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Two New Species of a New Genus of Leptobathynellinae (Crustacea, Bathynellacea) from California, USA

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Crustacea
Califobathynella
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A new genus and two new species of Bathynellacea are described from California in USA. *Califobathynella*, a new genus, belongs to the subfamily Leptobathynellinae, and is closely related to the genera *Parvulobathynella* and *Leptobathynella* but differs from them with respect to labrum, maxillule, maxilla, and male thoracopod VIII. Based on the detailed structure of mouthparts, the phylogenetic relationship of three genera are discussed. The phlogenetic age of the stem species of three genera are estimated at the late Jurassic, based on their phylogenetic relationship and distribution pattern. Two new species, *C. noodti* and *C. teucherti* differ from each other in the structure of labrum.

The Leptobathynellinae, which belongs to Parabathynellidae of the order Bathynellacea, was established by Noodt (1965) for six species and one subspecies of two genera from South America, based on the construction of mandible, the prehensile character of maxilla, and the structures of uropod and furcal rami. Subsequently, further species have been described sporadically by several workers so that only nine species and one subspecies of six genera are known in this subfamily today: *Brasilibathynella* Jakobi, 1958; *Leptobathynella* Noodt, 1965; *Acanthobathynella* Coineau, 1967; *Parvulobathynella* Schminke, 1973; *Odontobathynella* Delamare Deboutteville and Serban, 1979; *Lamtobathynella* Serban and Coineau, 1982. The genus *Parvulobathynella* includes three species, and *Leptobathynella* two species and one subspecies. The remaining four genera are monotypic.

In this paper, two new species of a new genus of Leptobathynellinae are described from California, USA. This is the first description of Leptobathynellidae from North America. All species of Leptobathynellinae known so far have been found in South America and Africa. The occurrence of Leptobathynellinae in North America is noticeable in so far as it may be beneficial in estimating the phylogenetic age of this subfamily more accurately.

The material on which this study is based were announced by Noodt (1974). The samples were preparated and mounted in the mixture of glycerin-formalin. For the drawing and investigation, a Polyvar-Microscope of Reichert-Jung Company with the interference-contrast equipment was used with oil immersion.

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Systematic Accounts

Family Parabathynellidae Noodt, 1965
Subfamily Leptobathynellinae Noodt, 1965
Califobathynella n. gen.

Description: Tiny parabathynellid with body length of less than 1.0 mm. Antennule 6-segmented; first segment sexually dimorphic. Antenna 5-segmented. Labrum massive; free margin bulged laterally, with teeth in middle region, setated or denticulated in lateral region. Mandible with incisor process of 3 teeth, spine row consisting of 4 teeth, palp 1-segmented. Maxillule 2-segmented; proximal segment with 1 terminal seta on inner margin, distal segment with 3 terminal claw and 2 setae, and with 2 claws on inner margin. Maxilla 3-segmented; first segment as long as wide, without ornaments, second segment 3 times as long as 1st segment, with 8 setae, third segment tiny, with each 1 prehensile claw and seta.

Thoracopods I-VII with 4-segmented endopod and 2-segmented exopod. Thoracopod VIII ♀ in form of stub bending medially. Thoracopod VIII ♂ rod-shaped, without seta. Sympodite of uropod with 2 distal spines, endopod of uropod with 1 subterminal spine on inner margin.

Type Species: *Califobathynella noodti* n. sp.

