10, copied

from Reeve) is somewhat more elongated, yet it intergrades fully with *guamensis*, judging from examples before me (see measurements above). The forms figured by von Martens from the ruins of Nanmatal belong to this more lengthened type. They further illustrate the variation in shape of aperture caused by the different degrees of inclination of the columella, and hence have been copied in my figs. 11, 12, 13, 14 of pl. 38.

Dr. von Martens gives the size as length 26, diam. 16, aperture 15 x 11 mm.

Both Hartman and von Moellendorff have renamed this species, objecting to the name *guamensis* "inasmuch as this mollusk certainly does not live on the island of Guam, where my friend Quadras collected for more than two months without finding it" (*Muldff.*); but if the name be rejected on that ground, the species should be called *brumalis* Rve.

*P. GUAMENSIS GRANDIS* Moellendorff is "much larger, diam. 19, alt. 30.5 mm., less solid, spiral sculpture somewhat less marked, peristome more expanded, less labiate;  $5\frac{3}{4}$  to nearly 6 whorls. Ponape, coast region (Etscheid, Kubary).

"There are three color-variations, viz., dark purple-brown with violet lip (typical); *castanea*, pale chestnut colored with white lip; and *flavescens*, pale greenish yellow. The last named albino is rather rare" (*Muldff.*).

106. *P. MARTENSIANA* Pilsbry, n. sp. Pl. 38, figs. 15, 16.

The shell is ovate-conic, solid and strong, opaque, with a small, compressed umbilicus; beneath a yellow cuticle (which is partially lost from the type specimen, a "dead" shell), the substance of the shell is dull flesh color, becoming darker on the spire, the first three whorls being dull brownish purple. The spire is conic, summit slightly obtuse; the early whorls are worn and show no sculpture; last whorl has no spiral incised lines, but some traces of fine spiral wrinkling may be seen in places, though it is very fine and weak. Whorls 5, convex, the last convex throughout. Aperture is very slightly oblique, flesh-pink within; peristome white, very slightly ex-

panded, strongly thickened within. Columellar margin dilated above, deep within, as in *P. guamensis*. Length 22.3, diam. 14.1, aperture 12.1 x 9 mm.

Caroline Is.: Ualan (John Brazier), type no 4298 Carnegie Museum.

*Partula rufa* Lesson, HARTMAN, Proc. A. N. S. Phila. 1886, p. 35, pl. 2, f. 15.—H. H. SMITH, Ann. Carnegie Mus. i, 469, no. 4298.

Related to *P. guamensis*, from which it differs by the absence of distinct spiral lines on the last whorl, the less expanded but more thickened lip and more contracted aperture. It was identified by Dr. Hartman with *P. rufa* Lesson, but that is a smaller, especially narrower shell.

The type specimen was collected by John Brazier "on the banks of the Lella river, Chabroul Harbor, Ouhalan or Strong's Island," according to a letter from Brazier to Dr. Hartman, written at Sydney, June 18, 1885.

A second specimen in the Hartman collection measures, length 21.5, diam. 14, aperture 11.7 mm. It is an old shell, faded and broken.

#### 107. *P. RUFa* Lesson.

This species resembles especially the preceding [*P. otahaitana*], but the aperture is turned to the right. The spire is less lengthened, more swollen, more conic. The last whorl is proportionally larger. The aperture is more oval and less contracted, and its peristome is not so thick. The color is dirty red. Length 8, diam. 4 lines (*Lesson*).

Caroline Is.: wooded hills of Ualan (Voy. Coquille).

*Partula rufa* LESS., Voy. de la Coquille, Zoologie ii, p. 324 (1831). Not *P. rufa* Martens or Hartman.

Lesson's brief description indicates a shell resembling *P. guamensis* in general features, but much smaller than any other known species of the group,—about 16 or 17 mm. long, 8 or 9 wide. It is hardly possible that the identifications of *P. rufa* made by either Hartman or von Martens are correct. This was also the opinion of Dr. O. von Moellendorff. *P. rufa* still awaits rediscovery.

*Group of P. lineata.*

108. *P. LINEATA* LESSON. Pl. 39, figs. 19, 20.

