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TWO NEW SEMI-SLUGS FROM GABON, WESTERN AFRICA (GASTROPODA: PULMONATA: UROCYCLIDAE)

by

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Zonitarion dewildei spec. nov. and *Z. wakaensis* spec. nov., both belonging to the subgenus *Belonarion*, are described from the rain-forest area of Gabon, western Africa. This is the first record of urocyclid semi-slugs from this malacologically poorly known area.

Descriptions are provided of both external and internal organs, viz., jaw, radula, genital system, pallial organs and spermatophore.

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The semi-slugs of the African family Urocyclidae were monographically treated by Van Mol (1970). This book greatly facilitates the study of this taxonomically difficult group, in which the soft parts are indispensable for a correct identification. It also shows how poorly the African continent is known with regard to this group. The snails treated in this paper are found in a region from which no semi-slugs have been reported before, although it lies well within the range of this group, especially in that of the genus *Zonitarion* (Van Mol, 1970, fig. 134).

Urocyclids constitute the larger part of some small collections of Mollusca made in Gabon by Dr. J. J. F. E. de Wilde in 1983 and by Drs. J. J. F. E. de Wilde and J. C. Arends (Dept. of Plant Taxonomy, Wageningen Agricultural University) in 1984.

Two new species, of which sufficient material is available, are described below. Several more species are awaiting description until more material has been gathered.

Abbreviations used: BA, body axis; BC, bursa copulatrix; C, penial caecum; DB, duct of bursa copulatrix; E, epiphallus; F, flagellum; K, kidney; O, free oviduct; P, penis; PE, pericard; PP, papilla of penis; PS, papilla of sarcobelum; PU, primary ureter; R, rachis (central tooth); RM, penial retractor muscle; RMNH, Rijksmuseum van Natuurlijke Historie, Leiden; S, sarcobelum; SP, spermatophore; SU, secondary ureter; V, vagina; VD, vas deferens.

Measurements are taken from specimens preserved in 70% alcohol without prior relaxation.

Both species described in this paper are provisionally attributed to the subgenus *Belonarion* Pilsbry, 1919. Van Mol (1970) considers *Belonarion* a subgenus of *Zonitarion* Pfeffer, 1883. Van Mol's interpretation will be followed here: *Zonitarion* is characterized by its paucispiral, largely membranous shell without microsculpture, by its right mantle lobe bearing a prominent crest, by its penial caecum completely covered by the penial-sheath, on which the penial retractor muscle is inserted, and by the radula which has a very large number of multicuspid marginal teeth. *Zonitarion* and *Belonarion* seem to differ mainly by the sarcobelum, which is associated to the atrium in the nominate subgenus, and to the penis in *Belonarion*. One may doubt the value of this character, in view of the existence of two species lacking a sarcobelum, which Van Mol attributes to *Belonarion*.

