Arctokonstantinus hardingi (Copepoda, Calanoida, Arctokonstantinidae): New family, new genus, and new species from the bathypelagial Arctic Basin

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Arctokonstantinus hardingi (Copepoda, Calanoida, Arctokonstantinidae): New family, new genus, and new species from the bathypelagial Arctic Basin

Elena L. Markhaseva & Ksenia N. Kosobokova

SARSIA

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Arctokonstantinus hardingi is based on a female specimen collected at bathypelagic depths in the Arctic Ocean. The new family has similarities with the family Spinocalanidae (superfamily Spinocalanoidea); however, it does not fit well the diagnosis of the superfamily and family in length of antennule, setation of mandible and maxillule, significantly deviating morphology of maxilla and maxilliped and segmentation of P1 exopod. Probably the new family represents a new calanoid superfamily; however, until the male is known the species it is tentatively placed into the superfamily Spinocalanoidea. Arctokonstantinidae is attributed to the Spinocalanoidea based on segmentation and setation pattern of swimming legs P2-P4 and antennule structure. Relying on mouth-part morphology *Arctokonstantinus* could be considered a predator.

Elena L. Markhaseva, Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St. Petersburg 199034, Russia. – Ksenia N. Kosobokova, Institute of Oceanology, Russian Academy of Sciences, Nakhimov ave., 36, Moscow 117218, Russia.
E-mail: lena@markhaseva.zin.ras.spb.ru

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INTRODUCTION

The superfamily Spinocalanoidea contains only the family Spinocalanidae Vervoort, 1951 with 10 genera: *Damkaeria* Fosshagen, 1983; *Isaacsicalanus* Fleminger, 1983; *Kunihulsea* Schulz, 1992; *Mimocalanus* Farran, 1908; *Monacilla* Sars, 1905; *Mospicalanus* Schulz, 1996; *Rhinomaxillaris* Grice & Hulsemann, 1967; *Sognocalanus* Fosshagen, 1967; *Spinocalanus* Giesbrecht, 1888; and *Teneriforma* Grice & Hulsemann, 1967. However, *Rhinomaxillaris* and *Sognocalanus* markedly deviate from the remaining spinocalanids in the setation of oral parts which strongly tend toward reduction, and in this character resemble *Arctokonstantinus* gen. nov. *Sognocalanus* together with *Arctokonstantinus* differ from the remaining spinocalanids in the absence of both an outer lobe at P1 Enp and an inner basal seta at P1. Apparently placement into the family Spinocalanidae of *Arctokonstantinus, Rhinomaxillaris* and *Sognocalanus* is tentative and their correct place in the Calanoida hierarchy must await additional material. In this work a new family and genus are described and incorporated into Spinocalanoidea.

