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A CONSPECTUS OF THE MARINE AND  
FRESH-WATER CILIATA BELONGING  
TO THE SUBORDER TINTINNOINEA,  
WITH DESCRIPTIONS OF NEW SPECIES  
PRINCIPALLY FROM THE AGASSIZ  
EXPEDITION TO THE EASTERN  
TROPICAL PACIFIC  
1904-1905

BY

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UNIVERSITY OF CALIFORNIA PRESS

BERKELEY, CALIFORNIA

1929

F B. 946

**Helicostomella edentata** (Fauré-Fremiet) emended

Figure 208

Non *Cyttarocypris subulatus*, Entz, Jr., 1904, pp. 128-130, 133, figs. 7, 8 (see *Tintinnopsis radix*).

*Tintinnus subulatus*, Brandt, *partim*, 1906, p. 31, pl. 65, fig. 5 (for pl. 65, figs. 1-4 see *H. subulata*); 1907, pp. 9, 15, 18, 22, 27, 30-47, 213, 259, 261, 344, 374-376, 392-401, 408, 445, 446, 448, 450, 480, 483 (see also *H. subulata*); Merkle, 1909, pp. 162-186, pl. 2, fig. 19, pl. 3, fig. 69.

*Amphorella subulata* var. *edentata* Fauré-Fremiet, 1924, pp. 108-110, fig. 35.

*Amphorella subulata*, Fauré-Fremiet, 1908, pp. 212, 234-236, fig. 21.

Raised to status of species.

Lorica awl-shaped, 6.9-7.8 oral diameters in length; oral rim entire; 5-7 suboral turns, subequal in width or slightly wider orally, with everted, undulating, but not dentate anterior edges; bowl cylindrical in the oral 0.66 of its length, conical ( $17^\circ$ ) aborally; aboral horn subconical ( $5^\circ$ ), 1.25-2.00 diameters in length; tip blunt. Length 147-168 $\mu$ .

The type locality is the Bay of Naples. Occurs also in the Bay of Croisic, France.

Differs from *H. subulata* in the absence of teeth on the oral margin, fewer turns, and less taper of the bowl.

**Helicostomella fusiformis** (Meunier) Jörgensen

Figure 207

*Amphorella subulata*, Meunier, 1910, p. 131, pl. 10, figs. 14, 15.

*Amphorella fusiformis* Meunier, 1919, pp. 18, 19, pl. 22, figs. 10-12.

*Helicostomella subulata* var. *fusiformis*, Jörgensen, 1927, p. 10, fig. 15.

*Helicostomella subulata*, *partim*, Jörgensen, 1924, pp. 25, 107, fig. 26a (for fig. 26b see *H. subulata*).

**Helicostomella kiliensis** (Laackmann) Jörgensen

Figure 210

*Tintinnus subulatus* var. *kiliensis* Laackmann, 1906, pp. 2, 17, 18, 36, pl. 1, figs. 1, 2, pl. 2, fig. 29; Brandt, 1907, pp. 43, 393-399, 469, 480; Lohmann, 1908, pp. 292, 295, 337, pl. 15; Entz, Jr., 1908, p. 105; Merkle, 1909, pp. 162-163.

*Amphorella subulata* var. *kiliensis* Bull. Plauk., 1908-1911, p. 74; Jörgensen, 1912, p. 2; Ostenfeld, 1916a, p. 41.

*Amphorella subulata*, Meunier, 1919, p. 17, pl. 22, figs. 8, 9.

*Helicostomella subulata* var. *kiliensis*, Jörgensen, 1924, p. 25.

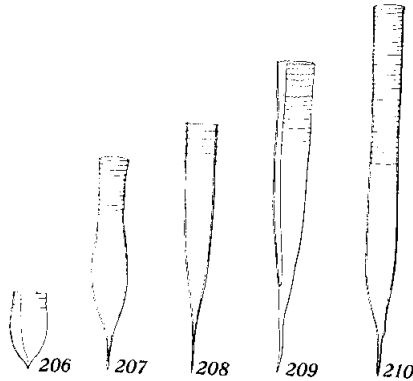
Raised to status of species.

Lorica stout awl-shaped, 6.2-12.5 oral diameters in length; oral rim sinuous; 5-32 aboral turns of equal width and sinuous upper margin; bowl cylindrical in the oral 0.7-0.8 of its length, conical ( $25^\circ$ )

aborally; aboral horn subcylindrical, short, 0.8–1.5 oral diameters in length; tip blunt. Length 97–240 $\mu$ .

The type locality is the Bay of Kiel.

Differs from *H. subulatus* and *H. edentata* in the more abrupt contraction of the aboral end of the bowl and from the former in the absence of oral teeth.



Figs. 206–210. Species of *Helicostomella* Jörg.  $\times 200$ .

Fig. 206. *H. longa* (Bdt.) after Brandt (1906, pl. 65, fig. 6) from off Talcahuano, Patagonia.

Fig. 207. *H. fusiformis* (Meunier) Jörgensen after Meunier (1919, pl. 22, fig. 12) from the Flemish Sea.

Fig. 208. *H. edentata* (Fauré-Fremiet) after Fauré-Fremiet (1924, p. 109, fig. 35) from the Bay of Croisic, France.

Fig. 209. *H. subulata* (Ehrbg.) Jörg. after Brandt (1906, pl. 65, fig. 4) from Station 931 "Princesse Alice" off the coast of Norway.

Fig. 210. *H. kilensis* (Laaek.) Jörgensen after Laaekmann (1906, pl. 1, fig. 1) from off Kiel.

### *Helicostomella longa* (Brandt)

#### Figure 206

*Tintinnus mediterraneus* var. *longa* Brandt, 1906, p. 31, pl. 65, figs. 6–8; Okamura, 1907, p. 140, pl. 6, fig. 66; non Rossolimo, 1922, pp. 29, 31, 33, pl. 2, fig. 26 (see *Metacyclis rossica*).

*Tintinnus patagonicus* Brandt, 1907, pp. 3, 38, 43, 376, 393, 401, 443, 444, 470, 471, 475; Laaekmann, 1913, p. 39; Faria and Cunha, 1917, p. 73; Fauré-Fremiet, 1924, p. 110.

Raised to status of species.

Lorica very short, bullet-shaped, 2.24–4.40 oral diameters in length; oral rim entire; 4–11 subequal suboral turns, not everted orally; bowl expanding slightly, widest 0.5–1.0 oral diameter below the spiral, convex conical ( $40^{\circ}$ – $70^{\circ}$ ) aborally; aboral horn scarcely differentiated, conical ( $35^{\circ}$ ). Length 50–80 $\mu$ .

The type locality is off Talcahuano, Patagonia.

Differs from all other species in the shorter, stouter lorica.

**Helicostomella subulata** (Ehrenberg) Jörgensen emended

Figure 209

Non *Vorticella vaginata* O. F. Müller, 1786, p. 310, pl. 44, figs. 12, 13 (not certainly one of the Tintinninea).

*Tintinnus subulatus* Ehrenberg, 1833, p. 274; 1838, pp. 294-295, pl. 30, fig. III, 1-3; Claparède and Lachmann, 1858, pp. 200, 205-206, pl. 8, fig. 15; Pritchard, 1861, p. 546; Kent, 1882, pp. 604-605, 610, 625, pl. 31, fig. 5; Hensen, 1887, pp. 17, 69-70, 93, pl. 4, fig. 31; Möbius, 1887, p. 120, pl. 8, fig. 34; Bütschli, 1889, pp. 1554, 1735, pl. 70, fig. 3; Laaekmann, 1906, p. 17, pl. 3, fig. 47; 1909, pp. 479, 483; 1913, pp. 3, 14, 17; Brandt, *partim*, 1906, p. 31, pl. 65, figs. 1-4 (for pl. 65, fig. 5 see *H. edentata*); 1907, pp. 9, 15, 18, 22, 27, 30-47, 213, 259, 261, 344, 374-376, 392-401, 408, 445, 446, 448, 450, 480, 483 (see also *H. edentata*); Lohmann, 1908, pp. 50, 365, pl. 15; Entz, Jr., 1908, pp. 10-130, pl. 10, fig. 1; 1909*b*, pp. 99-219, pl. 17, fig. 1; non Merkle, 1909, pp. 162-186, pl. 2, fig. 19, pl. 3, fig. 69 (see *H. edentata*); Meunier, 1910, p. 131; Rossolimo, 1922, pp. 29, 33, pl. 2, fig. 23; Wailes, 1925(?), p. 538, pl. 2, figs. 18-21.

*Tintinnus (Amphorella) subulatus*, Fauré-Fremiet, 1924, p. 110.

*Tintinnus Ussowi* Mereschkowsky, 1878, p. 22, pl. 2 (labelled III), fig. 8; 1879, pp. 160-162, pl. 10, fig. 40; Kent, 1882, pp. 609-610, pl. 31, fig. 4.

*Tintinnus Ussowii*, Fauré-Fremiet, 1908, p. 235.

*Tintinnus (Amphorella) Ussowii*, Fauré-Fremiet, 1924, p. 110.

*Amphorella Ussowi*, Ostefeld, 1906, p. 62; Brandt, 1907, p. 446; Bull. Plank., 1905, p. 52.

*Amphorella ussowi*, Breitfuss, 1912, pp. 51-52.

*Vaginicola subulata*, Dujardin, 1841, p. 562.

*Tintinnopsis subulatus*, Entz, Jr., 1908, p. 12; 1909*b*, p. 102.

Non *Cyttarocyclus subulatus*, Entz, Jr., 1904, pp. 128-130, 133, figs. 7, 8 (see *Tintinnopsis radix*).

*Cyttarocyclus subulata*, Bigelow, 1924, p. 415.

*Amphorella subulata*, Daday, 1887*b*, pp. 481, 483, 514, 534, 536, pl. 18, fig. 7; Wright, 1907, pp. 10-11, 18, pl. 4, fig. 10; non Meunier, 1910, p. 131, pl. 10, figs. 14, 15 (see *H. fusiformis*); non Fauré-Fremiet, 1908, pp. 212, 234-236, fig. 21 (see *H. edentata*).

*Helicostomella subulata*, Jörgensen, 1924, *partim*, pp. 25, 107, fig. 26*b* (for fig. 26*a* see *H. fusiformis*); 1927, pp. 10, 15-17, figs. 14, 31.



## Family CYTTAROCYLIDAE fam. nov.

Dietyocystiden, *partim*, Haeckel, 1873, pp. 562-564 (see also Dietyocystidae).

Dietyocystidae, *partim*, Kent, 1882, p. 624 (see also Dietyocystidae, Petalotrichidae, and Rhabdonellidae).

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxliellidae, Ptychoeylidae, Tintinnidae, Tintinnididae, Undellidae, and Xystonellidae).

Tintinnoinea with lorica generally large, campanulate, often pedicellate; oral margin simple, serrate, denticulate, wavy, with or without a collar; aboral end closed, without spiral structure except for supplemental turns added to the lorica of a few species of *Favella*; wall characteristically with primary and very regular secondary and sometimes tertiary structure; surface with short plications; with 2-12 or more macronuclei and 1-2 or more (?) micronuclei, 18-24 membranelles. Marine, largely eupelagic.

Differs from the Codonellidae, Tintinnididae, Undellidae, and Tintinnidae in prominent development of secondary prismatic structure between the two lamellae of the lorica; from the Codonellopsidae in the absence of a hyaline, spiral, or annulate collar; from the Rhabdonellidae in the absence of ribs; from the Coxliellidae in the absence of permanent spiral structure; from the Petalotrichidae in more permanent patterning of the wall and slight suboral differentiation; from the Ptychoeylidae in the absence of aboral sculpturing; from the Xystonellidae in the shape of the bowl or presence of oral denticulations; and from the Dietyocystidae in the absence of a fenestrated collar.

Includes two subfamilies, the Cyttarocylineae subfam. nov. and the Favellineae subfam. nov.

## Subfamily CYTTAROCYLINAE subfam. nov.

Cyttarocylidae with lorica bell-shaped, kettle-shaped, subconical to elongated conical; often with a flaring collar set off from bowl, never with spiral structure.

Differs from the Favellineae in the presence of the flaring collar, in the lack of a distinct aboral horn, and in the very coarse reticular structure of the wall.

Includes but a single genus, *Cyttarocylis* Fol emended Laack. emended Jörg.

## Cyttarocyliis Fol emended Laackmann emended Jørgensen

*Dictyocysta, partim*, Ehrenberg, 1854*b*, pp. 238-239; Haeckel, 1873, pp. 562-564 (see also *Dictyocysta*).

*Cyttarocyliis* Fol, 1881, p. 22; 1884, *partim*, p. 31 (see also *Codonella*): Bütschli, 1889, pp. 1736-1737; Brandt, *partim*, 1907, pp. 181-188 (see also *Climacocyliis*, *Coeliella*, *Craterella*, *Favella*, *Parafavella*, *Porococcus*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*); Laackmann, *partim*, 1909, pp. 443-445 (see also *Cymatocyliis* and *Protocymatocyliis*); Jørgensen, 1924, pp. 77-78.

*Stethocephalus* Haeckel, 1887, p. 1298.

Cyttarocylineae with lorica large, subconical, or acorn- or kettle-shaped; oral rim entire or denticulate; collar flaring, an inverted truncated cone, generally with a nuchal constriction; bowl convex conical or bag-like; aboral end rounded, pointed, or with an obtuse pedicel-like extension, sometimes with terminal canal; wall rather uniformly and finely reticulate with small subequal polygons, composed of an outer and an inner lamina enclosing a coarse secondary structure.

The type species is *Cyttarocyliis cassis* (Haeckel) Fol from the Mediterranean at Messina.

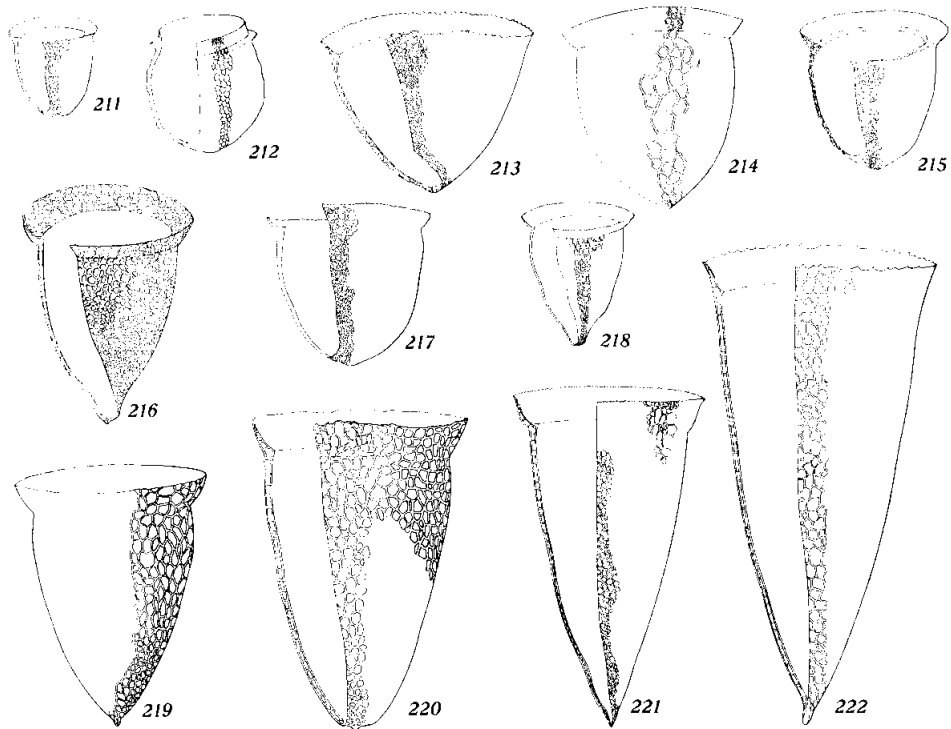
Includes 14 species as follows:

<ul style="list-style-type: none"> <li>acuminata (Ehrbg.) Bdt.</li> <li>acutiformis sp. nov.</li> <li>brandti sp. nov.</li> <li>cassis (Haeckel) Fol</li> <li>conica Bdt.</li> <li>euceeryphalus (Haeckel) Kofoid</li> <li>longa sp. nov.</li> </ul>	<ul style="list-style-type: none"> <li>magna Bdt.</li> <li>mucronata sp. nov.</li> <li>obtusa sp. nov.</li> <li>ollula Bdt.</li> <li>plagiostoma (Daday) Bdt.</li> <li>rieta sp. nov.</li> <li>rotundata Nordgaard</li> </ul>
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### **Cyttarocyliis acuminata** (Ehrenberg) Brandt

*Dictyocysta acuminata* Ehrenberg, 1854*b*, p. 239; Kent, 1882, p. 627; Daday, 1887*b*, p. 588; Brandt, 1907, pp. 50, 451.

This is an indeterminate species (*vide* Brandt, 1907) of *Cyttarocyliis* (?).



Figs. 211–222. Species of *Cyttarocypris* Föl emended Laackmann emended Jörgensen.  $\times 200$ .

Fig. 211. *C. euceryphalus* (Haeckel) Kofoid after Brandt (1906, pl. 36, fig. 3) from Station Pl. 55 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 212. *C. ollula* Bdt. after Brandt (1906, pl. 36, fig. 10) from Station "Krämer, 20-IX-93" off the Sunday Islands in the Western Tropical Pacific.

Fig. 213. *C. ricta* sp. nov. after Brandt (1906, pl. 36, fig. 7) from Station "Schott, 3-VIII-92" in the Benguela Current.

Fig. 214. *C. plagiostoma* (Daday) Bdt. after Brandt (1906, pl. 36, fig. 12) from the Bay of Naples, Italy.

Fig. 215. *C. brandti* sp. nov. after Brandt (1906, pl. 35, fig. 7) from Station "Krämer, 15-VIII-93" southwest of Australia.

Fig. 216. *C. mucronata* sp. nov. from Station 4721 in the South Equatorial Drift of the Pacific.

Fig. 217. *C. longa* sp. nov. after Brandt (1906, pl. 36, fig. 1) from Station Pl. 36 of the Plankton Expedition in the Sargasso Sea.

Fig. 218. *C. obtusa* sp. nov. after Brandt (1906, pl. 35, fig. 5) from Station Pl. 48 of the Plankton Expedition in the Sargasso Sea.

Fig. 219. *C. cassis* (Haeckel) Föl after Brandt (1906, pl. 34, fig. 2) from Station Pl. 83 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 220. *C. conica* Bdt. after Brandt (1906, pl. 34, fig. 6) from Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 221. *C. acutiformis* sp. nov. after Brandt (1906, pl. 35, fig. 1) from Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 222. *C. magna* Bdt. after Brandt (1906, pl. 34, fig. 3) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

**Cyttarocyliis acutiformis** sp. nov.

Figure 221

*Cyttarocyliis cassis* var. e Brandt, 1906, p. 22, pl. 35, fig. 6; 1907, p. 197 as var. d.

*Cyttarocyliis cassis* var. d Brandt, 1906, p. 21, pl. 35, figs. 1, 1a, 2, 2a; 1907, pp. 33, 189, 190, 191, 197-198, 458; Laackmann, 1909, pp. 423, 427, 429, 446, 447.

Lorica elongate conical, 1.54-1.96 oral diameters in length; oral rim minutely denticulate; collar an inverted truncated cone ( $50^\circ$ ) with flattened sigmoid outline, 0.13 total length in length; suboral shelf acute, horizontal; bowl slightly convex conical ( $30^\circ$ ) increasing from  $25^\circ$  anteriorly to  $35^\circ$  in its aboral 0.3; aboral end minutely truncated, with canal; wall minutely reticulated with nearly uniform polygons sometimes smaller in the oral rim and near the aboral end, about 56 below the collar. Length 200-257 $\mu$ .

The type locality is Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic. Occurs also in the South Equatorial and Florida currents, in the Sargasso Sea, and in the California, Peruvian, and South Equatorial currents, the Panamic Area, and the South Equatorial Drift of the Pacific.

Differs from *C. magna* in smaller size and more slender bowl and from *C. cassis* in greater elongation, less convex sides, and absence of terminal spinule.

**Cyttarocyliis brandti** sp. nov.

Figure 215

*Cyttarocyliis plagiostoma*, *partim*, Brandt, 1906, p. 22, pl. 35, fig. 7 (for pl. 36, fig. 6 see *C. longa* and for pl. 36, fig. 12 see *C. plagiostoma*); 1907, pp. 23, 26, 29, 31, 33, 35, 80, 96, 185-195, 198, 200, 338, 339, 444, 458, 476 (see also *C. eucecryphalus*, *C. longa*, *C. plagiostoma*, and *C. rieta*).

*Cyttarocyliis plagiostoma* var. a Brandt, *partim*, 1906, p. 22, pl. 36, fig. 8 (for pl. 36, figs. 1, 1a, 4, 4a see *C. longa*); 1907, pp. 189-191, 199, 476 (see *C. longa*); Laackmann, 1909, pp. 423, 424, 428, 429, 446-448.

*Cyttarocyliis eucecryphalus*, *partim*, Jørgensen, 1924, pp. 7, 78, 80, 92, 105, fig. 91 (see also *C. eucecryphalus*, *C. longa*, *C. plagiostoma*, and *C. rieta*).

Lorica acorn-shaped, 0.87-0.98 oral diameter in length; oral rim denticulate; collar flaring widely, an inverted truncated cone of  $90^\circ$ - $100^\circ$ , its width 0.1 oral diameter; suboral shelf forming a thin upturned ( $50^\circ$ ) shelf; bowl baggy, sack-like, widest below the collar, convex conical contracting, from  $35^\circ$  on the aboral half to  $130^\circ$  at the aboral end; aboral end bluntly pointed; wall with about 70 small

but variable polygons below the collar and 35-40 from oral rim to aboral point. Length 90-115 $\mu$ .

The type locality is southwest of Australia (Krämer). Occurs also in the Florida, Benguela, Brazil, and South Equatorial currents, Sargasso Sea, Indian Ocean, and Bay of Bengal; and in the Pacific Ocean in the Easter Island Eddy and the South Equatorial Drift.

Differs from *C. longa* in its more pointed, less baggy bowl; from *C. ricta* in its less flaring, more pointed lorica; from *C. plagiostoma* in its smaller size, shorter bowl and finer mesh; and from *C. eucecrophalus* in its aboral point.

### **Cyttarocyclus cassis** (Haeckel) Fol

Figure 219

*Dictyocysta cassis* Haeckel, 1873, p. 563, pl. 27, figs. 1-3; Kent, 1882, p. 624, pl. 32, figs. 29-31; Zacharias, 1906, p. 552.

*Cyttarocyclus cassis*, Fol, 1881a, pp. 18, 21, 22, pl. 1, fig. 6; 1881b, pp. 247, 248, pl. 17, fig. 6; 1884, pp. 38, 55-56, pl. 4, fig. 6, pl. 5, fig. 10; Daday, 1887a, pp. 176, 193, pl. 1, fig. 5; 1887b, pp. 486, 499, 515, 575, 580-581, pl. 21, fig. 3; Brandt, 1896, p. 48; 1906, p. 22, pl. 35, fig. 9; 1907, pp. 12, 14, 15, 26, 27, 29, 31, 33, 35, 42, 50, 76, 77, 181-199, 201, 444, 449, 458; Entz, Jr., 1908, pp. 19-135, pl. 5, fig. 6, pl. 13, fig. 23; 1909b, pp. 102-223, pl. 12, fig. 6, pl. 20, fig. 23; Laackmann, 1909, pp. 446-447; Jörgensen, 1924, pp. 5, 7, 78, 80, fig. 89.

*Cyttarocyclus cassis* var. a Brandt, 1906, p. 21, pl. 34, figs. 1, 2, 4, 5; 1907, pp. 189, 190, 195-196, 458; Laackmann, 1909, p. 446.

*Cyttarocyclus cassis* forma *acuta* Jörgensen, 1924, p. 79.

*Codonella cassis*, Cleve, 1901c, p. 9, 1901d, pp. 21, 102; 1902b, p. 13; 1903b, p. 349.

*Cyttaroclyps cassis*, Keller, 1894, p. 511, fig. 214[3]. *Lapsus pennae*.

### **Cyttarocyclus conica** Brandt

Figure 220

*Cyttarocyclus cassis* var. b *conica* Brandt, 1906, pp. 21, 22, pl. 34, figs. 6, 6a, pl. 35, fig. 8; 1907, pp. 189, 190, 196, 458, 460; Laackmann, 1909, pp. 446-447.

Raised to status of species.

Lorica truncate conical, 1.41-1.47 oral diameters in length; oral rim ragged; collar an inverted truncated cone (45°), convex outwardly; nuchal shelf horizontal, angled, not much developed; nuchal constriction slight; bowl an inverted, truncated somewhat convex cone, changing from 22° suborally to 57° in the aboral region; aboral end squarely truncated, 0.2 oral diameter in diameter; aboral point minute, conical; wall regularly reticulate, with about 50 polygons in the suboral circumference and 35-40 in the meridian. Length 170-210 $\mu$ .

The type locality is Station Pl. 17 of the Plankton Expedition in the North Equatorial Current of the Atlantic. Occurs also in the South Equatorial Current and in the Sargasso Sea.

Differs from all other species in the form of the aboral end.

### *Cyttarocyliis eucecryphalus* (Haeckel) Kofoid

Figure 211

[?] *Platyeryphalus sethodiscus* Haeckel, 1881, p. 430. *Nomen nudum* (as Radiolarian).

*Stethocephalus eucecryphalus* Haeckel, 1887, p. 1298, pl. 56, fig. 13 (as Radiolarian).

*Cyttarocyliis plagiostoma* var. *c* Brandt, 1906, p. 22, pl. 36, figs. 2, 2a, 3, 3a, 5, 9; 1907, *partim*, pp. 189, 190, 191, 200, 476 (see also *C. brandti*, *C. longa*, *C. plagiostoma*, and *C. rieta*); Entz, Jr., 1908, p. 99.

*Cyttarocyliis eucecryphalus*, Kofoid, 1912, pp. 354-357; Jørgensen, *partim*, 1924, pp. 7, 78, 80, 92 (for fig. 91 see *C. brandti*, see also *C. longa*, *C. plagiostoma*, and *C. rieta*).

### *Cyttarocyliis longa* sp. nov.

Figure 217

*Cyttarocyliis plagiostoma*, "typ.," *partim*, Brandt, 1906, p. 22, pl. 36, fig. 6 (for pl. 35, fig. 7 see *C. brandti* and for pl. 36, fig. 12 see *C. plagiostoma*); 1907, pp. 189, 190, 191, 198-199, 476 (see *C. brandti*, *C. eucecryphalus*, *C. plagiostoma*, and *C. rieta*).

*Cyttarocyliis plagiostoma* var. *a*, *partim*, Brandt, 1906, p. 22, pl. 36, figs. 1, 1a, 4, 4a (for pl. 36, fig. 8 see *C. brandti*); 1907, pp. 189, 190, 191, 199, 476 (see *C. brandti*); Laackmann, 1909, pp. 447-448.

*Cyttarocyliis eucecryphalus*, *partim*, Jørgensen, 1924, p. 80 (for fig. 91 see *C. brandti*, see also *C. eucecryphalus*, *C. plagiostoma*, and *C. rieta*).

Loricæ stout bag-like, 0.76-0.96 oral diameter in length; oral rim minutely and irregularly denticulate; collar spreading, forming an inverted truncated cone ( $65^{\circ}$ - $75^{\circ}$ ), its width 0.14 oral diameter; sub-oral shelf thin-edged, horizontal; bowl broadly sack-like, widest a short distance below the collar, convex subconical,  $30^{\circ}$  anteriorly,  $115^{\circ}$  aborally; aboral end rounded or scarcely pointed; wall minutely and regularly reticulate, 40-70 reticulations below the collar and 33-41 from oral margin to aboral apex. Length 100-115 $\mu$ .

The type locality is Station Pl. 36 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Florida, Benguela, and South Equatorial currents, the Indian Ocean, the Mediterranean, and widely throughout the Eastern Tropical Pacific.

Differs from *C. brandti* in larger average size, more baggy and less contracting bowl, and less pointed aboral end; from *C. eucecryphalus* in the absence of well defined aboral point; and from *C. plagiostoma* in much wider aboral region.

**Cyttarocyliis magna** Brandt

Figure 222

*Cyttarocyliis cassis* var. *e magna* Brandt, 1906, pp. 21, 23, pl. 34, fig. 3, pl. 35, fig. 3; 1907, pp. 33, 42, 189-191, 196-198, 458, 470; Laackmann, 1909, p. 447.

*Cyttarocyliis cassis* var. *magna*, Jörgensen, 1924, pp. 78, 79, fig. 90.

Raised to status of species.

Lorica tall funnel-shaped, 2.1-2.3 oral diameters in length; oral rim serrate; collar flaring inverted conical ( $40^\circ$ ), 0.14 oral diameter in length, with slight internal angle; bowl convex conical changing from  $20^\circ$  below the collar to  $45^\circ$  near the aboral end; aboral horn conical ( $20^\circ$ ), curved, 0.1 oral diameter in length; wall coarsely reticulate with about 25 polygons across one face in the nuchal region. Length 250-320 $\mu$ .

The type locality is Station Pl. 38 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Benguela Current, the North Equatorial Current of the Atlantic, and between Australia and the Tonga Islands.

Differs from all other species in larger lorica and less emergent collar.

**Cyttarocyliis mucronata** sp. nov.

Figure 216

*Cyttarocyliis cassis* var. *e, partim*, Brandt, 1907, p. 198 (see *C. obtusa*); non Brandt, 1906, pl. 36, figs. 4, 5 (see *C. obtusa*).

Lorica tapering acorn-shaped, with stout point, 1.3 oral diameters in length; oral rim entire or minutely and irregularly denticulate; collar very distinct from bowl, with nuchal groove, an inverted truncated cone ( $60^\circ$ - $70^\circ$ ), 0.11 oral diameter in width, convex outwardly; suboral shelf with a sharp edge; bowl convex conical, contracting distally to  $60^\circ$ ; pedicel a short (0.15-0.20 oral diameter) cone ( $45^\circ$ ); aboral end with a central projecting point; wall with small polygonal reticulation, decreasing in size aborally, about 60-65 below the collar and 40-45 from rim to apex. Length 142-150 $\mu$ .

The type locality is Station 4721 in the South Equatorial Drift. Occurs also in the Easter Island Eddy.

Differs from *C. obtusa* in the presence of a terminal point and finer reticulations.

**Cyttarocyliis obtusa** sp. nov.

Figure 218

*Cyttarocyliis cassis* var. c Brandt, 1906, p. 22, pl. 35, figs. 4, 5; 1907, *partim*, pp. 189, 190, 198, 458 (see *C. mucronata*); Entz, Jr., 1908, p. 98.

Lorica elongate, slender acorn-shaped, 1.06–1.36 oral diameters in length; oral margin very minutely denticulate; collar concave flaring, forming an inverted truncated cone ( $90^\circ$ ), 0.1 oral diameter in width; suboral shelf merely a sharp edge; bowl quite convex conical ( $30^\circ$ ) in its anterior 0.7, contracting aborally to  $80^\circ$ ; aboral region extended as a stout conical ( $36^\circ$ ) pedicel about 0.1 oral diameter in length; aboral end almost squarely truncate; wall regularly reticulate with small polygons which decrease in size aborally, 36–40 below the collar and 37–42 from oral rim to aboral end. Length 135–157 $\mu$ .

The type locality is Station Pl. 48 of the Plankton Expedition in the Sargasso Sea. Occurs also in the region of the NE Trades and the South Equatorial Current.

Differs from *C. mucronata* in the absence of a point on the aboral end.

**Cyttarocyliis ollula** Brandt

Figure 212

*Cyttarocyliis ollula* Brandt, 1906, pp. 5, 22, pl. 36, figs. 10, 11; 1907, pp. 26, 30, 33, 42, 186, 187, 200, 201, 408, 474; Entz, Jr., 1908, p. 99.

**Cyttarocyliis plagiostoma** (Daday) Brandt emended

Figure 214

*Cyttarocyliis cassis* var. *plagiostoma* Daday, 1887b, p. 581, pl. 21, fig. 13.

*Cyttarocyliis plagiostoma*, Brandt, *partim*, 1906, p. 22, pl. 36, fig. 12 (for pl. 35, fig. 7 see *C. brandti* and for pl. 36, fig. 6 see *C. longa*); 1907, pp. 23, 26, 29, 31, 33, 35, 80, 96, 185–195, 198–200, 338, 339, 444, 458, 476 (see also *C. brandti*, *C. eucecryphalus*, *C. longa*, and *C. ricta*); Entz, Jr., 1908, pp. 99–128, pl. 5, fig. 8; 1909b, pp. 129–216, pl. 12, fig. 8; Laackmann, 1909, pp. 447–448.

*Cyttarocyliis eucecryphalus*, *partim*, Jørgensen, 1924, p. 80 (for fig. 91 see *C. brandti*, see also *C. eucecryphalus*, *C. longa*, and *C. ricta*).

**Cyttarocyliis ricta** sp. nov.

Figure 213

*Cyttarocyliis plagiostoma* var. b Brandt, 1906, p. 22, pl. 36, figs. 7, 7a; 1907, *partim*, pp. 189–191, 199–200, 476 (see also *C. brandti*, *C. eucecryphalus*, *C. longa*, and *C. plagiostoma*); Laackmann, 1909, p. 448.

*Cyttarocyliis eucecryphalus*, *partim*, Jørgensen, 1924, p. 80 (for fig. 91 see *C. brandti*, see also *C. eucecryphalus*, *C. longa*, and *C. plagiostoma*).



Lorica stout conical, about  $70^\circ$ , with little separation of collar and bowl, 0.8–0.9 oral diameter in length; oral rim irregularly denticulate; collar an inverted truncated cone ( $50^\circ$ ), 0.05 oral diameter in width; suboral shelf a narrow acute ledge, slightly turned up; bowl convex conical, shaped like a bee-hive, changing gradually from  $20^\circ$  to  $90^\circ$ ; aboral end with a very broadly rounded apex; wall uniformly reticulate with small subequal polygons, 80 below the collar and 33 from rim to apex. Length 81–118 $\mu$ .

The type locality is Station Schott (3–viii–92) in the Benguela Current. Occurs also in the Florida, North and South Equatorial, and Guinea currents, the Sargasso Sea, region of the NE Trades, Southern Tropical Atlantic, Mascarene Current, Bay of Bengal, off Ceylon, and Southern Indian Ocean; and in the California Current and South Equatorial Drift of the Pacific.

Differs from *C. plagiostoma* and *C. euccryphalus* in lack of aboral point, steep collar, and fine mesh.

#### **Cyttarocyliis rotundata** Nordgaard

*Cyttarocyliis rotundata* Nordgaard, 1899, p. 28. *Nomen nudum*.

#### Subfamily FAVELLINEAE subfam. nov.

Cyttarocylidae with lorica usually bell-shaped; without flaring collar; often with an aboral horn; supplemental spiral structure sometimes present on collar, but never on bowl.

Differs from the Cyttarocylinae in the absence of flaring collar, in the usual presence of an aboral horn, and in the lack of marked, very coarse, reticular structure of the wall.

Includes five genera as follows: *Cymatocyliis* Laack. emended, *Favella* Jörg. emended, *Parafavella* gen. nov., *Poroecus* Cleve emended, and *Protacymatocyliis* gen. nov.

#### **Poroecus** Cleve emended

*Porella* Cleve, 1900d, p. 973 (preoccupied by *Porella* Gray, 1848, Bryozoa); Hickson, 1903, p. 409.

*Poroecus* Cleve, 1902b, p. 15; Jörgensen, 1924, pp. 9, 31.

*Cyttarocyliis*, partim, Brandt, 1907, pp. 181–188 (see also *Climacocyliis*, *Coxiella*, *Craterella*, *Cyttarocyliis*, *Favella*, *Parafavella*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*).

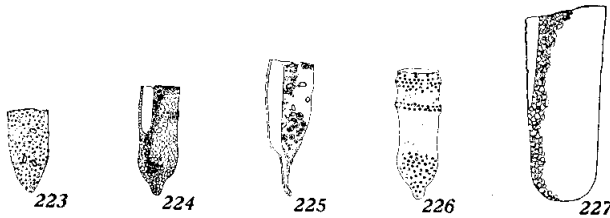
Favellinae with lorica generally moderately stout, tall campanulate; oral rim entire or irregular; bowl cylindrical; with or without

an aboral horn; wall with two laminae, its surface covered by cocoliths in varying degrees. Marine.

The type species is *Poroecus apiculatus* (Cleve) Cleve from the South Atlantic, the oldest and the only species included in the genus by Cleve (1902*b*).

Differs from *Protocymatocylis* gen. nov. and *Cymatocylis* Laack. emended in the absence of linear striae on the bowl and from the latter in the absence of oral channel and crest; from *Parafavella* gen. nov. in the absence of the regular prismatic structure of the wall; and from *Favella* Jörg. emended in generally simpler structure, absence of oral differentiations, and less regular prismatic structure of the wall.

Includes five species as follows: *Poroecus annulatus* sp. nov., *P. apiculatus* sp. nov., *P. apiculatus* (Cleve) Cleve, *P. brandti* nom. nov., and *P. curtus* sp. nov.



Figs. 223-227. Species of *Poroecus* Cleve emended.  $\times 200$ .

Fig. 223. *P. apiculatus* sp. nov. from Station 4732 in the South Equatorial Drift of the Eastern Tropical Pacific.

Fig. 224. *P. curtus* sp. nov. from Station 4648 in the Peruvian Current.

Fig. 225. *P. apiculatus* (Cleve) Cleve from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 226. *P. annulatus* sp. nov. from Station 4707 in the South Equatorial Drift of the Eastern Tropical Pacific.

Fig. 227. *P. brandti* nom. nov. after Brandt (1906, pl. 32, fig. 6) from Station Pl. 39 of the Plankton Expedition in the Sargasso Sea.

### ***Poroecus annulatus* sp. nov.**

#### Figure 226

Lorica annulate, tall chalice-shaped, 3 oral diameters in length; oral rim entire; bowl subcylindrical, with two low, wide annular thickenings in the oral half and a slight aboral expansion; aboral horn stout, 0.25 oral diameter in length and width; aboral end rounded; wall with cocoliths on the annuli and aboral region. Length  $85\mu$ .

The type locality is Station 4707 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from all other species in having annuli.

**Poroeucus apicatus** sp. nov.

Figure 223

Lorica small vase-shaped, 2 oral diameters in length; oral rim irregular; bowl cylindrical in the oral half, convex conical ( $55^\circ$ ) aborally; aboral end broadly rounded; wall filled with coecoliths. Length  $56\mu$ .

The type locality is Station 4732 in the South Equatorial Drift of the Eastern Tropical Pacific. Occurs also in the Panamic Area and the Galapagos Eddy.

Differs from other species in smaller size and lack of an aboral horn.

**Poroeucus apiculatus** (Cleve) Cleve

Figure 225

*Porella apiculata* Cleve, 1900d, p. 973, fig. 9; 1901e, p. 10; 1902b, p. 15; Entz, Jr., 1908, p. 101.

*Poroeucus apiculatus* Cleve, 1902b, p. 15; Brandt, 1907, pp. 13, 14, 203, 454; Jørgensen, 1924, pp. 31, 32, fig. 36.

*Cyttarocytilis apiculata*, Brandt, 1906, p. 21, pl. 32, figs. 3-5; 1907, pp. 27, 33, 35, 42, 186, 187, 202, 203, 454; Entz, Jr., 1908, p. 98; Meunier, 1919, p. 6.

**Poroeucus brandti** nom. nov.

Figure 227

*Cyttarocytilis cylindrica* Brandt, 1906, pp. 5, 21, pl. 32, figs. 6, 7; 1907, pp. 18, 20, 30, 33, 35, 42, 186, 187, 201-203, 460.

Non *Cyttarocytilis denticulata* var  $\beta$  *cylindrica* Jørgensen, 1899, pp. 33-34, 48, pl. 2, figs. 17, 18 (see *Parafavella cylindrica*).

Lorica elongated sack-shaped, 2.5 oral diameters in length; oral rim entire; bowl cylindrical; aboral end flattened subhemispherical; wall thin, with irregularly rounded secondary alveoli of uneven sizes, about 50 in the circumference. Length  $133-275\mu$ .

The type locality is Station Pl. 39 of the Plankton Expedition in the Sargasso Sea.

Differs from all other species in the sack-shaped bowl.

**Poroeucus curtus** sp. nov.

Figure 224

Lorica short, stout, its length 2.0-2.8 oral diameters; oral rim entire or coarsely toothed; bowl cylindrical in the oral 0.6-0.7 of the length, contracting almost hemispherically aborally; aboral horn stout conical ( $30^\circ-45^\circ$ ), 0.37-0.40 oral diameter in length; aboral end broadly rounded; wall with subuniform polygonal mesh, 25-30 around the bowl, usually filled with coecoliths. Length  $52-70\mu$ .

The type locality is Station 4648 in the Peruvian Current. Occurs also in the Panamic Area, Galapagos Eddy, and the South Equatorial Drift.

Differs from *P. annulatus* in absence of rings and from other species in its short, stout aboral horn.

### **Protocymatocylis** gen. nov.

*Cymatocylis, partim*, Laackmann, 1909, pp. 345-418 (see also *Cymatocylis*).

*Cyttarocylis, partim*, Laackmann, 1909, pp. 443-445 (see also *Cymatocylis* and *Cyttarocylis*).

Favellineae without channel or lip at the oral rim; oral margin simple; bowl conical or bag-shaped; wall striate. Marine.

The type species is *Protocymatocylis subrotundata* (Laackmann) from off Kaiser Wilhelm II Land in the Antarctic. *P. conicoides* and *P. vas* clearly belong in this genus. Since Laackmann's drawings of the oral margins of a number of his figures are on a small scale and indistinct, some uncertainty remains as to the generic allocation of *Cymatocylis calyx*, *C. diminuta*, and possibly other species.

Differs from *Cymatocylis* in the absence of differentiation of the oral rim.

Includes three species as follows: *Protocymatocylis conicoides* nom. nov., *P. subrotundata* (Laack.), and *P. vas* sp. nov.

### **Protocymatocylis conicoides** nom. nov.

Figure 228

*Cymatocylis vanhoeffeni* forma *conica* Laackmann, 1909, pp. 364, 366, 490, pl. 37, figs. 5, 30, pl. 38, figs. 4, 5.

Non *Cymatocylis flava* forma *conica* Laackmann, 1909, pp. 372, 373, 490, pl. 39, figs. 12, 13 (for fig. 12 see *C. conica* and for fig. 13 see *C. everta*).

Raised to status of species.

Lorica neatly conical, 3.04-5.36 oral diameters in length; oral rim channeled, inner edge minutely denticulate; bowl conical (18°); aboral horn conical (5°) anteriorly, subcylindrical posteriorly, tip pointed, its length 0.72-2.30 oral diameters; wall vertically striate for nearly an oral diameter from near the oral rim. Length 210-580 $\mu$ .

The type locality is "Gauss" Station off Kaiser William II Land in the Antarctic.

Differs from *Cymatocylis vanhoeffeni* and *C. minor* in the absence of the slight flare in the lower bowl, and from *P. subrotundata* and *P. vas* in the presence of an aboral horn.

**Protocymatocyelis subrotundata** (Laaekmann) emended

Figure 229

*Cymatocyelis vanhoeffeni* forma *subrotundata*, partim, Laaekmann, 1909, pp. 351, 361, 362, 365-366, 373, 490, pl. 37, fig. 19, pl. 38, figs. 1-2 (for pl. 37, fig. 20 see *C. digitabulum*, for pl. 37, fig. 21 see *P. vas*, for pl. 37, figs. 22-24, pl. 38, fig. 3 see *C. digitulus*, and for pl. 37, figs. 25-28 see *C. vanhoeffeni*).