***Zonitarion (Belonarion) dewildei* spec. nov.**

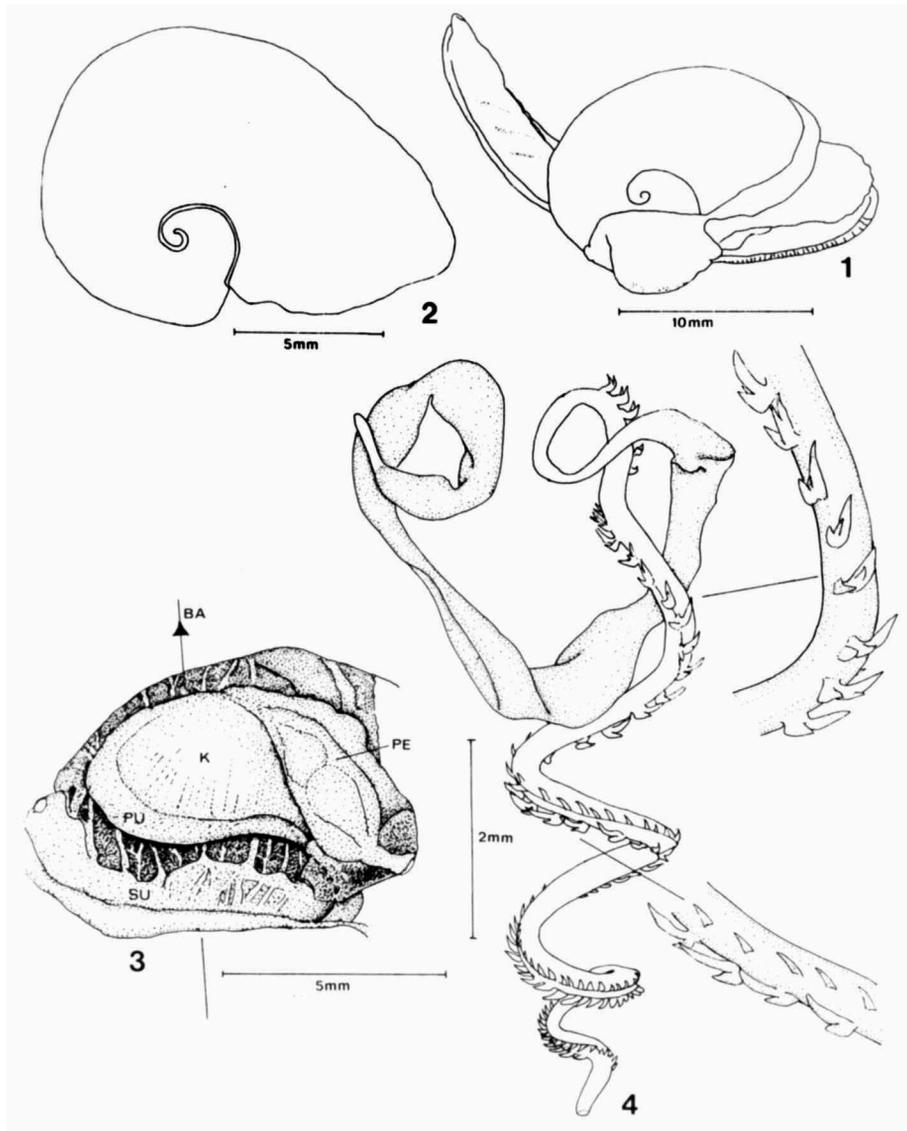
(figs. 1-11, 16-21)

Material. — Holotype (RMNH no. alc. 9153) and two paratypes (RMNH no. alc. 9154).

Type locality. — Gabon. Unfortunately the material from two different localities has not been kept separate. The types are either from Région Estuaire, Barrage du Kinguélé, about 40 km NNE of Kango, primary rain-forest; 0°31'N, 10°41'E, about 250 m alt., or from Région Ngounié, Massif du Chaillu near Mimongo, primary rain-forest; 1°12'S, 11°34'E; J. J. F. E. de Wilde leg.; February-March 1983. These localities are about 280 km apart.

Diagnosis. — A medium-sized semi-slug with little external pigmentation. Penis and sarcobelum not connected, both completely surrounded by the penis-sheath; each bears a distinct papilla. Penial papilla rather complex, distinctive. Penis much longer than the sarcobelum. The penis bears a large, spherical caecum, which is situated at the apex of the male copulatory organ (= penis + sarcobelum). Radula with about 500 teeth in each row.

External appearance. — (fig. 1) The length of the holotype as well as of an adult paratype is about 24 mm; one paratype with nearly mature genitalia



Figs. 1-4. *Zonitarion (Belonarion) dewildei* spec. nov. 1, external appearance of paratype; 2, shell of holotype; 3, pallial organs of holotype, ventral view; 4, spermatophore of paratype.

measures 21 mm. In the holotype and in the adult paratype little pigmentation is present on the caudal part of the foot, whereas in the semi-adult paratype there are a grey band and brownish spots. In all specimens pale brown spots are present on the crest of the right mantle lobe.

