Disentangling an Asian puzzle: Two new bathyellid (Crustacea, Syncarida, Parabathynellidae) genera from Vietnam

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Abstract
In this paper the 17 asiatic species of the family Parabathynellidae are reviewed from a taxonomic point of view using bibliographic data. Two new genera and two new species are described from caves in Vietnam. Paraeobathynella n. g. presents a unique combination of characters (antennule: seven segments; antenna: six segments; mandible: pars incisiva with five teeth and pars molaris with 10 teeth; maxillule: distal endite with seven claws; exopod of the thoracopods with three or more segments and epipods present in thoracopods 3–7; pleopods absent; endopod of the Th 8 male with two setae; seven spines on the sympod and two spines on the endopod of the uropod and the small minimum size of the adult body) and exclusive characters like the Th 8 female having two small spines and one long seta and the general size and aspect of the Th 8 male and its lobes. Sketinella n. g. presents a unique combination of characters (antennule: eight segments; antenna: six segments; mandible: pars incisiva with six teeth and pars molaris with eight teeth; maxillule: distal endite with seven claws; exopod of the thoracopods with three or more segments and epipods present in Th 3–7; endopod of the thoracopod 8 male with two setae; 12 spines on the sympod and two spines on the endopod and seven setae on the exopod of the uropod) and characters exclusive to the asiatic species are: a pair of pleopods reduced to a single seta; a very distinctive basipod and outer lobe of the Th 8 male and an exopod of the Th 8 male with a small tooth or protuberance. This is the first time that the Parabathynellidae has been found in Vietnam, this find extends the range of distribution of this family in Asia.

Keywords: Parabathynellidae, subterranean waters, Syncarida, Vietnam

Introduction
The asiatic family Parabathynellidae includes 17 known species to date, belonging to six genera. Two of these genera, Allobathynella Morimoto and Miura, 1957 (eight species and subspecies) and Eobathynella Birstein and Ljovuschkin, 1964 (five species and subspecies), contain most of these species. Current taxonomy is not satisfactory as the generic diagnoses are not complete and there is great morphological variability amongst the species which have been described. When the first species were found (Parabathynella malaya Sars, 1929;
P. carinata Ueno, 1952; P. gracillima Ueno, 1956; and P. kuma Ueno, 1956) they were included in the only genus that was then known, Parabathynella Chappuis, 1926. In 1957, Morimoto and Miura created a new genus, Allobathynella, in order to accommodate a new species found in Japan, A. japonica.

In 1964, Birstein and Ljovuschkin created the subgenus Parabathynella (Eobathynella) for a new species, P. (E.) mesasiatica, found in Central Asia (Kirghizie, Russia) and considered that the other four species found in Japan (Parabathynella carinata Ueno, 1952; P. gracillima Ueno, 1956; P. kuma Ueno, 1956; and P. gigantea Morimoto, 1959) and the other species known in Malaysia (P. malaya Sars, 1929) belonged to this subgenus as well. Jankowskaja (1964) described P. tianschanica, also from Central Asia. Noodt (1965) considered that the creation of this subgenus was not justified and thought that the species malaya, carinata, kuma, and gigantea belonged to the genus Allobathynella of Morimoto and Miura (1957). Birstein and Ljovuschkin revised this data in 1968, and disagreed with Noodt, and considered the subgenus Parabathynella (Eobathynella) to be a genus in its own right: Eobathynella, and included the species P. tianschanica in this genus as well.

Schminke (1973) accepted the validity of the genus Eobathynella. He gave a new diagnosis for this taxon and considered that the species mesasiatica, tianschanica, and minima from Central Asia should be included in it together with gracillima from Japan and matuta from South Korea. At the same time he described two new genera, Nipponbathynella, to include the species P. miurai from Japan, and Batubathynella, to include the species P. malaya from Malaysia.

In 1994, Serban had the opportunity to study specimens of E. tianschanica and of A. japonica and came to the following conclusions:

1. The genus Eobathynella is a valid taxon and distinct from the genus Parabathynella, but both the initial diagnosis and that provided by Schminke (1973) were insufficient for the identification of the species.
2. The description of the species mesasiatica contains useful information about important morphological characters, but there is no information about the thoracopod eight (Th 8) male whose characteristics are very important in the taxonomy of Bathynellacea. Owing to this, it is impossible to make the right decision about the allocations of the species to the genus Eobathynella as did Birstein and Ljovuschkin (1968) and Schminke (1973).
3. The diagnosis of the taxon Eobathynella cannot be made definitive until the type material can be studied in detail.

Bearing in mind these questions, Serban (1994) created a new genus, Issykkulibathynella, for the species E. tianschanica. As well as this, thanks to his study of specimens of Allobathynella japonica (provided by Mrs A. I. Jankowskaja), he was able to describe the Th 8 male very well, providing very important data for the diagnosis of this genus. Noodt (1965) mainly based the taxonomy of the genus Eobathynella on the characters of the uropod and Schminke (1973) mainly based the taxonomy on characters of the antenna (A.II) (he includes in the genus Eobathynella all the species which lack a seta on the antepenultimate segment); neither of them was able to resolve the taxonomic problems for the group of asiatic species, although they each contributed important information. The lack of complete diagnoses of the different genera resulted in many species with very different characters being included in the same genus.

In short, species have been assigned to genera in an arbitrary way. In the Appendix we show the accepted taxonomy to date with an asterisk next to those species which, according
to Serban (1994), do not belong to the genus to which they are currently assigned, but probably to a new genus.

