

Length 14 mm., diameter 3.2 mm.; 10 whorls, type.

Length 12 mm., diameter 3 mm.; $9\frac{1}{3}$ whorls.

Huadqueña Vilcanota Valley, 1500 meters (the head of Urubamba Valley), Peru. Type and paratype 180029 ANSP.

While these shells agree in the main with Morelet's account, there are discrepancies which indicate a different species or at least subspecies. He writes of *C. angrandi*: "Il porte un carène dorsale assez fortement crénelée par les stries que vont y aboutir." This could not be said of our shells. The locality for *C. angrandi* was "Maraynioc, dans la montaña de Tarma."

PERUINIA FLACHI BRADINA, new subspecies. Plate 3, fig. 6.

This form has the light color (pale cinnamon) of *P. peruana* (Troschel), but the more slender shape and nearly flat whorls of *P. flachi* (Boettger), which is decidedly smaller.

Length 35 mm., greatest diameter 7.3 mm.; 8 whorls.

Oxapampa, Peru, 1600 meters elevation. Type 17999 ANSP.

The upper two whorls in the figured type are empty and there is evidently a septum at a later stage, so that if normally broken back it would be slightly over 32 mm. long, with 6 whorls.

The size of *P. flachi* given by Boettger is $24-25\frac{1}{2} \times 6\frac{1}{2}$ mm., $5\frac{1}{2}$ to 6 whorls.

SOME AMERICAN ACHATINIDAE

By H. BURRINGTON BAKER

This is part 10 of a series on Mexican mollusks, which were collected for Dr. Bryant Walker in 1926. The dissections, on which it is based, were made about 15 years ago, but publication was deferred because additional and better material was being obtained in Jamaica and Puerto Rico. However, since some of the data have already crept into print, a preliminary resumé of the following groups may not be out of place.

Leptinaria Beck, 1837, Index Moll., p. 79; type (only vested species) *Leptinaria unilamellata* ("Fer." Orbigny) from Bolivia.

Opeas Albers, 1850, Die Helic., p. 175; type first selected by Martens, 1861, Die Helic., ed. 2, p. 265, *Stenogyra goodalli*

(Miller) = *O. pumilum* (Pfeiffer) from Cuba. Not *Opeas* (Albers) Fischer et Crosse, 1877, Miss. Scient. Mex. Moll. 1, p. 592; type (?) *O. subula* (Pfr) = *Lamellaxis gracilis* (Hutton) from Cuba.

Lamellaxis Strebel und Pfeffer, 1882, Beitrag Mex. Conch. 5, p. 109; type *L. mexicanus* (Pfeiffer) from Mexico.

Synopeas Jousseaume, 1889, Mem. Soc. Zool. France 2, p. 239; type *S. caracasensis* (Reeve) = *S. beckianum* (Pfeiffer) from Venezuela.

Neosubulina E. A. Smith, 1898, Proc. Malac. Soc. London 3, p. 115; type *N. harterti* Smith from Bonaire, West Indies.

Pseudopeas Putzeys, 1899, Ann. Soc. Malac. Belgique 34, p. lviii; type *P. pulchellum* Putzeys from Africa. Compare *P. egens* (d'Ailly), Odhner, 1932, Proc. Malac. Soc. London 20, p. 31, figs. 22-25, for anatomy.

Tomopeas Pilsbry, 1906, Man. Conch. 18, p. 123; type *Lamellaxis* (?) *layardi* (Benson) from Ceylon.

Comoropeas Pilsbry, 1906, loc. cit.; type *Lamellaxis* (?) *apiculum* (Morelet) from Grand Comoro.

Ochrodermella Pilsbry, 1907, op. cit., p. 327; type *O. martensi* (Dall) from Cocos Island.

Leptopeas H. B. B., 1927, Occ. Papers Mus. Zool. Univ. Mich. no. 182, p. 17; type *Lamellaxis bequaerti* (Pilsbry) from Brazil.

Connollya Odhner, 1932, op. cit., p. 36, figs. 30-32; type *C. camerunensis* Odhner from Africa.

Allopeas H. B. B., 1935, Naut. 48, p. 84; type *Lamellaxis gracilis* (Hutton) from Ceylon.

