

Notes on the non-marine molluscs of the island of Borneo 2. The genus *Opisthostoma* (Gastropoda Prosobranchia: Diplommatinidae)¹

J.J. VERMEULEN

Rijksherbarium, P.O. Box 9514, 2300 RA Leiden, The Netherlands

An illustrated account is given of the 14 species of the genus *Opisthostoma* (Diplommatinidae) found on the island of Borneo. Ten species are described as new, and *O. javanicum* (so far known only from Java and Celebes) is recorded from Borneo for the first time.

Key words: Gastropoda, Prosobranchia, Diplommatinidae, *Opisthostoma*, taxonomy, Malaysia, Indonesia, Borneo.

INTRODUCTION

The genus *Opisthostoma* is widespread in SE. Asia. In Borneo so far only three species were known. However, when soil samples are taken in some quantity, it appears that the genus constitutes a common and widespread element of the Bornean malacofauna: hardly a soil sample from a limestone hill is free of them. Most soil samples contain one or two different species, some up to five. Ten new species are proposed in this paper. *O. javanicum* is recorded from Borneo for the first time.

Because of the extraordinary shape many species display, the genus *Opisthostoma* has enjoyed the interest of several malacologists. So far, W. Malaysia is best documented in this respect; Van Benthem Jutting (1952, 1961) has written an extensive account on the rather numerous species occurring there. In 1952, she also gave a checklist of all *Opisthostoma* species.

She follows earlier publications in which the genus is generally synonymized with the genus *Plectostoma* H. Adams, 1865. However, the set of characters separating the two is rather substantial, be it polythetic. Only few species occur, mainly in W. Malaysia, which are morphologically intermediate. *Plectostoma* (which includes *Geothauma* Crosse, 1892) can be separated by the following set of characters: top whorls usually not or only slightly oblique; whorls four or more (inverted portion not included); top whorls and body whorls together forming a conical body (body whorls not cylindrical); shell higher than 1.3 mm. It is thought best here to keep *Plectostoma* and *Opisthostoma* as separate genera.

Almost all species of *Opisthostoma* have shells with a distinctly distorted appearance. Basically, they are dextral, but the last half whorl is sinistral, curving upwards along the spire. On the point of reversal all species show a constriction in their whorls. At this level the operculum is lodged when the animal is entirely retracted. The margin of the operculum is often supported by a narrow transverse ridge on the palatal side of the tube. Next to this ridge, one or more teeth may be present near the constriction,

¹ For no. 1 in this series see Basteria 54: 159-165, 1990.

as well as in the approximately half-whorl beyond the constriction. The occurrence of such teeth in operculate terrestrial gastropods is rare, and one would expect them to obstruct the movement of the operculum. Actually, the operculum fits closely in the narrowest part of the constriction, and the half whorl beyond the constriction becomes wider to such a degree that even the most protruding teeth are passed easily by the operculum.

Very little information is available about the anatomy of these tiny molluscs. Van Benthem Jutting (1948: 587, fig. 43) gives an illustration of the radula.

References to material present in the collection of the author are abbreviated as 'V', followed by a collection number. Eventually all material will be deposited at RMNH.

A few other abbreviations are used in the geographical references in the text, both derived from the Indonesian language: 'G.' = gunung (mountain); 'Kpg.' = kampung (village).

The holotype specimens of the species described here have been deposited in the Nationaal Natuurhistorisch Museum (formerly the Rijksmuseum van Natuurlijke Historie), Leiden (RMNH). Paratypes from the type-locality, if available, will be distributed to other institutes in the following order: British Museum (Natural History), London (BMNH), National Museum of Wales, Cardiff (NMW), Florida State Museum, Gainesville (FMNH), the natural history museum of those countries where the species occur.

ACKNOWLEDGEMENTS

Thanks are due to the staff of the Nationaal Natuurhistorisch Museum, Leiden (RMNH), for the use of their extensive library and generous help in other ways. Soil samples containing species of this genus were collected by Mrs. and Mr. (Ann and Rick) Ball (Longport, England), Mr. Anthony Lamb (Tenom, Sabah) and Dr. K. Mackinnon (Banjarbaru, Kalimantan, Indonesia), Dr. A.J. Whitten (Cambridge, England), Dr. E.F. de Vogel and Dr. W. Prud'homme van Reine (both Leiden, The Netherlands). These samples yielded several species of this wonderful genus.

SYSTEMATIC PART

Genus *Opisthostoma* Blanford, 1860

Shell white to cream-coloured and opaque to more or less translucent when fresh, dextral but seemingly sinistral because of the inverted last 1/4-1/2 whorl. Whorls 3-3 3/4 (inverted portion not counted). Top whorls oblique, smooth, generally only little elevated. Next whorls together forming a wide, approximately cylindrical, often more or less oblique main portion of the shell. Approximately 1/4-1/2 whorl previous to the aperture a constriction is present, the narrowest part of which is usually provided inside with a radial lamella on the palatal side, as well as one or more teeth. The approximately 1/4-1/2 whorl beyond the constriction (here called: tuba) is sinistral, growing upwards along the body whorls, ending in an aperture at the left side of the body whorls when the shell is observed in front (assuming it is dextral). Whorls with radial ribs which are generally crossed by a fine, concentric striation. Aperture sometimes with teeth. Peristome double, the outer rim often flaring. Operculum corneous, circular, multispiral. Shell less than 1.3 mm high.

Distribution (see Van Benthem Jutting, 1952): India, W. Malaysia, Borneo, Java, Celebes.

Notes. — 1. Three terms are introduced here to describe the aberrant shape of the shells. They are defined as follows.

Constriction: a narrow part present at approximately 1/4 to 1/2 whorl previous to the aperture.

Body whorls: the two whorls previous to the constriction. This term is used here in an aberrant sense: normally only the last whorl is called the body whorl.

Top whorls: all the whorls previous to the body whorls.

Tuba: the 1/4-1/2 whorl beyond the constriction.

2. As diameter of the aperture the diameter of the inner peristome is measured.

3. In order to properly observe the diagnostically important teeth in the constriction it is necessary to make a hole in the shell wall, or to break off the tuba. For a quick check it often suffices to moisten the shell with water or alcohol. The teeth can then be seen through the temporarily transparent shell.

Key to the Bornean species of *Opisthostoma*
(check a larger series of shells when possible)

- 1 a - Tuba entirely detached from the body whorls *O. telestoma* (1)
- b - Tuba touching the body whorls over most of its length 2
- 2 a - Upper margin of the aperture distinctly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex (see fig. 1a) 3
- b - Upper margin of the aperture at most touching the plane perpendicular to the coiling axis of the body whorls as well as through the apex (see fig. 1b) . 4
- 3 a - Outer peristome distinctly expanded on the parietal side, covering the top part of the shell. Constriction a sharply demarcated furrow. Umbilicus approximately closed *O. holzmarkii* (2)
- b - Outer peristome not expanded on the parietal side, not covering the top part of the shell. Constriction gradual, not sharply demarcated. Umbilicus open, narrow, deep *O. planiapex* (3)
- 4 a - Constriction inside with at least one short or long, distinct to inconspicuous, longitudinal (!) lamella in a parietal, angular or palatal position (open the shell at the constriction to check); this lamella is not visible on the outer surface of the shell as a distinct, longitudinal furrow (the lamella may or may not project into the tuba) 5
- b - Constriction inside either without a longitudinal lamella in a parietal, angular or palatal position (a transverse lamella may be present); or with a longitudinal ridge on the palatal side which is clearly visible on the surface of the shell as a distinct, longitudinal furrow 10
- 5 a - Aperture with a distinct, knob-like tooth along the upper margin 6
- b - Aperture without a distinct, knob-like tooth along the upper margin 7
- 6 a - Body whorls and tuba moderately angular. Tooth along the lower margin of the aperture ending close to the peristome, distinctly visible when the shell is observed in front *O. hailei* (4)
- b - Body whorls and tuba well rounded. Tooth along the lower margin of the

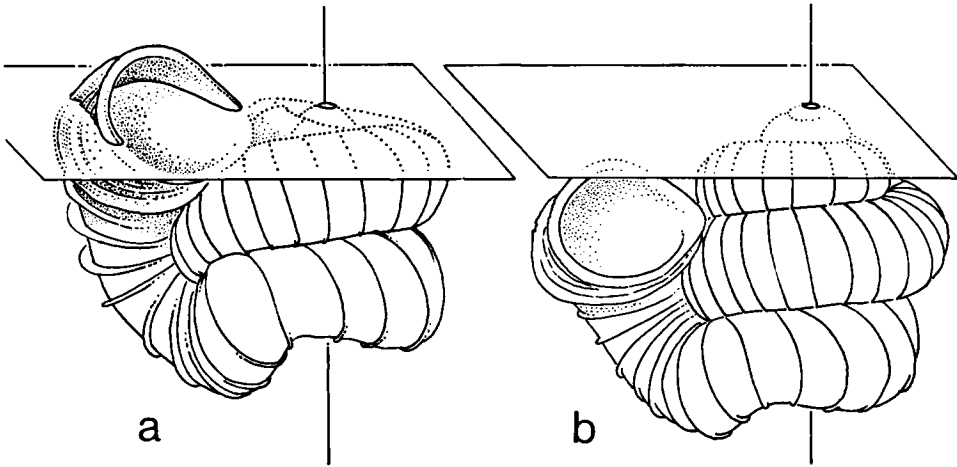


Fig. 1. Explanatory figures to couplet 2 of the key; a, to question 2a; b, to question 2b.