MATERIAL AND METHODS

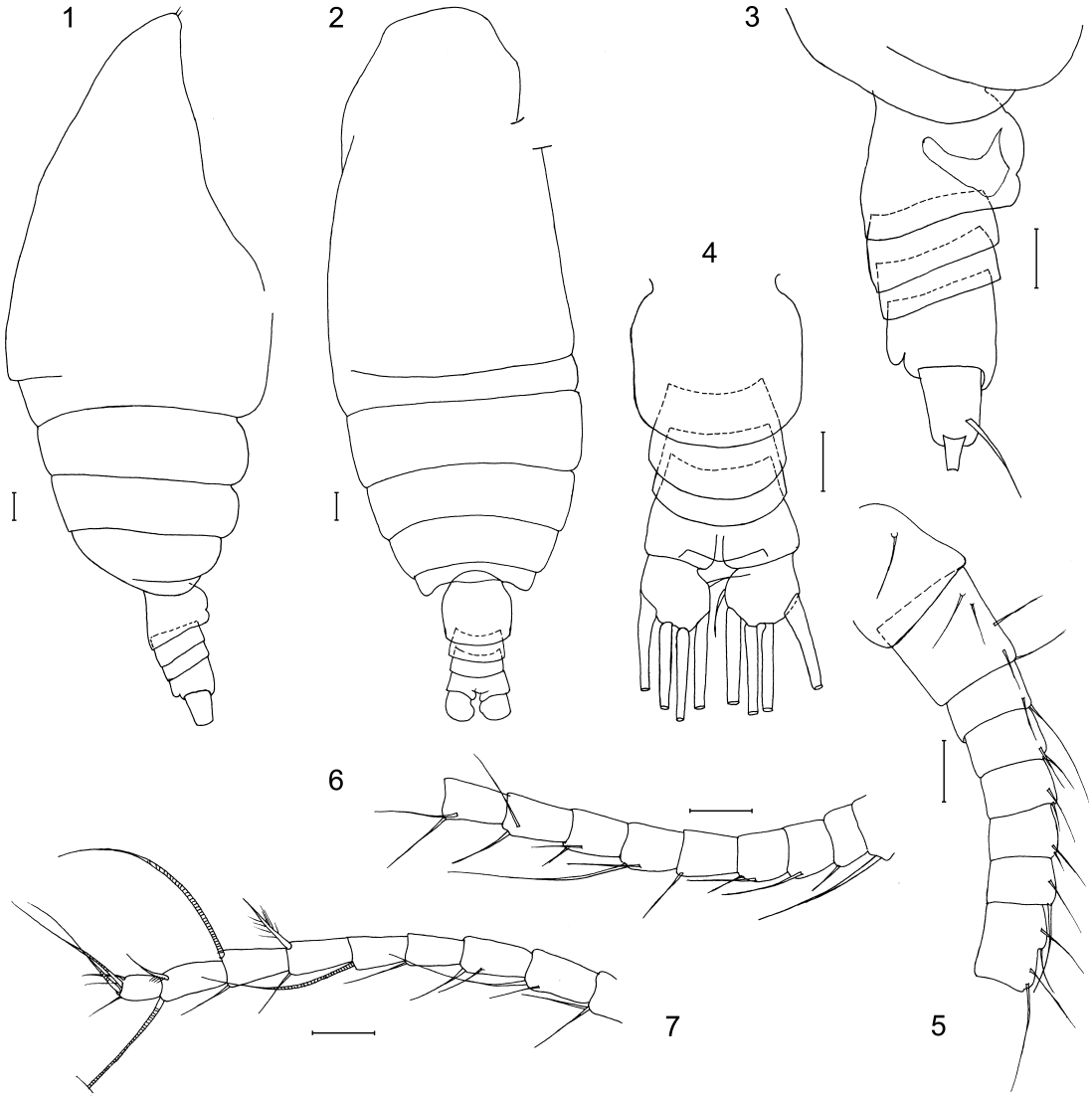
A single female was collected during RV *Polarstern* ARK XI/1 cruise (1995) at bathypelagic depths (3000-1000 m) in the Eastern Nansen Basin of the Arctic Ocean (81°13'N, 106°34'E) with multinet (MN1): mouth opening 0.25 m^2, 150 μm mesh. The specimen was dissected for the study under the microscope. All figures were prepared using *camera lucida*.

The following abbreviations are used in the descriptions: A1, antennule; A2, antenna; Enp, endopod; Exp, exopod; Gn, gnathobase; Gns, genital somite; Md, mandible; Mdp, mandibular palp; Mx1, maxillule; Mx1 Li1, praecoxal arthrite (first inner lobe); Mx1 Li2, coxal endite (second inner lobe); Mx1 Li3-4, basal endites (third and fourth inner lobes); Mx1 Le1, coxal epipodite (first outer lobe); Mx2, maxilla; Mx2 Li1-2, praecoxal endites (first and second lobes); Mx2 Li3-4, coxal endites (third and fourth lobes); Mx2 Li5, basal endite (fifth lobe); Mxp, maxilliped; P1-P4, swimming legs 1-4; Pd1-5, pedigerous somites 1-5; Ce, cephalosome; Pr, prosome; Ur, urosome.