We have reviewed all the literature on asiatic species and consider that the two new species described in this paper belong to two new genera, *Paraeobathynella vietnamensis* n. g. n. sp. and *Sketynella trontelji* n. g. n. sp. The species *Allobathynella gigantea* and *A. gigantea pluto* (Morimoto, 1963) could belong to the latter, but using only the data found in the literature it is impossible to assign them to the correct genus.

**Material and methods**

The specimens studied were found in four samples from caves sampled by Boris Sket and Peter Trontelj according to a contract with Fauna and Flora International—Vietnam; the subject of investigation was the cave fauna in the World Heritage area of Vinh Ha Long (= Ha Long Bay) in northern Vietnam.

The material was collected with a 0.2 mm mesh hand net. All samples containing bathynellaceans are from small puddles of percolated water. A complete dissection of all anatomical parts of all type series was made, and kept as permanent preparations (special metal slides, glycerine gelatine—Kaiser methods—stained with methylene blue as the mounting medium). Anatomical examinations were performed using an oil immersion lens (100 ×; Zeiss microscope). The descriptions were based on the type series. The material is deposited in the Museo Nacional de Ciencias Naturales, Madrid (MNCN).

**Systematic account**

*Paraeobathynella* n. g.

*Genus diagnosis*

Antennule (A.I) has seven segments and subterminal aesthetascs on the last segment. Antenna (A.II) has six segments, the fourth without setae. Mandible (Md) with protuding *pars molaris*. Maxillule (Mx.I) with proximal endite with four teeth and distal endite with seven teeth. Exopods of Th 1–7 with more than two segments; basipod of Th 1 with two setae. Thoracopod (Th) 8 male: large with very well-developed endopod which has two terminal setae; exopod very large, longer than wide and overhanging the basipod and is on the distal face of the basipod; inner lobe completely integrated into the basal region; rounded outer lobe is not fused with basipod; basipod trapezoidal with a protuberance on the internal lateral edge. Th 8 female: large and almost square, with a long terminal seta and small teeth. No pleopods. Ventral seta of the pleotelson in the basal part of the furca. Sympod of uropod with subequal spines; endopod with two spines and two apical setae.

*Type species.* *Paraeobathynella vietnamensis* n. sp.

*Paraeobathynella vietnamensis* n. g. n. sp.

(Figures 1–7)

*Material examined*

*Type locality.* Cave Hang Trinh Nu, Bo Hon Island, Vinh Ha Long, SW part (11 June 2003), (abundant males and females collected—very dense colony on the bottom covered
by a layer of pebbles). The details of the new description are based on adult specimens (15 males and 13 females). The holotype is a male and the type series contains 27 specimens (paratypes) (MNCN 20.04/5911).

There are two other populations: one in the Trung Trang Cave, Cat Ba Island, W of Vinh Ha Long (14 June 2003, five males and five females collected) and the other in the Ang Vem Cave, Cat Ba Island, W of Vinh Ha Long (one female, 15 June 2003).

Description

Body. Total length of holotype male 1.56 mm (species range type locality: males $n=15$: 0.90–1.56 mm; females $n=13$: 0.96–1.33 mm; population 1: males 1.16–1.71 mm and females 1.28–1.55 mm; population 2: female 1.38 mm). Body elongated, segments progressively widening towards posterior end of body (Figures 1, 2—female paratype and male holotype, respectively). Length of head greater than width. All drawings are of the holotype (male) and the Th 8 female is of one paratype (female selected).

Antennule (Figure 3A). Antennule has seven segments; no sexual dimorphism; length of first four segments greater than that of last three; setation as in Figure 3A (segment 5 with two aesthetascs; segments 6 and 7 with three aesthetascs, on the last segment aesthetascs are subterminal).
Antenna (Figure 3B). Antenna six-segmented, last four segments similar in size, longer than the two first segments; last segment with three smooth and one plumose terminal setae; segments 1 and 4 without setae; setation in the other segments as in Figure 3B.

Labrum (Figure 3C). Labrum concave, with eight main teeth, and three lateral teeth at either end.

Mandible (Figure 3D). Pars incisiva with five well-developed teeth and small proximal tooth as in Figure 3D; pars molaris with 10 teeth, eight being strong and distal with small spines and two small joined proximal teeth with a large number of fine setae; mandibular palp does not exceed pars incisiva in length.

Maxillule (Figure 3E). Proximal endite with four claws (spines of different sizes); distal endite with seven claws, two smooth and apical, the other five with strong spines and three subterminal smooth setae on outer distal margin.

Maxilla (Figure 3F). Four-segmented, with two setae on basal segment; segment 2 with two long setae and one shorter one at distal end; segment 3 elongated with 12 setae and last segment with a strong terminal seta and two lateral setae.
Figure 3. *Paraeobathynella vietnamensis* n. g. n. sp., male holotype. (A) Antennule (ventral view); (B) antenna (dorsal view); (C) labrum; (D) mandible (ventral view); (E) maxillule; (F) maxilla. Scale bar in mm.
Figure 4. *Paraebathynella vietnamensis* n. g. n. sp. (A–F) Male holotype: (A) thoracopod 1; (B) thoracopod 2; (C) thoracopod 3; (D) thoracopod 8 (lateral internal view); (E) thoracopod 8 (latero-external view); (F) thoracopod 8 (latero-frontal view); (G) Female paratype (frontal view). Scale bars in mm.
Thoracopods 1–7 (Figures 4A–C, 5, 6). Well developed, length gradually increasing from 1 to 5, last three similar in size; well-developed epipodite on 3–7, measuring more than half length of basipod; basipod with one lateral, barbed terminal seta in Th 2–7; exopods of the Th 1 and 2 shorter than endopods; exopods of the Th 3–7 longer than endopods. Thoracopod 1 (Figure 4A): has two lateral smooth terminal setae on basipod; exopod three-segmented, with two barbed setae on each segment and one group of ctenidia at the