- aperture ending well before the peristome, often hardly visible when the shell is observed in front *O. cryptodon* (5)
- 7 a - First ribs appearing near the protoconch widely spaced 8
 b - First ribs appearing near the protoconch placed closely together 9
- 8 a - Longitudinal lamella at the constriction in angular position, and projecting into the tuba *O. brachyacrum* (6)
 b - Longitudinal lamella at the constriction in palatal position, not or hardly projecting into the tuba *O. tridens* (7)
- 9 a - Constriction with a short longitudinal lamella in parietal position, which does not project into the tuba *O. tarphypleura* (8)
 b - Constriction with a long longitudinal lamella in parietal position, which projects well into the tuba *O. lambii* (9)
- 10 a - Imaginary plane through inner peristome tilted 60 to 90 degrees with regard to the coiling axis of the body whorls (aperture turned 'upwards', straight or obliquely, when looking at the shell in front) in the majority of the specimens 11
 b - Imaginary plane through inner peristome tilted up to 60 degrees with regard to the coiling axis of the body whorls (aperture turned towards the observer when looking at the shell in front) in the majority of the specimens 13
- 11 a - Umbilicus wide; top whorls easily visible inside *O. aetherscopa* (10)
 b - Umbilicus very narrow, almost closed; top whorls not visible inside, or with difficulty only 12
- 12 a - Body whorls distinctly obliquely cylindrical, when the shell is observed in front view. Top whorls moderately elevated *O. lechria* (11)
 b - Body whorls cylindrical, not oblique, when the shell is observed in front view. Top whorls hardly elevated *O. devogelii* (12)
- 13 a - First ribs appearing near the protoconch placed closely together. Ribs on the lower body whorl as well as the constriction rather closely together

- *O. tarphypleura* (6)
- b - First ribs appearing near the protoconch either widely spaced or rather close together, but in the latter case the ribs on the lowermost body whorl well spaced, and those over the constriction even wider spaced 14
- 14 a - Top whorls moderately to distinctly elevated. Body whorls distinctly oblique *O. javanicum* (13)
- b - Top whorls only slightly elevated. Body whorls only slightly oblique *O. ballorum* (14)

1 - *Opisthostoma telestoma* spec. nov.

fig. 2

Shell white, approximately opaque. Whorls 3-3 3/4 (tuba not included); top whorls moderately oblique, somewhat elevated; body whorls forming a somewhat obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl, free, approximately circular in section. Shell with thin radial ribs, which are widely spaced near the top, moderately spaced and low on the upper body whorl (13-21 ribs present on this whorl), slightly more prominent and wider spaced on the lower body whorl, widely spaced, inconspicuous and low over the area of the constriction, and widely spaced, distinct and very high on the tuba. Ribs crossed by fine spiral striation. Umbilicus usually open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 30 degrees with regard to the coiling axis of the body whorls; with the upper margin at most touching the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate; apertural teeth absent; inner peristome thickened, moderately reflected; outer peristome distinctly flaring on the palatal side. Constriction inside with two teeth: one distinct, oblique, short, rather high infracolumellaris, one rather inconspicuous, transverse, long, low palatalis.

Measurements. — Height of body whorls 0.9-1.2 mm; width including tuba 1.4-1.9 mm, without tuba 0.8-1.0 mm; height of aperture 0.5 mm; width of aperture 0.5-0.6 mm.

Ecology. — Callicole.

Distribution. — Borneo: Sabah, possibly rather widespread, but so far only recorded from two widely scattered locations.

Material seen. — SABAH. Interior Zone: Pun Batu approximately 30 km W. of Sepulot (V 1290, HOLOTYPE RMNH 56590, numerous paratypes). Kudat Zone: Pulau Banggi, southernmost point (V 1426 & 1445, all paratypes).

Notes. — This species can be easily recognized because of its entirely free tuba. The name has been derived from the Greek language and refers to this feature; 'tele' means far, and 'stoma' means mouth.

2 - *Opisthostoma holzmarkii* Thompson, 1978

fig. 3a, b

Opisthostoma holzmarkii Thompson, 1978: 387; holotype (Sarawak, Batu Niah) leg. Holzmark, 1976, UF 24836 (not seen).

Shell white, approximately opaque or slightly translucent. Whorls 3-3 3/8 (tuba not included); top whorls slightly to moderately oblique, somewhat elevated; body whorls

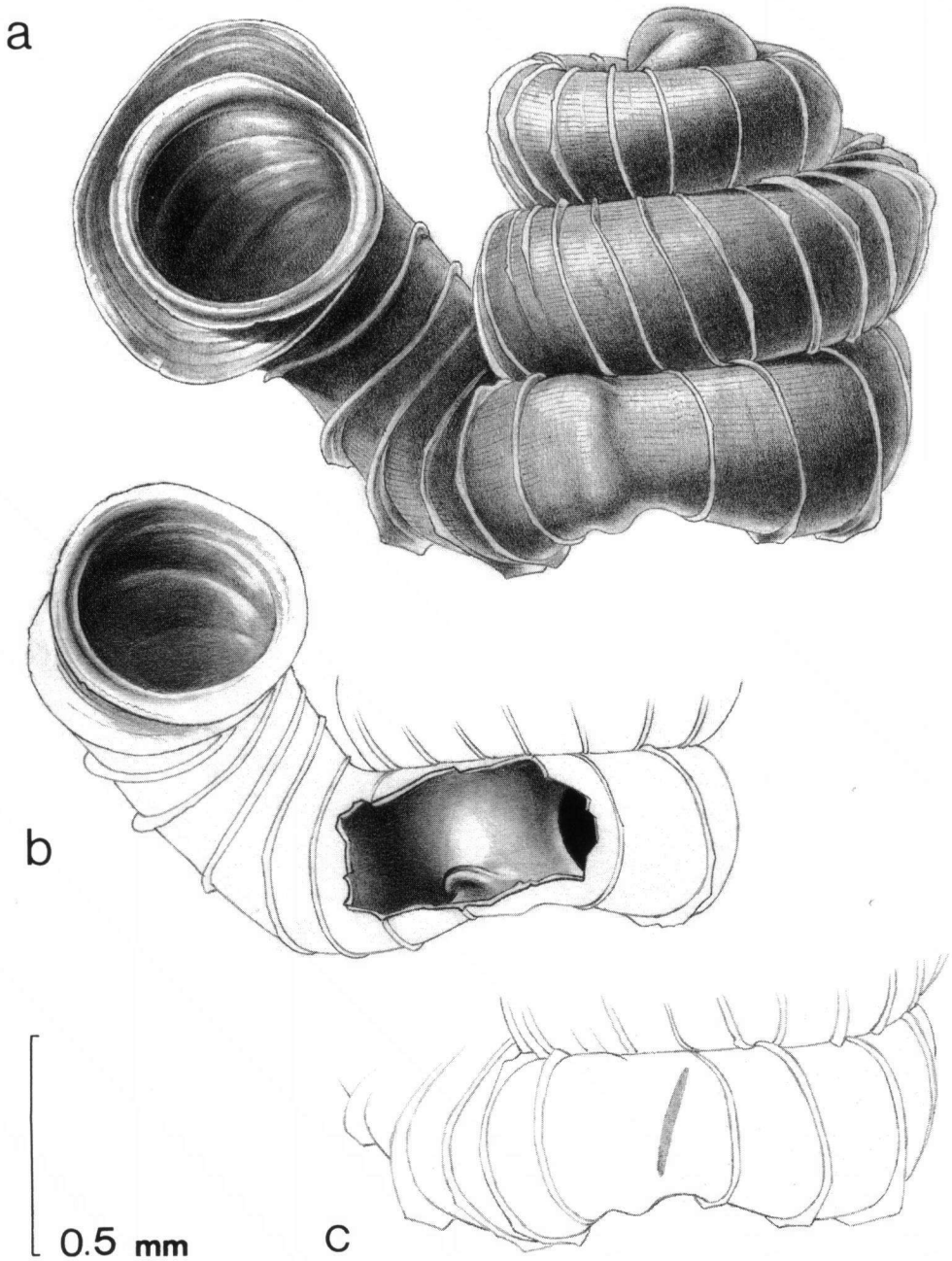


Fig. 2. a, *Opisthostoma telestoma* spec. nov., holotype specimen, Sabah: Pun Batu approximately 30 km W. of Sepulot (RMNH), front view; b, paratype from the same locality, part of shell removed to show infracolumellaris; c, do., position of palatalis indicated with a grey shading.

forming a cylindrical body, convex, the upper body whorl sometimes slightly angular, with the suture well impressed. Constriction rather distinct, a sharp furrow, with an equally sharp, longitudinal furrow on the tuba immediately in front of the constriction. Tuba consisting of 1/2 whorl, touching the body whorls over its entire length, approximately circular in section. Shell with thin radial ribs, which are moderately spaced and low on the upper body whorl (19-27 ribs present on this whorl), approximately similar but distinctly wider spaced on the lower body whorl and over the area of the constriction (sometimes absent on the latter), and moderately to widely spaced and slightly more prominent on the tuba. Ribs usually crossed by fine spiral striation. Umbilicus approximately closed. Aperture with the imaginary plane through the inner peristome tilted up to 30 degrees with regard to the coiling axis of the body whorls; with the upper margin distinctly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate; apertural teeth absent; inner peristome somewhat thickened, somewhat reflected; outer peristome flaring on the palatal side, on the parietal side widely and obliquely expanded and enveloping the top whorls of the shell. Constriction inside often with an inconspicuous, short transverse lamella close to the suture, corresponding with the transverse furrow on the outer surface, as well as with a transverse furrow inside, corresponding with the swelling of the tuba beyond the transverse furrow outside. No parieto-basal tooth present.