The shell of this species is oval, long, with conic spire, a half whorl swollen. The aperture opens on the right side. It is contracted by a thick rim recurved backward, and dilated at its junction with the columellar axis, a little in advance of the umbilical crevice. It is nearly of the same size and shape as the O-Taite Partula [*P. otahaitana*], but it is constantly a little shorter and more inflated. The color is pale yellow with two ribbon-like stripes of fawn, one short, surrounding the opening of the umbilicus, the other running around the middle of the large (last) whorl, and covered by the suture on the spire. Length 8, diam. 5 lines (about 16 x 10 mm.). (*Lesson*).

Caroline Islands: Ualan (Voy. Coquille).

*Partula lineata* LESSON, Voy. autour du Monde de La Coquille, Zoologie, p. 324, pl. 7, f. 8, 9.—? *Partulus torosus* BECK, Index Molluscorum p. 57 no. 6 (undefined, but identified with a ? with *P. lineata* Less.).

This species was considered the same as *P. suturalis* Pfr., of Moorea, Society Islands, by Mr. Garrett in his paper of 1884, but later he doubted the identification, in a letter written to Dr. Hartman. Mr. Brazier, who visited Ualan, did not find Lesson's species (H. H. Smith, Ann. Carnegie Museum i, p. 446).

The general appearance of the shell is that of a Society Island species; but the *Coquille* did not visit the island of Moorea where the forms (*P. suturalis*, *P. taniata*) best agreeing with Lesson's description occur, but only Tahiti and Borabora, obtaining *P. otahaitana* at the former, *P. lutca* at the latter place. They were at Ualan in the Carolines on June 15th, 1824, anchoring in Coquille Harbor on the N.-W. side of the island.

In view of the general reliability of the locality records in the Zoology of the Coquille, and the imperfection of our knowledge of the shells of Ualan, I think it not improbable that *P. lineata* may eventually be found there.

The nodule on the parietal wall, shown in Lesson's figure but not mentioned in the description, is a feature appearing also in species of the Society, Fiji and Marianne groups. The relationships of the species are obscure. I would not venture to assign it to any of the subgenera.

### XIII. MARIANNE (Ladrone) ISLAND GROUP.

(Section MARIANNA n. sect.).

*Harmonia* HARTMAN, Catal. Genus Partula, 1881, p. 13, type *P. gibba* Fér. (proec.).

The shell is ovate or inflated with a small umbilicus and a lip more or less thickened within; parietal wall plain or bearing a very deeply placed callous nodule. Type *P. gibba*.

Guam, the chief island of the group, is the only one which has been collected on.

109. *P. GIBBA* Férussac. Pl. 39, figs. 1 to 11.

Shell conic-ovate, perforate, rather solid, striatulate, pellucid, engraved longitudinally with equal lines, white or flesh-colored, the spire acute, rose-red, the suture milk-white; epidermis thin, rufescent. Whorls  $4\frac{1}{2}$ , the last swollen, gibbous, larger than the rest. Aperture long-ovate, subquadrangular; peristome reflexed, broadly dilated, white. (*Fér.*)

Marianne Is.: Guam (Gaudicho, Quadras, Rush *et al.*)

*Partula gibba* FÉR., Tableaux Systématiques des Animaux Mollusques etc., suivé d'un Prodrôme général pour tout les Moll., etc. p. 66, (1821), and in Freycinet, Voyage autour du Monde de l'Uranie et la Physicienne, Zoologie, p. 485, pl. 68, f. 15, 16, 17.—REEVE, Conch. Icon. pl. 3, f. 15.—PFR., Monogr. iii, 453; iv, 514; vi, 160; viii, 208; Conchyl. Cab. p. 269, pl. 64, f. 9-14.—*Bulimus gibbus* PFR., Monogr. ii, 69.—DESH. in FÉR., Hist. p. 122, pl. 158, f. 19, 20.—*Helix gibba* QUOY et GAIM., Zool. Astrolabe ii, p. 113, pl. 9, f. 18-20.—*Partula mastersi* PFR., P. Z. S. 1857, p. 110; Monogr. iv, 513 (Guam).

