Meiofauna Marina, Vol. 19, pp. 109–126, 11 figs., 3 tabs., September 2011

Description of a new species of *Zosime* Boeck, 1872 (Copepoda: Harpacticoida: Zosimeidae) from the Great Meteor Seamount, representing one of the few eurybathic Harpacticoida among the distinct plateau and deep-sea assemblages

Stefan Koller* and Kai Horst George*

Abstract

In 1998, qualitative samples of meiofauna were taken at the Great Meteor Seamount, one of the largest Atlantic seamounts. The present contribution provides the result of a comparative investigation of Zosimeidae Seifried, 2003. Twelve species were detected, all belonging to the genus *Zosime* Boeck, 1872. Just one species, namely *Z. bergensis* Drzycimski, 1968, is scientifically known from the Norwegian coast, while all remaining 11 species are new to science. The present paper provides the description of the most abundant species *Z. anneae* sp. nov. The new taxon may be characterized by six apomorphies: (i) P4 exp1 with outer spine remarkably dwarfed; (ii) FR elongate between furcal setae I and II; (iii) furcal seta I minute and (iv) displaced ventrally; (v) furcal seta II dwarfed; (vi) furcal seta VII dwarfed. Chorological comparison points to a perhaps worldwide distribution of *Zosime*, and even single species show wide distribution ranges. *Z. anneae* sp. nov. presents a distribution from the seamount's plateau down to its rise, showing eurybathic properties. Same flexibility is concluded with respect to other abiotic variables like e.g. sediment structure, oxygen demand, salinity, and temperature. Zosimeidae from the Great Meteor Seamount relativise the formerly supposed distributional restriction of harpacticoid taxa to particular topographic regions of the Great Meteor Seamount.

Keywords: Taxonomy, Meiofauna, Crustacea, Deep Sea, Atlantic

Introduction

After the discovery of the largest seamount in the Atlantic Ocean, the Great Meteor Seamount (GMS) in 1938 (Dietrich 1939, Ulrich 1971), several expeditions gained information and knowledge of this undersea feature (e.g. Pratt 1962, Hempel 1968, Hinz 1969, Thiel 1970, Emschermann 1971, Pasenau 1971, Ulrich 1971, Hempel & Nellen 1972, v. Rad 1974, v. Stackelberg et al. 1979, Ehrich 1977, Grevemeyer 1994, Mironov & Krylova 2006). In the frame of the SEAMEC (**SEAM**OUNT **EC**OLOGY) project (Pfannkuche et al. 2000), first qualitative faunistic studies of the meiofauna were

* Senckenberg am Meer, Abt. Deutsches Zentrum für Marine Biodiversitätsforschung DZMB, Südstrand 44, D-26382 Wilhelmshaven, Germany; e-mail: kgeorge@senckenberg.de

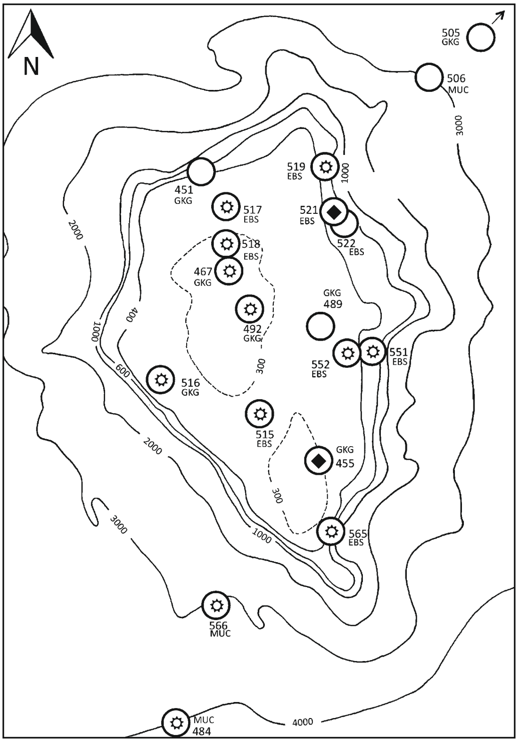

Fig. 1. Map of the Great Meteor Seamount (30°00' N 28°30' W) showing the 19 stations (circles) analysed in the present contribution, including station number and sampling gear. Black rhombuses indicate findings of Zosimeidae, white suns show findings of *Zosime anneae* sp. nov. Station 505 is located outside the figure (arrow). GKG: Giant Box Corer; EBS: Epibenthic sledge; MUC: Multicorer.

made possible (George & Schminke 2002). Within the meiofauna, the harpacticoid copepods play an important role, since they are generally the second most abundant group after the nematodes (Hicks & Coull 1983).

First qualitative investigations of the harpacticoid meiofauna detected a remarkable high number of unknown species (96 %), coupled with a clear distinction between a plateau- and a deep-sea fauna, with only low percentage of overlapping species (6–7 %) (George & Schminke 2002, George 2004, Plum & George 2009). Gad (2009) confirmed this kind of distinction for certain nematode taxa. In contrast, the present examination of Zosimeidae of the GMS at species level reveals a remarkably high number of species present on the plateau as well as at surrounding deep-sea localities. Up to date, Zosimeidae comprise only 17 species worldwide. The most abundant species of this taxon at the Great Meteor Seamount, *Zosime anneae* sp. nov., is described.

Material and Methods

The material was collected during expedition M42/3 of RV METEOR in 1998 at the Great Meteor Seamount in the northeast Atlantic Ocean (Pfannkuche et al. 2000) (Fig. 1). For meiobenthic sampling methods and sample treatment see George & Schminke (2002). The Zosimeidae were sorted and transferred on slides using glycerol as embedding medium. The material is stored at Senckenberg am Meer, Abt. DZMB, Südstrand 44, D–26382 Wilhelmshaven, Germany. Dissection of the described material was done under a Leica M12.5 dissection microscope. Dissected parts were mounted on different slides. The type material is deposited in Senckenberg Forschungsinstitut und Naturmuseum (SMF), Frankfurt/Main, Germany.

Seifried (2003) erected the new family Zosimidae Seifried, 2003 in excluding the genera *Zosime* Boeck, 1872, *Peresime* Dinet, 1974, and *Pseudozosime* T. Scott, 1912 from Tisbidae Stebbing, 1910. However, Huys (2009) showed that Zosimidae is a junior homonym of Zosiminae Alcock, 1898 (Decapoda, Xanthidae), based on the type genus *Zosimus* A.-G. Desmarest, 1823. The proposed emendation to Zosimeidae (Huys & Clark 2009, cited from Huys 2009) is adopted here.

Abbreviations used in the text: **A1**, antennula; **A2**, antenna; aes, aesthetasc; benp, baseoendopod; enp, endopod; exp, exopod; **enp-1 (2,3)**, proximal (middle, distal) segment of endopod; **exp-1 (2,3)**, proximal (middle, distal) segment of exopod; **FR**, furcal ramus/rami; **GF**, genital field; **GMS**, Great Meteor Seamount; **md**, mandibula; **mxl**, maxillula; mx, maxilla; **mxp**, maxilliped; **P1-P6**, first to sixth swimming leg.

Results

Family: Zosimeidae Seifried, 2003

Genus: *Zosime* Boeck, 1872

Type species: *Z. typica* Boeck, 1872. Additional species: see Table 2.

Type material: Female holotype, dissected and mounted on 12 slides, Coll. No. SMF 37002/1–12, and 9 paratypes (PT): PT1 (allotype), male, dissected and mounted on 9 slides, Coll. No. SMF 37003/1–9; PT2, female, mounted on 2 slides, Coll. No. SMF 37004/1–2; PT3, female, mounted on 1 slide, Coll. No. SMF 37005; PT4, female, mounted on 1 slide, Coll. No. SMF 37006; PT5, female, mounted on 1 slide, Coll. No. SMF 37007; PT6, male, mounted on 1 slide, Coll. No. SMF 37008; PT7, male, mounted on 1 slide, Coll. No. SMF 37009; PT8, male, mounted on 2 slides, Coll. No. SMF 37010/1–2; PT9, male, mounted on 1 slide, Coll. No. SMF 37011.

Type Locality: Northeast Atlantic Ocean, Great Meteor Seamount, Station #492, 29°58.5' N/28° 29.7' W, water depth 294 m, sampled on 09.09.1998.

Etymology: *Zosime anneae* sp. nov. is fondly dedicated to Miss Anne Springsgut (Frankfurt, Germany).

Description of Female. Habitus (Fig. 2) in dorsal view fusiform, dorso-ventrally compressed. Length measured from tip of rostrum to distal end of FR (without setae) 535–600 µm. Largest width at posterior edge of cephalothorax is 200 µm. Artificial variations may occur due to ventro-dorsal compression while embedding. Cephalothorax large, almost one third of entire body length. Cephalothoracic surface with sensilla in distinct pattern. Rostrum as in male (Fig. 9C) triangular in shape, with 2 sensilla. Surface of thoracic segments ornamented and covered with irregular rows of minute spinules. Posterodorsal margins of cephalothorax and thoracic pleurotergites strongly dentate, forming blunt or sharp cuticular processes. Second and third urosomite no fused. Penultimate abdominal segment with dentate posterodorsal margin, consisting of 4 large distinct, triangular-shaped extensions forming a pseudoperculum (Figs. 2A–B). Posterior margin of telson (Figs. 2A–B) ventrally and laterally with short spinules, and with 2 sensilla dorsally. Anal operculum absent. FR (Fig. 3A) cylindrical, slightly convex on the inner and outer margins, about 4 times longer than the broadest width, with 7 setae (I–VII). Proximal part of dorsal surface covered with irregular patterns of minute triangular shaped spinules. Seta I minute. Seta II dwarfed, inserting at ¾ of lateral margin, not even reaching the end of FR. Seta III dislocated ventrally and subdistally. Setae IV and V well developed. Seta VI inserting terminally and medially from seta V. Seta VII inserting subdistally at dorsal side from small pedestal, dwarfed, biarticulate at base.