Measurements. — Height of body whorls 0.8-0.9 mm; width including tuba 0.9-1.1 mm, without tuba 0.7 mm; height of aperture 0.5 mm; width of aperture 0.5-0.6 mm.

Ecology. — Calcicole.

Distribution. — Borneo: Sarawak, 4th Div., probably endemic to G. Subis (Batu Niah).

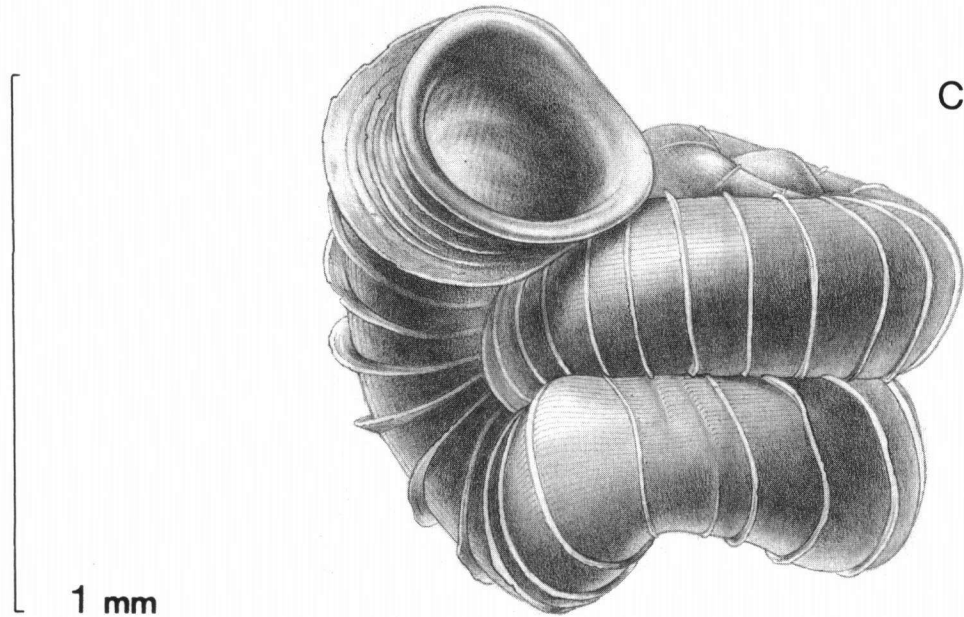
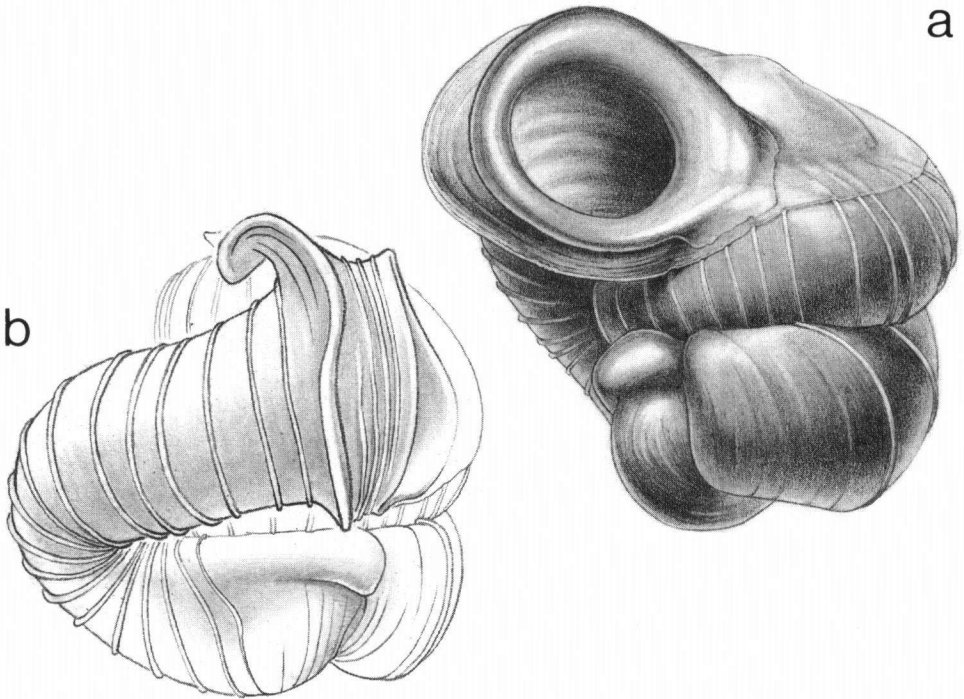
Material seen. — SARAWAK. 4th Div.: G. Subis (V 1515).

Notes. — *O. holzmarkii* is most similar *O. planiapex* but can be easily distinguished by the outer peristome, which is widely expanded and partly or entirely covers the top whorls of the shell.

3 - *Opisthostoma planiapex* spec. nov.

fig. 3c

Shell white, approximately opaque or slightly translucent. Whorls 3 1/8-3 1/2 (tuba not included); top whorls distinctly oblique, hardly elevated; body whorls forming a cylindrical body, convex, often slightly angular, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl (rarely somewhat less), touching the body whorls over its entire length, approximately circular in section. Shell with thin radial ribs, which are widely spaced near the top, moderately spaced and low on the upper body whorl (14-20 ribs present on this whorl), approximately similar but slightly wider spaced on the lower body whorl and over the area of the constriction, and widely spaced and rather high on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted 30-45 (-60) degrees with regard to the coiling axis of the body whorls; with the upper margin distinctly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate; apertural teeth absent; inner peristome somewhat thickened, slightly reflected;



outer peristome usually flaring on the palatal side. Constriction inside with two teeth: one distinct, slightly oblique, short, rather high infracolumellaris, one rather inconspicuous, transverse, long, low palatalis.

Measurements. — Height of body whorls 0.8-1.0 mm; width including tuba 1.2-1.5 mm, without tuba 0.9-1.0 mm; height of aperture 0.5 mm; width of aperture 0.5-0.6 mm.

Ecology. — Calcicole.

Distribution. — Borneo: Sarawak, 1st Div., a limestone hill SW. of Kuching. So far found at a single locality only.

Material seen. — SARAWAK. 1st Div.: G. Kapur 6 km SE. of Bau (V 2227, HOLOTYPE RMNH 56591, numerous paratypes).

Notes. — 1. *O. planiapex* is well characterized by the upper margin of the aperture overtopping the apex of the shell, and by the outer peristome only flaring on the palatal side, not on the parietal side as well, as in *O. holzmarkii*.

2. The name has been derived from the Latin '*planus*': flat, and '*apex*': top.

4- *Opisthostoma hailei* Solem, 1964
fig. 4a

Opisthostoma hailei Solem, 1964: 18; holotype (Sabah, Sandakan District, Gomatong Hill) leg. Haile, 1962, CNHM 118950 (not seen).

Shell white, slightly translucent. Whorls 3 1/8-3 1/2 (tuba not included); top whorls somewhat oblique, moderately elevated; body whorls forming a slightly obliquely cylindrical body, convex, moderately angular, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl (rarely somewhat less), touching the body whorls over its entire length, subtriangular in section. Shell with rather broad radial ribs, which are widely spaced near the top, moderately spaced and low on the upper body whorl (23-25 ribs present on this whorl), approximately similar but somewhat wider spaced on the lower body whorl and over the area of the constriction, and moderately spaced and slightly more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 15 degrees with regard to the coiling axis of the body whorls; with the upper margin not or hardly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; subtriangular; apertural teeth two: one very short, knob-like along the upper margin, close to the peristome; one long, lamella-like along the lower margin, starting at the constriction and ending close to the peristome; inner peristome moderately thickened, moderately reflected; outer peristome distinctly flaring on the palatal side. Constriction inside with two teeth: the above-mentioned longitudinal lamella starting as a parietalis, and a distinct, oblique, short, rather high infracolumellaris; palatalis absent, sometimes present but very inconspicuous.

Fig. 3. a, *Opisthostoma holzmarkii* Thompson, Sarawak: G. Subis (V), front view; b, do., lateral view; c, *Opisthostoma planiapex* spec. nov., holotype specimen, Sarawak: G. Kapur 6 km SE. of Bau (RMNH), front view.

Measurements. — Height of body whorls 1.1-1.3 mm; width including tuba 1.6-1.9 mm, without tuba 1.0-1.1 mm; height of aperture 0.6-0.7 mm; width of aperture 0.6-0.7 mm.

Ecology. — Calcicole.

Distribution. — Sabah, E. part, probably endemic to a few limestone hills along the lower Kinabatangan River.

Material seen. — SABAH. Sandakan Zone: Gomantong Hill 30 km S. of Sandakan (V 1591); Batu Putih along road Lahad Datu-Sandakan, along the Kinabatangan River (V 1475).

Notes. — Very similar to *O. cryptodon*; the differences between the two are given there.

5 - *Opisthostoma cryptodon* spec. nov.
fig. 4b

Shell white, slightly translucent. Whorls 3-3 5/8 (tuba not included); top whorls somewhat oblique, moderately elevated; body whorls forming an often slightly obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl (rarely somewhat less), touching the body whorls over its entire length, approximately circular in section. Shell with rather narrow radial ribs, which are moderately to widely spaced near the top, densely placed to widely spaced and low on the upper body whorl (17-55 ribs present on this whorl), approximately similar but widely spaced on the lower body whorl and over the area of the constriction, and widely spaced and more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 15 degrees with regard to the coiling axis of the body whorls; with the upper margin not or hardly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; subtriangular; one apertural tooth: a very short, knob-like one along the upper margin, close to the peristome; inner peristome moderately thickened, moderately reflected; outer peristome distinctly flaring on the palatal side. Constriction inside with three teeth: one longitudinal, long, lamella-like parietalis, starting at the constriction and projecting into the tuba, but ending well before reaching the peristome (the end only just visible deep inside the aperture); one distinct, oblique, short, rather high infracolumellaris; one transverse, long palatalis.