Etymology: Named after California, USA. (masculine)

Califobathynella noodti n. sp.
(Figs. 1 and 2)

Material examined: 5 ♀ ♀ and 2 ♂ ♂ from a shaded place of dry stream in San Clement Canyon Park, San Diego, California, USA. 2 km from coast, pit 60 cm deep in coarse sand. Temperature 19℃. leg. Noodt,

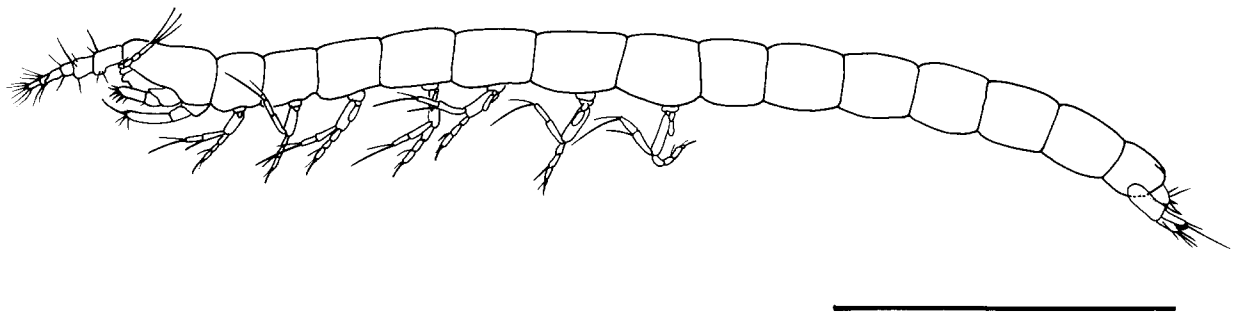

Fig. 1. *Califobathynella noodti* n. sp. General habitus, lateral view from left. Scale bar=250 μm.

14 August 1973. Holotype (♀), allotype (♂) and paratypes (2♀ ♀) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Dissected paratypes (2♀ ♀ and 1♂) are kept in Arachnological Institute of Korea, No. Cr-Ba-27.

Description: Body of adults 0.70-0.76 mm long, 18 times as long as wide.

Pleotelson without seta. Anal operculum concave. Furcal rami 1.3 times as long as wide, with 2 dorsal plumose setae, a tiny spine on its inner margin and 2 terminal spines: the outer terminal spine 2 times as long as inner one.

Antennule 6-segmented. First segment massive, sexually dimorphic, ventrally swelled out; with 1 ventral seta, 1 seta on inner distal margin, 1 long and 1 plumose setae on dorsal surface, and 1 ventrolateral plumose seta. On male 1 additional seta on dorsal surface. Second segment with 1 seta on inner margin and 1 group of 4 plumose setae. Third segment with each 1 simple and plumose seta on outer margin. Fourth segment with a stub seta on dorsal margin and 3 plumose setae on lateral apophysis. Fifth segment with 1 plumose seta, 2 setae and 1 group consisting of 1 seta and 1 aesthetasc. Sixth segment with 4 setae and 3 aesthetascs. Antenna 5-segmented, 70% length of antennule, setal formula: 0/0+1/1+0/1+0/3(1).

Labrum massive, triangular in ventral view, rounding off, bulged laterally. Free margin with 1 median group of diverse teeth followed laterally by 1 group of 2 teeth and 1 wide tooth on both lateral side. Mandible 1.5 times as long as wide, with incisor process of 3 teeth, spine row consisting of 4 teeth, palp 1-segmented, with 1 terminal seta.

Maxillule 2-segmented. Proximal segment with 1 terminal seta on inner margin. Distal segment with 3 terminal claw and 2 setae, and with 2 claws on inner margin. Maxilla 3-segmented. First segment as long as wide, without ornament. Second segment 3 times as long as 1st segment, with 8 setae. Third segment tiny, with 1 prehensile claw and 1 simple seta.

Thoracopods I-VII increasing in length. Thoracopods III-VII each with 1 epipodite, respectively. Basipodites of thoracopods I-VII without seta. Exopod 2-segmented; proximal segment segment with 1 ventral seta on distal margin; distal segment terminally with each 1 spiculated and pulmose setae. Endopod 4-segmented, setal formula 0+0/0+1/0+0/2(1). Thoracopod VIII♀ represented by a stub bending medially. Thoracopod VIII♂ rod-shaped, without seta.