Non *Cymatocyelis flava* forma *subrotundata* Laaekmann, 1909, pp. 373, 490, pl. 39, fig. 11; 1913, p. 21 (see *C. digitulus*).

Non *Cymatocyelis drygalskii* forma *subrotundata* Laaekmann, 1909, pp. 377, 381, 491, pl. 40, fig. 7; 1913, p. 21 (see *C. tubulosa*).

Non *Cymatocyelis nobilis* forma *subrotundata* Laaekmann, 1909, pp. 351, 389-391, 415, 491, pl. 42, fig. 3; 1913, p. 21 (see *C. folliculus*).

Raised to status of species.

Lorica thimble-shaped, 1.44-1.65 oral diameters in length; oral rim entire, not channeled, flaring 45° to 1.10-1.18 the uppermost diameter of the bowl; bowl stout sack-shaped, cylindrical anteriorly, or nearly so; aboral end broadly rounded, nearly hemispherical; walls striate throughout. Length 180 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *Cymatocyelis digitulus* in shorter, stouter lorica, from *C. digitabulum* in less taper and rounded aboral end, and from *P. conicoides* and *P. vas* in the rounded aboral end.

**Protocymatocyelis vas** sp. nov.

Figure 230

*Cymatocyelis vanhoeffeni* forma *subrotundata*, partim, Laaekmann, 1909, pp. 357, 361, 362, 365-366, 373, 490, pl. 37, fig. 21 (for pl. 37, fig. 19, pl. 38, figs. 1-2 see *P. subrotundata*, for pl. 37, figs. 22-24, pl. 38, fig. 3 see *C. digitulus*, for pl. 37, fig. 20 see *C. digitabulum*, and for pl. 37, figs. 25-28 see *C. vanhoeffeni*).

Raised to status of species.

Lorica broad shouldered, vase-shaped, 2.56 oral diameters in length; oral rim simple, without channel or teeth; bowl expanding 1 oral diameter below the rim to 1.25 oral diameters, subconical (20°) below; aboral end squarely truncated; wall striate with irregular striae for 0.66 oral diameter about 0.4 oral diameter below the rim. Length 200 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from all other species in the shape of the bowl and the truncated aboral end.

### **Cymatocylis** Laackmann emended

*Amphorella*, Cleve, 1901a, p. 923.

*Cyttarocylis, partim*, Laackmann, 1907, pp. 235-237 (see also *Coziella*); 1909, pp. 345-418 (see also *Cyttarocylis* and *Protoecymatocylis*).

*Ptychocylis*, Laackmann, 1907, p. 239.

*Cymatocylis, partim*, Laackmann, 1909, pp. 345-418 (see also *Protocymatocylis*).

Favellineae with lorica of various forms from small bowl- or urn-shaped to tall goblet- or chalice-shaped; oral rim usually modified by thickening, eversion, reflexion, channeling, and usually with a single entire or denticulate crest, sometimes with two; bowl cylindrical or conical, contracting aborally; aboral end with or without an aboral horn; wall sometimes striate throughout or locally, hyaline, with an inner and outer lamella and intermediate primary alveolar structure best developed in the thickened suboral region and on the middle of the bowl; 2 macronuclei and 2 micronuclei, 19 membranelles, 2-3 myonemes, stalk attached laterally. Exclusively marine and from the Antarctic primarily.

We designate as the type species *Cymatocylis drygalskii* (Laackmann) Laackmann emended, the first species described of those now included in the genus.

This genus exhibits a rather remarkable flare of speciation localized largely in the Antarctic. In his treatment of the material of the German South Polar Expedition, Laackmann has organized his classification on the idea that the genus is composed of a group of fundamental species most of which exhibit a differentiated series each of whose members he designates as a "forma." However, he treats these textually and in typography as systematic units, giving their distinguishing characteristics. Unfortunately he includes in each of these units designated by him as a "forma," a systematic group comparable to those which in other genera had often been treated as distinct species. Uniformity of treatment can be served only by regarding these "forma" of Laackmann as species in those cases in which the structural characteristics justify it. He has been influenced by the idea of parallel differentiation and has given identical names, e.g., "*typica*, *affinis*, *conica*, *cylindrica*, *simplex*, *subrotundata*, and *ventricosa*," to the units in each major species which may exhibit the respective parallel differentiations. In elevating these to specific rank it is obvious that "*typica*" becomes the main species, except where, as in *C. flava*, Laackmann included two different species in his "*typica*." In this

case "*typica*" becomes available as the name for a part of the complex. In the case of the other names such as "*conica*" the name can be used but once; and new names are perforce coined for the other species, designated by him as "*forma conica*." When feasible we have often used names suggestive in origin to the one thus displaced, e.g., "*conicoides*."

It is unfortunate that many of Laackmann's figures are drawn on a scale too small to permit a clear presentation of the structure of the oral region which throughout the Tintinnoinea is the area of the major structural differentiations largely used in classification. The status of some of the units we have raised to specific rank must therefore be tentative until Antarctic material can be reexamined.

Differs from all other genera of the Favellinae in the presence of striae or plicae which are found over more or less of the outer surface of the bowl, especially aborally and in the degree of development of eversion and reflexion of the oral rim and the crests.

Includes 45 species as follows:

<i>affinis</i> Laaek.	<i>flava</i> Laaek. emended
<i>affinoides</i> nom. nov.	<i>folliculus</i> nom. nov.
<i>antaretica</i> (Cleve)	<i>gaussi</i> nom. nov.
<i>brevicaudata</i> Laaek.	<i>glaucus</i> sp. nov.
<i>calyciformis</i> (Laaek.) Laaek.	<i>incondita</i> nom. nov.
<i>calyceina</i> Laaek.	<i>kerguelensis</i> Laaek.
<i>calyx</i> sp. nov.	<i>labiosa</i> nom. nov.
<i>conica</i> Laaek. emended	<i>meridiana</i> nom. nov.
<i>contracta</i> sp. nov.	<i>minor</i> Laaek. emended
<i>convallaria</i> Laaek.	<i>nobilis</i> (Laaek.) Laaek. emended
<i>crassa</i> nom. nov.	<i>ovata</i> Laaek.
<i>crystallina</i> Laaek.	<i>parva</i> (Laaek.) Laaek.
<i>culcullus</i> nom. nov.	<i>robusta</i> Laaek.
<i>cylindrella</i> nom. nov.	<i>scyphus</i> nom. nov.
<i>cylindrica</i> Laaek. emended	<i>simplex</i> Laaek.
<i>cylindroides</i> nom. nov.	<i>situla</i> nom. nov.
<i>cylindrus</i> nom. nov.	<i>subconica</i> sp. nov.
<i>digitabulum</i> nom. nov.	<i>tubulosa</i> nom. nov.
<i>digitulus</i> sp. nov.	<i>typica</i> Laaek. emended
<i>diminuta</i> sp. nov.	<i>urnula</i> Laaek.
<i>drygalskii</i> (Laaek.) Laaek.	<i>vanhöffeni</i> (Laaek.) Laaek.
emended	emended
<i>ecaulata</i> sp. nov.	<i>ventricosoides</i> sp. nov.
<i>everta</i> sp. nov.	

**Cymatocyliis affinis** Laackmann

Figure 275

*Cymatocyliis affinis* Laackmann, 1909, pp. 346, 348, 350, 359, 363, 364, 367, 371, 373, 376, 378, 379, 381-386, 414, 416-418, 421.

*Cymatocyliis affinis* forma *typica* Laackmann, 1909, pp. 384-386, 491, pl. 43, figs. 5, 6, 8, 9.

**Cymatocyliis affinoides** nom. nov.

Figure 247

*Cymatocyliis vanhoeffeni* forma *affinis*, *partim*, Laackmann, 1909, pp. 367, 384, 490, pl. 37, figs. 15-17 (for pl. 37, fig. 18 see *C. diminuta*).

*Cymatocyliis vanhoeffeni* forma *cylindrica*, *partim*, Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 11 (for pl. 37, fig. 10 see *C. cylindrica*, for pl. 37, figs. 12, 13 see *C. calyx*, and for pl. 38, fig. 7 see *C. contracta*).

Non *Cymatocyliis affinis* Laackmann, 1909, pp. 346, 348, 350, 359, 363, 364, 367, 371, 373, 376, 378, 379, 381-386, 414, 416-418, 421 (see *C. affinis*).

Raised to status of species.

Lorica conical vase-shaped, 1.7-1.9 oral diameters in length; oral rim scarcely flaring, channeled, inner ridge denticulate, outer thickened, everted horizontally; bowl conical, 20°-30° in the suboral 0.66-0.75 of the total length, changing to 45°-50° aborally; aboral horn 0.20-0.23 oral diameter in length, conical (20°), tip pointed; wall striate except just below oral rim and in some loricae on the lower bowl. Length 210-235 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. calycina* in less change in the conical contour and shorter aboral horn, from *C. cylindrica* in wider suboral region, from *C. calyx* in more tapering bowl, and from *C. diminuta* in larger size and absence of bulb at base of the aboral horn.

**Cymatocyliis antarctica** (Cleve)

Figure 235

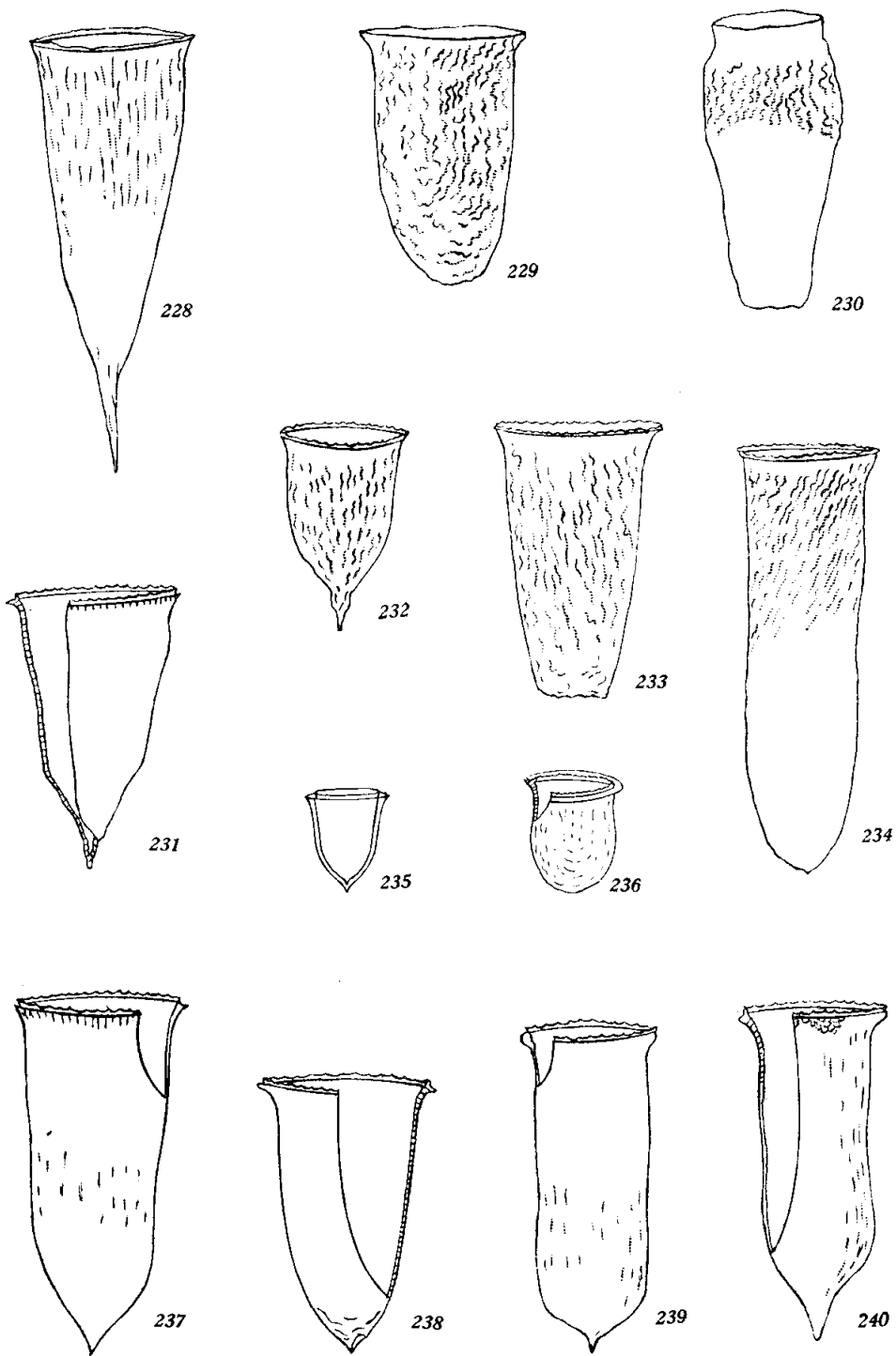
*Amphorella* (?) *antarctica* Cleve, 1901a, p. 923, fig. 1; Laackmann, 1906, p. 237; Entz, Jr., 1908, p. 97; Jörgensen, 1924, p. 23.

*Tintinnus antarcticus*, Brandt, 1907, pp. 408, 409, 454.

Non *Cymatocyliis parva*, see Jörgensen, 1924, p. 23.

*Cyttarocyliis antarctica*, Laackmann, 1909, p. 387.





Figs. 228-230. Species of *Protocymatocylis* gen. nov.  $\times 200$ .  
 Figs. 231-240. Species of *Cymatocylis* Laackmann emended.  $\times 200$ .

***Cymatocylis brevicaudata* Laackmann**

Figure 272

*Cymatocylis calyciformis* forma *brevicaudata* Laackmann, 1909, pp. 391, 491, pl. 42, figs. 7-10.

Raised to status of species.

Lorica stout eup-shaped, 1.21-1.47 oral diameters in length; oral rim acutely reflexed about 45° below the horizontal, not channeled, with a single slightly flaring denticulate crest and quadratic areoles; bowl short eup-shaped rotund, its height 0.8-1.0 oral diameter, contracting in a convex conical (85°) aboral region; aboral horn slender, irregular, 0.40-0.55 oral diameter in length, tip pointed, surface furrowed; wall filled with minute primary alveoli, largest at the middle of the bowl. Length 165-200 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. calyciformis* in the much shorter aboral horn and stouter bowl.

Figs. 228-230. Species of *Protocymatocylis* gen. nov.  $\times 200$ .

Fig. 228. *P. conicoides* nom. nov. after Laackmann (1909, pl. 38, fig. 4) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 229. *P. subrotundata* (Laack.) after Laackmann (1909, pl. 37, fig. 19) from "Gauss" Station in the Antarctic.

Fig. 230. *P. vas* sp. nov. after Laackmann (1909, pl. 37, fig. 21) from "Gauss" Station in the Antarctic.

Figs. 231-240; 241-251; 252-264; 265-275. Species of *Cymatocylis* Laackmann emended.  $\times 200$ .

Fig. 231. *C. urnula* Laack. after Laackmann (1909, pl. 41, fig. 9) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 232. *C. diminuta* sp. nov. after Laackmann (1909, pl. 37, fig. 18) from "Gauss" Station.

Fig. 233. *C. digitabulum* nom. nov. after Laackmann (1909, pl. 37, fig. 20) from "Gauss" Station.

Fig. 234. *C. digitulus* sp. nov. after Laackmann (1909, pl. 37, fig. 23) from "Gauss" Station.

Fig. 235. *C. antarctica* (Cleve) after Cleve (1901a, p. 921, fig. 1) from the South Atlantic Current.

Fig. 236. *C. kerguelensis* Laack. after Laackmann (1909, pl. 35, fig. 5) from "Gauss" Station.

Fig. 237. *C. cristallina* Laack. after Laackmann (1909, pl. 40, fig. 3) from "Gauss" Station.

Fig. 238. *C. subconica* sp. nov. after Laackmann (1909, pl. 40, fig. 1) from the Antarctic.

Fig. 239. *C. labiosa* nom. nov. after Laackmann (1909, pl. 40, fig. 12) from the Antarctic.

Fig. 240. *C. ventricosoides* sp. nov. from Laackmann (1909, pl. 39, fig. 7) from "Gauss" Station.

**Cymatocylis calyciformis** (Laackmann) Laackmann

Figure 265

*Cyttarocylis calyciformis* Laackmann, 1907, pp. 235-237, fig. 3; Brandt, 1907, pp. 444, 456; Entz, Jr., 1908, pp. 98, 391.

*Cymatocylis calyciformis* Laackmann, 1909, pp. 346-348, 350-352, 371, 389, 391-392, 415, 416, 418, 421.

*Cymatocylis calyciformis* forma *typica* Laackmann, 1909, pp. 490, 491, pl. 36, fig. 4, pl. 42, fig. 12.

**Cymatocylis calycina** Laackmann

Figure 249

*Cymatocylis vanhoeffeni* forma *calycina* Laackmann, 1909, pp. 367, 490, 494, pl. 37, fig. 14, pl. 38, fig. 6.

Raised to status of species.

Lorica conical, goblet-shaped, 2.40-2.75 oral diameters in length; oral rim entire, horizontal, not channeled and without crest, slightly flaring; bowl subconical, 25°-35° in suboral region, changing abruptly to 45° aborally, with traces of suboral and postmedian constriction; aboral horn conical (5°), 0.70-1.25 oral diameters in length, tip pointed. Length 280-315 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. vanhoeffeni* in much wider bowl and much wider horn and from *C. affinoides* in the wider flare of the bowl and longer aboral horn.

Species of *Cymatocylis* Laackmann emended.  $\times 200$ . (*Continued.*)

Figs. 241-251

Fig. 241. *C. vanhoeffeni* (Laack.) Laack. after Laackmann (1909, pl. 37, fig. 2) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 242. *C. robusta* Laack. after Laackmann (1909, pl. 37, fig. 1) from "Gauss" Station.

Fig. 243. *C. minor* Laack. emended after Laackmann (1909, pl. 37, fig. 8) from "Gauss" Station.

Fig. 244. *C. cylindrella* nom. nov. after Laackmann (1909, pl. 38, fig. 8) from "Gauss" Station.

Fig. 245. *C. conica* Laack. after Laackmann (1909, pl. 39, fig. 12) from "Gauss" Station.

Fig. 246. *C. calyx* sp. nov. after Laackmann (1909, pl. 37, fig. 12) from "Gauss" Station.

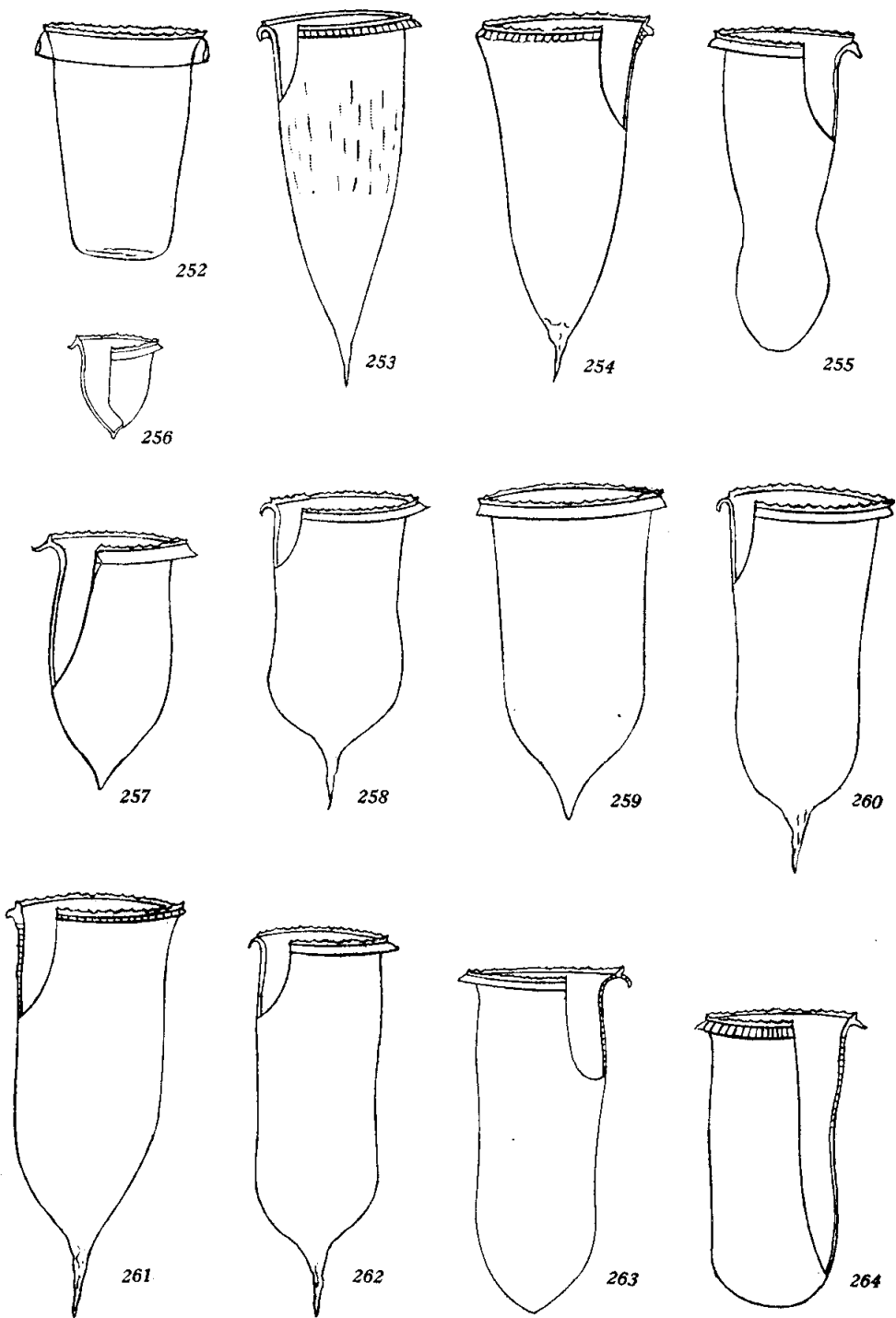
Fig. 247. *C. affinoides* nom. nov. after Laackmann (1909, pl. 37, fig. 16) from "Gauss" Station.

Fig. 248. *C. cylindrica* Laack. after Laackmann (1909, pl. 37, fig. 10) from "Gauss" Station.

Fig. 249. *C. calycina* Laack. after Laackmann (1909, pl. 37, fig. 14) from "Gauss" Station.

Fig. 250. *C. contracta* sp. nov. after Laackmann (1909, pl. 38, fig. 7) from "Gauss" Station.

Fig. 251. *C. flava* Laack. emended after Laackmann (1909, pl. 39, fig. 9) from "Gauss" Station.



Figs. 252-264. Species of *Cymatocylis* Laackmann emended.  $\times 200$ .  
 (Continued.)

***Cymatocylis calyx* sp. nov.**

Figure 246

*Cymatocylis vanhoeffeni* forma *cylindrica*, partim, Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, figs. 12, 13 (for pl. 37, fig. 10 see *C. cylindrica*, for pl. 37, fig. 11 see *C. affinoides*, and for pl. 38, fig. 7 see *C. contracta*).

Raised to status of species.

Lorica stout goblet-shaped, 1.8-2.0 oral diameters in length; oral rim not flared, channeled, inner edge denticulated; bowl conical ( $10^\circ$ ) in suboral 0.6-0.7 of the total length, contracting abruptly to a convex-conical ( $60^\circ$ - $80^\circ$ ) shape aborally; aboral horn conical ( $10^\circ$ ), 0.43-0.54 oral diameter in length, tip pointed; wall sparsely striate for about 0.5 oral diameter in the middle of the anterior part. Length 215-235 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. cylindrica* in shorter, stouter bowl and from *C. affinoides* in less taper of suboral region and restricted striation.

Species of *Cymatocylis* Laackmann emended.  $\times 200$ . (Continued.)

Figs. 252-264

Fig. 252. *C. situla* nom. nov. after Laackmann (1909, pl. 40, fig. 10) from the Antarctic.

Fig. 253. *C. everta* sp. nov. after Laackmann (1909, pl. 39, fig. 13) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 254. *C. crassa* nom. nov. after Laackmann (1909, pl. 40, fig. 2) from the Antarctic.

Fig. 255. *C. tubulosa* nom. nov. after Laackmann (1909, pl. 40, fig. 7) from "Gauss" Station.

Fig. 256. *C. parva* (Laack.) Laack. after Laackmann (1909, pl. 35, fig. 6) from "Gauss" Station.

Fig. 257. *C. ovata* Laack. after Laackmann (1909, pl. 41, fig. 3) from "Gauss" Station.

Fig. 258. *C. meridiana* nom. nov. after Laackmann (1909, pl. 43, fig. 16) from "Gauss" Station.

Fig. 259. *C. cylindrus* nom. nov. after Laackmann (1909, pl. 41, fig. 2) from "Gauss" Station.

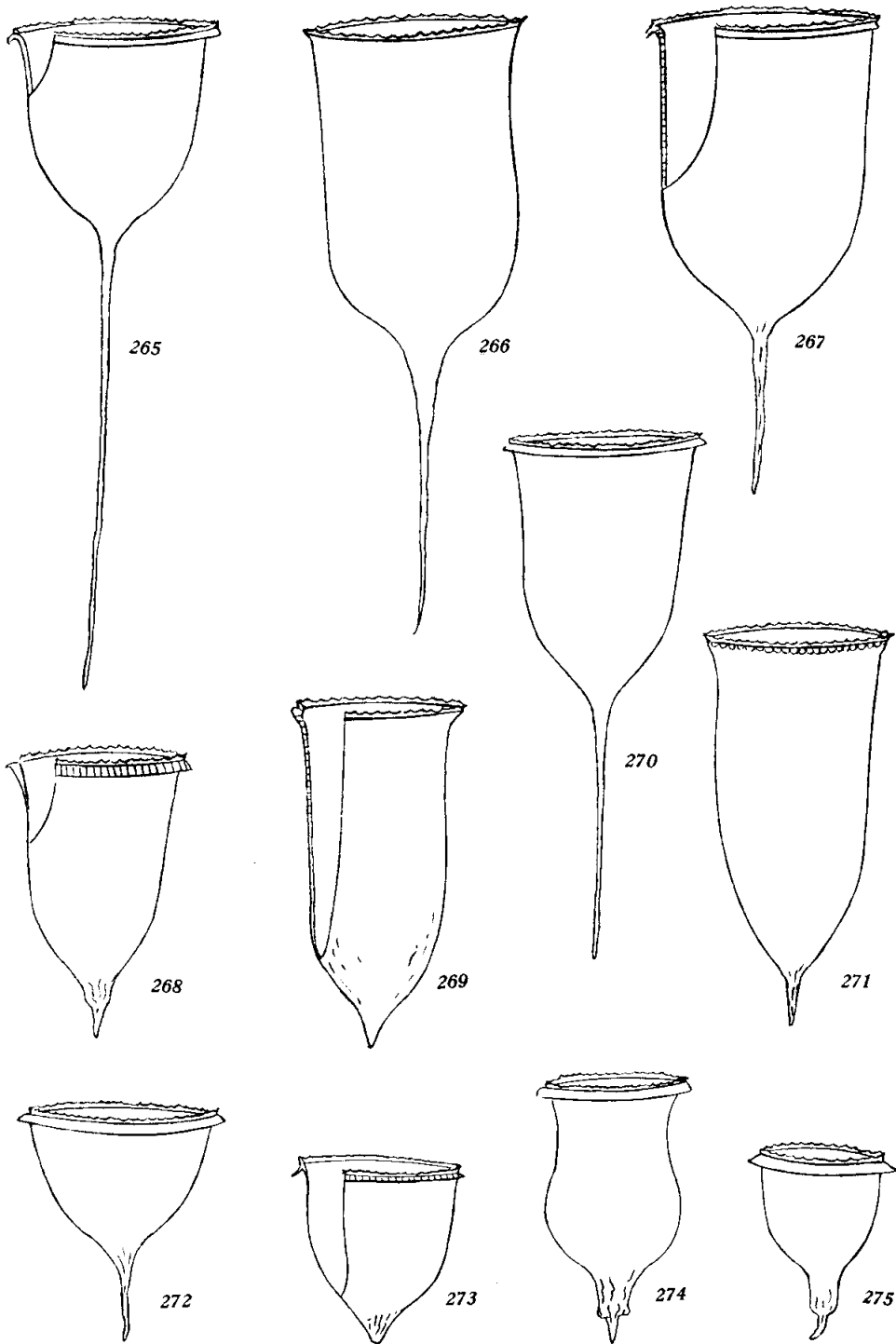
Fig. 260. *C. typica* Laack. emended after Laackmann (1909, pl. 40, fig. 11) from "Gauss" Station.

Fig. 261. *C. calcullus* nom. nov. after Laackmann (1909, pl. 40, fig. 9) from "Gauss" Station.

Fig. 262. *C. drygalskii* (Laack.) Laack. after Laackmann (1909, pl. 41, fig. 8) from "Gauss" Station.

Fig. 263. *C. caudata* sp. nov. after Laackmann (1909, pl. 41, fig. 6) from "Gauss" Station.

Fig. 264. *C. folliculus* nom. nov. after Laackmann (1909, pl. 42, fig. 3) from "Gauss" Station.



Figs. 265–275. Species of *Cymatocylis* Laackmann emended.  $\times 200$ .  
(Concluded.)

**Cymatocyliis conica** Laackmann emended

Figure 245

*Cymatocyliis flava* forma *conica*, *partim*, Laackmann, 1909, pp. 372, 373, 490, pl. 39, fig. 12 (for pl. 39, fig. 13 see *C. everta*).

Raised to status of species.

Loricæ tapering funnel-shaped, 2.39 oral diameters in length; oral rim abruptly flaring to 1.1 the diameter of the bowl below, acutely channeled, the outer crest flaring and thickened, the inner thin, erect, and denticulate; bowl convex conical, changing from 10° suborally to 30° aborally, a slight bulbous aboral inflation; aboral horn irregularly conical (20°), 0.25 oral diameter in length, heavily striate, tip pointed; wall sparsely vertically striate throughout. Length 256 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. everta* in the flaring rather than reflexed oral rim and in form of the antapical region.

**Cymatocyliis contracta** sp. nov.

Figure 250

*Cymatocyliis vanhoeffeni* forma *cylindrica*, *partim*, Laackmann, 1909, pp. 351, 366-367, 490, pl. 38, fig. 7 (for pl. 37 fig. 10 see *C. cylindrica*, for pl. 37, fig. 11 see *C. affinoides*, and for pl. 37, figs. 12, 13 see *C. calyx*).

Raised to status of species.

Loricæ tall goblet-shaped, 2.77 oral diameters in length; oral rim not everted, channeled, the inner ridge erect, denticulate, the outer

Species of *Cymatocyliis* Laackmann emended.  $\times 200$ . (*Concluded*.)

Figs. 265-275

Fig. 265. *C. calyciformis* (Laack.) Laack. emended after Laackmann (1909, pl. 42, fig. 12) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 266. *C. simplex* Laack. after Laackmann (1909, pl. 42, fig. 4) from "Gauss" Station.

Fig. 267. *C. nobilis* (Laack.) Laack. emended after Laackmann (1909, pl. 42, fig. 5) from "Gauss" Station.

Fig. 268. *C. scyphus* nom. nov. after Laackmann (1909, pl. 43, fig. 15) from "Gauss" Station.

Fig. 269. *C. glans* sp. nov. after Laackmann (1909, pl. 40, fig. 4) from "Gauss" Station.

Fig. 270. *C. cylindroides* nom. nov. after Laackmann (1909, pl. 42, fig. 11) from "Gauss" Station.

Fig. 271. *C. incondita* nom. nov. after Laackmann (1909, pl. 40, fig. 5) from the Antarctic.

Fig. 272. *C. brevicaudata* Laack. after Laackmann (1909, pl. 42, fig. 7) from "Gauss" Station.

Fig. 273. *C. convallaria* Laack. after Laackmann (1909, pl. 43, fig. 1) from "Gauss" Station.

Fig. 274. *C. gaussi* nom. nov. after Laackmann (1909, pl. 43, fig. 11) from "Gauss" Station.

Fig. 275. *C. affinis* Laack. after Laackmann (1909, pl. 43, fig. 9) from "Gauss" Station.

also erect; suboral region contracted to 0.96 oral diameter; bowl convex conical, contracting gradually from  $14^\circ$  in the suboral 0.5 of its length to  $60^\circ$  in the aboral region; aboral horn 0.85 oral diameter in length, subcylindrical with pointed tip; wall striate irregularly for about 0.5 oral diameter below the suboral constriction and on the horn. Length  $325\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. cylindrica* in the suboral contraction and more convexity of the bowl and from *C. calyx* and *C. affinoides* in this character and in longer bowl and horn.

### ***Cymatocylys convallaria* Laackmann**

Figure 273

*Cymatocylys convallaria* Laackmann, 1909, pp. 346, 348, 351, 352, 373, 382-386, 414, 416, 418, 421, 491, pl. 43, figs. 1-4.

*Cymatocylys convallaria* forma *typica* Laackmann, 1909, p. 490, pl. 33, fig. 5 (in error cited on p. 490 as pl. 36, fig. 5 and omitted on p. 489 in explanation of pl. 33).

### ***Cymatocylys crassa* nom. nov.**

Figure 254

*Cymatocylys cristallina* forma *conica, partim*, Laackmann, 1909, pp. 375, 490, pl. 40, figs. 2, 2a (for pl. 40, fig. 1 see *C. subconica*).

Non *Cymatocylys flava* forma *conica* Laackmann, 1909, pp. 372, 373, 490, pl. 39, fig. 12 (see *C. conica*).

Raised to status of species.

Lorica almost concave conical, 1.98 oral diameters in length; oral rim slightly everted, much thickened, convex, reticulate, with a single flaring ( $15^\circ$ ), thin, minutely denticulate crest; bowl conical ( $13^\circ$ ) in its anterior 0.75 with a slight concavity, changing to  $45^\circ$  aborally; aboral end somewhat irregular with a trace of a pedicel; aboral horn slender, conical ( $11^\circ$ ), 0.16 oral diameter in length, tip pointed. Length  $235\mu$ .

The type locality is in the Antarctic off Kaiser Wilhelm II Land.

Differs from *C. subconica* in more slender bowl, thicker oral rim, and shape of aboral end.



***Cymatocylys cristallina* Laackmann**

Figure 237

*Cymatocylys cristallina* Laackmann, 1909, pp. 345, 348, 350, 357, 373-378, 382, 414, 416, 421.

*Cymatocylys cristallina* forma *typica* Laackmann, 1909, pp. 375, 491, pl. 40, fig. 3.

***Cymatocylys culcullus* nom. nov.**

Figure 261

*Cymatocylys cristallina* forma *cylindrica*, *partim*, Laackmann, 1909, pp. 375-376, 386, 491, pl. 40, fig. 9 (for pl. 40, fig. 4 see *C. glans*).

Non *Cymatocylys vanhoeffeni* forma *cylindrica* Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica tall chalice-shaped, 2.5 oral diameters in length; oral rim horizontally everted, thickened for 0.25 oral diameter below, reticulate, with a single, flaring (20°) coarsely denticulate crest; bowl cylindrical in its anterior 0.7 of its length, contracted to 0.88 oral diameter below the rim, convex conical (75°) aborally; aboral horn tapering conical (35°) basally, changing to 10° distally, 0.5 oral diameter in length, tip pointed. Length 300 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. glans* in the more tapering aboral region, longer, more slender aboral horn, and in having striations on the horn.

***Cymatocylys cylindrella* nom. nov.**

Figure 244

*Cymatocylys flava* forma *cylindrica* Laackmann, 1909, pp. 373, 380, 490, pl. 38, fig. 8, pl. 39, fig. 14.

Non *Cymatocylys vanhoeffeni* forma *cylindrica* Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica tall cup-shaped, 2.5-4.0 oral diameters in length; oral rim flaring but not reflexed, slightly channeled, outer crest denticulate, inner not developed; bowl cylindrical in its anterior 0.60, convex conical (65°) aborally; aboral horn 0.5-1.0 oral diameter in length, attenuate, tip pointed; wall sparsely vertically striate for 0.4-0.7 of the length of the bowl. Length 275-395 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. flava* and *C. typica* in the absence of median constriction of the bowl.

**Cymatocylys cylindrica** Laackmann emended

Figure 248

*Cymatocylys vanhoeffeni* forma *cylindrica*, partim, Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (for pl. 37, fig. 11 see *C. affinoides*, for pl. 37, figs. 12, 13 see *C. calyx*, and for pl. 38, fig. 7 see *C. contracta*).

Raised to status of species.

Lorica slender, tall goblet-shaped, 3.25 oral diameters in length; oral rim slightly flared, channeled, inner ridge low, minutely denticulate, the outer erect; bowl contracting to 0.92 oral diameter below the rim, conical ( $9^\circ$ ) in the suboral 0.83 of its length, changing to  $50^\circ$  aborally; aboral horn conical ( $8^\circ$ ), about an oral diameter in length; wall striate throughout. Length  $325\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. contracta* in entire absence of the suboral furrow and in having complete striation and from *C. affinoides* and *C. calyx* in longer bowl.

**Cymatocylys cylindroides** nom. nov.

Figure 270

*Cymatocylys calyciformis* forma *cylindrica* Laackmann, 1909, pp. 392, 491, pl. 42, figs. 11, 13, 14.

Non *Cymatocylys vanhoeffeni* forma *cylindrica* Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica tall cup-shaped, with horn longer than the bowl, 2.70-3.87 oral diameters in length; oral rim reflexed and recurved, with a single erect, denticulate crest and no channel; bowl subcylindrical, 1.25-1.85 oral diameters in length; the aboral end more or less abruptly contracting as a convex cone ( $60^\circ$ - $90^\circ$ ); aboral horn longer than bowl, very slender, 1.4-2.25 oral diameters in length, narrowing from  $15^\circ$  to a cylindrical form within an oral diameter of the bowl, tip pointed. Length  $325$ - $525\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. calyciformis* in longer bowl.

***Cymatocylis cylindrus* nom. nov.**

Figure 259

*Cymatocylis drygalskii* forma *cylindrica* Laackmann, 1909, pp. 377, 380, 491, pl. 41, fig. 2.

Non *Cymatocylis vanhoeffeni* forma *cylindrica* Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica tall beaker-shaped, 1.87 oral diameters in length; oral rim obliquely reflexed ( $65^\circ$ ), not channeled, with a single, much flaring, irregularly denticulate crest; bowl neatly cylindrical, its length (as cylinder) 1.21 oral diameters; aboral region convex conical ( $90^\circ$ ); aboral horn concave conical ( $35^\circ$ ), 0.21 oral diameter in length, tip blunt. Length  $220\mu$  (possibly flattened).

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. drygalskii* in stouter proportions [flattened?], smaller size, and lack of median constriction of the bowl.

***Cymatocylis digitabulum* sp. nov.**

Figure 233

*Cymatocylis vanhoeffeni* forma *subrotundata*, partim, Laackmann, 1909, pp. 351, 361, 362, 365-366, 373, 490, pl. 37, fig. 20 (for pl. 37, fig. 19, pl. 38, figs. 1, 2 see *Protocymatocylis subrotundata*, for pl. 37, fig. 21 see *P. vas*, for pl. 37, figs. 22-24, pl. 38, fig. 3 see *C. digitulus*, and for pl. 37, figs. 25-28 see *C. vanhoeffeni*).

Raised to status of species.

Lorica slender thimble-shaped, with square end, 1.58 oral diameters in length; oral rim flaring  $45^\circ$ , outer edge denticulate; bowl truncated conical ( $14^\circ$ ); aboral end truncated; wall sparsely striate with leiotropic striae. Length  $190\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *Protocymatocylis subrotundata* in the truncate aboral end instead of a rounded one and in having the oral rim denticulate and from *C. digitulus* in the truncate aboral end and shorter bowl.

**Cymatocylys digitulus** sp. nov.

Figure 234

*Cymatocylys vanhoeffeni* forma *subrotundata*, partim, Laackmann, 1909, pp. 351, 361, 362, 365-366, 373, 490, pl. 37, figs. 22-24, pl. 38, fig. 3 (for pl. 37, fig. 19, pl. 38, figs. 1-2 see *Protocymatocylys subrotundata*, for pl. 37, fig. 21 see *P. vas*, for pl. 37, figs. 25-28 see *C. vanhoeffeni*, and for pl. 37, fig. 20 see *C. digitabulum*).

*Cymatocylys flava* forma *subrotundata* Laackmann, 1909, pp. 373, 490, pl. 39, fig. 11; 1913, p. 21.

Raised to status of species.

Lorica finger-shaped, 2.5-3.0 oral diameters in length; oral rim slightly flaring, rim channeled; its outer edge coarsely denticulate, the inner scarcely developed; bowl elongated sack-shaped, cylindrical to subconical ( $8^\circ$ ); aboral end rounded, with or without a point; wall with dextrotropic or irregular striae in the upper 0.4, or sparsely also in the aboral region. Length 290-300 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *Protocymatocylys subrotundata* in greater length and more slender bowl and from *C. vanhoeffeni* in the absence of an aboral horn.

**Cymatocylys diminuta** sp. nov.

Figure 232

*Cymatocylys vanhoeffeni* forma *affinis*, partim, Laackmann, 1909, pp. 367, 384, 490, pl. 37, fig. 18 (for pl. 37, figs. 15-17 see *C. affinoides*).

Non *Cymatocylys affinis* Laackmann, 1909, pp. 384-385 (see *C. affinis*).

Raised to status of species.

Lorica very stout goblet-shaped, 1.56 oral diameters in length; oral rim channeled, inner ridge denticulate, outer slightly flaring; bowl stout, conical ( $8^\circ$ ) in the suboral 0.7 of its length, changing to  $80^\circ$  aborally; aboral horn 0.33 oral diameter in length with a bulbous expansion in its basal half; wall striate throughout except below the oral rim. Length 140 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. affinoides* in the smaller size and the bulbous enlargement of the base of the aboral horn.

**Cymatocylis drygalskii** (Laaekmann) Laaekmann emended

Figure 262

*Cyttarocylis drygalskii* Laaekmann, 1907, pp. 235-236, fig. 2; Brandt, 1907, pp. 444, 463; Entz, Jr., 1908, p. 99; Laaekmann, 1909, p. 376.

*Cymatocylis drygalskii* Laaekmann, *partim*, 1909, pp. 346-359, 365, 368, 370-389, 414-418, 421, 489-491, pl. 34, figs. 1, 3, pl. 35, fig. 2, pl. 40, fig. 8, pl. 48, fig. 2 (for pl. 34, fig. 2, pl. 35, fig. 4, and pl. 41, fig. 6 see *C. ecaudata*).

*Cymatocylis drygalskii* forma *typica* Laaekmann, 1909, pp. 379, 380, 489-491, pl. 33, figs. 2, 3, pl. 35, fig. 1, pl. 36, fig. 3, pl. 40, fig. 13, pl. 41, figs. 1, 4 [flattened], 5, 7, 8.

**Cymatocylis ecaudata** sp. nov.

Figure 263

*Cymatocylis drygalskii*, *partim*, Laaekmann, 1909, pp. 346-359, 365, 368, 370-389, 414-418, 421, 489-491, pl. 34, fig. 2, pl. 35, fig. 4, pl. 41, fig. 6 (for pl. 34, figs. 1-3, pl. 35, fig. 2, pl. 40, fig. 8, and pl. 48, fig. 2 see *C. drygalskii*).

