

AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Richardson, Laurence R., 1981. On the Papuan *Elocobdella novabritanniae*, the Oceanian *Abessebdella palmyrae* (Haemadipsoidea: Domanibdellidae), and an Oceanian barbronid (Hirudinea). *Records of the Australian Museum* 33(14): 673–694. [31 July 1981].

doi:10.3853/j.0067-1975.33.1981.268

ISSN 0067-1975

Published by the Australian Museum, Sydney

nature culture **discover**

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ON THE PAPUAN *ELOCOBDELLA NOVABRITANNIAE*, THE OCEANIAN *ABESSEBDELLA PALMYRAE* (HAEMADIPSOIDEA: DOMANIBDELLIDAE), AND AN OCEANIAN BARBRONID (HIRUDINEA).¹

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SUMMARY

Generic definitions and detailed descriptions are given for the two domanibdelline land-leeches. An analysis of the nature of the barbronids indicates: separation of these from the Erpobdellidae s.l.; division into Australian and oriental groups; and association of the oceanian barbronid with the group of the Australian Region. It is noted that the characteristic strepsilaematous pharynx is formed by transposition of the ridges, not by torsion.

INTRODUCTION

This paper gives definitive descriptions of two land-leeches which were briefly characterized and named in the demonstration (Richardson, 1975) of a systematization for land-leeches within a Superfamily Haemadipsoidea, also such detail as can be taken from specimens of the first barbronid leech known in Polynesia.

Coming from islands with a wide oceanic separation, the two land-leeches differ in the level of annulation on the somites of the middle series: *Elocobdella novabritanniae* of New Britain, a high island between the Solomon Group and New Guinea, incomplete 7-annulate; *Abessebdella palmyrae* of Palmyra Island, a coral atoll at the northern end of the Line (Outlying) Group in Polynesia, 5-annulate. Both possess a high level of annulation on the anterior and posterior series of somites which is a characteristic feature of many in the Domanibdellinae, others having a high level of annulation only on the anterior or the posterior series (Richardson, 1975).

The subfamily is centred on the New Guinea Archipelago and has partial extensions into Borneo, Celebes, the Philippines, Malay Peninsula, the Australian Northern Territory, and previously was known in Oceania only in the 5-annulate *Fijibdella bilobata* (Moore, 1946) of Fiji, based on a single specimen 10.0 mm long. The only other land-leech known in Oceania is the 4-annulate *Samoabdella minuta* (Blanchard, 1917), Leiobdellinae, based on three specimens from Samoa, the largest 6.0 mm long.

Moore described the annuli of the posterior series in *bilobata* as "very irregular and much jumbled" on the dorsum, an erratic areolation as shown here on the dorsal aspect of xxvi and xxvii in the holotype of *A. palmyrae* (Fig. 1,B), which is somewhat similar to the areolation shown on the ventral aspect of v, vi, and vii, in the holotype of *E. novabritanniae* (Fig. 2,I). There was no erratic areolation in the paratype or smaller specimens of *palmyrae*.

A revised key to the Families and Subfamilies in the Haemadipsoidea is given (Richardson, 1978), and a key to the known 5-annulate domanibdellines (1977b). Incomplete 7-annulate domanibdellines are known to me also in specimens from Rabaul,

¹A study collateral to researchers on Australian freshwater and terrestrial leeches supported by an award from the Australian Research Grants Committee.

the Solomon Islands, and eastern New Guinea; but these are unsuitable for description and the group cannot be assembled at this time.

The barbronid was collected on Palmyra Island. The specimens are not in good condition, but sufficient detail can be taken which along with an analysis of the present knowledge of barbronids indicates a separation of barbronids from the Erpobdellidae s.l., division of the barbronids into an Oriental group and an Australian group, and association of the Palmyra barbronid with the barbronids of the Australian Region.

Palmyra Island provides the most easterly record for the Haemadipsoidea and for barbronids of the Australian group; and the first record for land-leeches and barbronids on an atoll.

The presence on Palmyra of two very different kinds of freshwater dependent leeches, with parallels elsewhere, indicates a dispersal process available to both, and independent of the sanguivorous habit.

Palmyra and other islands in the Out-Lying Group of the South Pacific Islands, are recognised as having been frequently visited by the Polynesians of the Hawaiian Islands.

Transport by man has been proposed as a means for the passive dispersal of freshwater leeches. There are no land-leeches in the Hawaiian Islands and the known barbronids in those islands belong to the Oriental group.

There is no support for this proposal in the freshwater dependent leeches on Palmyra Island.

Genus **Abessebdella** Richardson 1975

1st nephropores labial, lateral to the ocular areolae of iv, v; duognathous; no salivary gland papillae; vi incomplete 4-annulate, ($b_5 + b_6$) above, a_3 below; vii to xxiii complete 5-annulate; xxiv 4-annulate; xxv essentially 3-annulate; xxvi, xxvii 3- (?-2-) on the dorsum and 2-annulate on the lateral aspects; 9 (10) annuli on the dorsum between xxiii a_2 and the anus; no defined auricle; the 17th nephropores at the base of a deep pit; no lambertian organs; no ejaculatory bulbs; median regions of the reproductive systems, the male amyomeric, mesomorphic, the female with the recurrent limb slightly shorter than the procurrent limb; genital pores, xi b_5/b_6 , xii a_2/b_5 . Oceania.

TYPE SPECIES: *Abessebdella palmyrae* Richardson 1975. Palmyra Island.

Abessebdella palmyrae Richardson 1975, p.126.

Figs. 1, 2.

Holotype: Total length, 16.0 mm. Palmyra. Leeches crawling on *Tourefortia* near shore. Coll. D. Mitchell, June 13, 1935. Dissected. B.P. Museum acc. 2083

Paratype: Total length 17.0 mm. Same location, date, collector, as type, dissected; deposited Australian Museum, Sydney, Coll. No. W. 7217.

Additional Material: See below.

The following description is taken from the holotype.

GENERAL FORM: Fig. 1C. Preserved, contracted with the annuli compressed; small, heavy-bodied, the dorsum transversely convex; the venter shallowly concave; margins obtusely rounded; the maximum width at the level of the anterior margin of the posterior sucker which is narrower than the maximum width of the body. The margins converge

very gradually anteriorly from the widest region to the obtuse anterior sucker; more abruptly posteriorly to the wide base of the posterior sucker.

The posterior sucker is very heavy, strongly muscular, and in life would be much wider than the body.

There is no indication of a groove or other separation of the dorsal aspect of the posterior end of the body and the dorsum of the sucker, the two continuous, but separated by a groove laterally.

Total length, 16.0 mm; at v/vi, 1.0 mm from the end of the anterior sucker, the width 2.0 mm; at 4.0 mm, the width 4.0 mm, depth 2.0 mm; at 9.0 mm, the width 6.0 mm, depth 2.5 mm; at 12.0 mm, the width 5.0 mm; at 14.0 mm, the width 4.5 mm; the ventral face of the posterior sucker slightly longer (4.5) than wide (4.2 mm).

COLOUR: Preserved in alcohol, faded, generally pale off-white. Under magnification, the dorsum immaculate, very faintly brownish along its length; the margins, white, continuous with the white venter; the dorsum and venter of the posterior sucker, white, immaculate.

PATTERN: Fig. 1C. Very vaguely indicated: a median dorsal contrast stripe from in the ocular arch to the anus, the stripe relatively narrow but occupying the full width of the median field.

A broad dark band with a narrow darker medial margin, on each side of the median stripe occupies the line of the paramedian sense organs, the paramedian field, and extends laterally to beyond the level of the line of the nephropores, i.e. enters and appears to terminate in the lower portion of the marginal field. The bands extend the full length of the body.

There are very faint indications on the anterior half of the body of elongate patches in each of the dorsal bands, as: an inner row (two or ? three patches) medial in the paramedian field, and a second row lateral in the paramedian field or possibly in the intermediate field. The patches are of the length of a somite.