Measurements. — Height of body whorls 1.0-1.3 mm; width including tuba 1.3-1.8 mm, without tuba 0.8-1.1 mm; height of aperture 0.6-0.8 mm; width of aperture 0.6-0.7 mm.

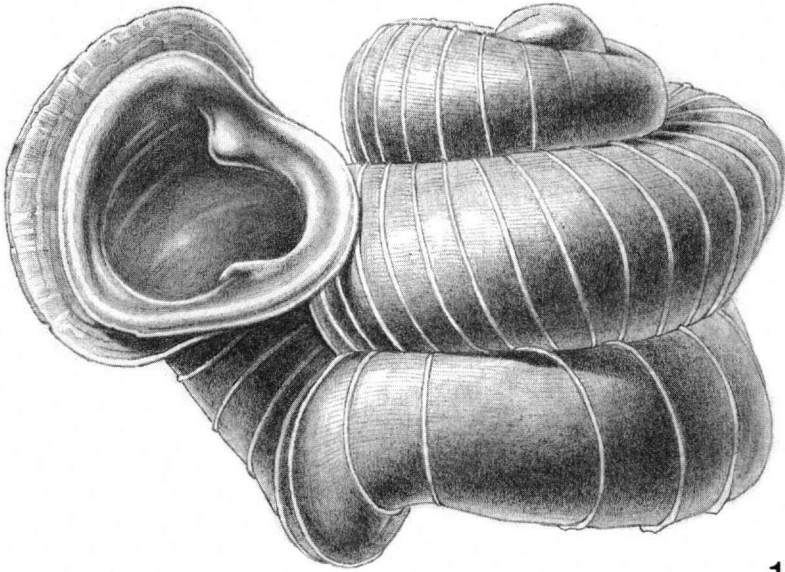
Ecology. — Calcicole.

Distribution. — Sarawak, 1st Div., widespread in limestone hills S. of Kuching.

Material seen. — SARAWAK. 1st Div.: G. Kapur 6 km SE. of Bau (V 2224; leg. De Vogel, V 2632); G. Pangga 3 km ENE. of Bau (V 2141); Kpg. Tiang Bekap 10 km SSW. of Kpg. Beratok (leg. De Vogel, V 2579) (all paratypes); W. of Kpg. Lobang Batu 12.5 km S. of Tebakang (V 2098, HOLOTYPE RMNH 56592, numerous paratypes); 7.5 km WNW. of Kpg. Piching, near Serian (V 1926, paratypes).

Notes. — 1. Sharing with *O. hailsi* the two teeth in the aperture. Differing from that species in the following features: body whorls and tuba well rounded, not angular;

a



1 mm

b

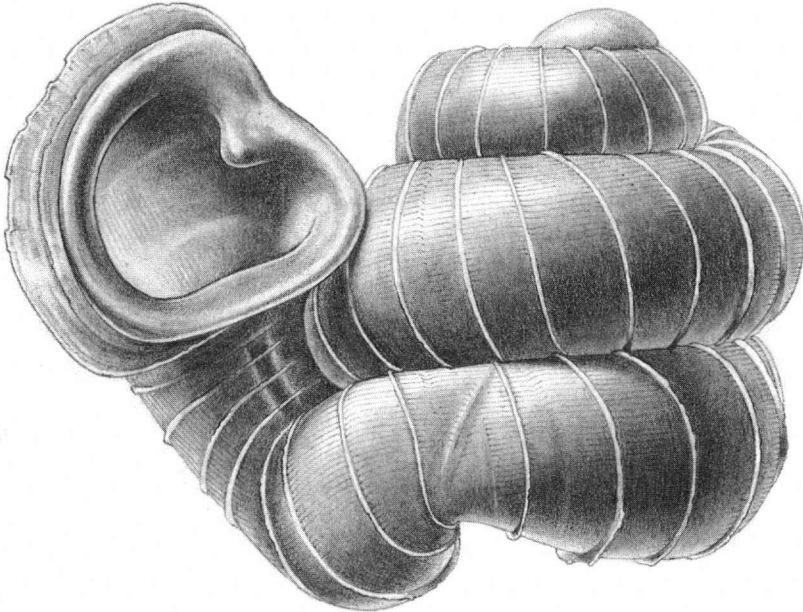


Fig. 4. a, *Opisthostoma hailei* Solem, Sabah: Batu Putih along road Lahad Datu-Sandakan, along the Kinabatangan River (V), front view; b, *Opisthostoma cryptodon* spec. nov., holotype specimen, Sarawak: W. of Kpg. Lobang Batu 12.5 km S. of Tebakang (RMNH), front view.

tooth along the lower margin of the aperture ending well before the peristome, often hardly visible when the shell is observed in front; palatalis in constriction present, distinct.

2. The name has been derived from the Greek language and refers to the teeth in the constriction; '*cryptodon*': with hidden teeth.

6 - *Opisthostoma brachyacrum* Thompson, 1978
fig. 5a, b

Opisthostoma brachyacrum Thompson, 1978: 388; holotype (Sarawak, Batu Niah) leg. Holzmark, 1976, UF 24837 (not seen).

Shell white, slightly translucent. Whorls $3\frac{1}{4}$ - $3\frac{1}{2}$ (tuba not included); top whorls slightly to moderately oblique, moderately elevated; body whorls forming an usually slightly obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately $\frac{1}{2}$ whorl (rarely somewhat less), touching the body whorls over its entire length, approximately circular in section. Shell with narrow, usually inconspicuous radial ribs, which are widely spaced near the top, moderately spaced and low on the upper body whorl (23-36 ribs present on this whorl), approximately similar but more widely spaced on the lower body whorl, widely spaced or almost absent over the area of the constriction, and moderately spaced and often slightly more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 30 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome moderately flaring on the palatal side. Constriction inside with two teeth: one longitudinal, long, lamella-like parietalis, starting at the constriction and projecting into the tuba, but ending well before reaching the peristome (the end not visible deep inside the aperture); one distinct, oblique, rather high infracolumellaris which projects as a distinct, transverse ridge over the palatal surface (missing in some specimens, see below).

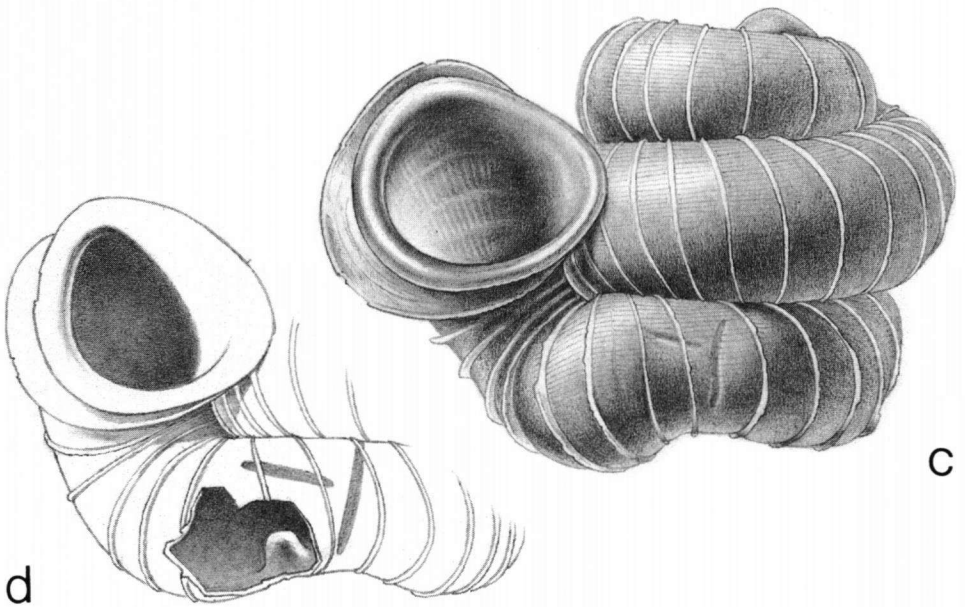
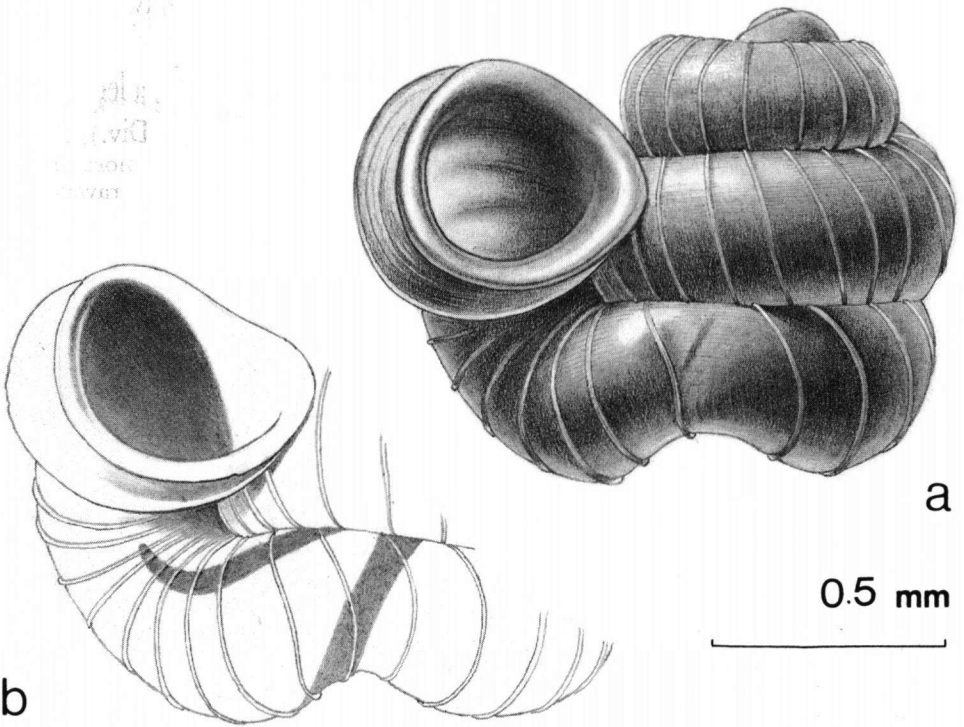
Measurements. — Height of body whorls 0.8-1.0 mm; width including tuba 1.2-1.4 mm, without tuba 0.6-0.8 mm; height of aperture 0.4-0.5 mm; width of aperture 0.4-0.6 mm.