Lorica stout, goblet-shaped, 2.10-2.13 oral diameters in length; oral rim obliquely reflexed, not channeled, with a single flaring ( $45^\circ$ ), finely and unevenly denticulate crest; bowl subcylindrical, with a slight median or postmedian constriction; aboral end convex-conical ( $80^\circ$ - $90^\circ$ ), tip pointed. Length 235-245 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. drygalskii* in the absence of an aboral horn.

**Cymatocylis everta** sp. nov.

Figure 253

*Cymatocylis flava* forma *conica*, *partim*, Laaekmann, 1909, pp. 372, 373, 490, pl. 39, fig. 13 (for pl. 39, fig. 12 see *C. conica*).

Raised to status of species.

Lorica tapering funnel-shaped, 2.5 oral diameters in length; oral rim completely reflexed, expanding to 1.2 the diameter of the bowl below, not channeled, with an inner, entire, erect crest; bowl convex conical, changing gradually from  $5^\circ$  below the rim to  $38^\circ$  aborally; aboral horn small, conical ( $5^\circ$ ), 0.29 oral diameter in length, tip pointed; wall sparsely vertically striate for about 0.6 oral diameter a short distance below the oral region. Length 270 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. conica* in everted instead of flaring oral rim, less striation and absence of aboral bulb.

**Cymatocylys flava** Laackmann emended

Figure 251

*Cymatocylys flava* Laackmann, 1909, pp. 345, 348, 350, 351, 359, 369-374, 376, 377, 380, 381, 414-416, 420.

*Cymatocylys flava* forma *typica*, *partim*, Laackmann, 1909, pp. 371-372, 490, pl. 39, figs. 1, 3, 9, 10 (for pl. 39, figs. 2, 4 see *C. typica*).

*Cymatocylys flava* forma *ventricosa*, *partim*, Laackmann, 1909, pp. 372, 377, 490, pl. 39, figs. 5, 6, 8 (for pl. 39, fig. 7 see *C. ventricosoides*).

**Cymatocylys folliculus** nom. nov.

Figure 264

*Cymatocylys nobilis* forma *subrotundata* Laackmann, 1909, pp. 351, 389-391, 415, 491, pl. 42, fig. 3; 1913, p. 21.

Non *Cymatocylys vanhoeffeni* forma *subrotundata* Laackmann, pp. 365-366, pl. 37, fig. 19, pl. 38, figs. 1-2 (see *Protocymatocylys subrotundata*).

Raised to status of species.

Lorica elongated bag-shaped, nearly 2 oral diameters in length; oral rim flaring, subhorizontal with radial striae and a single flaring (30°) coarsely denticulate crest; bowl nearly 2 oral diameters in length, with slight nuchal and slight postmedian constrictions; aboral end flattened hemispherical. Length 200 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. nobilis* in absence of aboral horn and from *C. digitulus* and *C. digitabulum* in stouter bowl with constrictions.

**Cymatocylys gaussi** nom. nov.

Figure 274

*Cymatocylys affinis* forma *ventricosa* Laackmann, 1909, pp. 382, 385, 491, pl. 43, figs. 10-11, 13-14.

Non *Cymatocylys vanhoeffeni* forma *ventricosa* Laackmann, 1909, pp. 364, 490, pl. 37, fig. 6 (combined with *C. vanhoeffeni*).

Raised to status of species.

Lorica short, stout goblet-shaped, 1.8-2.0 oral diameters in length; oral rim reflexed (35°), slightly thickened, striate, with a single slightly flaring (25°) denticulate crest; bowl subcylindrical, constricted above the middle to as much as 0.75 oral diameter, enlarging aborally to almost an oral diameter; aboral region conical (70°-90°); pedicel subcylindrical, conical to subconical, as long or longer than wide, abruptly contracting aborally; aboral horn conical (8°-15°), its length 0.2 oral diameter, tip pointed. Length 165-195 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. affinis* in longer bowl and from *C. scyphus* in presence of median constriction of bowl.

### ***Cymatocylis glans* sp. nov.**

Figure 269

*Cymatocylis cristallina* forma *cylindrica*, *partim*, Laackmann, 1909, pp. 375-376, 386, 491, pl. 40, fig. 4 (for pl. 40, fig. 9 see *C. culcullus*).

Non *Cymatocylis vanhoeffeni* forma *cylindrica* Laackmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica short bullet-shaped, 2 oral diameters in length; oral rim flaring 30° for nearly 0.1 oral diameter below the crest, thickened for this distance, with a single, flaring (45°), thin, coarsely denticulate crest; bowl almost cylindrical, its aboral region contracting to a convex conical (90°) contour; aboral horn stout conical (55°), tip pointed; wall with sparse striae on the aboral region. Length 235 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. culcullus* in its broadly conical (55°) aboral horn and less oral flare.

### ***Cymatocylis incondita* nom. nov.**

Figure 271

*Cymatocylis cristallina* forma *simplex* Laackmann, 1909, pp. 376, 491, pl. 40, figs. 5, 6, 6a.

Non *Cymatocylis nobilis* forma *simplex* Laackmann, 1909, p. 390, pl. 42, fig. 4 (see *C. simplex*).

Raised to status of species.

Lorica cylindrical goblet-shaped, 2.0-2.1 oral diameters in length; oral rim with slight flare (10°-20°), channeled, reticulate, with low, entire inner and slightly flaring, denticulate outer crest; bowl sub-cylindrical in the oral 0.65-0.70 of its length, a trifle concave near the middle, contracting aborally in a very convex conical (70°-90°) aboral region; aboral horn conical (13°-22°), with sinuous striations, 0.16-0.25 oral diameter in length, tip pointed. Length 240-260 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. cristallina* in the presence of an aboral horn and from other species of the *C. cristallina* group in the simple oral rim.

**Cymatocylis kerguelensis** Laackmann

Figure 236

*Amphorella norvegica*, Cleve, 1901a, p. 921, fig. 2.*Cymatocylis kerguelensis* Laackmann, 1909, pp. 346, 348, 350, 374, 387-388, 418, 420, 421, 490, pl. 35, fig. 5.**Cymatocylis labiosa** nom. nov.

Figure 239

*Cymatocylis cristallina* forma *ventricosa* Laackmann, 1909, pp. 375, 491, pl. 40, fig. 12.Non *Cymatocylis vanhoeffeni* forma *ventricosa* Laackmann, 1909, pp. 364, 490, pl. 37, fig. 6 (combined with *C. vanhoeffeni*).

Raised to status of species.

Lorica elongate sack-shaped, thick-lipped, 2.45 oral diameters in length; oral rim abruptly everted horizontally, greatly thickened, with a single, flaring ( $30^\circ$ ), coarsely and unevenly denticulate crest; bowl subcylindrical in the oral 0.78 of its length, with slight nuchal and median constrictions, contracted below the rim to 0.9 oral diameter; aboral region flattened hemispherical; aboral horn minute, conical ( $25^\circ$ ), 0.14 oral diameter in length, tip pointed; wall sparsely and faintly striate in the aboral 0.4. Length  $235\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. incondita* in its thickened oral rim and from all other species of the *C. cristallina* group in the baggy aboral region.

**Cymatocylis meridiana** nom. nov.

Figure 258

*Cymatocylis drygalskii* forma *ventricosa* Laackmann, 1909, pp. 380, 385, 491, pl. 43, fig. 16.Non *Cymatocylis vanhoeffeni* forma *ventricosa* Laackmann, 1909, pp. 364, 490, pl. 37, fig. 6 (combined with *C. vanhoeffeni*).

Raised to status of species.

Lorica stout goblet-shaped, 2 oral diameters in length; oral rim obliquely reflexed, not channeled, with a single flaring denticulate crest; bowl subcylindrical, slightly constricted at its middle, enlarged aborally to 1.12 its median diameter; aboral end subglobose, 0.9 oral diameter in diameter; aboral horn conical ( $15^\circ$ ) 0.4 oral diameter in length, irregular, tip pointed. Length  $220\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. drygalskii* in the much smaller aboral horn and more bulbous aboral expansion.



**Cymatocylis minor** Laackmann emended

Figure 243

*Cymatocylis vanhoeffeni* forma *minor*, *partim*, Laackmann, 1909, p. 490, pl. 37, figs. 8, 9 (for pl. 37, fig. 7 see *C. vanhoeffeni*).

Raised to status of species.

Lorica rather stout vase-shaped, 2.69–3.04 oral diameters in length; oral rim not everted, slightly channeled, outer edge coarsely denticulate, inner very low; bowl conical ( $18^{\circ}$ – $20^{\circ}$ ) in its anterior 0.5, cylindrical for a short distance, and then conical ( $40^{\circ}$ – $45^{\circ}$ ); aboral horn almost cylindrical, 0.6–1.0 oral diameter in length, tip blunt; wall with longitudinal striae in the anterior 0.5 of the bowl. Length 305–350 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic. Occurs also in the Indian Ocean off South Africa.

Differs from *C. vanhoeffeni* in shorter, wider bowl and shorter aboral horn.

**Cymatocylis nobilis** (Laackmann) Laackmann emended

Figure 267

*Cyttarocylis nobilis* Laackmann, 1907, pp. 235, 237, fig. 4; 1909, pp. 347, 389; Brandt, 1907, pp. 444, 473; Entz, Jr., 1908, p. 99.

*Cymatocylis nobilis* Laackmann, 1909, pp. 345–348, 350, 351–358, 371, 377, 378, 381, 382, 386, 388–391, 415, 416, 418, 421.

*Cymatocylis nobilis* forma *typica* Laackmann, 1909, pp. 490–491, pl. 36, fig. 2, pl. 42, figs. 1, 1a, 2, 5.

*Cymatocylis nobilis* forma *cylindrica* Laackmann, 1909, pp. 351, 390, 491, pl. 42, fig. 6.

**Cymatocylis ovata** Laackmann

Figure 257

*Cymatocylis drygalskii* forma *ovata* Laackmann, 1909, pp. 381, 491, pl. 41, fig. 3.

Raised to status of species.

Lorica neatly goblet-shaped, 1.8 oral diameters in length; oral rim reflexed ( $45^{\circ}$ ), concave above, not channeled, with a single, erect, irregularly and unevenly denticulate crest; nuchal constriction 0.87 oral diameter in diameter; bowl elongate ellipsoidal, widest (1 oral diameter) near its middle; aboral horn very stout, conical ( $60^{\circ}$ ), 0.48 oral diameter in length. Length 160 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from all other species in the ellipsoidal form of the bowl.

**Cymatocylys parva** (Laaekmann) Laaekmann

Figure 256

*Cyrtarocylys parva* Laaekmann, 1907, pp. 235, 237, fig. 5; 1909, p. 386; Brandt, 1907, pp. 444, 475; Entz, Jr., 1908, p. 99.

*Cymatocylys parva* Laaekmann, 1909, pp. 346, 348, 350, 374, 386-388, 416, 417, 420, 421, 490, pl. 35, figs. 6; Jørgensen, 1924, p. 23.

**Cymatocylys robusta** Laaekmann

Figure 242

*Cymatocylys vanhoeffeni* forma *robusta* Laaekmann, 1909, pp. 363, 364, 490, pl. 37, fig. 1.

Raised to status of species.

Lorica very slender vase-shaped, 5.56 oral diameters in length; oral rim distinctly flared, with a distinct collar, convex outwardly, outer rim minutely denticulate, inner apparently much lower than the outer; bowl with a nuchal constriction 0.91 oral diameter in diameter, concave conical (about  $15^\circ$ ), expanding in a bulbous region 0.5 oral diameter in diameter at its aboral end; aboral horn longer than the bowl, 3.25 oral diameters in length, conical, changing from  $35^\circ$  at its base to  $4^\circ$  distally, with pointed tip; wall with leiotropic striae for an oral diameter below the nuchal constriction, scattered striae on the bulbous enlargement and aboral horn, and scattered punctae over the bowl, more abundant in the suboral region. Length  $640\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from all other species in the form of the suboral collar.

**Cymatocylys scyphus** nom. nov.

Figure 268

*Cymatocylys affinis* forma *cylindrica* Laaekmann, 1909, pp. 367, 382, 385-386, 491, pl. 41, fig. 10, pl. 43, figs. 7, 12, 15.

Non *Cymatocylys vanhoeffeni* forma *cylindrica* Laaekmann, 1909, pp. 351, 366-367, 490, pl. 37, fig. 10 (see *C. cylindrica*).

Raised to status of species.

Lorica subcylindrical goblet-shaped, 1.62-1.93 oral diameters in length; oral rim deflected about  $10^\circ$  below the horizontal, striate basally, with a single, low, erect, slightly denticulate crest; bowl subconical ( $10^\circ$ - $15^\circ$ ), aborally convex conical ( $55^\circ$ - $70^\circ$ ); contracting to a stout pedicel 0.2 oral diameter in diameter and about as long as

wide, cylindrical to subconical, aborally truncated; aboral horn conical ( $25^\circ$ ), 0.20-0.25 oral diameter in length, tip pointed. Length 190-200 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. affinis* in longer bowl, from *C. cylindrella* and *C. cylindrica* in greater development of the oral rim, and from *C. cylindroides*, *C. cylindrus*, and most other species in the presence of a pedicel.

### ***Cymatocyelis simplex* Laackmann**

Figure 266

*Cymatocyelis nobilis* forma *simplex* Laackmann, 1909, pp. 389, 390, 491, pl. 42, fig. 4.

Raised to status of species.

Lorica stout goblet-shaped, 3 oral diameters in length; oral rim scarcely flaring, with a single, erect, strongly and regularly denticulate outer crest; bowl subcylindrical, slightly concave above the middle; its aboral region convex conical ( $90^\circ$ ); aboral horn 1.3 oral diameters in length, tapering conical ( $5^\circ$ ), tip aciculate. Length 360-380 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. nobilis* in absence of reflexed oral rim.

### ***Cymatocyelis situla* nom. nov.**

Figure 252

*Cymatocyelis drygalskii* forma *conica* Laackmann, 1909, pp. 377, 381, 491, pl. 40, fig. 10.

Non *Cymatocyelis flava* forma *conica* Laackmann, 1909, pp. 372, 373, 490, pl. 39, fig. 12 (see *C. conica*).

Raised to status of species.

Lorica tall bucket-shaped, 1.48 oral diameters in length; oral rim reflexed  $180^\circ$ , its margin thickened, convex outwardly, not channeled, with a single flaring ( $45^\circ$ ), strongly and regularly denticulate crest; bowl a truncated cone ( $14^\circ$ ); aboral end almost squarely truncated. Length 170 $\mu$ .

The type locality is off Kaiser Wilhelm II Land in the Antarctic.

Differs from all other species in the truncated conical shape of the bowl and the marked degree of aboral deflection of the oral rim.

**Cymatocylys subconica** sp. nov.

Figure 238

*Cymatocylys cristallina* forma *conica*, partim, Laackmann, 1909, pp. 375, 490, pl. 40, fig. 1 (for pl. 40, figs. 2, 2a see *C. crassa*).

Non *Cymatocylys flava* forma *conica* Laackmann, 1909, pp. 372, 373, 490, pl. 39, fig. 12 (see *C. conica*).

Raised to status of species.

Lorica elongated subconical, 1.62 oral diameters in length; oral rim everted horizontally, scarcely thickened, with a single, erect, thickened, denticulate crest; bowl convex conical, changing from  $15^\circ$  below the rim to  $90^\circ$  in the aboral region, most of the change occurring in the aboral 0.25 of the length, its suboral diameter 0.91 oral diameter; aboral end pointed with irregular surface. Length  $185\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. crassa* in stouter proportions of bowl, lack of aboral horn, and more everted oral rim.

**Cymatocylys tubulosa** nom. nov.

Figure 255

*Cymatocylys drygalskii* forma *subrotundata* Laackmann, 1909, pp. 377, 381, 491, pl. 40, fig. 7; 1913, p. 21.

Non *Cymatocylys vanhoeffeni* forma *subrotundata* Laackmann, pp. 365-366, pl. 37, fig. 19, pl. 38, figs. 1-2 (see *Protocymatocylys subrotundata*).

Raised to status of species.

Lorica finger-shaped with postmedian constriction, 2.30 oral diameters in length; oral rim reflexed ( $45^\circ$ ), not channeled, with a single erect, rather evenly and coarsely denticulated crest; bowl cylindrical in suboral region, constricted to 0.6 its suboral diameter at 0.61 its length from the oral rim; aboral end asymmetrically hemispherical. Length  $220\mu$ . Perhaps abnormal in the constriction.

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *Protocymatocylys subrotundata* in reflexed oral rim and absence of striae, and from *C. digitulus* in the reflexed oral rim and constriction of the bowl.

***Cymatocylis typica* Laackmann emended**

Figure 260

*Cymatocylis flava* forma *typica*, partim, Laackmann, 1909, pp. 371-372, 490, pl. 39, figs. 2, 4 (for pl. 39, figs. 1, 3, 9, 10 see *C. flava*).

*Cymatocylis drygalskii* forma *flava* Laackmann, 1909, pp. 377, 491, pl. 40, fig. 11.

Raised to status of species.

Lorica tall goblet-shaped, 3.05-3.21 oral diameters in length; oral rim reflexed, broadly channeled, with erect, denticulate outer and entire inner crest; diameter of bowl below rim 0.88 oral diameter; bowl subconical ( $8^{\circ}$ - $10^{\circ}$ ), constricted below its middle, expanded aborally, and then abruptly contracted in a cone of  $60^{\circ}$ - $70^{\circ}$ ; aboral horn 0.50-0.75 oral diameter in length, subconical ( $10^{\circ}$ ), undulating, tip pointed; wall with vertical striae for nearly an oral diameter below the rim; color yellowish. Length 300-350 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. flava* in having reflexed instead of merely flaring oral rim.

***Cymatocylis urnula* Laackmann**

Fig. 231

*Cymatocylis affinis* forma *urnula* Laackmann, 1909, pp. 386, 491, pl. 41, fig. 9.

Raised to status of species.

Lorica irregularly subconical, 1.65 oral diameters in length; oral rim everted horizontally, not channeled, with a single inner, erect, faintly denticulate crest, striate below; bowl subconical,  $20^{\circ}$  above, changing to  $50^{\circ}$  aborally, with slight nuchal and postmedian constrictions; aboral horn scarcely emergent, 0.09 oral diameter in length, tip blunt. Length 206 $\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. affinoides* in greater development of the oral rim and presence of lateral concavities.

**Cymatocylis vanhoeffeni** (Laackmann) Laackmann emended

Figure 241

*Ptychocylis vanhoeffeni* Laackmann, 1907, pp. 236, 238, 239, fig. 9; Brandt, 1907, p. 444; Entz, Jr., 1908, p. 102; Laackmann, 1909, pp. 347, 348, 358.

*Ptychocylis (Rhabdonella?) vanhoeffeni*, Brandt, 1907, p. 483.

*Cymatocylis vanhoeffeni* forma *typica* Laackmann, 1909, pp. 350, 363, 415, 489, 490, pl. 33, fig. 1, pl. 35, fig. 3, pl. 36, fig. 1, pl. 37, figs. 2-4.

*Cymatocylis vanhoeffeni* forma *ventricosa* Laackmann, 1909, pp. 364, 490, pl. 37, fig. 6.

*Cymatocylis vanhoeffeni* forma *subrotundata, partim*, Laackmann, 1909, pp. 351, 361, 365-366, 373, 490, pl. 37, figs. 25-28 (for pl. 37, fig. 19, pl. 38, figs. 1-2 see *Protocymatocylis subrotundata*, for pl. 37, fig. 21 see *P. vas*, for pl. 37, figs. 22-24, pl. 38, fig. 3 see *C. digitulus* and for pl. 37, fig. 20 see *C. digitabulum*).

*Cymatocylis vanhoeffeni* forma *minor, partim*, Laackmann, 1909, p. 490, pl. 37, fig. 7 (for pl. 37, figs. 8, 9 see *C. minor*).

*Cymatocylis vanhoeffeni*, Laackmann, 1909, pp. 345, 347, 348, 350-390, 414, 417, 424, 451, 489, 490, 492, pl. 37, fig. 29, pl. 38, figs. 9-15[?], pl. 48, figs. 1, 3.

**Cymatocylis ventricosoides** sp. nov.

Figure 240

*Cymatocylis flava* forma *ventricosa, partim*, Laackmann, 1909, pp. 372, 377, 490, pl. 39, fig. 7 (for pl. 39, figs. 5, 6, 8 see *C. flava*).

Non *Cymatocylis vanhoeffeni* forma *ventricosa* Laackmann, 1909, pp. 364, 490, pl. 37, fig. 6 (combined with *C. vanhoeffeni*).

Raised to status of species.

Lorica medium stout goblet-shaped with aboral inflation, 2.43 oral diameters in length; oral rim flaring to 1.23 diameters of the bowl below, its margin thickened, with a single, coarsely denticulate, flaring crest, no channel, and no inner crest; bowl subcylindrical in its suboral 0.66, globose aborally, 0.84 oral diameter in diameter; aboral horn stout conical ( $45^\circ$ ), 0.27 oral diameter in length, tip blunt; wall vertically striate throughout and reticulated below the oral rim. Length  $450\mu$ .

The type locality is "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Differs from *C. flava* and *C. typica* in the stout conical aboral horn.

### Favella Jörgensen emended

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coxiella*, *Parundella*, *Proplectella*, *Ptychocyclus*, *Salpingella*, *Stenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Möbius, 1887, pp. 110, 120.

*Cyttarocyclus*, Imhof, 1886, p. 199; Daday, *partim*, 1887b, pp. 574-575 (see also *Codonella*, *Coxiella*, and *Epiploeyclus*); Brandt, *partim*, 1907, pp. 181-188 (see also *Climacocyclus*, *Coxiella*, *Craterella*, *Cyttarocyclus*, *Parafavella*, *Porococcus*, *Tintinnopsis*, *Xystonella*, and *Xystoncellopsis*).

*Undella*, Cleve, *partim*, 1900d, pp. 974-975 (see also *Craterella* and *Xystoncellopsis*); Schmidt, 1901, p. 190.

*Favella*, Jörgensen, *partim*, 1924, pp. 7, 9, 16, 24-25, 32, 37, 50, 66, 71-72; 1927, pp. 3, 10-11, 22 (see also *Parafavella*); Campbell, 1927, p. 429.

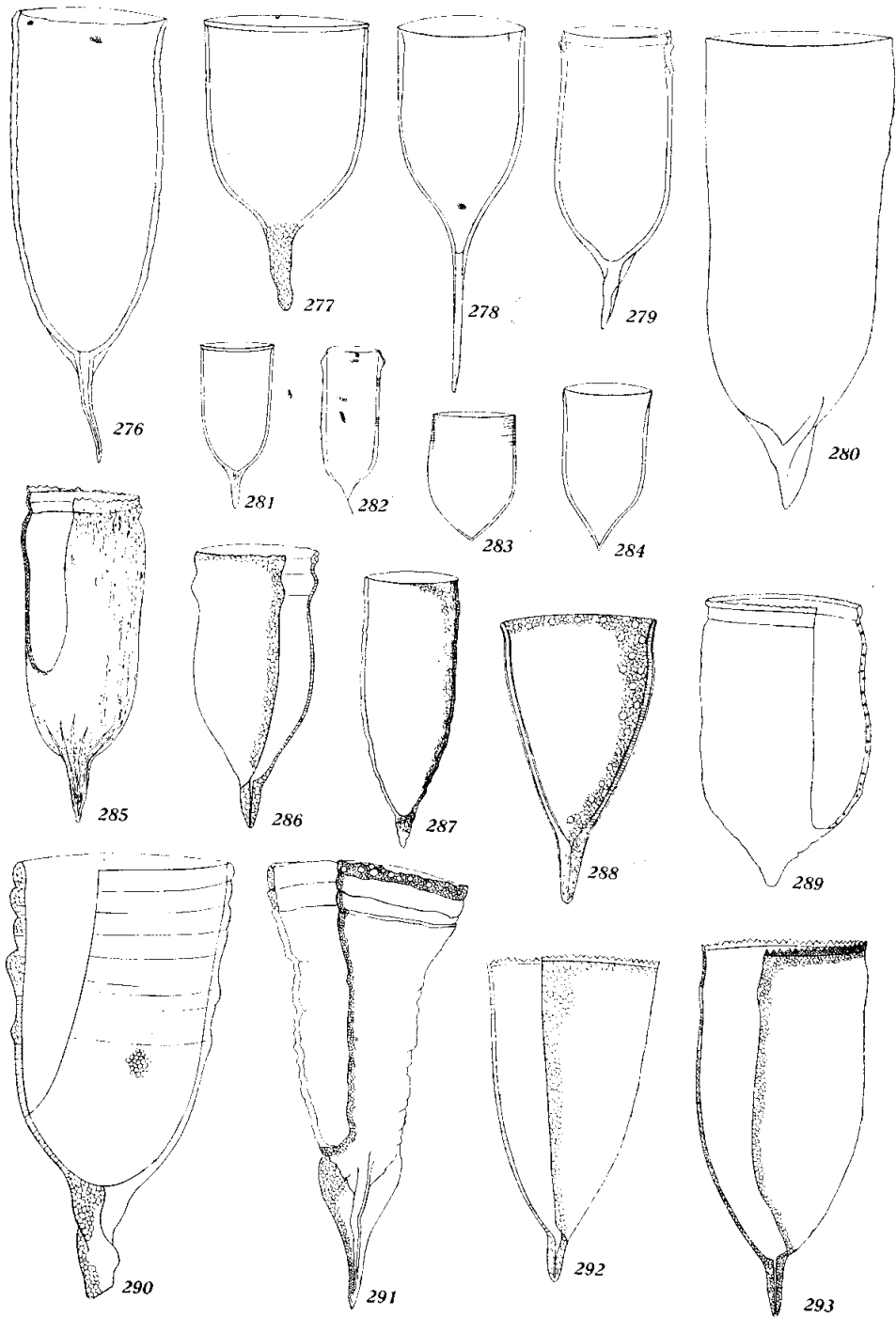
Favellineae with lorica generally campanulate or subconical; oral rim entire or with small skirt, or with denticles, with or without a suboral constriction and ridge; never with a collar separated by a band from the bowl proper, but sometimes with one or more annuli; bowl campanulate to conical, contracting aborally; aboral horn present, generally thick-walled; wall bilamellate, usually with coarse, intermediate prismatic secondary alveoli and a very fine, primary structure, never with regular polygonal structure. Marine.

We designate as the type species *Favella ehrenbergii* (Claparède and Lachmann) Jörgensen emended, from off Norway, the oldest species included in the genus.

Differs from *Protocymatocyclus* gen. nov. and *Cymatocyclus* Laack. emended in the absence of striae; from *Porococcus* (Cleve) Cleve in better developed more distinctly prismatic wall and more suboral development; and from *Parafavella* gen nov. in much less regular, less distinct, and smaller prisms in the wall.

Includes 18 species as follows:

- |                               |                             |
|-------------------------------|-----------------------------|
| ← aciculifera Jörg.           | fistulicauda Jörg.          |
| adriatica (Imhof) Jörg.       | franciscana sp. nov.        |
| arcuata (Bdt.) Jörg.          | helgolandica (Bdt.) emended |
| atingata sp. nov.             | Jörg.                       |
| azorica (Cleve) Jörg.         | infundibulum sp. nov.       |
| brevis nom. nov.              | markusovszkyi (Daday) Jörg. |
| campanula (Schmidt) Jörg.     | mcunieri sp. nov.           |
| composita Jörg.               | panamensis sp. nov.         |
| confessa sp. nov.             | † serrata (Möbius) Jörg.    |
| ehrenbergii (Clap. and Lach.) |                             |
| Jörg.                         |                             |



Figs. 276-293. Species of *Favella* Jörg. emended.  $\times 200$ .



**Favella aciculifera** Jörgensen

Figure 282

*Favella aciculifera* Jörgensen, 1924, pp. 29, 31, fig. 35; Campbell, 1927, p. 430.**Favella adriatica** (Imhof) Jörgensen emended

Figure 277

*Cyttarocyclus adriatica* Imhof, 1886, p. 199; Daday, 1887*b*, p. 581; Brandt, 1907, pp. 209, 211, 212, 452.*Cyttarocyclus ehrenbergi* var. *b adriatica*, Brandt, 1906, p. 24, pl. 41, figs. 9, 10; 1907, *partim*, pp. 205, 207, 209, 211-212, 443, 452, 458, 464 (pl. 61, fig. 9 included, for which see *F. markusovszkyi*).*Cyttarocyclus ehrenbergi* var. *adriatica*, Faria and Cunha, 1917, p. 71, pl. 26, fig. 2; non Laackmann, 1913, pp. 28-30, pl. 4, figs. 54-57 (see *F. ehrenbergii*).*Cyttarocyclus Ehrenbergi* var. *adriatica*, Rossolimo, 1922, pp. 27, 28, 31, 33, pl. 2, figs. 16, 17.Figs. 276-293. Species of *Favella* Jörg. emended. × 200.Fig. 276. *F. markusovszkyi* (Daday) Jörg. after Jörgensen (1924, p. 29, fig. 33) from the Bay of Naples.Fig. 277. *F. adriatica* (Imhof) Jörg. after Brandt (1906, pl. 41, fig. 9) from the Bay of Naples.Fig. 278. *F. fistulicauda* Jörg. after Jörgensen (1924, p. 29, fig. 34) from Station 179 of the "Thor" off the Dardanelles.Fig. 279. *F. panamensis* sp. nov. from the Bay of Panama.Fig. 280. *F. ehrenbergii* (Clap. and Laeh.) Jörg. emended after Brandt (1906, pl. 41, fig. 4) from Station "Apstein" at Helgoland.Fig. 281. *F. campanula* (Schmidt) Jörgensen after Schmidt (1901, p. 190, fig. 6) from the Gulf of Siam.Fig. 282. *F. aciculifera* Jörg. after Jörgensen (1924, p. 29, fig. 35) from Station 152 of the "Thor" off Biskra in the Eastern Mediterranean.Fig. 283. *F. composita* Jörg. after Jörgensen (1924, p. 27, fig. 29) from off the Balearic Islands.Fig. 284. *F. azorica* (Cleve) Jörg. after Cleve (1900*d*, p. 974, fig. [10]) from off the Azores.Fig. 285. *F. franciscana* sp. nov. after Campbell (1927, pl. 21, fig. 1) from San Francisco Bay, California.Fig. 286. *F. arcuata* (Bdt.) Jörg. after Brandt (1906, pl. 40, fig. 2) from Station "Schab, 23-I-93" from off Cape Cross on the southwest coast of Africa in the Atlantic.Fig. 287. *F. meunieri* sp. nov. after Meunier (1919, pl. 22, fig. 2) from the Flemish Sea.Fig. 288. *F. infundibulum* sp. nov. after Jörgensen (1899, pl. 1, fig. 12) from Byfiord, Norway.Fig. 289. *F. confessa* sp. nov. from the collection of the U. S. S. "Albatross," Yes Bay, Alaska.Fig. 290. *F. brevis* nom. nov. after Laackmann (1913, pl. 5, fig. 61) from the Adriatic off Zara.Fig. 291. *F. helgolandica* (Bdt.) emended Jörg. after Brandt (1906, pl. 41, fig. 8) from Helgoland.Fig. 292. *F. attingata* sp. nov. after Brandt (1906, pl. 40, fig. 1) from Station 926 "Princesse Alice" off the Norwegian Coast.Fig. 293. *F. serrata* (Möbius) Jörg. after Brandt (1906, pl. 39, fig. 6) from Station 931 [16-VII-98] "Princesse Alice" off the coast of Norway.

*Cyttarocyllis Ehrenbergii* var. *adriatica*, Entz, Jr., *partim*, 1908, pp. 99, 112, 127, pl. 3, fig. 9; 1909*b*, pp. 129, 194, 198, 199, pl. 10, fig. 9 (for 1908, pl. 3, fig. 8 and 1909*b*, pl. 10, fig. 8 see *F. composita*).

*Cyttarocyllis Ehrenbergii*, Entz, Jr., *partim*, 1908, pp. 6-128, pl. 3, fig. 7; 1909*b*, pp. 97-225, pl. 10, fig. 7 (for 1908, pl. 3, fig. 6 and 1909*b*, pl. 10, fig. 6 see *Coelocella longa* [?]; and for 1908, pl. 5, fig. 5, pl. 6, figs. 5, 6, 12, pl. 8, figs. 1, 2, 5, 7, pl. 9, fig. 2, pl. 10, figs. 4-6, 9, fig. 13, pl. 11, figs. 1-10, pl. 12, figs. 1-9, pl. 13, figs. 1-11, 28, 30-34 and for 1909*b*, pl. 12, fig. 5, pl. 13, figs. 5, 6, 12, pl. 15, figs. 1, 2, 5, 7, pl. 17, figs. 4-6, 9, 13, pl. 18, figs. 1-10, pl. 19, figs. 1-9, pl. 20, figs. 1-11, 28, 30-34, pl. 21, figs. 1, 3, 5, 10-12, 17 see *F. chrenbergii*).

*Favella adriatica*, Jörgensen, *partim*, 1924, pp. 27, 30-31, fig. 31 (see also *F. chrenbergii*); Campbell, 1927, p. 430.

*Favella chrenbergi*, Campbell, 1927, pp. 429-430, fig. A, 2, 6.

*Cyttarocyllus* [*sic*] *Ehrenbergii*, Okamura, 1907, p. 139, pl. 6, fig. 49*a* (for fig. 49*b* see *F. chrenbergii*). *Lapsus pennac.*

### **Favella arcuata** (Brandt) Jörgensen

Figure 286

*Cyttarocyllis arcuata* Brandt, 1906, pp. 5, 23, pl. 40, figs. 2-7; 1907, pp. 27, 30, 42, 185, 188, 204, 207-208, 212, 455; *non* Wailes, 1925, p. 534, pl. 1, figs. 2, 3 (for pl. 1, fig. 2 see *F. chrenbergii* and for pl. 1, fig. 3 see *F. franciscana*).

*Cyttarocyllis armata* Entz, Jr., 1908, p. 113. *Lapsus pennac* for *C. arcuata* (see his p. 127).

*Favella arcuata*, Jörgensen, 1924, p. 26.

*Non* "*Cyttarocyllis arcuata* [?] Brandt [= *C. serrata* v. *edentata* [?] Brandt]," Entz, Jr., 1908, pp. 98, 127, pl. 3, fig. 4; 1909*b*, p. 215, pl. 10, fig. 4 (see *F. chrenbergii*).

### **Favella attingata** sp. nov.

Figure 292

*Cyttarocyllis serrata* var. *a* Brandt, 1906, pp. 23-24, pl. 40, figs. 1, 8, 9; 1907, pp. 207, 478.

*Cyttarocyllis serrata*, *partim*, Entz, Jr., 1908, pp. 14, 15, 20, 99, 113, 127, pl. 3, fig. 10 (flattened?); 1909*b*, pp. 104, 105, 109, 124, 129, 132, 133, 195, 215, pl. 10, fig. 10 (see also *F. serrata*).

Lorica convex conical chalice-shaped, 1.84-2.00 oral diameters in length; oral rim deeply and regularly serrate, the teeth formed in a thin crest on the oral rim, no oral ring, furrow or bulge; bowl convex conical, 15° in the suboral region, changing gradually to 62°-80° aborally; aboral horn, conical (13°-26°) 0.33 oral diameter in length, tip bluntly pointed; wall finely and evenly prismatic. Length 250-300μ.

The type locality is Station 926 "Princesse Alice" off the Norwegian Coast. Occurs also off Naples and off Great Fish Bay on the West Coast of Africa.

Differs from *F. serrata* in the entire absence of the suboral constriction and bulge and in the more conical bowl.

**Favella azorica** (Cleve) Jörgensen

Figure 284

*Undella azorica* Cleve, 1900*d*, p. 974, fig. [10]; Brandt, 1907, pp. 212, 377, 405, 409, 455.

*Favella azorica*, Jörgensen, 1924, pp. 6-8, 24-27, 37, 72, 105, fig. 28.

Possibly a *Proplectella*.

**Favella brevis** nom. nov.

Figure 290

*Cyttarocyclus ehrenbergi* var. *claparedei* forma *curta* Laackmann, 1913, pp. 8, 30-31, 44, pl. 5, fig. 61.

Non *Cyttarocyclus ehrenbergi* forma *curta*, Laackmann, 1913, pp. 29-30, 44, pl. 4, figs. 58, 59 (see *F. ehrenbergii*).

Raised to status of species.

Lorica stout, flaring goblet-shaped, 2.02 oral diameters in length; oral rim entire, with four rings; bowl convex conical,  $12^\circ$  in the suboral 0.82 of its length, contracting to  $80^\circ$  aborally, with two thickened ridges near its middle; aboral horn very stout, spirally angled, 0.65 oral diameter in length, tip obliquely blunt. Length (*vide* text only)  $164\mu$ .

The type locality is in the Adriatic off Zara.

Differs from *F. adriatica* in smaller size, suboral rings, and thickened rings on the bowl.

**Favella campanula** (Schmidt) Jörgensen

Figure 281

*Undella campanula* Schmidt, 1901, p. 190, fig. 6.

*Favella azorica* var. *campanula*, Jörgensen, 1924, pp. 6-8, 24-27, 38, 72, 105, fig. 30.

**Favella composita** Jörgensen

Figure 283

*Favella azorica* var. *composita* Jörgensen, 1924, p. 27, fig. 29.

*Cyttarocyclus Ehrenbergii* var. *adriatica*, *partim*, Entz, Jr., 1908, pp. 99, 112, 127, pl. 3, fig. 8; 1909*b*, pp. 129, 194, 198, 199, pl. 10, fig. 8 (for 1908, pl. 3, fig. 9 and 1909*b*, pl. 10, fig. 9 see *F. adriatica*).

Raised to status of species.

Lorica stout campanulate, 1.88 oral diameters in length; oral margin entire; with 10 very narrow low rings; bowl cylindrical in its anterior 0.5, contracting as a bulging, inverted cone of  $79^\circ$  in the posterior half, tip pointed; wall regular and hyaline. Length  $116\mu$ .

The type locality is Station 206 [?] of the "Thor" off the Balearic Islands in the Western Mediterranean.

Differs from *F. azorica* in having rings and from *F. campanula* in lacking a distinct aboral horn with thickened wall.

***Favella confessa* sp. nov.**

Figure 289

Lorica stout campanulate, 1.88 oral diameters in length; oral margin with many low serrations surmounting a low angular crest upon the single suboral ring; bowl with slight nuchal constriction, inflated below its middle to 1.12 oral diameters, contracting aborally in a cone of 90°; aboral horn scarcely emergent, its length 0.12 oral diameter, about equaling its basal width, subconical (45°), tip rounded; wall with rather irregular surface and scattered coarser alveoles. Length 204 $\mu$ .

The type locality is Yes Bay, Alaska. From the collection of the U. S. S. "Albatross."

Differs from *F. serrata* in the absence of teeth and inflation of the bowl and from *F. arcuata* in the absence of the suboral bulge and shorter aboral horn.

***Favella ehrenbergii* (Claparède and Lachmann) Jörgensen emended**

Figure 280

[?] "Animalcula rapidissime," *partim*, Baster, 1756, p. 32, pl. 4, fig. 1b (for fig. 1a see *Calanus* [Copepoda], for fig. 1c see *Tintinnopsis bütschlii*).

*Tintinnus Ehrenbergii* Claparède and Lachmann, 1858, p. 203, pl. 8, figs. 6, 7; Claparède, 1863, p. 1, pl. 1, fig. 3; Kent, 1882, p. 607, pl. 31, fig. 1; Levander, 1894, pp. 59, 88, pl. 3, fig. 6.

*Tintinnus ehrenbergi*, Zacharias, 1906, pp. 524, 530-532, 536-538, 540, 542, 547, 555, 566, fig. 12; Doflein, 1916, p. 1132, fig. 1175.

*Cyttarocyclus Ehrenbergii*, Entz, Jr., 1908, *partim*, pp. 6-128, pl. 5, fig. 5, pl. 6, figs. 5, 6, 12, pl. 7, figs. 1-46, pl. 8, figs. 1, 2, 5, 7, pl. 9, fig. 2, pl. 10, figs. 4-6, 9, 13, pl. 11, figs. 1-10, pl. 12, figs. 1-9, pl. 13, figs. 1-11, 28, 30-34; 1909b, pp. 97-225, pl. 12, fig. 5, pl. 13, figs. 5, 6, 12, pl. 14, figs. 1-46, pl. 15, figs. 1, 2, 5, 7, pl. 16, fig. 2, pl. 17, figs. 4-6, 9, 13, pl. 18, figs. 1-10, pl. 19, figs. 1-9, pl. 20, figs. 1-11, 28, 30-35, pl. 21, figs. 1, 3, 5, 10-12, 17 (for 1908, pl. 3, fig. 6 and 1909b, pl. 10, fig. 6 see *Coxiella longa*, for 1908, pl. 3, fig. 7 and 1909b, pl. 10, fig. 7 see *F. adriatica*); non Meunier, 1919, pp. 7-9, 12, pl. 22, fig. 2, pl. 23, fig. 1 (see *Favella meunieri*).

*Cyttarocyclus Ehrenbergi*, Rossolimo, 1922, pp. 27, 33, pl. 2, fig. 15.

*Cyttarocyclus ehrenbergi*, Brandt, 1906, p. 24, pl. 41, figs. 2-4; 1907, *partim*, pp. 3, 11, 16, 18, 20, 22, 23, 27, 30, 32-34, 38, 42, 183-185, 188, 203-205, 208-213,

- 216-217, 254, 259, 260, 277, 366, 375, 444, 447, 459, 463, 464, 470 (see also *F. markusovszkyi* and *F. panamensis*).
- Cyttarocyclus ehrenbergi* var. *a. claparedei* Brandt, non 1906, p. 24, pl. 41, figs. 1, 5 (see *F. helgolandica*); 1907, *partim*, pp. 20, 38, 184, 209, 210-211, 444, 459, 464, 480 (see also *F. helgolandica*).
- Cyttarocyclus ehrenbergi* var. *claparedei*, Laackmann, 1913, p. 30, pl. 5, fig. 60.
- Cyttarocyclus claparedei*, Daday, 1887*b*, pp. 482-483, 486, 502-504, 515, 575, 582, pl. 21, fig. 5.
- Cyttarocyclus Claparèdii*, Cleve, 1900*a*, p. 16, fig. 1.
- Cyttarocyclus Claparèdei*, Entz, Jr., 1905, p. 128, fig. 3; Schweyer, 1909, pp. 138, 143, 165, 179, 186, pl. 10, fig. 1.
- Cyttarocyclus Ehrenbergii* var. *d. Claparedei*, Okamura, 1907, p. 139, pl. 6, figs. 50*a*, *b*. *Lapsus pennae*.
- Tintinnus Claparèdei*, Ostenfeld, 1913, p. 142.
- Cyttarocyclus ehrenbergii* var. *claparèdii*, Faria and Cunha, 1917, p. 71, pl. 26, figs. 3, 4.
- Cyttarocyclus Ehrenbergi* var. *Claparedei*, Rossolimo, 1922, pp. 27-28, 33, pl. 2, figs. 18, 19.
- Ptychoocyclus Claparèdii*, Cleve, 1900*a*, p. 31.
- Favella ehrenbergi* forma *claparèdei*, Jörgensen, 1924, pp. 28-31, 66, fig. 32*b*; 1927, pp. 3, 12.
- Favella claparedei*, Jörgensen, 1924, p. 31.
- Favella ehrenbergi* var. *claparèdei*, Jörgensen, 1927, pp. 3, 12, fig. 19.
- Cyttarocyclus Ehrenbergii* var. *subannulata* Jörgensen, 1899, pp. 37-39, pl. 3, figs. 31, 32.
- Cyttarocyclus Ehrenbergii* forma *curta* Entz, Jr., 1909*b*, pp. 129, 199.
- Cyttarocyclus ehrenbergii*, Schweyer, 1909, pp. 138-187, figs. 1, 5-9, pl. 10, fig. 4, pl. 11, figs. 10, 15*a-c*.
- Cyttarocyclus Ehrenbergi*, Chatton, 1919, pp. 323-324, fig. 139.
- Cyttarocyclus* [*sic*] *Ehrenbergii*, Okamura, *partim*, 1907, p. 139, pl. 6, fig. 49*b* (for fig. 49*a* see *F. adriatica*). *Lapsus pennae*.
- Cyttarocyclus (Favella) Ehrenbergii*, Entz, Jr., 1927, pp. 320-322, fig. 1. *Lapsus pennae*.
- Ptychoocyclus Ehrenbergii*, Cleve, 1899*b*, p. 24; 1900*a*, p. 16, fig. 2; Van Bree-man, 1905, p. 54; Brandt, 1907, pp. 206, 208, 209, 463, 464, 478.
- Favella ehrenbergi*, Jörgensen, 1924, pp. 8, 25, 26, 28, 30, 31, 74, 75, 107; 1927, pp. 3, 10, 11, 17, 21-23.
- Cyttarocyclus arcuata*, *partim*, Wailes, 1925, p. 534, pl. 1, fig. 2 (for fig. 3 see *F. franciscana*).
- "*Cyttarocyclus arcuata* [?] Brandt [= *C. serrata* v. *edentata* ? Brandt]," Entz, Jr., 1908, pp. 98, 127, pl. 3, fig. 4; 1909*b*, p. 215, pl. 10, fig. 4.
- Cyttarocyclus (Cozliella) ampla*, Entz, Jr., 1908, p. 135, pl. 13, fig. 35.
- Cyttarocyclus Ehrenbergii (Cozliella ampla?)*, Entz, Jr., 1909*b*, pp. 101-224, pl. 20, fig. 35.
- Cyttarocyclus ehrenbergi* forma *curta*, Laackmann, 1913, pp. 29-30, 44, pl. 4, figs. 58, 59.
- Cyttarocyclus ehrenbergii* var. *marginata* Meunier, 1919, pp. 7-9, pl. 22, fig. 3.
- Favella adriatica*, *partim*, Jörgensen, 1924, pp. 27, 30-31 (for fig. 31 see *F. adriatica*).
- Cyttarocyclus ehrenbergi* var. *adriatica*, Laackmann, 1913, pp. 28-30, pl. 4, figs. 54-57.

