

Two new sympatric species of the family Bathynellidae from North America (Crustacea, Syncarida, Bathynellacea)

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ABSTRACT

Two new coexisting species of the genus *Bathynella* of the Bathynellidae is described from North America. *B. germanitas* n. sp. is easily recognized by the basidorsal existence of cylindrical protrusion with a seta on endopod of uropod, whereas *B. fraterna* n. sp. is characterized by the setal nature of exopod of thoracopods II-VII.

Key words: new species, sympatric occurrence, Bathynellidae, North America

INTRODUCTION

Bathynellids are minute Syncarida living almost exclusively in continental groundwater. Since the first discovery from Europe (*Bathynella natans* Vejdovsky, 1882), about 70 species in 14 genera are hitherto described from nearly all continents (Schminke, 1986), but only two species were recorded from North America (Schminke and Noodt, 1988).

This paper represents two new species from North America. These species were found from a same sample, i.e. they would coexist in the same habitat. As surveyed by Schminke (1973), the sympatric occurrence of two bathynellid species is a rare phenomenon. Only three cases are so far known: *Baicalobathynella magna* and *B. baicalensis* from the Baical Sea, *B. natans* and *Antrobathynella stammeri* from Germany, and *B. tsushimana* and *B. canalis* from the Island Tsushima. As in these three cases, both new species differ from each other in numerous character, and should be, as in two former cases, classified into different genera. However, the exact classification of both species is hampered by the incomplete description of earlier records. Therefore, both new species are temporarily described in the heterogenous genus *Bathynella*.

DESCRIPTION

***Bathynella germanitas* n. sp. (Figs. 1-3)**

Type specimens. Numerous ♀♀ and ♂♂ from San Clemente Canyon Park, La Jolla, San Diego, California, USA. 2 km from coast, about 80 m above the sea level, typical canyon of the region, shadowed cite on drained stream bed, pit 60 cm deep, temp. 19 °C. 14. August 1973, leg. Noodt. Holotype (♀), allotype (♂) and paratypes (5 ♀♀ and 5 ♂♂) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Remaining paratypes are kept in the collection of the author.

Female. Body 0.92 mm long, 12 times as long as wide.

Antennule (Fig. 1A) 7-segmented. First segment with 2 setae on inner margin, with each 1 smooth and pulmose setae on dorsal surface, and with 4 lateral pulmose setae. Second segment with 1 setae on inner distal margin, and with group of 4 pulmose setae. Third segment with 1 seta on inner distal margin, with 2 setae on outer margin, and with 2 ventral setae. Peduncle on third segment with 3 setae. Fourth segment with 1 dorsal stub seta, 1 ventral seta and 1 group of 3 pulmose setae. Fifth segment with 3 setae. Sixth segment with 3 smooth setae on inner margin, with 1 smooth seta and 2 aesthetasc on dorsal margin, and with each 1 aesthetasc and smooth setae on outer margin. Seventh segment with 4 terminal seta and 3 ubterminal aesthetascs. Antenna (Fig. 1B) 7-segmented, as long as antennule, setal formula: 0/1+exp/2+0/1+0/0+0/2+1/5; exopod with 1 simple seta and 1 bare seta being bifurcated.

Labrum smooth. Mandible (Figs. 1C, 1D) 4-segmented. First segment with cutting edge. Second segment 30% as long as first segment, without seta. Third segment as long as first segment, without seta. 4th segment small, with 2 terminal claws. Cutting edge (Fig. 1D) with incisor process of 2 teeth and molar process consisting of 1 triangular tooth, 1 spine, 1 group of 4 teeth, 1 group of 5 teeth and 1 wide tooth toward proximally.

Maxillule (Fig. 1E) 2-segmented. Proximal segment with 4 spines, distal segment with 4 spines and 2 setae on inner margin and 3 setae on outer margin. Maxilla (Fig. 1F) 4-segmented; setal formula: 7, 4, 7, 5.

Thoracopods I-VII (Figs. 1G-H, 2A-E) represented by biramous leg. Thoracopod I (Fig. 1G) without epipodite; coxa with 1 pinnated seta on inner distal margin; inner margin of basipodite with 3 setae; outer margin of basipodite pinnated with long hairs. Thoracopods II-VII each with 1 epipodite, respectively; inner margin of basipodite with 1 seta. Exopods of thoracopods I-VII 1-segmented, with 2 terminal setae, and each 1 seta on ventral and dorsal margin. All exopodial setae of thoracopods I-II pinnated with long hair, those of thoracopods III-VII spiculated. Endopods of thoracopods I-VII 4-segmented, with setal formulae:

Thoracopod I	3+0/2+1/2+1/3
Thoracopod II	2+0/1+1/1+0/3
Thoracopod III	1+0/1+1/1+0/3
Thoracopod IV	1+0/1+1/0+0/3
Thoracopod V	1+0/0+1/0+0/2
Thoracopods VI-VII	0+0/0+1/0+0/1(1)

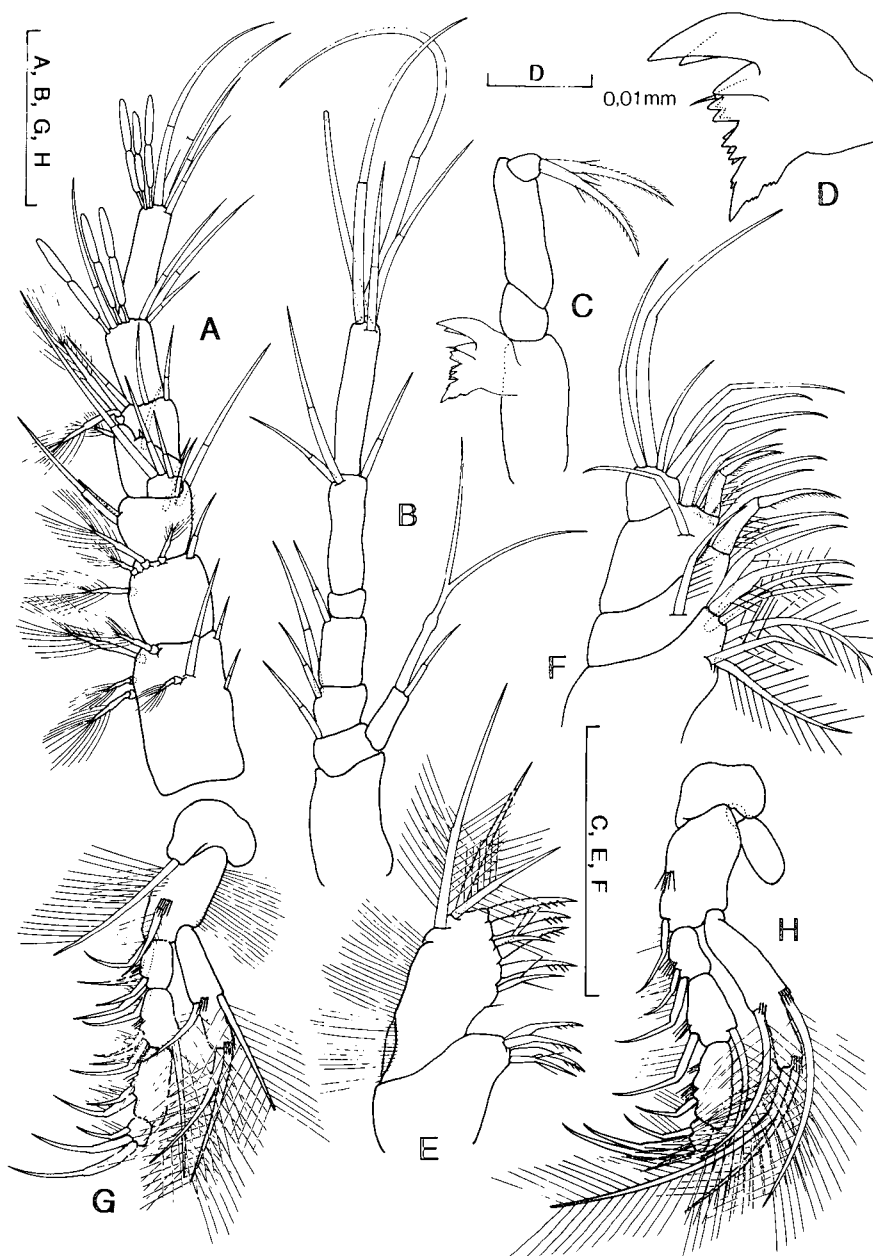


Fig. 1. *Bathynella germanitas* n. sp. A. Left antennule (dorsal); B. Right antenna (dorsal); C. Right mandible (dorsal); D. Cutting edge of mandible; E. Left maxillule (dorsal); F. Left maxilla (dorsal); G. Left thoracopod I (frontal); H. Left thoracopod II (frontal). Scale = 0.05 mm (except for D).