Ecology. — Calcicole.

Distribution. — Borneo: Sarawak, possibly widespread.

Material seen. — SARAWAK. 1st Div.: G. Kapur 6 km SE. of Bau (V 2230). 4th Div.: G. Subis (Batu Niah) (V 1514).

Fig. 5. a, *Opisthostoma brachyacrum* Thompson, Sarawak: G. Subis (V), front view; b, same locality, portion of shell to show the position of the teeth in the constriction (V); c, *Opisthostoma tridens* spec. nov., holotype specimen, Sarawak: Kpg. Beratok along road Kuching-Serian (RMNH), front view; d, same locality, portion of paratype to show the position of the teeth in the constriction (V).



Notes. — 1. Most similar to *O. tridens*; the differences between the two are given under the latter species.

2. The specimens originating from W. Sarawak (1st Div.) often have a less distinct transverse ridge in the constriction than those from E. Sarawak (4th Div.); in one specimen this was even entirely missing. They also tend to have slightly more prominent ribs. Because specimens more closely resembling those from E. Sarawak also occur, no subspecies can be distinguished.

7 - *Opisthostoma tridens* spec. nov.

fig. 5c, d

Shell white, slightly translucent. Whorls 3 1/8-3 5/8 (tuba not included); top whorls moderately oblique, moderately elevated; body whorls forming an usually moderately obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl (rarely somewhat less), touching the body whorls over its entire length, approximately circular in section. Shell with narrow, sometimes rather inconspicuous radial ribs, which are moderately to widely spaced near the top, rather densely placed to moderately spaced and rather low on the upper body whorl (30-46 ribs present on this whorl), approximately similar but more widely spaced on the lower body whorl, widely spaced over the area of the constriction, and moderately spaced and more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 30 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome moderately flaring on the palatal side. Constriction inside with three teeth: one longitudinal, short, lamella-like palatalis which does not or hardly project into the tuba; one distinct, oblique, short, rather high infracolumellaris; one often inconspicuous, transverse, rather long, palatalis (almost missing in some specimens).

Measurements. — Height of body whorls 0.8-1.0 mm; width including tuba 1.3-1.5 mm, without tuba 0.8-1.0 mm; height of aperture 0.5 mm; width of aperture 0.5-0.6 mm.

Ecology. — Calcicole.

Distribution. — Sarawak, 1st Div., limestone hills S. of Kuching.

Material seen. — SARAWAK. 1st Div.: Kpg. Beratok along road Kuching-Serian (V 2024, HOLOTYPE RMNH 56593, numerous paratypes); Kpg. Tiang Bekap 10 km SSW. of Kpg. Beratok (leg. De Vogel, V 2565); Kpg. Segur Benuk, mile 21 Penrissen Road (leg. De Vogel, V 2545) (all paratypes).

Notes. — 1. Very similar to *O. brachyacrum*. It is mainly different in the configuration of the teeth in the constriction: the longitudinal lamella is situated on the palatal and not on the parietal wall, and it does not or only slightly project into the tuba. Additional differences are that the infracolumellaris and the transverse palatalis are not fused, that the upper body whorl is generally more bulging, giving the shell a more oblique aspect, and that the ribs are generally more prominent and more distinct.

2. The name has been derived from the Latin and refers to the number of teeth present in the constriction; '*tridens*': with three teeth.

8 - *Opisthostoma tarphypleura* spec. nov.
fig. 6

Shell white, slightly translucent. Whorls $3\frac{1}{4}$ - $3\frac{1}{2}$ (tuba not included); top whorls moderately to distinctly oblique, moderately elevated; body whorls forming an usually slightly obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately $\frac{1}{2}$ whorl, touching the body whorls over its entire length, approximately circular in section. Shell with narrow, distinct radial ribs, which are very densely placed near the top, rather densely placed and rather low on the upper body whorl (44-75 ribs present on this whorl), approximately similar but slightly wider spaced on the lower body whorl and over the area of the constriction, and moderately spaced and slightly more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 30° degrees with regard to the coiling axis of the body whorls, with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome hardly to moderately flaring on the palatal side. Constriction inside with two to four teeth: one longitudinal, short, lamella-like angularis which does not project into the tuba; one parietalis of similar position, shape and size (one or both missing in some specimens, see below); one distinct, oblique, rather high infracolumellaris; one distinct, transverse palatalis.

Measurements. — Height of body whorls 0.7-1.0 mm; width including tuba 0.9-1.3 mm, without tuba 0.6-1.1 mm; height of aperture 0.4-0.5 mm; width of aperture 0.4-0.5 mm.

Ecology. — Calcicole.

Distribution. — Sarawak, 1st Div., widespread in limestone hills S. of Kuching.

Material seen. — SARAWAK. 1st Div.: G. Kapur 6 km SE. of Bau (V 2229); G. Pangga 3 km ENE. of Bau (V 2142); G. Jambusan 4 km SE. of Bau (V 2177); Kpg. Tiang Bekap 10 km SSW. of Kpg. Beratok (leg. De Vogel, V 2584); Kpg. Segur Benuk, mile 21 Penrissen Road (leg. De Vogel, V 2537) (all paratypes); W. of Kpg. Lobang Batu 12.5 km S. of Tebakang (V 2097, HOLOTYPE RMNH 56594, numerous paratypes).

Notes. — 1. *O. tarphypleura* is rather similar to *O. lambii*. The two species occur strictly allopatric; they occur on opposite sides of the island of Borneo. *O. tarphypleura* is characterized by either having no longitudinal lamellae in the constriction at all, or one or two short, parallel lamellae of equal length, which do not project into the tuba. *O. lambii* always has one long lamella which projects far into the tuba, and often a much shorter second one. *O. tarphypleura* is otherwise characterized by having the ribs generally more densely placed, in particular over the area of the constriction. However, one sample has been collected, well inside the range of the species (V 1925: 7.5 km WNW. of Kpg. Piching, near Serian) which has the configuration of the lamellae as in *O. tarphypleura*, but the outward appearance of *O. lambii*. Provisionally this sample has been included here, but it is not listed with the paratypes.

2. The differences with *O. ballorum* are given under that species.

3. The W. Malaysian species *O. paranomom* Van Benthem Jutting, 1952, *O. plagiostomum* Van Benthem Jutting, 1952, and *O. pulvisculum* Van Benthem Jutting,

