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Two new neritacean limpets (Gastropoda: Prosobranchia: Neritacea: Phenacolepadidae) from active hydrothermal vents at Hydrothermal Field 1 "Wienerwald" in the Manus Back-Arc Basin (Bismarck Sea, Papua-New Guinea)

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(With 3 Tables, 5 Figures and 7 Plates)

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Zusammenfassung

Zwei neue Gastropodenarten werden von hydrothermalen Quellen am Spreizungsrücken im Manus Back-Arc Basin (Bismarck-See, Papua-Neuguinea) beschrieben und die Morphologie ihrer Schale, des Weichkörpers und der Radula verglichen mit *Shinkailepas kaikatensis* OKUTANI & al., 1989 und der Gattung *Phenacolepas.* Beide neue Arten stimmen in folgenden Merkmalen mit *Phenacolepas* überein: Die Schalenform und -skulptur ist sehr ähnlich; die Calcitschicht der Schale fehlt; das Schalenwachstum ändert sich abrupt vom gewundenen Protoconch zur napfförmigen Schale; die cuticularisierten Seitenbereiche der Fußsohle sind ableitbar von Randflächen der Fußsohle von *Phenacolepas;* die Fortpflanzungsorgane sind sehr ähnlich: bei Männchen ist der rechte Kopflappen zu einem Penis umgeformt, bei Weibchen sind u. a. ein Gonoporus und eine Vaginal-Öffnung mit anschließender Spermatophorentasche zu finden. Die Variabilität der Radulamerkmale innerhalb der Gattung *Phenacolepas* umfaßt auch die beiden neuen Arten. Die morphologischen Ergebnisse sprechen deshalb für eine Einordnung in die Phenacolepadidae PILSBRY, 1895 und machen die Shinkailepadidae OKUTANI & al., 1989 überflüssig.

Summary

Two new gastropod species are described from hydrothermal vents at the Manus Back-Arc Basin. The morphology of their shell, the animal and the radula are compared with *Shinkailepas kaikatensis* OKUTANI & al., 1989 and with the genus *Phenacolepas.* The morphological evidence indicates the assignment to the Phenacolepadidae PILSBRY, 1895. Thus the Shinkailepadidae OKUTANI & al., 1989 become redundant.

Introduction

Recently, first reports of a gastropod fauna living on active hydrothermal vents in the West Pacific were published (e. g. Mariana Basin: OKUTANI 1988; OKUTANI & al., 1989; OKUTANI 1990; MCLEAN 1990; HESSLER & al., 1988; HESSLER & LONSDALE 1991; North Fiji-Basin: BOUCHET & WARÉN 1991; Manus Back-Arc

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Basin: BOTH & al., 1986, TUFAR 1990, TUFAR & JULLMANN 1991, BECK 1991, BECK 1992). They agree with numerous reports from the East Pacific Rise (21° N, 13° N), the Juan de Fuca Ridge, Galapagos Rift etc. (RONA & al., 1983; JONES 1985).

Most gastropods described were archaeogastropods, except for some mesogastropod taxa, e. g. *Provanna* spec. OKUTANI, 1990, WARÉN & PONDER, 1991, *Alviniconcha hessleri* OKUTANI & OHTA, 1988, *Olgaconcha tufari* BECK, 1991, *Ifremeria nautilei* BOUCHET & WARÉN, 1991 and some neogastropod buccinid and turrid whelks (WARÉN & BOUCHET 1989). Within the hydrothermal archaeogastropods a number of new families and even superfamilies were assigned (cf. MCLEAN 1981, 1988, 1989ab, 1990; MCLEAN & HASZPRUNAR 1987; WARÉN & BOUCHET 1989). Only a few new hydrothermal taxa could be definitely related to already known shallow or deep water families (e. g. *Homalopoma* OKUTANI & FUJIKURA, 1990 (Turbinidae); *Bathymargarites* WARÉN & BOUCHET, 1989 (Trochidae); Fissurellidae and Scissurellidae (MCLEAN 1989); Pyropeltidae (MCLEAN & HASZPRUNAR 1987) and Pseudococculinidae (MCLEAN 1991).

Recently, a member of the neritacean superfamily was described from hydrothermal vents at the Kaikatu Seamont (Ogasawara Isl. Japan): *Shinkailepas kaikatensis* OKUTANI & al., 1989, which is probably also present at Mariana Trough (HESSLER & LONSDALE 1991). OKUTANI established a new family Shinkailepadidae close to the Phenacolepadidae PILSBRY, 1895 which all have unusually cap-shaped shells. The two new forms described below are compared with *S. kaikatensis* and in part with the genus *Phenacolepas* PILSBRY, 1891 which has been studied anatomically by FRETTER (1984). In contrast to OKUTANI, *Shinkailepas* and *Olgasolaris* are assigned to the Phenacolepadidae.

This report is part of the results obtained by the German Research Cruise OLGA II i. e. **O**zeanische **L**agerstätten: **G**eologisch-Mineralogische **A**nalyse (Oceanic Deposits: Geological-Mineralogical Analysis) headed by Prof. Dr. W. TUFAR, Department of Geosciences, Philipps University Marburg (TUFAR 1990; TUFAR & JULLMANN 1991; BECK 1991, 1992).

Material and methods

All specimens were obtained by the German OLGA II project at the spreading center of the Manus Back-Arc Basin in May and June 1990. Four hydrothermal fields were discovered (TUFAR 1990). At Hydrothermal Field 1 "Wienerwald" ("Vienna Woods", see Fig. 1) samples could be taken with TV-controlled electrohydraulic grabs (GTVA, GTVD, Table 1). All specimens were collected from portions of active sulfide chimneys on board the German Research Vessel "Sonne", preserved in buffered formaldehyde and transferred to 70% ethanol later. In all 108 specimens of *Shinkailepas tufari* and 358 specimens of *Olgasolaris tollmanni* could be collected. Specimens from 56 GTVA were not well preserved and could not be used for anatomical observations. It is remarkable that well preserved specimens of *S. tufari* show translucent, milky shells; however,

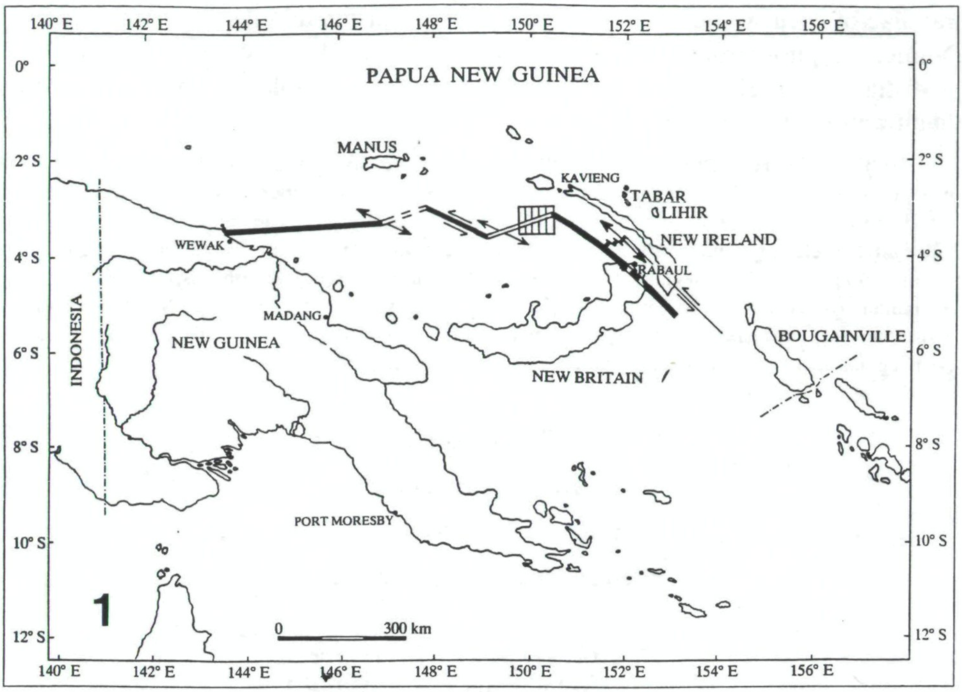

Fig. 1: Location map of Papua New Guinea and the Manus Back-Arc Basin; locus typicus of *Shinkailepas tufari* sp. n. and *Olgasolaris tollmanni* gen. n. et sp. n. at Hydrothermal Field 1, Wienerwald (Vienna Woods), 3° 9.8' S, 150° 16.7' E. Hatched region shows the area investigated during the German OLGA II Cruise (after TUFAR 1990).

when exposed to air for some minutes the ostracum changes to permanent opaque white.

