

A new genus and new species of Vesicomysidae (Mollusca, Bivalvia) from cold seeps on the Barbados accretionary prism, with comments on other species

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Cosel R. von & Olu K. 2008. — A new genus and new species of Vesicomysidae (Mollusca, Bivalvia) from cold seeps on the Barbados accretionary prism, with comments on other species. *Zoosystema* 30 (4): 929-944.

ABSTRACT

A new genus of Vesicomysidae, *Laubiericoncha* n. gen. is described. It includes four species: *L. myriamae* n. sp. (type species) from the Barbados accretionary prism, *L. chuni* (Thiele & Jaeckel, 1931) n. comb. from cold seeps in the Gulf of Guinea (Cameroon to seep sites near the Congo Canyon), *L. angulata* (Dall, 1896) n. comb. from the Gulf of Panama and *L. suavis* (Dall, 1913) n. comb. from Baja California. Two other undescribed species are tentatively placed in the genus pending the availability of fresh material for further research. *Laubiericoncha myriamae* n. sp. and *L. chuni* n. comb. are described in detail. Species in the new genus are characterized by an oblong shell with the posteriormost point at or just above the horizontal midline and the postero-dorsal area with two shallow and rounded ridges, absence of lunule and escutcheon, a well-marked triangular pallial sinus, a diverging hinge dentition with rather long and thin but prominent cardinal teeth and gills with two demibranchs on each side.

KEY WORDS

Mollusca,
Bivalvia,
Vesicomysidae,
eastern and western
Atlantic,
deep-sea environments,
cold seeps,
new genus,
new species.

RÉSUMÉ

Un nouveau genre et une nouvelle espèce de Vesicomylidae (Mollusca, Bivalvia) de suintements froids du prisme d'accrétion de la Barbade, et commentaires sur d'autres espèces.

Un genre nouveau de Vesicomylidae, *Laubiericoncha* n. gen. est décrit. Le genre comprend quatre espèces: *L. myriamae* n. sp. (espèce type) du prisme d'accrétion de la Barbade, *L. chuni* (Thiele & Jaekel, 1931) n. comb. des suintements froids dans le Golfe de Guinée (du Cameroun aux sites proches du canyon du fleuve Congo), *L. angulata* (Dall, 1896) n. comb. du Golfe de Panama et *L. suavis* (Dall, 1913) n. comb. de Basse Californie. Deux autres espèces non décrites sont placées provisoirement dans le nouveau genre en attente de matériel frais. *Laubiericoncha myriamae* n. sp. et *L. chuni* n. comb. sont traités en détail. Le nouveau genre est caractérisé par une coquille allongée dont le point le plus postérieur est situé dans ou juste au-dessus de la ligne médiane horizontale. D'autres caractères sont le champ postéro-dorsal avec deux sillons bas et arrondis, l'absence de lunule et écusson, la présence d'un sinus palléal triangulaire bien marqué, une dentition de la charnière divergente avec des dents cardinales longues, proéminentes et minces et des branchies avec deux demibranchies de chaque côté.

MOTS CLÉS

Mollusca,
Bivalvia,
Vesicomylidae,
Atlantique de l'ouest et
de l'est,
environnements
profonds,
suintements froids,
genre nouveau,
espèce nouvelle.

INTRODUCTION

Vesicomylidae are a rather species-rich bivalve family, living in deep water from about 100 m to more than 6000 m deep. They are among the seven bivalve families known to be chemosymbiotic and to host sulphide-oxidizing and/or methanotrophic bacteria in their gills (Fiala-Medioni & Felbeck 1990; Fisher 1990; Taylor pers. comm.) and occur at hydrothermal vents, cold seeps, hydrocarbon seeps and whale falls. Vesicomylidae are known to harbour sulphide-oxidizing bacteria only (Olu *et al.* 1996); many are ubiquitous at cold seeps between about 400 and 6400 m depth (Sibuet & Olu 1998). A checklist records 93 described and named Recent and 24 Tertiary vesicomylid species (Cosel unpublished), and there are still several other species awaiting description, which brings the total number of living species to more than 100. Among the listed species, 40 have been reported from cold seep environments. Moreover, many other species collected along continental margins before the discovery of cold seeps are likely to be linked with these special biotopes.

Of the 13 genera proposed within the family some are now regarded as synonyms by different authors, and the number of genera in use has considerably diminished pending morphological observations or molecular results, suggesting that the present genera do not comprise monophyletic species groups (Vrijenhoek *et al.* 1994; Kojima *et al.* 1995, 2004; Peek *et al.* 1997). Nevertheless, some genera represent well-defined entities based on clear shell and/or anatomical characters (see e.g., Cosel & Salas 2001; Krylova & Janssen 2006; Krylova & Sahling 2006). In this paper, we introduce a new genus for a small group of large Vesicomylidae which is distinguished from other large species of the family (e.g., in the genera *Calypptogena*, *Ectenagena*, *Archivesica*, etc.) by distinct common features.

MATERIAL AND METHODS

The vesicomylid species treated herein were collected on the southern part of the Barbados accretionary prism during the French cruises DIAPICAR 87

and DIAPISUB (chief scientist J.-C. Faugères) and on cold seeps on a giant pockmark off the coast of the Congo and northern Angola during the cruises ZAIROV (chief scientist H. Ondréas), BIOZAIRE 1, BIOZAIRE 2 (both M. Sibuet) and BIOZAIRE 3 (A. Khripounoff) of the Ifremer-TOTAL collaborative projects ZAIANGO and BIOZAIRE. Specimens from Barbados were collected with the submersible *Nautile*, aboard the RV *Nadir* and those from West Africa by the RV *Atalante* with the ROV *Victor* and also by means of a 6 m-beam trawl derived from the trawls used by the shrimp fishermen at Honfleur, north coast of France. The material was sorted in the Laboratoire Environnement profond de l'IFREMER, Brest.

ABBREVIATIONS

| | |
|------|--|
| BZ | BIOZAIRE cruises; |
| MNHN | Muséum national d'Histoire naturelle, Paris; |
| ROV | remote operated vehicle (<i>Victor</i> 6000); |
| USNM | National Museum of Natural History, Smithsonian Institution, Washington, DC; |
| ZMB | Museum für Naturkunde der Humboldt-Universität, Berlin; |
| lv. | left valve; |
| rv. | right valve; |
| sh. | dead-collected specimen with both valves; |
| spm. | live-collected specimen; |

SYSTEMATICS

Order VENEROIDA

H. Adams & A. Adams, 1856

Superfamily GLOSSOIDEA Gray, 1847

Family VESICOMYIDAE Dall & Simpson, 1901

Genus *Laubiericoncha* n. gen.

TYPE SPECIES. — *Laubiericoncha myriamae* n. sp., designated herein.

SPECIES INCLUDED. — *Laubiericoncha myriamae* n. sp., *L. chuni* (Thiele & Jaekel, 1931) n. comb.; *L. angulata* (Dall, 1896) n. comb.; *L. suavis* (Dall, 1913) n. comb., possibly Vesicomiyidae gen. et sp. indet. (Edison Seamount, see Krylova & Janssen 2006: 246, pl. 4, fig. 25).

ETYMOLOGY. — This new genus is named in memory of Prof. Lucien Laubier, Membre de l'Institut, who was one of the leading oceanographers in France and who passed away when this manuscript was in press.

DISTRIBUTION. — Western Atlantic: SW of Barbados, Barbados accretionary prism. Eastern Atlantic: Gulf of Guinea. Eastern Pacific: Panama Bay, Baja California.

