

On the family position of some Palau, New Guinea, and Queensland land snails.

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With Plates 12-13 and 2 Textfigures.

Most Pacific land snail species were described during the latter half of the nineteenth century. Some have been subsequently considered in faunal reviews or systematic monographs; others were carefully enough described and figured that their affinities are relatively clear; but many have never been figured or even re-examined since their original description. Subsequent studies have greatly altered the concepts of the nineteenth century genera and many anomalous generic records must be accounted for in any zoogeographic study on Pacific land snails.

The opportunity is taken to re-evaluate the taxonomic position of several problematic species. Perhaps the only unifying feature of these notes is that: (1) the species all come from areas near the distributional limits of the families concerned; and (2) in general appearance could belong equally probably to two or more families. In each of the species considered below, „positive shell-characters“ indicate affinities with taxa whose anatomy is sufficiently well known to enable family placement. The information gained from the examination of these species is included in a zoogeographical survey of the Pacific land snails. Since the species are rarely found in museum collections, it has been thought worthwhile to publish illustrations of critical taxonomic characters as an aid to future students.

The shells described as *Buliminus (Ena) colonus* MOELLENDORFF, 1895, *Bulimus macleayi* BRAZIER, 1876, and *Bulimus beddomei* BRAZIER, 1880 are placed in the Enidae; *Endodonta lacerata* SEMPER, 1874 in the Limacacea; *Rhytida bednalli* PONSONBY, 1907, *Charopa delectans* SMITH, 1898, and *Endodonta acuticarinata* THIELE, 1928 in the paryphantid genus *Ouagapia*; and *Paryphanta elegans* FULTON, 1902, *Paryphanta striata* FULTON, 1902, *Paryphanta louisadarum* MOELLENDORFF, 1899, and *Rhytida globosa* HEDLEY, 1890 in the Endodontidae.

Specimens were examined primarily at the University of Michigan Museum of Zoology (UMMZ), but also at the Academy of Natural Sciences of Philadelphia (ANSP) during the author's tenure as Jessup Fellow in the Summer of 1955, the United States National Museum (USNM) in 1954 and 1955, and the Chicago Natural History Museum (CNHM) in the Summer of 1956. I am deeply indebted to Drs. HENRY VAN DER SCHALIE, the late HENRY A. PILSBRY, HARALD A. REHDER, YOSHIO KONDO, and FRITZ HAAS for permission to ex-

amine specimens and for many helpful suggestions as to the possible affinities of these species. The excellent drawings accompanying this paper are the work of Mr. E. JOHN PFIFFNER, Staff Artist of the Chicago Natural History Museum.

SYSTEMATICS.

Palau Islands.

Endodonta lacerata SEMPER, 1874.

(Pl. 12 figs. 1-3; pl. 13 figs. 1-2).

Endodonta lacerata SEMPER (1874, Reis. Philippinen, 2, 3: 141) has never been figured or subsequently recorded in the literature. The original localities are Peleliu and Nermalck on Koror in the Palau Islands. Dr. YOSHIO KONDO of the Bishop Museum collected specimens near Ngalkol, Peleliu in 1936 and kindly furnished two shells and four preserved animals for examination.

Study of the only other available specimen (UMMZ 136719 ex WALKER, PONSONBY, HUNGERFORD) had suggested that *Endodonta lacerata* might belong to the trochomorphine genus *Videna*. The carinate shell, sculpture of tuberculate spiral lirae (Pl. 13 fig. 1), wide umbilicus, and two apertural lamellae (Pl. 13 fig. 2) are quite different from the usual endodontid structures. H. BURLINGTON BAKER (1941, Bull. Bernice P. Bishop Mus., 166: 271-285) monographed the remarkable trochomorphine taxa of the Palau and Caroline Islands. The endemic genera *Hogolua*, *Kondoa*, and *Brazieria* of the Carolines, and the endemic subgenera of *Videna* found in the Palau Islands are the most aberrant genera of the Trochomorphinae. *Brazieria* and *Kondoa* have distinctive surface sculpture, while *Videna* (*Periryua*) and *Brazieria* have apertural dentition.