10 specimens of each species were dissected for morphological studies. In addition, several specimens, including young stages, were critical point dried (via acetone and carbon dioxide) and then examined with an SEM (Hitachi S-530). 10

Table 1: Sampling position of *Shinkailepas tufari* sp. n. and *Olgasolaris tollmanni* gen. n. et sp. n. at Hydrothermal Field 1, "Wienerwald", Manus Back-Arc Basin

Station N°	latitude	longitude	water depth	Number
Shinkailepas tufari sp. n.				
25 GTVA	3°9.86′ S	150°16.79′ E	2489 m	11
42 GTVD	3°9.84′ S	150°16.78′ E	2505 m	22
56 GTVA	3°9.801′S	150°16.768′E	2450 m	75
Olgasolaris tollmanni gen. n. et sp. n.				
15 GTVA	3°9.88′ S	150°16.79′ E	2491 m	64
17 GTVA	3°9.861′S	150°16.777′E	2500 m	151
25 GTVA	3°9.86′ S	150°16.79′ E	2489 m	81
56 GTVA	3°9.801′S	150°16.768′E	2490 m	53
42 GTVA	8°9.84′ S	150°16.78′ E	2505 m	9

radulae of each species were studied with SEM at the middle third of the radula. Numerous photographs and video tapes taken by Prof. W. TUFAR during the investigation of Hydrothermal Field 1 were very valuable for considerations of habit and feeding biology.

Abbreviations. (a) anus, (ag) albumin gland, (ap) apex, (bg) buccal glands, (bm) buccal mass, (cg) capsule gland, (cl) cephalic lappet, (ctl) cutting line, (epp) epipodial papilla, (f) foot, (fg) foot gland opening, (g) gill, (go) gonopore, (gon) gonad, (h) heart, (ht) head tentacle, (i) intestine, (k) kidney, (lep) left epipodium, (m) mouth, (mc) mantle cavity, (mf) mantle fringe, (mg) midgut, (mp) mantle papilla, (mgg) midgut gland, (n) nucleus, (od) odontophore, (oe) oesophagus, (ol) oral lobe, (op) operculum, (ost) ostracum, (ov) ovary, (p) penis, (per) periostracum, (r) radula, (rep) right epipodium, (rs) radula sac, (sm) shell muscle, (sps) spermatophore sac, (st) stomach, (t) testis, (vc) vaginal canal, (vo) vaginal opening, (vp) visceral process, (vs) vesicula seminalis.

Taxonomy

Archaeogastropoda

Neritacea RAFINESQUE, 1815

Phenacolepadidae PILSBRY, 1895

Shinkailepas tufari sp. n.
(Pl. 1–3; Drawing Fig. 5, Table 2)

Description. In addition to the genus characters described by OKUTANI & al. (1989) the following characters define species status: Shell: cap-shaped with longish-oval outline of the aperture, outer surface light brown or whitish, apex at the posterior shell margin somewhat left of the center line and inclined to the right, mostly eroded; radial prominent ridges (up to 35) leading from apex to the shell margin; these have larger interspaces in the middle third of the shell surface (Pl. 1 Fig. 1), all interspaces showing several fine radial ridges in addition; concentric ridges indicate that shell growth occurs in intervals. Younger shells show this sculpture much more clearly; at points of intersection of prominent radial ridges and growth lines small prickles may exist. Shell growth starts without prominent ridges (see Pl. 1 Figs. 5, 6). The inner side of the shell has a posterior septum which fits into the interspace between the visceral mass (midgut gland) and the mantle skirt (Pl. 1 Fig. 2). The septum is on a level with the shell margin (cf. septum somewhat deeper in interior of shell and with a weakly arched rim posteriorly in *S. kaikatensis*). There are no radial threads on the septum as in *S. kaikatensis.* At the inner shell margin fine concentric lines exist which are caused by the texture of the ostracum; the periostracum is not overhanging as in *Olgasolaris* or brimlike as in *S. kaikatensis.* At the depression of the shell are larger and smaller pores (Pl. 1 Fig. 2; Pl. 2 Fig. 4), which correspond to the mantle papilla (Pl. 2 Fig. 1). With the naked eye, nacre is not recognizable, however, SEM shots show that a thin nacreous layer is present at the deep interior of the shell and particularly at the septum (Pl. 2 Fig. 4). The two reniform scars of shell muscles have a shining surface.

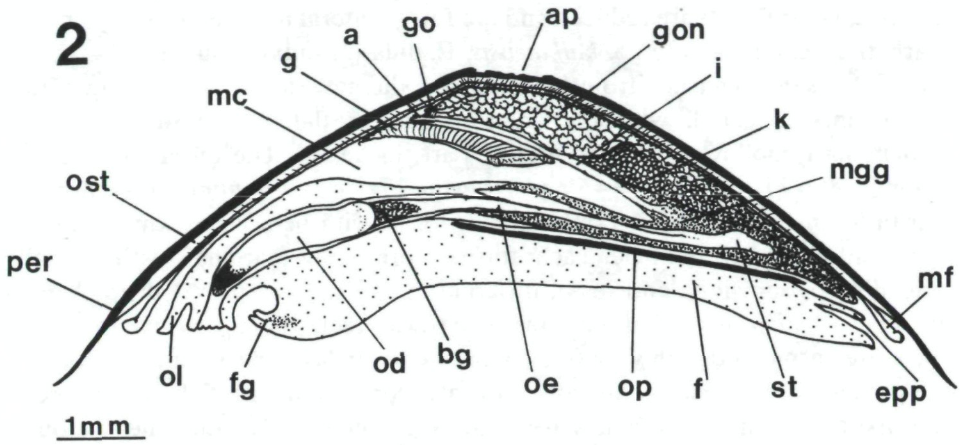

Fig. 2: *Olgasolaris tollmanni* gen. n. et sp. n. (longitudinal section, schematic, abbreviations see Material and Methods).

The grey and blackish protoconch is closely coiled several times (at least twice) in a nearly planispiral way; its general shape is comparable with that of adult shells of *Nerita;* protoconch diameter about 0.8 mm. The protoconch surface is smooth and shining; growth lines are visible only with SEM shots. Shell growth changes abruptly with a clearly visible boundary to a cap-shaped shell. At a shell length of about 3 mm most protoconchs are lost. The remaining crescent-shaped scar becomes overgrown by calcareous layers, which are simultaneously dissolved by hydrothermal solutions. Hence, the apex is irregularly shaped in all shell stages.

The animal (Pl. 2 Figs. 1, 3 and 5) is broad and flat, corresponding to the low shell height. Its general plan is similar to *S. kaikatensis* (cf. OKUTANI & al., 1989, Figs. 10–15). However, *S. tufari* is different in the following characters: the eyes are lacking, the foot sole is divided into three equal-sized parts without having clear boundaries, the middle part is ciliated, the two lateral parts are cuticularized; the paired shell muscles are smaller (30% of shell length); the visceral mass is more voluminous (its posterior part is filled with the large midgut gland and ends dorsally in a projecting part, which corresponds to the shell apex); the epipodial papilla are higher in number (20–22), the operculum has a short corneous part (30% of operculum length) and an anterior calcareous part which is marked by a bent edge leading from the nucleus to its anterior right corner (Pl. 1 Fig. 4); the nucleus is paucispiral (Pl. 2 Fig. 2) and has a minute vestige of the neritacean operculum-apophysis at its ventral side.

The rhipidoglossate radula (Pl. 3; Drawing Fig. 5C) has a basic pattern which is typical for neritaceans. The dentition is very similar to *Phenacolepas* (cf. FRETTER 1984; OKUTANI & al. 1989; HICKMAN 1984; BAKER 1923; BARNARD 1963; THIELE 1909, radula formula: 70 – 4 – 1 – 4 – 70), however, the denticles on the first and third lateral teeth are reduced and the fourth lateral tooth is convexly arched; nearly the same is found in *S. kaikatensis.* Radula formula: about 80 – 4 – 1 – 4 – about 80. As distinguished from *S. kaikatensis* the new species has a subquadrate rhachidian, elongated, with the anterior quarter flat, the posterior quarter semicircularly hollowed and the middle part thickened. The differences can be recognized in Plate 3, Figs. 3–5 and Drawing Fig. 5. In the numerous marginals four different forms are discernible: inner forms with bent cusps which bear six sharp and elongated denticles each; furthermore many marginals with specially formed cusps showing denticles of different length separated by a deep channel (Pl. 3 Fig. 4); near the end of the transverse row of teeth there are some marginals which are cuspidated with very fine comb-like denticles and with a distal tongue-like process; finally, each tooth row is distally completed with flabelliform teeth. The first two forms of marginals are also present in *S. kaikatensis;* the two outer forms could not be compared, since these are not considered by OKUTANI & al. (1989).