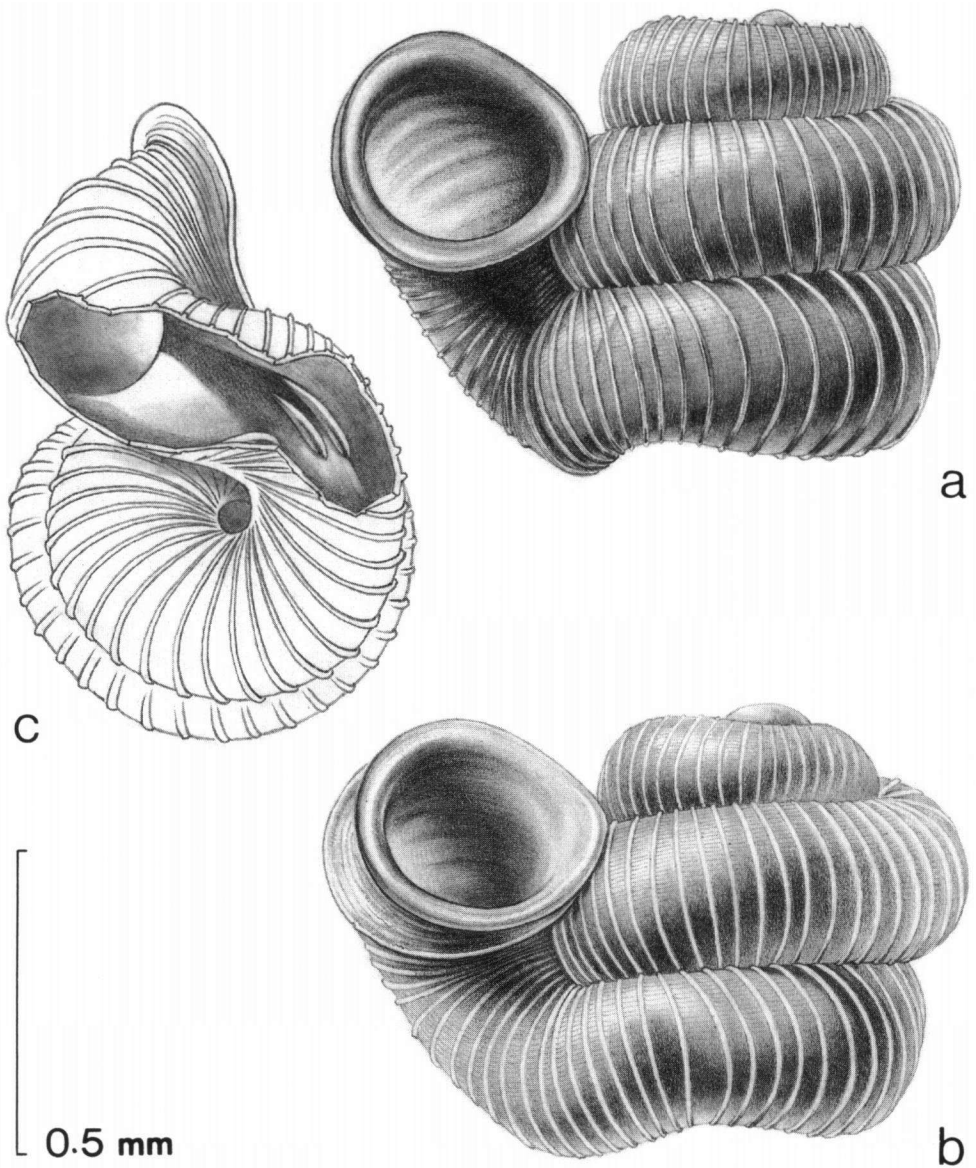


Fig. 6. a, *Opisthostoma tarphypleura* spec. nov., holotype specimen, Sarawak: W. of Kpg. Lobang Batu 12.5 km S. of Tebakang (RMNH), front view; b, paratype, Sarawak: G. Jambusan 4 km SE. of Bau (V), front view; c, paratype, Sarawak: G. Kapur 6 km SE. of Bau (V), umbilical view with a portion of the shell removed to show the position of the teeth in the constriction.

1952, are also densely ribbed and otherwise of rather similar shape, but distinctly more oblique.

4. The name has been derived from the Greek language: 'tarphys' means close; 'pleuron': rib.

9 - *Opisthostoma lambii* spec. nov.

fig. 7

Shell white, approximately opaque. Whorls 3 1/8-3 5/8 (tuba not included); top whorls moderately to distinctly oblique, moderately elevated; body whorls forming a slightly obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl, touching the body whorls over its entire length, approximately circular in section. Shell with narrow, distinct radial ribs, which are very densely placed near the top, rather densely placed and rather low on the upper body whorl (35-55 ribs present on this whorl), approximately similar but slightly wider spaced on the lower body whorl, more widely spaced over the area of the constriction, and moderately spaced and slightly more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 30 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome moderately flaring on the palatal side. Constriction inside with three to four teeth: one longitudinal, short, lamella-like angularis which does not project into the tuba (missing in some specimens); one longitudinal, long, lamella-like parietalis which projects well into the tuba; one distinct, oblique, rather high infracolumellaris; one distinct, transverse palatalis.

Measurements. — Height of body whorls 0.8-0.9 mm; width including tuba 1.1-1.3 mm, without tuba 0.7-0.8 mm; height of aperture 0.4-0.5 mm; width of aperture 0.5-0.6 mm.

Ecology. — Calcicole.

Distribution. — Borneo: Sabah, widespread in the interior part.

Material seen. — SABAH. Interior Zone: Lian Cave 12 km N. of Keningau (V 1113, HOLOTYPE RMNH 56595, numerous paratypes); Batu Urun near Sepulot (V 1150); Batu Punggol SE. of Sepulot (V 1890); Pun Batu approximately 30 km W. of Sepulot (V 1288) (all paratypes).

Notes: — 1. Rather similar to *O. tarphypleura*. The differences between the two are given under the latter species.

2. Named in honour of Mr. Anthony Lamb (Tenom, Sabah). Without his help the malacological exploration of the poorly accessible interior of Sabah would have been impossible.

10 - *Opisthostoma aetheroscopa* spec. nov.

fig. 8a, b

Shell white, approximately opaque. Whorls 3 1/8-3 1/2 (tuba not included); top whorls somewhat oblique, moderately elevated; body whorls forming a cylindrical

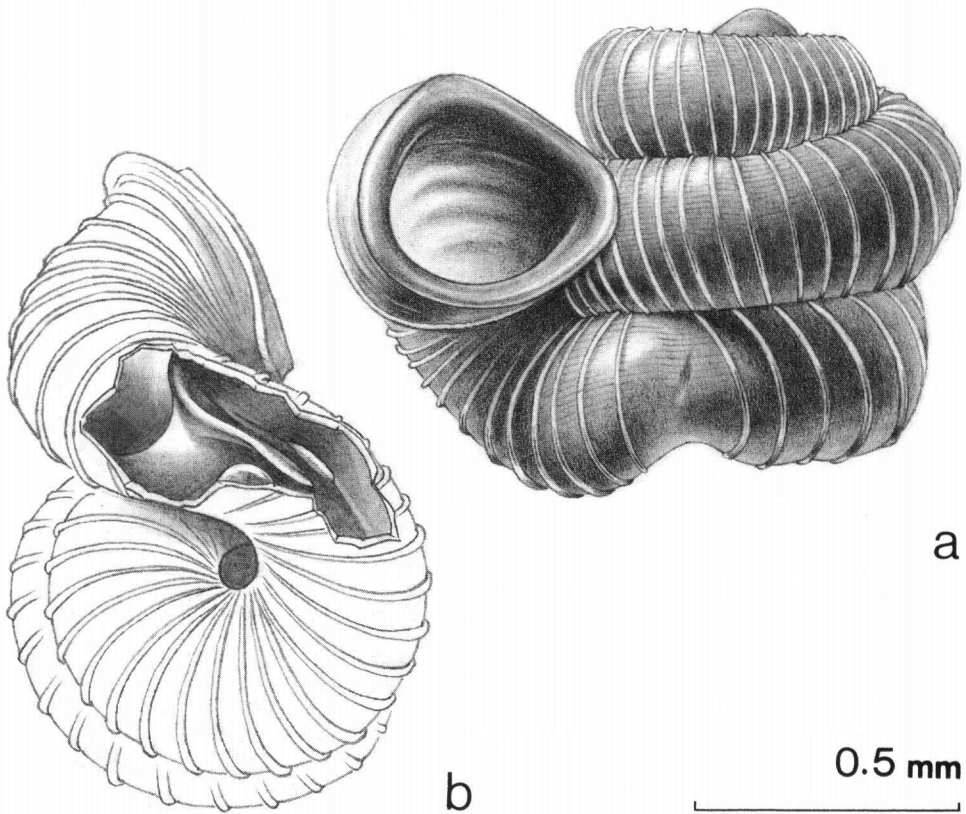


Fig. 7. a, *Opisthostoma lambii* spec. nov., holotype specimen, Sabah: Lian Cave 12 km N. of Keningau (RMNH), front view; b. paratype, same locality (V), umbilical view with a portion of the shell removed to show the position of the teeth in the constriction; c, paratype, same locality (V), lateral view.

body, convex, well rounded, sometimes slightly angular, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl or somewhat less, touching the body whorls over its entire length, approximately circular in section. Shell with rather thin radial ribs, which are widely spaced near the top, moderately spaced and low on the upper body whorl (24-28 ribs present on this whorl), slightly more prominent and somewhat wider spaced on the lower body whorl and over the area of the constriction, and moderately spaced and rather high on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, wide. Aperture with the imaginary plane through the inner peristome tilted 60-90 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate; apertural teeth absent; inner peristome somewhat thickened, slightly reflected; outer peristome distinctly flaring on the palatal side.

Constriction inside with two teeth: one rather inconspicuous, slightly oblique, rather low infracolumellaris which projects over the lower palatal wall, at some distance and approximately parallel to the palatalis, one rather inconspicuous, transverse, long, low palatalis.

Measurements. — Height of body whorls 0.7-0.9 mm; width including tuba 1.2-1.3 mm, without tuba 0.8-0.9 mm; height of aperture 0.5 mm; width of aperture 0.5 mm.

Ecology. — Calcicole.

Distribution. — Borneo: Sabah, E. part, probably endemic to one or a few limestone hills along the lower Kinabatangan River.

Material seen. — SABAH. Sandakan Zone: Gomantong Hill 30 km S. of Sandakan (V 1590, HOLOTYPE RMNH 56596, numerous paratypes).

Notes. — 1. Among the Bornean *Opisthostoma* species well characterized by the 'upwards' turned aperture as well as the wide umbilicus. A few rather similar species occur in W. Malaysia: *O. trapezium* Van Benthem Jutting, 1952, has a wider lower body whorl as well as a wider umbilicus; *O. coronatum* Van Benthem Jutting, 1952, has distinctly more prominent ribs.

2. The palatal continuation of the parieto-basal tooth and the true palatal tooth in the constriction may be seen shining through the shell wall as two approximately parallel lamellae.

3. The name has been derived from the Greek language; '*aetheroscopa*', meaning sky-gazing. It refers to the upwards turned aperture.

11 - *Opisthostoma lechria* spec. nov.

fig. 8c

Shell white, approximately opaque. Whorls $3\frac{1}{4}$ (tuba not included); top whorls moderately oblique, moderately elevated; body whorls forming an obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately $\frac{1}{2}$ whorl, touching the body whorls over its entire length, only the last $\frac{1}{4}$ whorl sinistral, approximately circular in section. Shell with rather thin radial ribs, which are densely placed near the top, densely placed and rather low on the upper body whorl (approximately 50 ribs present; ribs particularly close towards the top), approximately similar and densely placed on the lower body whorl, almost absent over the area of the constriction, and densely placed and somewhat more prominent on the tuba. Ribs crossed by inconspicuous, fine spiral striation. Umbilicus open, deep, very narrow. Aperture with the imaginary plane through the inner peristome tilted approximately 70 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate; apertural teeth absent; inner peristome thickened, somewhat reflected; outer peristome distinctly flaring on the palatal side. Constriction inside with two teeth: one distinct, slightly oblique, short, rather high infracolumellaris, one rather inconspicuous, transverse, long, low palatalis.