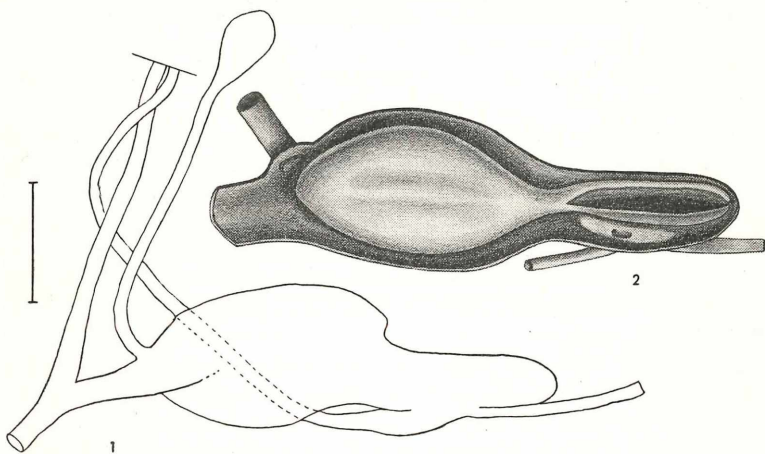


Fig. 1-2. *Videna* (*Liravidena*) *lacerata* (SEMPER).

1) Male genitalia. Scale line equals 2 mm.

2) Diagram of penial region, showing position and size of internal pilasters.

The Bishop Museum specimens were dissected. The male genitalia (Fig. 1) place *lacerata* in *Videna*, but the lateral position of the penial retractor and epiphallus, very large penial stimulator (Fig. 2), and the conchological characters mentioned above separate *lacerata* from any of the previously named sub-generic units (see H. B. BAKER, 1941: 281). A new subgenus, *Liravidena*, is described below.

Liravidena new subgenus.

Shell 10 mm in diameter, trochiform, carinate, with a sculpture of tuberculate spiral lirae. Aperture with columellar swelling and short high lamella within basal lip. Umbilicus widely open. Spermatheca entering base of penis. Penial cavity with single high stimulator. Epiphallus and penial retractor inserting laterally on penis.

Type species — *Endodonta lacerata* SEMPER.

Comparative measurements of the three specimens examined are:

Lot number	Height	Diameter	H/D ratio	Whorls
UMMZ 136719	4.1	8.8	0.47	5 ¹ / ₈
CNHM 57901	5.4	10.1	0.53	5 ⁵ / ₈
	5.0	9.9	0.50	5 ³ / ₈

In the same paper SEMPER described *Endodonta constricta* and *E. irregularis* from Peleliu. Both were examined and found to be endodontids. They represent a highly modified stock, however, and consideration of them is deferred until more Micronesian material is available.

New Guinea.

Buliminus (Ena) colonus MOELLENDORFF, 1895.

(Pl. 12 figs. 4, 5; pl. 13, figs. 3, 4).

Buliminus (Ena) colonus MOELLENDORFF, 1895, Proc. Malac. Soc. London, 1: 237-238, pl. 15 fig. 6. [Constantinhafen, New Guinea (KUBARY!).]

Buliminus (?) colonus MOELLENDORFF, KOBELT, 1899, Conch. Cab., I, 13 (2): 565-566, p. 88 figs. 19-21.

Buliminus colonus var. *tumida* KOBELT, 1899, Conch. Cab., I, 13 (2): 566.

KOBELT (1902, Conch. Cab., I, 13 (2): 1022) established a subgenus, *Apoëcus*, for *Buliminus colonus*, and in a later footnote (1902: 1030) suggested that *Apoëcus* may not be an enid, but might be related to *Coliolus arfakiensis* TAPPARONE-CANEFRI. THIELE (1931, Handb. Syst. Weichtierkunde, I, 2: 682) placed both *Apoëcus* and *Coliolus* in the camaenid genus *Ganesella*. The New Guinea species of *Ganesella* were catalogued by VAN BENTHEM JUTTING (1933, Nova Guinea, Zoology, 17: 26-28), but she did not include *Apoëcus*. *Coliolus arfakiensis* is a camaenid, but *Apoëcus* probably is an aberrant enid.