Morphological evidence and sampling circumstances point out that *S. tufari* is living associated with hydrothermal vents, grazing on bacterial mats. The gill is not enlarged, but colonized with bacteria. Whether this fact is of importance for nutrition, could not yet be determined.

Measurements and repository see Table 2.

Table 2: *Shinkailepas tufari* sp. n. repository, age, shell measurements, sexes and positions (length, width and height in mm, maximum measurable)

repository	age	length	width	height	sex	position
holotype NHMW N° 85984	adult	11.2	8.3	3.3	♀	42 GTVD
paratype 1 NHMW N° 85985	adult	10.3	8.0	3.2	♂	42 GTVD
paratype 2 NHMW N° 85986	adult	9.8	6.6	2.9	♂	42 GTVD
paratype 3 NHMW N° 85987	juv.	2.3	1.5	0.7	-	56 GTVA
SMF 309437	adult	6.0	4.3	1.7	♂	56 GTVA
SMF 309437	adult	9.5	6.7	2.5	♀	42 GTVD
SMF 309437	juv.	3.1	2.3	0.9	-	56 GTVA
USNM	adult	9.7	6.9	2.2	♂	42 GTVD
USNM	adult	9.8	6.9	2.6	♀	42 GTVD
USNM	juv.	4.3	2.1	1.4	-	56 GTVA
Slg. TOLLMANN	adult	9.7	7.0	2.4	♂	42 GTVD
Slg. TOLLMANN	adult	6.0	4.3	1.5	♀	42 GTVD
Slg. TOLLMANN	juv.	5.0	3.1	1.2	-	56 GTVA

NHMW = Naturhistorisches Museum Wien
SMF = Senckenberg Museum Frankfurt
USNM = United States National Museum Washington, Smithsonian Institution
Slg. TOLLMANN = Collection Prof. Dr. A. TOLLMANN, Wien

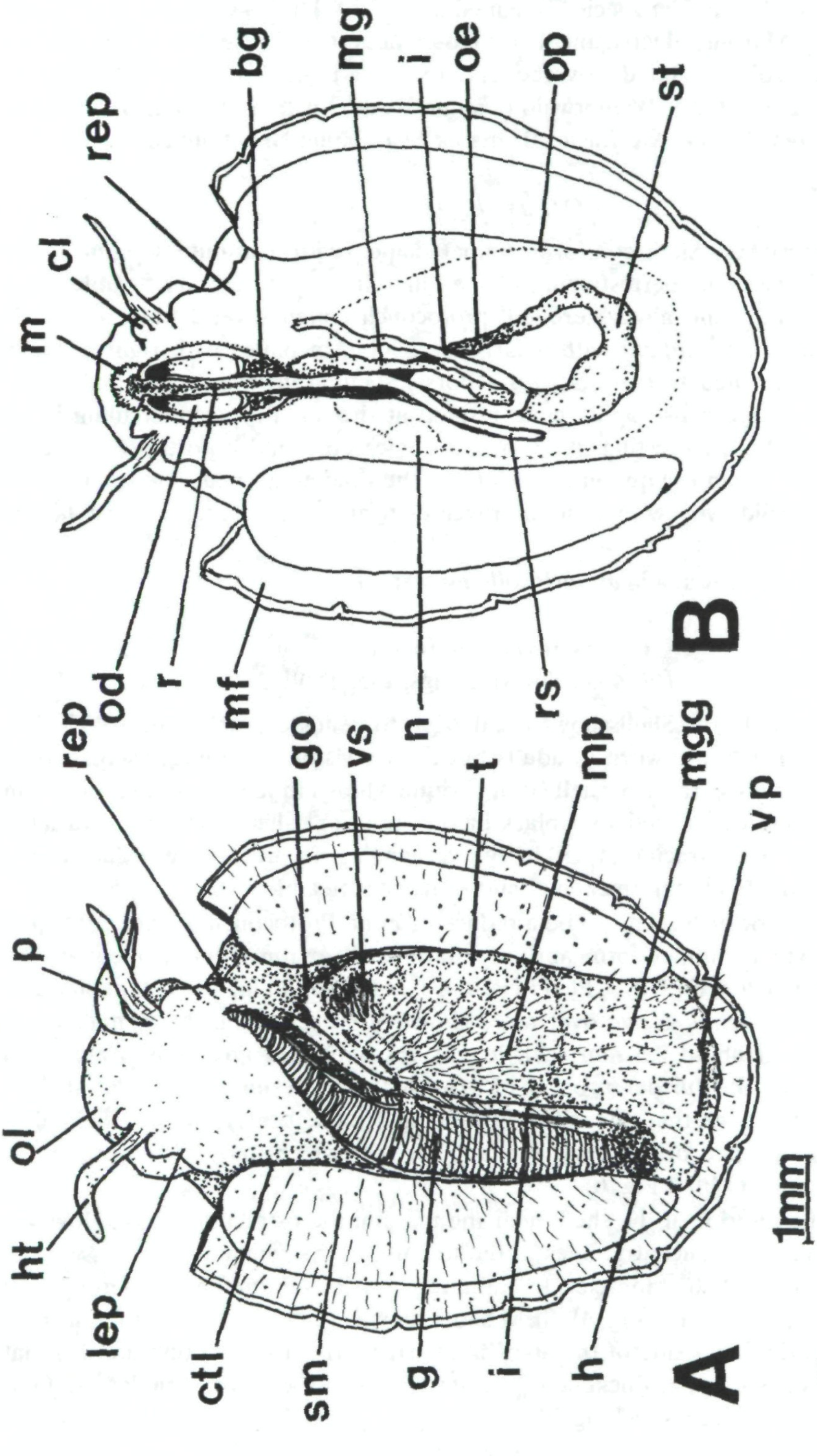

Fig. 3: *Olgasolaris tollmanni* gen. n. et sp. n. (schematic dorsal view; abbreviations see Material and Methods).
A – male, anterior part of mantle skirt removed
B – female, digestive system and operculum (dotted), drawn schematically.

Etymology. The species is named after Prof. Dr. WERNER TUFAR, Philipps University Marburg, Department of Geosciences, Chief Scientist of the OLGA Research Project, who discovered and recovered the hydrothermal fauna of Hydrothermal Field 1, Wienerwald (Vienna Woods) within the Manus Spreading Center (Manus Back-Arc Basin, Bismarck Sea, Papua New Guinea).

Olgasolaris gen. n.

Diagnosis. Shell coniform, limpet-shaped with a minute septum at the posterior inner side, periostracum at shell margin very broad and flexible, apex near the center and always eroded, protoconch coiled several times in nearly planispiral mode. Animal with a large oral lobe, in males with right cephalic lappet transformed to a penis with a dorsal seminal groove, mantle skirt with numerous filamentous papilla concentrated at the mantle tip; operculum in an internal position, consisting of an anterior calcareous and a posterior corneous part divided by an oblique line, nucleus of the operculum paucispiral; radula of phenacolepadid type with reduced rhachidian and very elongated first lateral tooth.

Type species: *Olgasolaris tollmanni* sp. n.

Olgasolaris tollmanni sp. n.
(Pl. 4–6; Drawing Figs. 2–5, Table 3)

Description. Shell shows in addition to genus characters up to 350 fine radial ribs, which are worn in adults but clearly visible in younger stages; shell measurements see Table 3; shell color opaque whitish in juveniles, light brown in adults; around the eroded apex black incrustations are always present to variable extents; the periostracum is strikingly overhanging, in juveniles translucent and tender, in adults brown, thickened and somewhat flexible.

The protoconch seems to be a reduced *Nerita*. Protoconch diameter 0.8 mm. Shell growth to limpet form abruptly starts with extreme enlargement of the apertural lip (Pl. 4 Figs. 8, 9; Pl. 5 Figs. 1–3); at the beginning the columellar part of the protoconch is grown over more slowly; however, when the protoconch is pushed off, at about 2.5 mm shell length, the shell will grow uniformly in all directions. In the further process of growth the posterior part of the shell is growing faster, so that the apex is moving to the center of the shell. The protoconch pushed off causes a semicircular scar which may still be present in adult specimens (Pl. 4 Fig. 6).

At the interior of the shell, near the margin, the ostracum shows a low rim characterized by concentric lines of the texture; at the remaining depression the two large scars of shell muscles, the minute posterior septum and numerous shell pores are striking (Pl. 4 Fig. 4). SEM shots show (1) that the vestige of a nacre is present at the inner side of the apex and particularly at the septum and (2) that the shell consists of a thickened periostracum and a crossed-lamellar aragonit layer; a calcite layer is lacking.