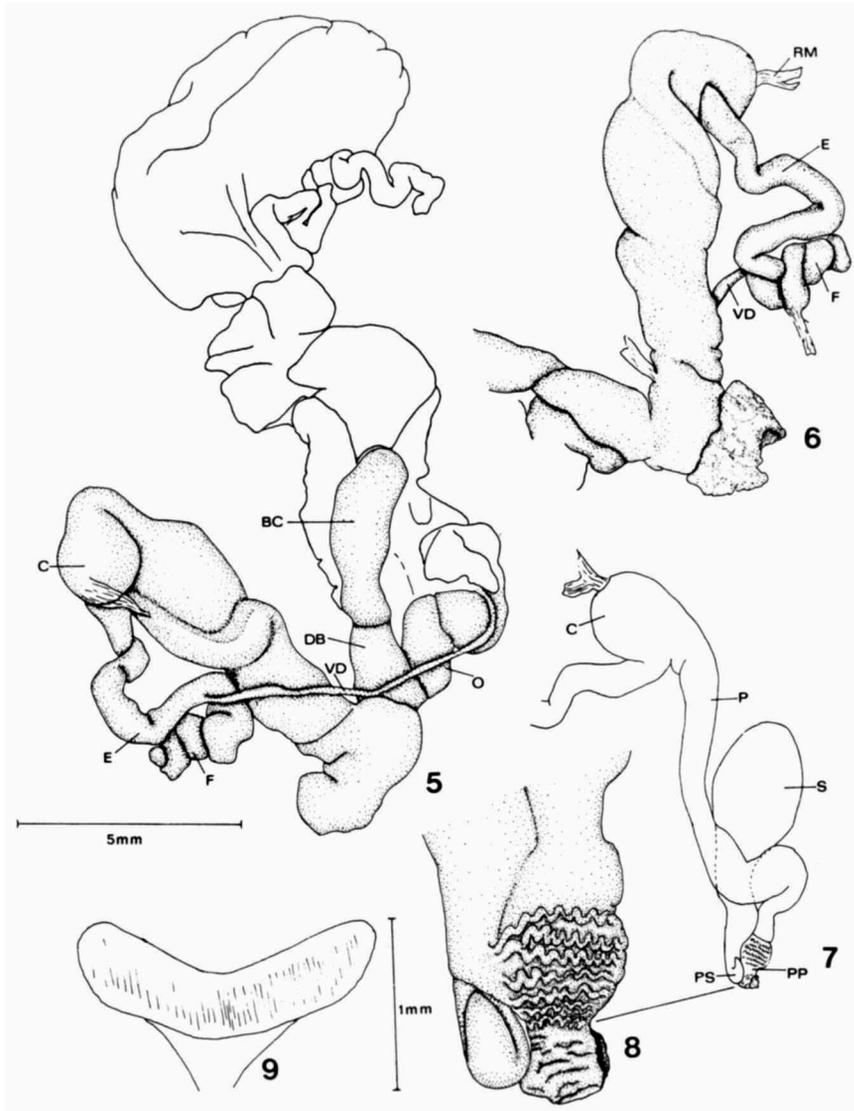
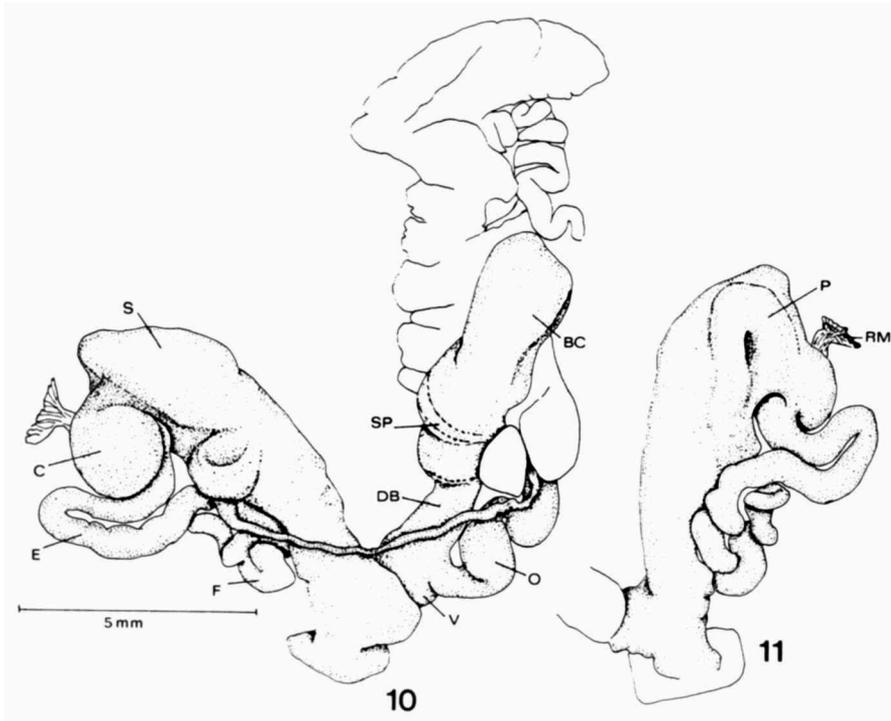