Figure 5. *Paraeobathynella vietnamensis* n. g. n. sp., male holotype. (A) Thoracopod 4; (B) thoracopod 5. Scale bar in mm.
base of setae; endopod four-segmented: first segment has three barbed dorsal setae and one plumose seta, second has three barbed dorsal setae and one plumose seta, third has three barbed dorsal setae and one small, smooth, terminal seta, terminal segment has two slightly

Figure 6. *Paraoxytynella vietnamensis* n. g. n. sp., male holotype. (A) Thoracopod 6; (B) thoracopod 7. Scale bar in mm.
Figure 7. *Paraobathynella vietnamensis* n. g. n. sp., male holotype. (A) Pleotelson and furca (lateral view); (B) pleotelson and furca (dorsal view); (C) uropod (latero-external view); (D) detail of terminal end of the endopod of the uropod (latero-external view). Scale bars in mm.
barbed claws of similar length and one smooth seta. Thoracopod 2 (Figure 4B): exopod four-segmented, with two barbed setae on each segment and with one group of ctenidia at the base of setae; endopod four-segmented, first segment short and with one barbed and one plumose seta; second with two groups of lateral ctenidia and three barbed dorsal setae and one plumose seta; third with two barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong slightly barbed claws of different length. Thoracopod 3 (Figure 4C): exopod five-segmented, with two barbed setae on each segment and one group of ctenidia at the base of setae; endopod four-segmented, first segment short with one barbed and one plumose seta; second with two groups of lateral ctenidia and two barbed dorsal setae and one plumose seta; third with two barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong slightly barbed claws of different length. Thoracopods 4–7 (Figure 5A, B, 6A, B): exopod five-segmented, with two barbed setae on each segment and with one group of ctenidia at the base of setae; endopod four-segmented, first segment short with one barbed and one plumose seta; second with four groups of lateral ctenidia and two barbed dorsal setae and one plumose seta; third with two barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong slightly barbed claws of different length. Thoracopod 8 male (Figure 4D, E, F): large, massive, almost square; basal region massive; inner lobe completely integrated into the basal region, barely exceeds distal end of dentate lobe; basipod with one distal protuberance on the internal lateral edge which exceeds the end of internal lobe; endopod almost square, with two long setae; large exopod, longer than wide and overhanging the basipod and the outer lobe; rounded outer lobe is not fused with basipod and exceeds the end of the external side of the basipod; dentate lobe with small teeth and rounded distal end. Thoracopod 8, female paratype (Figure 4G): large with smooth cuticle, almost square, has one long terminal seta and two small teeth. Dorsal margin of pleotelson (Figure 7A, B): pronounced anal operculum; one barbed ventral seta.

**Uropod (Figure 7C).** Sympod slightly longer than the endopod and four times longer than wide; with seven barbed spines of different size; endopod slightly shorter than exopod with two strong, barbed spines and one claw (Figure 7D) on the distal end and two plumose setae on the external part which exceed the distal end of the endopod, and two barbed terminal setae, four groups of ctenidia on dorsal face; exopod has two barbed terminal setae, the outer longer than the inner, and four barbed setae on external face.

**Furca (Figure 7A, B).** Furca has five barbed spines (the two terminal ones being a little longer and thicker); two dorsal plumose setae similar in size.

**Etymology**

The generic name is to be nearest to *Eobathynella* genus. The species name is dedicated to Vietnam.

**Remarks**

The combination of characters of *Paraeobathynella* n. g. (number 7 in Table I) is similar to some of the possible combinations present in the genus *Allobathynella* (number 1 in Table I) due to its great variability. According to Schminke (1973) and Serban (1994) it is possible that this last genus includes species that belong to two or three different genera. The
Table I. Character variability in the different Asian genera of the Parabathynellidae family.