Férussac's type of *P. gibba* was a small, short example. His figure is copied (pl. 39, fig. 1). The last whorl is pale yellowish-corneous, spire of a rather peculiar dull scarlet

color. The last three whorls have an opaque white border below the suture. The last whorl varies in the degree of swelling, and in small individuals is usually angular in front, at the periphery; base very full and convex. Umbilicus small and deep, more rounded than usual in *Partula*. The engraved spiral lines are distinct and not very close above the periphery, more crowded on the base. The aperture is oblique, white inside in the pale, variously colored in the dark varieties. The peristome is white, or in some forms flesh-tinted. The outer lip is expanded, rather heavily thickened within, the callus somewhat abruptly terminating at the beginning of the curve to the upper insertion; columellar lip dilated. Figs. 2, 3, 5 and 6 represent individuals of the typical *P. gibba*. Besides the typical coloration (*a*) described above, there are shells with (*b*) reddish spire and brown last whorl (fig. 2), and others (*c*) of the typical pale tint and a white spire (fig. 9). These forms occur together in some lots before me. Other forms are:

(*d*) Corneous-white, somewhat transparent, very thin (pl. 39, fig. 11).

(*e*) Drab with the spire dull dark purple, lip fleshy (fig. 7).

(*f*) Lilac, the spire darker, aperture brown within (fig. 8).

(*g*) Light reddish-brown (fig. 5).

(*h*) First  $2\frac{1}{2}$  whorls bicolored, brown and whitish, the rest corneous-yellow, becoming dull purple near the lip. Interior lilac, with a brown streak within the lip, which is flesh-colored (fig. 10).

There is considerable variation in the solidity of the shell, and the thickness of the lip-callus. The latter is sometimes perceptibly nodulous, as in fig. 6.

To what extent the variations in color and texture are local or racial is unknown. All have a white sutural border. Examples measure as follows:

(*a*) Length 17, diam. 11.3, aperture 9.8 mm. long.

(*d*) Length 17, diam. 12, aperture 10 mm. long.

(*e*) Length  $15\frac{1}{2}$ , diam. 11, aperture 9 mm. long.

(*f*) Length  $18\frac{1}{2}$ , diam.  $12\frac{1}{2}$ , aperture, 10 mm. long.



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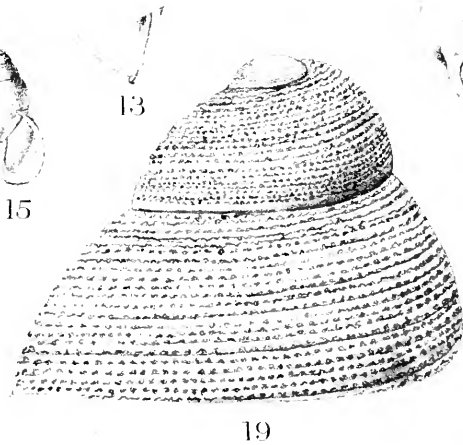


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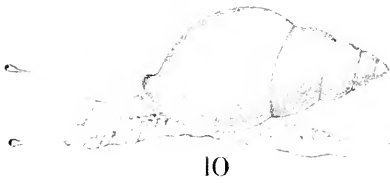








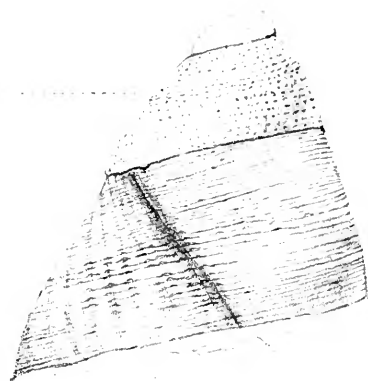








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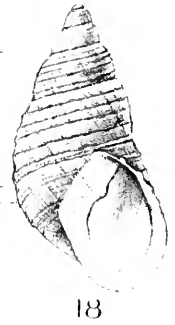


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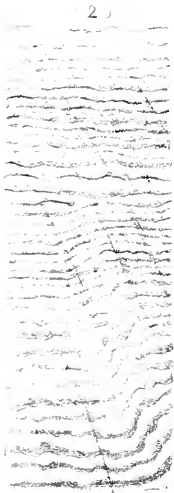
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(h) Length  $18\frac{1}{2}$ , diam. 13, aperture 11 mm. long.

Specimens of a lot consisting of rather solid shells of forms *b* and *g* show a thin callus or low tubercle on the parietal wall, approaching *P. bicolor* in this respect (figs. 5, 6).