Fig. 5-9. *Zonitarion (Belonarion) dewildei* spec. nov. holotype. 5, genitalia; 6, penis viewed from the other side; 7, penis and sarcobelum (penis-sheath removed); 8, papillae of penis and sarcobelum; 9, jaw.

Shell. — (fig. 2) The shell is completely membranaceous and therefore cannot be removed without damage. Any clear sculpture is absent. In the adult specimens the shell has about two whorls and measures about 14×10 mm.

Pallial organs. — (fig. 3) The pallial cavity is wider than long. The distance



Figs. 10-11. *Zonitarius (Belonarius) dewildei* spec. nov. paratype. 10, genitalia; 11, penis viewed from the other side.

between the anterior edge of the pallial cavity and the kidney is about equal to that between the two parts of the ureters. The kidney is perpendicular to the body's long axis, partly covered by the pericard, which measures slightly over half the length of the kidney. The secondary ureter is vascularized and wider than the primary ureter.

Genitalia. — (figs. 5-8, 10-11) The ovotestis consists of numerous small yellow-white acini, filling up the first $1\frac{1}{2}$ whorls of the shell. The free oviduct is rather long, much longer than the bursal duct. The short vagina measures about one fifth of the length of the bursal duct. The bursa copulatrix is a large oblong sac with a somewhat shorter duct. The male copulatory organ consists of a rather long penis and a much shorter sarcobelum, enclosed in a tight internal sheath, and completely surrounded by the (external) penis-sheath, through which both organs are partly discernable from the outside. Penis and sarcobelum are not connected to each other. The penis is more or less strongly coiled, especially in a paratype (fig. 10-11), which appears to be preserved shortly after copulation, as it contains an undamaged spermatophore. Apically

the penis bears a conspicuous spherical caecum, which is always situated at or very near the apex of the copulatory organ as a whole. A short penial retractor muscle is inserted on the upper part of the penial caecum. Both penis and sarcobelum possess a papilla. The latter organ has a shining, muscular papilla with an acute recurved apex. The penial papilla is rather complex, showing at its extremity a thin, wrinkled structure of variable shape, followed by a bulbous part covered by zig-zag furrows.

Spermatophore. – (fig. 4) In a paratype an undamaged spermatophore was found with its apex in the upper region of the bursa copulatrix and the tail in the lower part of this organ and in its duct. The head is slightly shorter than the tail and has a horny, finger-like projection anteriorly. On the tail, which is helicoidally coiled, rows of spines are spirally arranged. The first part of the tail is smooth, after which a single row of bicuspid spines arises, which become tricuspid after the fifth spine. Between the 17th and 18th spines a second row of unicuspid spines begins. Gradually the tricuspid spines become unicuspid. The hinder part of the spermatophore carries two parallel rows of identical, simple spines.

Jaw. – (fig. 9) The jaw is oxygnathous, without a median projection. According to Van Mol (1970: 15) this is a rare feature in Urocyclidae.

Radula. – (figs. 16-21) The number of teeth in each transverse row is very large. In the adult paratype there are nine laterals, one or two intermediates and about 240 marginals in each half row. The holotype has the same number of laterals and at least 200 marginals. The mesocone of the rachis is bifid in both examined specimens, which seems to be an unknown feature in this group (cf. Van Mol, 1970). The mesocone of the laterals is rather blunt, with several minute indentations. The marginals are bicuspid with a serrated outer margin (fig. 18).

Derivatio nominis. – The species is named in honour of the botanist Dr. J. J. F. E. de Wilde, who at my request was so kind as to collect snails during his botanical explorations in Gabon.