FERUSSACIINAE

The soft parts of the genera *Opeas*, *Neosubulina* and *Ochrodermella*, which somewhat tentatively are included here, all quite closely resemble those of *Connollya* Odhner (1932). Although, as Odhner decided in the case of his genus, these American groups seem more closely related to the Ferussaciinae than to the Subulininae, they are somewhat intermediate between the two subfamilies. In the true *Opeas* and its allies, the kidney is transverse, and the narrow plaits of the jaw are thoroughly cemented together. In the more typical genera of Ferussaciinae, the kidney extends farther anteriad between the hindgut and ureter, the anal lobe of the mantle glands is somewhat more prominently developed, and the jaw plaits appear to be less firmly united. In both groups, the foot has double pedal grooves. Incidentally, Thiele (1931) founded Opeatinae on the wrong *Opeas*.

NEOSUBULINA SCOPULORUM H. B. Baker.

1927, op. cit., p. 12, pl. 22, figs. 9-12, anatomy. Cf. *N. harterti* Smith, H. B. B., 1924, Occ. Papers no. 152, p. 87, radula and jaw.

The genus *Neosubulina* is evidently a native American group that belongs here. Its pedal grooves, although double, appear weaker than in *Opeas pyrgula*.

OPEAS PYRGULA Schmacker und Boettger.

O. pumilum (Pfr.), Vanatta, 1919, Naut. 33, p. 31, notes on animal.

Anatomy similar to *N. scopulorum* but pedal grooves better marked. Anal lobe of mantle glands crescentic, not markedly deflecting end of rectum. Lung about 3 times as long as its base or 5 times length of kidney, which is little over $\frac{1}{2}$ as long as wide and shorter than pericardium. Uterus very short in non-pregnant animals, but may be greatly swollen by 2 large eggs with white shells. Spermathecal stalk with shorter basal swelling which scarcely protrudes from pear-shaped vagina. Penis with a short muscular sheath around base; internally with ellipsoid epiphallic sac less than $\frac{1}{4}$ as long as penis proper and with almost no penial papilla. Columellar retractor gives off: (1) almost immediately, a heavy left retractor, which soon divides into buccal and left free retractors; (2) some distance below, the right free retractor and (3) continues as broad tail fan, from which arises long penial retractor. Each free retractor gives off: (1) lateral muscle to sides of foot (right one also to cloaca and around penis); (2) inferior tentacular and (3) continues as eye retractor (right one through penioviducal angle). Jaw evidently composed of numerous narrow overlapping plates, with denticulate margins, but are well cemented together (as in *Neosubulina*). Radular formula $10 + 8 + 1 + 20$, with 71 transverse rows; teeth very similar to *O. pumilum*.

The dissected animals (ANSP. 44024) were obtained by the late E. G. Vanatta from his yard in Philadelphia, May 22, 1919. The shell of *O. pyrgula* has less arcuate growth-wrinkles and much stronger spiral striae than does that of *O. pumilum*.

OPEAS PUMILUM (Pfeiffer)

O. goodalli (Miller) Pilsbry, 1906, op. cit., p. 200, pl. 28, figs. 72-74. *O. pumilum* H. B. B., 1927, op. cit., p. 8, pl. 21, fig. 3; radula from Tabasco, Mexico.

Animal similar to *O. pyrgula* but details of foot obscured. Kidney almost as long as pericardium. Uterus greatly stretched by 3 large, white shelled eggs in one example; another contains one embryo with 1.5 whorls inside a shell. Spermathecal sac lemon-shaped; base and vagina less enlarged. Penis relatively more elongate, with retractor arising from connective tissue over tail fan.

Unfortunately, *O. pumilum* is the type species of the genus *Opeas* and may change its name again to *O. hannense* (Rang). Even more unfortunately, "*Opeas gracile*," which generally has been accepted as the type species, is only distantly related. I owe the dissected animals to the kindness of Mr. Hugh Watson, who collected and sent me two lots of animals from the Botanic Gardens, Cambridge, England; all the shells represent the form with the large apex (Pilsbry's fig. 74). The snails succumbed during their sea voyage, and the animals were swollen and macerated.