A1 (Fig. 4) 8-segmented. First segment with 1 seta and several spinules. Second segment with 17 bi- to tripinnate setae (2 broken), some with rat-tail endings. Third segment bearing aes and 4 setae. Fourth segment with 1 seta. Fifth segment bearing 3 setae (2 broken), and sixth segment with 2 setae. Seventh segment with 2 setae; setation of eighth segment unknown (segment damaged). Armature formula: 1–1; 2–17; 3–3+aes; 4–1; 5–3; 6–2; 7–2; 8–unknown (damaged).

A2 as in male (Fig. 11A).

Md (Fig. 5A) with well-developed gnathobase, bearing 1 seta. Mandibular palp comprising basis, enp and exp. Basis with 3 apical setae. Both exp and enp 1-segmented, each with 1 lateral seta; enp additionally with 3, exp with 2 apical setae. Mxl (Fig. 5B) consisting of praecoxal arthrite, coxa, basis, exp, and enp. Praecoxa (# in Fig. 5B) with 2 surface setae (broken). Apically with 6 spines and 1 seta, 2 spines almost triangular in shape and armed with a number of spinules. Coxa (* in Fig. 5B) with 4 setae (1 seta broken), epipodite represented by 2 setae. Basis with 6 setae (all broken) and 3 slender spinules. Enp 1-segmented, with 6 setae (2 broken). Exp 1-segmented, with 3 strong and sturdy bipinnate setae (1 broken).

Mx (Fig. 6A) consisting of syncoxa, allobasis and 1-segmented enp. Syncoxa with 3 endites, inserting all at distal half. Proximal endite bilobate, with 3 setae on each lobe, one of them very slender. Middle endite with 2 apical setae, one being very slender. Distal endite terminally with 1 strong and 1 smaller seta. Basis bearing 2 claw-like spines and 1 seta. Additionally with 3 setae inserting close to enp. Enp very small, bearing 3 apical setae.

Mxp (Fig. 6B) comprising syncoxa, basis and 1-segmented endopod. Syncoxa unarmed, basis with 1 strong inner seta and row of fine spinules. Enp with 2 very slender outer setae and 2 apical setae.

P1 (Fig. 7A) basis with outer and inner biplumose seta. Inner seta nearly as long as enp. Exp 3-segmented, exp1 with outer spine (broken). Exp2 and exp3 each carrying 1 inner seta; exp2 with1 outer spine; exp3 with 2 outer spines and 3 apical setae, the innermost of which being twice as long as the remaining ones. All exopodal outer spines with pinnae of increasing length at outer distal margin. Enp 2-segmented, enp1 with 1

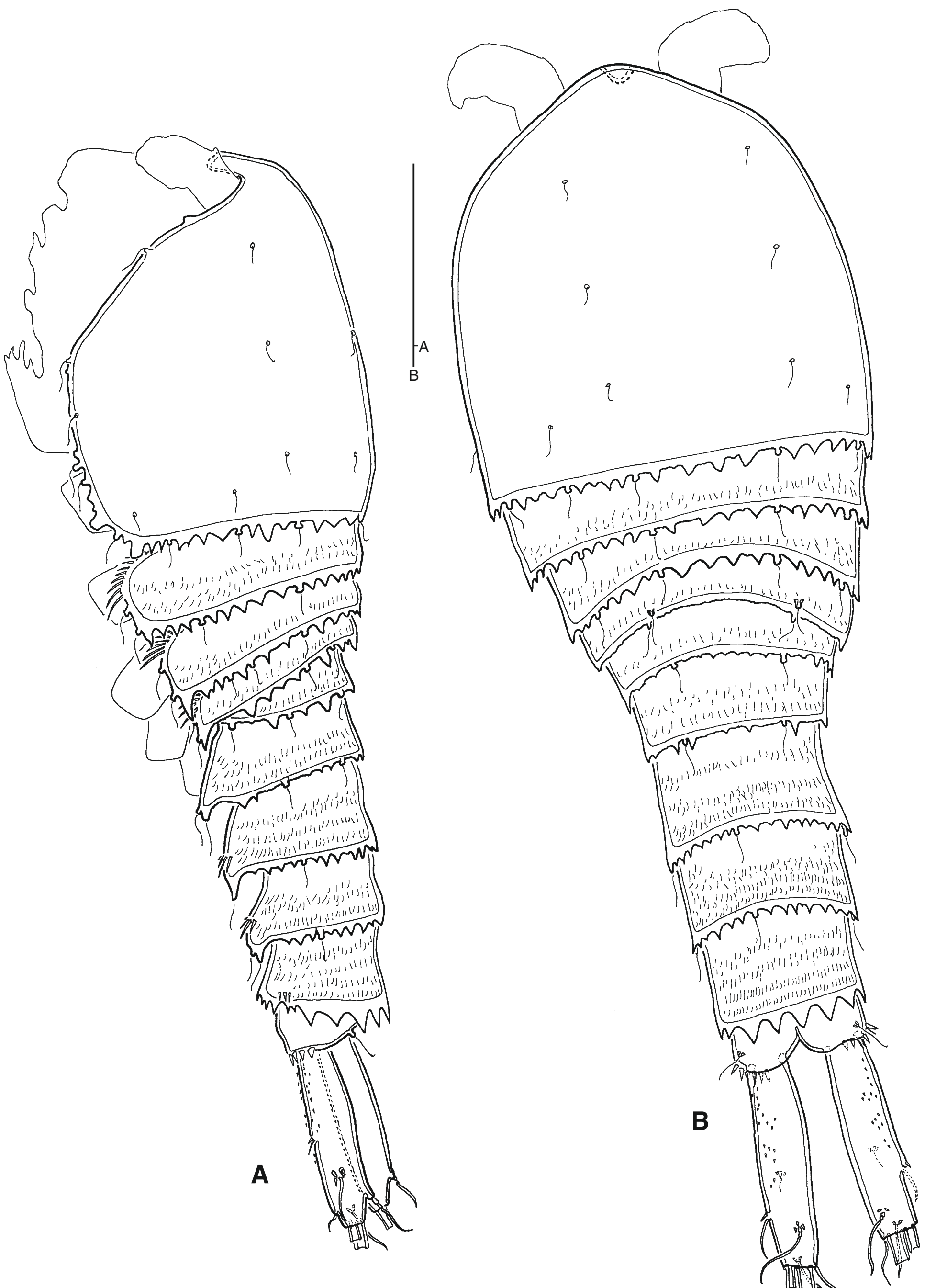

Fig. 2. *Zosime anneae* sp. nov., female habitus (paratype 2). **A.** lateral view; **B.** dorsal view. Scale: 100 µm.

inner seta inserting at subdistal half. Enp2 with 1 inner, 2 apical and 1 outer seta, the innermost of which being short, slender, and flexible, and the outermost showing the same shape as the exopodal outer setae. Both rami armed by rows of spinules at the outer margin as figured.

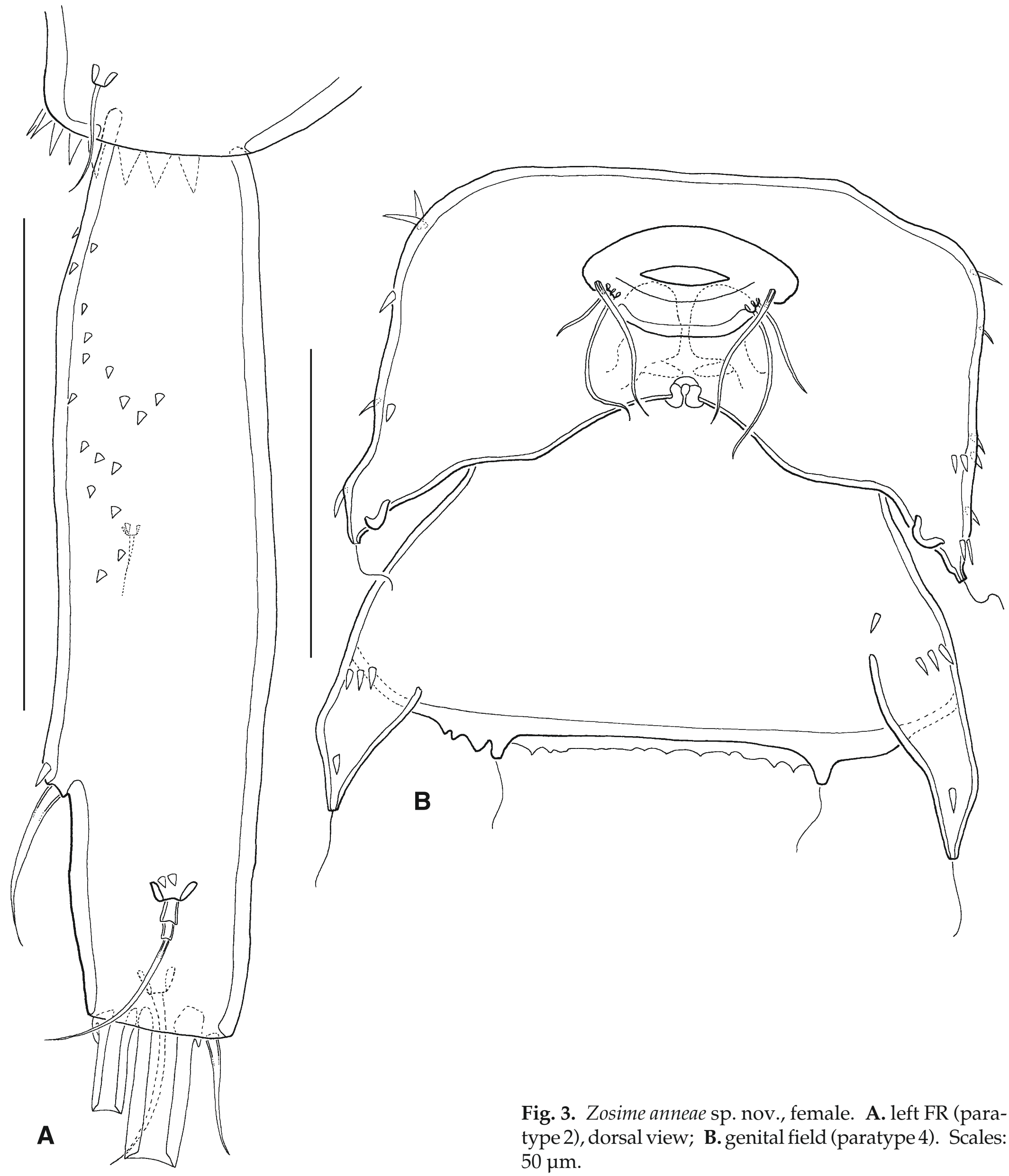

Fig. 3. *Zosime anneae* sp. nov., female. **A.** left FR (paratype 2), dorsal view; **B.** genital field (paratype 4). Scales: 50 µm.