Sympodite of uropod with 2 distal spines. Exopod 70% of length of sympodite, with each 1 terminal and subterminal setae. Endopod as long as exopod, somewhat shorter, with 2 rows of spicules and 1 subterminal spine on inner margin, 1 terminal seta, and 2 plumose setae.

Etymology: Named after Prof. Dr. Noodt (Kiel, Germany, deceased) in gratitude for his guidance of my study in this field.

Califobathynella teucherti n. sp.
(Fig. 3)

Material examined: 1♀ (holotype) from Hot spring river, Los Angeles, California, USA. Under the bridge of interstate highway 15, ca. 1 km from the junction of interstate 15 and 15E. Pit 50 cm deep in gravel, temperature 14℃. leg. Noodt, 03 July 1980. Holotype will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution.

Description: Body 0.74 mm long, 16 times as long as wide.

Pleotelson without seta. Anal operculum concave. Furcal rami 1.3 times as long as wide, with 2 dorsal plumose setae, a tiny spine on its inner margin and 2 terminal spines: the outer terminal spine 2 times as long as inner one.

Antennule 6-segmented. First segment massive, sexually dimorphic, ventrally swelled out; with 1 ventral seta, 1 seta on inner distal margin, 1 long and 1 plumose setae on dorsal surface, and 1 ventrolateral plumose seta. Second segment with 1 seta on inner margin and 1 group of 4 plumose setae. Third segment with each 1 simple and plumose seta on outer margin. Fourth segment with a stub seta on dorsal margin and 3 plumose setae on lateral apophysis. Fifth segment