DIAGNOSIS. — Shells medium-sized to large, suboval-triangular to oval-oblong (length: 35 to 120 mm, height about 21 to 62 mm), with subparallel dorsal and ventral margins, moderately inflated, with prosogyrate umbones situated well in front of the vertical midline. Posterior margin rounded or tapering, posteriormost point at or just above the horizontal midline. Postero-dorsal area with two shallow and rounded ridges, the more ventral of them being the posterior angle. No lunule and escutcheon. Umbones rather flattened and not prominent. Hinge with a long, thin and curved cardinal 1 and a fused cardinal 3a and 3b in the right valve and a long and strong cardinal, assumed to consist of fused 2a and 2b, and posterior short and laminar cardinal (4b) in the left valve. No posterior nymphal ridge. Ligament rather short, external. Subumbonal pit present but very small and narrow to indistinct. Pallial sinus well marked, triangular, without or occasionally with very short prolongation of the pallial line at the end of it. Ventral limb of the pallial sinus in general slightly broadened. Pallial line not completely parallel to the ventral margin but in its anterior part slightly more distant from it than in its posterior part. Anterior pedal retractor scar deep to very deep. Ctenidia with outer and inner demibranchs. Exhalant and inhalant siphonal tubes small but rather long, in correspondence to the pallial sinus, fused over their whole length, with numerous very short tentacles. Mantle lobes with outer, middle and inner mantle folds. Foot muscular and well developed, triangular. Mantle ventrally open from in front of the anterior adductor to the fusion just under the siphonal tubes.

REMARKS

Laubiericoncha n. gen. is distinguished from other large Vesicomiyidae by a combination of characters not seen elsewhere: its outline with broadly tapering posterior part with the posteriormost point (homologue to the postero-ventral corner in *Calyptogena* and other genera) situated in or just above the horizontal midline giving the valves the form of a *Lutraria*, the short, broad, acute and triangular pallial sinus, the two "posterior angles" and the typical hinge with diverging, rather long and thin but prominent cardinals, in the right valve a curved cardinal (fused 3a and 3b), a narrow anterior cardinal (1) situated under it and a very small to indistinct subumbonal pit. Species of the genus *Callogonia*, also with a well-developed and even deeper triangular pallial sinus, are smaller, somewhat shorter, the postero-ventral

TABLE 1. — Maximum length of the species of *Laubericoncha* n. gen.

| | |
|---|---------|
| <i>L. suavis</i> (Dall, 1913) n. comb. | 35 mm |
| <i>L. sp. indet.</i> (Edison Seamount) | 47.6 mm |
| <i>L. angulata</i> (Dall, 1895) n. comb. | 58 mm |
| <i>L. myriamae</i> n. gen., n. sp. | 96 mm |
| <i>L. chuni</i> (Thiele & Jaeckel, 1931) n. comb. | 120 mm |

corner is situated more ventrally, and in the hinge of the right valve, the cardinals 1, 3a and 3b are situated in a line, a hinge configuration also typical for *Vesicomya* s.s. and *Isorropodon* (for details, see Cosel & Salas 2001). The hinge configuration of *Laubericoncha* n. gen. is very close to that of *Calyptogena* s.s. and other Vesicomylidae hitherto grouped in *Calyptogena*. In *Calyptogena pacifica* Dall, 1891 (cf. Boss & Turner 1980: fig. 10B) the type species of *Calyptogena*, the cardinals 1 and 3a and 3b in the right valve and the cardinals 2a and 2b in the left valve are in the same position but shorter and thicker, while the cardinal 4b in the left valve is much longer. The gills of *Calyptogena* s.s. have only one demibranch, whereas in *Laubericoncha* n. gen. they have two. *Calyptogena* s.s. lacks a pallial sinus, there is no subumbonal pit, but a posterior nymphal ridge in the right valve is present. We follow Krylova & Sahling (2006) in using *Calyptogena* in a more restricted concept.

A superficially similar species is "*Calyptogena*" *diagonalis* Barry & Kochevar, 1999 from cold seeps off Oregon and Costa Rica (see Barry & Kochevar 1999). It is much larger (to 230 mm long) and much more elongate, but shares with *Laubericoncha* n. gen. the short ligament, the ctenidia with two demibranchs, the shallow but acute pallial sinus and the inclined ventral pallial line, which, however, in "*C.*" *diagonalis* is not slightly but markedly oblique. The posterior angle is rounded but much more pronounced and ends in a postero-ventral corner but not as high as in the horizontal midline as in *Laubericoncha* n. gen. In "*C.*" *diagonalis*, the basic arrangement of the teeth (see Barry & Kochevar 1999: fig. 1h) in the right valve is close to that of *Laubericoncha* n. gen., however, in *Laubericoncha* n. gen., the cardinals are much thinner and more elongately stretched. In the left valve, the dentition

of "*C.*" *diagonalis* has a different, more "venerid" aspect, with longer 2a and stronger 2b, according to the images, there is a small but well-marked subumbonal pit. Krylova & Sahling (2006) exclude *C. diagonalis* from *Calyptogena* in the strict sense but do not place it in another genus.

The most similar genus is *Archivesica* Dall, 1908 (type species: *Vesicomya gigas* Dall, 1895). As in *Laubericoncha* n. gen., the gills have two demibranchs, the subumbonal pit is also relatively small, but larger than in *Laubericoncha* n. gen. However, the pallial sinus has a different form: it is shorter, broader and not acute but just concave; the siphons are thicker and shorter, without tentacles seen. The anterior pedal retractor scar is shallow, in contrast to the deep scar in *Laubericoncha* n. gen. In *Archivesica gigas*, the shell is more subquadrate and more tumid, the umbones are more prominent, the posterior margin is not tapering, the ventral margin is straight, whereas in *Laubericoncha* n. gen. it is slightly to markedly convex (see Fig. 6B, for further figures of *Archivesica gigas* see Cosel [2006: 144, as "*Calyptogena gigas*"])

Besides *Laubericoncha myriamae* n. gen., n. sp. and *L. chuni* (Thiele & Jaeckel, 1931) n. comb., *Callogonia angulata* Dall, 1895 from the Gulf of Panama (2320–3050 m) is the third species to be placed in *Laubericoncha* n. gen. According to the figure in Dall (1908: fig. 263), it has a much more acute posterior margin than the two Atlantic species and is still more tapering posteriorly (see Fig. 6). The hinge of the figured right valve has the same configuration. Finally, following Krylova & Janssen (2006), we include also *Vesicomya suavis* Dall, 1913 from the W coast of Baja California, W of Tiburon Island (Animas) (25°N, 1345 m). Although Dall's figure (Dall 1925: pl. 27 fig. 1) shows only an external view, thanks to an unpublished sketch of the holotype (33.4 × 21.5 mm) by E. Krylova, the hinge dentition and pallial sinus prove its placement in the new genus. An undescribed species presumably also to be placed in the genus *Laubericoncha* n. gen. has recently been collected on Edison Seamount (SW Pacific) by the German RV *Sonne* (Krylova & Janssen 2006: 246, pl. 4 fig. 25). As the single valve obtained is of poor quality, we cannot positively confirm this until more and better material becomes

TABLE 2. — *Laubiericoncha myriamae* n. gen., n. sp., measurements (mm) with length/height ratio.

| Shell length × height × tumidity | Length/height ratio | Specimen |
|----------------------------------|---------------------|---|
| 96.2 × 53.2 × 35.7 | 1.8 | DIAPISUB, stn PL DS 10/15, holotype, MNHN 20550 |
| 71.8 × 43.5 × – | 1.7 | DIAPICAR 87 (no precision) |
| 68.6 × 39.6 × 25.6 | 1.8 | DIAPISUB, stn PL DS 03/1, paratype, MNHN 20551 |
| 49.0 × 31.2 × – | 1.6 | DIAPICAR 87 (no precision) |
| 41.5 × 24.6 × 14.7 | 1.7 | DIAPISUB, stn PL DS 04/2, associated spm. |

available. A further undescribed species cited for the new genus by Krylova & Janssen (2006: 249) comes from the Holocene of Gakkel Ridge in the Arctic. The known maximum lengths of each species are marked in Table 1.