Remarks. – *Z. dewildei* is clearly different from all other members of the subgenus *Belonarion* treated by Van Mol (1970), especially by its conspicuous penial caecum, its penial papilla and its spermatophore. The only species with both the penial caecum at the apex of the copulatory organ as well as a free sarcobelum is *Z. (B.) putzeysi* (Pilsbry, 1919), the type species of the subgenus *Belonarion* (Pilsbry, 1919: 263-64, fig. 127). Van Mol's (1970) interpretation of *Z. putzeysi* shows a species with its penial caecum and part of its penis uncovered by the penis-sheath, a feature unknown in other members of the genus, and not discernable in Pilsbry's figures. As it seems unlikely to me that Pilsbry simply overlooked this peculiarity, I am far from convinced that *Z.*

putzeysi (Pilsbry) and Van Mol's species described under that name are conspecific. *Z. dewildei* resembles *Z. putzeysi* in its long convoluted penis and apical penial caecum. It seems to differ in being much larger, in its not swollen free oviduct and in its recurved, more blunt sarcobelum.

The number of teeth in each transverse row of the radula is far greater than in any of the other *Belonarion* species of which the radula has been examined, which according to Van Mol have less than 100 teeth in half a row. In this respect it resembles *Z. (Z.) semimembranaceus* (Von Martens, 1876), which also can possess over 500 teeth in each row (Watson, 1920: 105; Van Mol, 1970: 202).

***Zonitarion (Belonarion) wakaensis* spec. nov.**

(figs. 12-15, 22-27)

Material. – Holotype (RMNH no. alc. 9155) and three paratypes (RMNH no. alc. 9156)

Type locality. – Gabon, Région Ngounié, old secondary forest along a forest exploitation road near waterfalls in the river Waka, about 35 km ESE of Fougamou; 1°15'S, 10°54'E, 370 m alt.; J. J. F. E. de Wilde & J. C. Arends leg; 19-XI-1984.

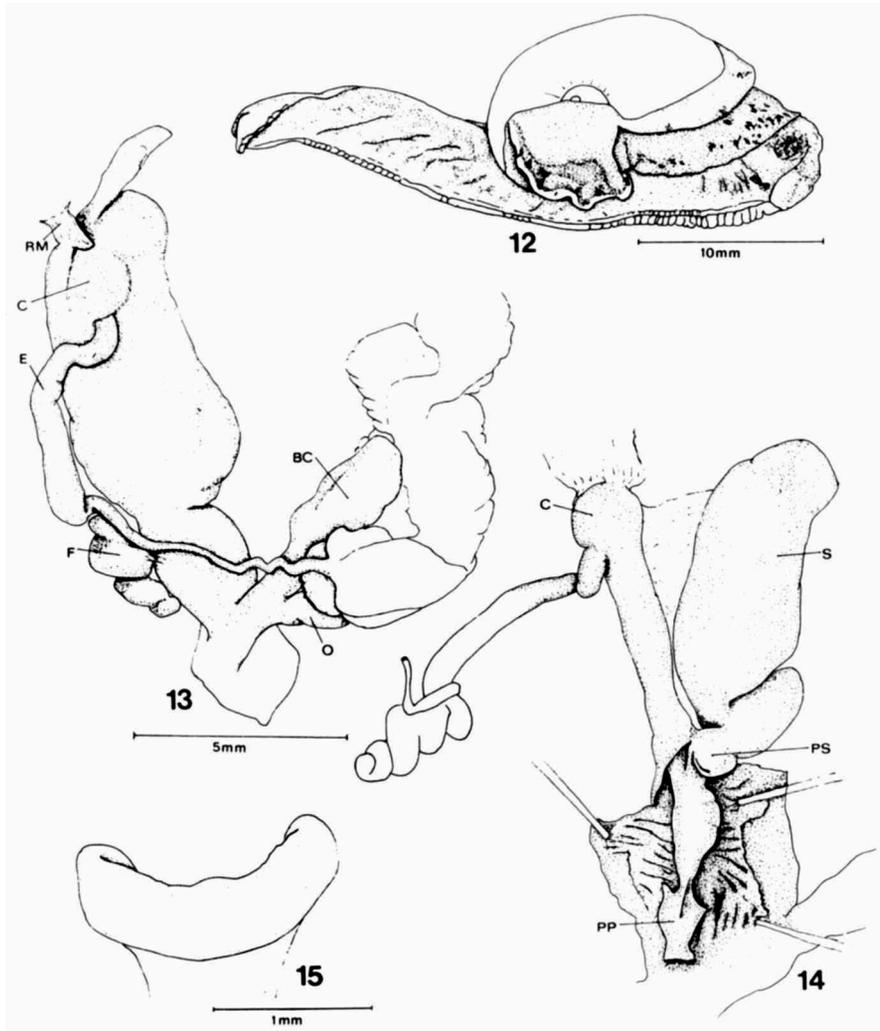
Diagnosis. – A large semi-slug with dark pigmentation on the foot and mantle. Penis and sarcobelum completely covered by the penial sheath. The sarcobelum is connected to the penis; both possess a papilla, which is spherical in the sarcobelum and irregularly arrow-shaped in the penis. Radula with about 280 teeth in each row.