P2–P4 (Figs. 7B,C, 8A,B) with 3-segmented rami. Coxa and basis with spinules as figured, basis also with outer seta (broken on P2). Intercoxal sclerites (Fig. 7B) bow-like. Variation in setation possible, as shown for on P2 Exp3, which may bear (Fig. 7B) or lack (Fig. 7C, arrow) the proximalmost outer spine. Setation of swimming legs P1–P4 is given in Table 1.

Table 1. *Zosime anneae* sp. nov., setation of swimming legs (outer setae/spines in Roman numbers).

	Exopod	Endopod
P1	I–0; I–1; III–2–1	0–1; I–2–1
P2	I–1; I–1; III–2–2	0–1; 0–1; I–2–1
P2 male	I–1; I–1; III–2–2	0–1; 0–1; 0–1+apophysis–0
P3	I–1; I–1; III–2–2	0–1; 0–1; I–2–1
P4	I–1; I–1; III–2–2	0–1; 0–1; I–2–1

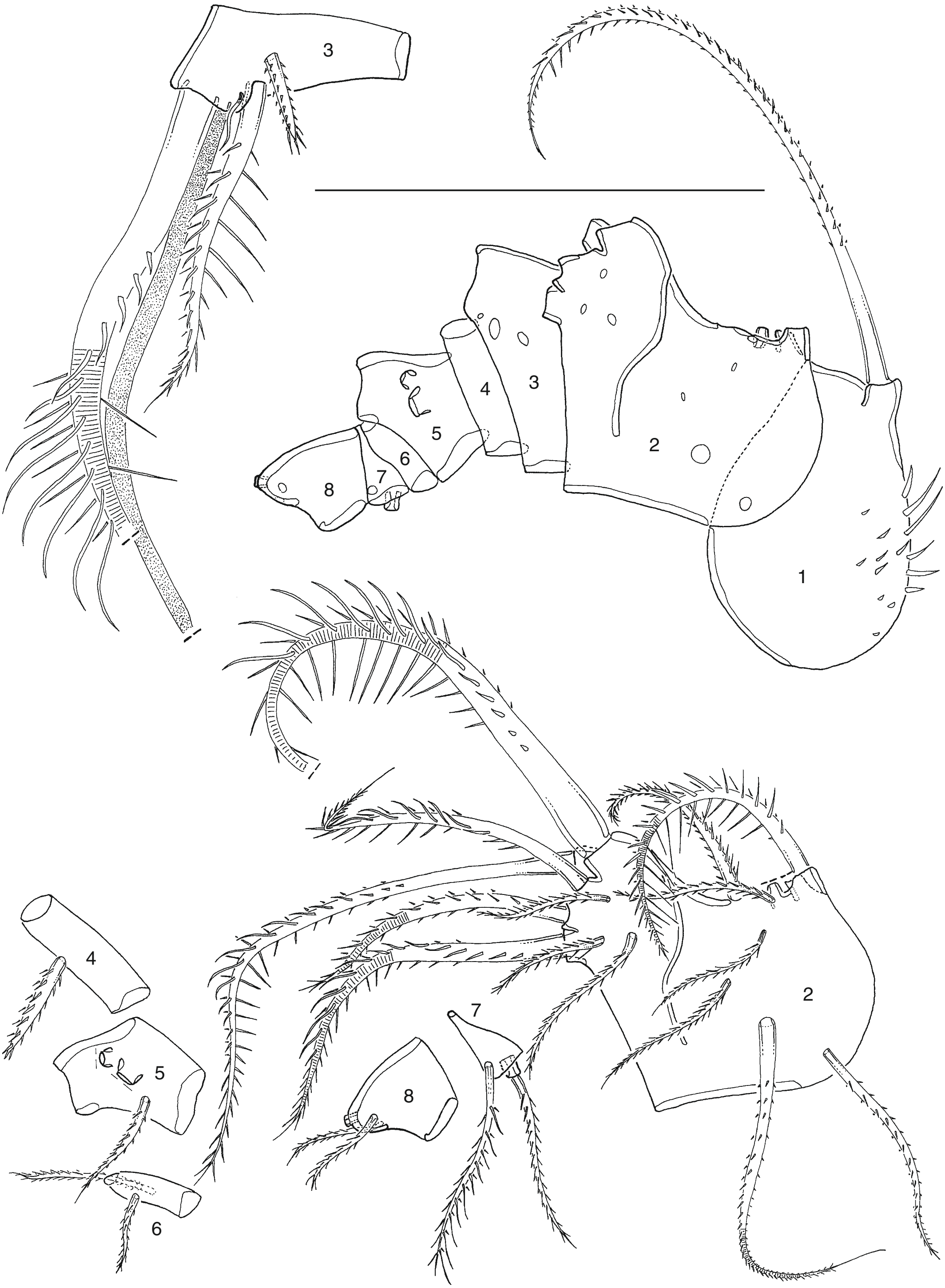

Fig. 4. *Zosime anneae* sp. nov., female A1 (holotype), showing the segmentation (segments 1–8) and their respective ornamentation. Scale: 50 µm.

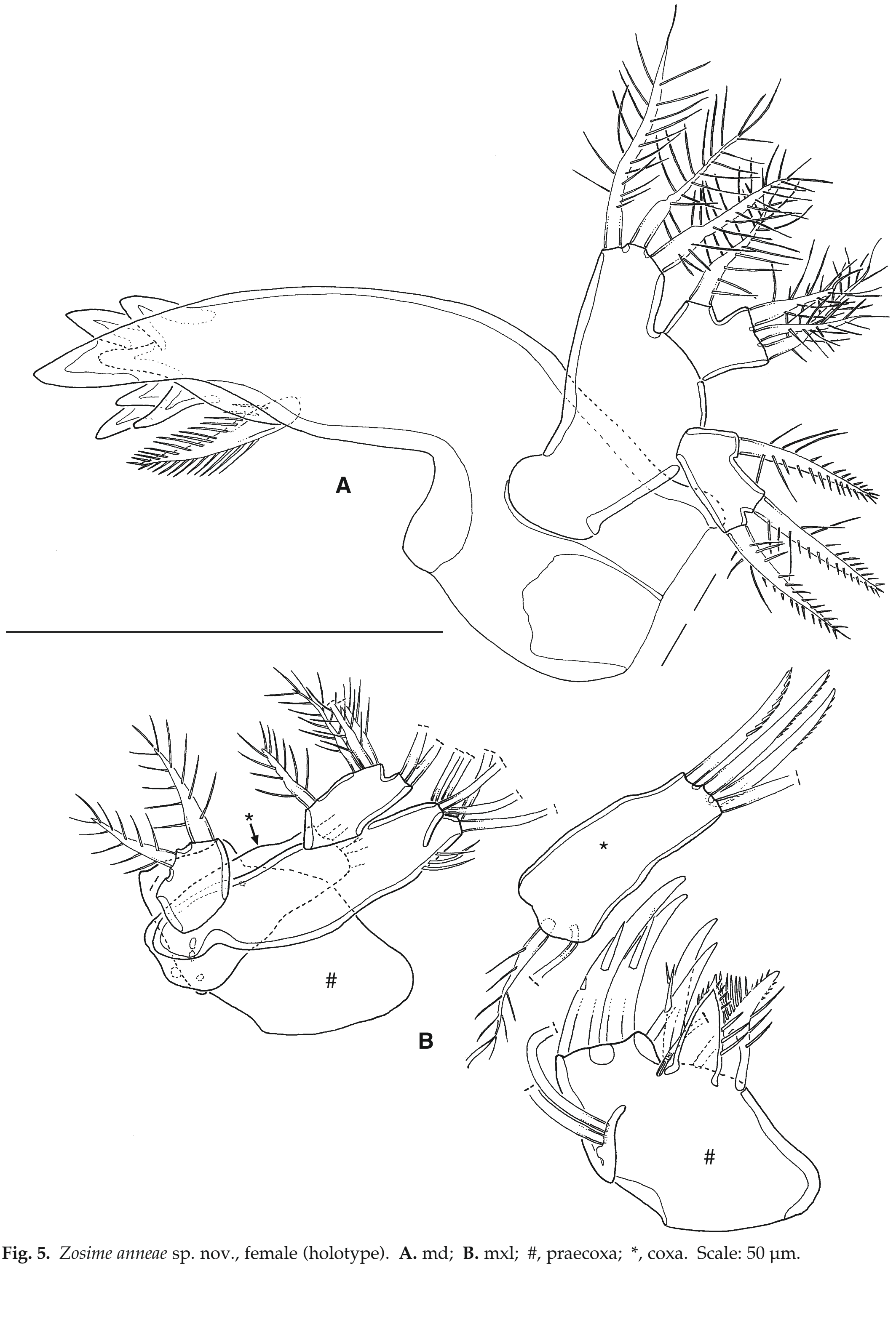

Fig. 5. *Zosime anneae* sp. nov., female (holotype). **A.** md; **B.** mxl; #, praecoxa; *, coxa. Scale: 50 µm.