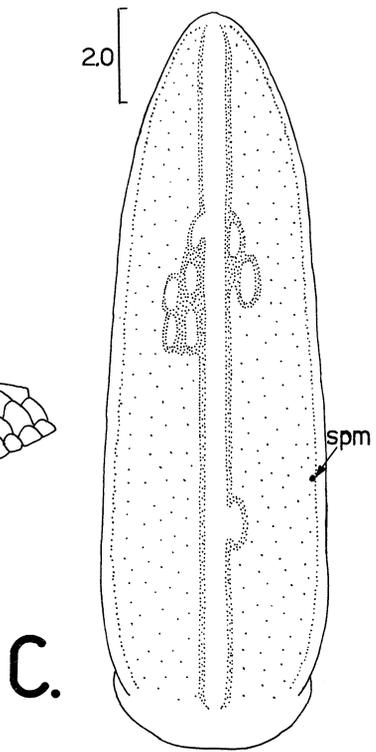
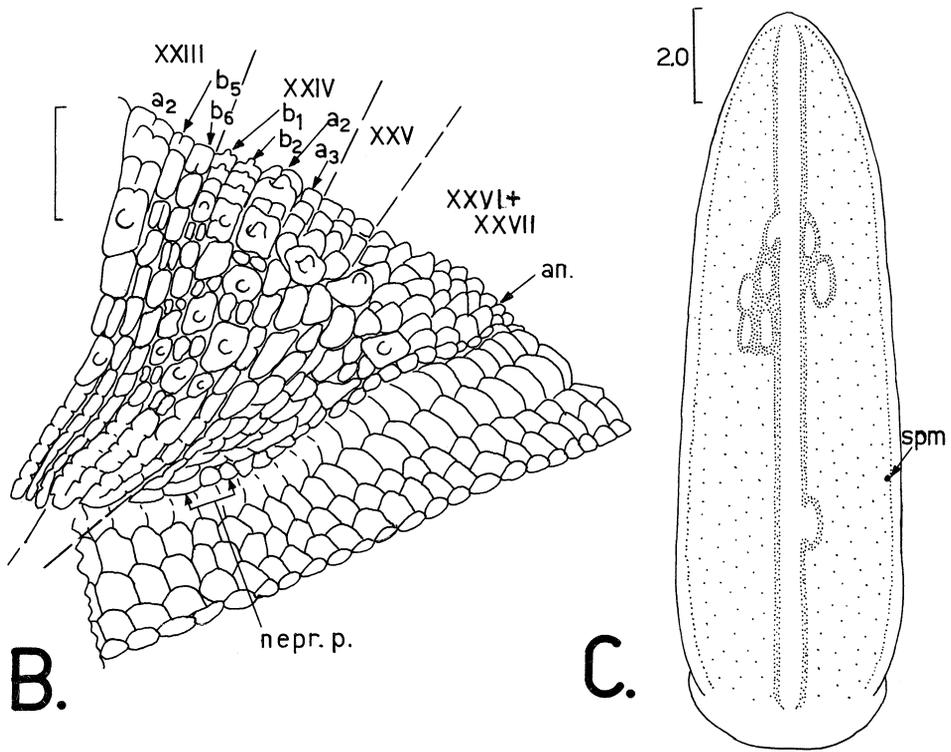
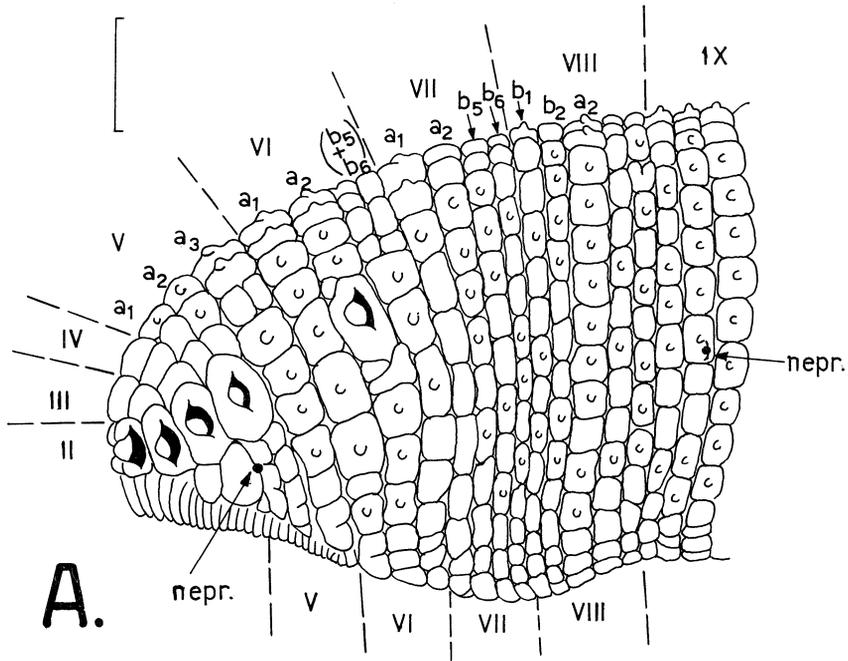
ANNULATION: Fig. 1A, B; 2D, E. Contracted so that the interannular furrows are narrow, deep; annuli strongly areolate; intersomital and interannular furrows, equivalent; somital limits not directly recognizable; somital sense organs generally obscure, the longitudinal lines of sense organs and the fields not generally definable with confidence; nephropores minute, on or near the posterior edge of the annulus and separated from the following furrows by a narrow fold of skin, the fold sometimes elevated to appear as a rounded low mound bridging between the nephroporic annulus and the following annulus.

No indication of a preocular somite i between the 1st pair of eyes and the fimbriated fold forming the anterior margin of the sucker; eyes large, protrudent, each in a large ocular areola; somite ii with the 1st pair of eyes assessable as partially 2-annulate, a single pair of reduced transverse areolae in tandem between the ocular areolae; iii, uniannulate, with 3 areolae between the oculars; iv, uniannulate, 5 areolae between the oculars; the 1st nephropores at iv/v, lateral to the ocular areolae; v, complete 3-annulate, $a_1 = a_2 < a_3$, a_1 and a_2 each with 6 areolae between the oculars, the 4th eyes in a_2 , and areolae on all 3 annuli between the oculars and the margin of the sucker, the annuli terminating on the ventrolateral margins of the sucker; vi, incomplete 4-annulate, $a_1 = a_2 > (b_5 + b_6)$ across the greater width of the dorsum, a_2 the 1st distinct annulus across the venter, forms the ventral margin of the sucker, a_3 the 2nd complete annulus (but see,

Fig. 1. *Abessebdella palmyrae* Richardson 1975. Lateral views showing annulation: A. anterior somites, B. posterior somites and sucker. C. Dorsal view showing general form and pattern.

Figures taken from the Holotype specimen, excepting Fig. 4. Somites and somital ganglia indicated by roman numerals; annuli, "a₂", etc.; somital limits, broken lines; somital ganglia shown at relative size. Scales, mm, 0.5 mm, or as indicated.

Abbreviations: a.g.m., ventral component of the anterior ganglionic mass; an., anus; at., atrium; con., dorsoventral connectives of the central nervous system; c.p., copulatory pore; dm.r., dorsomedian, and vl.r., ventrolateral internal muscular ridges of the pharynx; ej.b., ejaculatory bulb; f.p., female pore; i.r., inner ridge of margin of anterior sucker; int., intestine; j., jaw; l.o., lambertian organ; m.p., male pore; nepr., nephropore; nepr.p., nephroporic pit; o.r., outer rim of margin of anterior sucker; ov., ovary; ov.gl.s., oviducal glandular sac; p.c., postcaecum; p.g.m. posterior ganglionic mass; ph., pharynx; pr.l.m. procurrent, and re.l. recurrent limbs of the female median region; sp.d., sperm duct; spm., supramarginal somital sense organ; te., testis; v.d., vas deferens.