*P. mastersi* Pfr. seems to be identical with *gibba*, judging from the description and specimens before me. It is described as rather solid, buff, fleshy or violaceous, sometimes banded with brown on the upper whorls. It is 17 mm. long, with the aperture  $10\frac{1}{3}$  mm.

109a. *P. GIBBA BICOLOR* Pease. Pl. 39, figs. 12 to 18.

Shell solid, perforate, acutely ovate, glossy, transversely marked with close obsolete striae; straw-colored, the whorls of the spire encircled with a brownish band next to the suture. Peristome brownish outside and within. Whorls 4, convex, the last half the length of the shell. Peristome thickened, narrowly and equally expanded. Aperture slightly oblique, oval, with a small callus deep within on the belly of the penultimate whorl. Length 15, diam. 9 mm.; aperture 5 mm. long, 4 mm. wide (*Pease*).

Marianne Is.: Guam (*Pease*, *Quadrans*).

*Partula bicolor* PSE., Amer. Journ. of Conch. vii, p. 26, pl. 9, f. 4 (August 1, 1871).

The above may be distinguished from *P. gibba*, which occurs at the same locality, in being of smaller size, last whorl not inflated, and in its color (*Pse.*).

This form intergrades with *P. gibba*, and should evidently be regarded as a subspecies of that, chiefly distinguished by having the last whorl less swollen than in typical *gibba*, and by having a callous nodule deep within, on the parietal wall near the columella. This nodule is seen very weakly developed in some examples of *gibba*. Other supposed differences are even less constant.

Pease's original description reproduced above is not good; his figure is copied, pl. 39, fig. 17. The shell is rather solid, with sculpture of spiral lines as in *P. gibba*. On the last whorl these lines are very fine and close on the base, but a

little more separated above the periphery. The surface is glossy. The lip may be narrow and nearly uniform in width, but usually it is rather strongly thickened inside, the callus abruptly discontinued near the posterior curve. The color of the lip is quite variable. There is a callous nodule deep within, near the columella, but it is very variable in size. The suture may be marked with a whitish line, but often this is absent. No specimen I have seen has a well developed white band along the suture, such as is usual in *P. gibba*. The color-patterns known are as follows:

- (a) Straw colored or isabelline, with a reddish-brown band above the suture almost to its end, and covering the first  $1\frac{1}{2}$  whorls; outer half of the lip brown, inner rim white. This is the typical coloration (figs. 12).
- (b) First 2 whorls purplish-brown, the third pale below the suture with the dark color fading (or the subsutural pale area may extend nearly to the apex); last 2 whorls straw yellow or pale isabelline with faint or distinct brownish streaks; back of lip reddish or yellow; lip narrow, very pale brown; surface rather dull (fig. 18).
- (c) Same as the last but without brown on the spire; surface lusterless (fig. 15, 16).
- (d) Pale uniform sulphur-yellow throughout, the lip brown-tinted or brown-edged (fig. 14).
- (e) Pale sulphur-yellow, the lip heavily thickened and pure white (fig. 13).

The size varies as follows:

- (a) Length 17, diam. 11.5, aperture 10 mm.; whorls  $4\frac{2}{3}$ .
- (b) Length 17, diam. 11, aperture 9.5 mm.; whorls  $4\frac{1}{2}$ .
- (d) Length 16, diam. 11, aperture 9.4 mm.; whorls  $4\frac{1}{2}$ .
- (c) Length 15.7, diam. 10, aperture 9.1 mm.; whorls  $4\frac{1}{2}$ .

110. *P. RADIOLATA* (Pfeiffer). Pl. 41, figs. 1, 2, 3, 4.

Shell subperforate, oblong-tapering, the apex obtuse, thin; sculptured with distant impressed spiral lines; pale straw-colored, rayed with darker streaks and brown lines. Whorls 5, slightly convex, the last about equal to the spire, base

tumid in front. Columella short, shortly receding. Aperture obliquely oval, glossy inside, yellow; peristome simple, thin, white, expanded, the right margin somewhat straightened, columellar margin dilated above, spreading above the umbilicus. Length 19, diam. 10, aperture 9 x 5 mm. inside (*Pfr.*).

Marianne Is.: Guam, on bushes (Cuming, Quadras, Rush).