Both typical *colonus* (UMMZ 125613, New Guinea) and variety *tumida* were examined. The two probably represent extremes of individual variation and are not taxonomically separable. The only species similar to *A. colonus* is „*Pseudonapaeus*“ *apertus* (MARTENS) from Timor (see KOBELT, 1902, Conch.

Cab., I, 13 (2): 718-719, pl. 106 fig. 9) which B. RENSCH (1935, S.-B. Ges. naturf. Fr., Berlin, 1935: 320) has shown is an enid.

The 2½ apical whorls of *Apoëcus colonus* are sculptured with very fine incised spiral lines (Pl. 13 fig. 3). In this respect *Apoëcus* resembles the Pacific pachnodine enids, *Rhachistia* or *Eorrhachis* (= *Rhachispeculum* IREDALE, 1933), but the latter have unexpanded lips and are bulimuliform rather than pupiform in shape. The remaining whorls of *A. colonus* are minutely granulose with retractive growth riblets. Near the lower margin of each whorl is a series of sharply retractive impressed lines (Pl. 13 fig. 4). Further study may show that „*Pseudonapæus*“ *apertus* should be placed in *Apoëcus*.

Measurements of three specimens of *A. colonus* are:

Lot number	Height	Diameter	H/D ratio	Whorls
<i>A. c. colonus</i> (UMMZ 125163)	20·9	10·1	2·07	10½/8
<i>A. c. tumida</i> (UMMZ 112313)	20·6	10·4	1·98	9½/2
	19·1	10·0	1·91	9¼/4

***Bulimus macleayi* BRAZIER, 1876.**

(Pl. 12 fig. 6).

Bulimus macleayi BRAZIER, 1876, Proc. Linn. Soc. New South Wales, 1: 108. [Yule Island, Papua]; TAPPARONE-CANEFRI, 1883, Ann. Mus. Civ. Storia Nat., Genova, 19: 104, pl. 2 figs. 16-17; PILSBRY, 1909, Man. Conch., (2) 20: 319.

Bulimus beddomei BRAZIER, 1876, Proc. Linn. Soc. New South Wales, 1: 127. [Mt. Desert Island, N. Queensland] (nomen nudum); BRAZIER, 1880, I b i d., 4: 394. [Torres Strait, Thursday Island, Port Darwin].

Partula macleayi (BRAZIER), HEDLEY, 1894, Proc. Linn. Soc. New South Wales, (2) 9: 387, pl. 26 figs. 22-23. Rigo, Papua (radula and jaw).

Papuina macleayi (BRAZIER), PILSBRY, 1900, Man. Conch., (2) 13: 121-122.

Aminopina beddomei (BRAZIER), IREDALE, 1938, Austr. Zool., 9 (2): 93.

Aminopina macleayi (BRAZIER), IREDALE, 1941, Austr. Zool., 10 (1): 64.

Only specimens of the Australian *beddomei* (CNHM 41530 ex WEBB, FULTON from Port Darwin and USNM 169110 from North Australia) were available. Whether *macleayi* (New Guinea) and *beddomei* (Queensland) are synonymous (HEDLEY) or distinct (IREDALE) is beyond the scope of this paper. The shell of *Aminopina* (Pl. 12 fig. 6) closely resembles the enids *Rhachis* and *Rhachistia* in shape, but differs in being brownish in coloration and having a sculpture of only vague retractive growth wrinkles rather than spiral lines.

The jaw and radula of *Aminopina* were figured by HEDLEY (1894) who placed the species in the Partulidae. PILSBRY (1900) pointed out that the radula of *Aminopina* is not of the partulid type, but made no effort to suggest its true family position. If the obvious arboreal adaptation of widened cusps is ignored, *Aminopina* has a radula very similar to the Siamese *Rhachistia* figured by TOMLIN & PEILE (1930, Proc. Malac. Soc. London, 19: 154).