Laubiericoncha myriamae n. sp.
(Figs 1; 2; 5C, D; 7A)

“Vesicomiyidae sp.” – Faugères *et al.* 1987: 117.

Vesicomya aff. *chuni* – Jollivet *et al.* 1990: 31; fig. 7b.

Vesicomya sp. – Olu *et al.* 1996: 371.

TYPE MATERIAL. — Holotype: Barbados accretionary prism, site Orénoque B (Dome 13), DIAPISUB, stn PL DS 10/15, 10°19.97'N, 58°37.30'W, 1949 m, 2.I.1993, 1 spm. (MNHN 20550).

Paratype: same locality, site Orénoque A, 10°20.27'N, 58°53.73'W, 1730 m, DIAPISUB, stn PL DS 03/1, 1 spm. (MNHN 20551).

TYPE LOCALITY. — Southern part of Barbados accretionary prism, ESE of Trinidad.

ETYMOLOGY. — Dedicated to our colleague Myriam Sibuet, cruise leader of ZAIANGO BIOL 2, BIOZAIRE and BIOZAIRE 2.

OTHER MATERIAL EXAMINED. — Barbados accretionary prism (no precision), DIAPICAR cruise, 1 lv., 1 juv. rv., both older and discoloured brown (see Jollivet *et al.* 1990: fig. 7b). — Barbados accretionary prism, site Orénoque A, 10°19.72'N, 58°53.21'W, 1689 m, DIAPISUB, stn PL DS 04/2, 1 juv. spm. (all MNHN).

DISTRIBUTION. — Southern Caribbean, ESE of Trinidad, only known from the type locality.

DESCRIPTION

Shell to 96 mm long (see Table 2), oblong-oval, rather thick and moderately tumid. Anterior margin

broadly rounded. Ventral margin convex, in the middle part straight. Posterior margin rounded, somewhat more narrowly rounded close to the horizontal midline. Umbones very shallow; beaks prosogyrous, well in front of the vertical midline, in fully grown specimens just before the end of the anterior third of the valve.

Surface with fine, dense, irregular commarginal ridges and some coarser irregular growth waves and stages, stronger and more pronounced towards the ventral part and close to the ventral margin. There are also some fine, irregular and more or less oblique wrinkles on the anterior and postero-dorsal part of the valves, partly becoming slightly laminar. Lunule and escutcheon absent. In place of the escutcheon and parallel to the postero-dorsal margin a sulcus with a rounded delimitation which can be characterized as a second posterior angle. Posterior angle closely below this ridge rounded but well marked and ending at the posterior extremity. Between the two “angles” a shallow radial depression, in which the wrinkly sculpture is more pronounced than on the rest of the shell. Periostracum yellowish, glossy on the earlier part of the shell, becoming more dull ventrally and posteriorly.

Hinge line short and rather narrow but strong. Right valve with a lower anterior, strong and laminar cardinal (1) starting almost parallel to the antero-dorsal margin, then curving upwards and ending directly under the beaks, and a longer and stronger posterior cardinal, assumed to be fused 3a and 3b. It starts above the lower part of the anterior tooth (1) parallel to it, ascends towards the umbo and then descends backwards to beneath the anterior part of the ligament, with anterior limit almost vertical. Left valve anteriorly with a long, strong and somewhat irregular tooth 2a ascending towards the

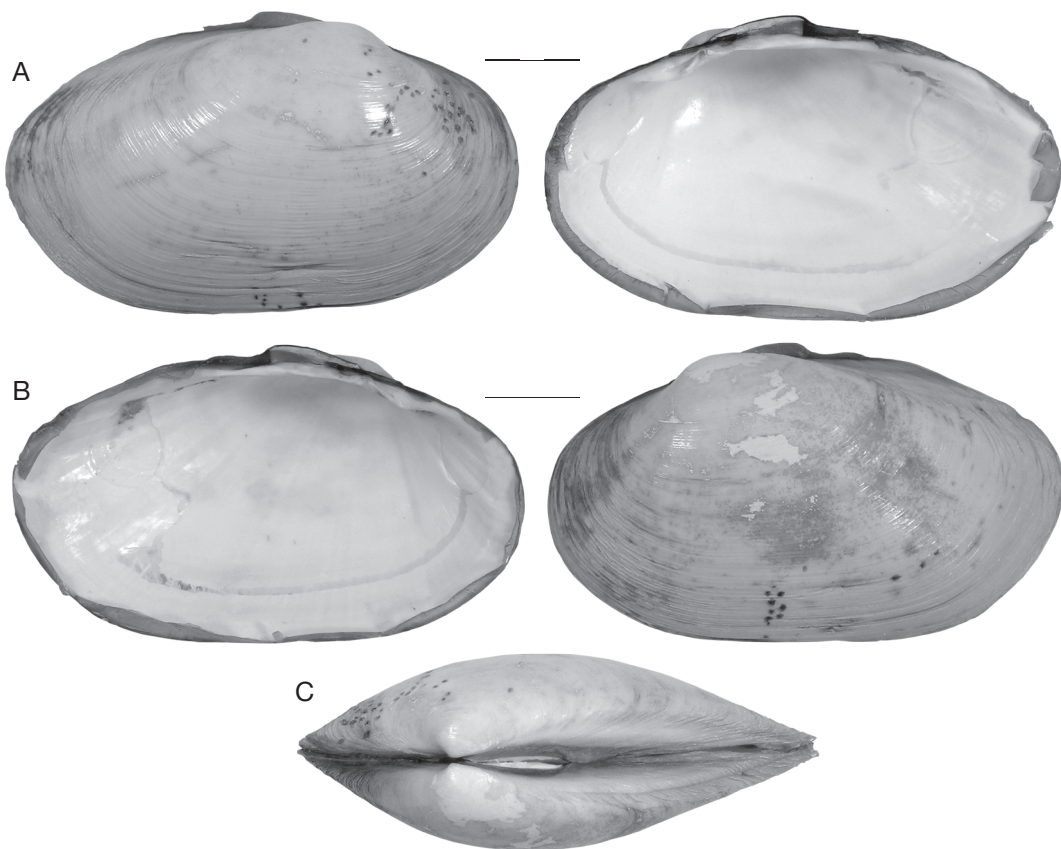


FIG. 1. — *Laubiericoncha myriamae* n. gen., n. sp., holotype, shell length 96.2 mm, Barbados accretionary prism, site Orénoque B (Dome 13), 10°19.97'N, 58°37.30'W, 1949 m, DIAPISUB cruise, stn PL DS 10/15, 2.I.1993: **A**, exterior and interior of right valves; **B**, exterior and interior of left valve; **C**, dorsal view.

dorsal margin and situated under the umbo and in front of it. Cardinal 2b fused with cardinal 2a under the umbo, descending to the ventral margin of the hinge plate and inclined anteriorly. Posteriorly to the teeth 2a and 2b the shorter and laminar posterior cardinal (4b), inclined towards posteriorly. Ligament external, opisthodetic, rather short, on a narrow but strong nymphal plate. Subumbonal pit very small, shallow to indistinct. Pallial sinus short but well developed, nearly triangular, acute and pointing to about the middle of the anterior adductor scar; no prolongation of the pallial line on the anterior side of the sinus extremity. Anterior pedal retractor scar deep, separate from the anterior adductor scar. Posterior pedal retractor scar united

with the posterior adductor scar. Inside of the valves with very faint, irregularly sized and spaced vermiculations or waves, more pronounced in the posterior part, and a very weak rib running from the umbonal cavity to the lower tip of the anterior adductor scar.

Valves entirely white.