*Bulimus radiolatus* PFR., P. Z. S. 1846, p. 39; Monogr. ii, 69.—*Partula radiolata* PFR., Monogr. iii, p. 450; viii. 198; Conchyl. Cab. p. 270, pl. 64, f. 17, 18.—REEVE, Conch. Icon. vi, pl. 2, f. 6.

This form was at first supposed to be from New Ireland, but was soon shown to come from Guam. It is a narrowly umbilicate, thin shell, copiously striped with corneous and opaque white, with more or less suffusion of pale lemon yellow. In the more fully colored examples there are also many olive-yellow lines among the stripes, scarcely visible except under a lens. These lines dilate at the periphery, which therefore, appears to have a faint band. This pattern is shown in fig. 4. Other examples lack the dark lines and peripheral band. The embryonic shell is very densely and distinctly engraved spirally, the lines disappearing towards the apex; the first whorl is weakly plicate radially. The last whorl is marked with rather widely spaced spiral lines, closer on the base. In the typical form these lines are rather weak. The last whorl is very full at the base. The lip is white, narrowly reflexed, very little thickened within. Specimens measure:

Length 19, diam. 11.2, aperture 11 x 7.1 mm.; whorls 4½.

Length 17.5, diam. 11, aperture 10 x 7 mm.; whorls 4½.

Length 17, diam. 10, aperture 9.5 x 7 mm.; whorls 4¾.

Length 16, diam. 9.9, aperture 10 x 7 mm.; whorls 4½.

A form (pl. 41, fig. 2) collected by Quadras is smaller, with a brown band above the suture on the first 2½ or 3 whorls of some specimens, the spire in others being pale lemon tinted. The last whorl has the typical coloration. The aperture is more or less brown inside in those with a dark summit. The first whorl does not seem to be plicate.

Length 16.5, diam. 10, aperture 9 mm.; whorls  $4\frac{1}{2}$ .

Length 14, diam. 8.3, aperture 8 mm.; whorls  $4\frac{2}{3}$ .

*P. radiolata rushi*, n. var., pl. 41, fig. 1. Dr. W. H. Rush collected examples much darker in color at Port San Luis d'Apra, Guam (no. 84841 A. N. S.). The last  $1\frac{1}{2}$  whorls are striped with cream and dark brown, with a narrow but continuous brown peripheral band. The spire is uniform dark brown, aperture brown within. Sculpture typical. Length 15, diam. 9, aperture 8.8 mm. (pl. 41, fig. 1).

111. *P. QUADRASI* Moellendorff.

Shell dextral, narrowly and half-covered perforate, rather ventricose ovate-conic, very thin, pellucid, delicately striatulate transversely, decussated by closely crowded spiral lines; a little shining, pale buff variegated with narrow darker and whitish streaks, sometimes ornamented with two indistinct bands. Spire subregularly conic, the apex somewhat obtuse. Whorls 4, a little convex, separated by an appressed, margined suture, the last whorl quite convex, nearly tumid. Aperture rather oblique, oval, a little excised; peristome simple, thin, well expanded, the columella dilated above, recurved, forming a distinct angle, almost channeled, with the parietal wall. Length 15, diam. 10.5, aperture 9 x 7 mm. (*Mlldff.*)

Marianne Is. (*Quadrasi*).

*Partula quadrasi* MLLDFF., *Nachrichtsblatt d. Deutschen Malak. Ges.* xxvi, Feb., 1894, p. 15.

An unfigured species which seems to differ from the small form of *P. radiolata* in sculpture and by having fewer whorls. It is possibly identical with Férussac's *P. fragilis*, a lost species which has not been figured. The description follows:

*P. fragilis* FÉRUSAC. Shell ovate-elongate, perforate, fragile, striatulate, pellucid, reddish; spire obtuse, sutures strongly marked. Whorls 4, the last ventricose, subcarinate, larger than the rest. Aperture ovate, peristome subreflexed. Marianne Is. (*Gaudiacho*).

*P. fragilis* FÉR., *Tableaux Syst. des Anim. Moll.* p. 66 (1821).



*Bulimus rubens* Mühl. is mentioned as a synonym of *fragilis* by Anton, Verzeichniss, p. 40. It is a nude name. No subsequent author has recognized *P. fragilis*.