The lack of spiral sculpture, simple lip, and smooth apex suggest that *Aminopina* may be an Enid. Examination of the pallial organs and genitalia would easily settle the enid or partulid question, since the two families show major structural differences in these regions. Iredale's suggestion that *Aminopina* is related to *Papuina* has no basis in conchology or anatomy.

Rhytida bednalli PONSONBY, 1907.

(Pl. 12 figs. 7-9; pl. 13 fig. 5).

Two cotypes from German New Guinea (UMMZ 136637 ex WALKER, PONSONBY, BEDNALL) enable clarification of the status of *R. bednalli*. The original figures (PONSONBY, 1907, Proc. Malac. Soc. London, 7: 224) show fine crowded ribs which extend into the umbilicus. Actually (Pl. 13 fig. 5) the ribs are widely spaced and are nearly obsolete below the middle of the whorl. The smooth apex, wide umbilicus, reduced basal sculpture, color pattern of greenish horn with red flammulations, and few irregular spiral lines at once place *R. bednalli* in the paryphantid genus *Ouagapia*. Most species of *Ouagapia* differ from *bednalli* in having the body whorl sharply and distinctly shouldered on the umbilical rim. This species can be placed in the typical section of *Ouagapia*, as defined by SOLEM (1959, Fieldiana Zoology, 43: 159-160).

The two cotypes measure:

Height	Diameter	H/D ratio	Whorls	Umbilicus	D/U ratio
3.7	6.7	0.55	4	2.7	2.48
3.8	6.7	0.57	4	2.7	2.48

Charopa delectans SMITH, 1898

and

Endodonta acuticarinata THIELE, 1928.

E. A. SMITH (1898, Proc. Malac. Soc. London, 3: 33, pl.2 figs. 23-24) described *Charopa delectans* from Kapaur, southwest New Guinea and J. THIELE (1928, Zool. Jb., Syst., 55: 127, pl. 5 fig. 13) named *Endodonta acuticarinata* from Ralum, New Britain. Subsequently ILSE RENSCH (1937, Arch. Naturgesch., N. F., 6 (4): 586, fig. 8) figured the radular teeth of *acuticarinata* and placed the species in the Polynesian endodontid genus *Nesodiscus*. A closely related species was reported from Milne Bay, South Papua by HEDLEY (1892, Proc. Linn. Soc. New South Wales, 6: 80-81). VAN BENTHEM-JUTTING (1958, Nova Guinea, n. s., 9 (2): 327) reported *Charopa delectans* from Misool Island.

Both of the descriptions mention a sculpture of weak spiral lines, smooth apical whorls, and an umbilical keel. The general appearance of the shells differs from the rhytidid genus *Ouagapia* only in the possession of a peripheral keel. The keel of *delectans* has the ribs continuing over it, while that of *acuticarinata* is smooth. The absence of minor riblets and apertural dentition, and presence of a very wide umbilicus are not characters usually associated with the Endodontidae. The Misool Island specimen was examined and found to have the basic sculpture of *Ouagapia*.

The radular structure offers conclusive evidence that *acuticarinata* is not an endodontid. The endodontid radula consists of about 100 small squarish teeth per row which are adapted for a herbivorous diet. The teeth of *acuticarinata* (I. RENSCH, 1937, Arch. Naturgesch., N. F., 6 (4): 586, fig. 28) are long and dagger-shaped with only thirteen in a row. Allowing for differences in drawing techniques, they are the same type of teeth found in the carnivorous

Paryphantidae [see KONDO, 1943, Occ. Pap. B. P. Bishop Mus., 17 (19): 236, fig. 2].

IREDALE (1933, Rec. Austr. Mus., 19: 54) proposed the genus *Torresiropa* for *Helix spaldingi* BRAZIER, which proved to be a member of this species complex (specimens in CNHM 46374). The basic structure of the shells is as in the typical Polynesian *Ouagapia* as defined by SOLEM (1959, Fieldiana, Zool., 43: 159-160). They are retained in the same generic unit, but the peripheral keel is a character easily separating a species complex and *Torresiropa* can be used as a subgenus. The species would thus be cited as *Ouagapia (Torresiropa) delectans* and *O. (T.) acuticarinata*.