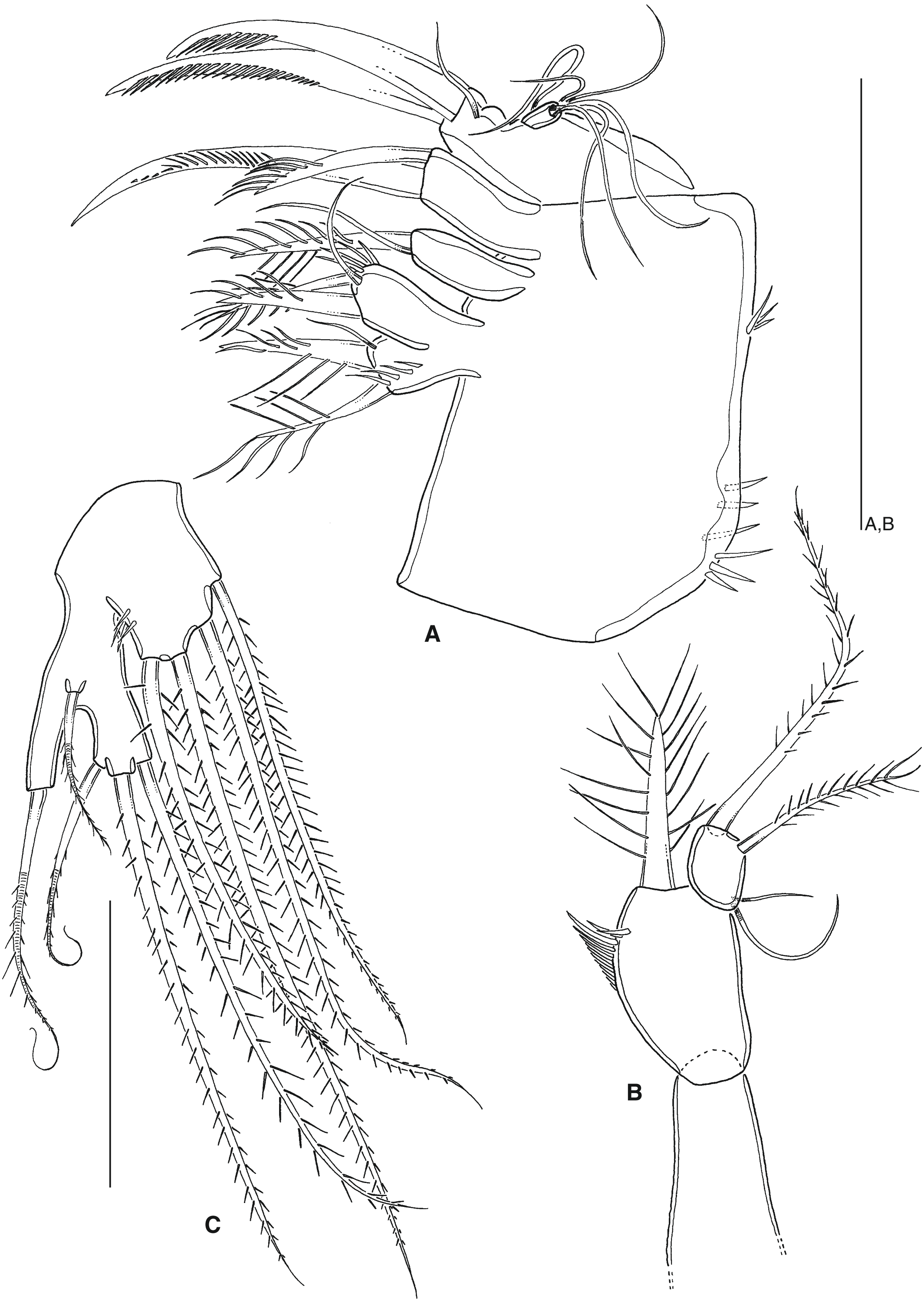

Fig. 6. *Zosime anneae* sp. nov., female. **A.** mx (holotype); **B.** mxp (paratype 5); **C.** P5 (paratype 3). Scales: 50 µm.

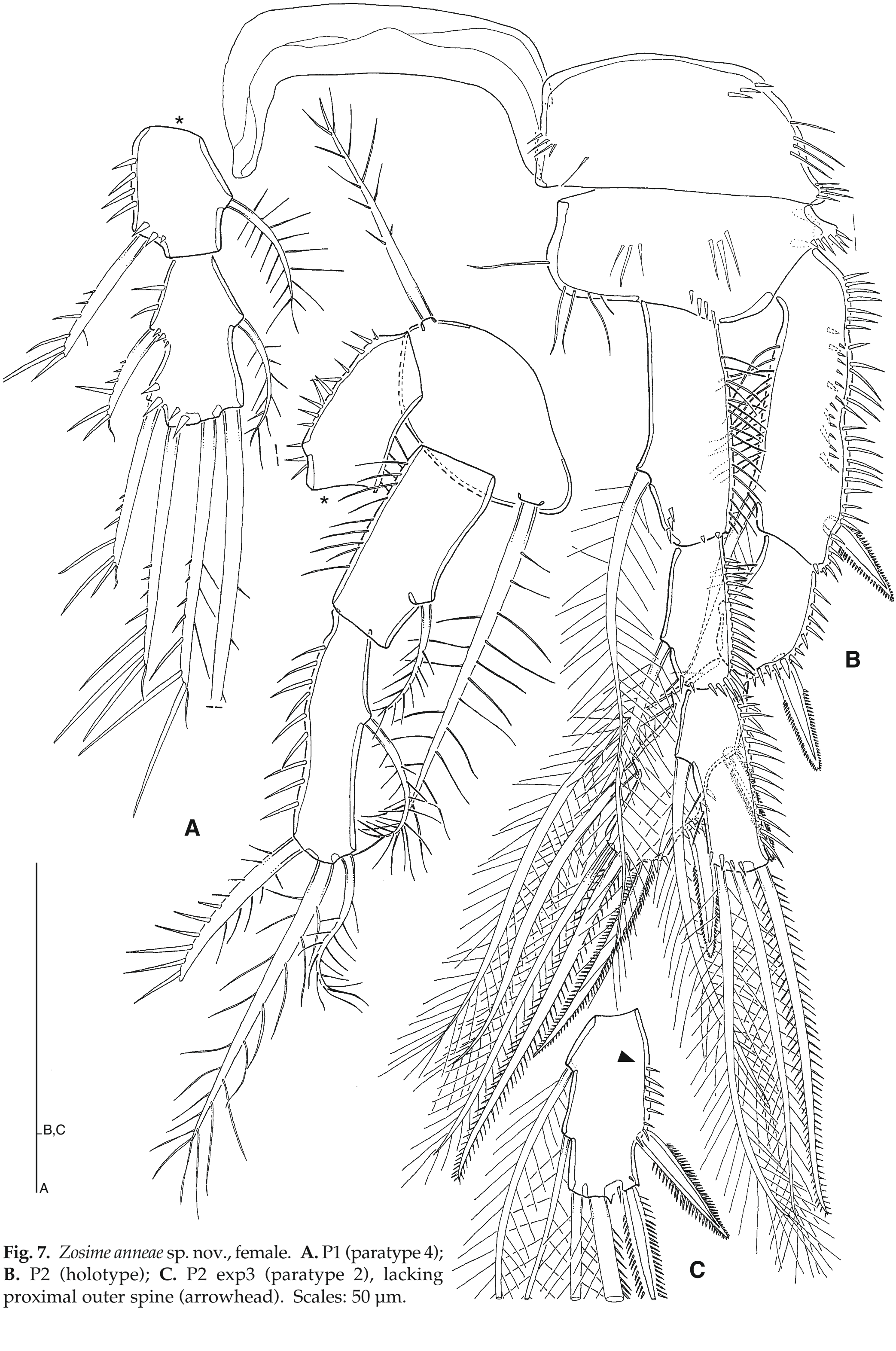

Fig. 7. *Zosime anneae* sp. nov., female. **A.** P1 (paratype 4); **B.** P2 (holotype); **C.** P2 exp3 (paratype 2), lacking proximal outer spine (arrowhead). Scales: 50 µm.