External appearance. – (fig. 12) This is the largest member of the subgenus *Belonarion* known so far. The holotype measures about 38 mm; the only adult paratype 32 mm. On the upper part of the foot a dark zone is present, with the pigment more or less in a reticulate pattern. The right mantle lobe has a conspicuous, wrinkled crest with dark spots. The left mantle lobe as well as the anterior part of the mantle show many small stripes and spots. The pigmentation is much more conspicuous in the immature paratypes. The head and especially the neck underneath the mantle are very dark.

Shell. – Completely membranaceous, without sculpture. It measures 14.5 × 11 mm in the holotype and has about 2¼ whorls.

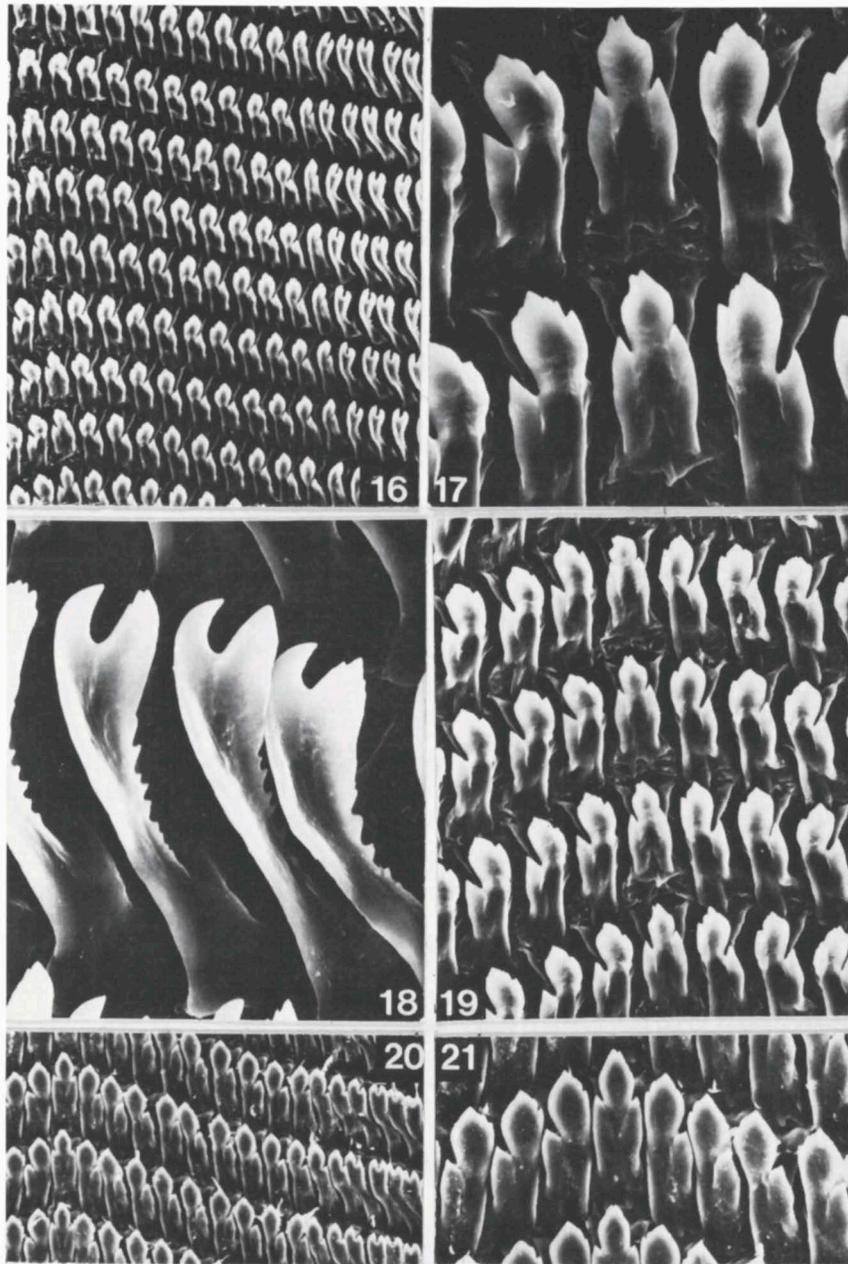
Pallial organs. – The situation is similar to that described in *Z. dewildei*. It differs mainly in the slightly smaller size of the kidney, which is nevertheless striking in view of the much smaller size of this species and in its primary ureter, which seems broader in ventral view.