**Favella fistulicauda** Jörgensen

Figure 278

*Favella fistulicauda* Jörgensen, 1924, pp. 29, 31, fig. 34; Campbell, 1927, p. 430.

**Favella franciscana** sp. nov.

Figure 285

*Cyttarocyclus arcuata*, partim, Wailes, 1925, p. 534, pl. 1, fig. 3 (for fig. 2 see *F. ehrenbergii*).

*Favella serrata*, Campbell, 1927, pp. 429-452, pls. 21-22, text figures A, 1, 3-5, 7, 8, B, C.

Lorica elongated campanulate, 2.58-2.90 oral diameters in length; oral rim variously and irregularly denticulate, usually with a thin erect or flaring ring; bowl cylindrical in the oral 0.75 of its length, with a well defined nuchal constriction, and a slight premedian lateral concavity; aboral region subhemispherical; aboral horn 0.26-0.55 oral diameter in length, conical ( $15^{\circ}$ - $22^{\circ}$ ), tip blunt; wall with minor irregular furrowings and ridges, aboral end and horn with stronger vertical ridges. Length 200-265 $\mu$ .

The type locality is San Francisco Bay, California. Occurs also off the Pacific Coast from Vancouver, B. C. to La Jolla, California.

Differs from *F. serrata* in less regular denticulation, more cylindrical bowl, and more rounded aboral region.

**Favella helgolandica** (Brandt) emended Jörgensen

Figure 291

*Cyttarocyclus ehrenbergi* var. a *helgolandica* Brandt, 1906, p. 24, pl. 41, figs. 6-8.

*Cyttarocyclus ehrenbergi* var. *helgolandica* Brandt, 1907, pp. 38, 185, 209, 211-213, 254, 464, 467.

*Favella ehrenbergi* var. *helgolandica*, Jörgensen, 1924, pp. 28-30, 74, 75, 107, fig. 32a; 1927, pp. 10-12, fig. 18.

*Cyttarocyclus ehrenbergi* var. a *claparedei* Brandt, 1906, p. 24, pl. 41, figs. 1, 5; 1907, partim, pp. 20, 38, 184, 209, 210-211, 444, 459, 464, 480 (see also *F. ehrenbergii*).

Raised to status of species.

Lorica elongate, narrow bell-shaped, 2.08-3.40 oral diameters in length; oral margin entire; bowl with or without one to four rings, cylindrical in the anterior 0.6 and a regular inverted cone ( $40^{\circ}$ ) in the posterior 0.4; aboral horn 0.6 oral diameter in length, with 4 broad blade-like fins extending to the base of the bowl, 0.3 of their

length in width; wall soft and irregular, with wrinkles (in glycerine alcohol). Length  $250\mu$ .

The type locality is off Helgoland (Apstein) in the North Sea.

Differs from *F. ehrenbergii* in having wings on the aboral horn.

**Favella infundibulum** sp. nov.

Figure 288

*Cyttarocyclus serrata* var. Jörgensen, 1899, pp. 30-31, pl. 1, fig. 12.

Lorica short funnel-shaped, 1.9 oral diameters in length; oral rim entire, with slight submarginal constriction; bowl below constriction slightly convex conical ( $42^\circ$ ); aboral horn subcylindrical, 0.45 oral diameter in length, thick-walled with fine central cavity, tip rounded; wall with numerous subuniform, evenly distributed areoles (coecoliths?). Length  $210\mu$ .

The type locality is Byfiord, Norway.

Differs from *F. adriatica* in more conical bowl and from *F. serrata* in absence of teeth and shape of bowl.

**Favella markusovszkyi** (Daday) Jörgensen

Figure 276

*Cyttarocyclus Márkusovszkyi* Daday, 1887b, pp. 482, 486, 502-504, 515, 574, 581, 583, pl. 21, fig. 4; non Entz, Jr., 1904, p. 125, figs. 4-6 (see *Parafavella edentata*).

*Cyttarocyclus markusovszkyi*, Brandt, 1907, pp. 11, 470.

*Ptychocyclus Markusovszkyi*, Cleve, 1899a, p. 17.

*Favella markusovszkyi*, Jörgensen, 1924, pp. 29, 30, 31, 107, fig. 33.

*Cyttarocyclus ehrenbergi*, partim, Brandt, 1907, pp. 3, 11, 16, 18, 20, 22, 23, 27, 30, 32-34, 38, 42, 143-185, 188, 203-205, 208-213, 216, 217, 254, 259, 260, 277, 366, 375, 444, 447, 459, 463, 464, 470 (see also *F. ehrenbergii* and *F. panamensis*).

*Cyttarocyclus ehrenbergi* var. *adriatica*, partim, Brandt, 1907, pp. 211-212 (see *F. adriatica*).

*Ptychocyclus markusovszkyi*, Brandt, 1906, p. 29, pl. 61, fig. 9; 1907, pp. 11, 210, 277, 470.

**Favella meunieri** sp. nov.

Figure 287

*Cyttarocyclus Ehrenbergii*, Meunier, 1919, pp. 7, 9, 12, pl. 22, fig. 2, pl. 23, fig. 1.

Lorica cylindrical chalice-shaped, 2.94 oral diameters in length; oral rim entire, without annuli; bowl cylindrical in the suboral 0.6 of the total length, slightly convex conical ( $45^\circ$ ) in the aboral region; no distinct delimitation of an aboral horn, tip blunt; wall thick, with many minor irregularities in contour, solid in aboral tip. Length  $188\mu$ .

The type locality is the North Sea off the Coast of Belgium.

Differs from *F. ehrenbergii* in the conical shape of the aboral region and the absence of the wings in that region.

**Favella panamensis** sp. nov.

Figure 279

*Cyttarocytilis serrata* var. Van Breeman, 1905, pp. 51-52, fig. 14.*Cyttarocytilis ehrenbergi*, partim, Brandt, 1907, pp. 3, 11, 16, 18, 20, 22, 23, 27, 30, 32-34, 38, 42, 143-185, 188, 203-205, 208-213, 216, 217, 254, 259, 260, 277, 366, 375, 444, 447, 459, 463, 464, 470 (see also *F. ehrenbergii* and *F. markusovszkyi*).

Lorica cylindrical, stout, its length 2.0-2.3 (rarely 2.9) oral diameters; oral rim entire, with 1, rarely 2-4 rings, slightly lipped below the ring; bowl without nuchal constriction, subcylindrical for 0.60-0.75 its length; aboral region contracting abruptly; aboral horn 0.3-0.8 oral diameter in length, conical ( $20^\circ$ ), with oblique wings, tip pointed. Length 136-232 $\mu$ .

The type locality is the Bay of Panama. Occurs also in California, Mexican, and Peruvian currents in the Pacific and (?) in the North Sea off Holland.

Differs from *F. ehrenbergii* in having a more cylindrical bowl and fuller aboral region.

**Favella serrata** (Möbius) Jörgensen

Figure 293

*Tintinnus serratus* Möbius, 1887, pp. 110, 120, pl. 8, fig. 40; non Kofoid 1905, pp. 287-288, pl. 26, fig. 1 (see *Tintinnus pectinis*).

*Cyttarocytilis serrata*, Brandt, 1896, p. 60; 1906, p. 23, pl. 39, figs. 1-6; 1907, pp. 18, 20, 23, 26, 27, 30, 33, 35, 38, 42, 184, 185, 187, 188, 203-209, 217, 225, 245, 254, 259, 260, 445, 447, 464, 478; Van Breeman, 1905, pp. 50, 54, 112, 123, 124, 135, 143, 161 (for fig. 14 see *F. panamensis*); Entz, Jr., partim, 1908, pp. 14, 15, 20, 99, 113, 127; 1909*b*, pp. 104, 105, 109, 124, 129, 132, 133, 195, 199, 215 (for 1908, pl. 3, fig. 10 and 1909*b*, pl. 10, fig. 10 see *F. attingata*); Merkle, 1909, pp. 159, 160, 167, 168, 186, pl. 3, fig. 74; Meunier, 1919, pp. 6, 7, 10, pl. 22, fig. 1; Fauré-Fremiet, 1924, pp. 102, 105, fig. 33; Wailes, 1925, p. 534, pl. 1, fig. 4; Schulz and Wulff, 1927, p. 253, figs. 18*a-c*.

*Cyttarocytilis serrata* forma *typica* Jörgensen, 1899, pp. 5, 30, 36, 42, pl. 1, fig. 11.

*Favella serrata*, Jörgensen, 1924, pp. 25-28, fig. 27; 1927, p. 16, fig. 17; non Campbell, 1927, pp. 432, 434, 436, 438, 439, 441, 444, 446, figs. A, 1, 3, 5, 7, 8, B, C, pl. 21, figs. 1-4, pl. 22, figs. 5-7 (see *F. franciscana*).

*Cyttarocytilis serrata* var. *conica* Wailes, 1925, pp. 533, 535, pl. 1, figs. 5, 6.*Cyttarocytilis serratus*, Entz, Jr., 1908, p. 69; 1909*b*, p. 167.



### Parafavella gen. nov.

*Tintinnus*, Ehrenberg, *partim*, 1840, p. 201 (see also *Tintinnopsis*).

*Cyttarocyllis*, Brandt, 1896, pp. 60-62; 1907, *partim*, pp. 181-188 (see also *Climacocyllis*, *Coxiella*, *Craterella*, *Cyttarocyllis*, *Favella*, *Poroccus*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*); Jørgensen, 1899, *partim*, p. 28 (see also *Acanthostomella*); 1901, pp. 3-7; 1905, p. 144; Cleve, 1899*a*, p. 21; Ostenfeld, 1899*b*, pp. 438-439; Meunier, 1910, pp. 113-119.

*Favella*, *partim*, Jørgensen, 1924, p. 25 (see also *Favella*).

Favellineae with the two lamellae of the wall enclosing a very regular, very coarse, polygonal, secondary structure; loricae variously goblet- and chalice-shaped, often elongated; oral rim denticulate or entire; bowl goblet-shaped, cylindrical or conical, contracting aborally; aboral end contracting to a point, or rounded, with or without an aboral horn; wall quite uniformly polygonate, 40-60 in the suboral circumference. Marine, and confined to the Arctic and Subarctic waters.

We designate as the type species *Parafavella denticulata* (Ehrenberg) from off Norway, the oldest species contained in the genus.

This genus is the northern counterpart of *Cymatocyllis* of the Antarctic and exhibits a comparable diversity and variability. The effort to express in nomenclature the interrelationships of the different forms led Jørgensen (1899, 1900) to adopt a quadrinomial system of genus, species, variety, and form with the same "forma" name repeated with each of the different species or varieties. Subsequent writers have shifted the category of certain of these names until the nomenclature permutations have grown almost as complex as the permutations of the characters on which classification is based. We have been guided in our set-up of the units which we designate as species mainly by (1) the structure of the oral region, (2) the structure of the aboral region, and (3) the pattern of the bowl. Differences in the length of the bowl and of the aboral horn clearly occur within the species and profoundly modify this dimension. Shortage of, or excess of secretion at the moment of building the lorica must cause such variations.

The presence or absence of the oral denticles has been used by us as a diagnostic character save in the case of *Parafavella gigantea* in which species Meunier (1910) presents evidence that the ring of denticles falls off (in preserved material?) in this species thus creating

an edentate form. Our observations confirm this. This does not prove that other edentate loricae have thus arisen. In fact most, but not all, of such loricae present a complex of characters comparable to, but not otherwise identical with, those complexes which characterize denticulate species. There is a passing phase in which the denticles have not as yet been formed, in the denticulate species. This is undoubtedly very brief but might give rise occasionally to an edentate lorica of a denticulate species.

This genus offers a fine field for the quantitative and statistical study of speciation and variation, by reason of the structural rigidity of the characters, the abundance of individuals, and the geographic range of the genus.

Differs from *Protocymatocylis* gen. nov. and *Ulimacocylis* Laack. emended in the absence of striae; from *Poroecus* Cleve emended in the more highly differentiated, more regularly prismatic wall; and from *Favella* Jörg. emended in less suboral differentiation and in the regular, well defined, and coarse prismatic structure of the wall.

Includes 23 species as follows:

<i>acuta</i> (Jörg.)	<i>inflata</i> sp. nov.
<i>calycina</i> (Jörg.)	<i>media</i> (Bdt.)
<i>curvata</i> nom. nov.	<i>obtusa</i> (Auriv.)
<i>cylindrica</i> (Jörg.)	<i>obtusangula</i> (Ost.)
<i>denticulata</i> (Ehrbg.)	<i>parumentata</i> (Bdt.)
<i>digitalis</i> nom. nov.	<i>robusta</i> (Jörg.)
<i>dilatata</i> (Jörg.)	<i>rotundata</i> (Jörg.)
<i>edentata</i> (Bdt.)	<i>subdentata</i> (Jörg.)
<i>elegans</i> (Ost.)	<i>subrotundata</i> (Jörg.)
<i>gigantea</i> (Bdt.)	<i>subula</i> sp. nov.
<i>greenlandica</i> sp. nov.	<i>ventricosa</i> (Jörg.)
<i>hemifusus</i> (Meunier)	

### **Parafavella acuta** (Jørgensen)

Figure 308

*Cyttarocylis denticulata* var. *typica* forma *acuta* Jørgensen, 1901, pp. 12, 26, 28, 36, pl. 3, figs. 25, 26; Brandt, 1907, p. 233; Entz, Jr., 1908, p. 99; Ostenfeld, 1910, p. 294; Schulz and Wulff, 1927, p. 258, fig. 19d.

*Cyttarocylis denticulata* var. *calycina*, *partim*, Jørgensen, 1901, pp. 7, 9, 28, 36, pl. 1, fig. 4 (for pl. 1, fig. 6 see *P. calycina*, see also *P. obtusa*); Brandt, 1907, pp. 223, 230, 231, 456, 462, 463 (see also *P. calycina* and *P. obtusa*).

*Cyttarocylis denticulata* var. *calycina* forma *acuta* Jørgensen, 1901, pp. 7, 10, 28, pl. 1, fig. 5.

*Cyttarocylis denticulata* var. *typica*, *partim*, Ostenfeld, 1910, pp. 293-296, fig. 3 [4 to the left] (for fig. 3 [5 to the right] see *P. denticulata*).

*Cyttarocyclus denticulata* var. *subdentata*, *partim*, Jörgensen, 1905, pp. 68, 72, 75, 82, 86, 145, pl. 18, fig. 119 (for pl. 14, fig. 121 see *P. subdentata* and for pl. 18, fig. 120 see *P. robusta*).

*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parumdentata*, *P. subula*, and *Ptychoocyclus ostensfeldi*).

*Cyttarocyclus hemifusus*, *partim*, Meunier, 1910, pp. 117-119, pl. 8, fig. 19, pl. 10, fig. 13, and pl. 11, fig. 17 (for pl. 8, figs. 18, 21 see *P. parumdentata*, for pl. 8, figs. 20, 22 and pl. 9, figs. 6, 7 see *P. elegans*, and for pl. 11, fig. 16 see *P. hemifusus*).

Raised to status of species.

Lorica tall vase-shaped, 2.25-3.50 oral diameters in length; oral rim denticulate; bowl convex subcylindrical in the suboral 0.5 of the total length; aboral region convex conical changing from 5° to 45°-55° aborally; no aboral horn, tip acute. Length 160-260 $\mu$ .

The type locality is off Jan Mayen Land in the Arctic. Occurs also off Northern Norway.

Differs from *P. denticulata* in the absence of an aboral horn.

### **Parafavella calycina** (Jörgensen)

Figure 305

*Cyttarocyclus denticulata* var. *calycina*, *partim*, Jörgensen, 1901, pp. 7, 9, 28, 36, pl. 1, fig. 6 (for pl. 1, fig. 4 see *P. acuta*, see also *P. obtusa*); Brandt, 1907, pp. 223, 230, 231, 456, 462, 463 (see also *P. acuta* and *P. obtusa*).

*Cyttarocyclus edentata* var. *calycina*, Brandt, 1907, pp. 228, 231, 232, 449, 456.

*Cyttarocyclus denticulata* var. *calycina* forma *caudata* Jörgensen, 1901, pp. 7, 10, 28, pl. 1, figs. 1-3, 7; Brandt, 1907, p. 223.

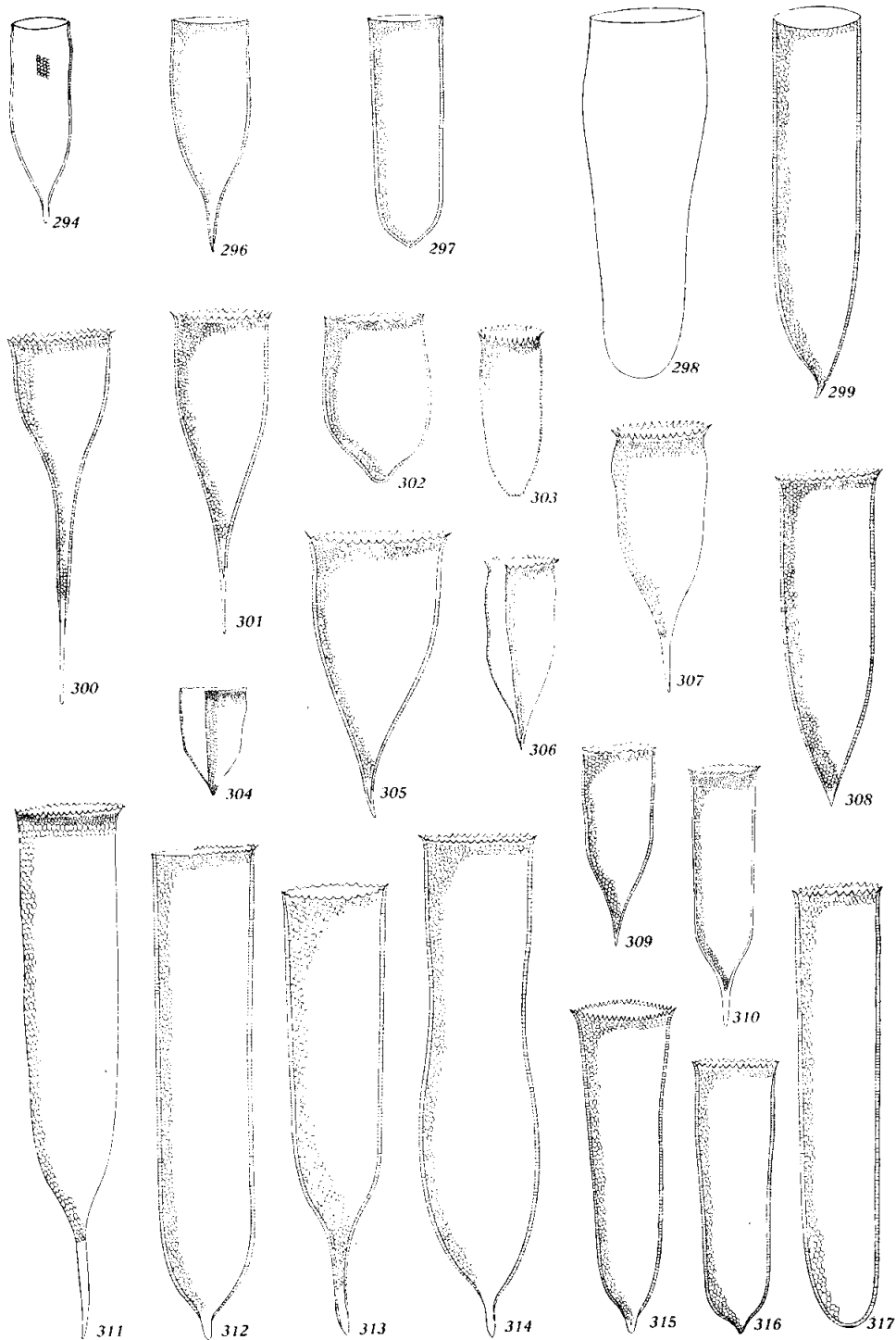
*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parumdentata*, *P. subula*, and *Ptychoocyclus ostensfeldi*).

Raised to status of species.

Lorica stout goblet-shaped, 2.0-2.5 oral diameters in length; oral rim everted, regularly denticulate with about 40 teeth; bowl with slight constriction below the rim, cylindrical portion relatively short, not over 1 oral diameter in length, convex conical (35°-45°) aborally; aboral horn scarcely differentiated, conical (15°-30°), 0.45-0.60 oral diameter in length, tip acute. Length 130-190 $\mu$ .

The type locality is the Greenland Sea between Tromsö and Jan Mayen.

Differs from all other species in the relative shortness of the cylindrical portion of the bowl and length of the aboral cone.



Figs. 294-317. Species of *Parafavella* gen. nov.  $\times 200$ .

**Parafavella curvata** nom. nov.

Figure 299

*Cyttarocyclus denticulata* var  $\beta$  *cylindrica* forma *edentata* Jörgensen, 1899, pp. 33, 35, pl. 2, fig. 19; 1900, pp. x, xxxvi, l, lxiv, lxxx; 1901, p. 8; Brandt, 1907, p. 222; non Jörgensen, 1899, pp. 33-34, 48, pl. 2, figs. 17, 18; 1901, pp. 5, 8, 14 (see *P. cylindrica*).

Non *Cyttarocyclus edentata* Brandt, 1896, pp. 47, 61-62, 65, 67, pl. 3, fig. 18 (see *P. edentata*).

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Figs. 294-317. Species of *Parafavella* gen. nov.  $\times$  200.

Fig. 294. *P. subedentata* (Jörg.) after Jörgensen (1905, pl. 14, fig. 121) from the Öx Fiord, Norway.

Fig. 295. Omitted.

Fig. 296. *P. edentata* (Bdt.) after Jörgensen (1899, pl. 2, fig. 14) from the Puddefiord, Norway.

Fig. 297. *P. digitalis* nom. nov. after Jörgensen (1899, pl. 3, fig. 22) from Byfiord, Norway.

Fig. 298. *P. inflata* sp. nov. after Schulz and Wulff (1927, p. 258, fig. 20k) from Station 31, "Zieten" Expedition in the Barents Sea.

Fig. 299. *P. curvata* nom. nov. after Jörgensen (1899, pl. 2, fig. 19) from Byfiord, Norway.

Fig. 300. *P. subula* sp. nov. after Jörgensen (1900, pl. 2, fig. 19) from the Arctic off Jan Mayen Land.

Fig. 301. *P. elegans* (Ost.) after Jörgensen (1901, pl. 2, fig. 14) from northwest of Jan Mayen Land.

Fig. 302. *P. obtusa* (Aurivillius) after Jörgensen (1901, pl. 1, fig. 9) from the North Sea.

Fig. 303. *P. hemifusus* (Meunier) emended after Meunier (1910, pl. 11, fig. 16) from the Kara Sea.

Fig. 304. *P. greenlandica* sp. nov. after Brandt (1906, pl. 37, fig. 1) from Station Pl. 18 of the Plankton Expedition in the Greenland Current.

Fig. 305. *P. calycina* (Jörg.) after Jörgensen (1901, pl. 1, fig. 1) from the North Sea.

Fig. 306. *P. parumentata* (Bdt.) after Brandt (1906, pl. 37, fig. 8) from Station Pl. 10 of the Plankton Expedition in the Irminger Sea.

Fig. 307. *P. media* (Bdt.) after Brandt (1896, pl. 3, fig. 19) from the Davis Strait west of Greenland.

Fig. 308. *P. acuta* (Jörg.) after Jörgensen (1901, pl. 3, fig. 25) from off Jan Mayen Land in the Arctic.

Fig. 309. *P. obtusangula* (Ost.) after Jörgensen (1901, pl. 1, fig. 13) from off Spitzbergen.

Fig. 310. *P. denticulata* (Ehrbg.) after Claparède and Lachmann (1858, pl. 8, fig. 1) from off Copenhagen, Denmark.

Fig. 311. *P. gigantea* (Bdt.) after Brandt (1896, pl. 3, fig. 24) from the Karajak Fiord, North Greenland.

Fig. 312. *P. cylindrica* (Jörg.) after Jörgensen (1899, pl. 2, fig. 18) from Byfiord, Norway.

Fig. 313. *P. robusta* (Jörg.) after Jörgensen (1901, pl. 3, fig. 22) from off Jan Mayen Land.

Fig. 314. *P. ventricosa* (Jörg.) after Jörgensen (1899, pl. 3, fig. 30) from Byfiord, Norway.

Fig. 315. *P. dilatata* (Jörg.) after Jörgensen (1899, pl. 3, fig. 25) from Byfiord, Norway.

Fig. 316. *P. subrotundata* (Jörg.) after Jörgensen (1899, pl. 2, fig. 21) from Byfiord, Norway.

Fig. 317. *P. rotundata* (Jörg.) after Jörgensen (1899, pl. 2, fig. 23) from Byfiord, Norway.

*Cyttarocyclus gigantea*, partim, Meunier, 1910, pp. 109-113, 115-116, 125, pl. 8, fig. 2 (for pl. 8, figs. 6, 7, pl. 9, figs. 1-5 see *P. cylindrica*, for pl. 8, figs. 1, 3-5, 8-11 see *P. gigantea*, and for pl. 11, fig. 15 see *P. obtusangula*).

Raised to status of species.

Lorica tubular chalice-shaped, 4.35 oral diameters in length; oral rim entire; bowl cylindrical, becoming convex-conical ( $55^\circ$ ) in the aboral region for 1.5 oral diameters; aboral horn convex, stout, conical ( $23^\circ$ ), 0.44 oral diameter in length, tip bluntish. Length 277 $\mu$ .

The type locality is Byfiord, Norway.

Differs from *P. rotundata* in presence of the aboral horn and from *P. cylindrica* in the absence of teeth.

### Parafavella cylindrica (Jørgensen)

Figure 312

*Cyttarocyclus denticulata* var.  $\beta$  *cylindrica* Jørgensen, 1899, pp. 33-34, 48, pl. 2, figs. 17, 18; 1901, pp. 5, 8, 14.

*Cyttarocyclus denticulata* var. *cylindrica*, Brandt, 1906, p. 23, pl. 38, figs. 5-7; 1907, pp. 222, 224, 228, 234-235, 460, 462; Schulz and Wulff, pp. 258-259, figs. 19f, 21s, t.

Non *Cyttarocyclus cylindrica* Brandt, 1906, pp. 5, 21, pl. 32, figs. 6, 7; 1907, pp. 18, 20, 26, 30, 33, 35, 42, 186, 187, 201-203, 460 (see *Porococcus brandti*).

*Cyttarocyclus gigantea*, partim, Meunier, 1910, pp. 109-113, 115, 116, 125, pl. 8, figs. 6, 7, pl. 9, figs. 1-5 (for pl. 8, fig. 2 see *P. curvata*, for pl. 8, figs. 1, 3-5, 8-11 see *P. gigantea*, and for pl. 11, fig. 15 see *P. obtusangula*).

*Cyttarocyclus denticulata* var. *gigantea*, partim, Ostefeld, 1910, pp. 294-295, fig. 4 [right] (for fig. 4 [left] see *P. gigantea*).

*Cyttarocyclus cuspidata*, partim, Meunier, 1910, pp. 113-116, 118, 123, pl. 8, figs. 12-16, pl. 10, figs. 11, 12, pl. 11, figs. 13, 14 (for pl. 10, figs. 8, 9 see *P. gigantea*, and for pl. 8, fig. 17 and pl. 10, fig. 10 see *P. rotundata*).

Raised to status of species.

Lorica elongated tubular, 4.8-5.0 oral diameters in length; oral rim denticulate; bowl cylindrical; aboral end convex subconical ( $70^\circ$ - $80^\circ$ ); aboral horn subconical ( $10^\circ$ ), 0.2-0.3 oral diameter in length, tip pointed or blunt. Length 300-500 $\mu$ .

The type locality is Byfiord, Norway.

Differs from *P. gigantea* and *P. robusta* in longer horn and from *P. ventricosa* in lack of lateral constriction.

**Parafavella denticulata** (Ehrenberg)

Figure 310

*Tintinnus denticulatus* Ehrenberg, 1840, p. 201; Claparède and Lachmann, 1858, pp. 201-203, pl. 8, figs. 1, 1a; Kent, 1882, p. 607, pl. 31, figs. 18, 19; Möbius, 1887, p. 120, pl. 8, fig. 39; Aurivillius, 1899, p. 61.

*Cothurnia ? perlepada* Bailey, 1854, p. 13, pl. 1, fig. 57; Claparède and Lachmann, 1858, pp. 201-202; Mereschkowsky, 1878, pp. 21-22; Bütschli, 1889, p. 1734.

*Cyttarocyclus denticulata*, Daday, 1887b, pp. 515, 575, 583; Brandt, 1907, pp. 17, 18, 21, 27, 30, 31, 33, 42, 79, 183-188, 208, 220-235, 245, 274, 303, 304, 306, 355, 367, 375, 445-447, 461, 482; 1910, pp. 7-13, fig. 2; Merkle, 1909, pp. 142, 143, 148, 157, 161, 164, 165, 167, 168, 170, 172, 174, 179, 186, pl. 3, figs. 39-61.

*Cyttarocyclus denticulata* var. *a typica* Jörgensen, 1899, pp. 31-33, pl. 2, figs. 13, 15; 1900, pp. 5, 8, 9, 12, 13, 36.

*Cyttarocyclus denticulata* var. *typica*, Brandt, 1906, *partim*, pp. 22-23, pl. 37, figs. 9, 10, 15, 16, 17 (for pl. 37, figs. 11, 11a, 18, 19 see *P. media*); 1907, pp. 222, 224, 225, 228, 232-233, 449, 461, 471, 482; Merkle, 1909, pp. 157, 158, 168-173, 186, pl. 2, fig. 27, pl. 3, figs. 31-38, 68, 72, 73; Ostenfeld, *partim*, 1910, pp. 293-296, fig. 3 [5 to the right] for fig. 3 [4 to the left] see *P. acuta*); Schulz and Wulff, 1927, p. 258, figs. 19a, b.

*Cyttarocyclus denticulata* var. *typica* forma *caudata* Jörgensen, 1901, p. 12.

*Favella denticulata*, Jörgensen, 1927, p. 16, fig. 31.

**Parafavella digitalis** nom. nov.

Figure 297

*Cyttarocyclus denticulata* var. *γ subrotundata* forma *edentata* Jörgensen, 1899, p. 35, pl. 3, fig. 22; 1900, p. xxxvi; 1901, p. 8; Brandt, 1907, p. 222.

Non *Cyttarocyclus edentata* Brandt, 1896, pp. 47, 61-62, 65, 67, pl. 3, fig. 18 (see *P. edentata*).

*Cyttarocyclus denticulata* var. *β cylindrica* forma *rotundata*, *partim*, Jörgensen, 1899, pp. 33-34, pl. 3, fig. 24 (for pl. 2, fig. 23 see *P. rotundata*).

Raised to status of species.

Lorica stout finger-shaped, 3.1 oral diameters in length; oral rim entire; bowl cylindrical; aboral end subhemispherical with slightly emergent blunt point. Length 167 $\mu$ .

The type locality is Byfiord, Norway.

Differs from *P. subrotundata* in the absence of teeth.

**Parafavella dilatata** (Jörgensen)

Figure 315

*Cyttarocyclus denticulata* var. *γ subrotundata* forma *dilatata* Jörgensen, 1899, pp. 34-35, pl. 3, fig. 25; 1901, p. 8; Brandt, 1906, p. 23, pl. 38, fig. 1; 1907, pp. 222, 224, 235, 462; Entz, Jr., 1908, p. 99.

*Cyttarocyclus denticulata* var. Schulz and Wulff, 1927, p. 258, fig. 20m.

Raised to status of species.

Lorica elongated chalice-shaped, 3-6 oral diameters in length; oral rim denticulate; bowl sometimes contracting (artifact?) toward the

oral rim, inverted conical ( $15^\circ$ ), contracting aborally more abruptly ( $35^\circ$ – $50^\circ$ ), with postmedian concavity; aboral horn 0.25–1.22 oral diameters in length, tip blunt. Length 247–390 $\mu$ .

The type locality is Byfjord, Norway. Occurs also in Davis Strait and Barents Sea.

Differs from other species in the *denticulata* group in the postmedian concavity of the bowl and its proportions.

Possibly *P. cylindrica* flattened anteriorly.

### Parafavella edentata (Brandt)

Figure 296

*Cyrtarocyliis edentata* Brandt, 1896, pp. 47, 61–62, 65, 67, pl. 3, fig. 18; 1906, *partim*, p. 22, pl. 37, figs. 2, 3, 5 (for pl. 37, figs. 1, 4 see *P. greenlandica*); 1907, *partim*, pp. 17, 27, 33, 42, 185, 188, 221–224, 227–232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parumentata*, *P. subula*, and *Ptychocyliis ostensfeldi*); non Wailes, 1928, p. 40, pl. 12, fig. 42 (see *P. parumentata*).

*Tintinnus (Cyrtarocyliis) edentatus*, Aurivillius, 1899, pp. 19, 48, 58, 60, 64, 68.

*Cyrtarocyliis edentulata*, Cleve, 1899a, p. 11.

*Cyrtarocyliis denticulata* var. *edentula* Cleve, 1899a, p. 21.

*Cyrtarocyliis denticulata* var. *edentata*, Nordgaard, 1899, p. 28; Forti, 1913, p. 29; Fauró-Fremiet, 1924, p. 106.

Non *Cyrtarocyliis denticulata* var.  $\beta$  *cylindrica* forma *edentata* Jörgensen, 1899, pp. 33, 35, pl. 2, fig. 19; 1900, pp. x, xxxvi, l, lxiv, lxxx; 1901, p. 8; Brandt, 1907, p. 222 (see *P. curvata*).

*Cyrtarocyliis denticulata* var. *a typica* forma *edentata* Jörgensen, 1899, pp. 31, 32, 35, pl. 2, figs. 14, 16; 1900, pp. x, xxiv, xxxvi, l, lxiv, lxxx; 1901, p. 8; Brandt, 1907, pp. 222, 230, 462, 463, 482.

Non *Cyrtarocyliis denticulata* var.  $\gamma$  *subrotundata* forma *edentata* Jörgensen, 1899, p. 35, pl. 3, fig. 222; 1900, p. xxxvi; 1901, p. 8; Brandt, 1907, p. 22 (see *P. digitalis*).

[?] *Cyrtarocyliis serrata* var. *edentata* Entz, Jr., 1908, p. 127; 1909, p. 215.

*Cyrtarocyliis obtusangula*, Ostensfeld, *partim*, 1899a, pp. 62, 63, 76, 86, tables 4, 5, 6, 7, 8; 1899b, pp. 438–439, figs. 2c, d (for fig. 2h see *P. obtusangula*); Jörgensen, 1901, p. 11; Brandt, 1907, pp. 222, 223, 229–231, 463, 474 (see *P. obtusangula*).

*Cyrtarocyliis denticulata* var. *obtusangula* forma *edentata* Jörgensen, 1901, pp. 9, 11; Brandt, 1907, p. 223.

*Cyrtarocyliis edentata* var. *obtusangula*, Brandt, 1907, pp. 224, 228, 231, 232, 463, 474.

*Favella edentata*, Jörgensen, 1927, p. 11.

*Cyrtarocyliis Markusovszkyi*, Entz, Jr., 1904, p. 125, figs. 4–6.



**Parafavella elegans (Ostenfeld)**

Figure 301

*Cyrtarocyelis elegans* Ostenfeld, 1899*b*, pp. 438-439, fig. 2*a*; 1900, pp. 61, 69, 70, tables 1-4, 7; Jörgensen, 1901, p. 11; Cleve, 1901*d*, p. 108; Brandt, 1907, pp. 222, 223, 229-231, 463, 464.

*Cyrtarocyelis denticulata* var. *elegans*, Jörgensen, 1901, *partim*, pp. 7, 8, 11, 28, 36, pl. 2, figs. 14-18, 20 (for fig. 19 see *P. subula*); Brandt, 1907, pp. 222-224, 228-232, 463, 464; Entz, Jr., 1908, p. 98; Paulsen, 1909, p. 30; Schulz and Wulff, 1927, p. 259, figs. 29*q*, *r*.

*Cyrtarocyelis gigantea*, *partim*, Vanhöffen, 1897, pp. 271, 291, pl. 5, fig. 24 (for pl. 5, fig. 23 see *P. gigantea*).

*Cyrtarocyelis media*, Vanhöffen, 1897, pp. 271, 291, pl. 5, fig. 25.

*Cyrtarocyelis edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parumdentata*, and *P. subula*).

*Cyrtarocyelis hemifusus*, *partim*, Meunier, 1910, pp. 117-119, pl. 8, figs. 20-22, pl. 9, figs. 6-7 (for pl. 8, fig. 19, pl. 10, fig. 13, and pl. 11, fig. 17 see *P. acuta*, for pl. 11, fig. 16 see *P. hemifusus*, and for pl. 8, figs. 18, 21 see *P. parumdentata*).

**Parafavella gigantea (Brandt) emended**

Figure 311

*Cyrtarocyelis gigantea*, Brandt, *partim*, 1896, pp. 61, 63-65, 67, pl. 3, figs. 20, 21, 24 (for pl. 3, figs. 22, 23 see *P. subedentata*); 1907, pp. 221, 222, 229, 233, 446, 447, 461, 466 (see also *P. subedentata*); Vanhöffen, *partim*, 1897, pp. 271, 291, pl. 5, fig. 23 (for pl. 5, fig. 24 see *P. elegans*); Meunier, *partim*, 1910, pp. 109-113, 115, 116, 125, pl. 8, figs. 1, 3, 4, 5, 8-11 (for pl. 8, figs. 6, 7, pl. 9, figs. 1-5 see *P. cylindrica*, for pl. 8, fig. 2 see *P. curvata*, and for pl. 11, fig. 15 see *P. obtusangula*).

*Cyrtarocyelis denticulata* var.  $\delta$  *gigantea*, Jörgensen, 1899, pp. 35, 48, pl. 3, figs. 26, 27, 28.

*Cyrtarocyelis denticulata* var. *gigantea*, Jörgensen, 1901, pp. 8, 9, 14, 28, 36, pl. 2, fig. 21; Brandt, *partim*, 1906, p. 23, pl. 38, figs. 3, 8, 8*a*, 9 (for pl. 38, figs. 2, 2*a*, see *P. subedentata*); 1907, pp. 41, 42, 222-224, 227-229, 233-234, 446, 447, 461, 466, 474 (see also *P. subedentata*); Wright, 1907, pp. 11, 18, pl. 4, fig. 18; Ostenfeld, *partim*, 1910, pp. 274-295, fig. 4 [left] (for fig. 4 [right] see *P. cylindrica*); Schulz and Wulff, 1927, p. 258, figs. 19*c*, *e*, *g*, *h*; Wailes, 1928, p. 40, pl. 12, fig. 41.

*Cyrtarocyelis cuspidata*, *partim*, Meunier, 1910, pp. 113-116, pl. 10, figs. 8, 9 (for pl. 8, figs. 12-16, pl. 10, figs. 11, 12, and pl. 11, figs. 13, 14 see *P. cylindrica* and for pl. 8, fig. 17 and pl. 10, fig. 10 see *P. rotundata*).

*Tintinnus gigantea*, Aurivillius, 1899, p. 54.

*Cyrtarocyelis denticulata* var. *elongata* Jörgensen, 1900, pp. 8, 14, 28, 36, pl. 3, figs. 23, 24; Jörgensen, 1905, pp. 53, 56, 59, 65, 68, 72, 82, 144; Brandt, 1907, pp. 223, 462, 465.

*Cyrtarocyelis denticulata*  $\delta$  var. *gigantea* forma *edentata* Jörgensen, 1900, pp. x, xxxvi; 1901, p. 8 (see Meunier, 1910, p. 110).

*Cyrtarocyelis gigantea* "var. *edentata*," Meunier, 1910, p. 110, pl. 8, fig. 5.

**Parafavella greenlandica** sp. nov.

Figure 304

*Cyttarocyclus edentata*, partim, Brandt, 1906, p. 23, pl. 37, figs. 1, 4 (for pl. 37, figs. 2, 3, 5 see *P. edentata*); 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. obtusa*, *P. obtusangula*, *P. parumdentata*, *P. subula*, and *Ptychocyclus ostentfeldi*).

Lorica short goblet-shaped, 1.69-2.00 oral diameters in length; oral rim entire; bowl convex subcylindrical in the suboral 0.64 of the total length, concave conical ( $59^{\circ}$ - $63^{\circ}$ ) aborally; no aboral horn, tip blunt. Length  $80\mu$ .

The type locality is Station Pl. 18 of the Plankton Expedition in the West Greenland Current. Occurs also in the Irminger Sea.

Differs from *P. edentata* in the absence of a distinct aboral horn.

**Parafavella hemifusus** (Meunier) emended

Figure 303

*Cyttarocyclus hemifusus*, partim, Meunier, 1910, pp. 117-119, pl. 11, fig. 16 (for pl. 8, figs. 18, 21 see *P. parumdentata*, for pl. 8, fig. 19, pl. 10, fig. 13, and pl. 11, fig. 17 see *P. acuta*, and for pl. 8, figs. 20, 22 and pl. 9, figs. 6, 7, see *P. elegans*).