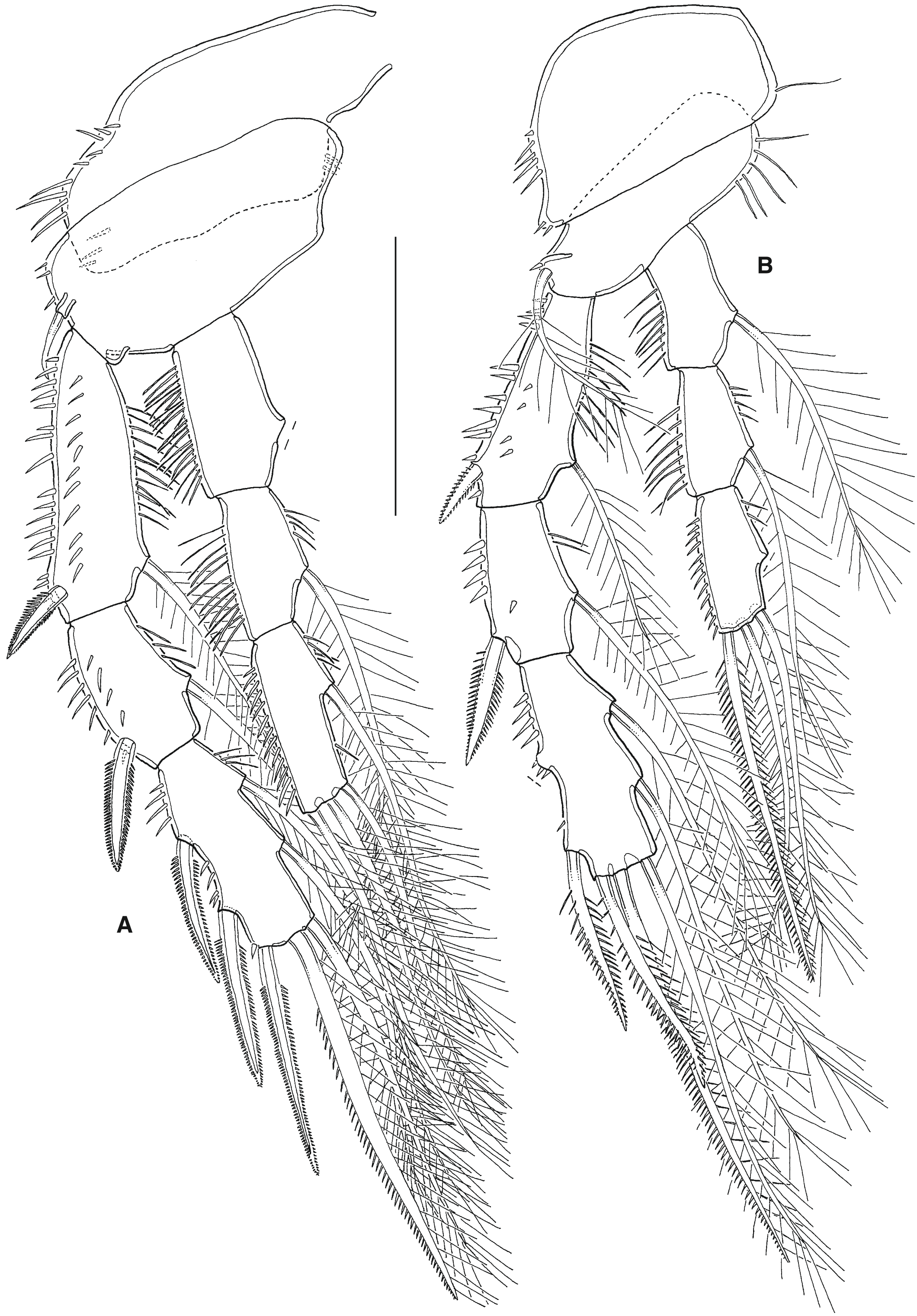

Fig. 8. *Zosime anneae* sp. nov., female (holotype). **A.** P3; **B.** P4. Scale: 50 µm.

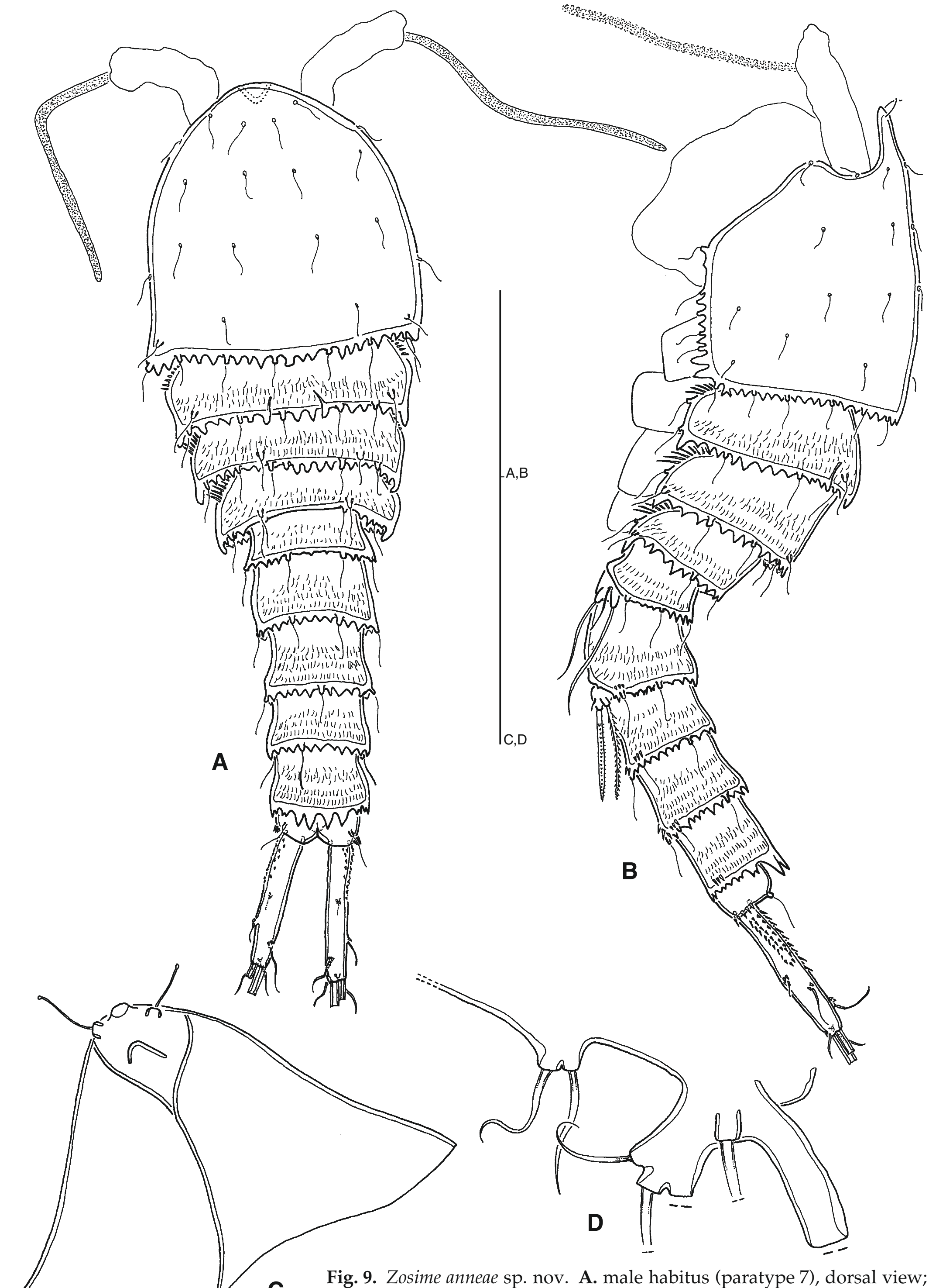

Fig. 9. *Zosime anneae* sp. nov. **A.** male habitus (paratype 7), dorsal view; **B.** male habitus (paratype 6), lateral view; **C.** male rostrum (allotype), ventral view; **D.** male P5 (paratype 9). Scales: A,B, 100 µm; C,D, 50 µm.

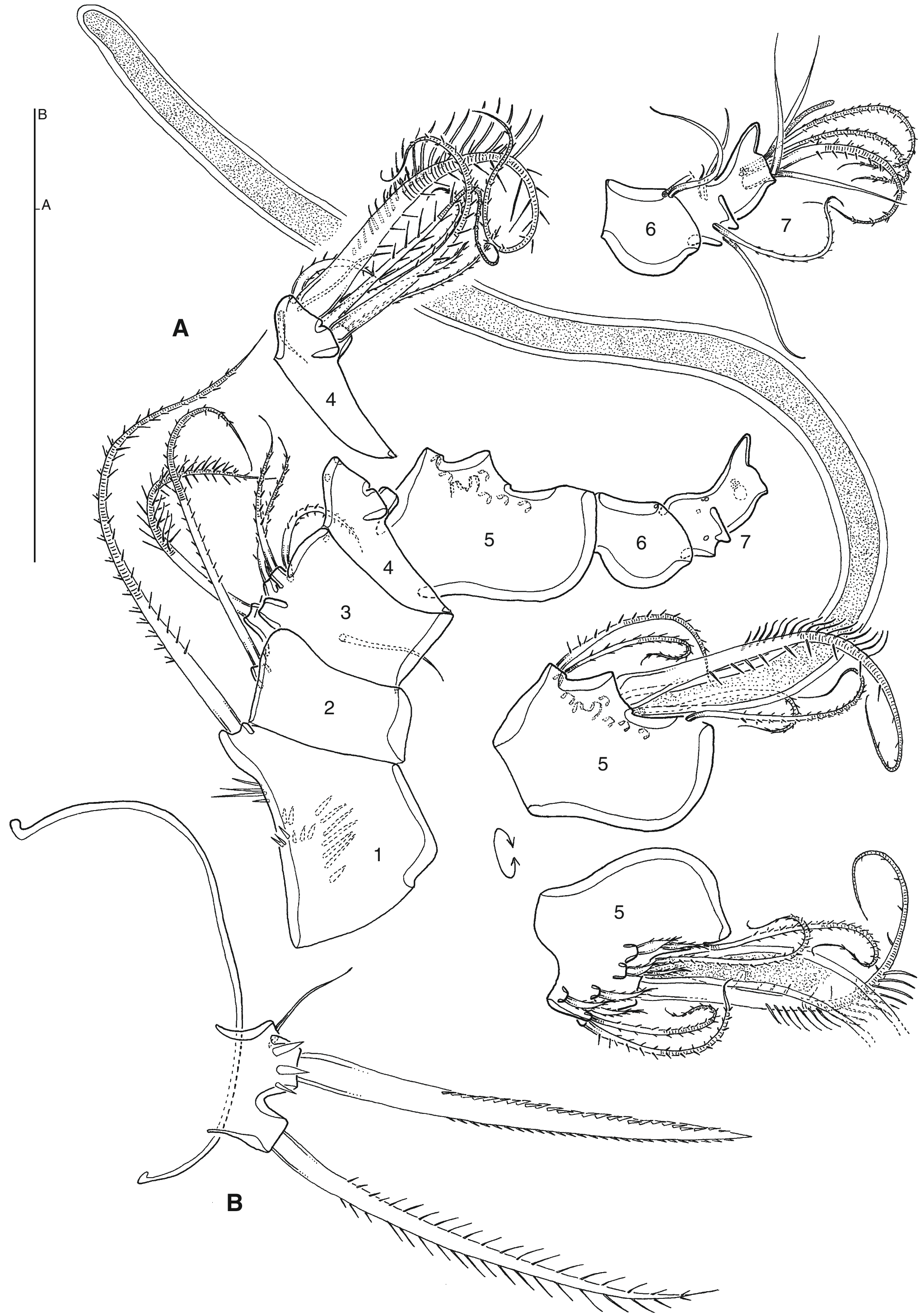

Fig. 10. *Zosime anneae* sp. nov., male. **A.** A1 (allotype), showing the segmentation (segments 1–7) and their respective ornamentation; **B.** P6 (paratype 9). Scales: 50 µm.