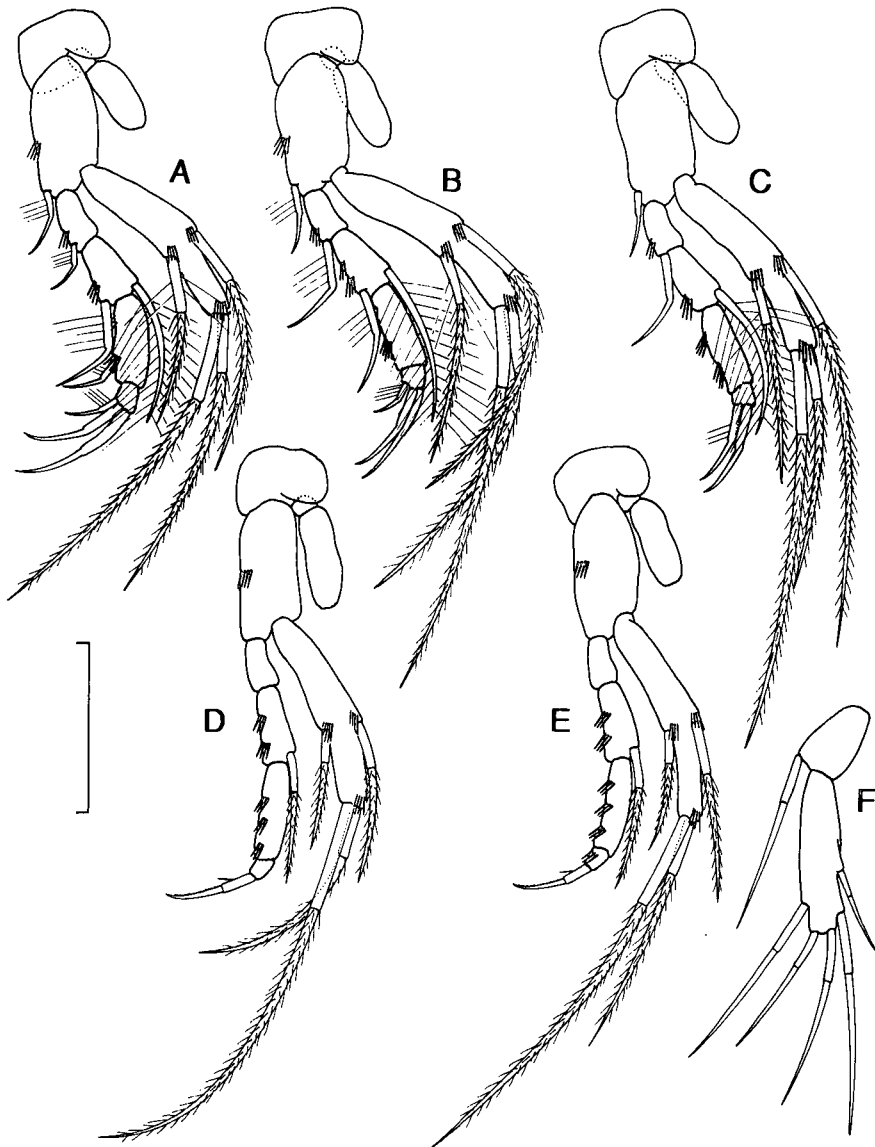


Fig. 2. *Bathynella germanitas* n. sp. A. Left thoracopod III (frontal); B. Left thoracopod IV (frontal); C. Left thoracopod V (frontal); D. Left thoracopod VI (frontal); E. Left thoracopod VII (frontal); F. Left pleopod I (frontal). Scale = 0.05 mm.