***Paryphanta elegans* FULTON, 1902.**

A single paratype (ANSP 109258 ex SOWERBY & FULTON from the Ava River, New Guinea) was examined. The apical sculpture is arranged in a series of minute spiral pits. On the base of the sharply keeled shell the pits are prominent, but above the keel the sculpture consists of retractive radial ribs at irregular intervals. The specimen is 4.7 mm in diameter, 2.1 mm high and has $2\frac{3}{4}$ whorls.

THIELE (1928, Zool. Jb., Syst., 55: 124-127) showed that two very closely related species, *P. lamelligera* THIELE and *P. similis* THIELE, have endodontid radulae. THIELE proposed a new genus, *Paryphantopsis*, for his species and *P. elegans* FULTON, 1902 and *P. striata* FULTON (1902, Ann. Mag. Nat. Hist., (7) 9: 182-183). THIELE provisionally referred a fifth species, *Paryphanta lousiadarum* MOELLENDORFF, to *Paryphantopsis*, although he had never seen any specimens. *P. lousiadarum* is discussed immediately below.

***Paryphanta lousiadarum* MOELLENDORFF, 1899.**

(Pl. 12 figs. 10-11; pl. 13 fig. 6).

The original description (MOELLENDORFF, 1899, Nachr.-Bl. dtsh. malak. Ges., 31: 89) and illustrations (MOELLENDORFF, 1902, Conch. Cab., I, 12, B: 17, pl. 3 figs. 1-3) omit the pitted apical sculpture (Pl. 13 fig. 6), which is the same type found in *Paryphantopsis elegans*. A paratype of *P. lousiadarum* from the Louisiades (UMMZ 127616 ex WALKER, PONSONBY, FULTON, STRUBELL) and a shell from Rossel Island, Louisiades (ANSP 109257 ex SOWERBY & FULTON) were examined.

IREDALE (1941, Austr. Zool., 10 (1): 93) apparently overlooked THIELE's paper and made *lousiadarum* the type of a new paryphantid genus *Illonesta*, in which he also included FULTON's species, *striata* and *elegans*. *Illonesta* thus becomes a synonym of *Paryphantopsis*.

***Rhytida globosa* HEDLEY, 1890.**

Rhytida globosa was found at an elevation of 13,000 feet on Mt. Victoria in the Owen Stanley Mountains of New Guinea (HEDLEY, 1890, Ann. Rep. British New Guinea, 1888-1889: 65). The description mentions the pitted api-

cal whorls, although the only illustrations (HEDLEY, 1891, Proc. Linn. Soc. New South Wales, (2) 6: 80, pl. 10 figs. 15-16) are not detailed enough to show the minute sculpture.

IREDALE (1941, Austr. Zool., 10 (1): 92) placed *globosa* in a new genus, *Gallodema*, together with *Rhytida trobriandensis* SMITH (1897, Proc. Malac. Soc. London, 2: 287, p. 17 figs. 1-3) from Trobriand Island, Louisiades and *Macrochlamys papuensis* PRESTON (1902, Proc. Malac. Soc. London, 5: 17, fig. 1) from the northern coast of British New Guinea. *Rhytida trobriandensis* probably belongs to the group of Queensland paryphantids IREDALE called *Murphitella*. Specimens from Collingwood Bay, New Guinea of *Macrochlamys papuensis* PRESTON (UMMZ 81103 ex WALKER, PONSONBY, PRESTON) are unquestionably a helicarionid snail, probably not even subgenerically separable from *Macrochlamys* s. str.