|                  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
|------------------|----|----|----|----|----|----|----|----|
| A.I: no. segments| 6–8| 6–7| 6  | 6  | 7  | 7  | 7  | 7  |
| A.II: no. segments| 5–6| 5–6| 2  | 5?–6| 6  | 6  | 6  | 6  |
| Th 1 Epipod      | Absent| Absent| Absent| Absent| Absent| Absent| Absent| Absent|
| Exopod: no. segments| 2–7| 2  | 2  | 2–3| 2  | 1  | 3  | 3  |
| Th 2 Epipod      | Absent| Absent| Present| Present| Absent| Present| Absent| Absent|
| Exopod: no. segments| 2–7| 2–3–4| 2  | 3  | 2  | 2  | 4  | 4  |
| Th 3 Epipod      | Present| Absent| Present| Present| Absent| Present| Present| Present|
| Exopod: no. segments| 2–7| 2–3–4| 2  | 3  | 2  | 2  | 5  | 5  |
| Th 4–7 Epipod    | Present| Present| Present| Present| Present| Present| Present| Present|
| Exopod: no. segments| 2–7| 2–3–4| 2  | 3  | 2  | 2  | 5  | 5  |
| Th 8 male endopod: no. setae| 2| 1| 2| 1?| 2| 2| 2| 2|
| Th 8 female      | 1-segmented| 1-segmented| 1-segmented| 1-segmented| 1-segmented| Without segments| 1-segmented| –|
| Pleopod: first pair| 1-segmented and 2 setae/absent| Absent| Absent| Absent| Absent| Absent| Absent| Single seta|
| Uropod Sympod    | No. spines| 6–18| 5–10| 9–13| 6–7| 10| 10| 7| 12|
| Type spines      | Similar/different| Distals short| Distal longer| Distal longer| Distal longer| Distal short| Similar| Different| Distal longer|
| Exopod: no. setae| 3–6| 2–4| 2–3| 4–5| 2| 4| 6| 7|
| Endopod No. spines| 0–6| 0–3| 0| 2| 1| 1| 2| 2|
| No. setae        | 2–5| 1–3| 2| 3| 4| 2| 4| 4|
| Furca: no. spines| 3–6| 3–5| 6–9| 4| 4| 3| 5| 7|
| Anal operculum b| Present (S–L)/absent| Present (S–M)| Present (S)| Present (S)| Absent (S)| Absent| Present/M| Present/M|
| Length male/female (mm)| 1.6–3.3/1.6–3.2| 2.1–2.3/1.7| 1.3–1.5/1.3–1.4| 1.3–1.5/1.0| 2.0/–| 2.1/2.1| 0.9–1.7/0.9–1.5| 1.7–1.9/–|
| Habitat b        | W/C| W/R| W/R| W/R| C| S| R| C|

Genera: 1, *Allobathynella*; 2, *Eobathynella*; 3, *Nipponbathynella*; 4, *Batubathynella*; 5, *Issykkulibathynella*; 6, *Sabahbathynella*; 7, *Paraobathynella* n. g.; 8, *Sketinella* n. g.

aS, small in size; M, medium-sized; L, large in size. bW, well; S, spring; C, cave; R, river bank.
different combinations of the characters of the species of the possible different genera (numbers 6–8 in Table II) do not coincide with *Paraeobathynella* n. g. (number 19) (see Table II). *Paraeobathynella vietnamensis* n. g. n. sp. is different to the five first species in Table II which are possibly true “allobathynels”. The most similar species is *A. coreana* (number 5) but this species has one pair of pleopods with one segment and two setae, whereas the new species do not have pleopods. In both species the Th 8 female and the uropod are very different and there are also other differences in almost all structures of the body. In *Allobathynella* the exopod of the Th 8 male is on the external face of the basipod, whereas in *Paraeobathynella* n. g. this structure is on the distal face of the basipod, as in the genus *Issykkulibathynella* (number 5 in Table I) and the other new genus, *Sketinella* n. g. (number 8 in Table I).

Only *E. mesasiatica* (number 9 in Table II) is definitely a species of the genus *Eobathynella* and the new species (number 19 in Table II) is very different from *E. mesasiatica* to belong to this genus. In *E. mesasiatica* the exopods of Th 1–7 have more than two segments and the A.I has seven segments, like *Paraeobathynella* n. g. (number 18 in Table II), whereas in the other four species assigned to *Eobathynella* (numbers 10 to 13 in Table II) the A.I has six segments and the exopods of all the thoracopods are always bisegmented. *Paraeobathynella* n. g. (number 19 in Table II) is a medium-sized species, but *E. mesasiatica* is a large species and both species have a lot of different characters (see Table II): number of teeth on *pars molaris*; number of teeth on distal endite of the Mx.I; epipodite of Th 3 present in *Paraeobathynella* n. g., absent in *Eobathynella*; number of setae in Th 1–7; ratio of exopod to endopod of the thoracopods; number of setae on the endopod of Th 8 male and size and shape of all the lobes; size and number of spines on the sympod and endopod of the uropod and number of setae on the exopod of the uropod and presence or absence of anal operculum.

In the new species the *pars molaris* of the Md is very well developed (with 11 teeth) as in *Allobathynella gigantea pluto* (number 7 in Table II), which is a very large species and very different from *P. vietnamensis* n. g. n. sp. in the rest of its characters.

*Paraeobathynella vietnamensis* n. g. n.sp has a unique combination of characters and the Th 8 female is completely different from the other asiatic species.

**Sketinella** n. g.
(Figures 8–13)

*Genus diagnosis*

Antennule (A.I) (Figure 9A) has eight segments, subterminal aesthetascs on the last segment. A.II has six segments. Md has a protruding *pars molaris*. Proximal endite of the Mx.I has four teeth and distal endite has seven teeth. Th 1–7 with more than two segments (three to five) on exopod; basipods of the thoracopods have only one seta; epipodites absent on Th 1 and 2. Th 8 male large, square; square endopod with two long plumose setae; the large exopod is on the distal face of the basipod, ending in a point with a small lateral tooth or tiny protuberance, curved and overhanging the basipod; distal end of inner lobe exceeding dentate lobe; outer lobe is not fused with basipod; rounded basipod with protuded distal end on the internal lateral edge; dentate lobe rounded and with strong teeth. The first pair of pleopods are a simple seta. Sympod of uropod has three distal spines which are longer than the rest; the endopod of the uropod has two strong distal spines and a kind of “claw” on the distal end; protuded anal operculum.
Table II. Character variability in the different Asian species of the Parabathynellidae family.