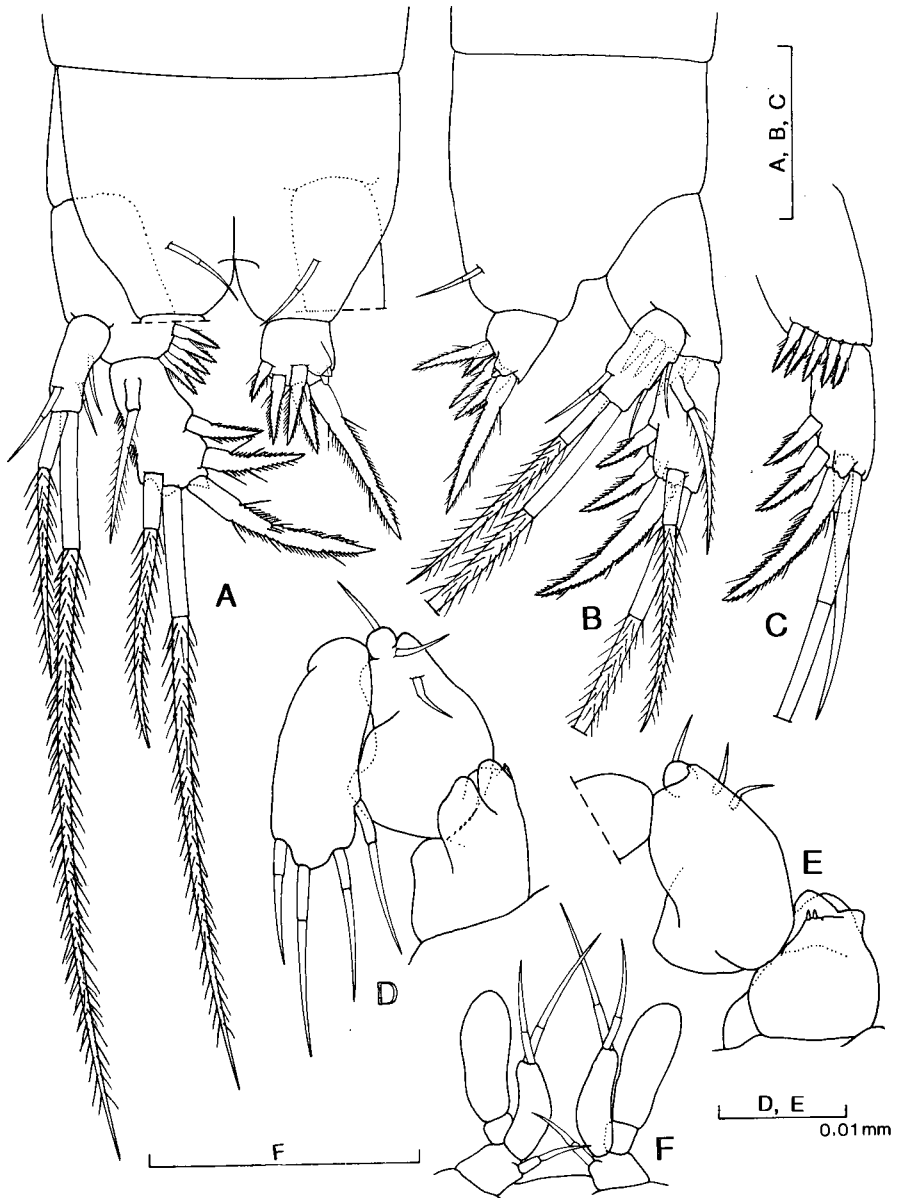


Fig. 3. *Bathynella germanitas* n. sp. A. Pleotelson, right furca and left uropod (dorsal); B. Dito (lateral); C. Endopod of left uropod (outer lateral). D. Left male thoracopod VIII (frontal); E. Dito (inner lateral); F. Right and left female thoracopod VIII (frontal). Scale = 0.05 mm (except for D and E).

Dorsal seta on second endopodial segment of thoracopods I-V pinnated with long hairs.

Thoracopod VIII (Fig. 3F) with coxa bearing 1 large epipodite and 1 seta on inner distal margin; basipodite and endopod reduced; exopod with 2 setae. Pleopod I (Fig. 2F) 2-segmented; first segment with 1 long seta; second segment with 5 setae.

Uropod (Figs. 3A-3C) with 5 spines in oblique row on inner distal margin of sympodite being 1.5 times as long as wide. Endopod a little shorter than sympodite, with 1 cylindrical dorsal protrusion bearing 1 seta at base, with 3 spines on inner margin, with 2 rows of spicules on outer margin, and with 2 terminal setae. Exopod shorter than endopod, with 2 terminal setae being strong and spiculated, and with 3 lateral setae.

Pleotelson with a pair of simple dorsal setae. Furcal rami as long as wide, with 5 spine; inner spine small, outer terminal spine 2.5 times as long as 3 other spines of equal size, furcal organ located dorsolaterally.

Male. Body length somewhat shorter than female. Penial region of thoracopod VIII (Fig. 3D, 3E) small, 3-lobed distally, inner lobe with 2 terminal teeth. Basipodite bulged laterally, with 2 setae on inner margin. Endopod fused with basipodite, with 1 terminal seta. Exopod with 4 setae. In all other characters male does not differ from female.

Remarks. The basidorsal existence of cylindrical protrusion with a seta on endopod of uropod, the most important distinctive character of *Bathynella germanitas* n. sp., is unknown in all other species of the Bathynellidae so far described. This character seems to be correlated with the size of dorsal setae on pleotelson, because in all known bathynellids the pleotelsonal appendages are always represented by stout and strong pinnated setae (cf. Figs. 5G, 6E, 6F).

The laterally bulged basipodite of the male thoracopod VIII is, the other unique character of *B. germanitas*, is present also in three species of the genus *Nannobathynella* Noodt, 1969, *N. marcusii* Noodt, 1969, *N. africana* Schminke and Wells, 1974 and *N. eburnea* Schminke, 1979. Accepting the view of Serban (1973) that the morphology of the male thoracopod VIII is the only criterion for the generic classification of the family Bathynellidae, *B. germanitas* seems to be classified into *Nannobathynella*. However, *B. germanitas* does not bear two unique characters of this genus. They are, according to Schminke (1979), the existence of 2 setae on the outer margin of distal segment of maxillule and the 3-segmented endopod of thoracopods I-VII. The similarity in the male thoracopod VIII may link *B. germanitas* to *Nannobathynella*. With respect to the bifurcated seta on exopod of antenna being bare, the exopodial structure and reduced endopod of female thoracopod VIII, setation on pleopod, the feature of spines on furcal rami, and the ornamentation on endopod of uropod with spines and setae, *B. germanitas* seems to be closely related to the South American species of the genus, *N. marcusii*.