Lorica truncated tall goblet-shaped, 2.75 oral diameters in length; oral rim denticulate; bowl with slight suboral constriction, convex conical, changing from  $7^{\circ}$  suborally to  $39^{\circ}$  aborally; aboral end squarely truncate, 0.25 oral diameter in diameter. Length  $110\mu$ .

The type locality is the Kara Sea.

Differs from all other species in the truncated aboral end. Possibly abnormal.

**Parafavella inflata** sp. nov.

Figure 298

*Cyttarocyclus denticulata* var. Schulz and Wulff, 1927, p. 258, fig. 20k.

Lorica blunt bullet-shaped, 3.44 oral diameters in length; oral rim denticulate; bowl conical ( $8^{\circ}$ ) in its suboral 0.33, then inverted, convex conical ( $20^{\circ}$ ) for 0.25 its length, thence subcylindrical; aboral end subhemispherical. Length  $255\mu$ .

The type locality is Station 31, "Zieten" Expedition in the Barents Sea.

Differs from all other species of the *denticulata* group in the distinct biconical shape of the bowl.

**Parafavella media** (Brandt)

Figure 307

*Cyttarocyclus media* Brandt, 1896, pp. 61, 63-65, 67, pl. 3, figs. 19, 20; 1907, pp. 221, 222, 229, 232, 461, 471, 482; *non* Vanhöffen, 1897, pp. 271, 291, pl. 5, fig. 25 (see *P. elegans*).

*Cyttarocyclus denticulata* var. *media*, Brandt, 1907, pp. 223, 224, 229, 233, 446, 447, 461, 471.

*Cyttarocyclus denticulata* var. *typica*, *partim*, Brandt, 1906, p. 23, pl. 37, figs. 11, 11a, 18, 19 (for pl. 37, figs. 9, 10, 15, 16, 17 see *P. denticulata*); 1907, pp. 222, 224, 225, 228, 232-233, 449, 461, 482 (see also *P. denticulata*).

**Parafavella obtusa** (Aurivillius)

Figure 302

*Tintinnus denticulatus* var. *obtusa* Aurivillius, 1899a, pp. 18, 54, 60.

*Cyttarocyclus denticulata* var. *obtusa*, Cleve, 1899a, pp. 11, 12, 21, 22; Brandt, 1907, pp. 461, 474.

*Cyttarocyclus denticulata* var. *calycina* forma *obtusa* Jörgensen, 1901, pp. 7, 10, 28, pl. 1, figs. 8-10; Brandt, 1907, p. 223.

*Cyttarocyclus denticulata* var. *calycina*, *partim*, Jörgensen, 1901, pp. 7, 9, 28, 36 (for pl. 1, fig. 4 see *P. acuta* and for pl. 1, fig. 6 see *P. calycina*); Brandt, 1907, pp. 231, 456, 462, 463 (see also *P. acuta* and *P. calycina*).

*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusangula*, *P. parumentata*, *P. subula* and *Ptychocyclus ostefeldi*).

Raised to status of species.

Loricæ very stout, short goblet-shaped, 1.5-1.9 oral diameters in length; oral rim slightly flaring, with 35-40 teeth; bowl very stout, contracting a little suborally, widest near the middle, not over 1.1 oral diameters in diameter, contracting aborally to a truncated cone of 60°-90°; aboral end scarcely emerging as a horn, truncated, rounded, about 0.25 oral diameter in diameter. Length 120-150 $\mu$ .

The type locality is the Greenland Sea between Tromsø and Jan Mayen.

Differs from all other species in the broadly truncated aboral end.

**Parafavella obtusangula** (Ostenfeld) emended

Figure 309

*Cyttarocyclus obtusangula*, *partim*, Ostenfeld, 1899a, pp. 62, 63, 76, 86 (see also *P. edentata*); 1899b, pp. 437-439, fig. 2*h* (for figs. 2*c, d* see *P. edentata*) [possibly *Ptychocyclus?*]; Brandt, *partim*, 1907, pp. 222, 223, 229-231, 463, 474 (see also *P. edentata*).

*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. parumdentata*, *P. subula*, and *Ptychocyclus ostenfeldi*).

*Cyttarocyclus denticulata* var. *obtusangula*, Jörgensen, 1901, pp. 9, 11, 28, 36, pl. 1, figs. 11 (?), 12, 13; Brandt, 1907, pp. 223, 230, 462, 463, 474.

*Cyttarocyclus gigantea*, *partim*, Meunier, 1910, pp. 109-113, 115-116, 125, pl. 11, fig. 15 (for pl. 8, figs. 6, 7, pl. 9, figs. 1-5 see *P. cylindrica*, for pl. 8, fig. 2 see *P. curvata*, and for pl. 8, figs. 1, 3-5, 8-11 see *P. gigantea*).

**Parafavella parumdentata** (Brandt)

Figure 306

*Cyttarocyclus edentata* var. *parumdentata* Brandt, 1906, p. 22, pl. 37, figs. 6, 7, 7a, 8, 8a; 1907, pp. 224, 228, 230-232, 463, 475; Lantz, Jr., 1908, p. 99; Ostenfeld, 1910, p. 294; Busch, 1920, pp. 756-758, fig. 1.

*Cyttarocyclus edentata* var. *parumdentata*, Merkle, 1909, p. 158. *Lapsus pennae*.

*Cyttarocyclus denticulata*, Brandt, 1896, p. 62 (*vide* Brandt, 1907, p. 222).

*Cyttarocyclus denticulata* var. Schulz and Wulff, 1927, p. 258, fig. 20*o*.

*Cyttarocyclus edentata*, Wailes, 1928, p. 40, pl. 12, fig. 42.

*Cyttarocyclus hemifusus*, *partim*, Meunier, 1910, pp. 117-119, pl. 8, figs. 18, 21 (for pl. 8, fig. 19, pl. 10, fig. 13, and pl. 11, fig. 17 see *P. acuta*, for pl. 8, figs. 20, 22, and pl. 9, figs. 6, 7 see *P. elegans*, and for pl. 11, fig. 16 see *P. hemifusus*).

*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. subula*, and *Ptychocyclus ostenfeldi*).

Raised to status of species.

Lorica tall goblet-shaped, 2.8-3.0 oral diameters in length; oral rim denticulate, flaring slightly; bowl convex conical ( $7^\circ$  anteriorly), with trace of suboral constriction, contracting aborally ( $47^\circ$ ); aboral horn scarcely differentiated, conical ( $12^\circ$ ), 0.5 oral diameter in length, tip acute. Length 127-200 $\mu$ .

The type locality is Station Pl. 10 of the Plankton Expedition in the Irminger Sea. Occurs also in the Arctic Ocean north of Europe and in the Labrador Current.

Differs from *P. edentata* in having oral teeth and in longer bowl.

**Parafavella robusta** (Jørgensen)

Figure 313

*Cyrtarocyclus denticulata* var. *robusta* Jørgensen, 1901, pp. 8, 13, 28, 36, pl. 3, fig. 22; Brandt, 1906, p. 23, pl. 38, figs. 4, 10; 1907, pp. 223, 224, 228, 233-235, 462, 477; Ostenfeld, 1910, p. 295, fig. 5; Schulz and Wulff, 1927, p. 259, fig. 21*p*.

*Cyrtarocyclus denticulata* var. *subdentata*, *partim*, Jørgensen, 1905, pp. 68, 72, 75, 82, 86, 145, pl. 18, fig. 120 (for pl. 14, fig. 121 see *P. subdentata*, and for pl. 18, fig. 119 see *P. acuta*).

Raised to status of species.

Lorica elongate goblet-shaped, 3.6-4.9 oral diameters in length; oral margin with about 28 sharp, triangular teeth; bowl tapering conical (10°) in the anterior 0.9 of its length, concave conical (35°) aborally; aboral horn, moderately stout, conical (10°), tip blunt. Length 300μ.

The type locality is between Jan Mayen Land and Norway.

Differs from *P. gigantea* in stouter proportions and blunt horn.

**Parafavella rotundata** (Jørgensen) emended

Figure 317

*Tintinnus inquilinus*, *partim*, Ehrenberg, 1832, p. 95; 1834, pp. 273-274; 1838, p. 294, pl. 30, fig. II, figs. 4, 5 (for pl. 30, fig. II, figs. 1-3 see *Tintinnidium inquilinum*, see also *Tdm. fluviatile*); Mercschkowsky, 1878, pp. 20-21; 1879, pp. 216, 245 (for 1878, pl. 1, fig. 12 and 1879, pl. 10, fig. 12 see *Tdm. inquilinum*, see also *Tdm. fluviatile*, *T. apertus*, and *T. tubulosus*); Kent, 1882, pp. 604-605, pl. 31, fig. 15 (see also *Tintinnus apertus* and *Tdm. fluviatile*); Brandt, 1907, pp. 378, 468, 471 (see also *T. apertus*, *T. tubulosus*, *Tdm. inquilinum*, and *Tdm. fluviatile*).

*Cyrtarocyclus denticulata* var. *β cylindrica* forma *rotundata* Jørgensen, *partim*, 1899, pp. 33-34, 47, pl. 2, fig. 23 (for pl. 3, fig. 24 see *P. digitalis*).

*Cyrtarocyclus denticulata* var. *rotundata*, Nordgaard, 1899, p. 28.

*Cyrtarocyclus denticulata* var. *gigantea* forma *obtusa* Jørgensen, 1901, pp. 8, 14; Brandt, 1907, pp. 223, 461, 474.

*Cyrtarocyclus denticulata* var. *subrotundata*, Brandt, 1906, p. 23, pl. 37, figs. 12-14; 1907, pp. 222, 224, 234-235, 462, 480.

*Cyrtarocyclus denticulata* var. *cylindrica* forma *rotundata*, Schulz and Wulff, 1927, p. 258, fig. 20*l*.

*Cyrtarocyclus cuspidata*, *partim*, Meunier, 1910, pp. 113-116, pl. 8, fig. 17, pl. 10, fig. 10 (for pl. 8, figs. 12-16, pl. 10, figs. 11, 12, and pl. 11, figs. 13, 14 see *P. cylindrica*, and for pl. 10, figs. 8, 9 see *P. gigantea*).

For a discussion of the synonymy of this species see that of *Tintinnidium inquilinum*.

Raised to status of species.

Lorica elongate, narrow capsular, 4.6 oral diameters in length; oral margin with numerous low triangular teeth; bowl cylindrical, with the aboral end rounded; no aboral horn. Length 327 $\mu$ .

The type locality is Byfiord, Norway.

Differs from *P. inflata* in the lack of any bulge and from *P. cylindrica* in the lack of an aboral horn.

### **Parafavella subedentata** (Jørgensen) emended

Figure 294

*Cyttarocyclus gigantea*, *partim*, Brandt, 1896, pp. 61, 63-65, 67, pl. 3, figs. 22, 23 (for pl. 3, figs. 20, 21, 24 see *P. gigantea*); 1907, pp. 221, 222, 229, 233, 446, 447, 461, 466 (see also *P. gigantea*).

*Cyttarocyclus denticulata* var. *subedentata*, *partim*, Jørgensen, 1905, pp. 68, 72, 75, 82, 86, 145, pl. 14, fig. 121 (for pl. 18, fig. 119 see *P. acuta* and for pl. 18, fig. 120 see *P. robusta*).

*Cyttarocyclus denticulata* var. *gigantea*, *partim*, Brandt, 1906, p. 23, pl. 38, figs. 2, 2a (for pl. 38, figs. 3, 8, 8a, 9 see *P. gigantea*); 1907, pp. 41, 42, 222-224, 227-229, 233-234, 446, 447, 461, 466, 474.

Raised to status of species.

Lorica elongate bell-shaped, 3.42 oral diameters in length; oral margin entire; bowl subcylindrical in the anterior 0.7 with a slight suboral bulge and an inverted cone of 45° in posterior 0.4; aboral horn 0.4 oral diameter in length, conical (12°), blunt. Length 145 $\mu$ .

The type locality is Öxfiord, Norway.

Differs from *P. edentata* in narrower bell-shape, more distinct, shorter, and blunter horn.

### **Parafavella subrotundata** (Jørgensen)

Figure 316

*Cyttarocyclus denticulata* var.  $\gamma$  *subrotundata* Jørgensen, 1899, pp. 34, 35, 48, pl. 2, figs. 20, 21; 1901, pp. 8, 13.

*Cyttarocyclus denticulata* var. *subrotundata*, *non* Brandt, 1906, p. 23, pl. 37, figs. 12-14; 1907, pp. 222, 224, 234-235, 462, 480 (see *P. rotundata*); Entz, Jr., 1908, p. 99; Merkle, 1909, pp. 157, 159; Laeekmann, 1909, pp. 360, 420; Schulz and Wulff, 1927, p. 258, fig. 20n.

*Cyttarocyclus denticulata* var. Schulz and Wulff, 1927, p. 258, fig. 20i.

*Cyttarocyclus denticulata*, var. *robusta* forma *subrotundata*, Ostenfeld, 1910, pp. 295-296.

[?] *Cyttarocyclus denticulata* var. *gigantea* forma *subacula* Jørgensen, 1900, pp. 8, 14, 36; Brandt, 1907, p. 223, Entz, Jr., 1908, p. 99.

Raised to status of species.

Lorica elongate, broad capsular, 3.0 oral diameters in length; oral margin with low, triangular spreading teeth; bowl an inverted cone

of  $5^\circ$  in anterior 0.85, contracting to nearly  $90^\circ$  posteriorly; aboral horn very short, blunt. Length  $209\mu$ .

The type locality is Byfjord, Norway.

Differs from *P. cylindrica* in stouter proportions and from *P. dilatata* in less conical bowl.

### **Parafavella subula** sp. nov.

Figure 300

*Cyttarocyclus denticulata* var. *elegans*, *partim*, Jörgensen, 1901, pp. 7, 8, 11-12, 26, 36, pl. 2, fig. 19 (for pl. 2, figs. 14-18, 20 see *P. elegans*).

*Cyttarocyclus edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *P. acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parvudentata*, and *Ptychoocyclus ostensfeldi*).

Lorica awl-shaped, 3.8 oral diameters in length; oral rim denticulate; bowl very short, 1.25 oral diameters in length, cylindrical in its anterior 0.33, convex conical ( $48^\circ$ ) aborally; aboral horn of two parts, a stout conical ( $7^\circ$ ) pedicel, 1.25 oral diameters in length and a distal, subcylindrical, non-reticulate horn proper, 1.25 oral diameters in length, tip blunt. Length  $265\mu$ .

The type locality is in the Arctic off Jan Mayen Land.

Differs from *P. elegans* in shorter bowl and partly developed pedicel.

### **Parafavella ventricosa** (Jörgensen)

Figure 314

*Cyttarocyclus denticulata* var.  $\beta$  *cylindrica* forma *ventricosa* Jörgensen, 1899, p. 34, pl. 3, fig. 30; 1900, p. 1; Brandt, 1907, pp. 222, 234; Entz, Jr., 1908, p. 99; Ostenfeld, 1909, p. 70; Merkle, 1909, pp. 157, 159.

Raised to status of species.

Lorica elongated gourd-shaped with dilated bowl, 5.17 oral diameters in length; oral rim denticulate; bowl cylindrical in the suboral 0.45 of its length; dilated in the aboral 0.55 to 1.25 oral diameters; aboral region convex conical ( $60^\circ$ ); aboral horn short conical ( $5^\circ$ ), 0.4 oral diameter in length. Length  $346\mu$ .

The type locality is Byfjord, Norway.

Differs from all other species of the *denticulata* group in the dilated aboral region of the bowl.

## Family PTYCHOCYLIDAE fam. nov.

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxliellidae, Cyttarocylidae, Tintinnidae, Tintinnididae, Undellidae, and Xystonellidae).

Tintinnoinca with stout kettle- or acorn-shaped lorica; with or without a suboral ledge or thickened region; aboral region sculptured externally; wall bilamellate, with a distinct reticulum over all except the suboral region; with 2-4 macronuclei and 18-20 membranelles. Marine, eupelagic.

Differs from all other families in the reticulations and in the external sculpturing of the aboral region.

Includes two genera, *Epiplocylis* Jörgensen and *Ptychocylis* Brandt emended Jörgensen.

**Epiplocylis** Jörgensen

*Cyttarocylis*, Daday, *partim*, 1887b, pp. 574-575 (see also *Codonella*, *Coxliella*, and *Favella*); Biedermann, 1893, pp. 22-23; Cleve, *partim*, 1900d, pp. 970-971 (see also *Protorhabdonella*, *Rhabdonella*, and *Rhabdonellopsis*); Ostenfeld and Schmidt, *partim*, 1901, pp. 179-180 (see also *Metacylis* and *Rhabdonella*).

*Tintinnus*, *partim*, Zacharias, 1906, pp. 519, 555 (see also *Rhabdonella*).

*Ptychocylis*, *partim*, Brandt, 1907, pp. 273-313 (see also *Ptychocylis*).

*Epiplocylis* Jörgensen, 1924, pp. 7-9, 24, 37, 54.

Ptychocylidae with lorica acorn-like in form, with or without a low collar, or a thickened suboral zone; oral rim without teeth; with a reticulated zone on the posterior portion which sometimes extends toward the collar, but never to the oral rim; a suboral zone free from reticulations usually present; always with a rather short aboral horn; wall with two laminae well developed, the outer giving rise to the coarse, elevated irregular reticulum, sometimes with secondary and usually with primary structure.

We designate as the type species *Epiplocylis acuminata* (Daday) Jörgensen emended from the Red Sea, a well-known and typical species fully discussed by Jörgensen, who founded this genus.

Differs from *Ptychocylis* in the much heavier, more elevated, and larger reticulations and thicker wall.

Includes two subgenera, *Epiplocylis* subgen. nov. and *Epicancellula* subgen. nov.



## Subgenus EPICANCELLA subgen. nov. →

*Epiplocylys* with the entire surface of lorica covered by a lattice-like network with dominant longitudinal elements; a low collar present.

The type species is *Epiplocylys nervosa* (Cleve) Jörgensen from the Sargasso Sea, a well-known species.

Differs from *Epiplocylys* subgen. nov. in the presence of predominating longitudinal ridges in the reticulations on the bowl.

Includes but a single species, *Epiplocylys nervosa* (Cleve) Jörg.

***Epiplocylys nervosa* (Cleve) Jörgensen**

Figure 318

*Cyttarocylys nervosa* Cleve, 1900d, p. 972, fig. [7].

*Ptychoocylys nervosa*, Brandt, 1906, p. 28, pl. 55, figs. 4-7; 1907, pp. 313-321, 473; Lühe, 1913, p. 176, fig. 168, no. 2.

*Ptychoocylys (Ehabdonella) nervosa*, Brandt, 1907, pp. 336-337, 473.

*Epiplocylys nervosa*, Jörgensen, 1924, p. 54.

## Subgenus EPIPILOCYLYS subgen. nov.

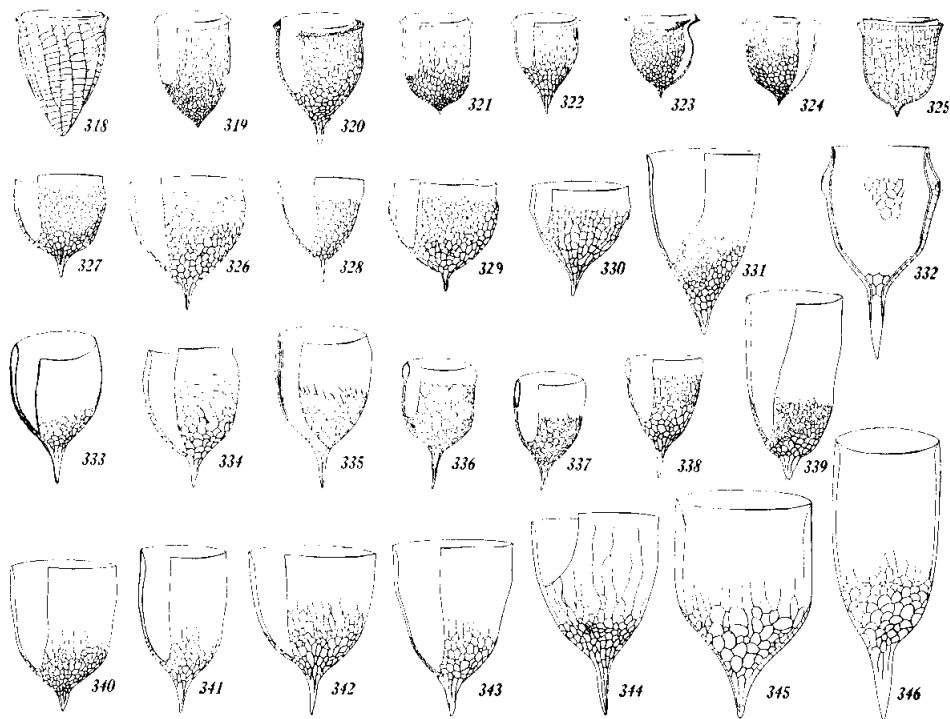
*Epiplocylys* with a coarse reticulum usually not covering the entire lorica and best developed aborally, never dominated by prominent longitudinal elements.

The type species is that of the genus, *Epiplocylys acuminata* (Daday) Jörgensen.

Differs from *Epicanella* subgen. nov. in the absence of dominating longitudinal ridges in the reticulations on the bowl.

Includes 28 species as follows:

<i>acuminata</i> (Daday) Jörg.	<i>impensa</i> sp. nov.
<i>acuta</i> sp. nov.	<i>inconspicuata</i> sp. nov.
<i>atlantica</i> sp. nov.	<i>inflata</i> sp. nov.
<i>blanda</i> Jörg.	<i>laackmanni</i> nom. nov.
<i>brandti</i> sp. nov.	<i>labiosa</i> sp. nov.
<i>bruhni</i> (Bdt.) Jörg.	<i>lata</i> sp. nov.
<i>calyx</i> (Bdt.) Jörg.	<i>lineata</i> sp. nov.
<i>constricta</i> sp. nov.	<i>mueronata</i> (Zacharias)
<i>curta</i> sp. nov.	<i>obtusa</i> sp. nov.
<i>deflexa</i> sp. nov.	<i>pacifica</i> sp. nov.
<i>exigua</i> sp. nov.	<i>ralumensis</i> (Bdt.)
<i>exquisita</i> sp. nov.	<i>reticulata</i> (Ost. and Schmidt) Jörg.
<i>freymadli</i> (Bdt.)	<i>sargassensis</i> (Bdt.)
<i>healdi</i> sp. nov.	<i>undella</i> (Ost. and Schmidt) Jörg.



Figs. 318-346. Species of *Epiplocypris* Jörgensen.  $\times 200$ .

Fig. 318. Subgenus *Epicancella* subgen. nov.

Fig. 318. *E. nervosa* (Cleve) Jörgensen after Brandt (1906, pl. 55, fig. 6) from Station Pl. 34 of the Plankton Expedition in the Sargasso Sea.

Figs. 319-346. Subgenus *Epiplocypris* subgen. nov.

Fig. 319. *E. curta* sp. nov. from Station 4655 in the Peruvian Current.

Fig. 320. *E. ratumensis* (Bdt.) after Brandt (1906, pl. 58, fig. 3) from Station "Dahl, 13-1-97" off Ralium in the Western Tropical Pacific.

Fig. 321. *E. healdi* sp. nov. from Station 4675 in the Peruvian Current.

Fig. 322. *E. acuta* sp. nov. from Station 4648 in the Peruvian Current.

Fig. 323. *E. freymadli* (Bdt.) after Brandt (1906, pl. 58, fig. 2) from Station "Freymadli, 16-I-95" off the Seychelles Islands in the Indian Ocean.

Fig. 324. *E. brandti* sp. nov. after Brandt (1906, pl. 58, fig. 1) from Station Pl. 88 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 325. *E. reticulata* (Ost. and Schm.) Jörg. after Ostenfeld and Schmidt (1901, p. 180, fig. 28) from the Red Sea.

Fig. 326. *E. inconspicuata* sp. nov. after Brandt (1906, pl. 58, fig. 11) from Station "Schott f" in the Benguela Current.

Fig. 327. *E. bruhni* (Bdt.) Jörg. after Brandt (1906, pl. 61, fig. 2) from Station "Bruhn, 22-VI-93" off the coast of Somaliland in the Indian Ocean.

Fig. 328. *E. calyx* (Bdt.) Jörg. after Brandt (1906, pl. 58, fig. 14) from Station Pl. 61 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 329. *E. inflata* sp. nov. after Brandt (1906, pl. 58, fig. 10) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Fig. 330. *E. laackmanni* nom. nov. after Laackmann (1909, pl. 49, fig. 10) from the Benguela Current.

**Epiplocypris acuminata** (Daday) Jörgensen emended

Figure 332

*Cyttarocypris acuminata* Daday, 1887b, pp. 578-579, pl. 20, fig. 33.*Cyttarocypris semireticulata* Biedermann, 1893, pp. 23-24, pl. 1, fig. 3.*Ptychocypris acuminata*, Brandt, 1906, p. 28, pl. 58, fig. 5; 1907, pp. 289-290, 452; Laackmann, 1913, pp. 33-35, pl. 5, figs. 66-68.*Ptychocypris acuminata* var. a *semireticulata* Brandt, 1906, p. 29, pl. 58, fig. 9; 1907, pp. 290-291 as var. *semireticulata*.*Ptychocypris acuminata* var. b, *partim*, Brandt, 1906, p. 29, pl. 59, fig. 6; 1907, pp. 270-280, 291 (for pl. 58, figs. 6, 10 see *E. inflata*).*Ptychocypris semireticulata*, Brandt, 1907, p. 291.*Epiplocypris acuminata*, *partim*, Jörgensen, 1924, pp. 54, 56, 106, figs. 63a, b (see also *E. inconspicua* and *E. inflata*).**Epiplocypris acuta** sp. nov.

Figure 322

Lorica distinctly subconical ( $60^\circ$ ) in aboral 0.5, convex in anterior 0.5, length 1.6 oral diameters; aboral spine 0.3 oral diameter in length; posterior 0.55 of lorica unevenly reticulated, with 32 free lines across one face, anastomosing and interrupted, extending to suboral ledge. Length  $70\mu$ .

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 Figs. 318-346. Species of *Epiplocypris* Jörgensen.  $\times 200$ . (Concluded.)
Fig. 331. *E. sargassensis* (Bdt.) after Brandt (1906, pl. 60, fig. 5) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.Fig. 332. *E. acuminata* (Daday) Jörg. after Jörgensen (1924, p. 54, fig. 63b) from Station 23 of the "Thor" south of the Saltee Islands in the English Channel.Fig. 333. *E. constricta* sp. nov. after Brandt (1906, pl. 59, fig. 2) from Station "Dahl, 13-1-97" off Ralum in the Western Tropical Pacific.Fig. 334. *E. deflexa* sp. nov. after Brandt (1906, pl. 59, fig. 3) from Station "Dahl, 13-1-97" off Ralum in the Western Tropical Pacific.Fig. 335. *E. pacifica* sp. nov. from Station 4594 in the Mexican Current.Fig. 336. *E. lata* sp. nov. from Station 4717 in the Galapagos Eddy.Fig. 337. *E. exigua* sp. nov. from Station 4683 in the South Equatorial Drift of the Pacific.Fig. 338. *E. labiosa* sp. nov. after Brandt (1906, pl. 58, fig. 13) from Station Pl. 104 of the Plankton Expedition in the South Equatorial Current of the Atlantic.Fig. 339. *E. obtusa* sp. nov. after Brandt (1906, pl. 60, fig. 3) from Station "Krämer, 17-111-94" off New Zealand.Fig. 340. *E. atlantica* sp. nov. after Brandt (1906, pl. 59, fig. 1) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.Fig. 341. *E. blanda* Jörg. emended after Brandt (1906, pl. 61, fig. 3) from Station Pl. 34 of the Plankton Expedition in the Sargasso Sea.Fig. 342. *E. exquisita* sp. nov. after Brandt (1906, pl. 61, fig. 1) from Station "Bruhn, 22-VI-93" off the Somali coast in the Indian Ocean.Fig. 343. *E. impensa* sp. nov. after Brandt (1906, pl. 60, fig. 2) from Station Pl. 34 of the Plankton Expedition in the Sargasso Sea.Fig. 344. *E. lineata* sp. nov. after Brandt (1906, pl. 59, fig. 4) from Station "Bruhn, 1892" off Madagascar.Fig. 345. *E. undella* (Ost. and Schm.) Jörg. after Ostenfeld and Schmidt (1901, p. 181, fig. 30) from the Red Sea.Fig. 346. *E. mucronata* (Zacharias) after Brandt (1906, pl. 61, fig. 8) from Station Pl. 32 of the Plankton Expedition in the Sargasso Sea.

The type locality is Station 4648 in the Peruvian Current. Occurs also in the California and Mexican currents, Panamic Area, Galapagos and Easter Island eddies, and the South Equatorial Drift.

Differs from *E. brandli* in narrower aboral cone and more numerous free lines and from *E. curta* in much less baggy aboral region.

### ***Epiplocypris atlantica* sp. nov.**

Figure 340

*Ptychocypris undella* var. a Brandt, 1906, p. 29, pl. 59, fig. 1; 1907, pp. 294, 482.

*Ptychocypris undella* var. h Brandt, 1906, p. 29, pl. 61, fig. 5; 1907, pp. 297, 482.

*Ptychocypris undella*, Okamura, 1907, pp. 139, 140, pl. 6, fig. 51; Jörgensen, *partim*, 1924, p. 54 (see also *E. constricta*, *E. exquisita*, *E. impensa*, *E. lineata*, *E. mucronata*, and *E. undella*).

Lorica 1.32–1.52 oral diameters in length; bowl broadly subconical, full below; fundus 95°; reticulated zone 0.32 oral diameter wide, free lines at least 0.2 oral diameter long, subvertical, anastomosing; aboral horn short, stout, 0.21 oral diameter long. Length 90–110 $\mu$ .

The type locality is Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Differs from *E. blanda* in wider bowl and in finer reticulation.

### ***Epiplocypris blanda* Jörgensen emended**

Figure 341

*Ptychocypris undella* var. b, Brandt, *partim*, 1906, p. 29, pl. 61, fig. 3; 1907, pp. 294–295, 482 (for pl. 59, fig. 3 see *E. deflexa*); Laackmann, 1909, pp. 423–430.

*Epiplocypris undella* var. *blanda*, *partim*, Jörgensen, 1924, p. 54, fig. 62 (see also *E. obtusa* and *E. sargassensis*).

Raised to status of species.

Lorica tall goblet-shaped, 1.78–1.90 oral diameters in length; oral margin entire, no collar; bowl elongate subcylindrical in anterior 0.7, convex conical (75°) aborally; aboral horn conical (23°), 0.25 oral diameter in length; free zone about 0.6 total length in length; free lines short, subvertical; reticulated zone subregular. Length 120–136 $\mu$ .

The type locality is Station Pl. 34 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Mediterranean.

Differs from *E. obtusa* in having free lines, in the less blunt aboral horn, and in proportions.

**Epiplocypris brandti** sp. nov.

Figure 324

*Ptychocypris reticulata*, Brandt, 1906, p. 28, pl. 58, figs. 1, 4; 1907, *partim*, pp. 287-288, 477; Laackmann, *partim*, 1909, p. 457; 1913, pp. 2, 34 (see *E. reticulata*).

*Epiplocypris reticulata*, *partim*, Jörgensen, 1924, pp. 54, 56 (see also *E. frey-madli*, *E. ralumensis* and *E. reticulata*).

Lorica with prominent, vertical, free lines on its upper 0.3 or more below shelf; bowl aborally convex-conical, tapering at least from the upper 0.3; aboral end with short, pointed spine, 0.25 oral diameter in length. Length 59-70 $\mu$ , rarely 87 $\mu$ .

The type locality is Station Pl. 88 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Differs from *E. reticulata* in having free lines and less baggy bowl and from *E. acuta* in less tapering aboral region.

**Epiplocypris bruhni** (Brandt) Jörgensen

Figure 327

*Ptychocypris undella* var. *g. bruhni* Brandt, 1906, p. 29, pl. 61, fig. 2; 1907, pp. 296, 456, 482.

*Epiplocypris bruhni*, Jörgensen, 1924, p. 54.

**Epiplocypris calyx** (Brandt) Jörgensen

Figure 328

*Ptychocypris calyx* Brandt, 1906, pp. 28, 29, pl. 58, figs. 7, 12; 1907, pp. 292, 457; Laackmann, 1909, p. 458.

*Ptychocypris calyx* var. *a* Brandt, 1906, p. 29, pl. 58, figs. 14, 14a; 1907, pp. 292, 457.

*Epiplocypris calyx*, Jörgensen, 1924, p. 54.

**Epiplocypris constricta** sp. nov.

Figure 333

*Ptychocypris undella* var. *c* Brandt, 1906, p. 29, pl. 59, fig. 2; 1907, pp. 295, 482.

*Epiplocypris undella*, *partim*, Jörgensen, 1924, p. 54 (see also *E. atlantica*, *E. exquisita*, *E. impensa*, *E. lineata*, *E. mucronata*, and *E. undella*).

Lorica 1.66-1.87 diameters in length; bowl short, rotund, contracting orally, 1.17-1.38 oral diameters in length; fundus convex, 70°-90°; reticulated zone 0.3-0.4 oral diameter wide, free lines turned 15°-50° to right; aboral horn long, 0.40-0.55 oral diameter in length. Length 95-103 $\mu$ .

The type locality is off Ralum (Dahl, 13-I-97). Occurs also in the California, Mexican, and South Equatorial currents, Easter Island Eddy, and the South Equatorial Drift.

Differs from *E. deflexa* in shorter free lines and lack of oral flare.

***Epiplocypris curta* sp. nov.**

Figure 319

Lorica with prominent, anastomosing, longitudinal free lines on its upper 0.5 or more; bowl elongate convex-conical ( $80^\circ$ ); aboral end with very short (0.15 oral diameter) pointed aboral spine. Length 73–80 $\mu$ .

The type locality is Station 4655 in the Peruvian Current. Occurs also in the Panamic Area.

Differs from *E. brandti* in greater elongation, more tapering bowl, and less regular free lines.

***Epiplocypris deflexa* sp. nov.**

Figure 334

*Ptychocypris undella* var. b [*sic*] Brandt, 1906, p. 29, pl. 59, fig. 3; 1907, pp. 295, 482, as var. d.

Lorica 1.48–1.86 oral diameters in length; oral rim flaring; bowl rotund; fundus  $85^\circ$ – $90^\circ$ ; reticulations over zone 0.40–0.75 oral diameter in width, free lines up to 0.6 oral diameter in length and to  $60^\circ$  from vertical; aboral horn 0.15–0.36 oral diameter in length. Length 88–104 $\mu$ .

The type locality is off Ralum (Dahl, 13–I–97). Occurs also in the California, Mexican, South Equatorial, and Equatorial Counter currents, Panamic Area, and South Equatorial Drift.

Differs from *E. brandti* in the shorter reticulated zone and dextro-tropic free lines.

***Epiplocypris exigua* sp. nov.**

Figure 337

Lorica rotund, subcylindrical above for less than 0.5 of the total length, contracting ( $80^\circ$ ) below; oral diameter 0.55–0.64 of total length; suboral thickening wide, 0.4 oral opening, thinning gradually especially posteriorly; aboral spine 0.4 oral diameter in length; reticulations subequal, absent on upper 0.25–0.40 of the bowl. Length 74–81 $\mu$ .

The type locality is Station 4683 in the South Equatorial Drift. Occurs also in the Peruvian Current.

Differs from *E. labiosa* in wider free zone and broader suboral thickening and from *E. calyx* in longer, narrower bowl and wider free zone.

**Epiplocypris exquisita** sp. nov.

Figure 342

*Ptychocypris undella* var. e Brandt, 1906, p. 29, pl. 61, figs. 1, 1a; 1907, pp. 295-296, 482; Laaekmann, 1909, pp. 423, 456, 459.

*Ptychocypris undella* var. f Brandt, 1906, p. 29, pl. 61, fig. 4; 1907, pp. 296, 482.

*Epiplocypris undella*, *partim*, Jörgensen, 1924, pp. 54, 55 (see also *E. atlantica*, *E. constricta*, *E. impensa*, *E. lineata*, *E. mucronata*, and *E. undella*).

Lorica rotund, tapering below, its length 1.75-1.96 oral diameters; bowl convex tapering subconical, its length 1.32-1.55 oral diameters; fundus 60°-85°; aboral horn 0.28-0.50 oral diameter in length; reticulated zone 0.28-0.50 oral diameter wide, 20 reticulations across one face, free lines subvertical to 25° to left, 0.12-0.30 oral diameter long. Length 93-110 $\mu$ .

The type locality is off the Somali Coast (Bruhn). Occurs also in the Easter Island Eddy and the South Equatorial Drift and off New Pomerania in the Pacific; off Argentina, in the Sargasso Sea, and North and South Equatorial Currents of the Atlantic; and in the Indian Ocean.

Differs from *E. exigua* in having a very limited reticulated zone.

**Epiplocypris freymadli** (Brandt)

Figure 323

*Ptychocypris reticulata* var. *freymadli* Brandt, 1906, pp. 28, 30, pl. 58, fig. 2, pl. 62, fig. 4; 1907, pp. 288, 466, 477.

*Ptychocypris obtusa* var. *freymadli*, Entz, Jr., 1908, p. 102.

*Epiplocypris reticulata*, *partim*, Jörgensen, 1924, pp. 54, 56 (see also *E. brandti*, *E. ralumensis*, and *E. reticulata*).

Raised to status of species.

Lorica distinctly goblet-shaped, 1.51 oral diameters in length; collar erect; suboral shelf 1.3 oral diameters in diameter; bowl subglobose, 0.90 oral diameters in diameter; aboral horn conical (30°) 0.2 oral diameter in diameter, free zone 0.2 oral diameter; no free lines; remaining portion of lorica with subuniform reticulations. Length 60 $\mu$ .

The type locality is Station "Freymadl 8" off the Seychelles Islands in the Indian Ocean.

Differs from *E. brandti* in the wide suboral shelf and subglobular bowl.

**Epiplocypris healdi** sp. nov.

Figure 321

Lorica stout and wide, length 1.3–1.6 oral diameters; collar faintly crenate; bowl subcylindrical in anterior 0.66, broadly round in posterior 0.33; aboral spine 0.2 oral opening in length; bowl subuniformly reticulated on lower 0.33, with vertical anastomosing free lines reaching to the suboral ledge. Length  $70\mu$ .

The type locality is Station 4675 in the Peruvian Current. Occurs also in the Mexican Current, Panamic Area, South Equatorial Drift, and the Galapagos Eddy.

Differs from *E. reticulata* in having free lines instead of reticulations on the upper 0.66 of the bowl.

**Epiplocypris impensa** sp. nov.

Figure 343

*Ptychocypris undella* var. i Brandt, 1906, p. 29, pl. 60, figs. 2, 4; 1907, pp. 297, 482.

*Epiplocypris undella*, partim, Jörgensen, 1924, pp. 54, 55 (see also *E. atlantica*, *E. constricta*, *E. exquisita*, *E. lineata*, *E. mucronata*, and *E. undella*).

Lorica tapering goblet-shaped, its length 1.92–2.14 oral diameters; bowl tapering convex subconical, its length 1.55–1.80 oral diameters; reticulated zone 0.45–0.65 oral diameter in width with subvertical free lines 0.14–0.30 oral diameter long. Length  $115\text{--}126\mu$ .

The type locality is off the Seychelles (Freyvadl). Occurs also in the Sargasso Sea, South Equatorial Current, off the Azores and in the Gulf Stream, and in the Eastern Tropical Pacific in the California Current.

Differs from *E. atlantica* in angled instead of convex lateral outline, in longer aboral spine and coarser reticulations.

**Epiplocypris inconspicuata** sp. nov.

Figure 326

*Ptychocypris acuminata* var. c Brandt, 1906, p. 29, pl. 58, fig. 11; 1907, pp. 291–292; Laackmann, 1909, p. 427.

*Epiplocypris acuminata*, partim, Jörgensen, 1924, p. 56 (for figs. 63a, b see *E. acuminata*, see also *E. inflata*).

Lorica short, bulging irregular, 1.2 oral diameters in length; suboral wall scarcely thickened; aboral horn 0.2 oral diameter in length; free zone 0.15 oral diameter wide; no free lines. Length  $72\mu$ .



The type locality is Station "Schott, f" (3-VIII-92) in the Benguela Current. Occurs also in the Agulhas Current.

Differs from *E. inflata* in having a narrower free zone and less suboral thickening and from *E. calyx* in greater convexity of bowl.

### ***Epiplocylys inflata* sp. nov.**

Figure 329

*Ptychocylys acuminata* var. b, *partim*, Brandt, 1906, pp. 28-29, pl. 58, figs. 6, 10; 1907, p. 291 (for pl. 59, fig. 6 see *E. acuminata*).

*Epiplocylys acuminata*, *partim*, Jörgensen, 1924, p. 56 (for figs. 63a, b see *E. acuminata*, see also *E. inconspicuata*).

Lorica short and wide, an oral diameter in length; free zone 0.2 oral diameter wide, few short, free lines, subvertical; aboral horn short 0.16 oral diameter in length; wall thickened below free zone. Length 77-85 $\mu$ .

The type locality is Station Pl. 38 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Florida Current and Gulf Stream.

Differs from *E. acuminata* in shorter bowl less than an oral diameter in length, and less suboral thickening and from *E. inconspicuata* in well defined suboral thickening.

### ***Epiplocylys laackmanni* nom. nov.**

Figure 330

Non *Cyttarocylys semireticulata* Biedermann, 1893, pp. 23-24, pl. 1, fig. 3 (see *E. acuminata*).

*Ptychocylys acuminata* var. *semireticulata*, Laackmann, 1909, pp. 456-458, 460.

*Ptychocylys acuminata* var. *Laackmann*, 1909, p. 493, pl. 49, fig. 10.

Lorica like that of *E. calyx*; suboral thickening forming 0.33 total length, with free zone extending upon its lower slope; bowl convex conical (75°); spine 0.25 oral diameter in length; reticulations subequal, with marked longitudinal development of ribs. Length 71 $\mu$ .

The type locality is the Benguela Current.

Lorica moderately elongate, 1.64 oral diameters in length; bowl and from all other species in longitudinal elements of the reticulations.

**Epiplocylis labiosa** sp. nov.

Figure 338

*Ptychocylis calyx* var. b Brandt, 1906, p. 29, pl. 58, figs. 13, 13a; 1907, pp. 292, 457.

Lorica subconical ( $35^\circ$ ), 1.66 oral diameters in length; suboral zone abruptly thickened above and below; bowl elongated, tapering; aboral horn slender, nearly 0.5 oral diameter in length; reticulum absent on upper 0.2 of bowl. Length 80–85 $\mu$ .

The type locality is Station Pl. 104 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Differs from *E. calyx* in being longer and narrower with a shorter free zone and thicker suboral zone.

**Epiplocylis lata** sp. nov.

Figure 336

Lorica 1.64–2.00 oral diameters in length; suboral zone narrow, 0.25 oral diameter wide, abruptly thickened; bowl subeylindrical in upper 0.5 of total length, contracting abruptly with wide shoulders below; aboral spine, sharp conical, 0.5 oral diameter in length; reticulum absent on upper 0.2 of bowl. Length 82–94 $\mu$ .

The type locality is Station 4717 in the Galapagos Eddy. Occurs also in the California, Mexican, and South Equatorial currents, the Easter Island Eddy, and South Equatorial Drift.

Differs from all species of *calyx* group in greater thickness of suboral thickening and abruptness of aboral contraction of the bowl.