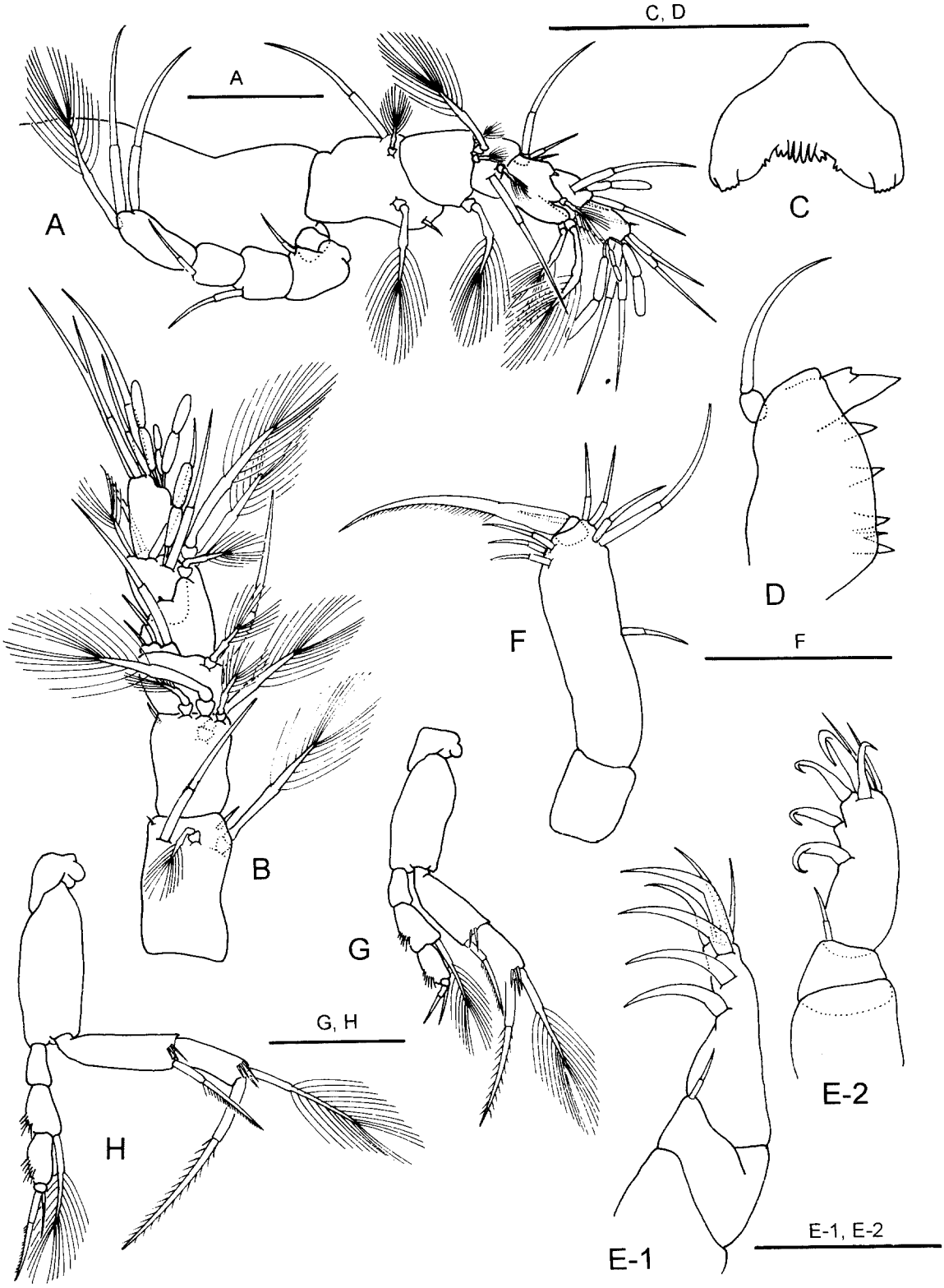

Fig. 2. *Califobathynella noodti* n. sp. A, Right antennule and antenna, lateral view. B, Right antennule, dorsal view. C, Labrum, ventral view. D, Left mandible, ventral view. E-1, Right maxillule, frontal view. E-2, Dito, ventral view. F, Right maxilla, ventral view. G, Left thoracopod I. H, Left thoracopod II. Scale bars=25 μm.