Etymology. Alluding to sympatric existence with *Bathynella fraterna* n. sp. The Latin *germanitas* means brotherhood.

***Bathynella fraterna* n. sp. (Figs. 4-6)**

Type specimens. Numerous ♀♀ and ♂♂ from San Clemente Canyon Park, La Jolla, San Diego, California, USA. 2 km from coast, about 80 m above the sea level, typical canyon of the region, shadowed cite on drained stream bed, pit 60 cm deep, temp. 19 °C. 14. August 1973, leg.

Noodt. Holotype (♀), allotype (♂) and paratypes (5 ♀♀ and 5 ♂♂) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Remaining paratypes are kept in the collection of the author.

Female. Body 0.85 mm long, 11 times as long as wide.

Antennule (Fig. 4A) 7-segmented, First segment with 2 setae on inner margin, with each 1 smooth and pulvose setae on dorsal surface, and with 2 lateral pulvose setae. Second segment with 1 setae on inner distal margin, and with group of 4 pulvose setae. Third segment with 1 seta on inner distal margin, with 2 setae on dorsal surface, and with 2 ventral setae. Peduncle on third segment with 3 setae. Fourth segment with 1 dorsal stub seta, 1 ventral seta and 1 group of 3 pulvose setae. Fifth segment with 3 setae. Sixth segment with 3 smooth setae on inner margin, with 1 smooth seta and 1 aesthetasc on dorsal margin, and with each 1 aesthetasc and smooth setae on outer margin. Seventh segment with 4 terminal seta and 3 subterminal aesthetascs. Antenna (Fig. 4B) 7-segmented, 20 % shorter than antennule, 7-segmented, setal formula: 0/2+exp/2+0/1+0/0+0/2+1/4; exopod with 1 simple seta and 1 bifurcated seta being pinnated with long hairs.

Labrum smooth. Mandible (Fig. 4C, 4D) 4-segmented. First segment with cutting edge. Second segment 30% length of first segment, without seta. Third segment as long as first segment, without seta. Fourth segment small, with 2 terminal claws. Cutting edge with incisor process of 2 teeth and molar process consisting of 1 triangular tooth, seta, small tooth, group of 4 teeth and group of 5 teeth toward proximally.

Maxillule (Fig. 4E) 2-segmented. Proximal segment with 4 spines, distal segment with 4 spines and 2 setae on inner margin and 3 setae on outer margin. Maxilla (Fig. 3F) 4-segmented; setal formula: 7, 4, 7, 5.

Thoracopods I-VII (Figs. 4F, 4G, 5A-5F, 6A, 6B) represented by biramous leg. Thoracopod I without epipodite; coxa with 1 pinnated seta on inner distal margin; inner margin of basipodite with 3 setae; outer margin of basipodite pinnated with long hairs; inner margin of basipodite with 1 seta. Thoracopod I (Fig. 4G) without epipodite. Thoracopods III-VII each with 1 epipodite, respectively; inner margin of basipodite with 1 seta. Exopods of thoracopods I-VII 1-segmented. Outer terminal seta on exopod of thoracopods II-VII longer than inner one. Exopodial setae of thoracopod I pinnated with long hair, those of thoracopods II-VII spiculated. Endopods of thoracopods I-VII 4-segmented, with setal formulae:

Thoracopod I	3+0/1+1/2+0/3
Thoracopod II-III	1+0/1+1/1+0/3
Thoracopod IV	1+0/0+1/0+0/3
Thoracopod V	0+0/0+1/0+0/3
Thoracopod VI-VII	0+0/0+1/0+0/2

In a female specimen, exopods of thoracopods IV-VI (Figs. 5C, 5E, 6A) and endopod of thoracopod VI (Fig. 5E) are malformed.