**Epiplocylis lineata** sp. nov.

Figure 344

*Ptychocylis undella* var. k Brandt, 1906, p. 29, pl. 59, figs. 4, 4a, pl. 61, fig. 6; 1907, pp. 297, 298, 482.

*Ptychocylis undella* var. l Brandt, 1906, p. 29, pl. 60, fig. 1; 1907, pp. 298, 482.

*Epiplocylis undella*, *partim*, Jörgensen, 1924, p. 54 (see also *E. atlantica*, *E. constricta*, *E. exquisita*, *E. impensa*, *E. mucronata*, and *E. undella*).

Lorica stout goblet-shaped, length nearly 1.5 oral diameters; bowl convex subconical; fundus  $80^\circ$ – $90^\circ$ ; reticulated zone 0.28 oral diameter wide, free lines subvertical, very long, anastomosing, nearly reaching the rim; aboral horn slender, 0.38 oral diameter long. Length 120–135 $\mu$ .

The type locality is off Madagascar (Bruhn). Occurs also in the Agulhas Current, off Ceylon, and in the Bay of Bengal in the Indian Ocean.

Differs from *E. impensa* in convex instead of angled lateral outline and from *E. atlantica* in longer aboral spine, coarser reticulations, and longer free lines.

### ***Epiplocypris mucronata* (Zacharias)**

Figure 346

*Tintinnus mucronatus* Zacharias 1906, pp. 532, 555, fig. 17.

*Ptychocypris undella* var. m, *partim*, Brandt, 1906, p. 29, pl. 61, fig. 8; 1907, pp. 298, 482 (for 1906, p. 29, pl. 59, fig. 5 see *E. undella*).

*Epiplocypris undella*, *partim*, Jörgensen, 1924, p. 54 (see also *E. atlantica*, *E. constricta*, *E. exquisita*, *E. impensa*, *E. lineata*, and *E. undella*).

Lorica very long, 2.5–2.8 oral diameters in length; contracting convexly in the distal 0.4 to an aboral spine 0.75 oral diameter in length; rather coarsely and uniformly reticulated in the distal 0.4, 11 reticulations across the bowl, with vertical free lines 0.14 oral diameter in length. Length 170 $\mu$ .

The type locality is the Sargasso Sea. Occurs also in the Western Tropical Pacific, off New Pomerania.

Differs from *E. undella* in much longer bowl, more distal convexity of bowl, vertical instead of dextrotropic free lines, and coarser and more regular reticulations.

### ***Epiplocypris obtusa* sp. nov.**

Figure 339

*Ptychocypris undella* var. o Brandt, 1906, p. 29, pl. 60, fig. 3; 1907, p. 299.

*Epiplocypris undella* var. *blanda*, *partim*, Jörgensen, 1924, p. 55 (for fig. 62 see *E. blanda*, see also *E. sargassensis*).

Lorica tall and stout, 2.0 oral diameters in length; free zone 1.2 oral diameters; no free lines; reticulated zone not well developed; aboral horn obtuse. Length 135 $\mu$ .

The type locality is off New Zealand (Krämer).

Differs from many species in absence of free lines, and from *E. sargassensis* in greater aboral rotundity and sharper set-off of the aboral spine.

**Epiplocypris pacifica** sp. nov.

Figure 335

Lorica 1.70–1.93 oral diameters in length; bowl long, 1.27–1.44 oral diameters in length; fundus well filled out, its angles  $80^{\circ}$ – $90^{\circ}$ ; reticulated zone 0.45–0.60 oral diameter in width; free lines somewhat oblique; aboral horn 0.36–0.58 oral diameters in length. Length 105–115 $\mu$ .

The type locality is Station 4594 in the Mexican Current. Occurs also widely distributed in the California, Peruvian, South Equatorial, and Equatorial Counter currents, the Easter Island and Galapagos eddies, the Panamic Area, and the South Equatorial Drift.

Differs from *E. constricta* in longer horn, less obliquity of free lines, and a fuller fundus.

**Epiplocypris ralumensis** (Brandt)

Figure 320

*Ptychocypris reticulata* var. *ralumensis* Brandt, 1906, pp. 28, 29, pl. 58, figs. 3, 8; 1907, pp. 289, 477.

*Ptychocypris obtusa* var. *ralumensis*, Eatz, Jr., 1908, p. 102.

*Epiplocypris reticulata*, partim, Jørgensen, 1924, pp. 54, 56 (see also *E. brandti*, *E. freymadli*, and *E. reticulata*).

Raised to status of species.

Lorica moderately stout, length 1.7 oral diameters; collar regular, entire and erect; bowl subconical ( $30^{\circ}$ ), bulging, 1.1 oral diameters in diameter at the middle, contracting posteriorly ( $80^{\circ}$ ) as a broad inverted cone; aboral horn conical ( $35^{\circ}$ ), 0.45 oral diameter in length; bowl subuniformly reticulated. Length 80 $\mu$ .

The type locality is Station "Dahl, 13-I-97" off Ralum in the Western Tropical Pacific.

Differs from *E. healdi* in subconical bowl, entire lack of free lines, and longer horn.

**Epiplocypris reticulata** (Ostenfeld and Schmidt) Jørgensen emended

Figure 325

*Cyttarocypris reticulata* Ostenfeld and Schmidt, 1901, p. 180, fig. 28.

*Ptychocypris reticulata* "typisch," partim, Brandt, 1907, pp. 287–288, 477 (see *E. brandti*).

*Ptychocypris reticulata*, partim, Laackmann, 1909, pp. 456–457; 1913, pp. 2, 34 (see *E. brandti*); Brandt, 1906, p. 28, pl. 58, figs. 1, 4 (see *E. brandti*).

*Epiplocypris reticulata*, partim, Jørgensen, 1924, pp. 54, 56 (see *E. brandti*, *E. freymadli*, and *E. ralumensis*).

**Epiplocypris sargassensis** (Brandt) emended

Figure 331

*Ptychocypris undella* var. n *sargassensis* Brandt, 1906, p. 29, pl. 60, fig. 5, pl. 61, fig. 7; 1907, pp. 298-299, 477.

*Ptychocypris undella*, Brandt, 1906, p. 29, pl. 60, figs. 6, 6a.

*Epiplocypris undella* var. *blanda*, partim, Jörgensen, 1924, p. 55 (for fig. 62 see *E. blanda*, see also *E. obtusa*).

Raised to status of species.

Lorica moderately elongate, 1.64 oral diameters in length; bowl inverted subconical ( $10^\circ$ ) in anterior 0.5, conical ( $60^\circ$ ) fundus; reticulated zone 0.6 oral diameter wide, no free lines; reticulations heavy; aboral horn short, conical ( $25^\circ$ ), 0.2 oral diameter in length. Length  $130\mu$ .

The type locality is Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Differs from *E. mucronata* in fuller fundus, shorter horn and lack of free lines, and from *E. obtusa* in less baggy fundus, broader reticulated zone, and longer horn.

**Epiplocypris undella** (Ostenfeld and Schmidt) Jörgensen emended

Figure 345

*Cyttarocypris Undella* Ostenfeld and Schmidt, 1901, p. 181, fig. 30.

*Ptychocypris undella* var. m, partim, Brandt, 1906, p. 29, pl. 59, fig. 5; 1907, pp. 298, 482 (for 1906, p. 29, pl. 61, fig. 7 see *E. mucronata*).

*Ptychocypris undella*, Schweyer, 1909, p. 137; Okamura, 1912, pp. 21, 35, pl. 5, fig. 97.

*Epiplocypris undella*, partim, Jörgensen, 1924, pp. 54, 55, fig. 61 (see also *E. atlantica*, *E. constricta*, *E. exquisita*, *E. impensa*, *E. lineata*, and *E. mucronata*).

**Ptychocypris** Brandt emended Jörgensen

*Tintinnus*, partim, Claparède and Lachmann, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coaliella*, *Favella*, *Parundella*, *Proplectella*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*).

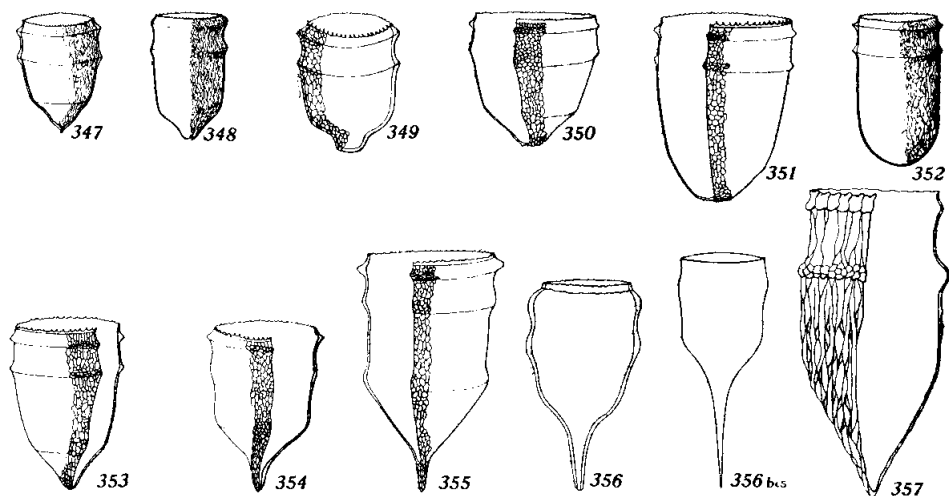
*Ptychocypris* Brandt, 1896, pp. 59, 60; 1907, partim, pp. 273-313 (see also *Epiplocypris*); Laackmann, 1909, pp. 456-460; Meunier, 1910, pp. 121-128; 1919, partim, pp. 14-16 (see also *Metacypris*); Jörgensen, 1924, pp. 24, 54; 1927, pp. 5, 13, 20.

*Cyttarocypris*, Wailes, 1925, p. 534.

Ptychocypridae with lorica without a collar or spiral structure; oral rim entire or with teeth; suboral region with 1 or 2 bulges; bowl usually bell-shaped; aboral end contracting to a conical or blunt point;

wall with weakly developed, scarcely separated lamellae; outer surface with a very fine, subregular mesh of delicate plications, sometimes less delicate near the antapex.

We designate as the type species *Ptychocylis urnula* (Claparède and Lachmann) Brandt of northern European waters, the oldest species of the genus. This genus has not been found to extend into the tropics.



Figs. 347-357. Species of *Ptychocylis* Brandt emended Jörgensen.  $\times 200$ .

Fig. 347. *P. glacialis* Meunier after Meunier (1910, pl. 9, fig. 17) from the Barents Sea.

Fig. 348. *P. cylindrica* Meunier after Meunier (1910, pl. 8, fig. 25) from the Barents Sea.

Fig. 349. *P. obtusa* Bdt. after Brandt (1906, pl. 57, fig. 8) from Station Pl. 24 of the Plankton Expedition in the Labrador Current.

Fig. 350. *P. drygalskii* Bdt. after Brandt (1906, pl. 55, fig. 2) from Station "Princesse Alice 993, 7-VIII-98" west of Southern Spitzbergen.

Fig. 351. *P. arctica* Bdt. emended after Brandt (1906, pl. 56, fig. 5) from Station "Vanhöffen, 6-IX-93" in the Davis Strait off Holstenberg.

Fig. 352. *P. basicurvata* Meunier after Meunier (1910, pl. 10, fig. 1) from the Barents Sea.

Fig. 353. *P. acuta* Bdt. after Brandt (1906, pl. 56, fig. 6) from Station "Vanhöffen, 6-IX-93" in the Davis Strait off Holstenberg.

Fig. 354. *P. minor* Jörg. after Brandt (1906, pl. 57, fig. 3) from Station Pl. 10 of the Plankton Expedition in the Irminger Sea.

Fig. 355. *P. urnula* (Clap. and Lach.) Bdt. after Brandt (1906, pl. 57, fig. 1) from Station "Princesse Alice 928, 15-VII-98" off Kristvik, Norway.

Fig. 356. *P. repanda* (Wailes) after Wailes (1925, pl. 1, fig. 14) from the Strait of Georgia, British Columbia.

Fig. 356 bis. *P. ostenfeldi* sp. nov. after Ostenfeld (1899b, p. 437, fig. 2b) from the North Atlantic.

Fig. 357. *P. wailsi* sp. nov. from off Vancouver, British Columbia.

Differs from *Epiplocyclus* in the more delicate, less elevated, and smaller reticulations and thinner wall.

Includes 12 species as follows:

<i>acuta</i> Bdt.	<i>minor</i> Jörg.
<i>arctica</i> Bdt.	<i>obtusa</i> Bdt.
<i>basicurvata</i> Meunier	<i>ostenfeldi</i> sp. nov.
<i>cylindrica</i> Meunier	<i>repanda</i> (Wailes)
<i>drygalskii</i> Bdt.	<i>urnula</i> (Clap. and Laeh.) Bdt.
<i>glacialis</i> Meunier	<i>wailesi</i> sp. nov.

### ***Ptychocyclus acuta* Brandt emended**

Figure 353

*Ptychocyclus acuta* Brandt, 1896, p. 59, pl. 3, figs. 13 (referred to *P. obtusa* on p. 61 and in 1907, p. 311), 16; 1907, p. 483.

*Ptychocyclus urnula* var. *acuta* Brandt, 1907, pp. 309-310, 483 (1906, p. 28, as var. b); Laackmann, 1909, p. 421.

*Ptychocyclus urnula* forma *acuta*, Broeh, 1910b, pp. 9, 10.

*Ptychocyclus urnula* var. b Brandt, 1906, p. 28, pl. 56, figs. 1, 2, 6, 6a, pl. 57, fig. 7; Entz, Jr., 1909b, p. 102.

*Ptychocyclus elongata* Meunier, 1910, p. 127, pl. 8, fig. 24.

*Ptychocyclus elegans* Meunier, 1910, p. 127, pl. 12, fig. 37.

*Ptychocyclus edentata* Meunier, 1910, p. 127, pl. 11, fig. 21.

### ***Ptychocyclus arctica* Brandt emended**

Figure 351

*Ptychocyclus arctica*, *partim*, Brandt, 1896, p. 60, pl. 3, fig. 17; 1906, p. 28, pl. 56, fig. 5, pl. 57, fig. 11; 1907, pp. 312-313, 483 (for pl. 57, fig. 9 see *P. basicurvata*).

*Tintinnus urnula* var. *digitale* Aurivillius, 1896a, pp. 188, 193, 211 (*vide* Brandt, 1907, p. 312).

*Ptychocyclus urnula* var. *subarctica* Jørgensen, 1905, pp. 56, 59, 62, 86, 144, pl. 18, fig. 118; Brandt, 1907, pp. 312, 483.

### ***Ptychocyclus basicurvata* Meunier**

Figure 352

*Ptychocyclus arctica*, *partim*, Brandt, 1906, p. 28, pl. 57, fig. 9; 1907, pp. 312-313 (for pl. 56, fig. 5 and pl. 57, fig. 11 see *P. arctica*).

*Ptychocyclus basicurvata* Meunier, 1910, p. 127, pl. 10, fig. 1.

### ***Ptychocyclus cylindrica* Meunier**

Figure 348

*Ptychocyclus cylindrica* Meunier, 1910, p. 127, pl. 8, fig. 25.

**Ptychocylis drygalskii** Brandt

Figure 350

*Ptychocylis Drygalskii* Brandt, 1896, p. 59, pl. 3, fig. 14; Vanhöffen, 1897, p. 272, pl. 5, figs. 29, 33.

*Ptychocylis urnula* var. *digitalis* forma *edentata* Jörgensen, 1901, p. 17, pl. 3, fig. 31; on p. 26 as the following—

*Ptychocylis urnula* var. *digitalis* forma *subintegerrima* Jörgensen, 1901, p. 26, pl. 3, fig. 31.

*Ptychocylis obtusa* var. *drygalskyi, partim*, Brandt, 1906, p. 28, pl. 55, figs. 1-3, pl. 56, figs. 3, 3a, pl. 57, fig. 10; 1907, pp. 312, 483 (for pl. 56, fig. 4 see *P. obtusa*).

*Ptychocylis urnula* var. *digitalis* Jörgensen, 1899, p. 19; 1901, p. 17, pl. 2, figs. 29, 30.

*Ptychocylis urnula*, Wright, 1907, pp. 11, 18, pl. 4, fig. 19.

*Ptychocylis ventricosa* Meunier, 1910, p. 127, pl. 10, fig. 3.

*Ptychocylis obtusa*, Wailes, 1925, p. 535, pl. 1, figs. 8, 13.

**Ptychocylis glacialis** Meunier emended

Figure 347

*Ptychocylis glacialis* Meunier, *partim*, 1910, pp. 124-126, pl. 9, figs. 15-17, pl. 11, fig. 20 (for pl. 8, fig. 27 and pl. 10, fig. 6 see *P. obtusa*).

**Ptychocylis minor** Jörgensen

Figure 354

*Tintinnus urnula*, Möbius, 1887, p. 120, pl. 8, fig. 35.

*Ptychocylis urnula* var. *β minor* Jörgensen, 1899, p. 19, pl. 1, fig. 9.

*Ptychocylis urnula* var. *minor* Jörgensen, 1927, p. 13, fig. 24.

*Ptychocylis minor*, Ostenfeld, 1906, p. 64.

*Ptychocylis urnula* var. *pelagica* Brandt, 1906, p. 28, pl. 57, figs. 3-5; 1907, pp. 310-311, 483; Wailes, 1925, p. 535, pl. 1, figs. 11, 12.

**Ptychocylis obtusa** Brandt emended

Figure 349

*Ptychocylis obtusa* Brandt, 1896, p. 59, pl. 3, fig. 15; 1906, p. 28, pl. 57, fig. 8; 1907, pp. 311-312, 483; Ostenfeld, 1910, p. 296, fig. 6.

Non *Ptychocylis acuta* Brandt, 1896, p. 59, pl. 3, fig. 13 (referred to *P. obtusa* on p. 61, and 1907, p. 311).

*Tintinnus obtusa*, Aurivillius, 1899, pp. 20, 60, 70.

*Ptychocylis urnula* var. *obtusa*, Jörgensen, 1901, pp. 18, 28, 36, pl. 3, fig. 32; Brandt, 1907, pp. 303, 305, 311, 447, 474, 483; 1910, pp. 17-19.

*Ptychocylis obtusa* var. *drygalskyi, partim*, Brandt, 1906, p. 28, pl. 56, fig. 4 (for pl. 55, figs. 1-3, pl. 56, figs. 3, 3a, pl. 57, fig. 10 see *P. drygalskyi*); 1907, pp. 311-312, 483.

(*Ptychocylis urnula*) var. *crassicaudata* Jörgensen, 1901, p. 17.

*Ptychocylis urnula* forma *obtusa*, Broch, 1908, pp. 33, 62.

*Ptychocylis urnula* forma *a major* Jörgensen, 1899, pp. 18, 20.



*Ptychocylys Drygalskii*, Meunier, 1910, p. 126, pl. 8, figs. 23, 26, 29-31, pl. 9, figs. 8-10, 12-14.

*Ptychocylys media* Meunier, 1910, p. 127, pl. 9, fig. 11, pl. 10, fig. 4.

*Ptychocylys ampla* Meunier, 1910, p. 127, pl. 12, fig. 36.

*Ptychocylys glacialis*, *partim*, Meunier, 1910, pp. 124-126, pl. 8, fig. 27, pl. 10, fig. 6 (for pl. 9, figs. 15-17, pl. 11, fig. 20 see *P. glacialis*).

*Ptychocylys* sp. Meunier, 1910, p. 123, pl. 8, fig. 28.

*Ptychocylys*, ingested by *Didinium*, Meunier, 1910, pp. 156-161, pl. 15, fig. 14, pl. 19, fig. 16.

*Ptychocylys duplicata* Meunier, 1910, pp. 126-127, pl. 10, figs. 2, 5.

### ***Ptychocylys ostenfeldi* sp. nov.**

Figure 356 bis

*Cyttarocylys elegans* var. *Ostenfeld*, 1899b, pp. 437-438, fig. 2b.

*Cyttarocylys edentata*, *partim*, Brandt, 1907, pp. 17, 27, 33, 42, 185, 188, 221-224, 227-232, 304, 355, 368, 462, 463, 480, 482 (see also *Parafavella acuta*, *P. calycina*, *P. edentata*, *P. elegans*, *P. greenlandica*, *P. obtusa*, *P. obtusangula*, *P. parumdentata*, and *P. subula*).

Lorica stout baggy goblet-shaped, 2.75 oral diameters in length; oral rim denticulate; bowl subcylindrical in the suboral 0.66 of its length with a slight suboral and a larger aboral expansion; aboral region conical (80°); aboral horn conical (15°), 1.3 oral diameters in length; tip pointed. Length 130-180 $\mu$ .

The type locality is the North Atlantic.

Differs from *Parafavella elegans* in the stout, non-tapering suboral section of the bowl and from *Ptychocylys repanda* in the presence of but a single suboral expansion.

### ***Ptychocylys repanda* (Wailes)**

Figure 356

*Cyttarocylys repanda* Wailes, 1925, p. 534, pl. 1, fig. 14.

### ***Ptychocylys urnula* (Claparède and Lachmann) Brandt**

Figure 355

*Tintinnus urnula* Claparède and Lachmann, 1858, p. 208, pl. 8, fig. 14; Kent, 1882, p. 609, pl. 31, fig. 3.

*Amphorella urnula*, Daday, 1887b, p. 514.

*Tintinnopsis urnula*, Daday, 1887b, p. 561.

*Ptychocylys urnula*, Brandt, 1896, p. 59; 1906, p. 28, pl. 57, figs. 1, 2, 6; 1907, pp. 300-311, 483; 1910, pp. 13-17; Merkle, 1909, pp. 160-162, 168-174, pl. 3, figs. 62-67; Linko, 1915, pp. 16, 17, 18; Wailes, 1925, p. 535, pl. 1, figs. 7, 9, 10; Jörgensen, 1927, p. 16, fig. 31.

**Ptychocylis wailesi** sp. nov.

Figure 357

Lorica 1.5-2.1 oral diameters in length; oral margin irregularly serrate; bowl cylindrical in anterior 0.2-0.6, contracting immediately below as a convex cone of  $45^{\circ}$ - $85^{\circ}$ ; aboral end pointed, without a distinct horn. Length 180-195 $\mu$ .

The type locality is off Vancouver, B. C., in plankton given the junior author by Mr. G. H. Wailes.

Differs from all other species in the conical form of the bowl.

## Family PETALOTRICHIDAE fam. nov.

Dictyocystidae, *partim*, Kent, 1882, p. 624 (see also Cyttarocylidae, Dictyocystidae, and Rhabdonellidae.)

Tintinnoinea with cup-shaped lorica; oral rim smooth or denticulate; mouth usually quite wide; with one or two collars; wall hyaline, or with primary prismatic structure. With 1 (2?) macronucleus and 18 membranelles. Marine only.

Differs from the Codonellidae, Codonellopsidae, Ptychocylidae, Rhabdonellidae, and Xystonellidae in the absence of secondary structure in the wall, except in a few species of *Craterella*; from the Tintinnididae in the firm, cup-shaped lorica; from the Undellidae in the presence of the well-defined collar; from the Dictyocystidae in the absence of quadrangular fenestrae in the collar; from the Coxliellidae in the absence of spiral structures; from the Cyttarocylidae in the types of suboral differentiation; and from the Tintinnidae in the shape of the lorica.

Includes three subfamilies, the Craterellinae subfam. nov., the Metacylinae subfam. nov., and the Petalotrichinae subfam. nov.

## Subfamily CRATERELLINAE subfam. nov.

Petalotrichidae with lorica usually with two collars, the outer sometimes with teeth.

Differs from the Petalotrichinae in having two collars instead of one and from the Metacylinae in the absence of suboral spiral structure.

Includes two genera, *Acanthostomella* Jørgensen and *Craterella* gen. nov.

### **Acanthostomella** Jörgensen

*Tintinnus, partim*, Claparède and Lachmann, 1858, pp. 195-196 (see also *Amphorella, Bursaopsis, Codonella, Cortiella, Favella, Parundella, Proplectella, Ptychocylis, Salpingella, Steenstrupicella, Stenoscymella, Tintinnidium, Tintinnopsis*, and *Tintinnus*); Brandt, 1896, p. 54 (see also *Bursaopsis*); Cleve, 1899a, p. 24 (see also *Leprotintinnus*).

*Amphorella, partim*, Daday 1887b, pp. 535-536 (see also *Amphorella, Bursaopsis*, and *Codonellopsis*).

*Cyrtarocylis*, Jörgensen, 1899, p. 28.

*Acanthostomella* Jörgensen, 1927, pp. 4, 13, 15.

Craterellineae with cup-shaped or subconical lorica; inner collar upright with entire rim, separated from the outer collar by a trough; outer collar with few to many, low or long triangular, outspreading teeth; aboral end closed, usually pointed or with spine; wall with well developed simple prismatic structure between the outer and inner laminae.

We designate as the type species *Acanthostomella norvegica* (Daday) Jörgensen from off Norway, the oldest and best known species of the genus.

Differs from *Craterella* gen. nov. in the presence of teeth on the outer collar and in the more evident prismatic structure of the intermediate layer of the wall.

Includes 7 species as follows:

*conicoides* sp. nov.

*elongata* sp. nov.

*gracilis* (Bdt.)

*lata* sp. nov.

*minutissima* sp. nov.

*norvegica* (Daday) Jörg.

*obtusa* sp. nov.

#### **Acanthostomella conicoides** sp. nov.

Figure 362

Lorica subconical, about 2 oral diameters in length; inner collar low; outer collar with 7 or 8 slender, dextrally curved teeth; bowl subconical ( $10^{\circ}$ - $12^{\circ}$ ) anteriorly, narrowing in the posterior half to  $55^{\circ}$ - $60^{\circ}$ ; aboral end contracting to a solid aboral spine 0.3-0.7 oral diameter in length; wall without marked structure. Length 35-45 $\mu$ .

The type locality is Station 4722 in the South Equatorial Drift.

Differs from *A. lata* in more slender bowl and fewer suboral teeth.

**Acanthostomella elongata** sp. nov.

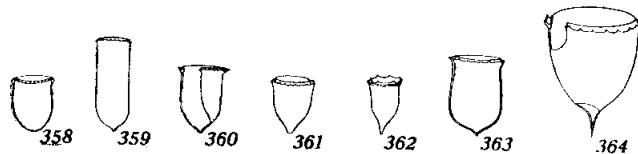
Figure 359

*Amphorella norvegica*, Meunier, *partim*, 1910, pp. 131-132, pl. 14, fig. 7 (for pl. 10, figs. 20-26 see *A. norvegica*); non Daday, 1887b, p. 543 (see *A. norvegica*).

Lorica very elongated, 3.0 oral diameters in length; inner collar high; outer collar with about 25 low teeth; bowl cylindrical in upper 0.8 of its length; aboral end subhemispherical with a short spine. Length 70 $\mu$ .

The type locality is the Barents Sea.

Differs from all other species in the greater length of the bowl.



Figs. 358-364. Species of *Acanthostomella* Jörgensen.  $\times 200$ .

Fig. 358. *A. minutissima* sp. nov. from Station 4666 in the Peruvian Current.

Fig. 359. *A. elongata* sp. nov. after Meunier (1910, pl. 14, fig. 7) from the Barents Sea.

Fig. 360. *A. gracilis* (Bdt.) after Brandt (1906, pl. 62, fig. 2) from Station Pl. 105 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 361. *A. obtusa* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 362. *A. conicoides* sp. nov. from Station 4722 in the South Equatorial Drift of the Pacific.

Fig. 363. *A. norvegica* (Daday) Jörg. after Jörgensen (1927, p. 13, fig. 23) from Bergen, Norway.

Fig. 364. *A. lata* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

**Acanthostomella gracilis** (Brandt)

Figure 360

*Tintinnus gracilis* Brandt, 1896, p. 54, pl. 3, fig. 7; Vanhöffen, 1897, pp. 271, 272, 291, 301, pl. 5, fig. 30.

*Tintinnus norvegicus* var. *a. gracilis* Brandt, 1906, pp. 29, 30, pl. 62, figs. 2, 7; 1907, pp. 407, 433.

*Cyttarocylis gracilis*, Jörgensen, 1905, p. 144; Brandt, 1907, p. 404.

**Acanthostomella lata** sp. nov.

Figure 364

Lorica stout goblet-shaped, 1.25 oral diameters in length; inner collar high (0.1 oral diameter), separated from the outer by a deep trough; outer collar with about 20 short, stout leiotropic teeth; bowl

convex-conical,  $15^\circ$  anteriorly,  $90^\circ$  posteriorly; aboral end with a hollow conical ( $20^\circ$ ) spine nearly 0.25 oral diameter in length; wall with distinct interlamellar alveoli. Length  $37\mu$ .

The type locality is Station 4724 in the South Equatorial Drift.

Differs from *A. conicoides* in wider oral region, more convex bowl, and more suboral teeth and in their leiotropic curvature and from *A. norvegica* in a stouter bowl tapering from the collar.

#### ***Acanthostomella minutissima* sp. nov.**

Figure 358

Lorica stout, short goblet-shaped, 1.30–1.64 oral diameters in length; inner collar low; outer collar distinctly flaring ( $30^\circ$ – $50^\circ$ ), with 16–25 slender, pointed, curved or erect teeth; bowl cylindrical in anterior 0.5 and contracting posteriorly, with convex sides; aboral end hemispherical to blunt subconical; wall relatively thick and usually filled from the collar to the aboral end with coecoliths, or distinctly and coarsely meshed with interlamellar alveoli. Length 29–36 $\mu$ .

The type locality is Station 4666 in the Peruvian Current. Occurs also in the South Equatorial Drift.

Differs from *A. norvegica* in the distinctly emergent outer collar and in smaller size.

#### ***Acanthostomella norvegica* (Daday) Jörgensen**

Figure 363

*Tintinnus* sp. Claparède and Lachmann, 1858, p. 210, pl. 8, fig. 16; Kent, 1882, pl. 31, fig. 17.

*Amphorella norvegica* Daday, 1887b, p. 543; Meunier, *partim*, 1910, pp. 131–132, pl. 10, figs. 20–26 (for pl. 14, fig. 7 see *A. elongata*).

*Tintinnus norvegicus*, Brandt, 1896, p. 54; 1907, pp. 401–407; Merkle, 1909, pp. 164–165, pl. 2, fig. 15.

*Tintinnus norvegicus* var. *b. minutus*, Brandt, 1906, p. 30, pl. 62, fig. 6.

*Cyttarocylis norvegica*, Jörgensen, 1899, p. 28, pl. 1, fig. 10.

*Tintinnus minutus* Cleve, 1899a, p. 24, pl. 1, fig. 3; Brandt, 1896, pp. 50, 55, 64, 66.

*Cyttarocylis norvegica* var. *minuta*, Jörgensen, 1901, p. 15, pl. 2, fig. 27.

*Cyttarocylis minuta*, Jörgensen, 1905, p. 144; Brandt, 1907, p. 404.

*Acanthostomella norvegica*, Jörgensen, 1927, pp. 13, 17, fig. 23.

***Acanthostomella obtusa* sp. nov.**

Figure 361

Lorica short, stout goblet-shaped, 1.6–1.7 oral diameters in length; inner collar quite high, thickened; outer collar heavy, with 10–20 low stout teeth; bowl convex subconical, narrowing from 16°–22° anteriorly to 60°–68° posteriorly, and more rapidly in the posterior third; aboral end with a stout truncated hollow horn about 0.25 oral diameter in length and width; wall thin, uniform, except in thickened collar. Length 26–36 $\mu$ .

The type locality is Station 4724 in the South Equatorial Drift. Occurs also in the Panamic Area and the Peruvian Current.

Differs from all other species in the stout, obtuse aboral horn.

***Craterella* gen. nov.**

*Tintinnus*, *partim*, Ostenfeld, 1899a, p. 63 (see also *Parundella*).

*Undella*, *partim*, Cleve, 1900d, pp. 974–975 (see also *Favella* and *Xystonellopsis*).

*Amphorella*, Ostenfeld and Schmidt, 1901, p. 178; Jörgensen, *partim*, 1924, pp. 15–16, 37, 57 (see also *Amphorella*, *Amphorellopsis*, *Canthariella*, *Dadayiella*, *Ormosella*, and *Steenstrupiella*).

*Cyrtarocydis*, *partim*, Brandt, 1907, pp. 181–188 (see also *Climacocydis*, *Corliella*, *Cyrtarocydis*, *Favella*, *Parafavella*, *Porococcus*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*).

Craterellineae with loricae quite small, goblet- or cup-shaped; with two collars, an inner and an outer separated by a trough between them, the latter sometimes repeated, neither collar with teeth; aboral end closed; wall with lamellae close together, either with simple prismatic structure or hyaline.

We designate as the type species *Craterella urceolata* (Ostenfeld) from off Greenland in the Irminger Sea, the oldest species of the genus.

Differs from *Acanthostomella* Jörg. in the absence of teeth on the collars and in the simpler, more hyaline, less prismatic wall.

Includes 7 species as follows:

<i>acuta</i> sp. nov.	<i>protuberans</i> sp. nov.
<i>armilla</i> sp. nov.	<i>torulata</i> (Jörg.)
<i>obscura</i> (Bdt.)	<i>urceolata</i> (Ost.)
<i>oxyura</i> (Jörg.)	

**Craterella acuta** sp. nov.

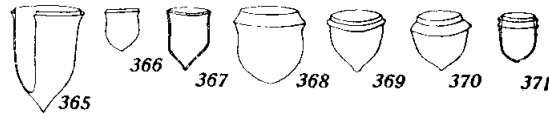
Figure 370

*Amphorella urceolata*, Jörgensen, 1924, pp. 17, 23-24, fig. 25a, b; non Ostenfeld and Schmidt, 1901, p. 178 (see *C. urceolata*).

Lorica stout, very short, cup-shaped, 1.3 oral diameters in length; inner collar high, 0.25 total length, expanding to 1.5 oral diameters; outer collar horizontal, scarcely emergent; bowl subconical, 40° anteriorly, contracting to 110° in the posterior third; aboral end distinctly pointed; wall uniformly thin. Length 43μ.

The type locality is Station 187 of the "Thor" Expedition in the Ionian Sea.

Differs from *C. urceolata* in higher and more flaring inner collar and pointed aboral end.



Figs. 365-371. Species of *Craterella* gen. nov. × 200.

Fig. 365. *C. obscura* (Bdt.) after Brandt (1906, pl. 62, fig. 1) from Station Pl. 105 of the Plankton Expedition in the South Equatorial Current.

Fig. 366. *C. torulata* (Jörg.) after Jörgensen (1924, p. 17, fig. 24) from Station 186 of the "Thor" in *Salpa* in the Ionian Sea.

Fig. 367. *C. oxyura* (Jörg.) after Jörgensen (1924, p. 17, fig. 23) from Station 14 of the "Thor" in the Adriatic.

Fig. 368. *C. urceolata* (Ost.) after Ostenfeld (1899b, p. 439, fig. 2g) from the North Atlantic.

Fig. 369. *C. protuberans* sp. nov. from Station 4705 in the South Equatorial Drift.

Fig. 370. *C. acuta* sp. nov. after Jörgensen (1924, p. 17, fig. 25a) from Station 187 of the "Thor" in the Ionian Sea.

Fig. 371. *C. armilla* sp. nov. from Station 4724 in the South Equatorial Drift.

**Craterella armilla** sp. nov.

Figure 371

Lorica sack-shaped, 1.43-1.75 oral diameters in length; inner collar low, erect; outer collar repeated, each flaring 45° to 1.14-1.23 oral diameters, with distinct trough; bowl nearly cylindrical in its anterior 0.66; aboral end subhemispherical, without distinct aboral point; wall thick, distinct interlamellar alveoli and surface rugosities. Length 27-35μ.

The type locality is Station 4724 in the South Equatorial Drift. Occurs also in the Galapagos Eddy.

Differs from all other species in the duplication of the outer collar and in the rugose surface.

**Craterella obscura** (Brandt)

Figure 365

*Cyttarocyllis obscura* Brandt, 1906, pp. 5, 29, 30, pl. 62, figs. 1, 1a, 5; 1907, pp. 201, 473; Entz, Jr., 1908, p. 99; Jörgensen, 1924, p. 23.

**Craterella oxyura** (Jörgensen)

Figure 367

*Amphorella oxyura* Jörgensen, 1924, pp. 8, 17, 23, fig. 23.

**Craterella protuberans** sp. nov.

Figure 369

Lorica stout, short goblet-shaped, 1.08 oral diameters in length; inner collar erect, 0.1 oral diameter; outer collar horizontal, 1.18 oral diameters in diameter, thickened, with no excavated trough; bowl sub-conical ( $22^\circ$ ) anteriorly, contracting ( $90^\circ$ ) in the aboral third; aboral end with an emergent blunt horn, 0.12 oral diameter in length. Length  $41\mu$ .

The type locality is Station 4705 in the South Equatorial Drift.

Differs from *C. acuta* in the lower, not flaring inner collar and blunt aboral horn.

**Craterella torulata** (Jörgensen)

Figure 366

*Amphorella torulata* Jörgensen, 1924, pp. 8, 17, 23, fig. 24.

**Craterella urceolata** (Ostenfeld)

Figure 368

*Tintinnus urceolatus* Ostenfeld, 1899a, p. 63; 1899b, p. 439, fig. 2g; 1901, pp. 17, 126; 1916b, p. 133; Brandt, 1907, pp. 407, 482; Entz, Jr., 1908, p. 105; Jörgensen, 1912, p. 4; 1924, p. 24.

*Amphorella urceolata*, Ostenfeld and Schmidt, 1901, p. 178; *non* Jörgensen, 1924, pp. 17, 23-24, figs. 5a, b (see *C. acuta*).

*Undella* (?) *urceolata*, Cleve, 1901d, p. 126.

*Non Tintinnus urceolatus* var. a Brandt, 1906, p. 30, pl. 62, fig. 3; 1907, p. 408 (see *Metacyllis jørgenseni*).



## Subfamily METACYLINEAE subfam. nov.

Petalotrichidae with the anterior part of the lorica differentiated as a collar composed of a few low turns of a spiral band below the oral opening; bowl non-annulate; wall bilaminate with indistinct structure.

Differs from the Petalotrichinae and the Craterellinae in the presence of suboral spiral structure.

Includes only one genus, *Metacylis* Jörg.

**Metacylis** Jörgensen

*Tintinnus*, Mereschkowsky, 1880, pp. 211-212; Brandt, *partim*, 1907, pp. 374-388 (see also *Amphorella*, *Brandtiella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Ormosella*, *Salpingacantha*, and *Tintinnus*).

*Cyttarocyclus*, Ostenfeld and Schmidt, *partim*, 1901, pp. 179-180 (see also *Epiplocyclus* and *Rhabdonella*).

*Codonella*, Cleve, 1902a, p. 22.

*Amphorella*, Fauré-Fremiet, 1908, p. 234; Meunier, *partim*, 1910, p. 133 (see also *Albatrossiella* and *Coziella*).

*Ptychocyclus*, *partim*, Meunier, 1919, pp. 14-16 (see also *Ptychocyclus*).

*Metacylis* Jörgensen, 1924, pp. 7, 9, 97; 1927, pp. 4, 14.

Metacylineae with lorica usually short and wide, oval, in some species elongate capsular; usually with a wide mouth and a short wide collar with a few, low spiral turns or annuli; bowl wide; aboral end rounded or pointed, flattened, or with a spinule; wall bilaminate, simple with indistinct structure, or with simple prismatic structure, or hyaline.

We select as the type species *Metacylis mediterranea* (Mereschkowsky) Jörgensen emended from the Mediterranean, the oldest species of the genus.

Includes 11 species as follows:

<i>annulata</i> (Meunier)	<i>mediterranea</i> (Mereschk.) Jörg.
<i>annulifera</i> (Ost. and Schm.)	emended
<i>conica</i> sp. nov.	<i>mereschkowskii</i> sp. nov.
<i>corbula</i> sp. nov.	<i>pontica</i> (Mereschk.)
<i>jörgensenii</i> (Cleve)	<i>rossica</i> nom. nov.
<i>lucasensis</i> sp. nov.	<i>vitreoides</i> nom. nov.

**Metacylis annulata** (Meunier)

Figure 375

*Amphorella annulata* Meunier, 1910, p. 133, pl. 10, fig. 28.

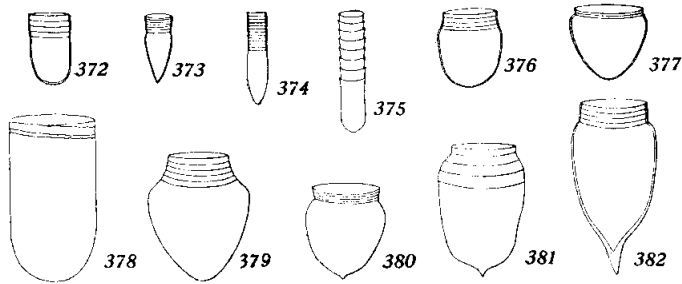
Figs. 372-382. Species of *Metacyclis* Jörgensen.  $\times 200$ .

Fig. 372. *M. lucasensis* sp. nov. from Station 4583 in the California Current off Cape San Lucas.

Fig. 373. *M. conica* sp. nov. from Station 4580 in the California Current.

Fig. 374. *M. annulifera* (Ost. and Schm.) after Ostenfeld and Schmidt (1901, p. 179, fig. 25) from the Red Sea.

Fig. 375. *M. annulata* (Meunier) after Meunier (1910, pl. 10, fig. 28) from Barents Sea.

Fig. 376. *M. corbula* sp. nov. from off Taboguilla Island, Bay of Panama.

Fig. 377. *M. mereschkowskii* sp. nov. after Jörgensen (1924, p. 98, 109b) from Station 153 "Thor" (probably Station 173 in the Black Sea).

Fig. 378. *M. vitreoides* nom. nov. after Meunier (1910, pl. 9, fig. 22) from the Barents Sea.

Fig. 379. *M. pontica* (Meresch.) after Mereschkowsky (1881, pl. 12, fig. 2) from the Black Sea.

Fig. 380. *M. jørgensenii* (Cleve) after Jörgensen (1924, p. 98, fig. 109a) from off Cadiz in the collections of the "Thor."

Fig. 381. *M. mediterranea* (Meresch.) Jörg. emended after Mereschkowsky (1881, pl. 12, fig. 1) from off Naples.

Fig. 382. *M. rossica* nom. nov. after Rossolimo (1922, pl. 2, fig. 26) from the Black Sea.

### ***Metacyclis annulifera* (Ostenfeld and Schmidt)**

#### Figure 374

*Cyttarocyclus annulifera* Ostenfeld and Schmidt, 1901, p. 179, fig. 25; Brandt, 1907, pp. 261, 392, 400, 443, 454; Laackmann, 1907, p. 238; 1909, p. 397.

*Tadlinus annuliferus*, Brandt, 1907, pp. 28, 38, 43, 376, 393-400, 443, 444, 454, 470, 471, 475; Fauré-Fremiet, 1924, p. 110.

*Coxiella annulifera*, Entz, Jr., 1908, p. 100.

*Cyttarocyclus annulata*, Kofoid, 1905, pp. 297-298. *Lapsus pennae*.

*Helicostomella annulifera*, Jörgensen, 1924, p. 24.

### ***Metacyclis conica* sp. nov.**

#### Figure 373

Lorica elongated, length 2.4 oral diameters; collar 0.24 total length, tapering to slight nuchal constriction, with 6 annuli; bowl widest at 0.33 total length from oral margin, contracting aborally in a cone  $30^\circ$ ; aboral end bluntly pointed. Length  $45\mu$ .

The type locality is Station 4580 in the California Current.

Differs from *M. annulifera* in nuchal contraction, narrow conical aboral region, fewer annuli, more pointed antapex, and smaller size.