The animal (Plates 5–6, Drawing Figs. 2–4) has, in dorsal view, an oval outline or, in lateral view, a coniform shape corresponding to the shell form. The head is characterized by a massive oral lobe, a papillated mouth, two ringed head tentacles and two cephalic lappets. In males the right cephalic lappet is transformed to a large penis with a dorsal seminal groove which originates at the base of the right head tentacle. Posterior of the head tentacles lateral folds originate which continue as weak epipodial folds. In males the right fold shows several yellowish humps just behind the head tentacle; sensory function of these humps is assumed.

Table 3: *Olgasolaris tollmanni* gen. n et sp. n. repository, age, shell measurements, sexes and positions (length, width and height in mm, maximum measurable) (Abbrev. see Table 2)

repository	age	length	width	height	sex	position
holotype NHMW N° 85988	adult	13.1	11.3	4.3	♂	25 GTVA
paratype 1 NHMW N° 85989	adult	12.5	10.5	3.8	♀	17 GTVA
paratype 2 NHMW N° 85990	juv.	4.7	3.5	1.4	–	17 GTVA
paratype 3 NHMW N° 85991	juv.	1.1	0.8	–	–	56 GTVA
SMF 309438	adult	10.9	9.5	3.3	♂	25 GTVA
SMF 309438	adult	11.0	9.2	3.4	♀	25 GTVA
SMF 309438	juv.	4.9	3.8	1.5	–	56 GTVA
SMF 309438	juv.	1.8	1.25	–	–	25 GTVA
USNM	adult	11.7	10.3	3.6	♂	17 GTVA
USNM	adult	10.0	8.2	3.0	♀	25 GTVA
USNM	juv.	6.8	5.6	2.7	–	56 GTVA
USNM	juv.	1.1	0.8	–	–	17 GTVA
Slg. Tollmann	adult	11.2	9.2	4.0	♂	15 GTVA
Slg. Tollmann	adult	12.1	10.2	4.4	♀	15 GTVA
Slg. Tollmann	juv.	4.4	3.3	1.2	–	25 GTVA
Slg Tollmann	juv.	1.0	0.7	–	–	42 GTVA

The foot is broad and flat; its sole is clearly divided into three parts; the middle third is densely coated with cilia, while the lateral thirds have a warty surface (observations by SEM). It is assumed that the lateral parts of the side derive from lateral foot areas. Anteriorly, a small opening of the foot gland is recognizable, and posteriorly, the foot becomes somewhat pointed, like a tail. As in *S. tufari* posterior epipodial papillae are present (number: 14–15).

The mantle skirt has an oval outline, reaching beyond the head and the foot, it is very thin except for the moderately thickened margin, which shows two clearly separated mantle grooves. Numerous filamentous dorsal papillae connect the mantle skirt with the shell. The papillae are unequal in size and concentrated at the mantle tip at the inner side of the shell apex. Each papilla corresponds to a shell pore reaching only through the ostracum; the periostracum is not pored. The outline of the papillae is club-formed; at their distal ends dark pigments and granula are present (observations by optical microscope). SEM shots of broken, critical point dried mantle papillae show that they contain 25–30 fine filaments. Besides the function of fixing the mantle skirt to the shell also a secretory or excretory function is assumed.

The mantle skirt and the mantle cavity are pigmented with numerous very fine darkred or black dots. The mantle cavity is limited by the left shell muscle and the long intestine (Drawing Fig. 3 A). It is very deep on the left side, containing the moderate-sized gill. SEM observations show that the gill lamellae are colonized by globular bacteria (Pl. 6 Fig. 6). The right part of the mantle cavity is short, receiving the anus and the gonad opening. The visceral mass consists of a large basal midgut gland covered by the left kidney, while the gonad fills the remaining dorsal space. The digestive system (Drawing Fig. 3 B) shows a well-developed buccal mass with paired buccal glands and a radula which originates in a long radula sac. Oesophagus, stomach, midgut and intestine are lying in the visceral mass and bent in three loops before ending at the right roof of the mantle cavity.

Some additional comments to the genus characters of the operculum: at the anterior calcareous part very fine lines of growth are visible, while the corneous part is translucent and breakable (similar to the genus *Septaria;* cf. HAYNES & WAWRA 1989). At the ventral side of the nucleus a very weak ridge is the only remaining evidence of the ventral apophysis typical for neritaceans. The unusual position of the operculum is illustrated by the Drawing Figs. 2 and 3 B. Obviously, the original function of the operculum (to shut the aperture) is rapidly lost in early shell stages, i. e. during changing to limpet shape (Pl. 5 Figs. 2, 3).

The radula pattern is similar to that of *Shinkailepas,* radula formula about 70 – 4 – 1 – 4 – about 70 (Pl. 6 and Drawing Fig. 5A). Differences to *Shinkailepas* are clearly visible, not only in the size of the first lateral tooth, which is very elongated anteriorly and in some details at the other laterals (L3 and L4), but also in the number of marginal teeth. There are four different forms of marginal teeth, as in *Shinkailepas.*

The habitat of *O. tollmanni* is limited to hydrothermal vents (Fig. 6). Its feeding biology is grazing bacterial mats from surfaces of sulfide chimneys and of shells of associated gastropods (e. g. *Olgaconcha tufari, Symmetromphalus hageni).* Bacterial colonization of the gill is shown but endosymbiosis as reported from other hydrothermal gastropods is not yet demonstrated (cf. DE BURGH & SINGLA 1984; STEIN & al. 1988). Filter-feeding is not probable.

O. tollmanni seems to be very abundant in the Manus Basin. The species is living in competition with e. g. *S. tufari, A. hessleri, O. tufari, S. hageni* and *Lepetodrilus* spec. (description in preparation).

Remarks. Some facts have to be added which could not be generalized and used for description: an osphradium could not be found; a crystal sac at the

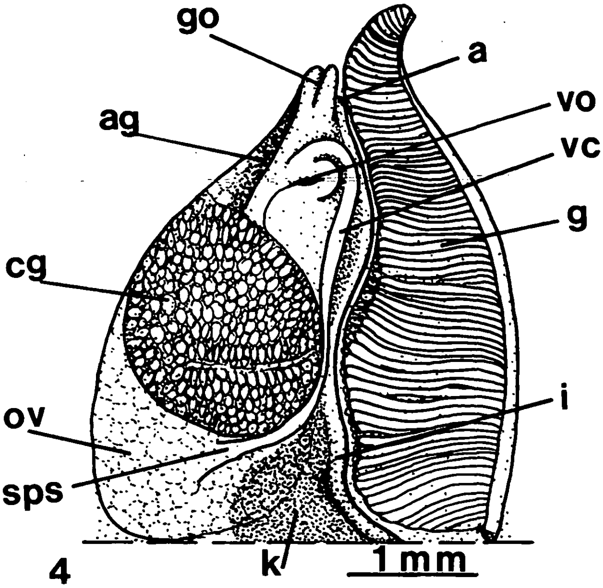

Fig. 4: *Olgasolaris tollmanni* gen. n. et sp. n., female, anterior part of the visceral mass in ventral view (mantle roof, abbreviations see Material and Methods).

stomach seems to be absent; the mantle skirt above the kidney was sometimes very strongly pigmented; in several female specimens the right epipodium (at the neck) was strongly folded and its dorsal side black pigmented; some females had a light brown glandular ridge at the ventral side of the right mantle fringe; it is assumed that these features are useful during egg-laying. White oval dots (diameter about 1 mm) found on the shell surface of *O. tufari* (BECK 1991, Plate 1) are identified now as neritacean egg-capsules; however, a relation to *Shinkailepas* or to *Olgasolaris* cannot be shown yet.

Etymology. Genus name deriving from the German Research Project OLGA (**O**zeanische **L**agerstätten: **G**eologisch-Mineralogische **A**nalyse = Oceanic Deposits: Geological-Mineralogical Analysis) of the Philipps University Marburg, Chief Scientist Prof. Dr. WERNER TUFAR, funded by the Federal German Minister for Research and Technology (Bundesminister für Forschung und Technologie), and from the German Research Vessel "Sonne" with which the Research Cruise OLGA II was carried out. The species name is in honor of Prof. Dr. ALEXANDER TOLLMANN and his wife Doz. Dr. EDITH KRISTAN-TOLLMANN, Department of Geosciences, University of Vienna, whose scientific knowledge was of great value for the OLGA Research Project.

Discussion

S. tufari is clearly distinguished from *S. kaikatensis* by several morphological characters (see descriptions above) *Olgasolaris* is clearly distinguished from the latter genus. The new taxa are therefore warranted.