Thoracopod VIII (Fig. 4H) with coxa bearing 1 epipodite and 1 tiny seta on inner subterminal margin; basipodite as long as epipodite; endopod small, with 2 setae; exopod as long as basipodite, bearing 2 setae. Pleopod I (Fig. 4I) 2-segmented, with 1 long seta on first segment,

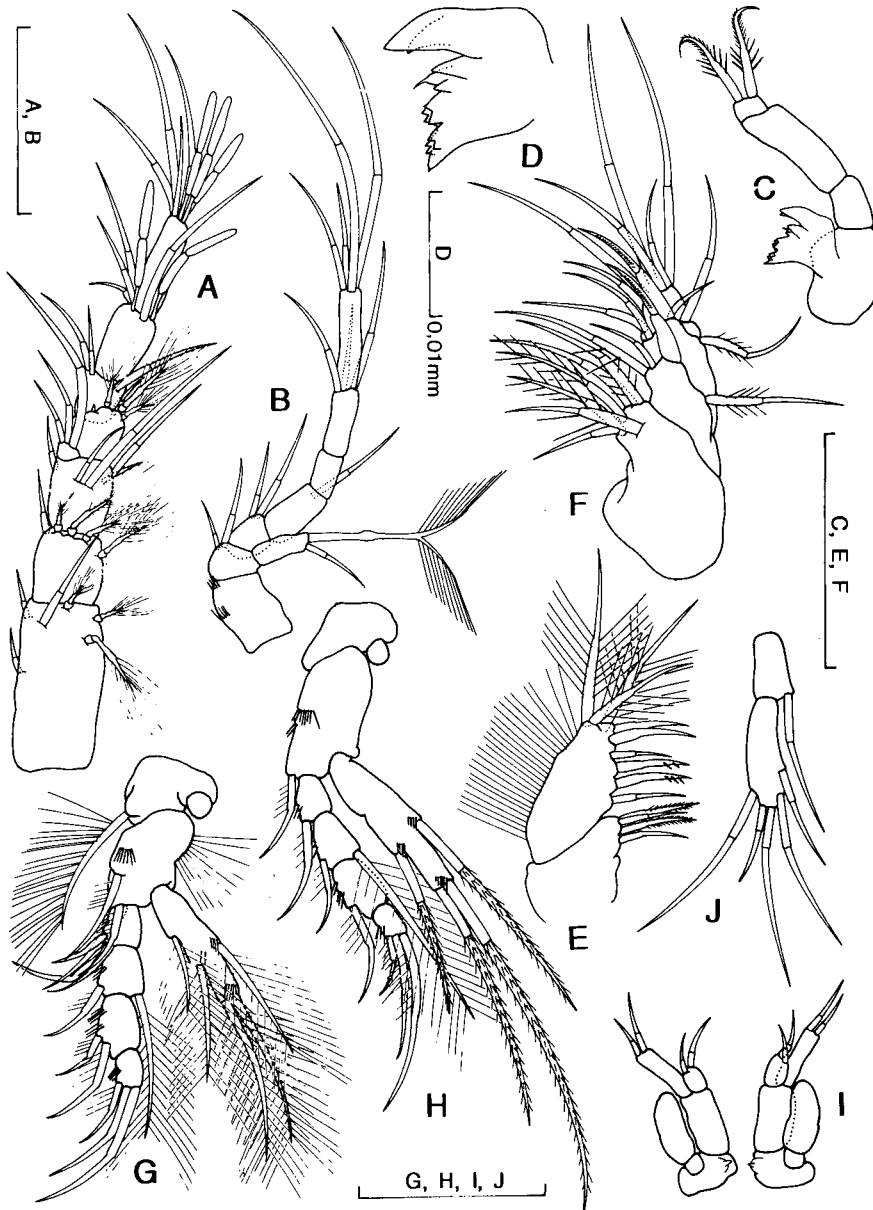


Fig. 4. *Bathynella fraterna* n. sp. A. Right antennule (dorsal); B. Right antenna (dorsal); C. Right mandible (dorsal); D. Cutting edge of mandible; E. Left maxillule (dorsal); F. Left maxilla (dorsal); G. Left thoracopod I (frontal); H. Left thoracopod II (frontal). I. Right and left female thoracopod VIII (frontal). J. Right pleopod I (frontal) Scale = 0.05 mm (except for D).