SYSTEMATICS

Family Arctokonstantinidae fam. nov.

Diagnosis. Female. Arctokonstantinidae share with the Spinocalanidae the following characters (Andronov, 1974; Damkaer, 1975): 1) P1 Enp l-segmented with 4 setae (spinocalanids may have 3 to 5 setae); 2) P3-P4 rami 3-segmented; 3) P2-P4 Exp3 with 5 inner setae;



Figs 1- 7. *Arctokonstantinus hardingi* gen. et sp. n., female. 1. Right lateral view; 2. Dorsal view; 3. Pd4-5 & Ur (right lateral view); 4. Ur (dorsal view); 5. A1 articulated segments 1-8; 6. A1 articulated segments 9-16; 7. A1 articulated segments 17-24. Scale bars here and in other figures 0.1 mm

4) P3-P4 Enp2 with 1 seta; Enp3 with 5 setae (spinocalanids may have 4 to 6 setae); 5) P5 absent.

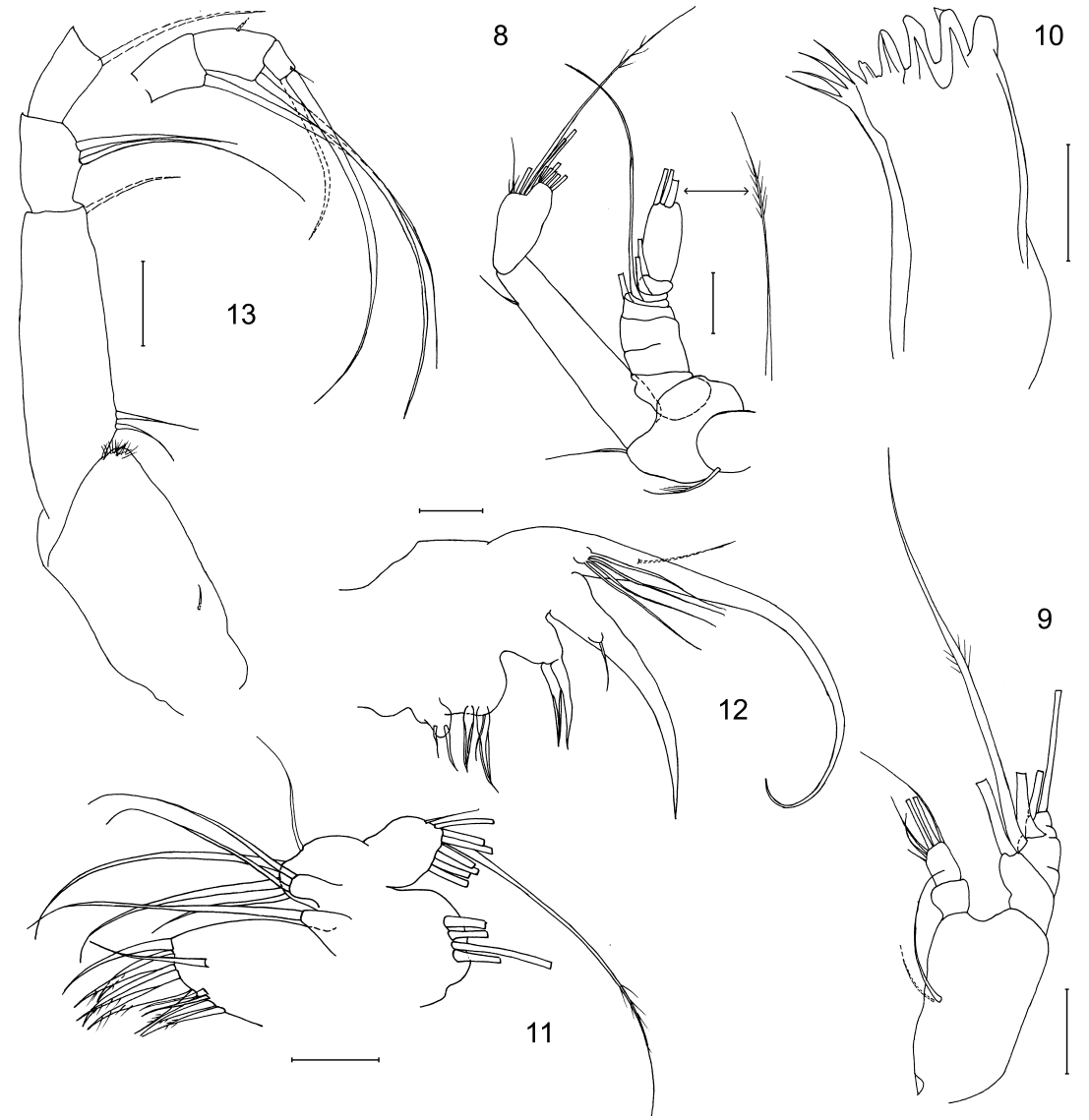
Family differs from the spinocalanids in the following apomorphies: 1) Mx2 is strongly transformed with distal endites attenuated into claw-like protrusions, setal equipment as follows: Li1 with 2 setae, Li2 with 2 thick short spines plus 1 thin seta, Li3 with 2 thick short spines, Li4 and Li5 transformed into claw-like attenuations with 1 seta retained on each, distal part of limb with 4 setae; 2) Mxp syncoxa with 1 minute seta, basis with 2 setae located in the proximal part of the segment, Enp1 (fused to basis) with 1 seta, Enp2 with 2 setae, Enp3-4 with 1 seta each, Enp5 with 2 setae, and Enp6 with 3 setae; 3) P1 Exp 1-segmented with 4 inner setae; 4) P2 Enp 1-segmented not 2-segmented.