There remains to substantiate why the new taxa are assigned to the Phenacolepadidae and not to the Shinkailepadidae: OKUTANI (1989) established this family with characters of the genus *Shinkailepas*: "Shell patelliform, with narrow septa inside posteriorly; animal with large oral lobe, penis on the right, and filamentous mantle papillae; operculum half calcareous and half corneous; radula of neritoid type." However, these characters could also be found in the genera *Phenacolepas, Neritina* or *Septaria* (cf. BOURNE 1908; THIELE 1909; GRASSÉ 1968; BANDEL 1982; FRETTER 1984). Even the unusual, filamentous mantle papilla can be derived from minute papillae (or contractile tentacles) at the mantle fringe of *Phenacolepas.* The following special characters of *S. tufari* and *O. tollmanni* point out that assignment to the Phenacolepadidae is warranted: The shell form and sculpture is very similar to *Phenacolepas* (e. g. *P. osculans* (C. B. ADAMS, 1857), *P. galathea* (LAM.), *P. indica* THIELE, 1909); the calcite layer at the ostracum is unusually lacking (as in *P. hamillei,* BANDEL 1982 p. 91); the shell growth is abruptly changing from protoconch to limpet form (cf. BANDEL 1982, Table 21, Figs. 7–8); the cuticularized lateral parts of the foot sole can be derived from marginal flanges of the foot sole of *Phenacolepas* (cf. FRETTER 1984 Fig. 5); the oral lobes are very similar. Reproductive system: in males the right cephalic lappet is transformed to a penis; the female system consists of (1) main gonopore with capsule gland, albumen gland and ovary and (2) vaginal opening with vaginal canal and spermatophore sac, (the third neritacean female pore could not yet be demonstrated); the radula is similar to *Neritina* and *Septaria (= Navicella),* both Neritidae, and particularly to *Phenacolepas* (cf. TROSCHEL (THIELE) 1866–1893; THIELE 1909); the variability of radula characters within the genus *Phenacolepas* is extensive enough to include both of the new taxa. Summing up, it may be estimated that *Shinkailepas* and *Olgasolaris* are apomorphic genera which are descended from shallow water phenacolepadid limpets, while *Olgasolaris* seems to be the more apomorphic one. It must have been adapted to hydrothermal vents for a very long time.

At the radula of both new forms the outer forms of marginal teeth are striking and require additional comments: the outer forms are flabelliform as in Pleurotomariacea, covering some marginal teeth with comb-like cusps and distal tongue-like processes which are very similar to the marginal teeth of Neomphalacea. Both facts and the presence of nacre have to be considered during phylogenetical reflections. They may be helpful to clarify the uncertain status of Neritacea between Archaeogastropoda and Mesogastropoda.

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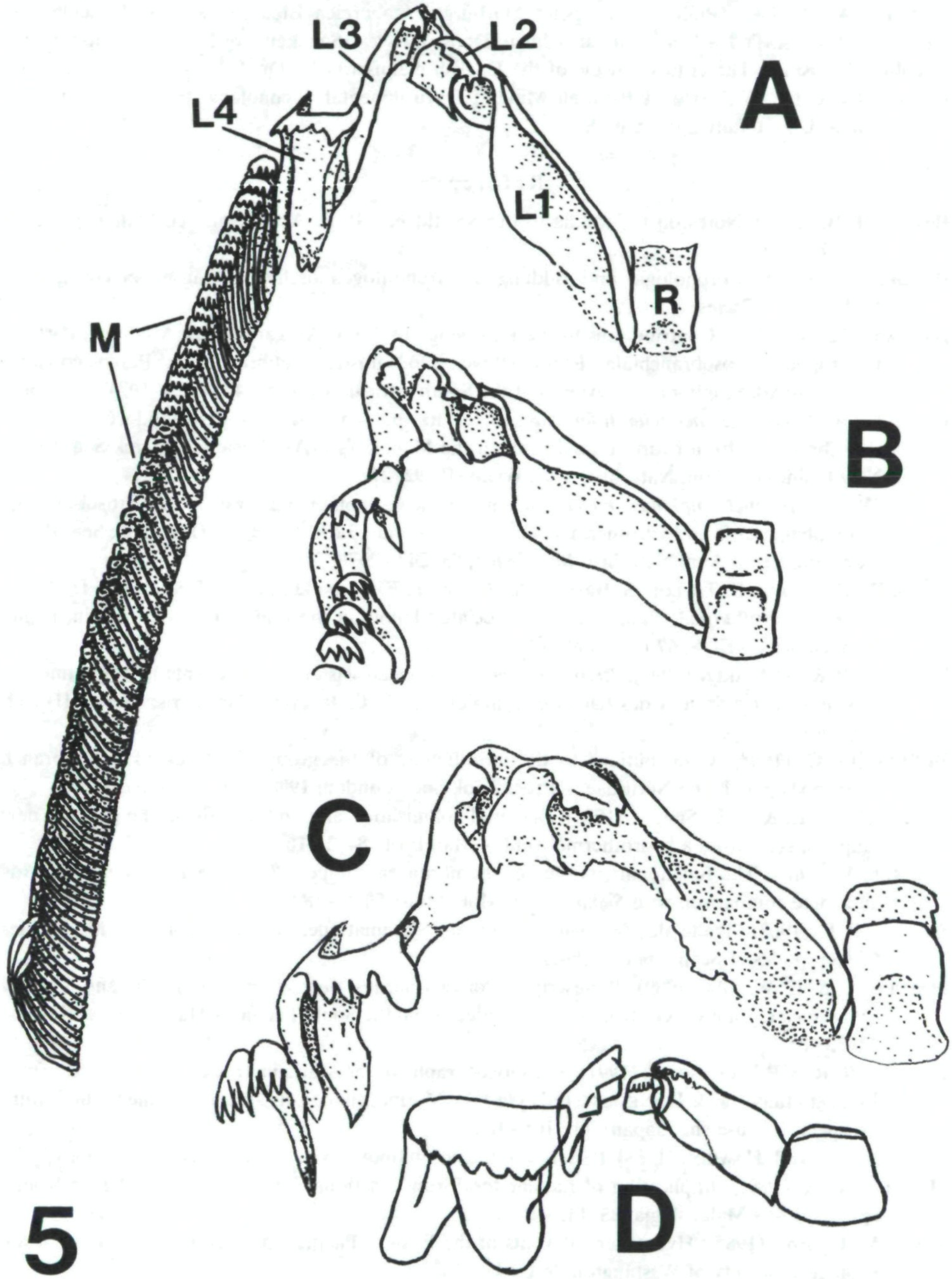

Fig. 5: Radulae of some Phenacolepadidae (not drawn to scale; A, B and C with the aid of SEM-shots; D with the aid of optical microscope).

A – *Olgasolaris tollmanni* gen. n. et sp. n., complete half-row,

B – *Shinkailepas kaikatensis,* (drawn after OKUTANI & al. 1989),

C – *Shinkailepas tufari* sp. n.,

D – *Phenacolepas arabica,* (drawn after THIELE 1909),

(R) rhachidian tooth, (L1–L4) lateral teeth, (M) marginal teeth.

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Plate explanations

Plate 1

Shinkailepas tufari sp. n.

Fig. 1-3: Holotype, shell length 11.2 mm.

Fig. 4: Operculum (length 3 mm), calcareous part with fine growth lines and with a bent edge leading from the nucleus (at bottom) to the anterior right corner, nucleus with a minute vestige of the neritacean operculum-apophysis.

Fig. 5-6: Coiled protoconch, abrupt change of shell growth from protoconch to limpet shell (Fig. 5 SEM shot, Fig. 6 optical microscope, shell length 2.6 mm).

Plate 2

Shinkailepas tufari sp. n. (abbreviations see p. 3)

Fig. 1: Anterior part of the animal (shell length 8.5 mm) in ventral view, note the protruded buccal mass with the radula (cf. Pl. 3. Figs. 1 and 3) and the broken mantle papilla.

Fig. 2: Detail of the operculum, paucispiral nucleus in dorsal view.

Fig. 3: Animal removed from shell (length 6.5 mm) in ventral view.

Fig. 4: Detail of the interior of the shell at apex with nacre and shell pores.

Fig. 5: Animal removed from shell; female (length 6.5 mm) in dorsal view.

Plate 3

Shinkailepas tufari sp. n., radula (Fig. 1 ventral view on buccal mass, cf. Pl. 2 Fig. 1; Figs. 2–5 dorsal view on the middle third of the radula).

Fig. 1: Radula on buccal mass, overview.

Fig. 2: Rhachidian tooth, anterior quarter flat, middle part thickened and posterior quarter semicircularly hollowed.

Fig. 3: Lateral teeth, (1) first lateral with reduced basal lamella (arrow), (2) second lateral with 5 denticles, (3) third lateral, (4) fourth lateral with one large denticle and four smaller denticals distally, tooth base consisting of two columns.