Genitalia. – (figs. 12-14) The free oviduct is very short. The bursa copu-

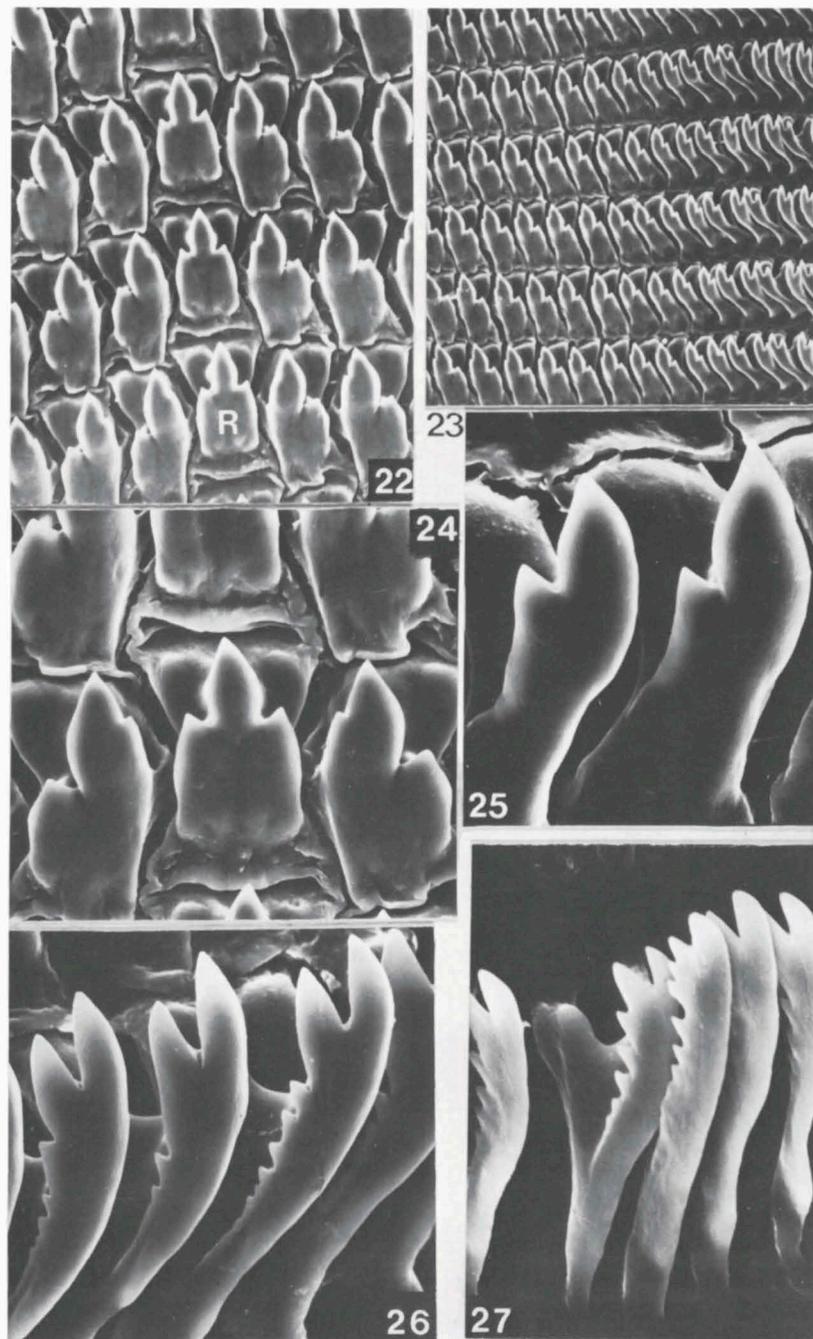


Figs. 12-15. *Zonitarion (Belonarion) wakaensis* spec. nov. 12, external appearance of paratype; 13, genitalia of holotype; 14, copulatory organ of holotype opened, showing penis and sarcobelum; 15, jaw of paratype.

latrix is relatively small, consisting of an oval sac and a short, stout duct. The penis-sheath encloses both penis and sarcobelum entirely. In the holotype an appendix is present on the upper part of the penis-sheath, which is probably additional space for the sarcobelum. In the paratype it is lacking. The sarcobelum is very broad, with a deep constriction basally and a spherical papilla with a slit-like opening. Unlike all other species of *Belonarion*, in which the sarcobelum has a papilla, the sarcobelum is connected to the penis by means of



Figs. 16-21. Radula of *Zonitarion (Belonarion) dewildei* spec. nov. 16, paratype: rachis, laterals and transition into marginals, $\times 500$; 17, paratype: rachis and first laterals, $\times 2000$; 18, paratype: inner marginals, $\times 3500$; 19, paratype: rachis and inner laterals, $\times 1000$; 20, holotype: idem as 16, $\times 500$; 21, holotype: idem as 19, $\times 2000$.



Figs. 22-27. Radula of *Zonitarion (Belonarion) wakaensis* spec. nov. paratype. 22, rachis and inner laterals, $\times 1000$; 23, transition from outer laterals into marginals, $\times 500$; 24, rachis and first laterals, $\times 2000$; 25, transitional teeth, $\times 3500$; 26, inner marginals, $\times 3500$; 27, outer marginals, $\times 3500$.

a short duct. The penis bears a peculiar, irregular, arrow-shaped papilla. Penis straight, with apically a spherical caecum, on top of which the penial retractor is inserted. Epiphallus characteristically without convolutions.

Jaw. – (fig. 15) Oxygnathous, with a very small median projection.