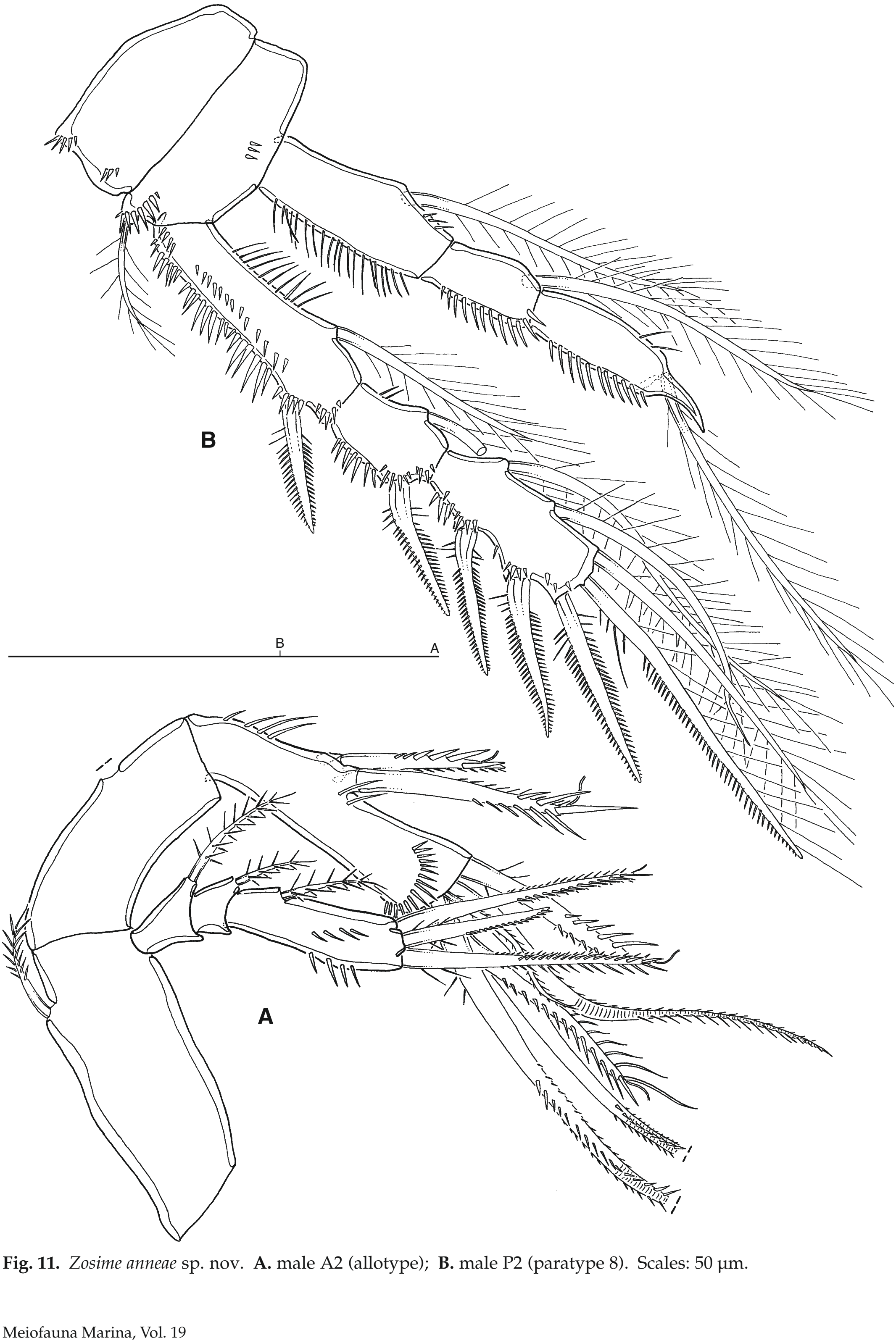

Fig. 11. *Zosime anneae* sp. nov. **A.** male A2 (allotype); **B.** male P2 (paratype 8). Scales: 50 µm.

P5 (Fig. 6C) exp fused with benp. Endopodal lobe with 4 long bipinnate setae. Exp with 4 setae, one of which displaced to the base of the outer basal seta, the remaining ones inserting apically; the outermost apical seta rat-tailed and smaller than the others. Outer basal seta implanted on a long setophore.

GF (Fig. 3B) large and strongly sclerotized. P6 fused and forming single plate carrying 3 fine setae on each side.

Description of the male. The male resembles the female in most characteristics, except for the following features that are described below:

Habitus (Figs. 9A,B) more slender and with different sensillar pattern on cephalothoracic shield.

A1 (Fig. 10A) subchirocer, 7-segmented. Most, but not all setae with rat-tail endings. First segment with several spinules and 1 seta. Second segment also bearing 1 seta. Third segment with 7 setae (2 broken), fourth segment with 9 setae. Fifth segment with 1 large aes and 12 setae. Sixth segment with 2 slender setae, seventh segment with 1 small aes and 10 setae, with blunt apical process.

Armature formula: 1−1; 2−1; 3−7; 4−9; 5−12+aes; 6−2; 7−10+aes.

A2 (Fig. 11A) with basis and 3-segmented exp. Basis with 1 short abexopodal seta. Exps 1 and 2 each with 1 lateral seta, exp3 with 1 lateral and 3 apical setae. Enp 2-segmented, enp1 with 1 seta (broken), enp2 with 2 lateral spines, apically with 1 spine and 5 setae. Additionally with spinules alongside and in a distally located half circle.

P2 (Fig. 11B) enp3 sexually dimorphic, bearing only 1 apical seta and apically a curved, smooth, hook-shaped apophysis.

P5 (Fig. 9D) remarkably smaller than in female; exp fused with benp, slightly longer than broad, apical setae smaller than in female (outer seta broken). Endopodal lobe weakly developed, with 2 small, smooth setae. Exp with 3 setae (1 broken). Outer basal seta (broken) arising from long setophore, accompanied by 1 seta inserted on a small elevation.

P6 (Fig. 10B) protruded and armed with 3 spinules, bearing 2 long bipinnate setae and 1 inner, dwarfed, fine seta.

Remarks on the distribution of the genus *Zosime* on the Great Meteor Seamount. Of all 6126 harpacticoid copepods collected at the GMS (George & Schminke 2002), 475 (7.75 %) belong to Zosimeidae (formerly assigned to Tisbidae Stebbing, 1910). At the GMS, the taxon is represented by 12 species, all belonging to the single genus *Zosime*. Only one species, namely *Zosime bergensis* Drzycimski, 1968 is also known from other locations (west coast of Norway [Drzycimski 1968], Porcupine Seabight [Gheerardyn et al. 2009]), all remaining 11 species are new to science.

Of the 19 analysed stations, 14 contain Zosimeidae (Fig. 1). *Z. anneae* sp. nov. is by numbers the most frequent zosimeid of the GMS, being present at 12 stations and distributed over the three topographical regions at the GMS (cf. Ulrich 1971): plateau (7 of 8 plateau stations), slope (3 of 4 slope stations), and the rise (all stations; Fig. 1). The new species shows a plateau-wide dispersal but is missing at station 455 (297 m). All stations combined, 161 adult specimens were found, including 93 females (58 %) and 68 males (42 %). The other 314 zosimeids sampled at GMS show a comparable sex ratio with 188 females (60 %) and 126 males (40 %). The bulk of these 314 zosimeids is represented by four species (including the known species *Z. bergensis*), which make up for 94 % of the 314 individuals (295 individuals). These four species show a similar distribution as *Z. anneae* sp. nov and were also found in all topographical regions of GMS (excluding one species, which was absent on the slope). The remaining 6 % (19 individuals) are represented by seven species, all unknown. Five species are present as singletons, and two species are represented by seven individuals each, with one species also occurring in all regions and the other only missing at the rise. Summarizing, six of twelve zosimeid species (representing 463 individuals or 97.5 %) were present on the plateau (292–325 m) and at the rise (4015 m). Within the different regions, no distinct distributional pattern can be recognized.

Due to sampling difficulties (Pfannkuche et al. 2000), there are no samples from the western and south-western slopes of GMS (Fig. 1). However, samples from the north-eastern (St. 519), eastern (St. 551) and south-eastern (St. 564) side of the slope yielded specimens of *Z. anneae* sp. nov. Below 3000 m, 4 stations were sampled during M42/3 (Pfannkuche et al. 2000). Two stations are located in the Northeast (Sts. 505, 506), and two in the Southwest (Sts. 484, 566), respectively (Fig. 1). Only the south-western stations provided Zosimeidae, including *Z. anneae* sp. nov.