Fig. 4: Marginal teeth, right: inner marginals with bent cusps bearing six sharp and elongated denticles, left: middle marginals with specially formed cusps showing different long denticles separated by a deep channel (arrow).

Fig. 5: Marginal teeth, overview.

Fig. 6: Marginal teeth, detail of Fig. 5 showing outer flabelliform marginals and neomphalacean-like marginals (cusps with fine comb-like denticles and distal tongue-like processes).

Plate 4

Olgasolaris tollmanni gen. n. et sp. n.

Figs. 1 and 3: Holotype, shell length 13.1 mm.

Fig. 2: Ventral view of anterior part of paratype 1 (shell length 12.5 mm): note the broad periostracum and the shell pores.

Fig. 4: Interior of the shell, posterior part with minute septum and numerous pores (shell length 9.3 mm).

Fig. 5: Juvenile specimen (shell length 4.5 mm) with translucent periostracum at shell margin.

Fig. 6: Shell apex of an adult specimen (shell length 9.3 mm), with eroded apex with a posterior, semicircular scar of the pushed-off protoconch, apex surrounded by black mineral incrustations.

Fig. 7: Protoconch, apertural view (length 0.8 mm).

Figs. 8 and 9: Juvenile stages with protoconch.

Plate 5

Olgasolaris tollmanni gen. n. et sp. n.

Fig. 1: Protoconch, coiled several times.

Fig. 2: Juvenile, with operculum.

Fig. 3: Juvenile, operculum in internal position and no longer recognizable, posterior part of the limpet-shaped shell starting to grow.

Fig. 4: Operculum (length 4.1 mm) with an anterior calcareous part and a posterior corneous part divided by an oblique line.

Fig. 5: Female, head in frontal view, mantle skirt removed.

Fig. 6: Male, right side of the head in frontal view: note the ringed head tentacle and the cephalic lappet transformed to a penis with a dorsal seminal groove.

Plate 6

Olgasolaris tollmanni gen. n. et sp. n.

Fig. 1: Radula, halfrow.

Fig. 2: Marginal teeth.

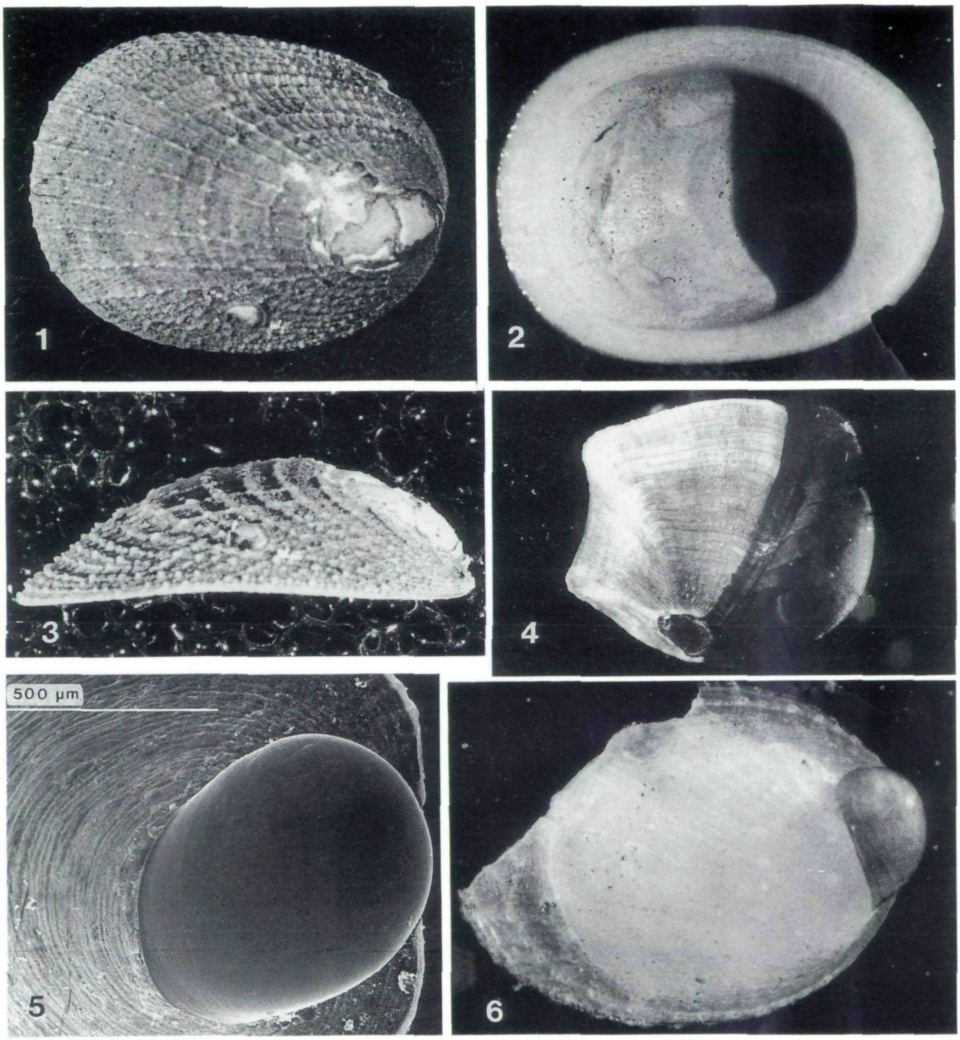
Fig. 3: Lateral teeth 1–4.

Fig. 5: SEM-shots of the anterior part of a male specimen; note the two mantle grooves at the mantle fringe, the mantle papilla and the anterior opening of the foot gland (arrow).

Fig. 6: SEM-shots of the gill lamellae showing globular bacteria within the gill-cilia.