OCHRODERMELLA PITTIERI (Martens)

Ochrodermella sp., H. B. B., Man. Conch. 28, p. 207.

Foot small, rounded posteriad, with well marked pedal grooves and coarse tessellation. Pallial complex similar to *Neosubulina* but lung about 4.5 times as long as its base or 5 times length of kidney, which is slightly longer than broad, more incurved along ureter, and has more extensive lobe between hindgut and ureter. Jaw much as in *Opeas pyrgula*, but relatively heavier. Radular formula $19 + 9 + 1 + 28$, with 109 rows; teeth similar to those of *Opeas pumilum*, but central practically unicuspid and other teeth squarish.

The animals dissected were collected near Chatham Bay, Cocos Island, by Dr. Pilsbry on the Gifford Pinchot Expedition.

SUBULININAE

Apparently many or most of the species usually included in *Opeas* belong in this subfamily and are placed temporarily in the genus *Lamellaxis*. Since my dissections were made, Odhner (1932) has shown that much of the anatomy of *Pseudo-peas egens* (d'Ailly) is very similar to that of *Lamellaxis*, although he does not describe the origin of the penial retractor or the position of the right eye muscle. What is here called the epiphallus appears to be represented in his figure 25 by the thick

walled sac at the left of the penial apex, while my appendicular caecum seems similar to the thin walled sac on the right side.

The following key defines *Lamellaxis* and the closely related genera *Leptinaria* and *Synopeas*:

- A. Right eye retractor in penioviducal angle; penial retractor arising from (or near) tail retractor; outer teeth of radula multicuspid.
- B. Penial apex bifid, with caecum along side of epiphallus, near apex of which vas deferens enters; radular laterals tricuspid; shell without parietal lamella *Lamellaxis* S. & P.
- BB. Penial apex simple, but with vas entrance near middle of epiphallus; outer laterals bicuspid with aculeate mesocones; shell with parietal and extensive columellar lamellae at some stage *Leptinaria* Beck.
- AA. Right eye retractor free from genitalia; penial apex simple with vas entrance near apex of epiphallus; penial retractor arising from right free retractor; radular teeth quite consistently tricuspid; shell stout and closely coiled *Synopeas* Jousseaume.

LAMELLAXIS (ALLOPEAS) GRACILIS (Hutton)

Opeas gracile H. B. B., 1927, op. cit., p. 7.

Animal similar to *Leptinaria unilamellata*, but foot relatively small, although also with only one irregular pedal groove. Lung about 4.5 times as long as its base or 4 times length of kidney, which is over 1.5 times its base or $1\frac{1}{4}$ times length of large pericardium. Ovotestis of 5 lobes. Talon very shortly recurved. Carrefour quite long. Uterus more elongate, swollen by 4 to 10 large, white shelled eggs. Spermathecal sac fusiform. Vagina swollen. Vas deferens entering apex of epiphallus. Penis slender with enlarged apex when extended, but capable of almost complete retraction into heavy basal sheath that receives branch of right lateral retractor; epiphallus terminating in short vergic papilla; appendicular caecum (along side of epiphallus) lanceolate, with thick tessellate wall and with apex some distance below that of epiphallus. Penial retractor connected by anastomosing fibers with right lateral muscle; inserting on loop of vas and on apices of both epiphallus and appendix. Atrium opening about midway between base of right ommatophore and anterior margin of visceral stalk. Columellar retractor gives off left retractor near origin, right one shortly below, and spreads out into tail fan, which gives off penial retractor. Left retractor gives off heavy buccal muscle near root of tail and divides into

left ommatophoral, inferior tentacular and a few weak bands to side of foot. Right one gives off tentacular retractors and spreads out to side of foot, atrium and basal penial sheath. Right eye muscle in penioviducal angle.

One dissected animal was collected near San Juan, Porto Rico, and several were obtained by Dr. W. H. Rush at Cavite, Luzon, Philippine Islands (ANSP. 84847). Interpretation of the genitalia was greatly aided by serial sections, made by Dr. Eleanor Carothers.