|       | 1   | 2   | 3   | 4   | 5   | 6*  | 7*  | 8*  | 9   | 10* | 11* | 12* | 13* | 14  | 15  | 16  | 17  | 18  | 19  | 20  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| A.I: no. segments | 7   | 7   | 7   | 7   | 7   | 6   | 8   | 8   | 7   | 6   | 6   | 6   | 6   | 6   | 6   | 7   | 7   | 7   | 7   | 8   |
| A.II: no. segments | 5   | 5   | 5   | 5   | 6   | 6   | 6   | 5   | 6   | 5   | 5   | 5   | 5   | 2   | 2   | 6   | 5   | 6   | 6   | 6   |
| Md    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| No. teeth |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| **Pars incisiva** |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| No. teeth | 4   | 5   | 4   | ?   | 4   | ?   | 6   | 3   | 5   | 3   | 4   | 4   | 4   | 3   | 3   | 5   | 4   | 6   | 5   | 6   |
| **Pars molaris** |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| No. teeth | 9   | 4   | 9   | ?   | 9   | ?   | 12  | 7   | 6   | 7   | 8   | 5   | 5   | 5   | 5   | 5   | 6   | 7   | 10  | 8   |
| Palp<sup>a</sup> |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| No. teeth | N   | E   | N   | ?   | N   | ?   | E   | ?   | N   | E   | E   | E   | E   | E   | E   | N   | E   | N   | E   | N   |
| Exopod: no. segments | 2   | 2   | 2   | 2   | 3   | 2   | 4   | 3   | 2   | 2   | 1   | 2   | 2   | 1   | 2   | 2   | 1   | 3   | 3   | 3   |
| Th 1 Epipod<sup>b</sup> | A   | A   | A   | A   | A   | P   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   |
| Exopod: no. segments | 2   | 2   | 2   | 2   | 3   | 2   | 4   | 3   | 2   | 2   | 1   | 2   | 2   | 1   | 2   | 2   | 1   | 3   | 3   | 3   |
| Th 2 Epipod<sup>b</sup> | A   | A   | A   | A   | A   | A   | P   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | P   | P   | P   | A   |
| Exopod: no. segments | 3   | 3   | 4   | 2   | 4   | 2   | 4   | 4   | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 3   | 2   | 4   |
| Th 3 Epipod<sup>b</sup> | P   | P   | A   | P   | P   | P   | P   | A   | A   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   |
| Exopod: no. segments | 4   | 3   | 4   | 2   | 4–5 | 2   | 5   | 4   | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 3   | 2   | 5   |
| Th 4–7 Epipod<sup>b</sup> | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   |
| Exopod: no. segments | 4–5 | 3   | 5   | 2   | 4–5 | 2   | 6   | 4–5 | 3–4 | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 3–4 | 2   | 5   |
| Th 8 male endopod: no. setae | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 1   | 1   | 1   | 1   | 1   | 2   | 2   | 2   | 1   | 2   | 2   | 2   |
| Th 8 female: no. setae | 0   | ?   | ?   | 1   | 1   | ?   | 4   | 0   | 0   | 0   | 0   | A   | 0   | 0   | 0   | 1   | 2   | 1   | –   |
| Pleopod: first pair<sup>c</sup> | 1-seg | 1-seg | 1-seg | 1-seg | 1-seg | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | A   | Seta |
| Uropod Sympod |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| No. spines | 6   | 14  | 12  | 6–7 | 11  | 15  | 18  | 15  | 10  | 7–8 | 8   | 5   | 7   | 9   | 13  | 10  | 6–7 | 9–10 | 7   | 12  |
| Type spines<sup>d</sup> | U   | U   | U   | U   | U   | U   | D   | U   | D   | U   | D   | D   | D   | D   | D   | D   | U   | U   | U   | D   |
| Exopod: no. setae | 5   | 3   | 5   | 3   | 6   | 3   | 6   | 5   | 3   | 3   | 2   | 3   | 4   | 3   | 2   | 2   | 4   | 4   | 4   | 6   |

<sup>a</sup>Palp

<sup>b</sup>Epipod

<sup>c</sup>Pleopod: first pair

<sup>d</sup>Type spines
Table II. (Continued.)

|   | 1 | 2 | 3 | 4 | 5 | 6* | 7* | 8* | 9 | 10* | 11* | 12* | 13* | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|----|----|----|---|-----|-----|-----|-----|----|----|----|----|----|----|----|
| **Endopod** |   |   |   |   |   |   |   |   |   |     |     |     |     |   |   |   |   |   |   |   |
| No. spines | 5 | 2 | 6 | 0 | 5 | 2 | 2 | 2 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 1 | 2 | 1 | 2 | 2 |
| No. setae | 4 | 2 | 5 | 3 | 5 | 4 | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 4 |
| **Furca: no. spines** | 5 | 5 | 6 | 3 | 5 | 6 | 6 | 6 | 5 | 3 | 3 | 4 | 3 | 6 | 9 | 4 | 5 | 4 | 3 | 5 | 7 |
| **Anal operculum** |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Np | Pr/S | Np | Pr/L | Pr/S | Pr/L | Np | Pr/S | Pr/M | Np? | Pr/S | Pr/S | Pr/S | Pr/S | Pr/S | Np | Pr/M | Pr/M |     |     |     |     |
| **Maximum size (mm)** | 2.2 | 2.0 | 2.0 | 1.4 | 1.7 | 2.2 | 3.2 | 2.3 | 2.3 | 1.2 | 1.5 | 1.0 | 1.3 | 1.3 | 2.0 | 1.5 | 2.1 | 1.6 | 1.9 |     |     |     |
| **Habitat** | W | W | W | W | C/W | W | W | W | C | W/R | W | W | R | W | C | R | C |     |     |     |     |     |