**Metacyclis corbula** sp. nov.

Figure 376

A minute species with stout basket-shaped lorica, 1.4 oral diameters in length; collar with 4 spiral laminae confined to the short, contracted neck region; bowl broadly ovoidal; aboral end broadly rounded; oral diameter 0.83 greatest diameter of bowl; wall hyaline. Length 50 $\mu$ .

The type locality is off Taboguilla Island, Bay of Panama. Occurs also in the Bay of Panama generally.

Differs from *M. mediterranea* in wider bowl and absence of aboral point and from *M. mereschkowskii* in absence of aboral taper to the bowl.

**Metacyclis jørgensenii** (Cleve)

Figure 380

*Codonella Jørgensenii* Cleve, 1902a, p. 22, fig. 1.

*Tintinnus urceolatus*, Brandt, 1906, p. 30, pl. 62, fig. 3.

*Tintinnus urceolatus* var. a Brandt, 1907, pp. 408, 482.

*Amphorella Jørgensenii* sp. nov. Fauré-Fremiet, 1908, pp. 212, 235, 236, fig. 22, in explanation of figure as *A. Jørgensi*.

*Tintinnus mediterraneus*, Laackmann, 1913, pp. 38-40, pl. 6, figs. 88-90.

*Tintinnus mediterraneus* (?), Ostefeld, 1913, p. 357.

*Tintinnus Jørgensenii*, Ostefeld, 1916b, pp. 133-134, 176-177.

*Ptychoeclis Amphorella* Meunier, 1919, pp. 14-17, pl. 22, figs. 4-7.

*Tintinnus mediterraneus* var. *pontica*, partim, Rossolimo, 1922, pp. 29, 31, pl. 2, fig. 24 right figure only (for left figure see *M. mereschkowskii*).

*Tintinnus mediterraneus* var. *neapolitana*, Rossolimo, 1922, pp. 29, 31, fig. 25

*Metacyclis mediterranea* forma *neapolitana*, Jørgensen, 1924, pp. 97-98, fig. 109a (for var. *pontica*, fig. 109b see *M. mereschkowskii*).

*Metacyclis mediterranea*, partim, Jørgensen, 1924, pp. 24, 97-98, 107; 1927, pp. 14, 17, fig. 25 (see also *M. mediterranea*).

**Metacyclis lucasensis** sp. nov.

Figure 372

A minute species with a cylindrical, capsule-like lorica, 1.75 oral diameters in length; collar with four spiral turns in the anterior 0.3 of total length; oral margin entire; aboral end hemispherical, without point; wall very thin. Length 47 $\mu$ .

The type locality is Station 4583 in the California Current off Cape San Lucas.

Differs from all other species in the cylindrical shape of the lorica.

**Metacylis mediterranea** (Mereschkowsky) Jörgensen emended

Figure 381

*Tintinnus mediterraneus*, *partim*, Mereschkowsky, 1880, p. 6; 1881, pp. 211-212; Kent, 1882, p. 610; Brandt, 1907, pp. 400-401, 471 (see also *M. pontica*); non Laackmann, 1913, pp. 38-40, pl. 6, figs. 88-90 (see *M. jørgensenii*).

*Tintinnus mediterraneus* var. *neapolitana* Mereschkowsky, 1881, pp. 211-212, pl. 12, fig. 1; non Rossolimo, 1922, pp. 29, 31, pl. 2, fig. 25 (see *M. jørgensenii*).

Non *Tintinnus mediterraneus* var. *pontica*, Rossolimo, 1922, pp. 29, 31, pl. 2, fig. 24 (for left figure see *M. mereschkowskii*, for right see *M. jørgensenii*).

*Metacylis mediterranea*, *partim*, Jörgensen, 1924, pp. 24, 97-98, 107 (see *M. jørgensenii*); 1927, pp. 14, 17 (for fig. 25 see *M. jørgensenii*).

*Amphorella mediterranea*, Daday, 1887*b*, p. 543.

Non *Metacylis mediterranea* forma *neapolitana*, Jörgensen, 1924, pp. 97-98, (see *M. jørgensenii*).

**Metacylis mereschkowskii** sp. nov.

Figure 377

*Tintinnus mediterraneus* var. *neapolitana*, *partim*, Rossolimo, 1922, pp. 29, 31, pl. 2, fig. 24, left figure only (for right figure see *M. jørgensenii*).

*Metacylis mediterranea* var. *pontica*, Jörgensen, 1924, pp. 97-98, fig. 109*b* (for fig. 109*a* forma *neapolitana* see *M. jørgensenii*, see also *M. mediterranea*).

Lorica broadly bowl-like, length 1.1 oral diameters; oral opening nearly equaling diameter of bowl; with a very low, erect collar with two rings; bowl broadly ovate; aboral end rounded, without a point. Length 50-53 $\mu$ .

The type locality is Station 153 of the "Thor" (probably Station 173) in the Black Sea. Occurs also off the west coast of Europe to Bergen.

Differs from *M. mediterranea* in erect instead of spreading collar, absence of rings on the bowl, and in much larger oral opening.

**Metacylis pontica** (Mereschkowsky)

Figure 379

*Tintinnus mediterraneus*, *partim*, Mereschkowsky, 1880, p. 6; 1881, pp. 211-212; Kent, 1882, p. 610; Brandt, 1907, pp. 400-401, 471 (see also *M. mediterranea*).

*Tintinnus mediterraneus* var. *pontica* Mereschkowsky, 1881, p. 212, pl. 12, fig. 2; Kent, 1882, p. 610; Daday, 1887*a*, p. 167; 1887*b*, pp. 478, 544; Brandt, 1907, pp. 393, 400, 401, 471, 475, 476; Laackmann, 1913, p. 38; Ostenfeld, 1916*b*, pp. 133, 176.

Raised to status of species.

Lorica short amphora-shaped, 1.55 oral diameters in length; collar truncated conical (30°) with concave sides, 0.5 oral diameter in

height, with 5 equal turns; bowl with a very wide sloping ( $30^\circ$ ) shoulder, changing abruptly below to convex conical, widest at the shoulder, changing below from  $40^\circ$  to  $90^\circ$  at the rounded aboral end. Length  $16\mu$  according to Mereschkowsky (1881) but this is undoubtedly an error. In our figure ( $\times 200$ ) its length would be  $85\mu$ .

The type locality is the Black Sea.

Differs from all other species in the high degree of development of the shoulder of the bowl.

### **Metacylis rossica** nom. nov.

Figure 382

*Tintinnus mediterraneus* var. *longa*, Rossolino, 1922, p. 29, pl. 2, fig. 26; non Brandt, 1906, p. 31, pl. 65, figs. 6-8 (see *Helicostomella longa*).

Non *Tintinnus patagonicus* Brandt, 1907, pp. 3, 38, 43, 376, 393, 401, 443-444, 470, 471, 475; Laackmann, 1913, p. 39; Faria and Cunha, 1917, p. 73; Fauré-Fremiet, 1924, p. 110 (see *Helicostomella longa*).

Raised to status of species.

Lorica short bullet-shaped, 3 oral diameters in length; collar cylindrical, 0.35 oral diameter in height, with 4 subequal turns; bowl elongate ovate with distinct shoulder; aboral region convex conical ( $45^\circ$  distally); aboral horn conical ( $20^\circ$ ), 0.5 oral diameter in length. Length 109-116 $\mu$ .

The type locality is the Black Sea.

Differs from all species of *Metacylis* in the developed aboral horn and from *Helicostomella longa* in the texture of the lorica and the presence of the shoulder.

### **Metacylis vitreoides** nom. nov.

Figure 378

*Amphorella vitrea*, Meunier, 1910, pp. 128, 129, pl. 9, figs. 21-22, pl. 14, figs. 1-3.

*Tintinnus vitreus*, Ostefeld, 1910, pp. 297-298, fig. 7; non Brandt, 1896, p. 54, pl. 3, figs. 8, 9; 1906, p. 32, pl. 66, fig. 7; 1907, pp. 438, 484 (see *Bursaopsis vitrea*).

Lorica wide capsular, 2.0-3.5 oral diameters in length; oral rim entire, not everted; bowl cylindrical; aboral end hemispherical, with a very low, but distinct, aboral point; wall distinctly spirally laminate in the anterior part only, with 5-14 turns with their anterior edge outwardly lipped. Length 123-200 $\mu$ .

The type locality is the Barents Sea.

Differs from all species of *Metacyclis* except *M. annulata* and *M. lucasensis* in the tubular form of the lorica; from *M. annulata* in much greater diameter and stouter proportions; from *M. lucasensis* in thinner wall and larger lorica; and from *Coxiella tubularis* in the limitation of the spiral to the anterior part of the lorica. Possibly a *Coxiella*.

Subfamily PETALOTRICHINEAE subfam. nov.

Petalotrichidae with bowl-shaped lorica, with an oral shelf and a single, widely spreading, distinct collar, with a nuchal constriction; suboral and subnuchal fenestrae present.

Differs from the Craterellinae in having but a single collar and from the Metacylinae in the absence of suboral spiral structure.

Includes only one genus, *Petalotricha* Kent emended Daday emended Brandt.

**Petalotricha** Kent emended Daday emended Brandt

*Tintinnus*, *partim*, Føl, 1881, pp. 20-21 (see also *Rhabdonella*).

*Petalotricha* Kent, 1882, p. 627; Daday, 1887b, pp. 573-574; Brandt, 1907, pp. 337-341; Laackmann, 1909, pp. 466-467; Jörgensen, 1924, pp. 5, 7, 8, 88.

Petalotrichinae with bowl-shaped or conical lorica; oral shelf spreading; low oral ridge, flaring conical collar; slight or deep nuchal constriction, prominent internal nuchal ledge; globular, sack-like, or subconical bowl; aboral end hemispherical, flattened, minutely pointed or bluntly rounded; wall with inner and outer laminae enclosing 1-3 layers of minute, faint or thick-walled, rounded, uneven prisms; suboral fenestrae in one row with horizontal axis, subnuchal fenestrae circular or elliptical in a more or less restricted zone, with long axis oblique or vertical.

We designate as the type species *Petalotricha ampulla* (Føl) Kent from off Villefranche in the Mediterranean, the oldest species included in the genus.

Includes 8 species as follows:

<i>ampulla</i> (Føl) Kent	<i>indica</i> sp. nov.
<i>capsa</i> Bdt.	<i>major</i> Jörg.
<i>entzi</i> Kofoid	<i>paecifica</i> sp. nov.
<i>foli</i> sp. nov.	<i>serrata</i> sp. nov.

UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ZOOLOGY

Volume 34, pp. 1-403, 697 figures in text

Issued December 31, 1929

UNIVERSITY OF CALIFORNIA PRESS  
BERKELEY, CALIFORNIA

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CAMBRIDGE UNIVERSITY PRESS  
LONDON, ENGLAND

A CONSPECTUS OF THE MARINE AND FRESH-  
WATER CILIATA BELONGING TO THE SUBORDER  
TINTINNOINEA, WITH DESCRIPTIONS OF NEW  
SPECIES PRINCIPALLY FROM THE AGASSIZ  
EXPEDITION TO THE EASTERN TROPICAL PACIFIC  
1904-1905

BY

CHARLES A. KOFOID AND ARTHUR S. CAMPBELL

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The preparation of a report upon this important group of pelagic ciliates found in the plankton collections of the Agassiz Expedition to the Eastern Tropical Pacific, in 1904-1905 of the U. S. Fisheries Steamer "Albatross," has entailed a monographic treatment of the entire group and the critical organization of the existing information concerning its content of species and their relationships. Over 1750 species, subspecies, varieties, forms, and different permutations and applications of these nomenclatural categories of the Tintinnoinea occur in the literature. There has arisen not a little confusion between different investigators both in regard to the status and to the relationships of these systematic entities. This is especially true in the matter of generic limits and the allocation of species therein. The phenomena of convergence and the plastic phase of certain common species also add to the perplexities of the systematist who attempts a survey of any considerable collection of these widely distributed pelagic organisms.

This brief and condensed summary of our systematic analysis of the Tintinnoinea is based upon tow-net collections taken by the Agassiz Expedition, 1904-1905, at 127 stations in the Eastern Tropical Pacific; upon pelagic collections made over a period of many years off the coast of California by the Scripps Institution and its predecessors, and in San Francisco Bay by the U.S.S. "Albatross" and the University of California; and upon collections made by the U.S.S. "Albatross" off the Alaskan and Californian coasts. In addition, the senior author made daily collections from the steamer's circulating system while en route from Seattle, Washington, to Colombo, Ceylon, in 1916. The material available in these collections is fairly representative of the North Temperate, Tropical, and South Temperate Pacific from the Arctic Circle to the Tropic of Capricorn, especially in the eastern part of this ocean.

The reports of Brandt (1906, 1907) on the collections of the Plankton Expedition, of Laackmann (1909) on those of the German



South Polar Expedition, and of Jörgensen (1924) on the collections of the "Thor" from the Mediterranean and adjacent Atlantic have greatly extended our knowledge of this group; but none of these authors, except Brandt (1907), has attempted to treat the group as a whole. This we have attempted in this conspectus, with the inevitable result that the older genera established for a few species, which had become aggregates of many often quite diverse species, have been split up by us into smaller, but more coherent and logically definable groupings of species. This has been especially true of the genus *Tintinnus* and some related genera of the Tintinnidae. A somewhat similar clarification was previously accomplished for the genera *Amphorella*, *Xystonella*, and *Rhabdonella* by Jörgensen (1924), in which we have largely concurred.

The systematist is restricted in his treatment of the Tintinnoinea to the evidences of relationships derivable from the lorica, since the animal building it is rarely retained in the lorica in plankton collections, and, when found in preserved plankton, is rarely in a condition for satisfactory determination of structural features, or attached to the lorica to which it belongs. The lorica is the product of a stereotyped behavior of the ciliate occupant and records in rigid form both the nature of the parental secretion and the shaping and molding action of the organelles of the two schizonts at binary fission.

Our drawings of upwards of 3000 loricae lead us to the conclusion that the lorica as clearly reveals specific characters and as distinctly exhibits generic affiliations as does the exoskeleton of the Dinoflagellata or the internal skeleton of the Radiolaria. It affords a reliable index of relationship and a sound basis for classification. There are wide lacunae in our knowledge of the number of nuclei, number of membranelles, number and disposition of accessory structures in the membranelle zone, and of the number and arrangement of longitudinal lines of cilia on the body. These are so great, especially with regard to the eupelagic species, that the investigator of the oceanic plankton, in contrast to the one who works with neritic collections, is at present forced to rely upon the characters to be found in the lorica, composed of a secreted substance, molded into widely divergent patterns in different species and genera by the movements of the body, of the adoral membranelles, and of the ciliary lines on the body, in conjunction with the outpouring of the stored-up secretion. This secretion in certain species usually contains the skeletal remains, in the form of coccoliths of certain flagellates utilized as food by the ciliate.

The morphological features of the lorica of greatest diagnostic value are the finer structure of the wall with its lamellae, prismatic or alveolar structure, inclusions, and its tendency to accumulate adherent particles; the proportions of the loricae; the circumoral differentiations, including the oral rim, the collar, teeth or serrations, suboral band or rings; the proportions and outline of the bowl; the aboral structures including pedicel, knob, lance, apophyses, and other expansions; the form and proportions of aboral opening, when present; modifications of the surface of the bowl, such as annulations and horizontal angles, longitudinal striae, ridges, plicae, spiral shelf, angles and fluting, with reference to their number, spacing, distribution, direction, and anastomoses; and surface markings in the form of reticulations, fenestrae, coccoliths, and other skeletal inclusions.

Size is used with caution, as this seems to bear a correlation with temperature and to be subject to considerable variation within the range of distribution. In conjunction with structural differences, however, it is usually of value as a distinctive specific character. A large number of drawings were made for the specific purpose of representing the extreme range of variation in size and other details.

This conspectus includes all species which in our judgment are valid, with their synonymy, including bibliographic citations of the original description and figures, and later citations of literature of systematic or biological value; and the *nomina nuda*. Two hundred and seventy-six new species are diagnosed. Thirty-eight others are given new names. The new ones are mainly from the Eastern Tropical Pacific, with a few from Californian and Alaskan waters.

We have designated types for all of the 51 genera, including 23 new genera. As a rule the oldest species included in the genus has been designated as the type. Wherever this is not the case the grounds are given, as when the oldest species is an aberrant one, or is imperfectly known. The type locality of each new species is stated explicitly by station number in case of the species from the Expedition to the Eastern Tropical Pacific. The precise location of these stations will be found in Alexander Agassiz's Report (1906) of this expedition.

Every species in the Tintinnoinea is figured to the same scale of magnification. All the species of each genus are grouped together. The terminal bibliography includes only papers cited. A full bibliography will appear in our final monograph, in the Memoirs of the Museum of Comparative Zoology of Harvard University, the publication of which will be delayed for several years.

In our synonymies we have endeavored to allocate all published figures of the Tintinnoinea. Cases of doubtful allocation are queried by us thus [?]. All cases of the division by us of an author's figures of a genus, species, variety, or form, into two or more assignments, are designated by "*partim*" and our allocations cited. In those cases in which the text of an author is allocated, our distribution is usually based upon the figures of other authors included by him in his synonymy or on other textual evidence. We have endeavored further to clarify the all-too-often perplexing nomenclatural difficulties by also allocating the homonyms, and by double entries of both synonyms and homonyms.

Certain uniform bibliographical usages of nomenclatural significance have been followed by us. We place a comma after the specific name in those instances in which this name does not originate with the author quoted; for example, *Codonella lagenula*, Entz, Sr., indicates that *lagenula* was not proposed by Entz, Sr. We also place a comma after the specific name when the latter is "*partim*"; in case no comma follows the specific name, as *Codonella galea* Haeckel, 1873, we indicate that the name *galea* was first proposed by Haeckel at the stated date. A similar usage has been followed in the case of higher systematic categories.

We have adhered strictly to a binomial nomenclature. Our experience with the trinomial, quadrimomial, and even quinquenomial systems which emerged in the papers of Jörgensen (1899, 1900), and with the extensive use of combined generic and subgeneric names in Brandt's (1907) monograph has convinced us that their introduction leads only to perplexities, as other authors, and even the author himself, permutate these combinations.

In our treatment in the matter of the synonymy of the names used in the various subordinate categories below species, such as subspecies, variety, and form, we have regarded them all as subject *equally with species* to the rule of priority *within the genus in which they are used*. This applies to all such nomenclatural designations used as names in Latin form and in italics or equivalent. We have not treated "var. a, var. b," etc., as valid designations having nomenclatural status or claims to priority, since they are not names in the sense of the Code of Nomenclature, but have only a serial connotation.

We have therefore used subgenera sparingly and have excluded them from specific nomenclature by referring to the species only under the generic name. In like manner we have excluded all varietal and form names. This has led to our elevation to specific status of

many of the varieties and forms of other authors, or to their reduction to synonyms. It is by no means essential, in fact it is impossible, to regard species as in any sense equal to each other. If a group of individuals has sufficient structural distinctness from others in the genus to justify their setting apart from known species, it is far simpler and more convenient to designate them as a species, e.g., *elongata* or as "an elongate form," rather than as forma *elongata*.

When one attempts, as we have done, to prepare a conspectus of the entire group and to designate succinctly the differential characteristics of its constituent families, genera, and species, one comes in time to at least a better understanding of significant differences in structure, as over against the insignificant. The conclusions recorded in the conspectus are the results of numerous revisions and represent far more extensive material and more critical comparisons than can be presented in a conspectus such as this.

The families, subfamilies, and genera are arranged with reference to relationships, but the species are arranged in alphabetical order within the genus. Within the restricted limits of this paper it is not possible to discuss the grounds of groupings indicative of relationships in the several categories of classification. Such groupings and the discussions of the grounds upon which they rest will be presented in our final monograph.

The presentation in our treatise of figures of all species of the Tintinnoinea and references to the pertinent literature will, we hope, be useful to other workers in this very interesting group of Protozoa, and at the same time provide a definite basis for criticism and discussion of the results of our systematic analysis of these ciliates. Much still remains to be done with the neritic representatives of this group in many parts of the world.

This paper is published by permission of Dr. Thomas Barbour, Curator of the Museum of Comparative Zoology of Harvard University, and the Hon. H. O'Malley, United States Commissioner of Fisheries.

All citations of station numbers such as "Station 4709" without specification of the ship or expedition are those of the Agassiz Expedition to the Eastern Tropical Pacific of the U.S.S. "Albatross" in 1904-1905.

Acknowledgments are made for grants in aid to the Board of Research of the University of California, to Mrs. Elizabeth Heald Purington, who collaborated with the senior author in the earlier years of the project, and to Mrs. Dora Priaulx Henry, M.A., and Mrs. A. G. Marshall for aid in the task of coördinating and verifying citations.

## SYSTEM OF THE TINTINNOINEA

Phylum PROTOZOA Goldfuss (1818)

Subphylum CILIOPHORA Doflein (1909)

Class CILIATA Perty (1852)

Order HETEROTRICHIDA Stein (1867)

Suborder TINTINNOINEA subord. nov.

A. Family TINTINNIDIDAE fam. nov.

1. Genus *Tintinnidium* Kent
2. Genus *Leprotintinnus* Jörgensen

B. Family CODONELLIDAE Kent emended

3. Genus *Tintinnopsis* Stein emended Brandt emended Jörgensen
4. Genus *Codonella* Haeckel emended Brandt emended Jörgensen

C. Family CODONELLOPSIDAE fam. nov.

5. Genus *Stenosemella* Jörgensen
6. Genus *Codonellopsis* Jörgensen
7. Genus *Laackmanniella* gen. nov.

D. Family COXLIELLIDAE fam. nov.

8. Genus *Climacocyclus* Jörgensen
9. Genus *Coxliella* Brandt emended Laackmann emended Jörgensen
  - a. Subgenus *Coxliella* nom. nov.
  - b. Subgenus *Protocoxliella* Jörgensen
10. Genus *Helicostomella* Jörgensen emended

E. Family CYTTAROCYLIDAE fam. nov.

I. Subfamily CYTTAROCYLINAE subfam. nov.

11. Genus *Cyttarocyclus* Fol emended Laackmann emended Jörgensen

II. Subfamily FAVELLINAE subfam. nov.

12. Genus *Poroecus* Cleve emended
13. Genus *Protocymatocyclus* gen. nov.
14. Genus *Cymatocyclus* Laackmann emended
15. Genus *Favella* Jörgensen emended
16. Genus *Parafavella* gen. nov.

F. Family PTYCHOCYLIDAE fam. nov.

17. Genus *Epiocyclus* Jörgensen
  - a. Subgenus *Epicancella* subgen. nov.
  - b. Subgenus ~~*Epiocyclus*~~ subgen. nov.
18. Genus *Ptychocyclus* Brandt emended Jörgensen

## G. Family PETALOTRICHIDAE fam. nov.

## I. Subfamily CRATERELLINAE subfam. nov.

19. Genus *Acanthostomella* Jörgensen20. Genus *Craterella* gen. nov.

## II. Subfamily METACYLINAE subfam. nov.

21. Genus *Metacylis* Jörgensen

## III. Subfamily PETALOTRICHINAE subfam. nov.

22. Genus *Petalotricha* Kent emended Daday emended Brandt

## H. Family RHABDONELLIDAE fam. nov.

23. Genus *Protorhabdonella* Jörgensen24. Genus *Rhabdonella* Brandt emended Laackmann emended Jörgensen emended25. Genus *Rhabdonellopsis* gen. nov.

## I. Family XYSTONELLIDAE fam. nov.

26. Genus *Parundella* Jörgensen emended27. Genus *Xystonella* Brandt emended Laackmann emended Jörgensen28. Genus *Xystonellopsis* Jörgensen

## J. Family UNDELLIDAE fam. nov.

29. Genus *Amplectella* gen. nov.30. Genus *Amplectellopsis* gen. nov.31. Genus *Cricundella* gen. nov.32. Genus *Undella* Daday emended33. Genus *Undellopsis* gen. nov.a. Subgenus *Undellopsis* subgen. nov.b. Subgenus *Undellicricos* subgen. nov.34. Genus *Proplectella* gen. nov.

## K. Family DICTYOCYSTIDAE Haeckel emended

35. Genus *Dictyocysta* Ehrenberg emended

## L. Family TINTINNIDAE Claparède and Lachmann emended Claus emended

## I. Subfamily AMPHORELLINAE subfam. nov.

36. Genus *Bursaopsis* gen. nov.37. Genus *Canthariella* gen. nov.38. Genus *Amphorella* Daday emended Jörgensen emended39. Genus *Steenstrupiella* gen. nov.40. Genus *Amphorellopsis* gen. nov.41. Genus *Odontophorella* gen. nov.42. Genus *Albatrossiella* gen. nov.43. Genus *Dadayiella* gen. nov.

## II. Subfamily STELIDIELLINAE subfam. nov.

44. Genus *Ormosella* gen. nov.45. Genus *Brandtiella* gen. nov.46. Genus *Stelidiella* gen. nov.

## III. Subfamily TINTINNINEAE subfam. nov.

- 47. Genus **Tintinnus** Schrank emended Jörgensen emended
- 48. Genus **Daturella** gen. nov.
- 49. Genus **Salpingella** Jörgensen emended
  - a. Subgenus **Rhabdosella** subgen. nov.
  - b. Subgenus **Salpingella** subgen. nov.
- 50. Genus **Salpingacantha** gen. nov.
- 51. Genus **Epicranella** gen. nov.

## TINTINNOINEA suborder nov.

Tintinnodea Claparède and Lachmann, 1858, pp. 192-195.

Tintinnidae Claus, 1876, p. 178; Kofoid, 1905, p. 287; Doflein, 1909, p. 856; 1916, p. 1132; Poche, 1913, pp. 259, 284; Calkins, 1901, p. 208; 1926, pp. 408, 409; Jörgensen, 1924, p. 1; 1927, p. 1.

Tintinninae Delage and Hérouard, 1896, p. 467.

Tintinnoina Bütschli, 1889, pp. 1733-1734; Hickson, 1903, p. 409.

Tintinnodeen Brandt, 1907, pp. 9-14; Laackmann, 1909, p. 345.

Tintinnen Laackmann, 1909, p. 345.

Heterotricha with a conical or trumpet-shaped body, attached inside a lorica; with a leiotropic (from within) adoral zone of 16-22 membranelles and 4(?) or more lines of longitudinal cilia; lorica secreted, often incorporating coccoliths or other faecal residues, and sometimes agglomerating particles of the secreted substance; often separable into a flaring or cylindrical collar and a conical, globose, or variously ovoidal bowl; aboral region rounded, pointed, or differentiated into an aboral horn, pedicel, knob, and lance; closing apparatus formed from an inner membrane often present; wall of lorica often exhibiting structural evidences of annular or spiral formation; substance of the wall exhibiting a fine, uniform, primary alveolar structure, often with inner and outer lamellae, between which a secondary, coarser, patterned, prismatic structure may be developed with local differentiations in different parts of the lorica; with 1-4, usually 2, macronuclei and micronuclei (records of more nuclei require inspection to exclude meiotic or endomitotic nuclear multiplication and possibly also parasitic infections); generally free-swimming; from fresh water, brackish water, and the sea.

## Family TINTINNIDIDAE fam. nov.

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxiellidae, Cyttarocylidae, Ptychocylidae, Tintinnidae, Undellidae, and Xystonellidae).

Tintinnoinea with lorica usually tubular or diversely saccular in form; with or without suboral spiral structure but rarely with collar or other suboral differentiation; aboral end sometimes expanded, never with fins, either open or closed; wall with primary alveoli only, (in the main) soft and gelatinous, freely agglomerating particles of wall material and foreign bodies; 1-2 macronuclei and 16 membranelles. From fresh water, brackish water, and the sea.

Differs from all other families, in the main, in having only the fine primary structure in the wall and in the absence of highly developed, well separated lamellae in the lorica.

Includes two genera, *Leprotintinnus* Jörg. and *Tintinnidium* Kent.

**Tintinnidium** Kent

*Trichoda* O. F. Müller, 1776, p. 218.

*Tintinnus* Schrank, *partim*, 1803, p. 317 (see also *Tintinnus*); Ehrenberg, 1830, p. 61; Claparède and Lachmann, 1858, *partim*, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coxiella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocylis*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnopsis*, and *Tintinnus*); Sterki, 1879, pp. 460-465; Stein, 1867, pp. 151-154.

*Vaginicola* Lamarck, 1816, vol. 2, p. 27.

*Tintinnidium* Kent, 1882, pp. 604, 605, 611, 612; Bütschli, 1889, p. 1734; Delage and Hérourard, 1896, p. 466; Entz, Sr., 1896, p. 10; Entz, Jr., 1905, p. 205; Fauré-Fremiet, 1908, pp. 227, 236, 240, 245, 246; Jörgensen, 1924, p. 5.

*Nematopoda* Sand, 1897, pp. 85-99.

Tintinnididae with lorica generally elongated but highly irregular in form and soft in consistency; collar sometimes present; aboral end closed or with a minute opening; wall viscous and freely agglomerating foreign objects.

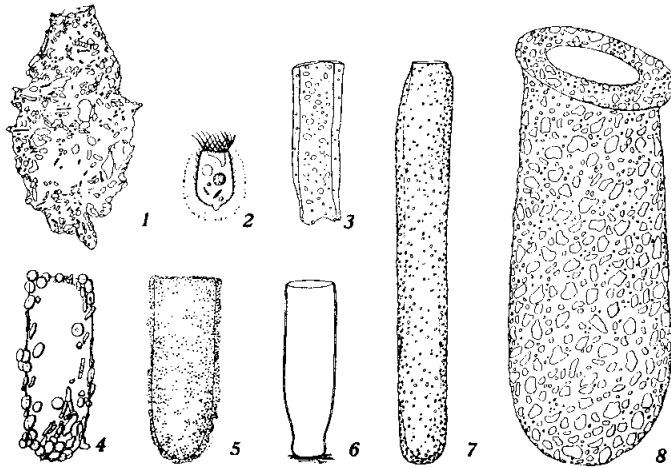
We designate as the type species *Tintinnidium mucicola* (Claparède and Lachmann) Daday from off Norway.

Differs from *Leprotintinnus* in the closed aboral end, or, if open, in the minute size of the opening.

Includes 9 species as follows:

fluviatile (Stein) Kent	neapolitanum Daday
incertum Bdt.	primitivum Busch
inquilinum (O. F. Müller) Fauré-Fremiet	pusillum Entz, Jr.
mucicola (Clap. and Lach.) Daday	ranunculi Penard
	semiciliatum (Sterki) Kent





Figs. 1-8. Species of *Tintinnidium* Kent.  $\times 200$ .

Fig. 1. *Tdm. mucicola* (Clap. and Lach.) Daday after Brandt (1906, pl. 70, fig. 8) from the Kiel Fiord.

Fig. 2. *Tdm. ranunculi* Penard after Penard (1922, p. 237, fig. 226) from ditch water near Pinchat, Switzerland.

Fig. 3. *Tdm. primitivum* Busch after Busch (1925, p. 185, fig. B) from the Java Sea.

Fig. 4. *Tdm. semiciliatum* (Sterki) Kent after Entz, Jr. (1905, pl. 5, fig. 3) from Lake Városliget, Hungary.

Fig. 5. *Tdm. fluviatile* (Stein) Kent after Entz, Jr. (1905, pl. 5, fig. 1) from Lake Lagymányos, Hungary.

Fig. 6. *Tdm. inquilinum* (O. F. Müller) Fauré-Fremiet after Fauré-Fremiet (1908, pl. 12, fig. 1) from off St. Jean de Luz on the coast of France.

Fig. 7. *Tdm. incertum* Bdt. after Brandt (1906, pl. 31, fig. 7) from Station Pl. 110 of the Plankton Expedition from the Gulf of Tocantins.

Fig. 8. *Tdm. neapolitanum* Daday after Daday (1887b, pl. 19, fig. 32) from the Bay of Naples.

### *Tintinnidium fluviatile* (Stein) Kent emended

#### Figure 5

*Trichoda inquilinus, partim*, O. F. Müller, 1776, appendix, p. 218; 1777, pp. 8-9, pl. 9, fig. 2, first and third to ninth figures; 1788, pp. 8-9, pl. 9, fig. 2, first and third to ninth figures (for fig. 2, second figure only on both plates see *Tdm. inquilinum*); Bruguière, 1791, p. 48, pl. 16, figs. 15-17 (for pl. 16, fig. 14 see *Tdm. inquilinum*).

*Vaginicola inquilina, partim*, Lamarck, 1816, vol. 2, p. 27; 1836, vol. 2, p. 27 (see *Tdm. inquilinum*).

*Tintinnus inquilinus, partim*, Schrank, 1803, vol. 3, pt. 2, p. 317 (see *Tdm. inquilinum*); Ehrenberg, 1834, pp. 273-274; 1838, p. 294 (for pl. 30, fig. II, 1-3 see *Tdm. inquilinum* and for pl. 30, fig. 11, 4, 5 see *Parafavella rotundata*); Oken, 1835, vol. 2, p. 35 (see also *Tdm. inquilinum*); Mereschkowsky, 1878, pp. 20-21; 1879, pp. 216, 245 (for pl. 1, fig. 12 and pl. 10, fig. 12 see *Tdm. inquilinum*, see also *Tintinnus apertus*, *T. tubulosus*, and *Parafavella rotundata*); Kent, 1882, pp. 604-605 (for pl. 31, fig. 15 see *Parafavella rotundata*, see also *Tintinnus*

*apertus*); Daday, 1887*b*, pp. 528-531 (for pl. 18, figs. 2, 10-13 see *Tintinnus apertus*, see also *T. tubulosus*, *Tdm. inquilinum*, *Parafavella rotundata*, and *Rhabdonella elegans*); Brandt, 1907, pp. 378, 468, 471 (see also *Tdm. inquilinum*, *Tintinnus apertus*, *T. tubulosus*, and *Parafavella rotundata*); Jörgensen, 1924, p. 12 (for figs. 7*a*, *b* see *Tintinnus apertus*, see also *Tintinnus tubulosus* and *Tdm. inquilinum*).

*Tintinnus* (no species), *partim*, Ehrenberg, 1830, p. 61, *fide* Ehrenberg, 1838, p. 294 (see *Tdm. inquilinum*).

*Tintynnus fluviatilis* Leuckart, 1864, p. 202. *Lapsus pennae*.

*Tintinnus fluviatile* Stein 1863, pp. 161-162; 1867, pp. 151-154.

*Tintinnidium fluviatile*, Kent, 1882, p. 611, pl. 31, fig. 8 (after Bolton); Entz, Sr., 1885, pp. 185-196, 211, pl. 13, figs. 1-9; Daday, 1887*b*, p. 523; Bütschli, 1889, p. 1734, pl. 69, fig. 10, pl. 70, figs. 1*a*-1*b*; Blochmann, 1895, p. 109, pl. 6, fig. 213; Delage and Hérouard, 1896, p. 466, fig. 789; Apstein, 1896, p. 154, fig. 595; Schönichen and Kalberlah, 1900, p. 382, pl. 13, fig. 3; Schönichen, 1909, p. 427, pl. 13, fig. 3; 1927, p. 226, pl. 13, fig. 3; Zykoff, 1903, pp. 35, 108, 118, fig. 16; Wesenberg-Lund, 1904, pp. 125, 127, 128, pl. 2, fig. 18, pl. 5, fig. 56, pl. 7, fig. 81; Entz, Jr., 1905, pp. 198-208, pl. 5, figs. 1, 2; 1909*a*, pp. 197-224, pl. 3, figs. 1, 2; Henderson, 1906, pp. 16-17, fig. 3; Francé, 1907, p. 24, fig. 7; Seligo, 1907, p. 71, fig. 118; 1908, pp. 41-42, fig. 150; Brandt, 1907, pp. 16-22, 439-440, 447, 465; Ward and Whipple, 1918, p. 286; fig. (no number [516]); Fauré-Fremiet, 1924, pp. 84-87, fig. 27; Lepsi, 1926*b*, pp. 79, 99, fig. 380.

*Tintinnopsis fluviatile*, Schweyer, 1909, p. 161.

A widely distributed fresh-water species, common in the San Joaquin River at Stockton, California, and in reservoirs in the vicinity of San Francisco. Also occurs widely in American and European lakes and reservoirs.

For a discussion of the synonymy of this species see that of *Tintinnidium inquilinum*.

### ***Tintinnidium incertum* Brandt**

Figure 7

*Tintinnidium incertum* Brandt, 1906, pp. 9, 20-21, pl. 31, figs. 6, 7; 1907, pp. 441-442, 468; Entz, Jr., 1908, p. 103.

### ***Tintinnidium inquilinum* (O. F. Müller) Fauré-Fremiet**

Figure 6

*Trichoda inquilinus*, *partim*, O. F. Müller, 1776, appendix, p. 218; 1777, pp. 8-9, pl. 9, fig. 2, second figure only; 1788, pp. 8-9, pl. 9, fig. 2, second figure only (for first and third to ninth figures on both plates see *Tdm. fluviatile*); Bruguière, 1791, p. 48, pl. 16, fig. 14 (for figs. 15-17 see *Tdm. fluviatile*).

*Vaginicola inquilina*, *partim*, Lamarck, 1816, vol. 2, p. 27; 1836, vol. 2, p. 27 (see also *Tdm. fluviatile*); *non* Dujardin, 1841, pp. 561-562, pl. 16 *bis*, fig. 5 (see *Tintinnus tubulosus*).

*Tintinnus* [no species], *partim*, Ehrenberg, 1830, p. 61, *fide* Ehrenberg, 1838, p. 294 (see *Tdm. fluviatile*).

*Tintinnus inquilinus*, Schrank, *partim*, 1803, vol. 3, pt. 2, p. 317 (see *Tdm. fluviatile*); Ehrenberg, *partim*, 1834, pp. 273-274; 1838, p. 294, pl. 30, fig. II,

1-3 (for pl. 30, fig. II, 4, 5 see *Parafavella rotundata* and *Tdm. fluviatile*); Oken, *partim*, 1835, vol. 2, p. 35 (see also *Tdm. fluviatile*); Pritchard, 1852, p. 546, pl. 5, fig. 255; 1861, p. 601; Mereschkowsky, *partim*, 1878, pp. 20-21, pl. 1, fig. 12; 1879, pp. 216, 245, pl. 10, fig. 12 (see also *Tdm. fluviatile*, *Tintinnus tubulosus*, *T. apertus*, and *Parafavella rotundata*; Daday, *partim*, 1887b, pp. 528-531 (for pl. 18, figs. 2, 10-13 see *T. apertus*, see also *T. tubulosus*, *Tdm. fluviatile*, *Parafavella rotundata*, and *Rhabdonella elegans*); Brandt, *partim*, 1907, pp. 378, 468, 471 (see also *Tdm. fluviatile*, *Tintinnus apertus*, *T. tubulosus*, and *Parafavella rotundata*); Jörgensen, *partim*, 1924, p. 12 (for figs. 7a, b see *Tintinnus apertus*, see also *Tdm. fluviatile* and *T. tubulosus*).

*Tintynnus inquilinus*, Leuckart, 1864, p. 202. *Lapsus pennae*.

*Tintinnidium marinum* Kent, 1882, p. 611, pl. 31, fig. 9; Lepsi, 1926b, pp. 78, 99, pl. 9, fig. 382.

*Nematopoda cylindrica* Sand, 1897, pp. 85-99, figs. a-f.

*Tintinnopsis inquilinus*, Entz, Jr., 1909b, p. 138.

*Tintinnidium inquilinum*, Fauré-Fremiet, 1908, pp. 225-251, figs. 1-11, pl. 12, figs. 1-4.

There has existed a long-continued confusion as to the content of this species and as to the various species which may have been included under this name by different investigators who have used it to designate ciliates referable to the Tintinnoinea, alike from fresh water, from brackish water, and from the sea; alike with a free-swimming and with an attached mode of life; with a lorica alike with an open, and with a closed aboral end; and alike with a hemispherical, a truncated, and a contracted aboral region. There has also been some confusion as to the generic assignment of the species *inquilinum* resulting from the confusion as to the structure of the aboral end. If the lorica is open aborally the species belongs in *Tintinnus*, if closed, in *Tintinnidium*. If both these conditions prevail within the one species this degree of variation would be anomalous in the Tintinnidae, and the distinction between the two genera dubious.

Fortunately no one has definitely designated the species *inquilinum* as the type of any genus and therefore its allocation by us in this revision does not disturb nomenclature elsewhere by resulting generic restrictions and shifts of species from long-standing allocations.

Decisions as to the applicability of the specific names can be made only on the basis of figures and published original observations on structure and habitat. On these bases we have arrived at the following conclusions in the light (often obscurity!) of the literature and of our present knowledge of the species involved. The species concerned are five, as follows: *Tintinnidium fluviatile*, a fresh-water species, best seen in the figures of Entz, Jr. (1905); *Tdm. inquilinum*, an attached marine species, with closed aboral end, best diagnosed

and figured by Fauré-Fremiet (1908); *Tintinnus tubulosus*, a pelagic marine species with open aboral end, described by Ostenfeld (1899); *Tintinnus apertus* sp. nov., an undescribed, pelagic, marine species, with open aboral end, often attached to pelagic diatoms, best figured by Daday, 1887*b*) and Famintzin (1889); and *Parafavella rotundata*, a marine, pelagic, yellowish species, with closed aboral end, described and figured by Jörgensen (1899) and Brandt (1906).

The following are the grounds for our allocations of figures and of synonyms among these five species. Müller's (1776, 1777, 1788) original species *Trichoda inquilinus* includes two species, *Tintinnidium fluviatile* and *Tdm. inquilinum*. The former is suggested by (1) the fresh-water habitat, (2) the rounded, closed, aboral end, and (3) the attached monads characteristic of at least some individuals of this species, as recorded in his figures. The latter by (1) the marine habitat, (2) the square aboral end (his fig. 2), and (3) the attachment to algae. The citations of Bruguière (1791), Schrank (1803), Lamarek (1816, 1824), Oken (1835), and Ehrenberg (1832, 1834, 1838), and others later, citing these authors or using their figures, as did Pritchard (1852, 1861), Kent (1882), and Brandt (1907), continue this confusion.

Dujardin's (1841) figures of *Vaginicola inquilina* have the morphology which conforms to *Tintinnus tubulosus* as later described by Ostenfeld (1899). This is shown in the proportions, open aboral end, and lack of aboral constriction. The fact that Dujardin reports their attachment to algae militates against this decision, but *Tintinnus lusus-undae* is also reported by Pavillard (1916) as attached to diatoms, and *T. apertus* is often so attached (Famintzin, 1889).

Claparède and Lachmann's (1858) figure presumably, and those of Daday (1887*b*), Famintzin (1889), Entz, Jr. (1908, 1909*b*), Schweyer (1909), and Jörgensen (1924, 1927) certainly, have the contracted, open, aboral end, quite unlike the closed end which characterizes the genus *Tintinnidium* and the loricae of tintinnids with the sessile as over against the pelagic habit of life.

To Fauré-Fremiet (1908) is due the credit of allocating the organism of the marine and brackish-water habitat, with the sessile habit and closed aboral end in the genus *Tintinnidium*, as *Tdm. inquilinum*. However, he still leaves a species of this same name in the genus *Tintinnus*, and suggests that Müller's species is either *Tintinnus subulatus* or *Cyttarocyllis gigantea*. With this latter allocation we are not in agreement nor does this allocation accord with the rules

of nomenclature. Kent's (1882) *Tintinnidium marinum* and Sand's (1897) *Nematopoda cylindrica* are straight renamings of *Tintinnidium inquilinum*. Fauré-Fremiet (1908) did not review the entire literature nor treat the data from the standpoint of synonymy, but he did give a full account with adequate figures of what we believe to be the marine species figured by Müller (1788) and later by Ehrenberg (1838, pl. 30, fig. II, 1-3) from Kiel on algae. This same species (*Tdm. inquilinum*) was later figured by Mereschkowsky (1878, 1879, figure too incomplete for certain allocation) and by Möbius (1887). Sand (1897) later redescribed it as *Nematopoda cylindrica*. The figures of Pritchard (1851) and Kent (1882) are not originals.