Most of the species of *Paryphantopsis* mentioned above are auriform. Only *P. louisadarum* begins to approach a depressed-globose shape similar to that of *Gallodema globosa*. The latter is a high mountain species and obviously differs in shape from the lowland *Paryphantopsis*. The similarity of sculpture is unmistakable, however, and probably anatomical investigations will prove that all the species are closely related. In many „zonitid“ taxa, shifts from depressed-globose to auriform or vestigial shells occur with practically no important anatomical changes, i. e., the North American *Mesomphix-Vitrinizonites*. It is possible that the *Paryphantopsis-Gallodema* series represent a similar development. Since the sculpture of the two taxa is the same, affinities will be better shown by considering *Gallodema* to be a subgenus of *Paryphantopsis*.

CONCLUSIONS.

On the basis of shell sculpture and the anatomy of allied taxa, the species discussed above have been placed in the following systematic categories¹⁾:

Pulmonata Orthurethra.

Family Enidae.

Apoëcus colonus (MOELLENDORFF) (Enidae, Camaenidae).

Aminopina macleayi (BRAZIER) (Partulidae, Camaenidae).

Pulmonata Sigmurethra.

Aulacopoda.

Family Endodontidae.

Paryphantopsis (*P.*) *elegans* (FULTON) (Paryphantidae).

P. (*P.*) *striata* (FULTON) (Paryphantidae).

P. (*P.*) *louisadarum* (MOELLENDORFF) (Paryphantidae).

P. (*Gallodema*) *globosa* (HEDLEY) (Paryphantidae).

Family Zonitidae.

Videna (*Liravidena*) *lacerata* (SEMPER) (Endodontidae).

Holopoda.

Family Paryphantidae.

Ouagapia bednalli (PONSONBY) (Paryphantidae).

O. (*Torresiropa*) *delectans* (SMITH) (Endodontidae).

O. (*T.*) *acuticarinata* (THIELE) (Endodontidae).

¹⁾ The names in parenthesis indicate the families the species are commonly referred to.

The systematic conclusions are important for the bearing they have on the zoogeographic affinities of New Guinea and northern Queensland. If the anatomy confirms the place of *Apoëcus* and *Aminopina* in the Enidae, this will be an Asiatic relationship; as a partulid, *Aminopina* would derive from the Pacific Ocean fauna.

The presence of the Austral-New Zealand „*Paryphanta*“ in New Guinea, or even determination of *Paryphantopsis* as a paryphantid, suggests Australian rather than Oriental ties. Normally any species of Endodontidae would be considered as Australian or Pacific Ocean in relationship, but *Paryphantopsis* has a pitted apical sculpture which is found in no Australian, Polynesian, or Micronesian endodontid taxa. The nearest type of sculpture is found in some Indonesian species which have an apical sculpture of both spiral and radial ribs. The transition from a „cross-hatch“ to pitted sculpture is seen in other families and suggests an Indonesian origin for *Paryphantopsis*.

Transfer of the „endodontids“ to the Paryphantidae (*Ouagapia*) and the Palau species to the Zonitidae (*Videna*) clarifies several distributional patterns, but does not have the regional significance that the other three changes do.

Plate 12

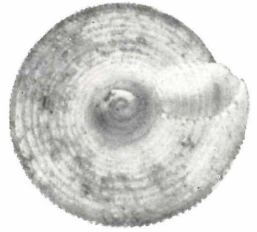
- Fig. 1-3. *Videna (Liravidena) lacerata* (SEMPER). Palau Islands. UMMZ 136719.
Fig. 4. *Apoëcus colonus* (MOELLENDORFF). New Guinea. UMMZ 125163.
Fig. 5. *Apoëcus colonus* var. *tumidus* KOBELT. Constantihaven, New Guinea. UMMZ 112313 (paratype?).
Fig. 6. *Aminopina macleayi* (BRAZIER). Port Darwin, Australia. CNHM 41530.
Fig. 7-9. *Ouagapia (O.) bednalli* (PONSONBY). German New Guinea. UMMZ 136637 (cotypes).
Fig. 10-11. *Paryphantopsis (P.) louisadarum* (MOELLENDORFF). Louisiade Islands. UMMZ 127616 (paratype).