Ctenidia large and fleshy, inner demibranch with about half the shell length (53 mm in the holotype), outer demibranch shorter, 45 mm in the holotype (see Fig. 5C). Food groove very narrow and visible in both demibranchs. Exhalant and inhalant siphonal tubes small but rather long, fused over their whole length, with numerous very short tentacles around the common opening (Fig. 5D). Siphonal

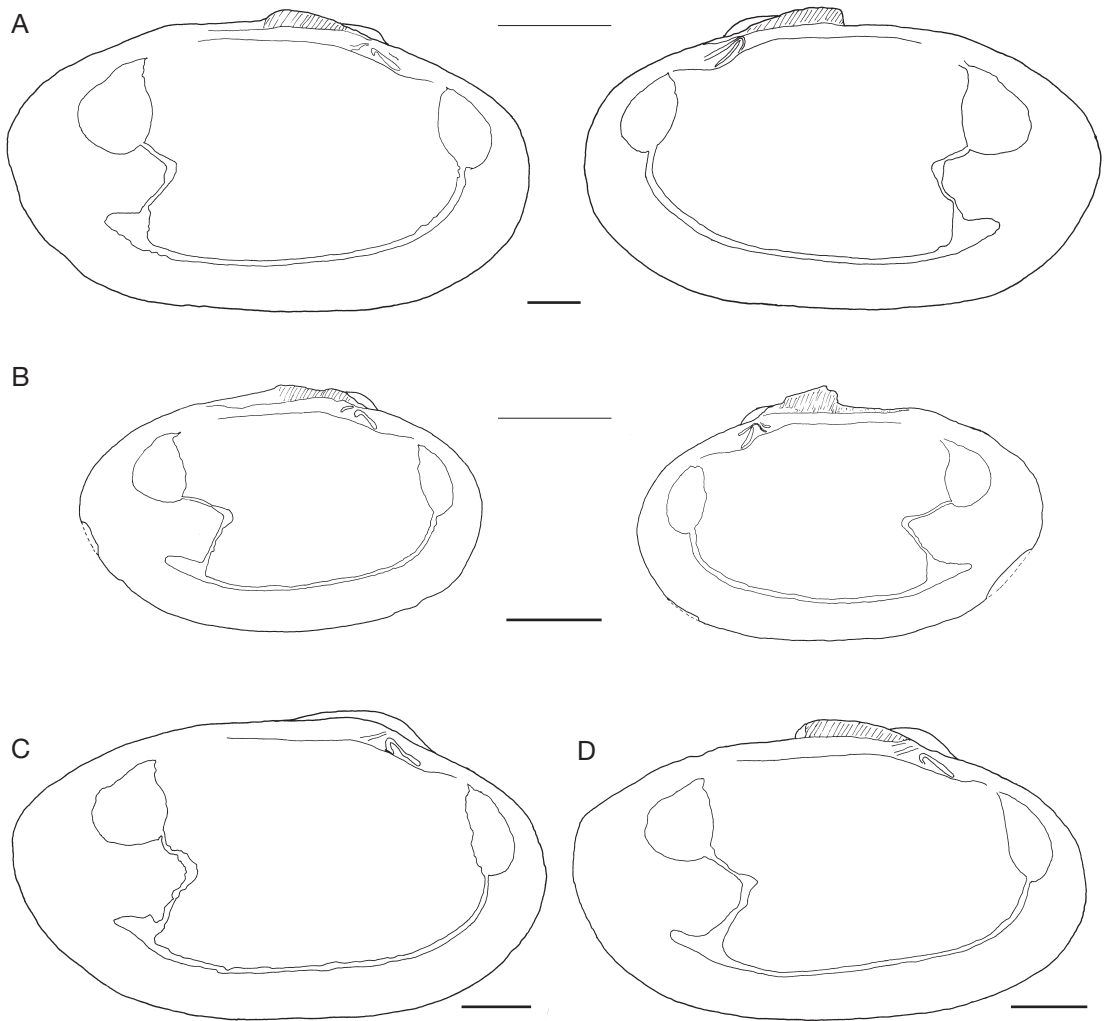


FIG. 2. — *Laubiericoncha myriamae* n. gen., n. sp., semi-schematic drawings of the insides of valves: **A**, holotype, rv. and lv.; **B**, associated juvenile specimen, rv. and lv.; **C**, paratype, lv.; **D**, specimen from DIAPICAR cruise (no precision), lv. Subligamental pits not drawn, see Figure 6. Scale bars: 10 mm.

tentacles with a small thickening at their ends. Inner mantle fold in its posterior part with very small, blunt tentacles for a length of about 3 mm (holotype) on both sides from the mantle fusion under the inhalant siphonal tube towards anterior. Foot muscular, laterally somewhat flattened.

BIOTOPE

Laubiericoncha myriamae n. sp. has been sampled on two cold seep sites on the southern part of the

Barbados accretionary prism. The first site is located at the top of a diapiric ridge of the Orénoque A sector described by Faugères *et al.* (1987) and Jollivet *et al.* (1990) (DIAPICAR cruise) and by Olu *et al.* (1996) (DIAPISUB cruise with submersible). The species was living there together with two *Bathymodiolus* species, *B. boomerang* Cosel & Olu, 1998 and *Bathymodiolus* sp. aff. *B. childressi* Gustafson, Turner, Lutz & Vrijenhoek, 1998 (see also Olu-Le Roy *et al.* 2007b) and with several species of “vestmentiferan”

TABLE 3. — *Laubiericoncha chuni* (Thiele & Jaeckel, 1931) n. comb., selected measurements (mm) with length/height ratio.

| Shell length × height × tumidity | Length/height ratio | Specimen |
|----------------------------------|---------------------|------------------------|
| 120.2 × 62.1 × 41.4 | 1.9 | REGAB, stn CP 20 BZ 3 |
| 120.1 × 60.6 × — | 2.0 | REGAB, stn CP 20 BZ 3 |
| 115.4 × 67.2 × 41.2 | 1.7 | REGAB, stn CP 20 BZ 3 |
| 112.2 × 60.4 × — | 1.9 | REGAB, stn CP 20 BZ 3 |
| 110.8 × 63.6 × 39.1 | 1.7 | REGAB, stn CP 20 BZ 3 |
| 105.3 × 52.4 × 36.2 | 2.0 | REGAB, stn PL 145 BZ 2 |
| 100.8 × 57.3 × 39.2 | 1.8 | REGAB, stn CP 20 BZ 3 |
| 95.9 × 62.4 × — | 1.7 | paralectotype ZMB |
| 92.5 × 55.5 × — | 1.8 | lectotype ZMB |
| 91.8 × 45.5 × 31.5 | 2.0 | REGAB, stn CP 20 BZ 3 |
| 86.2 × 49.2 × 33.2 | 1.8 | REGAB, stn CP 20 BZ 3 |
| 55.0 × 34.1 × — | 1.6 | REGAB, stn CP 20 BZ 3 |
| 40.8 × 22.7 × 13.8 | 1.8 | REGAB, stn CP 20 BZ 3 |
| 32.3 × 19.2 × 11.0 | 1.7 | REGAB, stn CP 20 BZ 3 |
| 26.6 × 15.5 × 10.3 | 1.7 | REGAB, stn CP 20 BZ 3 |
| 25.8 × 16.2 × 9.6 | 1.6 | REGAB, stn CP 20 BZ 3 |
| 21.2 × 13.7 × 8.0 | 1.5 | REGAB, stn CP 20 BZ 3 |
| 20.4 × 13.1 × 7.9 | 1.6 | REGAB, stn CP 20 BZ 3 |
| 19.8 × 12.3 × 7.0 | 1.6 | REGAB, CP 20 BZ 3 |

worms (Siboglinidae, Polychaeta). Aggregates of a few tens of *L. myriamae* n. sp. were observed in the sedimentary areas and a few individuals were observed around the *Bathymodiolus* spp. aggregates, associated with carbonate concretions. Numerous shells were also observed; some of them were taken and dated, their age was between 10 000 and 20 000 years. Temperature gradient measurements in the sediment indicated active fluid venting at this site. The second site is located at the top of a mud dome of the Orénoque B sector (Olu *et al.* 1996). *Laubiericoncha myriamae* n. sp. was living there in small aggregations in association with *Bathymodiolus boomerang* and Siboglinidae. Temperature measurement indicated no active venting at this time.