Species: 1, *Allobathynella japonica* Morimoto and Miura, 1957 (Japan); 2, *Allobathynella kuma* (Ueno, 1956) (Japan); 3, *Allobathynella mirabilis* Ueno, 1961 (Japan); 4, *Allobathynella yaye* (Ueno, 1956) (Japan); 5, *Allobathynella coreana* Morimoto, 1970 (South Korea); 6, *Allobathynella carinata* (Ueno, 1952) (Japan); 7, *Allobathynella gigantea pluto* (Morimoto, 1963) (Japan); 8, *Allobathynella gigantea* (Morimoto, 1959) (Japan); 9, *E. mesasiatica* (Birstein and Ljovuschkin, 1964) (Central Asia); 10, *E. gracillima* (Ueno, 1956) (Japan); 11, *E. gracillima matuta* (Morimoto, 1970) (South Korea); 12, *E. minima* (Jankowskaja, 1972) (Central Asia); 13, *E. gracillima insularis* (Morimoto, 1959) (Japan); 14, *Nipponbathynella miurai* (Ueno, 1952) (Japan); 15, *Nipponbathynella uozumi* Morimoto, 2002 (Japan); 16, *Issykkulibathynella tianschanica* (Jankowskaja, 1964) (Central Asia); 17, *Batubathynella malaya* (Sars, 1929) (Malaysia); 18, *Sabahbathynella voongi* Schminke, 1988 (Borneo); 19, *Paraeobathynella vietnamensis* n. sp. (Vietnam); 20, *Sketinella trontelji* n. sp. (Vietnam). *Genus uncertain. *A, mandibular palp exceeds distal end; N, mandibular palp does not exceed distal end. bA, absent; P, present. 1-seg, 1-segmented; A, absent. dD, different; U, uniform in size. Pr, pronounced; Np, not pronounced; S, small in size; M, medium-sized; L, large in size. W, wells; C, caves; R, interstitial river banks.
Type species. *Sketinella trontelji* n. sp.

*Sketinella trontelji* n. sp.
(Figures 8–13)

**Material examined**

_Type locality._ Cave with no name, Rom Island, Vinh Ha Long, E part (16 June 2003, three males and three juveniles collected). The details of the new description are based on adult specimens (three males). The holotype is a male and the type series contains two specimens (paratypes) (MNCN 20.04/5911).

**Description**

_Body._ Total length of holotype male 1.70 mm (species range: \( n=2: 1.80–1.94 \) mm). Body elongated, segments progressively widening towards posterior end of body. Length of head greater than width (Figure 8). All drawings are of the holotype (male).

_Antennule (Figure 9A)._ Antennule has eight segments; no sexual dimorphism; length of first four segments slightly longer than that of last four; setation as in Figure 1A (segments 6–8 have three aesthetascs, on the last segment aesthetascs are subterminal).
Figure 9. *Sketinella tronteli* n. g. n. sp., male holotype. (A) Antennule (dorsal view); (B) antenna (dorsal view); (C) labrum; (D) mandible; (E) maxillule; (F) maxilla. Scale bar in mm.
Figure 10. *Sketinella trontelji* n. g. n. sp., male holotype. (A) Thoracopod 1; (B) thoracopod 2; (C) thoracopod 3; (D) thoracopod 8 male (lateral internal view); (E) thoracopod 8 male (latero-caudal view). Scale bars in mm.
Antenna (Figure 9B). Six-segmented, last three segments are longer than the three first segments; last segment has three smooth and one plumose terminal setae; segments 1 and 4 have no setae; setation in other segments as in Figure 6B.

Labrum (Figure 9C). Concave, with eight main teeth, and two lateral teeth at either end.

Mandible (Figure 9D). Pars incisiva has six well-developed teeth; pars molaris has eight teeth, five of which are strong and distal with small spines, the remaining three being small joined and proximal with a large number of fine setae; mandibular palp does not exceed pars incisiva in length.
Maxillule (Figure 9E). Proximal endite has four claws (with spines of different sizes); distal endite has seven claws, two smooth and apical, the other five with strong spines; and with three subterminal smooth setae on outer distal margin.

Maxilla (Figure 9F). Four-segmented, with three setae on basal segment, two of which are distal; segment 2 with two long setae and one shorter one at distal end; segment 3 elongated with 11 setae, the last segment having a strong terminal seta and four lateral setae.