#### XIV. SNAILS OF OTHER GENERA DESCRIBED AS PARTULÆ.

*Partula acuticosta*, *consimilis* and *lamellicosta*, Journ. A. N. S. Phila. ix, 113, are errors for *Partula a.*, *c.* and *l.*

*Partula auricula* Fér., 1821 = *Auriculella*.

*Partula australis* Bowdich 1822 = *Strophocheilus*.

*Partula bataviæ* Grateloup, 1840, = *Amphidromus adamsi* var. *rubiginosus* Fulton (Proc. Malac. Soc. London viii, 44).

*Partula delatouri* Hartm. = *Diplomorpha*, Vol. xiii, 118.

*Partula dumartrouyi* Souleyet = *Auriculella*.

*Partula flavescens* King, 1831 = *Bulimulus chilensis* Less. Man. Conch. XI, p. 8.

*Partula glaber* Hartman, Proc. A. N. S. Phila. 1885, p. 205, is *Drymæus strigatus* Sowb., color-form *purus*. See MANUAL XI, p. 228. The type specimen of *glaber*, no. 4291 Carnegie Museum, agrees exactly with the Peruvian shell, but the internal lilac lip-border, though still noticeable, has faded.

*Partula layardi* Braz., Hartm. is a *Diplomorpha*, Vol. xiii, p. 116.

*Bulimus macleayi* Brazier from Yule Island, other islands in Torres Strait, and Queensland, was described as a *Papuina* in this Manual, Vol. XIII, p. 121. It has been referred by Hedley to *Partula* (Proc. Linn. Soc. N. S. Wales ix, 1894, p. 387, pl. 26, f. 22, 23); the radula figured by him has marginal teeth resembling those of *Partula*, yet differing by the larger size of the second cusp, whereas in *Partula* the inner cusp is the larger. The central tooth has no side-cusps. There are 160 rows of 40,6,1,6,40 teeth. If the pallial organs etc., confirm the relationship claimed by Hedley (but which I doubt) this species will form a new genus of *Partulidæ*, characterized by the unexpanded, thin and simple lip of the shell, and the absence of the typical apical sculpture of *Partula*.

*Partula maximiliana* Pot. et Mich. is *Auris bilabiata* B. et S., Man. Conch. X, 100.

*Partula peasei* Cox = *Diplomorpha*, Vol. xiii, 117.

*Partula pudica* Fér. = *Strophocheilus*.

*Partula pusilla* Gould = *Tornatellina*.

*Partula rohri* Pfr., Journ. de Conchyl. 1892, p. 129, is an error for *Achatinella rohri* Pfr.

*Partula salomonis* Pfr. 1852 = *Placostylus salomonis*. See Vol. XIII, p. 70.

*Partulus torosus* Beck, Index Moll. 1837, p. 57. Nude name.

*Partula unidentata* Sowerby = *Strophocheilus*. Vol X, p. 9.

*Partula virgulata* Mighels 1845 = *Achatinella*.

#### ERRATA.

P. 45. The last word of line 16 from bottom should be *two*.

P. 53. Add the following species:

*GLESSULA SINHILA* Preston. Pl. 43, fig. 7.

Shell moderately thin, polished, dark yellowish-horn color, obtusely lanceolate. Whorls  $7\frac{1}{4}$ , marked with very faint lines of growth only; sutures impressed. Columella descending in a very oblique curve; peristome simple, bent slightly inwards above. Aperture inversely, elongately auriform. Alt. 21.75, diam. 9, alt. of aperture 7.75, diam. 4 mm. (*Preston*).

Ceylon.

*Glessula sinhila* Preston, Records of the Indian Museum iii, pt. 2, no. 6, p. 135, pl. 22, f. 14 (June, 1909).

“Allied to *G. inornata* Pfr., but easily distinguished from that species by its much more slender form.”

P. 173. Add fig. 13 to those cited after P. *BELLULA*.

P. 287. The name *Partula minor* Hartman might by some be considered unavailable on account of the earlier *B. roseus* var. *b. minor*, of Pfeiffer; yet it appears that Pfeiffer here intended the word *minor* as a description, not as a name.