REMARKS

Laubiericoncha myriamae n. sp. is close to *L. chuni* n. comb. (see below) but is slightly shorter and is distinguished by the more regular elongate-oval outline with more rounded and less tapering posterior margin, subparallel dorsal and ventral margins, the broader hinge plate, the less pronounced to obsolete commarginal wrinkles giving the surface a smooth appearance, and the periostracum which

on the whole valve is glossy and not leafy as in *L. chuni* n. comb. The valves of *L. myriamae* n. sp. are somewhat thicker and heavier. The subumbonal pit is very small and almost indistinct, whereas in *L. chuni* it is small but deep and well distinguished. The umbones of *L. chuni* n. comb. are slightly more prominent and placed more forward than in *L. myriamae* n. sp. The tube uniting the fused siphons is slightly smaller and more delicate than in *L. chuni* n. comb.

Laubiericoncha chuni

(Thiele & Jaeckel, 1931) n. comb.
(Figs 3; 4; 5A, B; 7B)

Vesicomya chuni Thiele & Jaeckel, 1931: 228, pl. 9 (4), fig. 100.

Vesicomya (Callogonia) chuni – Boss 1970: 68, 69, figs 1, 2, 21, 24.

“*Vesicomya*” *chuni* – Cosel & Salas 2001: 356–358, figs 74, 75, 96, 97, 107.

TYPE MATERIAL. — Lectotype, a lv., selected by Boss (1970: 68) (ZMB Moll. 77848a); paralectotype: same locality, a rv., (ZMB Moll. 77848a), both trawled by RV *Valdivia*. The numerous additional valves from the same locality (ZMB Moll. 77848b) were not mentioned by Boss (1970) apparently he may not have seen them. These valves are also paralectotypes.

TYPE LOCALITY. — W of Campo, Cameroon, Gulf of Guinea, 2°00'N, 8°4.3'E, 2492 m.

OTHER MATERIAL EXAMINED. — Cabinda, W of Congo river mouth, REGAB site, N of Congo Canyon, 5°46.89'S, 9°44.65'E, 3159–3113 m, trawled by RV *Atalante*, BIOZAIRE 3 cruise, stn CP 20, 2.I.2004, leg. R. von Cosel, numerous sh., valves and fragments. W of Congo (Brazzaville), ASTRID site, ZAIROV 2 cruise, ROV *Victor*, stn PI 73–13 (CT 0), 4°57'S, 10°09.5'E, 2820–2840 m, 1 juv. sh. (all MNHN).

DISTRIBUTION. — Gulf of Guinea from Cameroon (2°N) to the Congo Canyon (5°46'S). Boss (1970) mentions an additional record from SE of Accra, Ghana at 4°58'N, 3°48'E, 2268–2332 m, RV *Pillsbury* (University of Miami), stn 314.

DESCRIPTION

Shell to 120 mm long (see Table 3), oblong-oval, quite variable in shell shape and outline, moderately

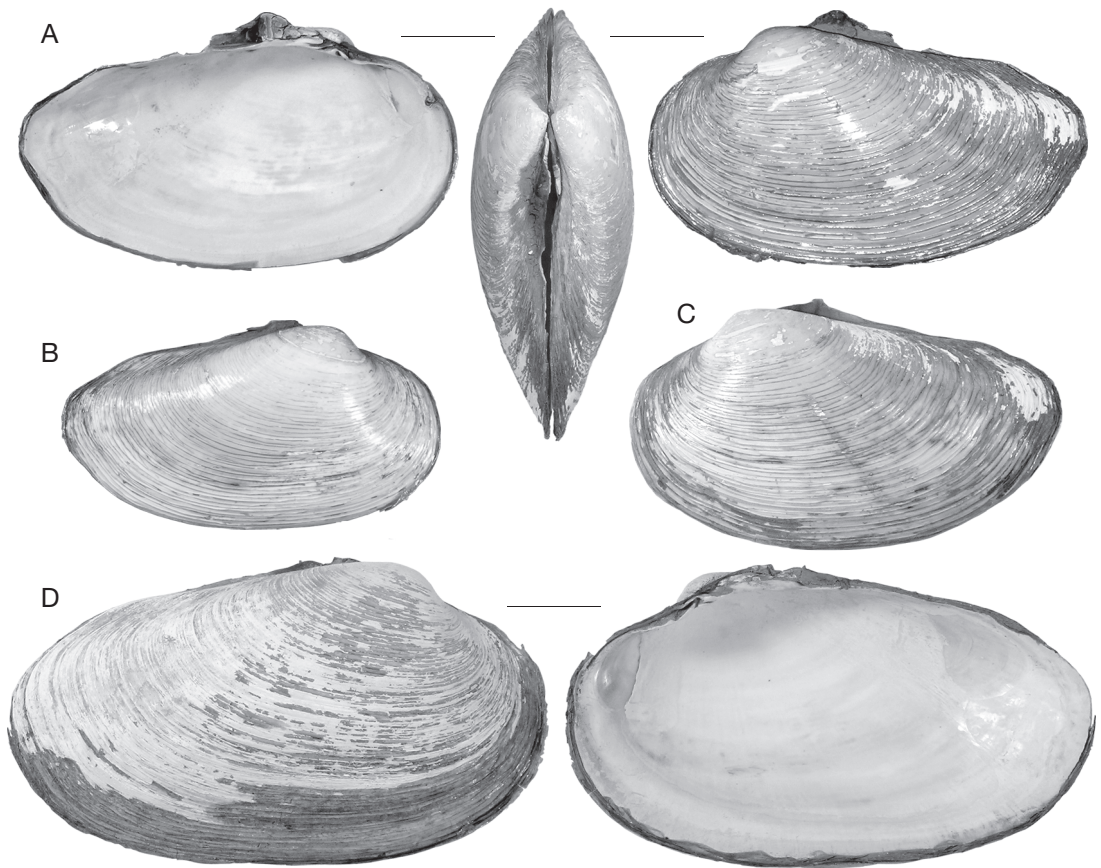


FIG. 3. — *Laubiericoncha chuni* (Thiele & Jaekel, 1931) n. comb.: **A**, interior and exterior of lv., dorsal view, shell length 83.2 mm; **B**, juvenile spm., exterior of rv., shell length 75.0 mm; **C**, exterior of lv., shell length 85.0 mm; **D**, fully grown specimen, exterior and interior of rv., shell length 108.6 mm. All from the REGAB site, N of Congo Canyon, 5°47.378'S, 9°44.205'E, 3159-3113 m, trawled by RV *Atalante*, BIOZAIRE 3, stn CP 20.

tumid, rather light and thin-shelled and only in large fully grown specimens occasionally becoming thicker. Anterior margin broadly rounded. Ventral margin convex, in the middle part slightly convex, in very large specimens occasionally almost straight. Posterior part broadly tapering, ending in a rounded corner close to the horizontal midline. Umbones very shallow; beaks prosogyrous, well in front of the vertical midline, in fully grown specimens just before the end of the anterior third of the valve.