Measurements. — Height of body whorls 0.9 mm; width including tuba 1.2 mm, without tuba 0.8 mm; height of aperture 0.5 mm; width of aperture 0.5 mm.

Ecology. — Calcicole.

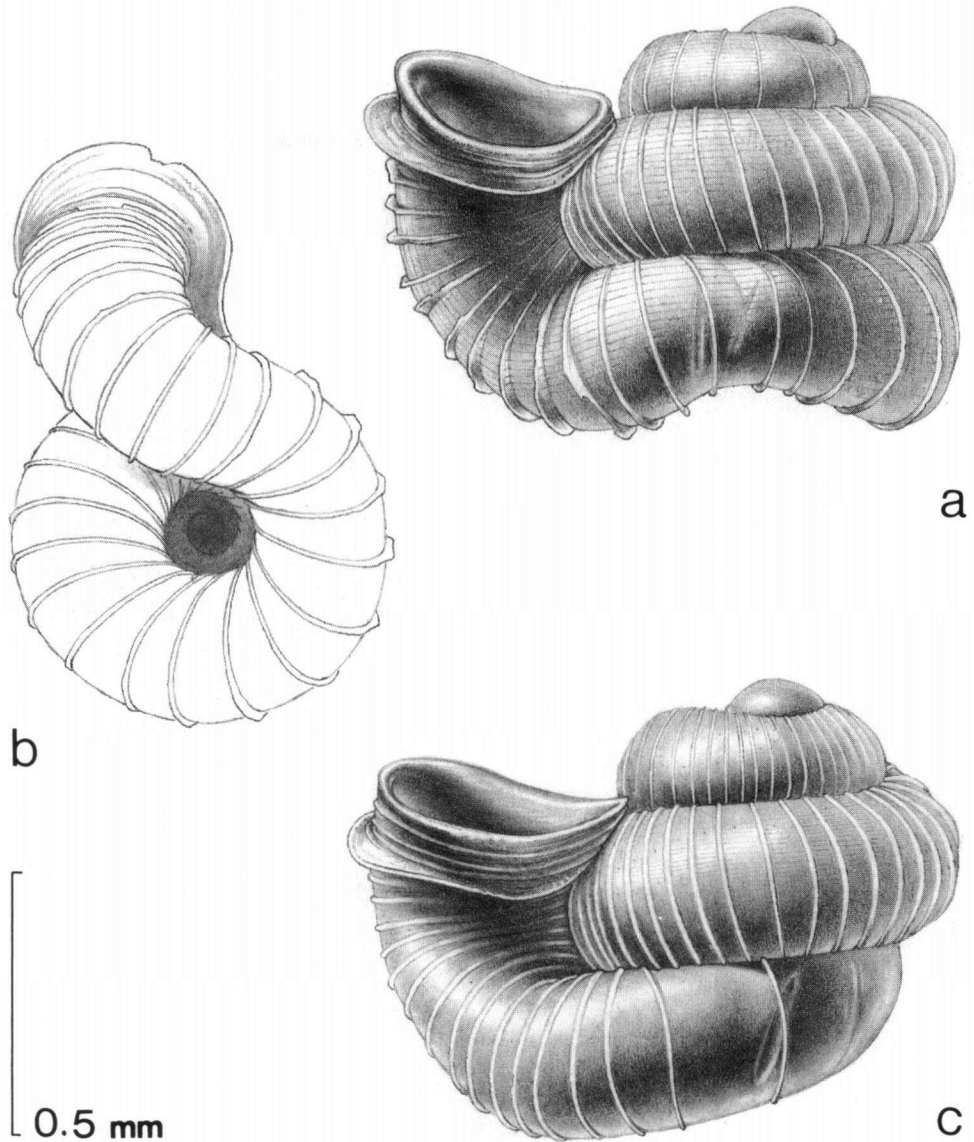


Fig. 8. a, *Opisthostoma aetheroscopia* spec. nov., holotype specimen, Sabah: Gomantong Hill 30 km S. of Sandakan (RMNH), front view; b, paratype, same locality (V), umbilical view; c, *Opisthostoma lechria* spec. nov., holotype specimen, Sabah: Pun Batu approximately 30 km W. of Sepulot (RMNH), front view.

Distribution. — Borneo: Sabah, Interior Zone. So far found in a single locality only.

Material seen. — SABAH. Interior Zone: Pun Batu approximately 30 km W. of Sepulut (V 2517, HOLOTYPE RMNH 56599, no paratypes).

Notes. — 1. Differs from *O. devogelii* in having a distinctly slanting lowermost body whorl, as well as a moderately protruding top. Similar species from W. Malaysia, like *O. atalum* Van Benthem Jutting, 1961, and *O. obtusum* Van Benthem Jutting, 1952, have a less distinctly oblique lowermost body whorl, and have the ribs approximately equally widely spaced over the lowermost body whorl, the constriction as well as the tuba.

2. Only one specimen is available which has not been destroyed to observe the teeth in the constriction. Their presence and position have only been observed through the wall of the shell.

3. The name has been derived from the Greek '*lechrios*': slanting. It refers to the oblique body whorls.

12 - *Opisthostoma devogelii* spec. nov.

fig. 9

Shell white, approximately opaque. Whorls 3 1/4-3 1/2 (tuba not included); top whorls moderately oblique, hardly elevated; body whorls forming a cylindrical body, convex, well rounded, with the suture well impressed. Constriction inconspicuous, gradual. Tuba consisting of approximately 1/4 whorl or slightly more, touching the body whorls over its entire length, approximately circular in section. Shell with rather thin radial ribs, which are densely placed near the top, densely placed and low on the upper body whorl (approximately 45-80 ribs present; ribs particularly close towards the top), approximately similar and only slightly wider spaced on the lower body whorl as well as over the area of the constriction, and densely placed again and somewhat more prominent on the tuba. Spiral striation absent. Umbilicus open, deep, very narrow. Aperture with the imaginary plane through the inner peristome tilted 70-90 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to approximately circular; apertural teeth absent; inner peristome thickened, somewhat reflected; outer peristome moderately flaring on the palatal side. Constriction inside with one tooth: a rather inconspicuous, transverse, long, low palatalis; infracolumellaris absent.

Measurements. — Height of body whorls 0.5-0.6 mm; width including tuba 1.0-1.1 mm, without tuba 0.7 mm; height of aperture 0.4 mm; width of aperture 0.4 mm.

Ecology. — Calcicole.

Distribution. — Sarawak, 1st Div., Penrissen Valley S. of Kuching.

Material seen. — SARAWAK. 1st Div.: Kpg. Tiang Bekap 10 km SSW. of Kpg. Beratok (leg. De Vogel, V 2567, paratypes); Kpg. Segur Benuk, mile 21 Penrissen Road (leg. De Vogel, V 2547, HOLOTYPE RMNH 56597, numerous paratypes).

Notes. — 1. Among the Bornean *Opisthostoma* species sufficiently characterized by the combination of the following characters: the 'upwards' turned aperture, the not oblique lowermost body whorl and the narrow umbilicus. A few species occur elsewhere which look rather similar, but which have a somewhat oblique lowermost body

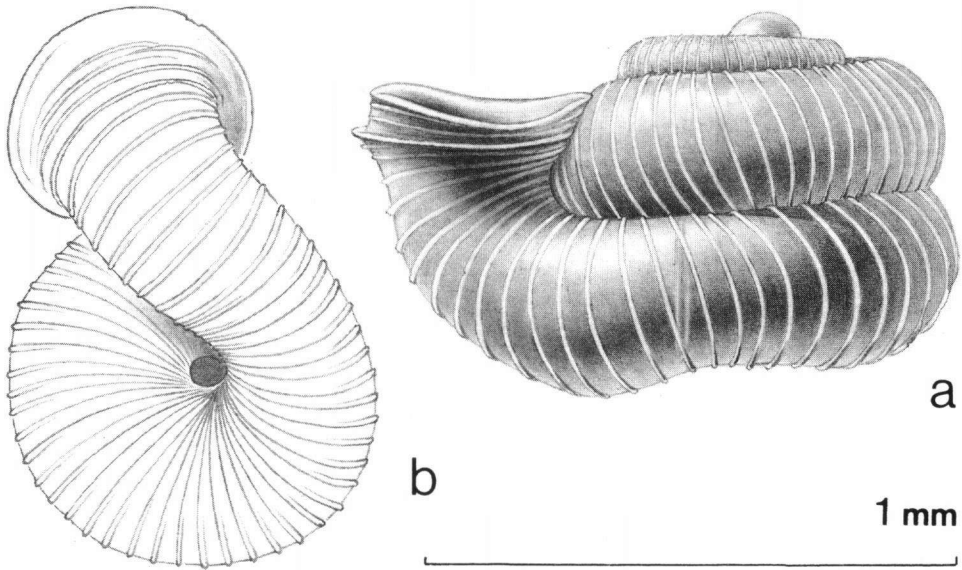


Fig. 9. a, *Opisthostoma devogelii* spec. nov., holotype specimen, Sarawak: Kpg. Segur Benuk on mile 21 Penrissen Road (RMNH), front view; b, paratype, same locality (V), umbilical view.

whorl: *O. atalum* Van Benthem Jutting, 1961, *O. obtusum* Van Benthem Jutting, 1952 (both from W. Malaysia), and *O. uranoscopium* Van Benthem Jutting, 1932 (from Java).