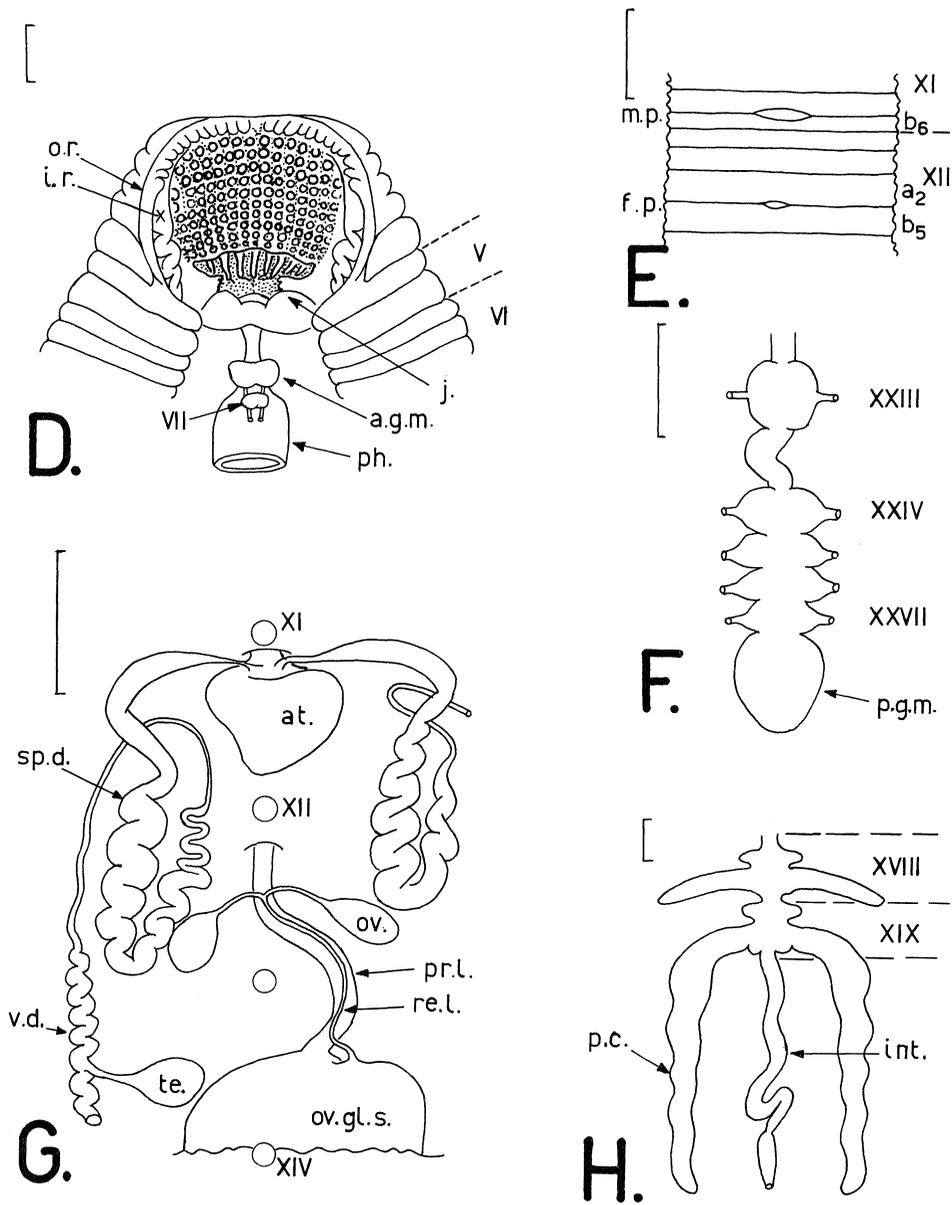


Fig. 2. *Abessebdella palmyrae* Richardson 1975. D. Anterior sucker, annular groove, jaws, anterior ganglionic mass, pharynx, etc., as displayed by a ventral median longitudinal incision. E. Ventral aspect, somites xi, xii, showing genital pores. F. Somital ganglia xxiii to xxvii and posterior ganglionic mass. H. Crop compartments xviii, xix, showing caecation, postcaeca, intestine. G. Anterior region of male paired ducts, male median region, the dorsal aspect of the atrium turned posteriorly, and female reproductive system. For abbreviations, etc., see Fig. 1.

Additional Material, 1); vii, complete 4-annulate $a_1 > a_2 > b_5 > b_6$, intermediate somital sense organs detectable on a_2 ; viii to xxiii complete 5-annulate (total, 16); viii, $b_1 < b_2 < a_2 > b_5 = b_6$, as also ix with the 2nd nephropores on b_2 ; x, xi, xii, $b_1 < b_2 < a_2 > b_5 > b_6$; xiii to xviii, $b_1 < b_2 < a_2 > b_5 = b_6$; xix to xxii, $b_1 = b_2 < a_2 > b_5 = b_6$; xxiii, b_1 slightly $< b_2 < a_2 > b_5$ much $> b_6$, the 16th nephropores on b_2 ; ?10+ "annuli" between xxiii a_2 and the anus; xxiv, incomplete 4-annulate, $b_1 < b_2 < a_2$ much $> a_3$, and below ($b_1 + b_2$) the last annulus across the venter, a_2 and a_3 continue as thin ridges onto the dorsum of the sucker.

Somites xxiii and xxiv have erratic partial or complete transverse subdivision of some areolae.

The annulation of the incomplete somites posterior to xxiv is confused on the dorsum; the areolae large, papilliform to conical, jumbled without clearly indicated interannular furrows excepting a few immediately anterior to the anus.

The annulation can be assessed only as: xxv incomplete 3-annulate, $a_1 < a_2 = a_3$, $a_1 a_2$ in the margins; xxvi 3-annulate; xxvii apparently 2-annulate.

No defined auricles; interannular and intersomital furrows of xxv, xxvi, xxvii, continue to the lateral edges of the somites, as also the areolation.

A distinct nephroporic pit, acutely conical, the depth 2 or more times the width (0.2 mm) of the entrance which is situated beneath the ends of the contiguous annuli of xxv and xxvi. There is no papilla in the pit.

Dorsum of the posterior sucker with 4 concentric rows of areolae; the venter with a closely papillate central disc about 1/3rd of the width of the sucker, the outer papillae merging into about 56 radiating muscular ridges which divide to terminate as some 90 ridges at the margin; 9 muscular ridges extend into the clamp.

BODY WALL AND MUSCULAR SYSTEMS: The oblique muscular layers of the body wall are not obvious in dissection. The internal longitudinal layer is thick and formed of broad flat muscle strands in intimate contact and forming a distinct sheet.

The paramedian palisade of dorsoventral muscles is represented along the crop by clusters of strands at the intersomital levels. Posterior to xix, the mm. habenae (Richardson, 1977a.) are present as spaced, laterally compressed, heavy bands of muscles radiating from a restricted ventral base and more widely inserted on the dorsal body wall.

CENTRAL NERVOUS SYSTEM: Fig. 2D, F. The ventral component of the anterior ganglionic mass is situated in vi; ganglion vii, posterior in vi close to vi/vii, separated from the ventral component by less than 1/2 the length of ganglion vii.

Ganglion xxiii is the most posterior independent ganglion, separated by 1 1/2 times its length from ganglion xxiv.

Ganglia xxiv, xxv, xxvi, xxvii, are a series of individual ganglia in intimate contact; xxiv, distinctly the larger; xxvii, in intimate contact with the posterior ganglionic mass.

ALIMENTARY TRACT: Fig. 2D, H. The dorsal, transverse margin of the anterior sucker is formed by an erect thin ridge-like primary fold, incised along the free edge to appear as though papillate or fimbriate. The fold divides in the lateral margins into a plain fold continuing to form the ventral margin, and a second fold internal and parallel to it on the lateral and ventral inner surfaces of the chamber of the sucker.

The internal dorsal surface of the chamber is coarsely and closely papillate.

The posterior face of the chamber is membranous, perforated by a wide transverse slit. The lateral and ventral portions of the membrane form the anterior wall of the well-formed annular groove which is deeper ventrally and laterally than dorsally. The dorsal surface of the groove is longitudinally plicate.

The jaws are housed in the annular groove. They are ventrolateral, transverse, subhorizontal; moderately compressed, minute, the medial end about 0.2 mm high and the width slightly less. The anterior margin is smoothly low convex, the length about 0.6 mm, and armed with a chitinous edge having the appearance of extremely minute teeth.

The entrance to the pharynx is a transverse slit about 0.3 mm wide; the dorsal margin, a thin fold forming a minute dorsomedian pad; the ventral margin, continuous with the bases of the jaws, slightly thickened and muscular, recognizable as a ventromedian muscular pad which is not attached to the wall of the annular groove.

Salivary glands were not recognisable in dissection.

The entrance to the pharynx leads into a short very narrow membranous-walled initial portion of the pharynx which passes through the circumpharyngeal elements of the central nervous system, widening in vii/viii into the pharynx proper. This is about 0.5 mm in diameter, very thin-walled; the internal surface, weakly rugose longitudinally and not divided into the usual primary ridges.

The pharynx terminates at a small sphincter at viii/ix.

The crop commences with a compartment in ix extended briefly laterally with a single pair of wide-based caeca. Each compartment in x to xviii carries a pair of short secondary caeca in the anterior position, and a longer pair of primary caeca in the posterior position, the primary caeca increasing in length to xiii, and then uniform in length, very narrow and elongate, almost tubular for the greater part of their length.