Surface dull, chalky, with fine, very densely spaced, irregular commarginal, slightly laminar ridges which on the anterior, ventral and posterior part of the valves become more or less wrinkly and oblique. Earliest

part almost smooth, only with fine to indistinct growth lines. Lunule and escutcheon absent. In place of the escutcheon and parallel to the postero-dorsal margin a sulcus with a rounded delimitation which can be characterized as a second posterior angle (see also Boss [1970]). Posterior angle closely below this ridge rounded but well marked and ending at the posteriormost margin. Between the two "angles" a shallow radial depression, in which the wrinkly sculpture is denser than on the rest of the shell. On juvenile and subadult specimens periostracum glossy, pale straw-coloured, especially on the earlier parts, on fully grown specimens more brownish on the ventral part and more or less eroded on the rest

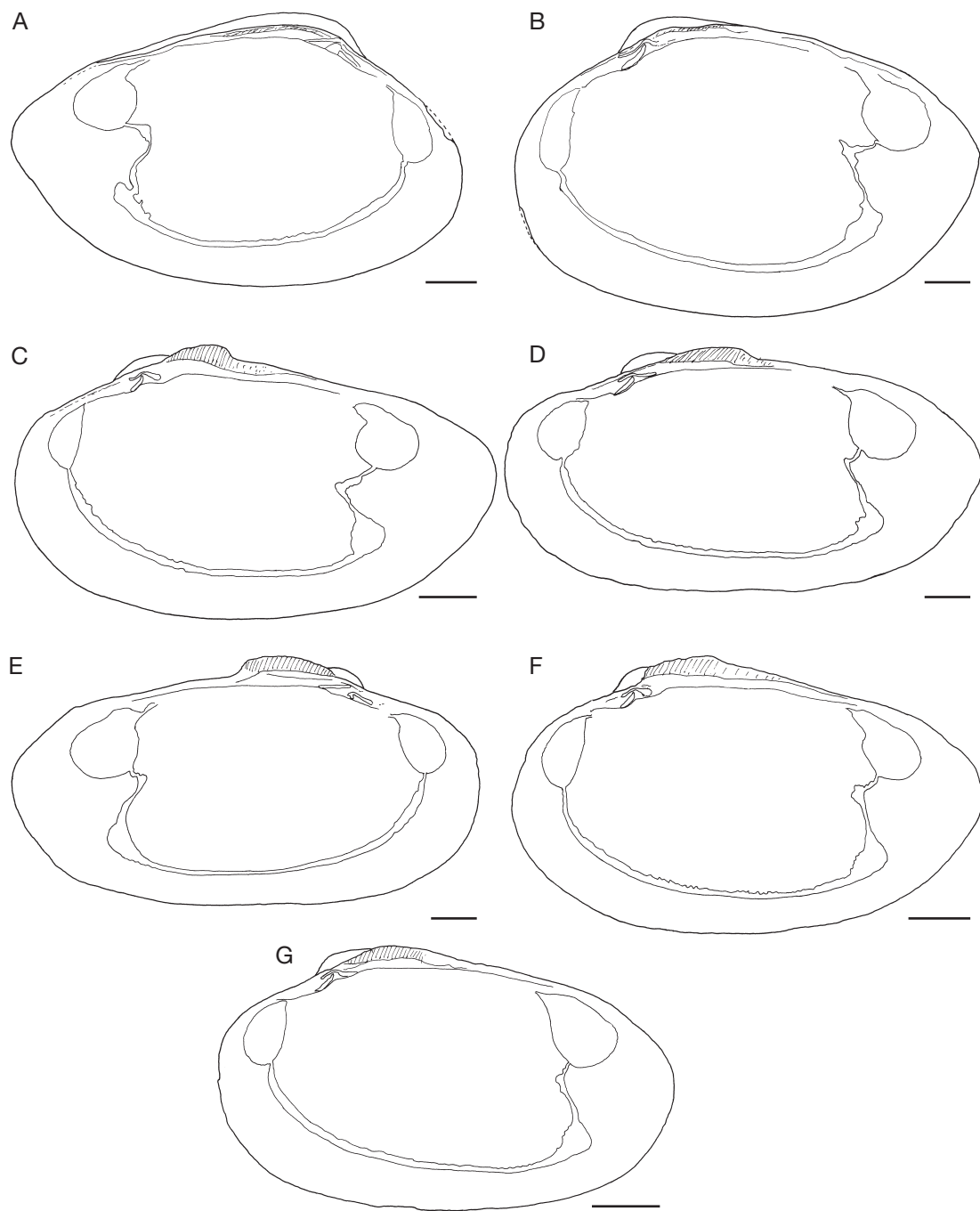


FIG. 4. — *Laubiericoncha chuni* (Thiele & Jaeckel, 1931) n. comb., semi-schematic drawings of the insides of valves: **A**, lectotype (ZMB Moll. 77848a), Cameroon, lv.; **B**, paralectotype (ZMB Moll. 77848a), rv.; **C-G**, specimens from the REGAB site, N of Congo Canyon, 5°47.378'S, 9°44.205'E, 3159-3113 m, trawled by RV *Atalante*, BIOZAIRE 3, stn CP 20, to show outline variability. Subligamental pits not drawn, see Figure 7. Scale bars: 10 mm.

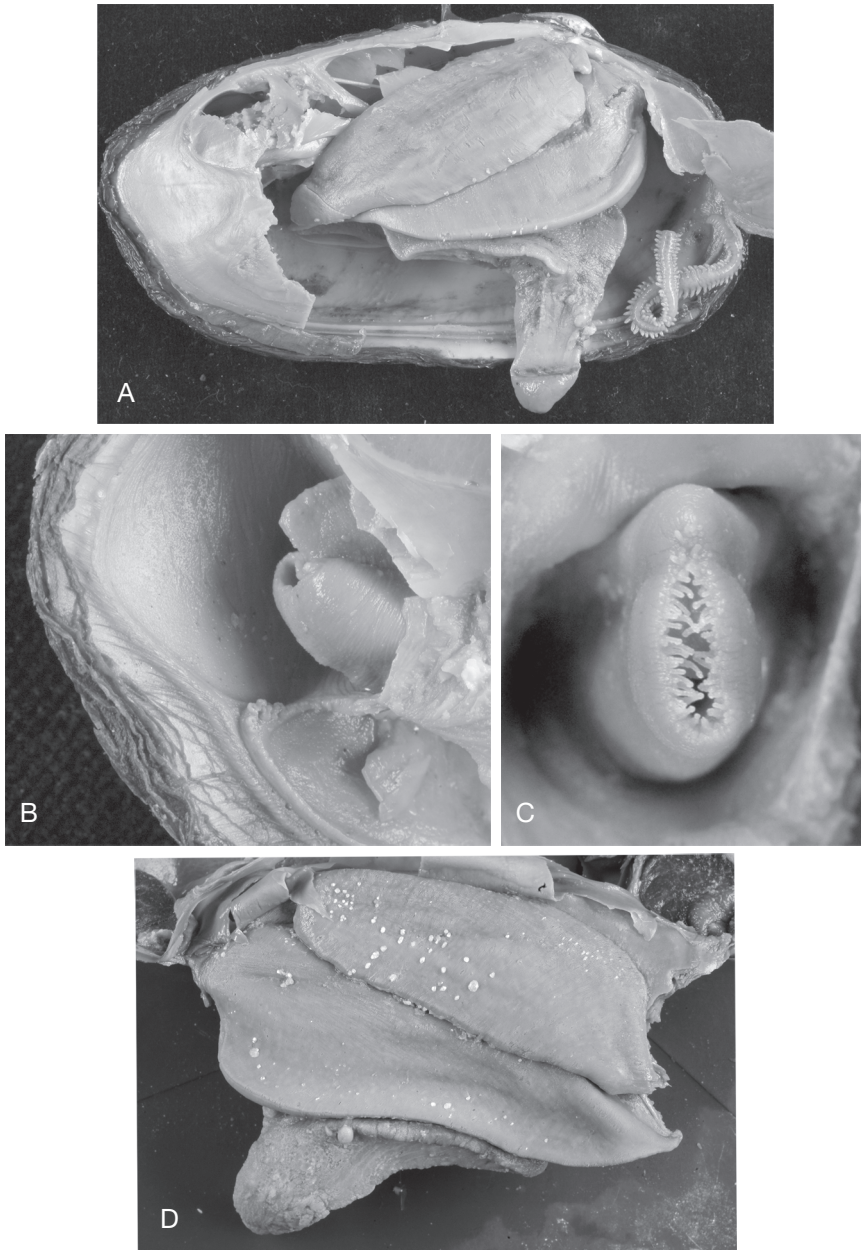


FIG. 5. — Soft parts of *Laubiericoncha* n. gen.: **A, B**, *L. chuni* (Thiele & Jaeckel, 1931) n. comb., ZAIROV 2, PL 14 REGAB site; **A**, general view of soft parts showing ctenidia, mantle lobes removed, shell length 93.7 mm. The polychaete was in the mantle cavity; **B**, close-up view of the posterior end, showing the siphons, mantle lobe cut and removed, diameter of the tube of inhalant siphon about 5×6 mm; **C, D**, *L. myriamae* n. gen., n. sp.; **C**, paratype, close-up view of the siphons from behind, showing tentacles of inhalant (lower) siphon, dorsoventral diameter of inhalant siphon 3.3 mm, shell length 68.6 mm; **D**, holotype, ctenidia and foot viewed from the left, shell length 96.2 mm.