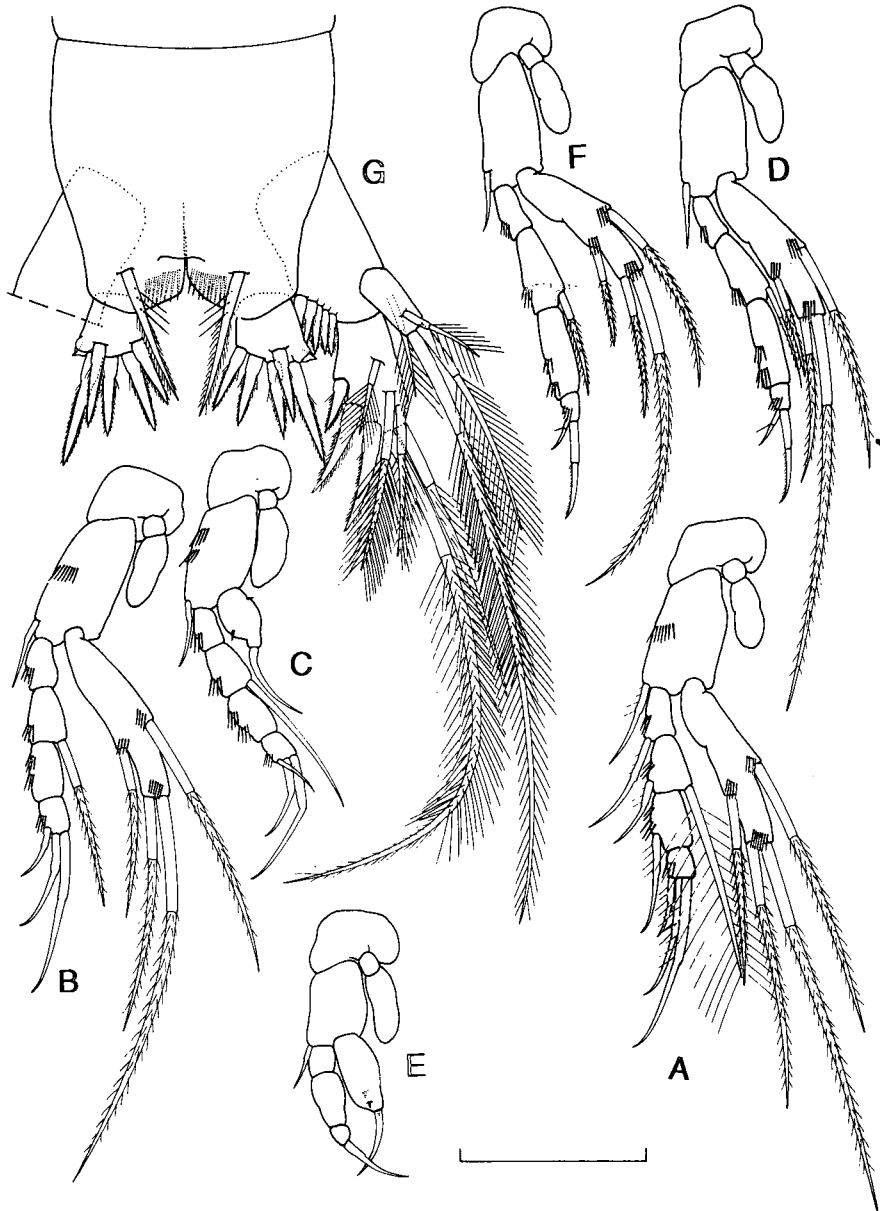


Fig. 5. *Bathynella fraterna* n. sp. A. Left thoracopod III (frontal); B. Left thoracopod V; C. Malformed thoracopod V; D. Left thoracopod VI; E. Malformed thoracopod VI; F. Left thoracopod VII (frontal); G. Pleotelson, right furca and left uropod (dorsal). Scale = 0.05 mm.