Thoracopods 1–7 (Figures 10A–C, 11, 12). Well developed, length gradually increasing from 1 to 5, last three similar in size; well-developed epipodite on 3–7, measuring half length of basipod; basipod has one barbed lateral terminal seta on Th 1–7; exopods of Th 1 and 2 shorter than the endopods; exopod of Th 3 and 4 longer than the endopod, and exopods of
Figure 13. Sketinella trontelji n. g. n. sp., male holotype. (A) First pleopod (latero-ventral view); (B) pleotelson and furca (dorsal view); (C) uropod (latero-external view). Scale bar in mm.
Th 5–7 similar in length to the endopods. Thoracopod 1 (Figure 10A): two lateral smooth terminal setae on basipod; exopod three-segmented, with three barbed setae on the first segment and two barbed setae on the other two segments and one group of ctenidia at the base of the setae; endopod four-segmented: first segment with three barbed dorsal setae and one plumose seta, second with four barbed dorsal setae and one plumose seta, third with three barbed dorsal setae and one small, smooth, terminal seta, terminal segment with two claws of similar length and one smooth seta. Thoracopod 2 (Figure 10B): exopod four-segmented, with three barbed setae on first segment and two barbed setae on the rest of the segments, and with one group of ctenidia at the base of the setae; endopod four-segmented, first segment short and with two barbed setae and one plumose seta; second with four groups of lateral ctenidia and three barbed dorsal setae and one plumose seta; third with three barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong claws of similar length. Thoracopod 3 (Figure 10C): exopod five-segmented, with three barbed setae on the first segment and two barbed setae on each one of the other segments and with one group of ctenidia at the base of the setae; endopod four-segmented, first segment short with one barbed and one plumose seta; second with three groups of lateral ctenidia and three barbed dorsal setae and one plumose seta; third with two barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong claws of different length. Thoracopods 4–7 (Figures 11A, B, 12A, B): exopod five-segmented, with two barbed setae on each segment and with one group of ctenidia at the base of setae; endopod four-segmented, first segment short with one barbed and one plumose seta; second with groups of lateral ctenidia and three barbed dorsal setae and one plumose seta; third with two barbed dorsal setae and one tiny terminal seta; and fourth with one smooth seta and two strong claws of different length. Thoracopod 8 male (Figure 10D, E): large, massive and square; basal region massive; inner lobe almost trapezoidal; basipod with protuded distal end on the internal lateral edge; endopod, well developed with two long plumose setae; very large exopod, terminal end sharply pointed and with one small “tooth”; outer lobe is not fused with basipod and is tongue-like in shape and does not exceed the distal end of basipod; dentate lobe with strong teeth.

Pleopod (Figure 13A). Pleopod present, as a single long seta, on the first segment of the pleon.

Dorsal margin of pleotelson (Figure 13B). Dorsal margin of pleotelson pronounced, but not very pronounced, anal operculum; one ventral barbed seta.

Uropod (Figure 13C). Sympod longer than endopod and four times longer than wide; has 12 barbed spines, the three terminal ones longer than the rest; endopod shorter than exopod with two strong, barbed spines and one claw (Figure 13C) on the distal end and two plumose setae on the external face, of these the most distal exceeds the distal end of the endopod, the basal one being small, and two barbed terminal setae have five groups of ctenidia on dorsal face; exopod has two terminal barbed setae, the outer longer than the inner, and five barbed setae on external face.

Furca (Figure 13B). Furca has seven barbed spines (the two terminal ones being longer and thicker); and two dorsal barbed setae which are similar in size.
Etymology

The new genus is named after Prof. Boris Sket and consists of the surname Sket, plus “i”, followed by the last five letters of the name of the first genus described, Bathynella, and the species is named after Peter Trontelj, with thanks for their providing me with the material.

Remarks

The combination of characters in Sketinella n. g. is unique (see Table I). Its exclusive characters are: the pleopods (it only has the first pair) are reduced to a single seta (in the asiatic species which have pleopods these consist of a segment and two long setae); the basipod, the outer lobe and the exopod of the Th 8 male are different to that found in the other known asiatic species.

Skeetinella n. g. presents some characters which are similar to Allobathynella (see Table I). According to Schminke (1973) and Serban (1994), the generic diagnosis of Allobathynella is not sufficiently detailed to assign any species to it and it is possible that the genus may include species that belong to two or three different genera. The only five species (1–5 in Table II) that belong to Allobathynella (A.I with seven segments; four or five of teeth on pars incisiva, and four or nine teeth on pars molaris of the Md; exopod of the Th 8 male on latero-external face of the basipod; pleopods one-segmented and with two long setae; etc.) are very different from Sketinella trontelji n. sp. (number 20 in Table II).

Sketinella trontelji n. sp. has a unique combination of characters. This species is nearest to Allobathynella gigantea pluto in the number of segments that make up the A.I and A.II, the number of teeth on the Md and the type of uropod. But the new species (medium-sized and cave dwelling) is different from Allobathynella gigantea pluto (large and an inhabitant of wells) in that it has: seven teeth on the distal endite of the Mx.I; protruded anal operculum; epipod present on the Th 3; a simplified first pair of pleopods; different number of segments in the exopod of Th 1–3 and the exopod and endopod of different proportions; more spines on the furca in spite of it being smaller in size, and a male Th 8 which is square and in which the basipod, the outer lobe and the exopod (with a lateral “tooth”) are exclusive in shape. The internal side of the basipod of the Th 8 male (which has protruded distal end) is similar in the two new genera, but the external side is different in both genera (bigger in Sketinella); the exopod is similar in both new genera in shape, but is smaller and less curved in Sketinella than in Paraeobathynella, and the lateral tooth does not exist in Paraeobathynella.

Discussion and conclusion

Table I shows the variability that exists in different characters in the diagnoses of the six asiatic genera accepted to date and the two new genera proposed in this paper. It is obvious that Allobathynella and Eobathynella ought to be studied and diagnosed again.