The compartment in xix has small secondary anterior caeca, and postcaeca originating at the posterior level, entering the paramedian splanchnic chambers to extend posteriorly and terminate in xxvi.

There are no lambertian organs.

The crop ends at xix/xx, connecting terminally to the narrowly tubular intestine, in turn connecting terminally to the short rectum.

REPRODUCTIVE SYSTEMS: Fig. 2E, G. Assessed as adult; female mature; male immature.

Genital pores xi b_5/b_6 , xii a_2/b_5 .

Testes saccular; 10 pairs located in the median chamber; the most posterior at xxii/xxiii; the anterior pair at xiii/xiv.

A vas efferens extends laterally from each testis, entering the paramedian splanchnic chamber to join the vas deferens which is compactly folded on itself and white to in xiii where it narrows into a thin-walled colourless duct. This duct turns medially in the vicinity of xi/xii to pass through the paramedian palisade of dorsoventral muscles and enter the median splanchnic chamber where it forms a posteriorly directed primary loop.

Both loops reflect in the contiguous halves of xii/xiii; the relationship, parallel. The recurrent and procurrent limbs of the loop are thin-walled, the duct progressively

expanding on the recurrent limb to become a sperm duct which is closely folded along both limbs without differentiation as an epididymis.

The sperm ducts reduce abruptly in diameter in the vicinity of the male atrium, each connecting independently low on the anterior face of the atrium. There are no ejaculatory bulbs.

The male atrium is about 1.5 mm high, about 0.5 mm wide across the dorsal aspect and a little shorter than wide. It stands high above and conceals the ventral nerve cord and ganglion xi. The wall is thin, lacking developed layers of organised muscular tissues.

It is accordingly, mesomorphic and amyomeric.

The two saccular ovaries are in the contiguous annuli of xii and xiii, each continuing as a thin-walled transparent oviduct.

The oviducts join without a distinctive atrium and form the median region which is developed on a posteriorly directed primary loop reflecting at xiii/xiv.

The initial recurrent limb of the loop is a little wider than an oviduct, thin-walled, transparent, non-muscular, and less than half of the width of the thick-walled strongly muscular terminal procurrent limb which ends at the female pore. The two limbs are nearly equal in length.

The posterior face of the elbow of the loop is expanded posteriorly as the thin-walled glandular sac, terminating in xvii in the contracted specimen (possibly anterior to this in an extended specimen).

There is nothing recognisable as aggregated prostate or albumin glands.

PARATYPE: General form, colour (faded), pattern, as in the Type, but lacking indications of elongate oval dorsal patches.

General somital annulation as in the Type: v complete 3-annulate; vi, incomplete 4-annulate, $a_1 = a_2$ ($b_5 + b_6$) above; vii, 4-annulate; viii to xxiii, 5-annulate with a_2 long, and 10 annuli between xxiii a_2 and the anus; areolae not jumbled on the posterior somites; nephroporic pit, as in the Type.

Genital pores, xi b_5/b_6 ; xii, a_2/b_5 .

The primary fold on the margin of the anterior sucker dividing as in the Type; dorsal surface of the chamber of the sucker, papillate; entrance to the annular groove, the groove, entrance to pharynx, jaws, etc. as in the Type.

No obvious salivary glands.

Pharynx, crop, intestine, as in the Type.

No lambertian organs.

Reproductive systems as in the Type.

No aggregated prostate or albumin glands.

ADDITIONAL MATERIAL:

(1) B. P. Museum acc. 2083, Mitchill, June 13, 1935.

This contained the holotype, paratype, and 3 small specimens: (a) 5.5 mm long; (b) 5.2 mm long; (c) 5.75 mm long.

The three small specimens are similar in form, heavy-bodied: (a) 5.5 mm long is almost uniform in depth (1.0 mm) along the length of the body; the margins obtusely rounded, parallel from 1.5 to 4.5 mm from the anterior end with a width of 1.75 mm, narrowing very gradually anteriorly to 1.0 mm at v/vi; the posterior sucker, large, 1.7 mm long and 1.5 mm wide.

Colour, (a) and (b) uniformly darkish brown on all aspects as in juveniles, with white elevated obvious large rounded intermediate, supramarginal and submarginal somital sense organs; (c) the dorsum almost white with a very faint tinge of brown vaguely indicating two wide plain bands, and between these a median white stripe, margins and venter white as also both aspects of the posterior sucker, somital sense organs as in (a) and (b) but relatively smaller.

In all three, the eyes very large, protrudent, and each in a large ocular aerola.

General somital annulation, as Type in all three: v a_2 with obvious supramarginal and submarginal somital sense organs lateral to the ocular aerolae; 1st nephropores at iv/v lateral to the ocular areola; vi incomplete 4-annulate, $a_1 = a_2 < (b_5 + b_6)$ above, b_5/b_6 very short and faint in (b), distinct in (a) and (c), and in all a, the 1st annulus complete across the venter; vii, $a_1 > a_2 > b_5 > b_6$ in all; viii to xxiii 5-annulate, a_2 distinctly the longest annulus in all; 9 (? 10) annuli between xxiii a_2 and the anus, the count of a possible 10 annuli due to the presence on xxv or on xxvi of a weak short irregular broken furrow; xxiv, $b_1 = b_2 < a_2 > a_3$ in all, and a_1 the last annulus complete across the venter; xxv 2-annulate; xxvi, xxvii, uniannulate. Posterior sucker as in Type.

In all three, xxv, xxvi, xxvii, swollen laterally as a low wide mound with a smooth lateral edge and not subdivided; a nephroporic pit beneath this mound.

The margin of the anterior sucker as in the Type in all three, and the dorsal surfaces of the chamber of the sucker, papillate.

Genital pores, xi b_5/b_6 , xii a_2/b_5 in all three.

Specimens (a) and (b) have been retained with the Type in B. P. Museum acc. 2083. (c) has been deposited with the Paratype in the Australian Museum Coll, No. W. 7217.

(2) B. P. Museum No. 147. Palmyra Island. Collectors Thaanum and Thurston, No. 158.

One specimen, 22.0 mm long, in very poor condition, the surface epithelium eroded, the body soft, the wall fragile and broken.

Somite vi, $a_1 < (b_3 + b_4) < (b_5 + b_6)$, although this is most unusual, the furrow b_3/b_4 is very definite, equivalent to b_5/b_6 , and continues into the intermediate field; vii, $(b_1 + b_2) < (b_3 + b_4) > b_5 > b_6$ below; viii, $(c_1 + c_2) < (c_3 + c_4) ? = (b_3 + b_4) > b_5 < (c_{11} + c_{12})$ above, $a_1/a_2/b_5/b_6$ but distinctly $b_1/b_2/a_2/b_5/b_6$ below; ix to xxiii 5-annulate; 10 annuli between xxiii a_2 and the anus; 17th nephropores housed as in the Type.

Genital pores xi b_5/b_6 , xii a_2/b_5 .

No further information can be taken from the specimen.

Genus **Elocobdella** Richardson 1975

1st nephropores labial, lateral to the ocular areolae of v; duognathous; no salivary gland papillae; vi incomplete 4-annulate, $(b_1 + b_2)$ above, a_1 below; vii incomplete 5-annulate, $(b_5 + b_6)$ above, a_3 below; viii and ix complete 6-annulate, c_{11} , c_{12} ; x to xxiii incomplete 7-annulate, $(c_1 + c_2)$, b_2 , a_2 , b_5 , c_{11} , c_{12} , above and b_1 below; xxiv incomplete

5-annulate, (b_1+b_2) , a_2 , (b_5+b_6) above, a_1 , a_3 , below*; xxv incomplete 3-annulate; xxvi 2-annulate; 14 annuli on the dorsum between xxiii a_2 and the anus; no defined auricle; no nephroporic pit; lambertian organs, elongate, the duct very short; well formed ejaculatory bulbs; median regions of the reproductive systems, the male, an amyomeric, micromorphic atrium, the female with recurrent and procurrent limbs subequal in length; genital pores, xi b_2/a_2 , xii b_2/a_2 . Papuan. Australian Region.

Type Species: *Elocobdella novabritanniae* Richardson 1975. New Britain.

Elocobdella novabritanniae Richardson 1975, p. 128.

Fig. 3.

Holotype: Total length, 16.0 mm. New Britain, Gazelle Peninsula, Mt. Sinewit, 5-14, xi, 1962. J. Sadlacek Collector. BISHOP. B.P.H. Museum Cat. No. 567. The Holotype, dissected, separated as Cat. No. 567A.