Discussion

Phylogenetic remarks. The taxon Zosimeidae Seifried, 2003 (erected by Seifried [2003] as "Zosimidae", cf. above "Material & Methods"), encloses three genera: the type genus *Zosime*, including 14 so far described species (Tab. 2), and the genera *Peresime* (2 species) and *Pseudozosime* (monotypic). That author provided the following 19 autapomorphies for Zosimeidae, compared with its adelphotaxon Idyanthidae Lang, 1944, which clearly support the monophyly of Zosimeidae [plesiomorphies in square brackets]:

1 Loss of subterminal seta 4 at A2 enp2 [subterminal seta 4 present];
2 Distal border of A2 enp2 not bevelled [border clearly bevelled];
3 Basal setae of md inserting on a bulge of inner border [no bulge developed];
4 Md enp with 1 lateral seta [with at least 2 setae];
5 Md enp with 3 apical setae [with 7 setae];
6 Md exp 1-segmented, with 3 lateral and 1 apical seta [2-segmented, with 4 lateral, and 2 apical setae];
7 Mxl: 2 terminal spines (VII + VIII) lacking [both spines present];

Table 2. List of known *Zosime* species including sampling localities and authors.

Species	Sampling locality/ies	Depth(s) [m]	Reference(s)
Zosime anneae sp. nov.	Great Meteor Seamount (Atlantic Ocean)	292–4015	Present contribution
Z. atlantica Bodin, 1968	Gulf of Gascogne (France, Atlantic Ocean)	1200	Bodin 1968
Z. bathyalis Por, 1967	Gulf of Elat (Israel, Red Sea)	180–700	Por 1967
Z. bergensis Drzycimski, 1968	Korsfjord, Raunefjord (Norway, Atlantic Ocean); Porcupine Seabight (Atlantic Ocean)	155–512	Drzycimski 1968, Gheerardyn et al. 2009
Z. erythraea Por, 1967	Gulf of Elat (Israel, Red Sea)	180–190	Por 1967
Z. gisleni Lang, 1948	Gullmarfjord (Sweden, Atlantic Ocean); Gulf of Elat (Israel, Red Sea); Kattegat (Germany, Baltic Sea)	20–300	Lang 1948, Por 1967, Arlt 1983
Z. incrassata Sars, 1910 (Bodin [1968] described *Z. bathybia* that was later on translocated into *Z. incrassata* by Apostolov & Petkovski [1980] as *Z. i. bathybia* Bodin, 1968)	Lyngdal Fjord, Bergen (Norway, Atlantic Ocean); Gullmarfjord (Sweden, Atlantic Ocean); off North Carolina (USA, Atlantic Ocean); Gulf of Gascogne (France, Atlantic Ocean); Kvarneric (Croatia, Adriatic Sea)	40–3940	Sars 1910, Lang 1948, Por 1964, Bodin 1968, Drzycimski 1969, Coull 1973, Apostolov & Petkovski 1980,
Z. major Sars, 1919	Korshaven, Risør (Norway, Atlantic Ocean), Gullmarfjord (Sweden, Atlantic Ocean)	20–92	Sars 1921, Lang 1948
Z. mediterranea Lang, 1948	Castiglione (Algeria, Mediterranean Sea)	Littoral	Lang 1948
Z. pacifica Fiers, 1991	Santa Maria Basin, California (USA, Pacific Ocean), Porcupine Seabight (Atlantic Ocean)	50–565	Fiers 1991, Gheerardyn et al. 2009
Z. paramajor Bodin, 1968	Gulf of Gascogne (France, Atlantic Ocean), off North Carolina (USA, Atlantic Ocean), Porcupine Seabight (Atlantic Ocean)	900–3000	Bodin 1968, Coull 1973, Gheerardyn et al. 2009
Z. paratypica Becker & Schriever, 1979	Iberian deep sea (Atlantic Ocean)	3920	Becker & Schriever 1979
Z. reyssi Dinet, 1974	Cape Basin (Southeast Atlantic Ocean)	3694	Dinet 1974
Z. typica Boeck, 1872	Oslo Fjord, Farsund, Risør (Norway, Atlantic Ocean), Gullmarfjord (Sweden, Atlantic Ocean)	29–70	Boeck 1872, Sars 1910, Lang 1948
Z. valida Sars, 1919 (described by Brady [1880] as *Z. typica*, but transferred subsequently into *Z. valida* by Sars [1919])	North Sea/Atlantic Ocean (UK, Norway, Sweden); Baltic Sea (Germany, Sweden); Eastern Mediterranean Sea (Israel), White Sea (Russia)	20–100	Brady 1880, Sars 1919, Lang 1948 for more distribution data, Por 1964, Kornev & Chertoprud 2008

8 Mxl: exp small [exp. At least as long as enp];
9 Mx: proximal endites displaced distally [endites on original proximal position];
10 Mx enp 1-segmented [3-segmented];
11 Mxp with syncoxa reduced, almost square in size [syncoxa elongate];
12 Mxp without join between syncoxa and basis [joint present];
13 Mxp without join between basis and enp [joint present];
14 Mxp: enp1 lost, thus only 1-segmented [enp1 present, i.e. enp 2-segmented];
15 P1 enp1 almost square [enp1 elongate];
16 P1 enp2 longer than enp1, resulting from fusion of former enp2 and enp3 [enp2 and enp3 distinct, altogether being shorter than enp1];
17 P5 outer basal seta arising from long setophore [seta arising from small protrusion only];
18 P5 female with strong incision between benp and exp [no incision developed];
19 P5 exp of male very small [shape of P5 exp of male like in female].

As *Zosime anneae* sp. nov. shows all 19 apomorphies, its assignment to Zosimeidae is doubtless. From a diagnostic point of view, the allocation of a new zosimeid species into one of the three genera seems unproblematic. It depends on the number of P2–P4 endopodal segments that is different in the three genera (Tab. 3). In that context, the tentative allocation of *Z. anneae* sp. nov. to *Zosime* is diagnostically justified. However, no autapomorphy could be detected yet for that genus. Some observed derived features nonetheless await manifestation for all *Zosime* species. For instance, the P5 exp in almost all *Zosime* species presents the outermost exopodal seta arising from a (more or less strong evolved) protrusion that becomes displaced towards the exopodal surface but is absent in the remaining zosimeid genera. However, *Z. reyssi* lacks that derived condition (Dinet 1974). The same applies to the length of the furcal rami. While *Peresime* and *Pseudozosime* show furcal rami of almost square size, the FR of *Zosime* species are at least twice as long as broad. Nevertheless, this is not true neither for *Z. incrassata* Sars, 1910 nor for *Z. reyssi*, both sharing the almost square FR with above mentioned *Peresime* and *Pseudozosime*. Thus, all so far recognized possible autapomorphies of *Zosime* show incongruent conditions. Comparison of *Z. anneae* sp. nov. with remaining *Zosime* species provides more phylogenetic confusion. The new species presents an 8-segmented female A1 that presumably is the most primitive condition of all known Zosimeidae and supposed to be the zosimeid groundpattern (Seifried 2003), as all remaining representatives of the family show a 6–7-segmented A1. Thus, the new species may represent a relatively primitive taxon inside *Zosime* and even inside Zosimeidae. This is, however, contradicted if looking at the P5: *Z. anneae* sp. nov. shows a fusion of benp and exp in both sexes, being here regarded as derived and shared with all other representatives of the genus except *Z. incrassata* and *Z. incrassata bathybia* Bodin, 1968, which retain the plesiomorphic distinction between benp and exp.

Table 3. Number of endopodal segments in P2-P4 in Zosimeidae.

Genus	P2 enp	P3 enp	P4 enp
Peresime	3	2	2
Pseudozosime	2	2	2
Zosime	3	3	3

An outstanding extensive phylogenetic analysis may clear up the phylogenetic status of *Zosime*. Such analysis certainly requires comparison not with the descriptions provided in the literature but with the type material of most species; it cannot be achieved in the present contribution. Nevertheless, *Z. anneae* sp. nov. may perhaps yield some unique characters at the FR as true apomorphies for the species, although they cannot be proven for all *Zosime* species due to inadequate descriptions [plesiomorphies in square brackets]:

20 Furcal setae I and II set widely apart from each other, due to FR elongation [setae I and II standing much closer together]
21 Furcal seta I minute, reaching the size of a fine setule [seta I as long as or slightly smaller than seta II]
22 Furcal seta I displaced ventrally, inserting at the middle of the FR [seta inserting laterally/ lateroventrally at distal half of FR]
23 Furcal seta II dwarfed, not even reaching the end of FR [seta II at least reaching end of FR]
24 Furcal seta VII dwarfed, very slender [seta VII much longer]

In particular the FR seems to be object of some phylogenetic derivation. Furcal elongation [20] is generally considered rather a derived than a primitive feature, as observable generally in Copepoda (Huys & Boxshall 1991) and Harpacticoida (Lang 1948). The furcal setae I and II are commonly located closely together, being I slightly smaller than and located ventral to II (Huys & Boxshall 1991). Thus, the remarkable size reduction and displacement of seta I compared to II [21; 22] displays a derived, i.e. apomorphic condition inside *Zosime*. The same applies to setae II and VII in comparison with the remaining species of that genus [23; 24].

Geographic and bathymetric distribution of *Zosime*. The taxon *Zosime* shows a wide geographical distribution, with most reports from the boreal and northern cold-temperate Atlantic (Table 2). Findings from the Baltic Sea (Lang 1948, Arlt 1983), the Mediterranean (Lang 1948), the Magellan Region (George & Schminke 1999), the South China Sea (Chertoprud et al. 2009), the South-eastern Atlantic (Dinet 1974), and the Pacific (Fiers 1991) point to a distribution range that may even be cosmopolitan; the present report of *Z. anneae* sp. nov. from the subtropical Atlantic as well as recent findings of seven new species from the Angola basin (Seifried pers. comm.) and nine new species from the Pacific Clarion-Clipperton Fracture Zone (Mahatma pers. comm.) support such an assumption and demonstrate that the low number of known *Zosime* species is rather due to lack of sampling than reflecting the rarity of this taxon. An indication for wide distribution ranges even at the species level is observable for e.g. *Z. gisleni*, which has been found in the North Sea, the Baltic, and the Mediterranean (Table 2); for *Z. incrassata*, reported from both Eastern and Western North Atlantic and the Adriatic Sea, and for *Z. valida* from the North-eastern Atlantic, the Baltic Sea, and the Mediterranean (Table 2).