According to Serban (1994), the generic diagnosis of Allobathynella is insufficient: the Th 8 male is not described and some characters show great variability (e.g. A.I with six to eight segments; A.II with five or six segments; pleopod present or absent; exopod of the Th 1–7 with two to seven segments; etc.). In all probability only five species (1–5 in Table II) belong to Allobathynella, species 6–8 in Table II (with asterisk) almost certainly belong to one or two different genera.

Within Eobathynella only the type species, E. mesasiatica (number 9 in Table II), may in reality belong to this genus, the other four species (10–13 in Table II, with asterisk) surely
belong to one or two different genera because they are very different from *E. mesasiatica* (see Table II). 

*Nipponbathynella*, *Sabahbathynela*, and *Issykkulibathynella* are well described, and new species can easily be assigned to these genera. However, the diagnosis of *Batubathynella* is not complete and the Th 8 male is not described in enough detail.

In conclusion, the creation of the two new genera, *Paraeobathynella* and *Skeninella*, are justified by the absence of:

- usable diagnoses of *Eobathynella* and *Allobathynella*;
- a single set of taxonomic criteria for the Asian parabathynelids on which every specialist agrees (the taxonomic status of most of the known taxa is uncertain);
- a thorough study of the Th 8 male of almost all the asiatic species in the *Parabathynellidae* family.

The distribution to date of the 20 asiatic species in the family *Parabathynellidae* now covers Japan, South Korea, Central Asia, Malaysia, Borneo and, including the two new species described here, Vietnam, where *Bathynellacea* has been found for the first time.

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**Appendix. Systematic account of the asiatic taxa in the Parabathynellidae family**

**Allobathynella** Morimoto and Miura, 1957

Syn.: *Parabathynella* Chappuis, 1926 *partim

*P. (Eobathynella)* Birstein and Ljovuschkin, 1964 *partim

*Allobathynella carinata* (Ueno, 1952). Japan.

Syn.: *Parabathynella carinata* Ueno, 1952.

*P. (Eobathynella) carinata* (Ueno, 1952).

*Allobathynella kuma* (Ueno, 1956). Japan.

Syn.: *P. kuma* Ueno, 1956.

*P. (Eobathynella) kuma* Ueno, 1956.

*Allobathynella yaye* (Ueno, 1956). Japan.

Syn.: *P. gracilima yaye* Ueno, 1956.

*Allobathynella gigantea* (Morimoto, 1959). Japan.

Syn.: *P. gigantea* Morimoto, 1959.

*P. (Eobathynella) gigantea* Morimoto, 1959.

*Allobathynella mirabilis* Ueno, 1961. Japan.

*Allobathynella gigantea pluto* (Morimoto, 1963). Japan.

Syn.: *P. gigantea pluto* Morimoto, 1963.

*Allobathynella coreana* Morimoto, 1970. South Korea.

*Allobathynella japonica* Morimoto and Miura, 1957. Japan. Type species.

**Eobathynella** Birstein and Ljovuschkin, 1964

Syn.: *Parabathynella* Chappuis, 1926 *partim

*Allobathynella* Morimoto and Miura, 1957 (*sensu* Noodt) *partim

*E. mesasiatica* (Birstein and Ljovuschkin, 1964). Type species. Central Asia.

Syn.: *P. (Eobathynella) mesasiatica* Birstein and Ljovuschkin, 1964.

*E. minima* (Jankowskaja, 1972). Central Asia.

Syn.: *P. (Eobathynella) minima* Jankowskaja, 1972.

*E. gracillima* (Ueno, 1956). Japan.

Syn.: *P. gracillima* Ueno, 1956.

*P. (Eobathynella) gracillima* Ueno, 1956.
*E. gracillima insularis* (Morimoto, 1959).
Syn.: *P. gracillima insularis* Morimoto, 1959.

*E. matuta* (Morimoto, 1970). South Korea.
Syn.: *P. gracillima matuta* Morimoto, 1970.

**Issykkulibathynella** Serban, 1994
Syn.: *Parabathynella* Chappuis, 1926 *partim*
*P. (Eobathynella) Birstein and Ljovuschkin, 1964 *partim*
*Eobathynella* Birstein and Ljovuschkin, 1968 *partim*

*I. tianschanica* (Jankowskaja, 1964). Central Asia.
Syn.: *P. tianschanica* Jankowskaja, 1964.
*E. tianschanica* (Jankowskaja, 1964).

**Nipponbathynella** Schminke, 1973
Syn.: *Parabathynella* Chappuis, 1926 *partim*
*Nipponbathynella* miurai (Ueno, 1952).
Syn.: *P. miurai* Ueno, 1952.
*Nipponbathynella* uozumii Morimoto, 2002. Japan.

**Batubathynella** Schminke, 1973
Syn.: *Parabathynella* Chappuis, 1926 *partim*
*Allobathynella* Morimoto and Miura, 1957 (sensu Noodt) *partim*
*Eobathynella* Birstein and Ljovuschkin, 1968 *partim*

*Batubathynella* malaya (Sars, 1929). Malaysia.
Syn.: *P. malaya* Sars, 1929.
*P. (Eobathynella) malaya* Sars, 1929.

**Sabahbathynella** Schminke, 1988
*Sabahbathynella* wongi Schminke, 1988. Borneo.

**Paraeobathynella** n. g.
*Paraeobathynella* vietnamensis n. sp. Vietnam.

**Skeitinella** n. g.
*Skeitinella* trontelji n. sp. Vietnam.