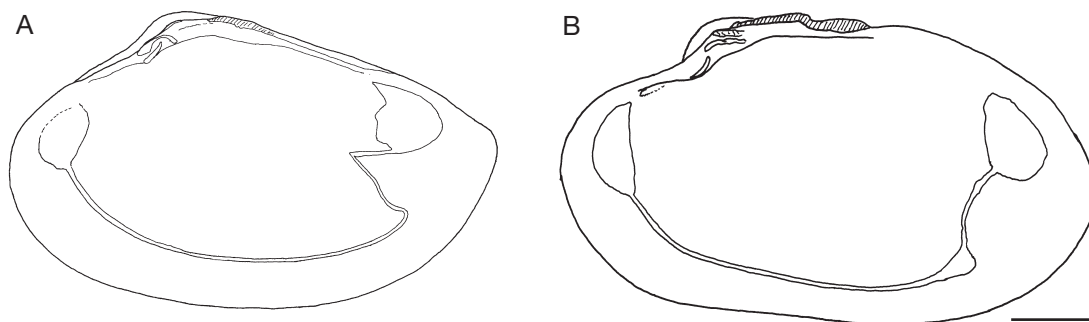


FIG. 6. — **A**, *Laubiericoncha angulata* (Dall, 1895) n. comb., semi-schematic drawing of the inside; holotype (USNM), a rv. (after Dall 1908: pl. 6, fig. 12), shell length 58 mm; **B**, *Archivesica gigas* (Dall, 1895), semi-schematic drawing of the inside of a rv., shell length 67.0 mm, Guaymas Basin, Gulf of California, Mexico, Claire site, 27°00,94'N, 111°24.66'W, 2025 m, GUAYNAUT cruise, strn Pl. 18, 30.XI.1991 (MNHN). Scale bar: B, 10 mm.

of the shell, close to the margins becoming slightly leafy along the lamellae.

Hinge line rather narrow and short. Right valve with a lower anterior, strong and laminar cardinal tooth (1), which starts almost parallel to the antero-dorsal margin, then curves upwards and ends directly under the beaks, and a longer and stronger posterior tooth, assumed to be fused 3a and 3b. It starts above the anterior tooth parallel to it, ascends towards the umbo and then descends backwards to beneath the anterior part of the ligament, in form of an inverted “V”. Left valve anteriorly with a strong and somewhat irregular tooth 2a ascending towards the dorsal margin and situated beneath the umbo. Cardinal 2b thick and more or less triangular, fused with cardinal 2a under the umbo, descending vertically to the ventral margin of the hinge plate or somewhat inclined towards anteriorly. Posterior to 2a and 2b the well-inclined laminar posterior tooth (4b), inclined towards posteriorly. Ligament external, opisthodontic, rather short, on a narrow but strong nymphal plate. Subumbonal pit very short, shorter than 4a or 3a + 3b teeth, but deep and well marked. Pallial sinus variable, more or less deep, nearly triangular, acute or more rounded at the end and pointing to the upper limit of the anterior adductor scar; prolongation of the pallial line on the anterior side of the sinus extremity in general absent, in few specimens, however, a very small prolongation can be seen. Anterior pedal retractor scar deep to very deep, separate from the

anterior adductor scar. Posterior pedal retractor scar united with the posterior adductor scar. Inside of the valves with very faint, irregularly sized and spaced radial vermiculations or waves and a very weak rib running from the umbonal cavity to the lower tip of the anterior adductor scar.

Valves whitish, with pale reddish brown hue on the interior within the limits of the pallial line.

Ctenidia with two demibranchs, large, moderately thick and fleshy, 52 mm long (inner demibranch) and about 45 mm (outer demibranch) in a 93 mm specimen (38 mm and 34 mm in a 88.4 mm specimen). Weak food-groove visible in both demibranchs. Siphons small but rather long and fused (in the preserved specimens retracted). Inhalant siphon with numerous very short tentacles, not well visible in preserved specimens. Blood with haemoglobin. Inner mantle fold in its posterior part with small blunt tentacles for a length of about 10 mm on both sides from the mantle fusion under the inhalant siphonal tube towards anterior.

BIOTOPE

Laubiericoncha chuni n. comb. has been sampled on the giant pockmark called REGAB (south of Gabon, 6°S) which is a very active cold seep site (Ondreas *et al.* 2005; Olu-le Roy *et al.* 2007a), it is situated 8 km N of the Congo Canyon at 3150 m depth. Methane rich fluids are expelled at different places on the pockmark, and preferentially in its central zone where carbonate concretions