Paratype: Total length, 17.0 mm. Same location, date collector, as Holotype. Deposited Australian Museum, Sydney, Coll. No. W. 7216.

Additional Material: See below.

The paratype and additional material were referred to in the study of the holotype. The following description is taken from the holotype.

GENERAL FORM: Preserved, contracted, the annuli strongly compressed: dorsum transversely smooth high convex, the venter flat, and an abrupt transition between the dorsum and venter: depth uniform along the greater length of the body, as also the width with the greatest width along the posterior half of the body narrowing very gradually anteriorly and then abruptly close to the broadly obtuse anterior sucker; the posterior sucker slightly wider than its base.

Total length, 16.0 mm; at v/vi, 0.75 mm from the anterior end, the width 1.8 mm; at ix/x, 2.0 mm, the width 2.3 mm and depth 1.5 mm; at 4.0 mm, the width 2.5 mm and depth 1.8 mm, and essentially of these dimensions nearly to the anus at 13.5 mm; the posterior sucker, 2.8 mm wide and 3.0 mm long.

COLOUR: Preserved in alcohol. Off-white on all aspects as also the dorsum and venter of the posterior sucker, excepting for faded remnants of black bands on the dorsum of the body.

PATTERN: Preserved. Faded. On the dorsum in the middle of the body for a length of about three somites, indications of a narrow light contrast stripe filling the median field, defined by fragments of a pair of dark bands, each band including the line of the paramedian somital sense organs and extending into the paramedian field.

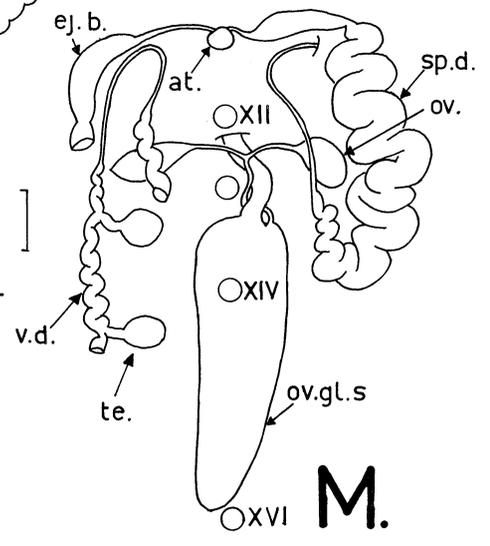
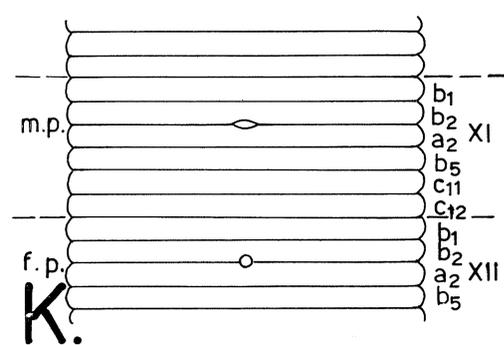
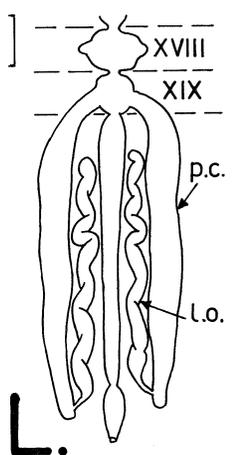
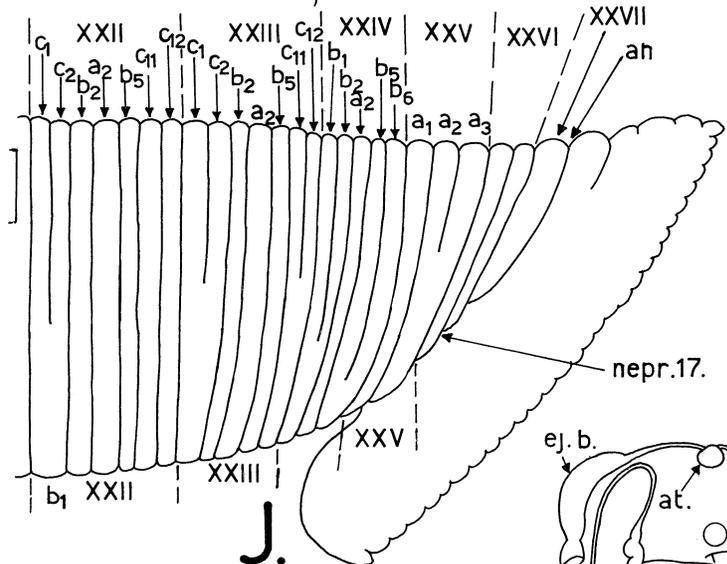
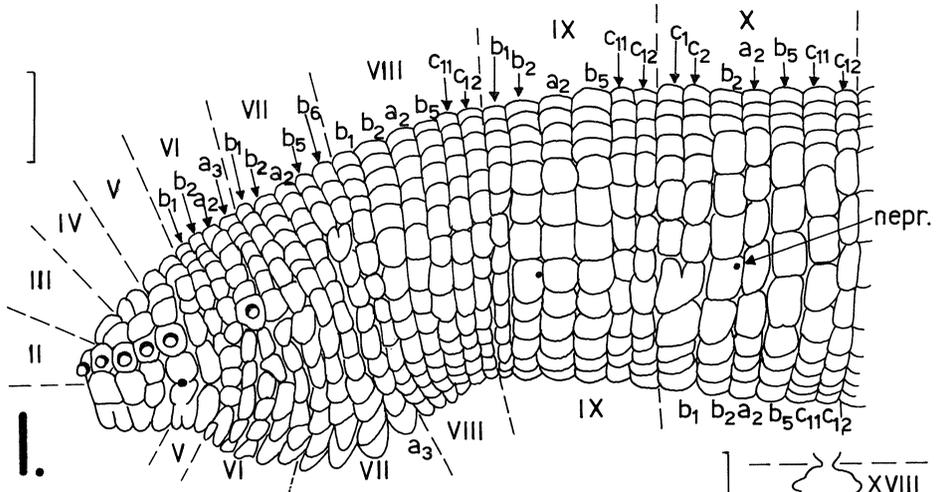
Lateral to and widely spaced from each band, an outer narrow paired dark band indicated along a length of some 15 somites by fragments along the line of the intermediate somital sense organs.

From these indications, the pattern includes a contrast stripe filling the median field along the greater length of the body; an inner and an outer pair of dark bands separated by a light stripe and the edges of the outer bands not sharply defined; venter, plain. See also Additional Material.

ANNULATION: Fig. 3 I, J, K. Preserved, contracted so that the annuli are strongly

*The study of the additional material confirmed the annulation of xxiii and xxiv as above; not xxiv (c_1+c_2), b_2 , a_2 , a_3 , as originally recorded for the Type.

Fig. 3. *Elocobdella novabritanniae* Richardson 1975. Lateral views showing annulation: I., anterior somites, J. posterior somites (areolation omitted), and K., ventral aspect, somites xi, xii showing genital pores. L. Crop compartments xviii, xix, showing caecation, postcaeca, lambertian ducts and organs, intestine, rectum. M. Anterior region of male paired ducts, male median region, and female reproductive system. For abbreviations, etc., see Fig. 1.



compressed along the greater length of the body, and the areolae poorly defined excepting enlarged protrudent conical areolae on the ventral aspect of vi and vii; interannular and intersomital furrows deep, equivalent; somital limits not directly recognisable; somital sense organs generally obscure; nephropores, minute apertures on the posterior face of the nephroporic annuli, concealed and difficult to detect.

No defined preocular somite i between ii and the margin of the sucker; the eyes situated each in a distinct ocular areola, with areolae on ii to v lateral to the ocular areolae; ii uniannulate, the ocular areolae in contact; iii uniannulate, 3 areolae as a transverse row between the oculars; iv 2-annulate, a_1a_2 with 4 areolae $< a_3$ with 4 areolae, a_1a_2 and a_3 joining to the ocular by a single common areola; v complete 2-annulate, a_1a_2 continues to the lateral margin of the sucker, a_3 along the ventrolateral margin; the 1st nephropores in v a_1a_2 .

Somite vi is 4-annulate above, $(b_1 + b_2) > a_2$ with the 5th eyes $> a_3$, the furrow b_1/b_2 short, terminating in the intermediate field, and a_1 below this.