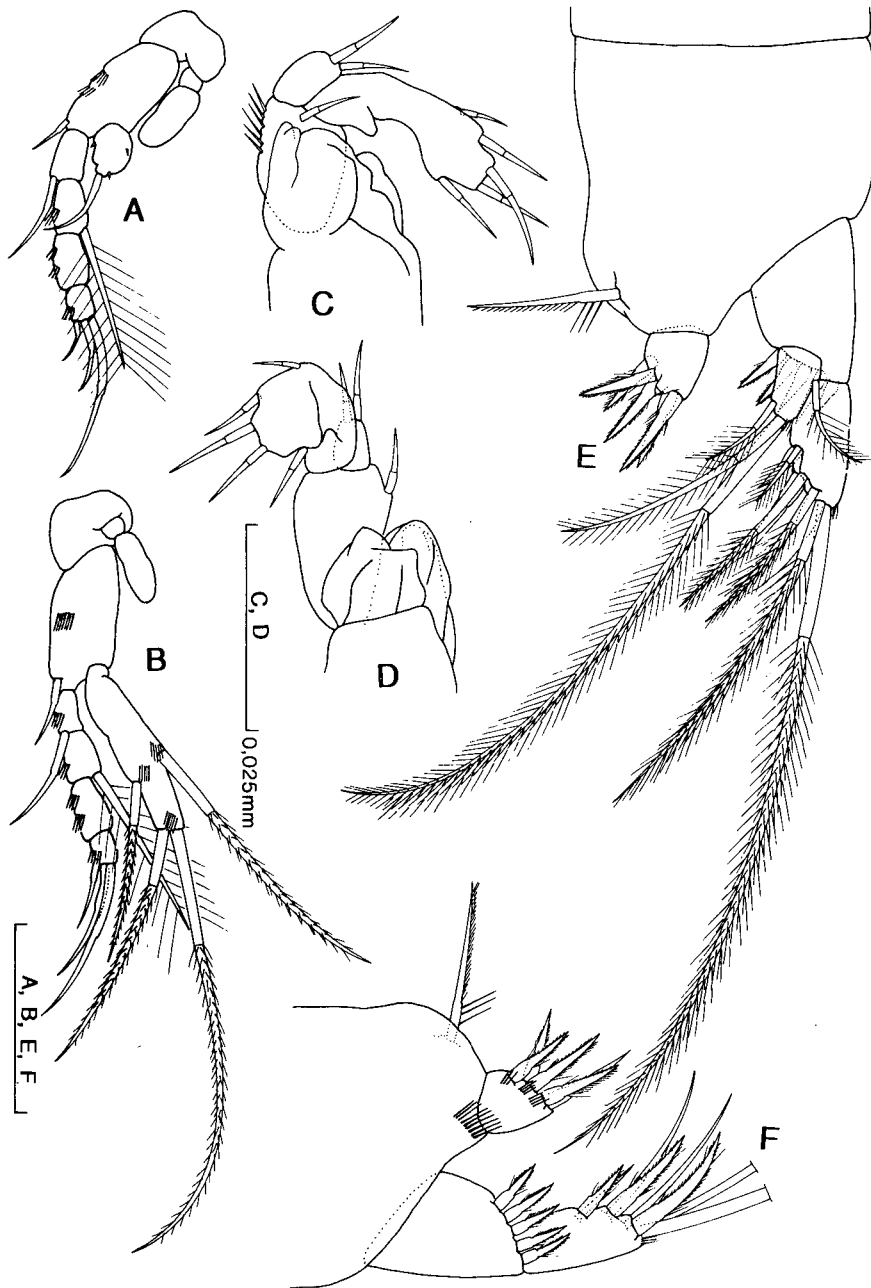


Fig. 6. *Bathynella fraterna* n. sp. A. Left thoracopod IV (frontal); B. Malformed thoracopod IV; C. Right male thoracopod VIII (lateral); D. Ditto (frontal); E. Pleotelson, furca and uropod (dorsal); F. Ditto (inner lateral). Scale = 0.05 mm (except for C and D).

and with 5 setae on second segment.

Uropod (Figs. 5G, 6E, 6F) with 5 spines in oblique row on inner distal margin of sympodite. Sympodite 1.5 times as long as wide. Endopod 70% as long as sympodite, with 3 spines on inner margin, and with 2 terminal setae and 3 dorsal setae. Exopod 40 % of the length of endopod, with 2 terminal setae, 1 dorsal and 1 ventral setae. All setae on uropod pinnated stoutly.

Pleotelson with 1 pair of stout dorsal setae, and 1 row of tiny spines on ventral surface. Furcal rami as long as wide, with 5 spines. Outer terminal spine a little longer than 4 other spines of equal length. Furcal organ dorsolaterally.

Male. Thoracopod VIII (Fig. 6C, 6D) with 2-lobed penial region; frontal lobe protruded slightly. Basipodite with 1 subterminal seta and 1 row of tiny spines on inner margin. Exopod 1-segmented, with 5 setae. Endopod 1-segmented, with 2 setae of different length. In all other characters male does not differ from female.

Remarks. *B. fraterna* n. sp. can be easily recognized by the setal nature of exopod of thoracopods II-VII: the inner terminal seta is shorter than outer one. This reversed condition is, though it is confined only to thoracopod I, also present in *Pseudoantrobathynella husmani* Schminke, 1988 from Germany. There exist more characters which both species have in common: the setation of antennule and antenna, the feature of male thoracopod VIII, and the ornamentation of endopod and exopod with setae and spines. In spite of these similarity, it seems to be premature to conclude a relationship between *B. fraterna* and *P. husmani*, since they differ from each other in the dentation of cutting edge of mandible, in the setation of thoracopods I-VII, in the feature of female thoracopod VIII, and in the number of spines of uropodal sympodite.

B. fraterna may not be related to *Pacificabathynella sequoiae* in San Francisco. According to Schminke and Noodt (1988), *P. sequoiae* has a sexual dimorphism on thoracopod VI. Further differences are present in the setation of antennule, antenna, thoracopods I-VII and uropod, in the feature of male thoracopod VIII, and in the number spines of uropodal sympodite.

Etymology. Alluding to sympatric existence with *Bathynella germanitas* n. sp. The Latin *fraternus* means brotherhood.

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공존하는 미국산 Bathynellidae과의 두 신종

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요 약

한 서식지에 공존하는 Bathynellidae과의 두 신종을 기록하였다.

Bathynella germanitas n. sp.는 Uropod의 Endopod에 실린더 모양의 돌기를 갖고 있는 것이 특징이며 *B. fraterna* n. sp.는 흉각지들의 Exopod에 존재하는 강모에 의해 특징이 지워진다.