Male unknown.

Type genus *Arctokonstantinus* gen. nov.

Arctokonstantinus gen. nov.

Diagnosis. Female. Rostrum absent. Ce and Pd1 incom-



Figs 8-13. *Arctokonstantinus hardingi* gen. et sp. n., female (right limbs, by dotted line - additions after left limbs). 8. A2; 9. Mdp; 10. Gn; 11. Mx1; 12. Mx2; 13. Mxp.

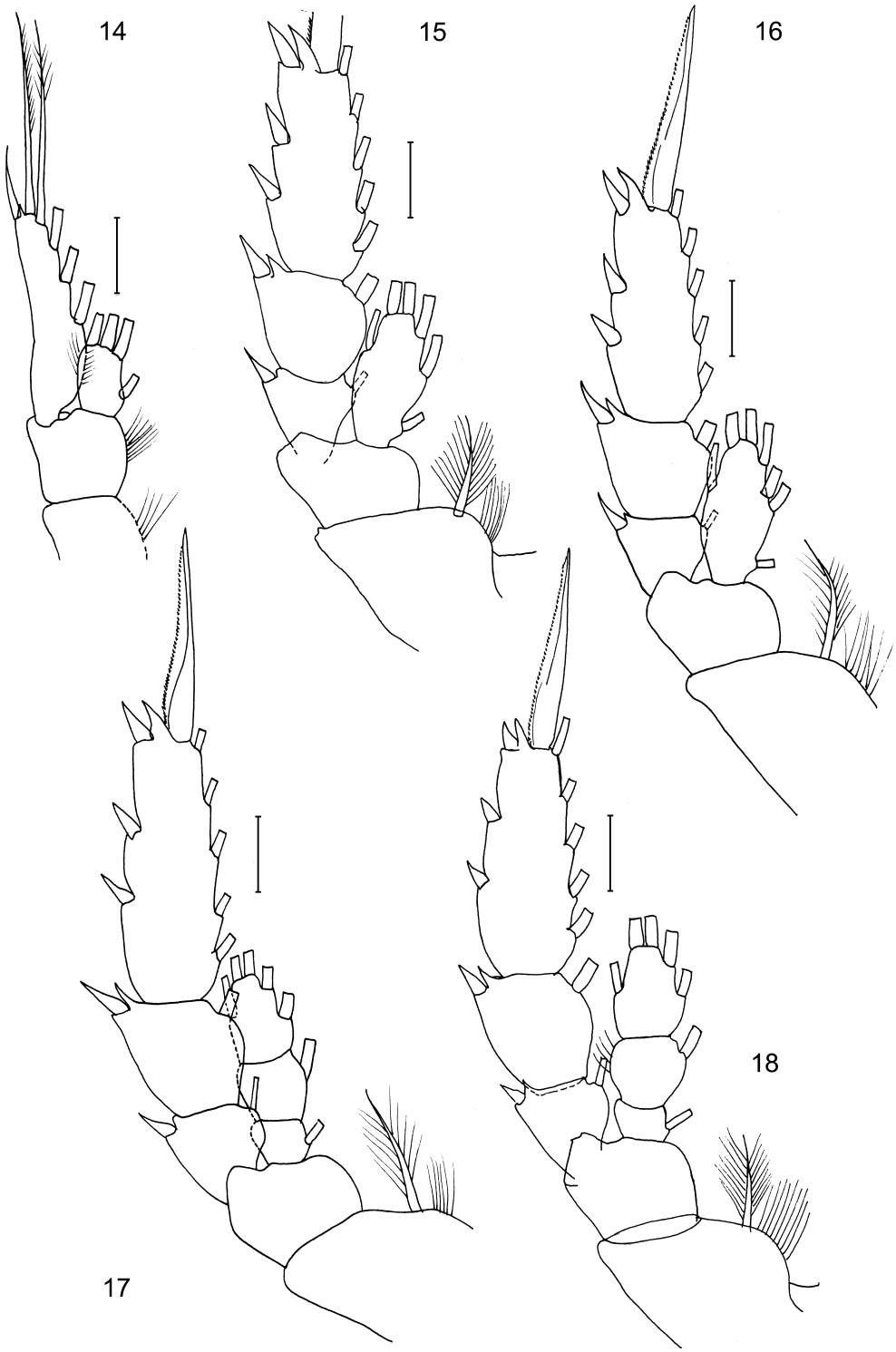
pletely separate, Pd4 and Pd5 separate. Ur of 4 somites, Gns symmetrical. A1 of 24 articulated segments. A2 Exp incompletely 8-segmented (Exp2-3 are partly fused), shorter than Enp; Enp1 with 1 seta. Md Enp1 without seta, Enp2 with 6 setae. Mx1 Li4 without setae (as in *Rhinomaxillaris*), Enp rudimentary with 4 setae. P1 Enp without outer lobe and basis without inner setae (as in *Sognocalanus*).

Type species *Arctokonstantinus hardingi* gen. nov., sp. nov., by monotypy.

Arctokonstantinus hardingi gen. et sp. nov.
(Figs 1-18)

Holotype. Female of total length 4.1 mm collected in the Arctic Ocean's eastern Nansen Basin at station 36-027 during RV *Polarstern* ARK XI/1 cruise, in a vertical haul 3000-1000 m (total depth 3133 m), 8 August 1995, by K.N. Kosobokova.

Holotype N 90698 at the Zoological Institute of the Russian Academy of Sciences (St. Petersburg).



Figs. 14-18. *Arctokonstantinus hardingi* gen. et sp. n., female. 14. P1; 15. Left P2; 16. Right P2; 17. P3; 18. P4.