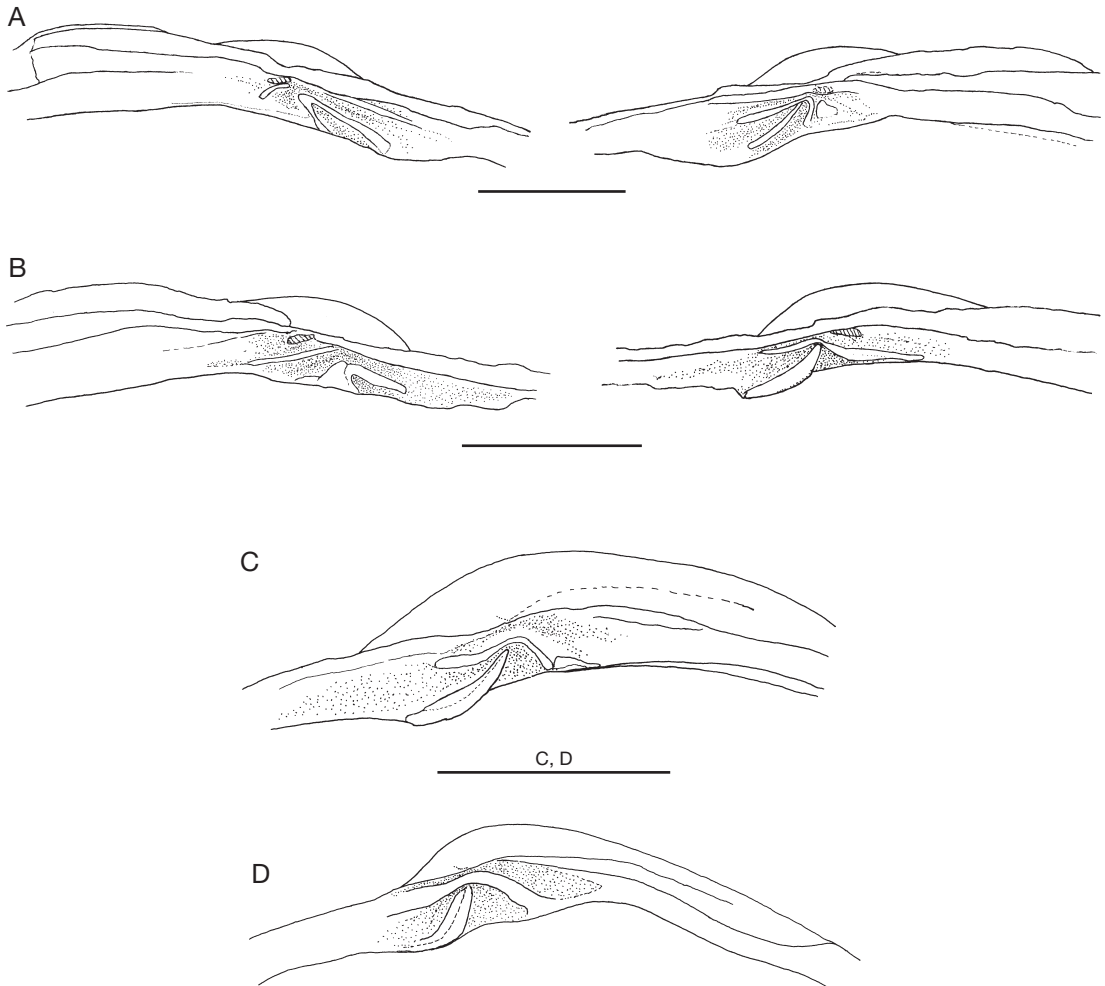


FIG. 7. — Hinges of *Laubiericoncha* n. gen.: **A**, *L. myriamae* n. gen., n. sp., holotype, lv. and rv.; **B**, *L. chuni* (Thiele & Jaeckel, 1931) n. comb.; **C**, specimen from the REGAB site, 5°47.378'S, 9°44.205'E, 3159–3113 m, trawled RV *Atalante*, BIOZAIRE 3, stn CP 20, lv. and rv.; **C**, paralectotype ZMB Berlin, W of Campo, Cameroon, 2°00'N, 8°4.3'E; **D**, *L. suavis* (Dall, 1913) n. comb., rv., from a sketch by E. Krylova, shell length 35 mm. Scale bars: 10 mm.

are developed. *Laubiericoncha chuni* n. comb. was collected in sedimentary areas at the southwestern part of the pockmark where a very large (100 × 50 m) vesicomid field was observed. Other vesicomid aggregations occurred in the central area in dark and sulfide rich sediment around the concretions. *Laubiericoncha chuni* n. comb. co-occurs with another large vesicomid species, which is currently under description by the present authors. During beam trawl operations on the northern part of the

pockmark during the BIOZAIRE 3 cruise (December 2003–January 2004), the trawl accidentally hit a large agglomeration of mostly empty fresh shells of both species on rather sticky grey mud, among them hundreds of complete shells and a few live specimens of *Laubiericoncha* n. gen. The material taken by the *Valdivia* off Cameroon consisted of old and subrecent-looking valves only, and it cannot be excluded that the seeps at that very place are not active any more.

REMARKS

The type material of *L. chuni* n. comb. was already figured and the separation of *Laubiericoncha* n. gen. from *Callogonia* Dall, 1889 discussed by Cosel & Salas (2001: 356-358, figs 74, 75, 96, 97, 107). Subsequently, during the BIOZAIRE cruises, live-collected specimens of *Laubiericoncha* n. gen. already considered very close to *L. chuni* n. comb., were taken on the REGAB cold-seep site (see above). The specimens of this population show slight differences from the type material of *L. chuni* n. comb. originating from off Cameroon (2°N), which is situated at a distance of about 900 km to the North of REGAB. However, both populations are very variable in outline, and much overlap occurs. REGAB specimens are in general more elongate-lutrariform and more thin-shelled than the specimens from Cameroon, the beaks are situated more forward, the ventral margin is often less convex to almost straight in its middle. The hinge teeth are, within their basic configuration typical for the genus, quite variable in length and form. However, given the variability of the vast collected material from the REGAB site and all specimens from the type locality, we do not see any reason for morphologically separating the Gabon-Congo specimens from the Cameroon specimens of *Laubiericoncha chuni* n. comb. at species or subspecies level.

DISCUSSION

Vesicomidae are very heterogenous in shell form, size and hinge configuration. Ninety seven Recent and Tertiary species have been described in the family and 13 genera or subgenera proposed (Cosel unpublished list). However, genera were not always well defined or delimited, and it was often not very clear into which genus a species should be placed. For example, the genera *Pleurophopsis*, *Phreagena*, *Ectenagena*, *Akebiconcha* and *Hubertschenckia* were synonymized with *Calyptogena* by Boss & Turner (1980). This confusion on the generic level, backed by results of recent molecular works then led several authors to limit the employed genera to *Vesicomya*, *Calyptogena*, *Archivesica* and *Ectenagena* or *Archivesica*

and *Ectenagena* as subgenus of *Vesicomya* (Okutani 2000) or of *Calyptogena* (Okutani *et al.* 2000; Cosel 2006) or just *Vesicomya* for all (Coan *et al.* 2000; Goffredi *et al.* 2003). During the last decade, several genetic and evolutionary studies on Vesicomidae, mostly the larger species, were published (Peek *et al.* 1997; Baco *et al.* 1999; Goffredi *et al.* 2003), and from these, it resulted that the attribution to genera as it was done until then, is finally without an evolutionary background. Goffredi *et al.* (2003) underline that the genera as they have been employed up to now, "do not circumscribe monophyletic groups of species". Anyway, the family needs a division into different and clearly defined genera.

A first attempt, based on morphology and departing from the type species of *Vesicomya*, was made by Cosel & Salas (2001), who redefined the genera *Vesicomya*, *Waisiuconcha*, *Isorropodon* and *Callogonia* based on shell characters, mainly hinge configuration, pallial sinus, pallial line and, to a lesser extent, shell form, and also on the soft parts where these were available. A further important step was made by Krylova & Sahling (2006) with a revision and precise definition of the genus *Calyptogena* s.s.

Laubiericoncha n. gen. is founded on well-defined characters: form of the hinge teeth, shell outline, shallow but pronounced triangular pallial sinus, quite thin shell, rather highly placed posteriormost point; gills with two demibranchs and small, fused tubular siphons. This combination is not found in other Vesicomidae and sets the group apart. This genus is distributed with four species in three major zoogeographical provinces: tropical eastern Atlantic, Caribbean Province and tropical eastern Pacific. Of the other two species presumed to belong to the same genus, the available material is not sufficient to, at present, definitely include them in the genus. In this case the distribution would be enlarged to the southwestern Pacific and to the Arctic.

Preliminary phylogenetic analyses including *Laubiericoncha myriamae* n. gen., n. sp. and its symbionts based on COI for the vesicomid and 16S RNA for the symbiont included it in a quite robust clade having a common ancestor with *Calyptogena elongata* from the Santa Barbara basin, California. This clade includes eastern Pacific species from Peru, the Guaymas basin (*Calyptogena gigas*), to

the Gorda Ridge (*Ectenagena extenta*) and Oregon (*C. kilmeri*) (Jollivet *et al.* unpubl.). However, the two morphotypes of *L. myriamae* n. gen., n. sp. that correspond to one species (98% similarity) form a well-identified group apart and being isolated from the eastern Pacific species and from another group including an undescribed vesicomysid, *Calyptogena* sp., from the deep Barbados prism. These results will be published in a more general phylogenetic study including most large species of Vesicomysidae from the Gulf of Guinea.

Acknowledgements

We are grateful to J.-C. Faugères and the participants of the DIAPISUB cruise, to H. Ondréas and the participants of the ZAIROV cruise, to M. Sibuet and the participants of the BIOZAIRE 1 and BIOZAIRE 2 cruises and to A. Khripounoff and the participants of BIOZAIRE 3, as well as captain and crew of the RV's *Nadir* and *Atalante*. We are indebted to E. Krylova for kindly sending a drawing of the inside of *L. suavis* (Dall, 1913). E. Krylova and J. Taylor revised earlier drafts of the manuscript and gave valuable hints to improve it.

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Submitted on 30 July 2007;
accepted on 8 January 2008.