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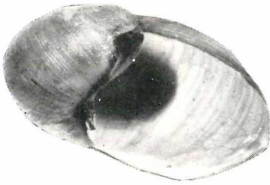
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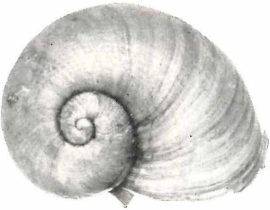
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A. SOLEM: On the family position of some Palau, New Guinea, and Queensland land snails.

Plate 13.

Fig. 1-2. *Videna (Liravidena) lacerata* (SEMPER).

1) Sculpture on body whorl.

2) Apertural dentition.

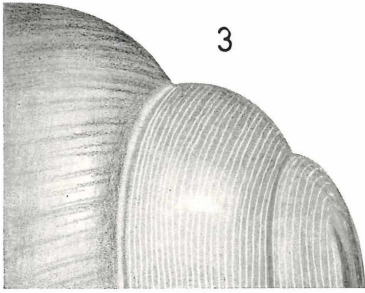
Fig. 3-4. *Apoëcus colonus* (MOELLENDORFF).

3) Apical sculpture.

4) Margin of penultimate whorl.

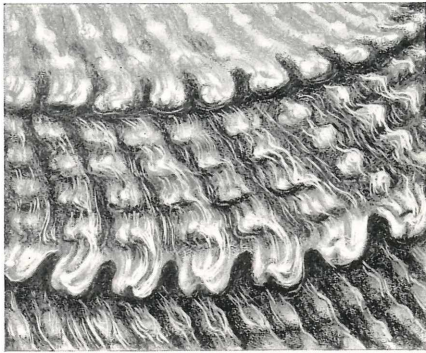
Fig. 5. *Ouagapia (O.) bednalli* (PONSONBY). Sculpture below periphery of body whorl.

Fig. 6. *Paryphantopsis (P.) lousiadarum* (MOELLENDORFF). Apical sculpture.



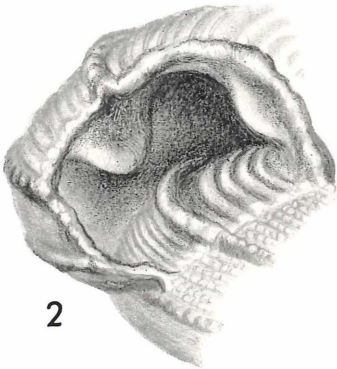
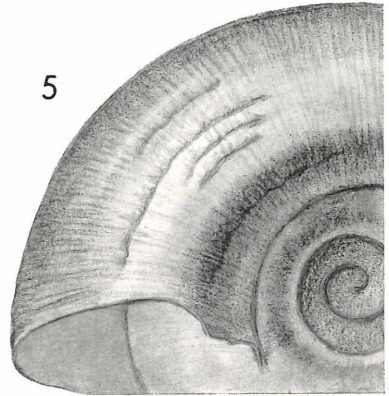
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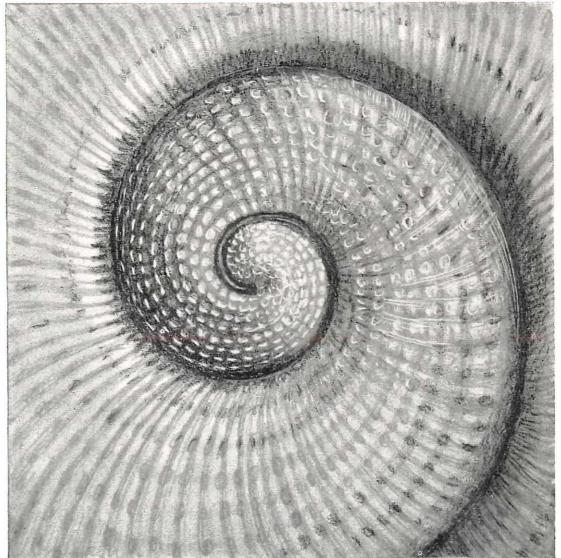
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A. SOLEM: On the family position of some Palau, New Guinea, and Queensland land snails.

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