There is difficulty in assessing with confidence the ventral annulation of vi where there are very large high conical papillae appearing in ventral view as though arranged in diagonal rows, and in lateral view a_2 dividing below the ocular areola into 3 annuli and a_3 continues across the venter.

Similar large papillae are present on the venter of vii, but vii is clearly incomplete 5-annulate, $b_1 < b_2 < a_2 < (b_5 + b_6)$ on the dorsum, b_5/b_6 well defined across the median and paramedian fields, and a_3 below.

Somite viii and the following somites are strongly compressed; viii complete 6-annulate, $b_1 < b_2 > a_2 > b_5 > c_{11} = c_{12}$; ix 6-annulate, $b_1 < b_2 > a_2 < b_5 > c_{11} = c_{12}$, the second nephropores posterior on b_2 .

Somites x to xxii, incomplete 7-annulate (total 13), (c_1 always much $< c_2$), $(c_1 + c_2)$ always much $> b_2$, c_1/c_2 extends into the marginal fields, b_1 below this.

Somites x, xi, $(c_1 + c_2) > b_2 > a_2 < b_5 < c_{11} > c_{12}$; xii to xx, the midnephric series, typically $(c_1 + c_2) > b_2 < a_2 > b_5 = c_{11}, < c_{12}$, as also xxi, xxii, excepting $c_{11} = c_{12}$.

Somite xxiii and the following somites very strongly contracted, reduced in length, and difficult to assess on the lateral aspect. The annulation appears to be: xxiii, incomplete 7-annulate, $(c_1 + c_2) > b_2 < a_2 > b_5 < (c_{11} + c_{12})$ on the dorsum, with $c_{11} = c_{12}$, and b_1, b_6 below; xxiv incomplete 5-annulate, $(b_1 + b_2) > a_2 < (b_5 + b_6)$ above, $a_1/a_2/a_3$ below, and a_2 the last annulus fully formed across the venter; xxv, incomplete 3-annulate, $a_1 < a_2 = a_3$, a_2/a_3 terminating on the lateral aspect; xxvi 2-annulate, a_1a_2, a_3 ; xxvii uniannulate; 14 annuli on the dorsum between xxiii a_2 and the anus which is at the posterior margin of xxvii; an indication of a postanal annulus.

There is no formed auricle. The intersomital and interannular furrows of xxiv to xxvii, and the areolation continue to the lateral ends of all annuli and these do not coalesce. The 17th nephropores are beneath the lateral end of xxvi. There is no formed nephroporic pit.

The dorsum of the posterior sucker with some 4 concentric rows of areolae; the venter with a coarsely papillate disc about $\frac{1}{2}$ the diameter of the sucker, and some 60 radiating muscular ridges.

CENTRAL NERVOUS SYSTEM: Ganglion vii is in close contact with the posterior face of the ventral component of the anterior ganglionic mass; ganglia xxiv, xxv, xxvi, xxvii, are in intimate contact, xxiv the larger, and xxvii in contact with the anterior face of the

posterior ganglionic mass.

ALIMENTARY TRACT: Fig. 3, L. The anterior and lateral margins of the anterior sucker formed by a single papillate fold, dividing into an outer papillate fold completing the margin of the sucker, and an inner fold as a thick undulant ridge parallel to the outer fold; dorsal surface of the chamber of the sucker, closely and richly papillate, the papillae assembling into longitudinal rows continuing each as a ridge to the transverse slit-like entrance to the annular groove housing the ventrolateral jaws.

The jaws transverse, the anterior margin nearly straight, 0.5 mm long, the jaw 0.25 mm high at the medial end and strongly compressed; a low thin chitinous cutting edge appearing as though a row of closely crowded minute teeth, the row uniform in height along its length.

No detectable salivary gland papillae.

Entrance to the pharynx at vi/vii, a narrow transverse slit about 0.3 mm wide, the dorsomedian margin, a thin fold.

The pharynx is very thin-walled, narrowly tubular, the width posterior to the anterior ganglionic mass about 0.25 mm; the length about 0.5 mm; terminating at viii/ix.

The anterior end of the pharynx is firmly fastened to the body wall; the posterior portion, freely movable and extrinsic radial muscles are not obvious.

Salivary glands, not recognizable. No columns of aggregated ducts.

The thin-walled crop is strongly contracted; compartmented in xi to xviii, each compartment carrying a single pair of wide-based caeca centred on the middle of the compartment.

In xix, the compartment gives off a pair of postcaeca, each entering the paramedian splanchnic chamber and extending to the level of xxiv/xxv.

A very short lambertian duct commences subterminally on the ventral face of each postcaecum connecting to a lambertian organ which is elongate cylindrical, the width about 0.25 mm, closely applied to the ventral surface of the postcaecum, slightly convoluted to folded on itself, and extends into xx, so that the length even in this contracted specimen exceeds 3.0 mm.

The crop ends at xix/xx, connecting terminally to the narrow subcylindrical intestine which tapers before connecting terminally at xxiii/xxiv to the short simple rectum.

REPRODUCTIVE SYSTEMS: Fig. 3K, M. Adult, assessed as female, gravid. Contracted, the median regions closely compacted.

Genital pores xi b_2/a_2 , xii b_2/a_2 .

Testes, saccular, the posterior pair at xxii/xxiii, the anterior pair at xiii/xiv. A vas efferens extends laterally from each testis to join a white, compactly folded vas deferens extending anteriorly, reducing in width at xii/xiii to a narrow thin-walled delicate duct turning medially and entering the median splanchnic chamber in the posterior half of xi, extending posteriorly as a primary loop, the left reflecting in xv, the right in xiv, the two more parallel than tandem in relationship; no distinctly differentiated epididymis; a sperm duct on both limbs of the primary loop connecting to an elongate well-formed muscularized ejaculatory bulb; the bulb reducing to a narrow thin-walled ejaculatory duct; the ejaculatory ducts joining independently low on the anterior face of the minute

thin-walled male atrium which is entirely ventral to the nerve cord, amyomeric and micromorphic.

The single pair of saccular ovaries are at xii/xiii; the thin-walled narrow oviducts join without an obvious atrium; the female median region formed on a posteriorly directed loop; the initial recurrent limb of the loop, thin-walled, narrow, much less than $\frac{1}{2}$ of the width of the strongly muscular procurrent limb; the two limbs subequal, the recurrent only slightly shorter than the procurrent. The glandular sac extends into xvi.

Prostate glands, sparse, aggregated around the male atrium. There is no indication of aggregated albumin glands.

ADDITIONAL MATERIAL:

- (1) The Type collection contained two other specimens, 14.0 mm, 8.5 mm, returned to the B.P.B. Museum as Cat. No. 567.
- (2) One specimen, folded, 11.5 mm, same locality as the Type. BBM-N.G. 20781. 14. xi. 1962, ex Crane. H. Clissold.
- (3) Noona Dan Expedition, 1961-62, Zool. Mus. København.
 - (a) Two specimens, 9.0 mm, 15.0 mm. On the path, Pathes-Yalom, 35 km. SE of Cape Lambert, New Britain. Ca. 600 m. 6-5-1962. 9.0 mm, faded, a pale median longitudinal stripe, fragments of a dark band along each side of this stripe; a pale stripe lateral to each dark band; fragments of a dark band lateral to each paired stripe; the whole indicating a dorsal pattern of 3 longitudinal light stripes and 4 longitudinal dark bands, the stripes and bands of nearly the same width.
 - (b) 1 specimen, 6.0 mm. On the ground, Rain Forest, Valoka, Cape Hoskins, New Britain, 13-7-62. Coll. T. Wolff. The median light stripe present along the posterior half of the body; wide undivided dark bands on either side of this stripe continuous laterally with a fragmented dark band. Pattern transitional between juvenile and adult.
 - (c) In nose cavity of young of *Casuaris*. Yalom, 35 km SE of Cape Lambert, New Britain, 1000 m. 12-5-1962. 4 specimens, 11.0 mm, 12.0 mm, 13.0 mm, 26.0 mm. Pattern, 11.0 mm, 12.0 mm, 26.0 mm, faded to spaced fragments of the dark lateral edges of the lateral bands. Nephropores commonly enclosed in small dark circles. The 13.0 mm specimen, a median longitudinal light stripe distinct from in iii to the anus; on each side of this in the 1/3rd quarter of the body, short lengths of pale dark bands, these lengths including a line of elongate pale ovals, each oval about half of the length of a somite; lateral to the dark band, a pale stripe narrower than the band, the lateral edge of each stripe continuous with triangular dark patches as a spaced row, the "apex" of each patch directed ventrally into a light stripe, dividing the stripe into suboval sections, the stripe paler than and distinct from the venter.