Radula. – (figs. 22-27) The number of teeth in each transverse row is rather large. In an adult paratype there are 15 laterals, three intermediates and about 120 marginals in each half row. The mesocones of both rachis and laterals are rather sharp, without minor incisions. In the transitional teeth the endocone disappears (fig. 25). In the bicuspid marginals the outer margin is serrated.

Derivatio nominis. – Named after the river Waka, in the vicinity of which the specimens were collected.

Remarks. – This species occupies a special position in the phylogeny of the subgenus *Belonarion*, as proposed by Van Mol (1970), in which there is a gradual tendency towards the individualization of the sarcobelum. The only species known with its sarcobelum connected to the penis is *Z. (B.) bicarinatus* Van Mol, 1970, in which the sarcobelum is poorly developed and lacks a papilla. In view of its large sarcobelum, which has a papilla, *Z. wakaensis* may be placed in Van Mol's evolutionary scheme between stages B and C (Van Mol, 1970: 25, fig. 9). However, this seems to be in contradiction with its large number of radular teeth, which according to the same author is an advanced character (Van Mol, 1970: 13).

One may wonder whether the radula in this genus provides reliable characters for species recognition. In all investigated species of *Belonarion* there seem to be clear differences in shape and number of the teeth. However, in *Zonitarion (Z.) semimembranaceus* there seem to be large differences in the number of teeth in a transverse row, which according to Van Mol (1970) varies between about 125 and 280. One wonders if such differences are possible within one species. It seems possible that more than one species is involved, also in view of the large variation in external pigmentation and the large distributional range reported in this species (cf. Van Mol, 1970: 195, fig. 134; 205).

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