Lamellaxis is separated from *Leptinaria* and expanded, as a genus, to cover most of the species which have usually been included in *Opeas*. Although the simple straight columella of *Allopeas* is very different from the spirally thickened axis of *Lamellaxis* s.s., almost every integradation occurs in intermediate species, just as it does in the genus *Spiraxis*. Retention of this broad genus *Lamellaxis* seems best until the soft parts are known in the type species of the groups *Tomopeas* and *Comoro-peas*, of one of which *Allopeas* may be a section.

LAMELLAXIS (ALLOPEAS) MAURITIANUS (Pfeiffer).

Animal similar to *L. gracilis* but kidney triangular, about $\frac{2}{3}$ as long as its base and about $1\frac{1}{3}$ times pericardial length. Uterus with 3 eggs (diam. 1.3 mm.). Spermatheca with shorter stalk and with ovoid basal swelling. Vagina with more globose enlargement, which in one animal contained 3 spermatophores with fusiform horny capsules. Penis with thinner basal sheath; lower .6 slender with internal pilasters; apical .4 swollen; epiphallus shorter and stouter than appendicular caecum, which reaches penial apex. Radular formula $22 + 17 + 1 + 39$, with 97 rows; outer teeth with elongate backs, retaining tricuspid fascies although multicuspid.

Through the kindness of Dr. Pilsbry, animals from Mauritius, collected by W. F. Webb in 1906 (ANSP. 91186) have been dissected.

LAMELLAXIS (TOMOPEAS?) CLAVULINUS (Potiez et Michaud).

Opeas clavulinum Pilsbry, 1906, op cit., p. 135. ?*Subulina urichi* Smith, 1896, Jour of Conch. 8, p. 235, from Trinidad.

Animal similar to *L. gracilis* but lung about 3.5 times as long as its base or length of kidney, which is a little longer than its base or length of pericardium. Free oviduct considerably

shorter, vagina relatively larger and basal sheath of penis less extensive. Uterus may contain 4 eggs. Penial retractor arising from connective tissue above tail fan although connected with it. Penis long and slender; epiphallus .2 total length and slightly shorter than very attenuate caecum. Radular formula $25 + 1 + 25$, with 87 rows; central unicuspid; laterals squarish; outer teeth mainly with tricuspid fascies but with spatulate cusps.

Mr. Hugh Watson has sent me the dissected specimens under the name of *Leptinaria urichi*. They come from the hot-houses of the Royal Botanical Garden, Edinburgh, Scotland and were collected by A. R. Waterson. They agree very closely with Dr. Pilsbry's *Opeas clavulinum*. Although the genitalia and the retention of tricuspid fascies in the outer radular teeth are more like *Allopeas*, the penial caecum is slender as in *Leptopeas*. Its unicuspid central, the cusps of its outer teeth and the origin of the penial retractor are peculiar. If the anatomy of the type of *Tomopeas* be found similar, *Allopeas* should become a section.

LAMELLAXIS (LEPTOPEAS?) MICRA (d'Orbigny)

Opeas micra H. B. B., 1927, op. cit., p. 10, radula.

A single, badly retracted animal from Marianao, near Habana, Cuba, collected June 14, 1926, has been dissected. It is certainly that of a *Lamellaxis* but seems closer to the next group than to the preceding ones.

LAMELLAXIS (LEPTOPEAS) ARGUTUS (Pilsbry).

Animal similar to *L. gracilis* but lung wall over 4 times as long as its base and less than 4 times length of kidney, which is $1\frac{1}{4}$ times its base and almost 1.5 times percardial length. Ootestis of two small lobes. Uterus with 3 large, white shelled eggs. Spermatheca with small sac and prominent basal swelling. Penis slender, with a loose basal investment of fibers from right lateral retractor; apical $\frac{1}{4}$ bifid; epiphallus with entrance of vas $\frac{1}{3}$ way down and opening through low penial papilla; appendicular caecum very attenuate. Penial retractor arising from left side of tail retractor. Salivary glands slender, lanceolate and almost symmetric; ducts short. Radular formula $14 + 7 + 1 + 21$, with 87 rows; laterals even shorter and broader than in *L. bequaerti*; marginals with more numerous cusps.