The pattern suggests these may be a second species.

Gen. et sp? aff. g. **Barbronia** s.s. Johansson 1918.

Fig. 4.

The genus was based on *Barbronia rouxi* Johansson 1918, from Canala (= Kanala) New Caledonia. A specimen from Kanala, Australian Museum, Sydney, W. 1621, has been studied along with the following:

Eight specimens, B.P.B.M., No. R148. Palmyra Island. Thaanum & Thurston.

The description below is taken from a specimen 31.0 mm long. In this and others opened, the crop, intestine and testes are disintegrated and a complete description

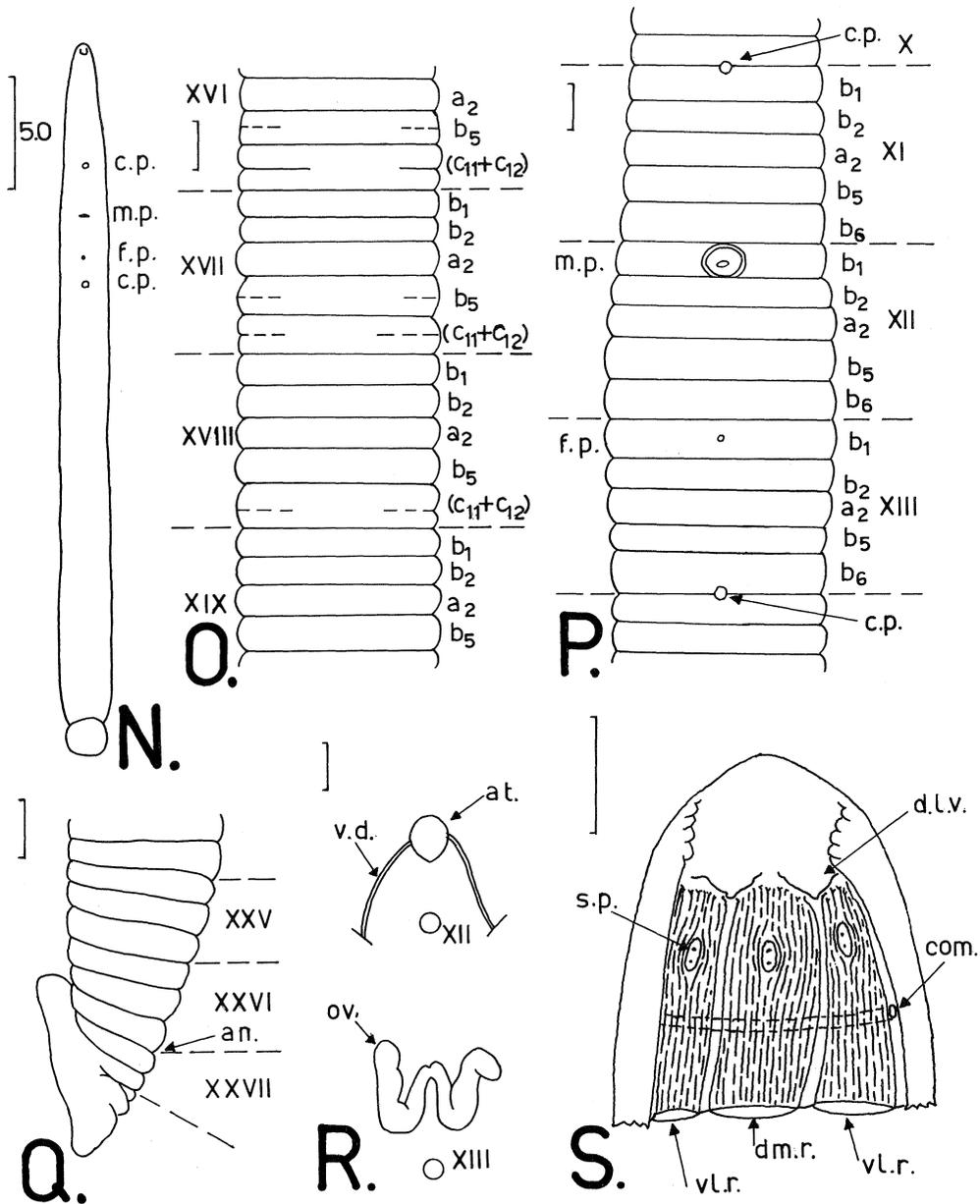


Fig. 4. Sp. aff. g. *Barbronia* s.s. Excepting O., the illustrations taken from the 31.0 mm specimen. N., Ventral aspect showing general form, the location of the genital pores and copulatory pores. Somital annulation; O., dorsal view, somites xvi to xix; P., ventral view, somites x to xiv, showing genital pores, copulatory pores; and Q., lateral view, somites xxv to xxvii and posterior sucker. R. Anterior region of male paired ducts, male median region, and female reproductive system. S. Chamber of the anterior sucker, entrance to and the initial portion of the pharynx, as exposed by a median ventral incision. For abbreviations, etc. see Fig. 1.

cannot be prepared.

GENERAL FORM: Fig. 4N. Elongate, subcylindrical, the width slightly greater than the depth; the dorsum and venter, very low convex; the margins obtusely rounded.

The anterior sucker, small, short, acute. The width and depth increasing very gradually to the clitellum which is not clearly indicated, uniform along the postclitellar region, the depth then increasing slightly in the posterior third of the body, and the width diminishing abruptly at the posterior end to form the base narrower than the circular sucker which is of the maximum width of the body. The anus is in advance of the base of the sucker which is continuous with the postanal portion of the body.

In the 31.0 mm specimen, the width at the posterior end of the anterior sucker is 1.0 mm, increasing to 2.0 mm and the depth 1.75 mm at x/xi, 5.0 mm from the anterior end, and of these dimensions posteriorly to 20.0 mm, the depth then diminishing to 1.5 mm, and of these dimensions to 27.0 mm, then diminishing to form the base of the sucker of which the ventral face is 2.0 mm long and wide.

COLOUR, PATTERN: Uniformly pale off-white; opaque; unpigmented; no indication of pattern.

ANNULATION: Fig. 4 O, P, Q. Extended, curved ventrally longitudinally so that the dorsal annulation is weakly defined to obscure; intersomital and interannular furrows, equivalent, generally detectable with difficulty on the dorsum and venter, or entirely lacking, faintly to more definite on the lateral aspects. The annulation is not complete in any specimen; no couplets or triplets of annuli; no obvious dermal papillae, nephropores, somital sense organs; eyes, not detectable.

The following somital annulation is assembled from several specimens. As is usual in these leeches, the posterior annulus in most somites is distinctly long, longer than the anterior annulus of the following somite. The posterior annulus, b_6 , is commonly recognizable in fully divided somites as subdivided on the dorsolateral aspects into $(c_{11} + c_{12})$, with $c_{11} > c_{12}$, the furrow c_{11}/c_{12} occasionally recognisable on the dorsum but not on the venter. In some specimens (Fig. 4.0.) b_5 appears very weakly divided on the margins, but this is irregular and not recognised below.

In one specimen, there are 2 annuli, ii, iii, anterior to uniannulate iv which forms the lateral and ventral margins of the sucker; v, incomplete 2-annulate, $a_1 a_2 < a_3$ above, uniannulate below; vi, 3-annulate; vii, ?; viii 4-annulate in 2 specimens, $a_1 = a_2 < b_5 = b_6$; ix to xi appear to be 5-annulate; ix $b_1 > b_2 < a_2 = b_5 < b_6$; x, $b_1 < b_2 < a_2 = b_5 < b_6$; xi, $b_1 > b_2 < a_2 = b_5 < b_6$. Somites xii to xxii incomplete 6-annulate; xii $b_1 > b_2 < a_2 < b_5 = (c_{11} + c_{12})$, as also xiii.

In the middle series in one specimen, in the vicinity of xvi to xviii, 3 somites have $b_1 > b_2 < a_2 < b_5 < (c_{11} + c_{12})$, $> b_1$, with $c_{11} > c_{12}$.