P. 313. Under XIII etc., read Section *MARIANELLA*, in place of “*MARIANNA*.” The former term was used on p. 166.







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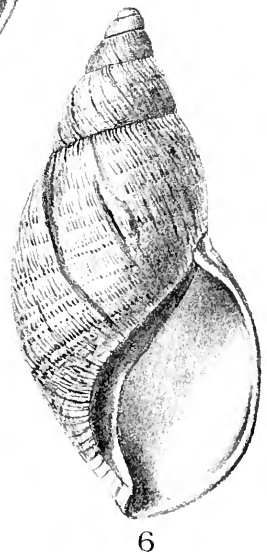
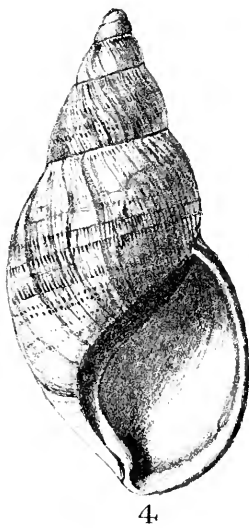
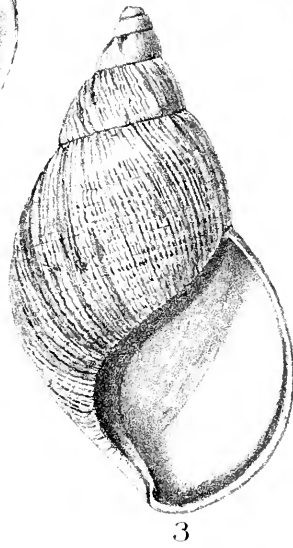
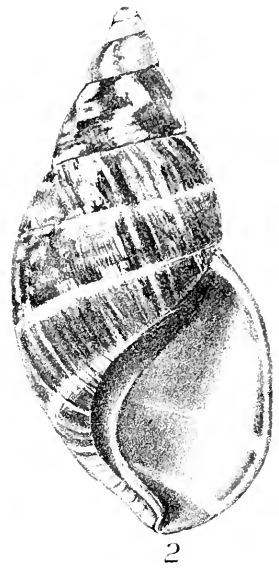
16















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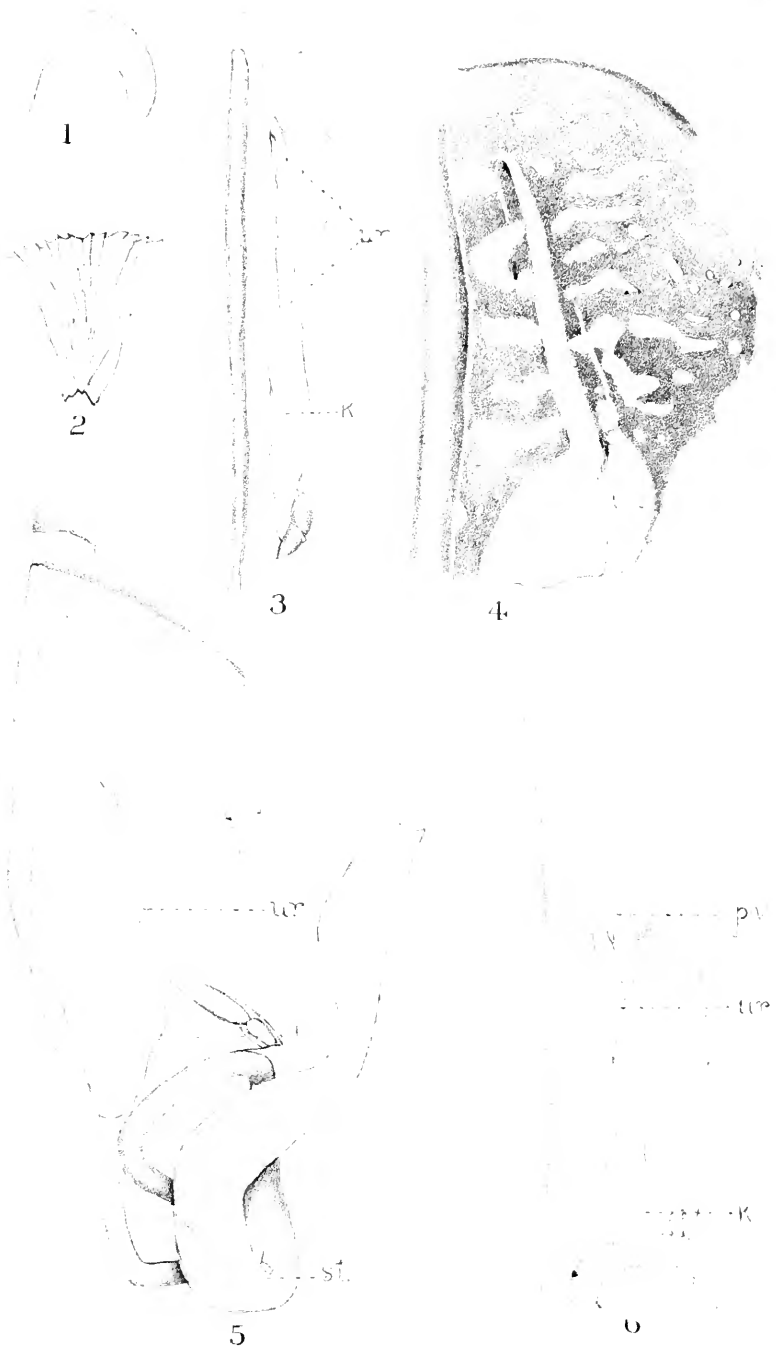