The animals dissected are from Córdoba (station 4) and belong to the typical form.

LAMELLAXIS (S. S.) MEXICANUS (Pfeiffer).

Animal similar to *L. gracilis* but lung wall slightly longer; kidney $1\frac{1}{3}$ times as long as base and little longer than large pericardium. Ovotestis with 3 lobes. Uterus containing 3 or 4 eggs. Neither spermathecal sac nor base much swollen. Penis more slender; epiphallus .4 total length, with prominent conical penial papilla; lower .6 with heavy pilaster; caecum very slender but as long as epiphallus. Radular formula is $19 + 8 + 1 + 27$, with 77 rows; laterals with more prominent entocones and less aculeate mesocones than in *L. martensiana*; outer 15 teeth approach comb-like shape of *Leptoceas*.

The dissected animals come from above Necaxa (station 34). The anatomy is very similar to that of *L. argutus*.

LAMELLAXIS MARTENSI (Pfeiffer).

Animal similar to *L. mexicanus* but lung wall 3.5 as long as its base or kidney. Penis with marked swelling below base of epiphallus, which is about $\frac{1}{4}$ length of entire organ, and which opens through more distinct penial papilla. Radular formula $15 + 8 + 1 + 23$, with 73 rows; 1st lateral relatively broader.

In my only animal, form *modestus* from Atoyac, the female organs are very immature but the penis is quite large.

LEPTINARIA UNILAMELLATA (Orbigny).

L. lamellata (P. et M.), H. B. B., 1927, op. cit., p. 22, pl. 20, figs. 100-2, pl. 21, f. 8; anatomy and radula.

My earlier drawing (fig. 100) of the penis shows the entrance of the vas deferens too low; it actually runs up the side of the epiphallus and opens into the latter near the middle of its length.

SYNOPEAS BECKIANUM (Pfeiffer).

Opeas caracasensis Str. & Pfeffer, 1882, op. cit., p. 101, anatomy (largely incorrect). *O. beckianum* H. B. B., 1923, Occ. Papers no. 135, p. 8, pl. 1, fig. 6, radula.

Animal similar to *Lamellaxis gracilis* but foot relatively large; lower pedal groove well impressed. Right and left neck-lappets more prominent. Lung 6 times as long as its base. Ovotestis of 4 lobes; talon tongue-shaped. Uterus containing 5 eggs, which are relatively smaller. Free oviduct and vagina slender.

Spermatheca with obovoid sac and slender stalk. Penis slender, fusiform; basal sheath reduced to investing fibers from right lateral muscles; epiphallus almost $\frac{1}{3}$ length of penis, similar to that of *L. argutus*; appendicular caecum absent; penis proper with heavy pilasters. Penial retractor arising from right free retractor just above division of same. Atrial opening near anterior edge of visceral stalk. Right eye retractor free from genitalia.

The animals dissected come from around Córdoba and are very large obese examples. *Synopeas* appears to be a very distinct genus.

DESCRIPTION OF NEW SPECIES OF ACMAEA.

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The study during which these species were examined and described was made at the University of California, under the guidance of Professor S. F. Light, to whom I want to express my great gratitude. The shells were in part collected personally, in part loaned by the United States National Museum, the Stockholm Riksmuseum, the Zoologisches Museum der Universität, Berlin, and the California Academy of Sciences, San Francisco, California.

ACMAEA CONA, new species.

Apex near anterior third of shell, erect, highest point of shell. Lateral and anterior faces plane or slightly convex. Sculpturing of roughly rounded ribs, often branched, irregularly spaced, with a suggestion of spines near the apex. Interspaces usually wider at margin than ribs, and often finely corded in irregular fashion. Margin crenate due to slight projection of ribs. Surface of interior highly lustrous, with large brown "owl" filling apical area inside muscle scar; intermediate area white, with pencil lines from exterior often showing through; border irregularly marked with brown; muscle scar not conspicuous. External color pattern of ivory ribs alternating with interspaces tinged throughout with pale verdigris streaked with ramifying pencil lines of brown, the brown lines frequently forming a network, which near the apex often is stelliform. Soft parts



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