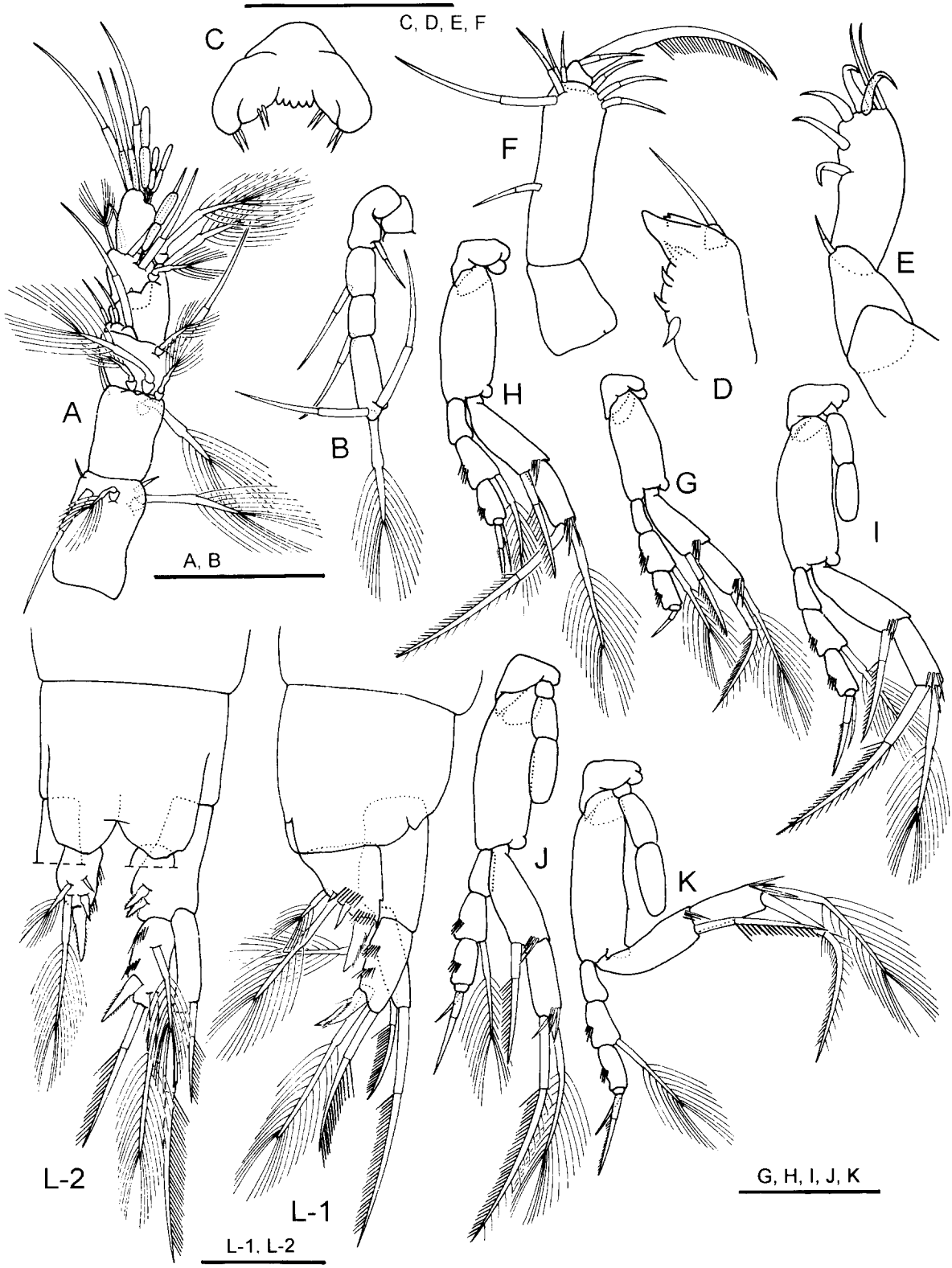

Fig. 3. *Califobathynella teucherti* n. sp. A, Right antennule, dorsal view. B, Left antenna, dorsal view. C, Labrum, ventral view. D, Right mandible, ventral view. E, Right maxillule, ventral view. F, Left maxilla, ventral view. G, Left thoracopod I. H, Left thoracopod II. I, Left thoracopod III. J, Left thoracopod IV. K, Left thoracopod V. L-1, Pleotelson, furca and uropod, dorsal view. L-2, Dito, lateral inner-view. Scale bars=25 μm.

with 1 plumose seta, 2 setae and 1 group consisting of 1 seta and 1 aesthetasc. Sixth segment with 4 setae and 3 aesthetascs. Antenna 5-segmented, 70% length of antennule, setal formula: 0/0+1/1+0/1+0/3(1).

Labrum massive, triangular in ventral view, rounding off, bulged laterally. Free margin with 1 median group of 5 truncate teeth followed laterally by 2 group of 2 setae on both side. Mandible 1.5 times as long as wide, with incisor process of 3 teeth, spine row consisting of 4 teeth, palp 1-segmented, with 1 terminal seta.

Maxillule 2-segmented. Proximal segment with 1 terminal seta on inner margin. Distal segment with 3 terminal claw and 2 setae, and with 2 claws on inner margin. Maxilla 3-segmented. First segment as long as wide, without ornament. Second segment 3 times as long as 1st segment, with 8 setae. Third segment tiny, with 1 prehensile claw and 1 simple seta.

Thoracopods I-VII increasing in length. Thoracopods III-VII each with 1 epipodite, respectively. Basipodite of thoracopods I-VII without seta. Exopod 2-segmented; proximal segment with 1 ventral seta on distal margin; distal segment terminally with each 1 spiculated and plumose setae. Endopod 4-segmented, setal formula 0+0/0+1/0+0/2(1). Thoracopod VIII ♀ represented by a stub bending medially.