The distribution of *Z. anneae* sp. nov. at the Great Meteor Seamount extends from the plateau along the slope down to the rise. As the depth range between plateau and rise is about 4000 m, *Z. anneae* sp. nov. is considered to be eurybathic. As there are differences in sediment structure, sediment composition, pore size, oxygen concentration, salinity, and temperature between the plateau and the rise (see Pfannkuche et al. 2000), the present species may also be eurytopic, being able to adapt to quite different environmental conditions.

Acknowledgments

The authors are indebted to two anonymous reviewers for constructive and helpful comments on the manuscript. Prof. Dr. M. Türkay (Frankfurt, Germany) made valuable comments and indications on nomenclatoric aspects.

References

Apostolov, A. & T. P. Petkovski 1980. Copépodes Harpacticoïdes de la mer Adriatique (Région de Rovigne). Acta Zoologica Bulgarica 15: 24–35

Arlt, G. 1983. Taxonomy and ecology of some harpacticoids (Crustacea, Copepoda) in the Baltic Sea and Kattegat. Zoologische Jahrbücher, Abteilung für Systematik 110 (1): 45–85

Becker, K. H. & G. Schriever 1979. Eidonomie und Taxonomie abyssaler Harpacticoida (Crustacea, Copepoda) Teil III. 13 neue Tiefsee-Copepoda Harpacticoidea der Familien Canuellidae, Cerviniidae, Tisbidae, Thalestridae, Diosaccidae und Ameiridae. "Meteor" Forschungs-Ergebnisse D 31: 38–62

Bodin, P 1968. Copépodes Harpacticoides des étages bathyal et abyssal du Golfe de Gascogne. Mémoires du Muséum National d'Histoire Naturelle A 55 (1): 1–107

Boeck, A. 1872. Nye Slægter og Arter af Saltvands-Copepoder. Forhandlinger i Videnskabsselskabet i Kristiana (Oslo) 14: 35–60

Brady G. S. 1880. A monograph of the free and semi-parasitic Copepoda of the British Islands 2. The Ray Society, London, 182 pp.

Chertoprud, E. S., S. Gómez & H. Gheerardyn 2009. Harpacticoida (Copepoda) Fauna and the Taxocene Diversity of the South China Sea. Oceanology 49: 488–198

Coull, B. C. 1973. Meiobenthic Harpacticoida (Crustacea, Copepoda) from the deep sea off North Carolina III. The families Tisbidae Stebbing emend. Lang, Thalestridae Sars emend. Lang, and Diosaccidae Sars. Transactions of the American Microscopical Society 92 (4): 592–603

Dietrich, G. 1939. Some Morphological Results of the Cruise of the "METEOR" January to May 1838. International Hydrographic Review 16 (2): 52–55

Dinet, A. 1974. Espèces nouvelles de Copépodes Harpacticoïdes (Crustacea) des sédiments profonds de la dorsale de Walvis. Arch. Zool. exp. gén. 115: 549–577

Drzycimski, I. 1968. Neue Harpacticoida (Copepoda) aus dem westnorwegischen Küstengebiet. Sarsia 31: 15–24

Ehrich, S. 1977. Die Fischfauna der Großen Meteorbank. "Meteor" Forschungs-Ergebnisse D 25: 1–23

Emschermann, P. 1971. *Loxomespilon perezi* – ein Enteroproctenfund im Mittelatlantik. Überlegungen zur Benthosbesiedlung der Großen Meteorbank. Marine Biology 9: 51–62

Fiers, F. 1991. Three new harpacticoid copepods from the Santa Maria Basin off the Californian Pacific

Coast (Copepoda, Harpacticoida). Beaufortia 42 (2): 13–47

Gad, G. 2009. Colonisation and speciation on seamounts, evidence from Draconematidae (Nematoda) of the Great Meteor Seamount. Marine Biodiversity 39: 57–69

George, K. H. 2004. Description of two new species of *Bodinia*, a new genus incertae sedis in Argestidae Por, 1986 (Copepoda, Harpacticoida), with reflections on argestid colonization of the Great Meteor Seamount plateau. Organisms, Diversity & Evolution 4 (4): 241–254

George, K. H. & H. K. Schminke 1999. Sublittoral Harpacticoida (Crustacea, Copepoda) from the Magellan Straits and the Beagle Channel (Chile). Preliminary results of abundances and generic diversity. Scientia Marina 63 (Suppl. 1): 133–137

— 2002. Harpacticoida (Crustacea, Copepoda) of the Great Meteor Seamount, with first conclusions as to the origin of the plateau fauna. Marine Biology 141: 887–895

Gheerardyn, H., M. De Troch, M. Vincx & A. Vanreusel 2009. Harpacticoida (Crustacea: Copepoda) associated with cold-water coral substrates in the Porcupine Seabight (NE Atlantic): species composition, diversity and reflections on the origin of the fauna. Scientia Marina 73: 747–760

Grevemeyer, I. 1994. Der Atlantis-Meteor Seamount Komplex. PhD thesis, Zentrum für Meeres- und Klimaforschung der Universität Hamburg, Institut für Geophysik, 126 pp.

Hempel, G. 1968. Biologische Arbeiten auf den Atlantischen Kuppenfahrten 1967 von FS “Meteor”. Naturwissenschaftliche Rundschau 21: 108–113

Hempel, G. & W. Nellen 1972. Bericht über den Verlauf der Roßbreiten-Expedition 1970. “Meteor” Forschungs-Ergebnisse A 10: 51–78

Hicks, G. R. F. & B. C. Coull 1983. The ecology of marine meiobenthic harpacticoid copepods. Oceanography and Marine Biology, Annual Review 21: 67–175

Hinz, K. 1969. The Great Meteor Seamount. Results of seismic reflection measurements with a pneumatic sound source and their geological interpretation. “Meteor” Forschungs-Ergebnisse C 2: 63–77

Huys, R. 2009. Unresolved cases of type fixation, synonymy and homonymy in harpacticoid copepod nomenclature (Crustacea: Copepoda). Zootaxa 2183: 1–99

Huys, R. & G. A. Boxshall 1991. Copepod Evolution. The Ray Society, London, 468 pp.

Huys, R. & P. F. Clark 2009. Case 3467. Zosimidae Seifried, 2003 (Crustacea, Copepoda, Harpacticoida): proposed emendation of spelling to Zosimeidae to remove homonymy with Zosiminae Alcock, 1898 (Crustacea, Decapoda, Xanthidae). Bulletin of Zoological Nomenclature 66: 24–29

Kornev, P. N. & E. S. Chertoprud 2008. Harpacticoid Copepods of the White Sea: Morphology, Systematics, Ecology. KMK Scientific Press Ltd., Moscow, 379 pp.

Lang, K. 1948. Monographie der Harpacticiden. Otto Koeltz Science Publishers, Königstein, 1682 pp.

Mironov, A. N. & E. N. Krylova 2006. Origin of the fauna of the Meteor Seamounts, north-east Atlantic. In: Mironov, A. N., Gebruk, A. V., Southward, A. J. (eds.). Biogeography of the North Atlantic Seamounts. KMK Scientific Press, Moscow: 22–57

Pasenau, H. 1971. Morphometrische Untersuchungen an Hangterrassen der Großen Meteorbank. Meteor Forschungs-Ergebnisse C 6: 69–82

Pfannkuche, O., T. J. Müller, W. Nellen & G. Wefer 2000 (eds.). Ostatlantik 1998, Cruise No. 42, 16 June – 26 October 1998. Meteor-Berichte, Universität Hamburg, 00-1, 259 pp.

Plum, C. & K. H. George 2009. The paramesochrid fauna of the Great Meteor Seamount (Northeast Atlantic) including the description of a new species of *Scottopsyllus (Intermedopsyllus)* Kunz (Copepoda: Harpacticoida: Paramesochridae). Marine Biodiversity 39: 265–289

Por, F. D. 1964. A study of Levantine and Pontic Harpacticoida (Crustacea, Copepoda). Zoologische Verhandelingen 64: 1–128

— 1967. Level bottom Harpacticoida (Crustacea, Copepoda) from Elat (Red Sea), Part I. Israel Journal of Zoology 16: 101–165

Pratt, R. M. 1962. Great Meteor Seamount. Deep-Sea Research 10, 17–25

v. Rad, U. 1974. Great Meteor and Josephine Seamounts (eastern North Atlantic): Composition and origin of bioclastic sands, carbonate and pyroclastic rocks. Meteor Forschungs-Ergebnisse C 19: 1–61

Sars, G. O. 1910. Copepoda Harpacticoida. Parts XXIX & XXX. Tachidiidae (concluded), Metidae, Balaenophilidae, supplement (part). An account of the Crustacea of Norway, with short descriptions and figures of all the species V: 337–368

— 1919. Copepoda Supplement. Parts I & II. Calanoida, Harpacticoida (part). An account of the Crustacea of Norway, with short descriptions and figures of all the species VII: 1–24

— 1921. Copepoda Supplement. Parts IX & X. Harpacticoida (concluded), Cyclopoida. An account of the Crustacea of Norway, with short descriptions and figures of all the species VII: 93–121

Seifried, S. 2003. Phylogeny of Harpacticoida (Copepoda): Revision of “Maxillipedasphalea” and Exanechentera. Cuvillier Verlag Göttingen, 259 pp.

v. Stackelberg, U., U. v. Rad & B. Zobel 1979. Asymmetric sedimentation around Great Meteor Seamount (North Atlantic). Marine Geology 33: 117–132

Thiel, H. 1970. Bericht über die Benthosuntersuchungen während der “Atlantischen Kuppenfahrten 1967” von F.S. “Meteor”. “Meteor” Forschungs-Ergebnisse D 7: 23–42

Ulrich, J. 1971. Zur Topographie und Morphologie der Großen Meteorbank. “Meteor” Forschungs-Ergebnisse C 6: 48–68