Description. Characters as the family and genus. Female: total length 4.1 mm. Prosome: urosome ratio 4.3:1 (Figs. 1-4). Posterior corners of Pd5 as short lobes. A1 (Figs. 5-7) reaching posterior border of Pd2, of 24 articulated segments with 1, 5, 2, 2, 2, 2, 2, 4, 1, 1, 2, 1, 2, 2, 2, 2, 2, 2, 1, 1, 2, 2, 2, 5 setae. A2 Exp1-3 lacking setae (Fig. 8). Md as described for the genus and figured (Figs. 9-10). Mx1 (Fig. 11) Li1 with 10 terminal spines, 1 anterior and 1 posterior seta; Li2 with 1 seta, Li3 with 2 setae, Li4 without setae, Enp with 4 setae; Exp with 9 setae. Mx2 and Mxp as described for the family and figured (Figs. 12-13). P1 as described for the genus and figured (Fig. 14). P2 Enp differs in setation on right (7 setae) and left (6 setae) legs (Figs. 15-16); in remaining details P2-P4 as figured (Figs. 15-18). P5 absent.

Etymology. The generic name is derived from the name of Dr. Konstantin Brodsky (1907-1991), for his significant contributions in the study of calanoids and the Arctic Ocean where the new genus was found. The species is named after Gareth C.H. Harding who was the first to figure this species, as unidentified sp. B (Harding 1966:36-37).

DISCUSSION

The superfamily Spinocalanoidea was established by Park (1986) to accommodate the single family Spinocalanidae that had earlier been placed in the superfamily Clausocalanoidea. The main characters distinguishing Spinocalanoidea from Clausocalanoidea are the presence of 4 inner setae at P1 Exp3 and 5 inner setae at P2-P3 Exp3 (contrary to 3 and 4 respectively). The family contains 10 genera (Schulz 1996), including *Sognocalanus* Fosshagen, 1967 and *Rhinomaxillaris* Grice & Hulsemann, 1967 (Andronov 1992).

The placement of two later genera into Spinocalanidae is under question and awaits further revision. Arctokonstantinidae is tentatively attributed to Spinocalanoidea based on the following characters: segments 8 and 9 of the antennule are fused; P1 endopod is 1-segmented with 4 setae; 1 inner seta on the middle endopod segment of P3 and P4; 5 setae on the distal endopod segment of P3 and P4; and 5 inner setae on the third exopod segment of swimming legs P2, P3, and P4.

Spinocalanidae are worldwide deep-water calanoids found at meso- and bathypelagic depths; *Isaacsicalanus* was reported from bathyal waters in a hydrothermal vent community (Fleminger 1983).

Based on mouth parts morphology (Arashkevich 1969; Schnack 1989) and gut content analysis (Harding 1974; Gowing & Wishner 1992) nearly all spinocalanid genera are considered to be omnivorous (predominantly detritovores). However, morphology of the *Sognocalanus* mouth parts strongly deviates from the regular spinocalanid type, and to less degree this deviation is true for *Rhinomaxillaris* and *Isaacsicalanus* (Schulz 1989). Unfortunately, descriptions and figures of the *Rhinomaxillaris* and *Sognocalanus* mouth parts are not sufficiently detailed to assign these genera without doubt either to carnivory or omnivory. It is noteworthy that the new genus *Arctokonstantinus* demonstrates even more abrupt deviations in this regard from the spinocalanid type. Relying on mouth-part morphology this could be considered a predator: Mx1 with strongly developed Li1; Mx2 highly specialized with Li2-Li3 bearing short flat spines and Li4 and Li5 transformed into spine-like attenuations with the distal part of the limb heavily strengthened; Mxp with basis and Enp segments well developed, Enp segments with strong setae poorly setuled, with only a few setules observed on distal setae; and Md gnathobase with 4 well developed teeth. Some convergences (e.g., transformation of distal Mx2 endites into spine-like attenuations with distal part of limb significantly reduced) have been noticed in the trend of specialization of Mx2 in *Arctokonstantinus* and distantly related calanoids (the group of highly specialized species of the aetideid genus *Chiridiella* (*abyssalis*, *gibba*, *ovata*, and others) (see Markhaseva 1996: 87). Feeding habits of *Chiridiella* are not sufficiently known, but it could be hypothesized that they are similar to those of *Arctokonstantinus*.

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