Sympodite of uropod with 2 distal spines. Exopod 70% of length of Sympodite, with each 1 terminal and subterminal setae. Endopod as long as exopod, somewhat shorter, with 2 rows of spicules and 1 subterminal spine on inner margin, 1 terminal seta, and 2 plumose setae.

Male unknown.

Etymology: Named after Prof. Dr. Teuchert-Noodt (Bielefeld, Germany) in gratitude for her aid during my stay in Germany.

Discussion

Both new species described above belong to subfamily Leptobathynellinae with respect to the general habitus, 5-segmented antenna with a setal formula 0/0+1/1+0/1+0/3(1), the structures of mouthparts, female and male thoracopods VIII and uropod, and 2-segmented exopods of thoracopods I-VII. Especially, they are similar to *Leptobathynella*, *Parvulobathynella* and *Lamtobathynella* in most characteristics. According to Cho (1995), *Lamtobathynella*, with a single species *L. pentadonta*, will be synonymized with *Parvulobathynella* so that it seems to be reasonable to compare both new species with *Leptobathynella* and *Parvulobathynella*.

Differences which distinguish both new species from *Leptobathynella* and *Parvulobathynella*, are the structures of labrum, mouthparts and male thoracopod VIII. Labra of two new species are both massive, triangular and rounding off. Their free margin are either denticulated or setated, but equipped with median teeth in both cases. According to Cho (1995), labra of *Parvulobathynella* and *Leptobathynella* are sometimes setated, but without median teeth, i.e. show different conditions. Incisor process of mandible consists of five teeth in *Parvulobathynella*, three teeth in *Leptobathynella* (Cho, 1995), and three teeth in both new species. Differences in the structure of maxillule are as follows: the proximal segment bears four terminal setae in *Parvulobathynella*, whereas a terminal seta in both new species, and a subterminal seta in *Leptobathynella*; on the inner edge of distal segment there are five claws in *Parvulobathynella* and in both new species, but four claws in *Leptobathynella*; the outer margin of distal segment swells out only in *Leptobathynella*. There is no difference between both new species and *Leptobathynella* in the structure of maxilla. But the second segment of maxilla of *Parvulobathynella* bears a median seta on inner edge (Schminke, 1973). In *Parvulobathynella* and *Leptobathynella* the male thoracopod VIII is always with a seta which is interpreted as basipodial seta (Schminke, 1973; Serban et al., 1982). No such seta exists in the male thoracopods VIII of *Califobathynella noodti* sp. n.

The differences mentioned above make it possible to unite both new species in the new genus *Califobathynella*. *C. noodti* and *C. teucherti* sp. n. differ from each other in respect to the structure of labrum. The difference seems to be enough to distinguish both species, since it is known that the species of *Parvulobathynella* and *Leptobathynella* differ from each other mainly in the structure of labrum (Cho, 1995).

According to Schminke (1973), *Parvulobathynella* and *Leptobathynella* are closely related to each other, and the latter genus is more advanced than the former one with respect to maxillule and maxilla. Considering the general evolutionary tendency of Bathynellacea referred by Schminke (1973), and deducing from the conditions of two extremities, it is assumed that *Califobathynella* occupies the intermediate phylogenetic position between *Parvulobathynella* and *Leptobathynella*. Accepting the phylogenetic relationships of three genera mentioned, the minimal phylogenetic age of Leptobathynellinae can be estimated with respect to the existence of *Califobathynella* in North America. According to Stanley (1989), North America was separated from South America before the late Jurassic. Following the opinion of Schminke (1973) that the dispersal of all Bathynellacea had occurred in continental groundwater, it is appreciable that the stem species of three genera had already existed 144 million years ago.

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