Plate 7

Hydrothermal Field 1, Vienna Woods, 3° 9.40' S, 150° 16.92' E, water depth 2495 m. Active sulfide chimney (black smoker) totally coated by living gastropods, mostly *Olgaconcha tufari* BECK, 1991, along with *Alviniconcha hessleri* OKUTANI & OHTA, 1988 (probably subspecies). Locally bythograeid crabs are marching over the gastropod coated chimneys. More or less colorless hydrothermal solutions are seen to emanate from the sulfide chimney and run through the dense coating of living gastropods and causing "defocussing" effects (formation of schlieren). The 26 cm diameter instrument basket at the end of the cable serves as a scale (after TUFAR 1990).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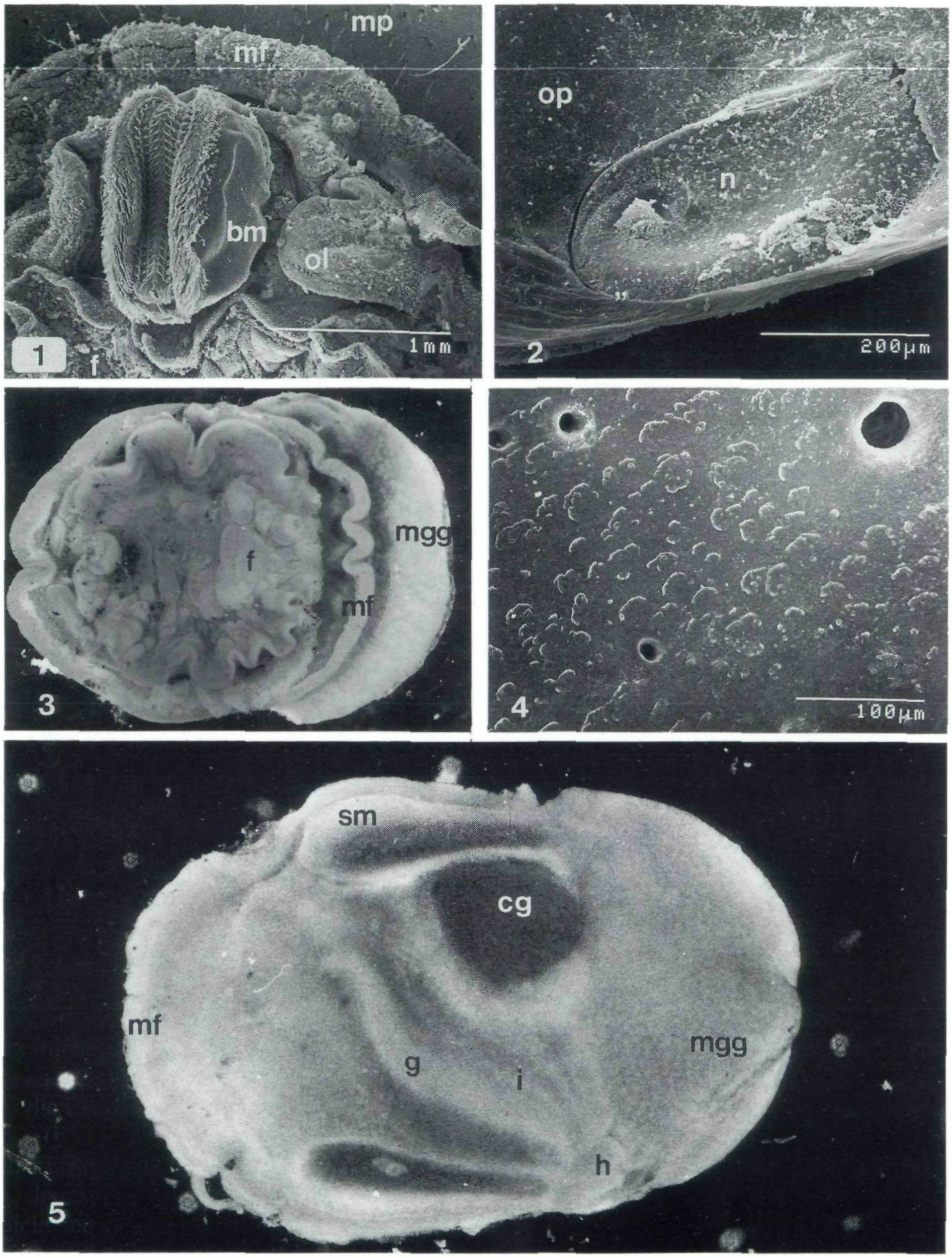
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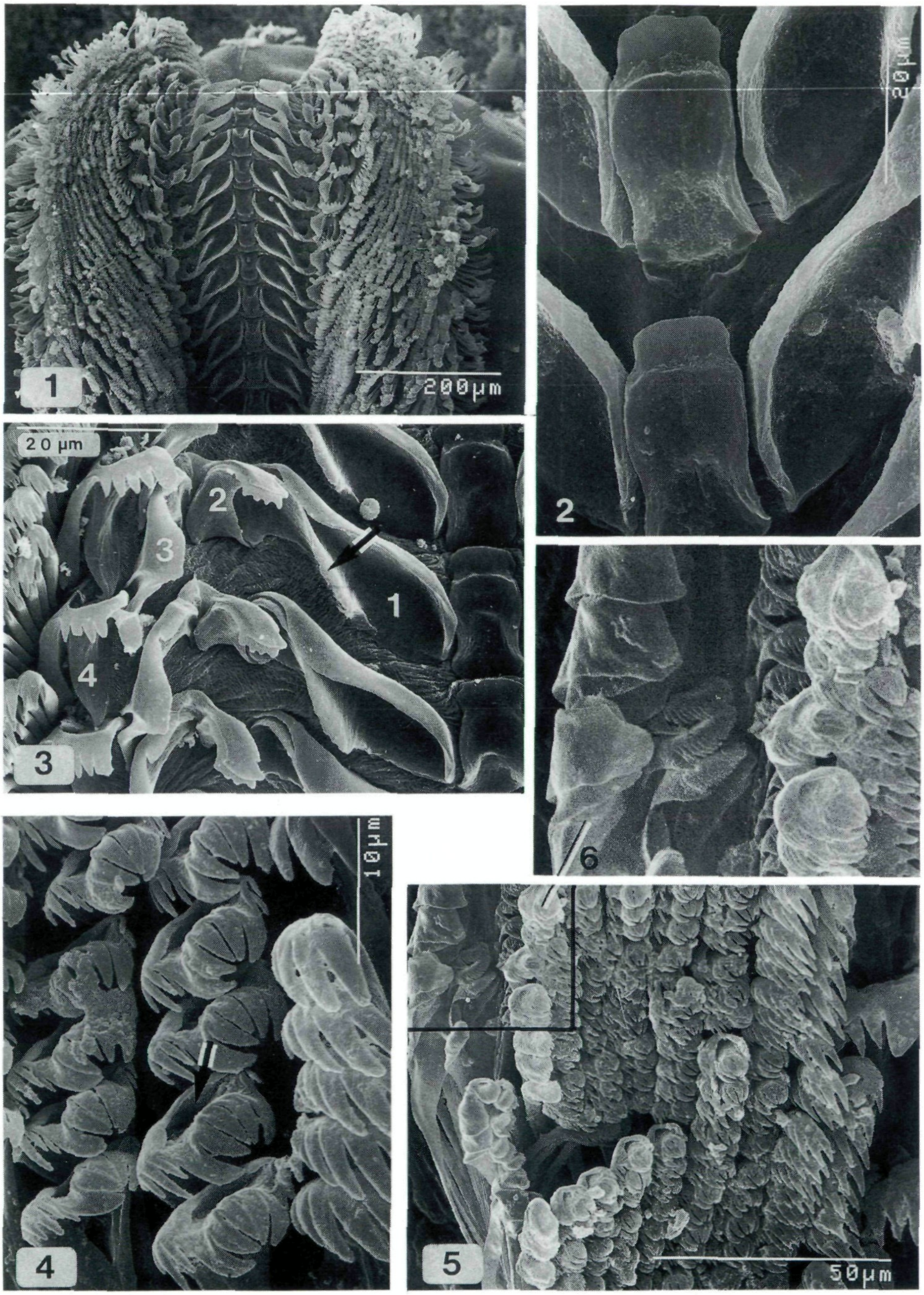
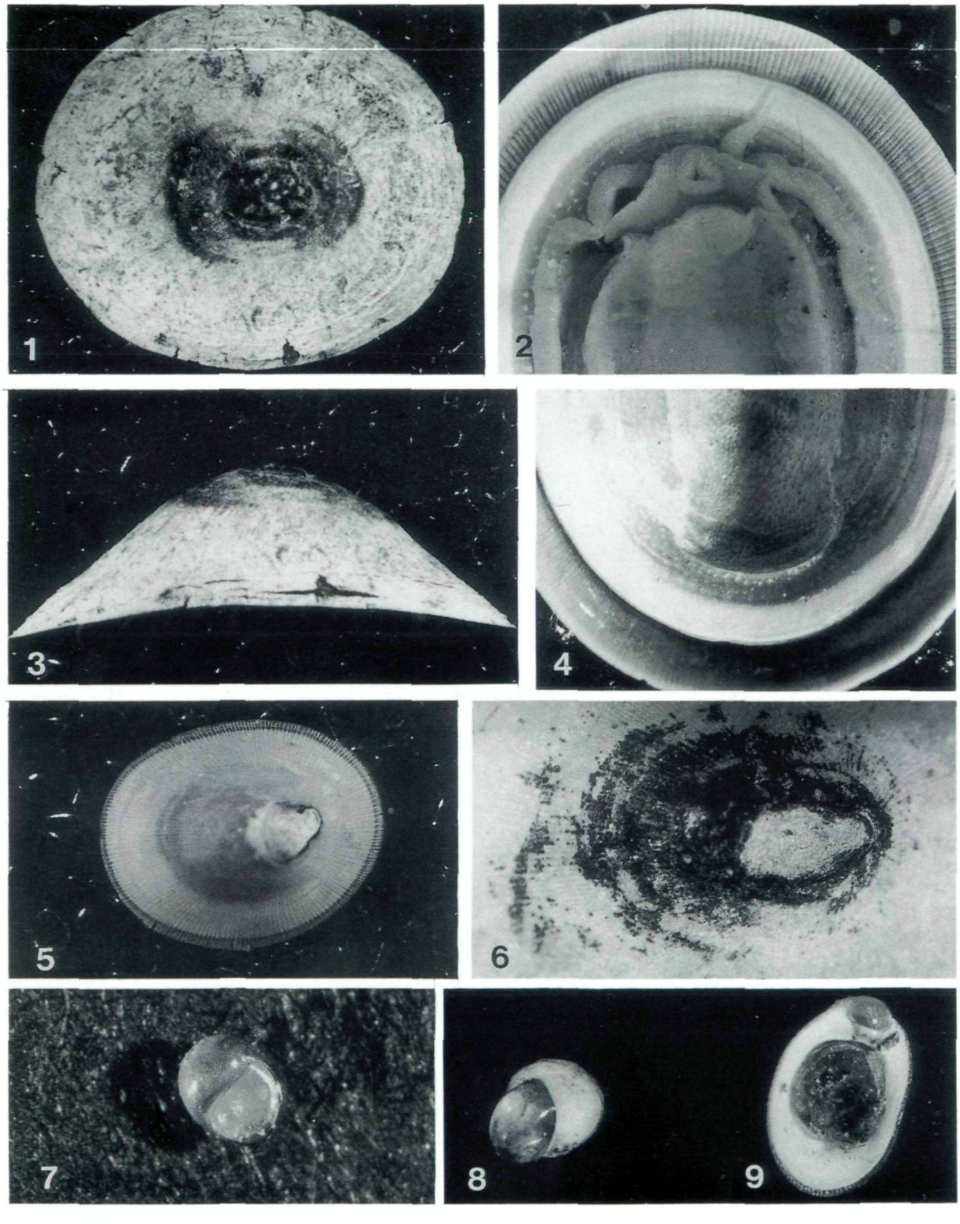
L. A. BECK: Two new neritacean limpets (Gastropoda: Prosobranchia: Neritacea: Phenacolepadidae) from active hydrothermal vents at Hydrothermal Field 1 "Wienerwald" in the Manus Back-Arc Basin (Bismarck Sea, Papua-New Guinea) Plate 3