2. Named in honour of Dr. E.F. de Vogel (Leiden, The Netherlands) who collected this species.

13 - *Opisthostoma javanicum* Van Benthem Jutting, 1932
fig. 10a

Opisthostoma javanicum Van Benthem Jutting, 1932: 203; holotype (Java, Ciampea near Bogor) leg. Van Benthem Jutting (not seen).

Opisthostoma aspastum Van Benthem Jutting, 1951: 30; holotype (Celebes, Pankadjene near Makassar) leg. Tammes-Bolt (not seen).

Shell white, slightly translucent. Whorls approximately $3 \frac{1}{2}$ (tuba not included); top whorls slightly oblique, moderately to distinctly elevated; body whorls forming a cylindrical body which may often be slightly oblique, convex, well rounded or somewhat angular, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately $\frac{1}{2}$ whorl, touching the body whorls over its entire length, approximately circular in section. Shell with rather wide, distinct radial ribs, which are widely spaced near the top, slightly more densely placed and rather low on the upper body whorl (17-45 ribs present on this whorl), somewhat wider spaced again on the lower body whorl and particularly over the area of the constriction, and

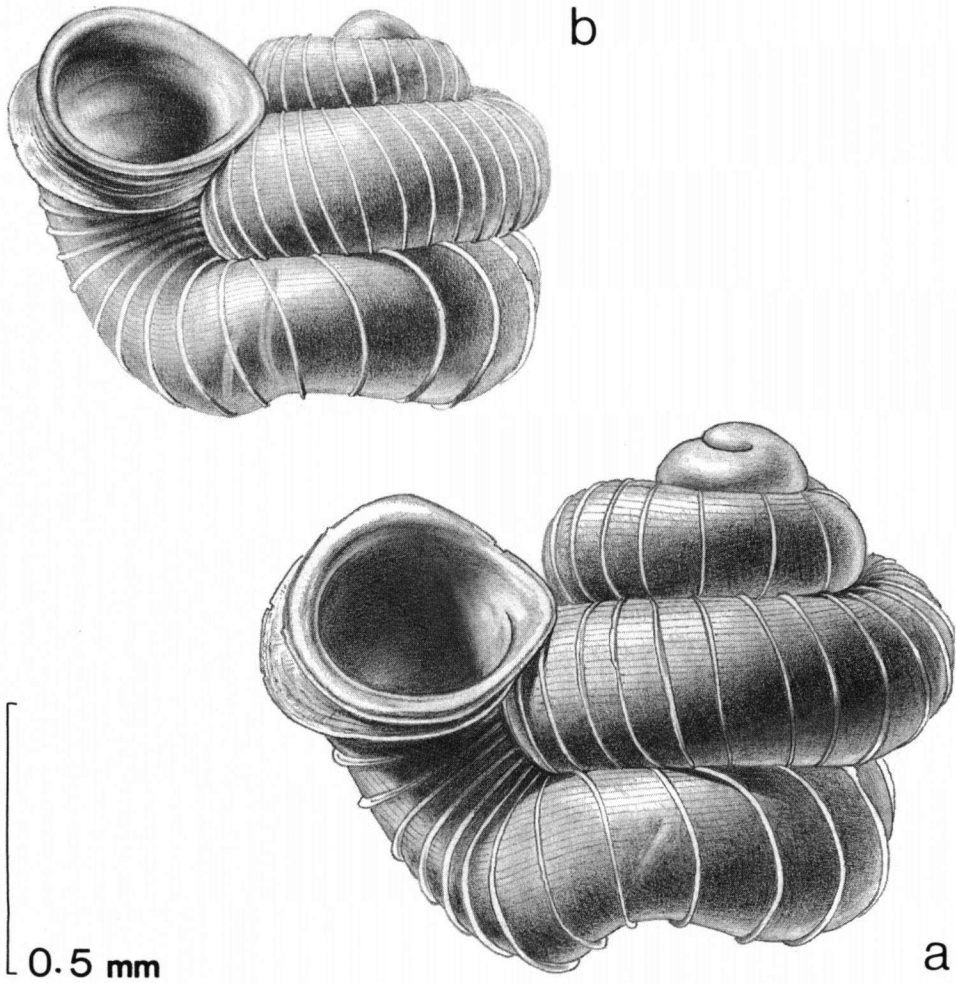


Fig. 10. a, *Opisthostoma javanicum* Van Benthem Jutting, Kalimantan Timur: 30 km W. of Balikpapan (V), front view; b, *Opisthostoma ballorum* spec. nov., holotype specimen, Sarawak: G. Kapur 6 km. SE. of Bau (RMNH), front view.

moderately spaced and more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 45 degrees with regard to the coiling axis of the body whorls; with the upper margin not protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome moderately to distinctly flaring on the palatal side. Constriction inside

with two teeth: one rather distinct, oblique infracolumellaris; one transverse palatalis.

Measurements. — Height of body whorls 0.8-1.1 mm; width including tuba 1.0-1.5 mm, without tuba 0.7-1.0 mm; height of aperture 0.4-0.6 mm; width of aperture 0.4-0.6 mm.

Ecology. — Calcicole.

Distribution. — Kalimantan, SE. and E. part. Also on Java, Madura, Celebes.

Material seen. — KALIMANTAN. Kalimantan Selatan: Meratus Mts., approximately 35 km NE. of Martapura (leg. Lamb & Mackinnon, V 2466). Kalimantan Timur: 30 km. W. of Balikpapan (leg. Van Balgooij, V 2498). Material seen from elsewhere: Madura (leg. Whitten, V 2525). Celebes: Maros Mts., Bantimurung (leg. Prud'homme van Reine, V 2756).

Notes. — 1. Rather similar to *O. ballorum*; the differences are given under that species.

2. Comparison of the samples from Madura, Celebes and Borneo shows that they belong to a single species.

14 - *Opisthostoma ballorum* spec. nov.

fig. 10b

Shell white, slightly translucent. Whorls 3 1/8-3 5/8 (tuba not included); top whorls moderately to distinctly oblique, slightly to moderately elevated; body whorls forming an often slightly obliquely cylindrical body, convex, well rounded, with the suture well impressed. Constriction rather distinct, gradual. Tuba consisting of approximately 1/2 whorl or somewhat less, touching the body whorls over its entire length, approximately circular in section. Shell with narrow, distinct radial ribs, which are widely spaced to rather densely placed near the top, rather widely spaced to rather densely placed and rather low on the upper body whorl (17-45 ribs present on this whorl), much wider spaced on the lower body whorl and over the area of the constriction, and moderately spaced and more prominent on the tuba. Ribs crossed by fine spiral striation. Umbilicus open, deep, narrow. Aperture with the imaginary plane through the inner peristome tilted up to 45 degrees with regard to the coiling axis of the body whorls; with the upper margin not or hardly protruding beyond the plane perpendicular to the coiling axis of the body whorls as well as through the apex; widely ovate to circular; apertural teeth absent; inner peristome moderately thickened, moderately reflected; outer peristome moderately flaring on the palatal side. Constriction inside with two teeth: one rather distinct, oblique infracolumellaris; one transverse palatalis.

Measurements. — Height of body whorls 0.7-1.0 mm; width including tuba 1.0-1.2 mm, without tuba 0.6-0.8 mm; height of aperture 0.5 mm; width of aperture 0.5 mm.

Ecology. — Calcicole.

Distribution. — Sarawak, possibly widespread but known from widely scattered locations only.

Material seen. — SARAWAK. 1st Div.: G. Kapur 6 km SE. of Bau (leg. De Vogel, V 2228, HOLOTYPE RMNH 56598, numerous paratypes; V 2605). 4th Div.: G. Mulu (leg. Ball, V 2669, paratypes).

Notes. — 1. *O. ballorum* differs from *O. javanicum* in having much less elevated top whorls.

2. *O. ballorum* can be distinguished from those specimens of *O. tarphypleura* which lack the longitudinal lamellae in the constriction by the distribution of the ribs on the shell: in *O. ballorum* the ribs on the lower body whorl and over the constriction, and often those on the top whorls as well, are much wider spaced.

3. The specimens from W. Sarawak (1st Div.) differ slightly from those from E. Sarawak (4th Div.). They tend to have the upper body whorl as well as the top whorls more densely ribbed. However, specimens more closely resembling those from E. Sarawak also occur and no subspecies can therefore be distinguished.

4. Named in honour of Mrs. and Mr. (Ann and Rick) Ball (Longport, England), who collected soil samples containing this species at the G. Mulu.

REFERENCES

- BENTHEM JUTTING, W.S.S. VAN, 1932. Notes on land Mollusca of the Malay Archipelago. — J. Conch., London 19: 196-210.
- , 1951. On a new species of *Opisthostoma* from Celebes (*Opisthostoma (Opisthostoma) aspastum* nov. spec.). — *Basteria* 15: 30-31.
- , 1952. The Malayan species of *Opisthostoma* (Gastropoda, Prosobranchia, Cyclophoridae), with a catalogue of all species hitherto described. — *Bull. Raffles Mus., Singapore* 24: 5-62.
- , 1961. Additional new species and new localities of the family Vertiginidae and the genera *Oophana* and *Opisthostoma* from Malaya. — *Bull. Raffles Mus., Singapore* 26: 34-47.
- SOLEM, A., 1964. A collection of non-marine molluscs from Sabah, Malaysia. — *Sabah Soc. J.* 2: 1-40.
- THOMPSON, F.G., 1978. Two new land snails of the genus *Opisthostoma* from Borneo (Prosobranchia: Cyclophoracea: Diplommatinidae). — *Proc. Biol. Soc. Washington* 91: 386-391.