Somite xxiii, $b_1 > b_2 < a_2 < b_5 < b_6$; xxiv, 4-annulate, $b_1 = b_2 > a_2 < a_3$, $> xxv$ a_1 ; xxv, 3-annulate, $a_1 > a_2 < a_3$, $> xxvi$ a_1 ; xxvi, 3-annulate, $a_1 < a_2 > a_3$, a_2 the last annulus formed across the venter; xxvii, 2- (possibly 3-) annulate; 2 accessory postanal annuli; anus, xxvi/xxvii.

Obvious large copulatory pores, x/xi, xiii/xiv; genital pores, xii b_1 , xiii b_1 ; male pore everted in some as a low conical non-muscular penis, as is typical of the amyomeric micromorphic male atrium; female pore, a minute aperture.

ALIMENTARY TRACT: Fig. 4,S. The chamber of the anterior sucker, small, short, the

dorsal margin of the sucker papillate in one specimen (as also A.M.W. 1621), smooth in two others; lateral and ventral margins, papillate or smooth. There is nothing in the nature of a well-defined annular groove.

Posterior in the chamber of the sucker, a right and a left dorsal valve, triangular in form, the base anterior, the valves extending posteriorly each as a free flap with the apex entering the anterior end of the dorsolateral groove between the dorsomedian and ventrolateral primary internal muscular ridges of the pharynx. A.M.W. 1621, lacks flaps but has a papilla at the anterior end of each of these grooves.

The entrance to the pharynx is anterior to the dorsoventral connectives of the central nervous system, and between the entrance and the connectives is a wide chamber with the anterior ends of the primary muscular ridges in the dorsomedian and ventrolateral positions, and median in each, a small smooth style pocket with two minute stylets in tandem, the stylets lacking in one or two pockets in some, and one specimen lacking pockets on the ventrolateral ridges.

Posterior to the dorsoventral connectives, the dorsomedian ridge narrows on the left, expands on the right, and in this way the dorsomedian ridge is transposed into the right ventrolateral position.

This is correlated with a narrowing of the margin along the dorsal edge of the right ventrolateral and expansion of the ventral edge of this ridge medially, transposing the ridge into the ventromedian position.

The left ventrolateral ridge continues unchanged in position to the end of the pharynx which terminates in xiii.*

The crop, intestine and rectum are decomposed with nothing remaining of these structures (as also in A.M.W. 1621).

REPRODUCTIVE SYSTEMS: Fig. 4P,R. Testes, not recognizable. The vasa deferentia obvious in xii as very narrow delicate white ducts extending anteromedially to connect independently to the thin-walled male atrium which is small, about 3 times the length of a somital ganglion, and entirely ventral to the nerve cord in xii b₁.

Ovaries, tubular, short, folded and entirely in the anterior half of xiii, each connecting to the bursa which is minute and does not rise above the body wall.

There is no indication of aggregated prostate or albumin glands.

SYSTEMATIC STATUS OF THE PALMYRA BARBRONID.

This requires review of the knowledge of barbronids.

Barbronids are aquatic strepsilaematous macrophages; eyes in transverse pairs, a dorsal anterior and two lateral pairs; 14 pairs of ventral nephropores; pharynx, terminating in xiii, with or lacking stylets; anus, xxvi/xxvii; genital pores, anterior in xii

*Oka (1923. *Annot. Zool. Japan.* 10:243-252) in distinguishing between the euthylaematous and strepsilaematous forms of pharynx, described the change in position of the primary internal muscular ridges in the strepsilaematous pharynx as resulting from torsion. It has been referred to in this way since then. Opening the strepsilaematous pharynx by a longitudinal incision commencing at a ventral corner of the margin of the sucker, the right corner in those I have examined including *erpbodellids*, shows the dorsomedian and one ventrolateral transposing as described here, with the other ventrolateral unchanged in position as described also by Moore (1927) in *Herpbodelloidea lateroculata* and *H. indica*. Accordingly the term 'torsion' is not appropriate.

and xiii; median copulatory pores, x/xi, xiii/xiv; so far as known, a small number of saccular testes, 5 to 12 pairs irregularly arranged, some in clusters, in xiii, xiv, to xvi; anterior region of male paired ducts, tubular, linear, joining to the male atrium; ovaries, tubular connecting directly to the female bursa; cocoon, where known, with a plain translucent thin wall, depressed oval, a plug at each end, attached by the flat lower surface to stones and other objects.

Johansson (1918) forecasted a family (Barbronidae), but took no action. The barbronids became assigned to the Erpobdellidae s.l., and on the presence of stylets associated with such leeches as the ethiopian *Salifa perspicax* Blanchard 1897, the oriental *Herpobdelloidea lateroculata* Kaburaki 1921, v. Soós, 1970; the ethiopian *S. elongata* Moore 1931; and the oriental *Nematobdella indica* Kaburaki 1921 (v. Soos, 1966a,b).

Barbronids resemble erpobdellids in general facies; ocular pattern; general somital annulation; nephropores; the nature of the pharynx, crop, female system; and where known, the cocoon. The resemblances are similar to those shared by the different families of aquatic jawed sanguivores, and not familial in status.

They differ from typical erpobdellids in having stylets; the genital pores anterior in xii, xiii, not xi, xii; median copulatory pores at x/xi, xiii/xiv, not known in erpobdellids; a small number of saccular testes in xiii, xiv to xvi, not multiple testes in xiii, xiv, and posteriorly into xxii, or further.

Barbronids differ from the *Salifa* group which lacks copulatory pores and has multiple testes in xiii, xiv, to xxiii, xxiv, or with a few in xiii and posteriorly into xxiii, or xvii to xxiii (Moore, 1927, 1939, 1958). In these features, as in some others, the *Salifa* group is more erpobdellid than barbronid. *S. elongata* is exceptional in having the pharynx extending to xv.

The barbronids s.s. divide into:

- (A) The male median region, a micromorphic amyomeric atrium; somites of the middle series 5– or incomplete 6– annulate with $c_{11}+c_{12}$ above, b_6 below: gg. *Barbronia* s.s., New Caledonia, *Vivabdella*, both Richardson 1971, ? *Dineta* Goddard 1909, Eastern Australia; the Palmyra barbronid; as also others known to me in New Guinea, Tasmania; and New Zealand (Mason, 1976)*. “*Dina*” *weberi* Blanchard 1897, Java, is 6-annulate with c_{11}, c_{12} complete, and might belong to this group.
- (B) The male median region, a mesomorphic atrium with cornua; somites of the middle series 7-annulate, $b_1, b_2, b_3, b_4, b_5, c_{11}, c_{12}$, or further subdivided.
g. *Sciobdella* Richardson 1971, based on “*Barbronia weberi*” as in Moore (1927), India, also “*B. weberi* var. *formosana* as in Moore (1946) based on *Herpobdella formosana* Oka 1927, Formosa, and others in Amoy, China, Manchuria, and the Hawaiian Islands. Moore (1946) refers to the male pore as in xi $b_1, b_4/b_2$, a possible lapsus.

The Palmyra barbronid differs from the original description of *B. rouxi* and from the specimen A.M.W. 1621: ii, iii, iv, uniannulate — *rouxi*, ii, iii, 2-annulate, iv 3-annulate (possibly incomplete 4-annulate), 1621, ii and iv 2-annulate; v, incomplete 2-annulate — *rouxi* and 1621, 3-annulate; viii, 4-annulate — *rouxi*, 6-annulate, 1621 incomplete 5-annulate; ix to xi, 5-annulate — *rouxi*, 6-annulate, 1621, incomplete 7-annulate with $c_1/c_2, c_3/c_4$ very weak as noted also by Johansson.

*Mason assigns the New Zealand specimens to *Barbronia weberi* (Blanchard, 1897) as in Moore (1927). This cannot be sustained.

The three are in agreement in the incomplete 6-annulate nature of the somites of the middle series and in the location of the genital pores and copulatory pits.

ACKNOWLEDGEMENTS

I am grateful to the Director and to Dr D. M. Devaney, Invertebrate Zoologist, of the Bernice P. Bishop Museum, Honolulu, as also to Dr Torben Wolff of the Universitetets Zoologiske Museum, København, and to the Director, to Miss E. Pope and Dr P. Hutchings, the Australian Museum, Sydney, for the opportunity to study the leeches reported on in this paper.

I have been assisted with literature by the Librarians, CSIRO, the University of New England, and the Australian Museum. Professor Emeritus Marvin C. Meyer, University of Maine, has been most helpful with difficult literature.

This study has been greatly facilitated by the scholarly accounts of the genera and species in the Hirudinea, published by Dr A. Soos, the Hungarian Natural History Museum.

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Manuscript accepted for publication 27 March, 1980.