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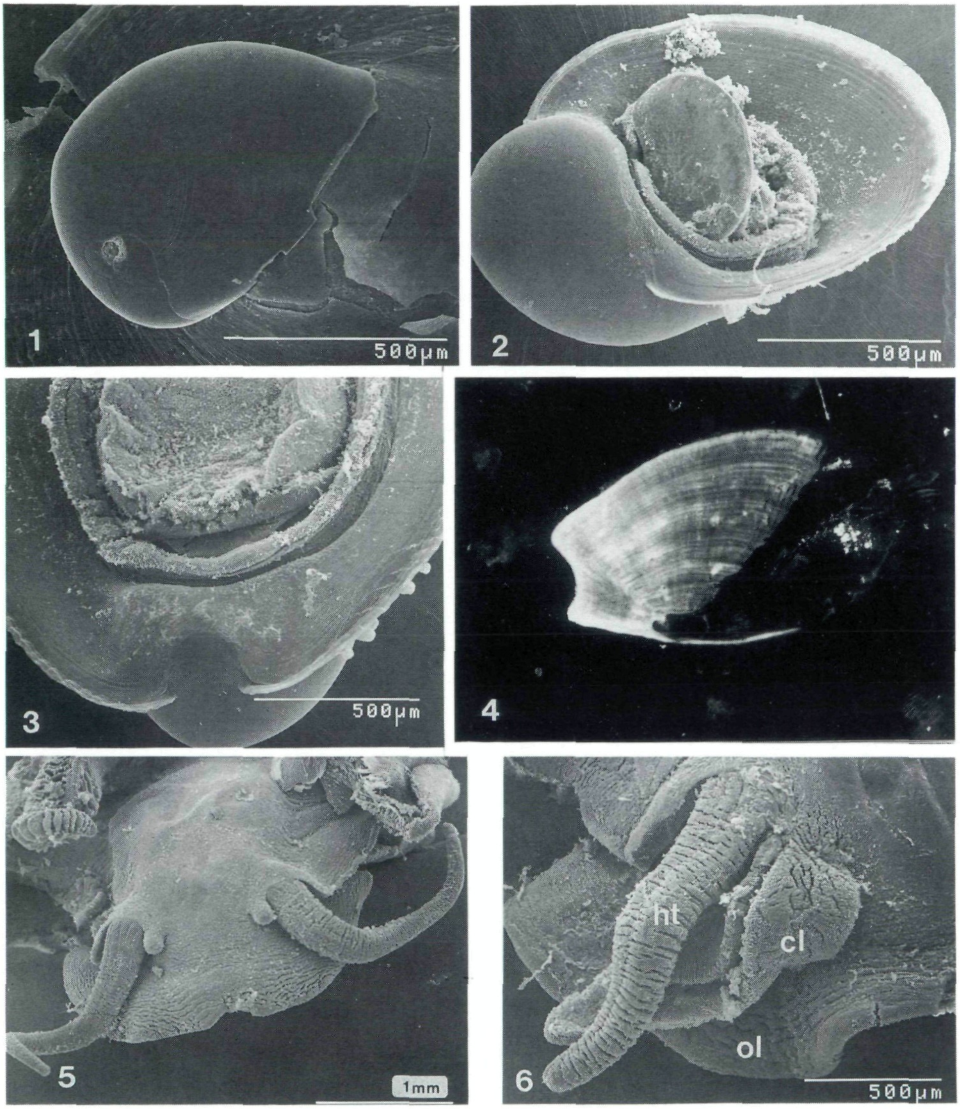
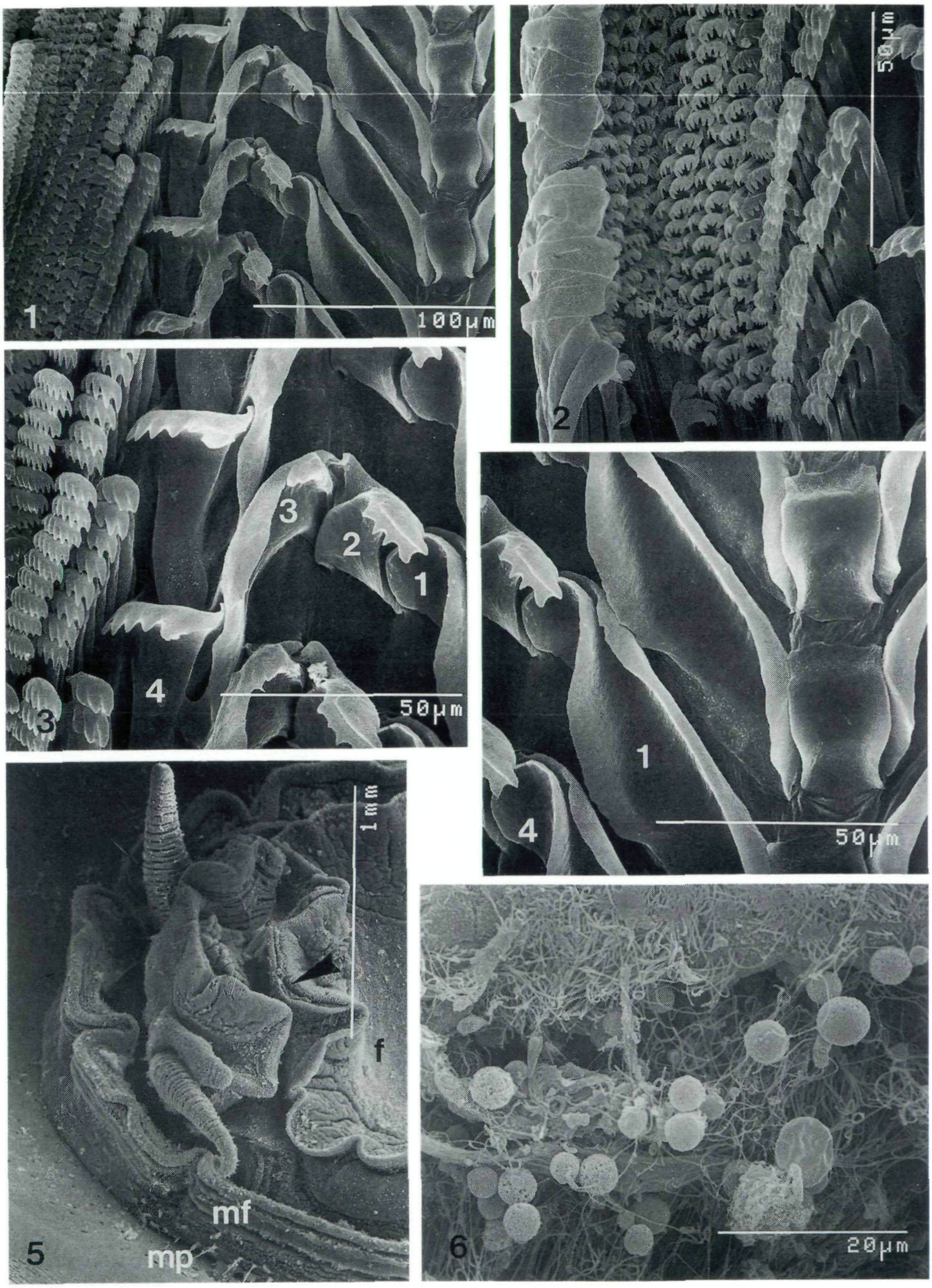
L. A. BECK: Two new neritacean limpets (Gastropoda: Prosobranchia: Neritacea: Phenacolepadidae) from active hydrothermal vents at Hydrothermal Field 1 "Wienerwald" in the Manus Back-Arc Basin (Bismarck Sea, Papua-New Guinea)

Plate 5

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L. A. BECK: Two new neritacean limpets (Gastropoda: Prosobranchia: Neritacea: Phenacolepadidae) from active hydrothermal vents at Hydrothermal Field 1 "Wienerwald" in the Manus Back-Arc Basin (Bismarck Sea, Papua-New Guinea) Plate 7

top