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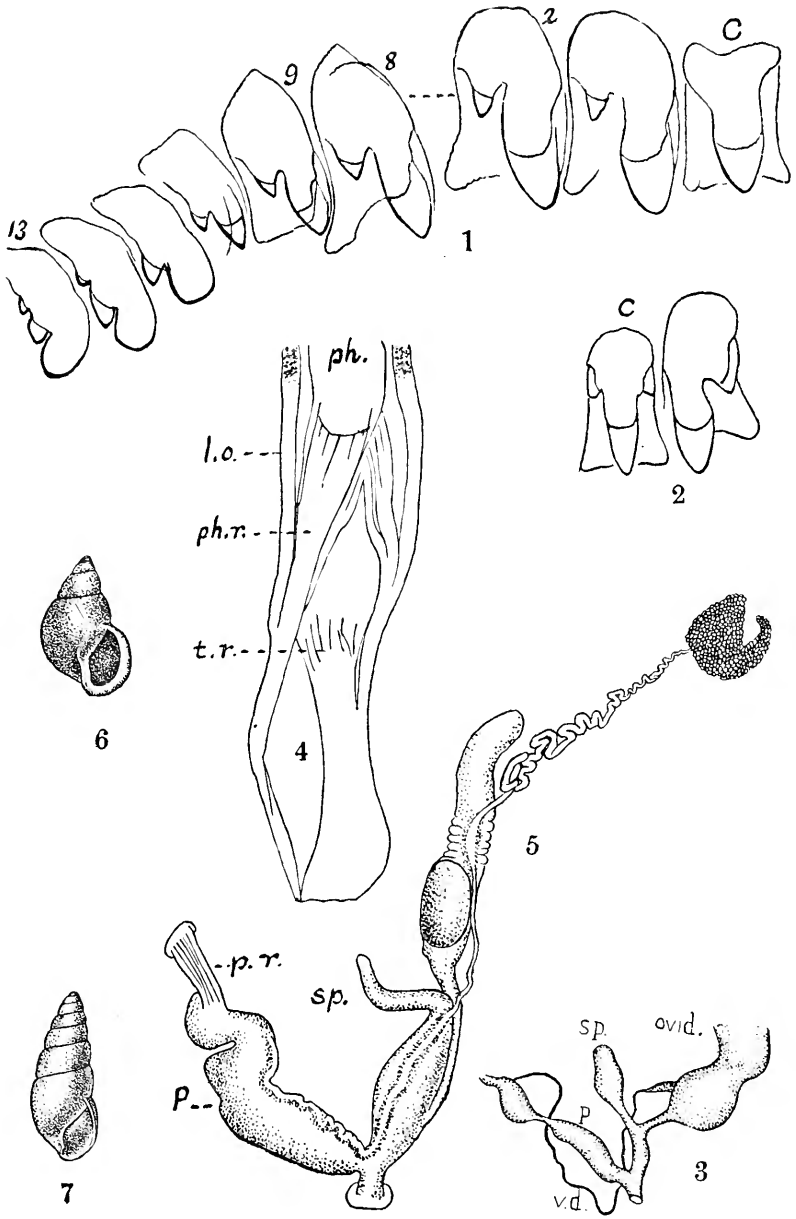


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