There seems to be considerable variation in the shape of the posterior end of the lorica in *Tdm. inquilinum* in these figures, but throughout the figures there are consistent indications that the species with the open aboral end is abruptly contracted above the aboral end at a distance from that end about equal to the diameter of the aboral opening.

Kent (1882) and Fauré-Fremiet (1908) have both called attention to the fact that the free-swimming tintinnid figured by Ehrenberg from Kiel (1838, fig. II, 1-3) differs from that from Copenhagen (1838, fig. II, 4, 5). The identification of these two groups of figures is fraught with difficulty. Kent (1882) was the first to note the differences. He accordingly divided Ehrenberg's material into two species, *Tintinnidium marinum* to which he assigned the smaller attached forms (his pl. 31, fig. 9) from Kiel, and *Tintinnus inquilinus* Müller to which he assigned the larger, yellow, free-swimming specimens (his pl. 31, fig. 15) of Ehrenberg's from Copenhagen. Those from Copenhagen belong neither to *Tintinnus* nor to *Tintinnidium* but are *Parafavella rotundata*. The specimens from Kiel in our opinion are *Tdm. inquilinum* Müller (1777). The grounds for this conclusion are: (1) the occurrence of *Parafavella rotundata* in Baltic waters; (2) the yellowish color; (3) the stalk attached to the bottom of the lorica as in *Parafavella*, and not lateral as in the free-swimming *Tintinnus* with an open aboral end (see Fauré-Fremiet, 1908); (4) the larger size; (5) the irregularities of surface, possibly suggesting prismatic structure; and (6) the somewhat angular aboral end. Kent's *Tintinnus inquilinus* is therefore a synonym of *Parafavella rotundata* and his *Tdm. marinum* is in the synonymy of *Tdm. inquilinum*.

These conclusions leave the tintinnid with open aboral end figured by Daday (1887b), Famintzin (1889), and others, but not that of

Dujardin (1841) referred by us to *Tintinnus tubulosus*, without specific designation. After the study of the literature and an abundance of material, we propose the name *Tintinnus apertus* sp. nov. for this species.

**Tintinnidium mucicola** (Claparède and Lachmann) Daday

Figure 1

*Tintinnus mucicola* Claparède and Lachmann, 1858, p. 209, pl. 8, fig. 12; Kent, 1882, p. 605, pl. 31, fig. 16.

*Tintinnidium mucicola*, Daday, 1887b, p. 524; Brandt, 1906, p. 33, pl. 70, figs. 8-10; 1907, pp. 439-442, 472; Lohmann, 1908, pp. 292-299, pl. 15; Rossolimo, 1922, pp. 29-33, pl. 2, fig. 27; Jörgensen, 1927, p. 16, fig. 31.

**Tintinnidium neapolitanum** Daday

Figure 8

*Tintinnidium neapolitanum* Daday, 1887a, pp. 171, 174, 190, pl. 2, fig. 10; 1887b, pp. 482, 484, 513, 522-524, 555, pl. 19, fig. 32; Brandt, 1907, pp. 11, 18, 22, 440, 441, 473; Entz, Jr., 1908, pp. 24, 103, 114; 1909b, pp. 114, 195, 200.

**Tintinnidium primitivum** Busch

Figure 3

*Tintinnidium primitivum* Busch, 1923, p. 71; 1925, pp. 183-190, figs. A-D; Campbell, 1926a, p. 214.

**Tintinnidium pusillum** Entz, Jr.

*Tintinnidium pusillum* Entz, Jr., 1909b, pp. 118, 131, 138, 160, 161, 164, 167, 173, 197, 200; Campbell, 1926a, p. 191.

A fresh-water species from near Budapest, Hungary.

**Tintinnidium ranunculi** Penard

Figure 2

*Tintinnidium ranunculi* Penard, 1922, pp. 236, 237, fig. 226, (1-5); Kahl, 1926, pp. 251-252, fig. 5a.

A fresh-water species from Lake Geneva, Switzerland.

**Tintinnidium semiciliatum** (Sterki) Kent

Figure 4

*Tintinnus semiciliatus* Sterki, 1879, pp. 460-465, figs. 1-5.

*Tintinnidium semiciliatum*, Kent, 1882, p. 612, pl. 31, figs. 6, 7; Stokes, 1884, pp. 102-104, figs. 1, 2 (on p. 102 as *Tdm. "conciliatum"*); Entz, Jr., 1905, pp. 198-208, pl. 5, fig. 3; 1909a, pp. 197-224, pl. 3, fig. 3; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 381.

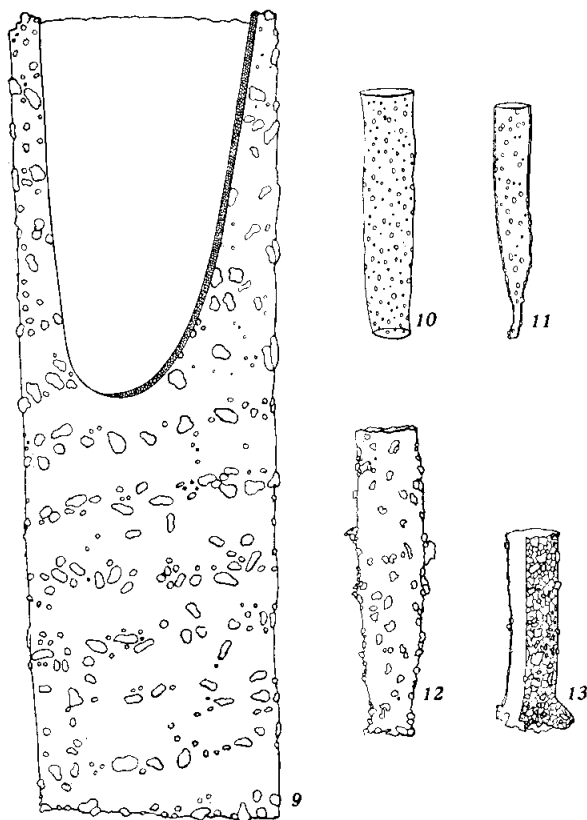
A fresh-water species from Schleithem, Switzerland and Trenton, New Jersey.

### Leprotintinnus Jörgensen

*Tintinnus*, Nordqvist, 1890, p. 126; Cleve, *partim*, 1899a, p. 24 (see also *Acanthostomella*); Campbell, 1926b, pp. 237-239.

*Leprotintinnus* Jörgensen, 1899, pp. 10-12; 1905, p. 14; 1912, p. 2; 1924, p. 65; 1927, pp. 4-5, 8; Laeckmann, *partim*, 1909, pp. 398-402 (see also *Codonellopsis* and *Laeckmanniella*).

*Tintinnopsis*, *partim*, Brandt, 1907, pp. 126-135 (see also *Tintinnopsis*).



Figs. 9-13. Species of *Leprotintinnus* Jörg. × 200.

Fig. 9. *L. ueriticus* (Campbell) after Campbell (1926b, p. 238, fig. 1) from San Francisco Bay, California.

Fig. 10. *L. simplex* Schmidt after Schmidt (1901, p. 184, fig. 1) from the Gulf of Siam.

Fig. 11. *L. bothnicus* (Nordqvist) Jörg. after Nordqvist (1890, pl. [1], fig. 5) from the Gulf of Bothnia.

Fig. 12. *L. pellucidus* (Cleve) Jörg. after Jörgensen (1905, pl. 18, fig. 114) from the Skjerstad Fiord.

Fig. 13. *L. nordqvisti* (Bdt.) after Brandt (1906, pl. 24, fig. 4) from off Borneo.

Tintinnididae with lorica elongated, tube-like, open at both ends; frequently, but not always with spiral structures as in *Coxliella* either for the whole or part of the length of the lorica; no collar; surface viscous, freely agglomerating foreign bodies; wall soft and coarsely alveolar.

We designate as the type species *Leprotintinnus pellucidus* (Cleve) Jörgensen from the North Atlantic, especially coastal waters, a typical and well-known species.

Differs from *Tintinnidium* in the widely open aboral end.

Includes five species as follows: *Leprotintinnus bottnicus* (Nordqvist) Jörg., *L. neriticus* (Campbell), *L. nordqvisti* (Bdt.), *L. pellucidus* (Cleve) Jörg., and *L. simplex* Schmidt.

### **Leprotintinnus bottnicus** (Nordqvist) Jörgensen

Figure 11

*Tintinnus bottnicus* Nordqvist, 1890, pp. 92, 97, 126, pl. [1], fig. 5; Brandt, 1896, p. 53, pl. 3, figs. 10, 11; Vanhöffen, 1897, pp. 271, 272, pl. 5, fig. 26; Meunier, 1910, p. 136, pl. 11, figs. 11, 12.

*Codonella bottnica*, Levander, 1894c, pp. 59, 89, pl. 3, fig. 7.

*Tintinnopsis bottnica*, Levander, 1901, pp. 8, 14, 15, 17, 19, 28, 33; Van Breckman, 1905, pp. 56-57, fig. 15; Brandt, 1906, p. 18, pl. 23, figs. 2, 2a, 6, 7, 16; 1907, pp. 171-172, 456; *non* Rossolimo, 1922, pp. 26, 33, pl. 2, fig. 10 (see *Tps. cylindrica*).

*Leprotintinnus bottnicus*, Jörgensen, 1912, p. 4.

### **Leprotintinnus neriticus** (Campbell)

Figure 9

*Tintinnus neriticus* Campbell, 1926b, pp. 237-239, fig. 1.

### **Leprotintinnus nordqvisti** (Brandt)

Figure 13

*Tintinnopsis nordqvisti* Brandt, 1906, p. 18, pl. 24, figs. 1-4; 1907, pp. 166-167, 444, 473.

### **Leprotintinnus pellucidus** (Cleve) Jörgensen

Figure 12

*Tintinnus pellucidus* Cleve, 1899a, p. 24, pl. 1, fig. 4; Meunier, 1910, pp. 134-135, pl. 11, figs. 1-10.

*Leprotintinnus pellucidus*, Jörgensen, 1901, pp. 18, 36; 1905, pp. 62, 68, 86, 142, pl. 18, fig. 114; 1912, p. 2; 1927, p. 8, fig. 8; Broch, 1910a, pp. 33-34, fig. 5 [a-e].

*Tintinnopsis pellucida*, Brandt, 1906, p. 18, pl. 23, figs. 8, 14, 15; 1907, pp. 172-174, 475; Merkle, 1909, pp. 156, 186, pl. 2, fig. 22; Ostefeld, 1910, p. 292, fig. 2.

*Leprotintinnus bottnicus*, Jörgensen, 1900, pp. 10-11, pl. 2, fig. 13.



**Leprotintinnus simplex** Schmidt

Figure 10

*Leprotintinnus simplex* Schmidt, 1901, p. 184, fig. 1; Entz, Jr., 1908, p. 101.  
*Tintinnus simplex*, Brandt, 1907, pp. 417, 478.

## Family CODONELLIDAE Kent emended

Codonelliden Haeckel, *partim*, 1873, pp. 564-565 (see also Codonellopsidae).

Codonellidae, *partim*, Kent, 1882, p. 615 (see also Codonellopsidae).

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellopsidae, Coxiellidae, Cyttaroeylidae, Ptychoeylidae, Tintinnidae, Tintinnididae, Undellidae, and Xystonellidae).

Tintinnoinea with lorica with or without a collar; bowl variously shaped, from globose to conical, or cylindrical; aboral end rounded, pointed, with or without an aboral horn; aboral end generally, but not in all species, closed; wall composed of minute primary alveoli and much coarser secondary structures, which are often irregular in distribution and uneven in size, and very often exhibit a distinctive pattern, with the inner and outer lamina feebly developed, if at all. Largely marine with a few brackish-water and fresh-water species.

Differs from the Codonellopsidae in the absence of hyaline structure in the collar; from the Tintinnididae in the presence of secondary structure in the wall; from the Cyttaroeylidae in the greater development of the collar, relative infrequency of teeth on the oral margin; from the Coxiellidae in the relatively greater absence of spiral structure; from the Petalotrichidae in the structure of the suboral region and the pattern of the wall; from the Ptychoeylidae in the absence of the external sculpturing of the aboral region; from the Rhabdonellidae in the absence of ribs; from the Xystonellidae in the presence of a large, well defined collar; from the Undellidae in the patterned wall and shape of the collar; from the Dictyocystidae in the absence of a fenestrated collar with large quadrangular fenestrae; and from the Tintinnidae in heavily patterned wall and the absence of striae and fins.

Includes two genera, *Tintinnopsis* Stein emended Brandt emended Jørgensen and *Codonella* Haeckel emended Brandt emended Jørgensen.

**Tintinnopsis** Stein emended Brandt emended Jörgensen

*Tintinnus*, Ehrenberg, *partim*, 1840 p. 201 (see also *Parafavella*); Claparède and Lachmann, *partim*, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coxiella*, *Favella*, *Parundella*, *Proplectella*, *Ptychoeylis*, *Salpingella*, *Stenstrupiella*, *Stenosemella*, *Tintinnidium*, and *Tintinnus*); Merschowsky, 1878, pp. 179-180; Hensen, 1887, p. 67; Dixon and Joly, 1898, pp. 748-749; Entz, Jr., 1908, pp. 433, 442; 1909b, p. 95.

*Diffugia*, Stein, 1867, p. 153.

*Tintinnopsis* Stein, 1867, p. 154; Kent, 1882, p. 617; Bütschli, 1889, pp. 1735-1736; Brandt, *partim*, 1907, pp. 126-135 (see also *Leprotintinnus*); Jörgensen, 1924, pp. 65-66.

*Codonella* Haeckel, *partim*, 1873, pp. 564-567 (see also *Codonella* and *Codonellopsis*); Fol, 1884, p. 60; Entz, Sr., 1884, pp. 412, 414-415; Daday, 1887b, pp. 568-569; Nordqvist, 1890, p. 126; Levander, 1894, p. 90.

*Cyttarocyliis*, Brandt, *partim*, 1907, pp. 181-188 (see also *Climacocyliis*, *Coxiella*, *Craterella*, *Cyttarocyliis*, *Favella*, *Parafavella*, *Porococcus*, *Xystonella*, and *Xystonellopsis*).

*Coniocyclus* Fol, 1881a, p. 21.

Codonellidae with lorica usually bowl-shaped, never with a narrow oral aperture; distinct aboral end closed or rarely with an irregular (broken?) aperture; sometimes with a posterior horn but more usually not; wall thin and homogeneous, or with a fine primary structure, with freely agglomerated "foreign" matter as well as bits of detritus, scattered abundantly on outer surface; spiral structure rare.

We designate as the type species *Tintinnopsis beroidea* Stein emended Jörg. from the Baltic Sea, an abundant neritic species and the oldest included in the genus.

This is a very difficult genus of many species practically all of which are either neritic, or fresh-water inhabitants. The characterization of the species of this genus is very difficult and as yet not satisfactory, largely because of the great irregularities in the loricae due to agglomeration, which obscures the underlying structure apparent in most other genera.

Differs from *Codonella* in less regular pattern of the secondary structure of the wall and in the lack of a nuchal groove or an inner nuchal shelf.

Includes 85 species as follows:

<i>acuminata</i> Daday	<i>beroidea</i> Stein
<i>amphora</i> nom. nov.	<i>bornandi</i> (Daday)
<i>angulata</i> Daday	<i>brandti</i> (Nordqvist) Levander
<i>angusta</i> Meunier	<i>brasiliensis</i> sp. nov.
<i>annulata</i> (Clap. and Lach.) Bdt.	<i>bütschlii</i> Daday
<i>aperta</i> Bdt.	<i>campanula</i> (Ehrbg.) Daday
<i>baltica</i> Bdt.	<i>capulus</i> Bdt.
<i>bermudensis</i> Bdt.	<i>chyzeri</i> Daday

eineta (Clap. and Lach.) Daday	nitida Bdt.
cochleata (Bdt.) Laack.	nucula (Fol) Bdt.
compressa Daday	orientalis sp. nov.
coronata nom. nov.	ovalis Daday.
eyathus Daday	pallida Bdt.
cylindrata nom. nov.	panamensis sp. nov.
cylindrica Daday	parva Merkle
dadayi Kofoid	parvula Jörg.
denticulata sp. nov.	patula Meunier
ecaudata sp. nov.	pistillum sp. nov.
elongata Daday	plagiostoma Daday
entzii Daday	platensis Cunha and Fonseca
evarta nom. nov.	prowazeki Faria and Cunha
fennica sp. nov.	radix (Imhof) Bdt.
fimbriata Meunier	rapa Meunier
fusiformis Daday	reflexa Kofoid
gracilis sp. nov.	rotundata Jörg.
illinoisensis Hempel	sacculus Bdt.
incurvata Meunier	schotti Bdt.
infundibulum Daday	sinuata Bdt.
karajacensis Bdt.	spiralis nom. nov.
lata Meunier	strigosa Meunier
levigata nom. nov.	subacuta Jörg.
lindeni Daday	toeantinensis sp. nov.
lobianei Daday	tubulosa Levander
loricata Bdt.	tubulosoides Meunier
maculosa Mansfeld	turbo Meunier
magna Merkle	turgida sp. nov.
major Meunier	undella Meunier
mayeri Daday	urniger (Entz, Sr.) Daday
meunieri nom. nov.	urnula Meunier
minuta Wailes	vaseculum Meunier
mortensenii Schmidt	vosmaeri Daday
muletrella sp. nov.	wailesi sp. nov.
nana Lohmann	

### **Tintinnopsis acuminata** Daday

Figure 43

*Tintinnopsis beroidea* var. *acuminata*, *partim*, Daday, 1887*b*, p. 547, pl. 19, fig. 29 (for pl. 19, figs. 4, 5 see *Tps. beroidea*).

*Tintinnopsis karajacensis* var. *acuta* Paulsen, 1904, p. 24, fig. 12.

*Tintinnopsis beroidea* var. *b* Brandt, 1906, pp. 16, 17, pl. 16, fig. 15, pl. 19, fig. 22; 1907, p. 133; Laackmann, 1913, pp. 12, 13, pl. 1, fig. 8.

*Tintinnopsis beroidea* var. *compressa* Fauré-Fremiet, 1908, pp. 212, 234, 236, fig. 20; *non* Daday, 1887*b*, pl. 19, figs. 7-9, 28 (see *Tps. compressa*).

*Tintinnopsis beroidea* var. *angustior* Jörgensen, 1924, pp. 67, 68, fig. 73.

*Tintinnus minimus* Entz, Jr., 1908, pp. 39, 105, 114, 120, pl. 2, fig. 4; 1909*b*, p. 133, pl. 9, fig. 4.

Raised to status of species.

Lorica bullet-shaped, 3 oral diameters in length; oral rim ragged; no collar; cylindrical below; aboral region conical ( $70^\circ$ ); aboral end blunt; wall without spiral structure, with sparse agglomerations. Length  $54\mu$ .

The type locality is off Barcelona, Spain.

Differs from *Tps. beroidea* in more slender bowl.

### **Tintinnopsis amphora** nom. nov.

Figure 36

*Tintinnopsis lobiancoi* var. *fusiformis* Brandt, 1906, p. 17, pl. 20, figs. 13, 14, pl. 21, fig. 3; 1907, pp. 161, 466.

Non *Tintinnopsis fusiformis* Daday, 1892, pp. 172, 173, 175, 194, 198, 201-202, pl. 1, fig. 11 (see *Tps. fusiformis*).

Non *Tintinnopsis cylindrica* var. *fusiformis*, Entz, Jr., 1909a, pp. 204-207 (see *Tps. fusiformis*).

*Tintinnopsis Lobiancoi*, *partim*, Entz, Jr., 1908, pp. 69, 104, 107, 113, 126, pl. 2, fig. 12; 1909b, pp. 129, 195, 199, 215, 216, 225, pl. 9, fig. 12 (for 1908, pl. 2, fig. 2, pl. 5, fig. 4 and for 1909b, pl. 9, fig. 2, pl. 12, fig. 4 and pl. 21, fig. 6 see *Tps. lobiancoi*).

Lorica asymmetrically fusiform, elongated ovoidal, larger aboral end; 5-6 oral diameters in length; oral rim entire; oral  $0.50-0.75$  of total length convex conical ( $25^\circ$ ); aboral region ovoidal; aboral end broadly rounded; wall laid up of irregular platelets of alveolar material with foreign inclusions. Length  $130-160\mu$ .

The type locality is Kaiser Wilhelm Canal, Germany.

Differs from all other species of the genus in the prolonged taper of the oral half or more of the lorica.

### **Tintinnopsis angulata** Daday

Figure 81

*Tintinnopsis angulata* Daday, 1887b, p. 561, pl. 20, fig. 22; Brandt, 1907, p. 180; Laackmann, 1913, pp. 26-28, pl. 4, figs. 48-53; Jørgensen, 1924, pp. 67, 70, 71, 107, figs. 78, 79.

*Tintinnus angulatus*, Entz, Jr., 1908, p. 105.

*Tintinnopsis angulata* var. a Brandt, 1906, p. 19, pl. 26, figs. 1, 2; 1907, pp. 180, 454.

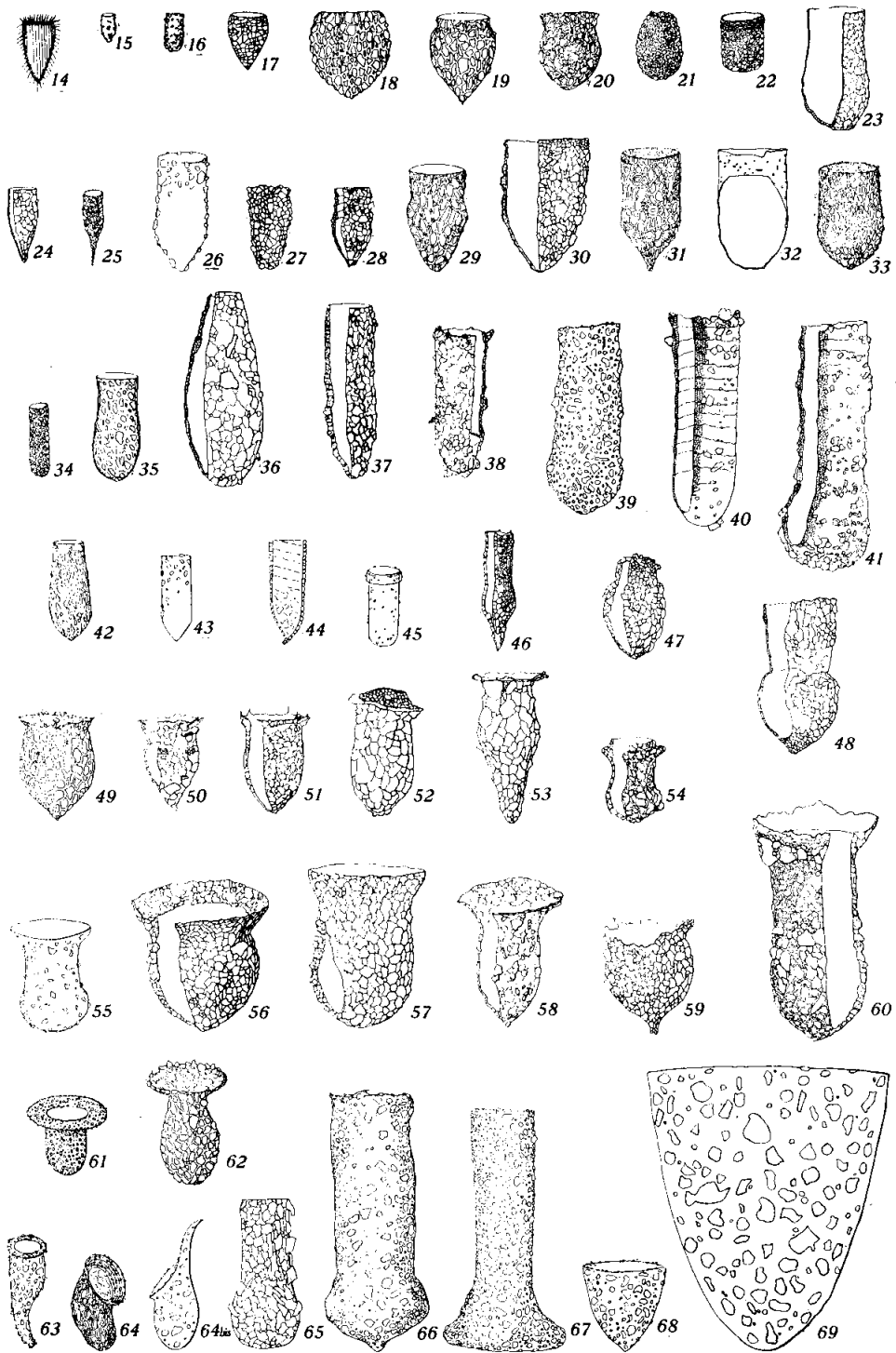
*Tintinnopsis lindeni*, Schmidt, 1901, p. 186.

### **Tintinnopsis angusta** Meunier

Figure 42

*Tintinnopsis angusta* Meunier, 1910, p. 141, pl. 12, figs. 23, 24.





Figs. 14-69; 70-97. Species of *Tintinnopsis* Stein emended Brandt emended Jørgensen.  $\times 200$ .

Figs. 14-69; 70-97. Species of *Tintinnopsis* Stein emended Brandt emended Jörgensen.  $\times 200$ .

Fig. 14. *Tps. maculosa* Mansfeld after Mansfeld (1923, p. 118, fig. 10) from cultures at Berlin of sludge from the Adriatic at Rovigno [?].

Fig. 15. *Tps. nana* Lohmann after Lohmann (1908, pl. 17, fig. 12) from the Bay of Kiel.

Fig. 16. *Tps. minuta* Wailes after Wailes (1925, pl. 2, fig. 7) from the Strait of Georgia, British Columbia.

Fig. 17. *Tps. parva* Merkle after Merkle (1909, pl. 2, fig. 9) from the Cattegat.

Fig. 18. *Tps. major* Meunier after Meunier (1910, pl. 12, fig. 1) from off Tromsø, Norway.

Fig. 19. *Tps. turbo* Meunier after Meunier (1919, pl. 22, fig. 27) from the Flemish Sea.

Fig. 20. *Tps. urnula* Meunier after Meunier (1910, pl. 13, fig. 24) from the Kara Sea.

Fig. 21. *Tps. ovalis* Daday after Daday (1892, pl. 1, fig. 9) from the Mesö-Záh Pond, Hungary.

Fig. 22. *Tps. entzii* Daday after Daday (1892, pl. 1, fig. 8) from the Mesö-Záh Pond, Hungary.

Fig. 23. *Tps. pallida* Bdt. after Brandt (1906, pl. 19, fig. 15) from Station Pl. 33 of the Plankton Expedition off the Bermudas.

Fig. 24. *Tps. rapa* Meunier after Brandt (1906, pl. 16, fig. 6) from Station N931 "Princesse Alice" off the coast of Norway.

Fig. 25. *Tps. fusiformis* Daday after Daday (1892, pl. 1, fig. 11) from the Mesö-Záh Pond, Hungary.

Fig. 26. *Tps. beroidica* Stein emended Entz, Sr. emended Jörg. after Jörgensen (1924, p. 67, fig. 72a) from off Barcelona, Spain.

Fig. 27. *Tps. illinoisensis* Hempel after Hempel (1896, pl. 26, fig. 14) from the Illinois River.

Fig. 28. *Tps. parvula* Jörg. after Brandt (1906, pl. 16, fig. 5) from Kiel Fiord.

Fig. 29. *Tps. vasculum* Meunier after Meunier (1919, pl. 22, fig. 25) from the Flemish Sea.

Fig. 30. *Tps. brasiliensis* sp. nov. after Brandt (1906, pl. 16, fig. 8) from Station Pl. 110 of the Plankton Expedition off the mouth of the Tocantins River.

Fig. 31. *Tps. strigosa* Meunier after Meunier (1919, pl. 22, fig. 26) from the Flemish Sea.

Fig. 32. *Tps. sacculus* Bdt. after Brandt (1906, pl. 19, fig. 13) from Karajak Fiord, North Greenland.

Fig. 33. *Tps. lata* Meunier after Meunier (1910, pl. 12, fig. 20) from the Kara Sea.

Fig. 34. *Tps. cylindrata* nom. nov. after Daday (1892, pl. 1, fig. 10) from Mezö-Záh Pond, Hungary.

Fig. 35. *Tps. undella* Meunier after Meunier (1910, pl. 13, fig. 28) from the Kara Sea.

Fig. 36. *Tps. amphora* nom. nov. after Brandt (1906, pl. 21, fig. 3) from Kaiser Wilhelm Canal.

Fig. 37. *Tps. gracilis* sp. nov. after Brandt (1906, pl. 19, fig. 1) from off Borneo.

Fig. 38. *Tps. karajaensis* Bdt. after Brandt (1906, pl. 19, fig. 5) from Davis Strait.

Fig. 39. *Tps. tubulosa* Levander emended after Levander (1900a, pl. 18, fig. 4) from the Gulf of Finland.

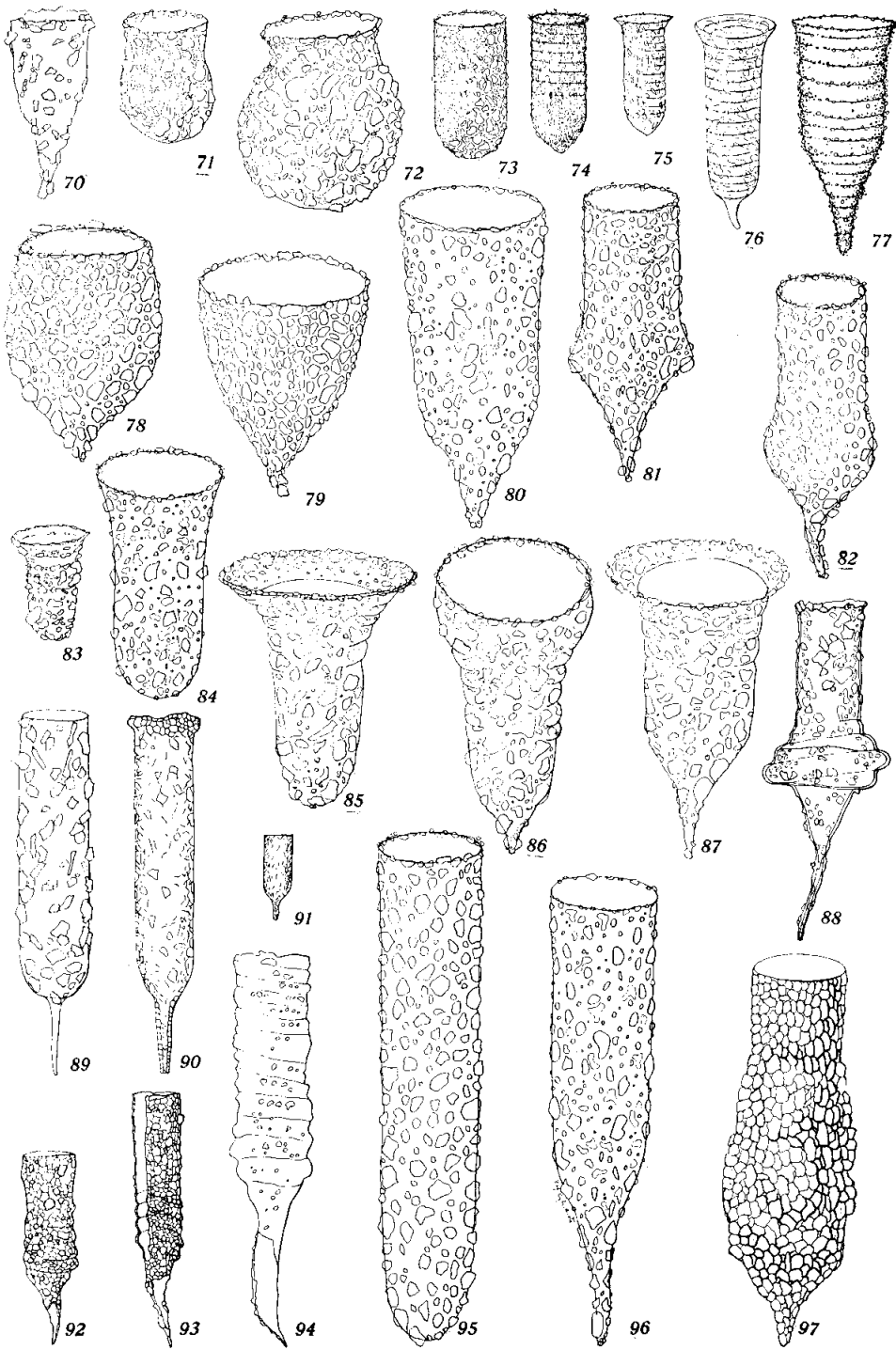
Fig. 40. *Tps. cochleata* (Bdt.) Laackmann emended after Brandt (1906, pl. 33, fig. 1) from Kaiser Wilhelm Canal.

Fig. 41. *Tps. pistillum* sp. nov. after Brandt (1906, pl. 33, fig. 2) from the Kiel Fiord.

Fig. 42. *Tps. angusta* Meunier after Meunier (1910, pl. 12, fig. 24) from north of Barents Sea.

Figs. 14-69; 70-97. Species of *Tintinnopsis* Stein emended Brandt emended Jörgensen. × 200. (Continued.)

- + Fig. 43. *Tps. acuminata* Daday after Jörgensen (1924, p. 67, fig. 73) from off Barcelona, Spain.
- Fig. 44. *Tps. wailesi* sp. nov. after Wailes (1925, pl. 1, fig. 32) from the Strait of Georgia, British Columbia.
- Fig. 45. *Tps. reflexa* Kofoid after Kofoid (1905, pl. 26, fig. 2) from the California Current off San Diego.
- Fig. 46. *Tps. tocantinensis* sp. nov. after Brandt (1906, pl. 25, fig. 7) from Station Pl. 108 of the Plankton Expedition off the mouth of the Tocantins River.
- Fig. 47. *Tps. nucula* (Fol) Bdt. after Brandt (1906, pl. 16, fig. 10) from Kiel Fiord.
- Fig. 48. *Tps. bermudensis* Bdt. after Brandt (1906, pl. 12, fig. 3) from Station Pl. 33 of the Plankton Expedition off the Bermudas.
- Fig. 49. *Tps. fimbriata* Meunier after Meunier (1919, pl. 22, fig. 39) from brackish water in the Nieuwendamme, Belgium.
- Fig. 50. *Tps. baltica* Bdt. after Brandt (1906, pl. 15, fig. 6) from the Bay of Kiel.
- Fig. 51. *Tps. denticulata* sp. nov. after Brandt (1906, pl. 15, fig. 13) from Station Pl. 108 of the Plankton Expedition off the mouth of the Tocantins River.
- Fig. 52. *Tps. nitida* Bdt. after Brandt (1896, pl. 3, fig. 1) from Karajak Fiord, North Greenland.
- Fig. 53. *Tps. sinuata* Bdt. after Brandt (1906, pl. 15, fig. 3) from Karajak Fiord, North Greenland.
- Fig. 54. *Tps. capulus* Bdt. after Brandt (1906, pl. 15, fig. 14) from Station Pl. 108 of the Plankton Expedition off the mouth of the Tocantins River.
- Fig. 55. *Tps. dadayi* Kofoid after Kofoid (1905, pl. 26, fig. 3) from the California Current off San Diego.
- Fig. 56. *Tps. schotti* Bdt. after Brandt (1906, pl. 22, fig. 2) from off Borneo.
- Fig. 57. *Tps. orientalis* sp. nov. after Brandt (1906, pl. 18, fig. 9) from off Bombay in the Arabian Sea.
- Fig. 58. *Tps. caudata* sp. nov. after Brandt (1906, pl. 19, fig. 18) from Station 931 "Princesse Alice" off the coast of Norway.
- Fig. 59. *Tps. meunieri* nom. nov. after Brandt (1906, pl. 17, fig. 7) from the Kaiser Wilhelm Canal.
- Fig. 60. *Tps. loricata* Bdt. after Brandt (1906, pl. 19, fig. 4) from off Borneo.
- Fig. 61. *Tps. mortensenii* Schmidt after Schmidt (1901, p. 186, fig. 3) from the Gulf of Siam.
- Fig. 62. *Tps. patula* Meunier after Meunier (1910, pl. 13, fig. 19) from north of Barents Sea.
- Fig. 63. *Tps. chyzeri* Daday after Daday (1887b, pl. 20, fig. 1) from the Bay of Naples.
- Fig. 64. *Tps. incurvata* Meunier after Meunier (1910, pl. 13, fig. 29) from the Barents or Kara Sea.
- Fig. 64 bis. *Tps. muletrella* sp. nov. after Entz, Sr. (1885b, pl. 14, fig. 17) from *Salpa* in the Bay of Naples.
- Fig. 65. *Tps. turgida* sp. nov. after Brandt (1906, pl. 19, fig. 20) from off Borneo.
- Fig. 66. *Tps. subacuta* Jörg. after Nordqvist (1890, pl. [1], fig. 4) from the Gulf of Bothnia.
- Fig. 67. *Tps. brandti* (Nordqvist) Levander after Nordqvist (1890, pl. [1], fig. 2) from the waters of Finland between Högsar and Vänö.
- Fig. 68. *Tps. plagiostoma* Daday after Entz, Sr. (1884, pl. 24, fig. 1) from the Bay of Naples.
- Fig. 69. *Tps. magna* Merkle after Merkle (1909, pl. 2, fig. 1) from the Stavanger Fiord, Norway.



Figs. 70-97. Species of *Tintinnopsis* Stein emended Brandt emended Jørgensen.  $\times 200$ . (Concluded.)



Figs. 14-69; 70-97. Species of *Tintinnopsis* Stein emended Brandt emended Jørgensen.  $\times 200$ . (Concluded.)

Fig. 70. *Tps. fennica* sp. nov. after Brandt (1906, pl. 30, fig. 7) from the Gulf of Bothnia.

Fig. 71. *Tps. compressa* Daday after Daday (1887b, pl. 19, fig. 8) from the Bay of Naples.

Fig. 72. *Tps. bornandi* (Daday) Bdt. after Daday (1887b, pl. 19, fig. 22) from the Bay of Naples.

Fig. 73. *Tps. rotundata* Jörg. after Daday (1887b, pl. 19, fig. 14) from the Bay of Naples.

Fig. 74. *Tps. tubulosoides* Meunier after Meunier (1910, pl. 12, fig. 10) from the Barents Sea.

Fig. 75. *Tps. spiralis* nom. nov. after Meunier (1910, pl. 12, fig. 12) from the Barents Sea.

Fig. 76. *Tps. cineta* (Clap. and Lach.) Daday after Claparède and Lachmann (1858, pl. 8, fig. 13) from off the Norwegian coast near Glesnacsholm.

Fig. 77. *Tps. wuiger* (Entz, Sr.) Daday after Entz, Sr. (1884, pl. 24, fig. 23) from the Bay of Naples.

Fig. 78. *Tps. mayeri* Daday after Daday (1887b, pl. 19, fig. 20) from the Bay of Naples.

Fig. 79. *Tps. vosmaeri* Daday after Daday (1887b, pl. 19, fig. 10) from the Bay of Naples.

Fig. 80. *Tps. elongata* Daday emended after Daday (1887b, pl. 19, fig. 15) from the Bay of Naples.

Fig. 81. *Tps. angulata* Daday after Daday (1887b, pl. 20, fig. 22) from the Bay of Naples.

Fig. 82. *Tps. lindeni* Daday after Daday (1887b, pl. 20, fig. 23) from the Bay of Naples.

Fig. 83. *Tps. everta* nom. nov. after Laackmann (1906, pl. 1, fig. 9) from the Bay of Kiel.

Fig. 84. *Tps. cyathus* Daday after Daday (1887b, pl. 20, fig. 2) from the Bay of Naples.

Fig. 85. *Tps. bütschlii* Daday after Daday (1887b, pl. 20, fig. 5) from the Bay of Naples.

Fig. 86. *Tps. infundibulum* Daday after Daday (1887b, pl. 20, fig. 17) from the Bay of Naples.

Fig. 87. *Tps. campanula* (Ehrbg.) Daday after Daday (1887b, pl. 20, fig. 9) from the Bay of Naples.

Fig. 88. *Tps. prwaczeki* Faria and Cunha after Faria and Cunha (1917, pl. 26, fig. 1) from the Bay of Rio de Janeiro.

Fig. 89. *Tps. platensis* Cunha and Fonseca after Cunha and Fonseca (1917, p. 141, fig. [1]) from the South Atlantic near the Gulf of La Plata.

Fig. 90. *Tps. coronata* nom. nov. after Wailes (1925, pl. 2, fig. 3) from the Strait of Georgia, British Columbia. Possibly an exconjugant.

Fig. 91. *Tps. levigata* nom. nov. after Wailes (1925, pl. 2, fig. 4) from the Strait of Georgia, British Columbia.

Fig. 92. *Tps. aperta* Bdt. after Brandt (1906, pl. 25, fig. 11) from off Monrovia, Liberia.

Fig. 93. *Tps. radix* (Imhof) Bdt. after Brandt (1906, pl. 23, fig. 9) from off Bagamojo, Zanzibar.

Fig. 94. *Tps. panamensis* sp. nov. from the Bay of Panama.

Fig. 95. *Tps. lobiancoi* Daday after Daday (1887b, pl. 19, fig. 27) from the Bay of Naples.

Fig. 96. *Tps. cylindrica* Daday after Daday (1887b, pl. 19, fig. 24) from the Bay of Naples.

Fig. 97. *Tps. annulata* (Clap. and Lach.) Bdt. after Claparède and Lachmann (1858, pl. 9, fig. 2) from the Christiania Fiord near Valløe.

**Tintinnopsis annulata** (Claparède and Lachmann) Brandt

## Figure 97

*Tintinnus annulatus* Claparède and Lachmann, 1858, p. 207, pl. 9, fig. 2; Kent, 1882, p. 609, pl. 31, fig. 25; Brandt, 1907, pp. 9, 102, 127, 169, 176, 454.

*Coniocyclus annulata*, Fol, 1881a, p. 22.

*Tintinnopsis annulata*, *partim*, Brandt, 1907, pp. 169, 454 (see *Tps. cincta*); *non* Daday, 1887b, p. 550, pl. 19, fig. 17 (see *Tps. cincta*); *non* Entz, Jr., 1908, pp. 103, 113, 123, pl. 1, fig. 4; 1909b, pp. 198, 199, 214, pl. 8, fig. 4 (see *Tps. urniger*).

*Non Codonella annulata* Daday, 1886, p. 496, pl. 25, fig. 15 (see *Coxiella helix*).

*Non Codonella annulata* Clap. and Lach., Daday, 1887a, pp. 159-208, pl. 1, fig. 4; 1887b, pp. 571-572, pl. 20, fig. 21 (see *Codonellopsis orthoceras*).

Doubtfully recognizable and possibly only an aberrant form of *Tps. subacuta* Jörgensen.

**Tintinnopsis aperta** Brandt

## Figure 92

*Tintinnopsis aperta* Brandt, 1906, pp. 4, 19, pl. 25, figs. 9-12; 1907, pp. 26, 27, 42, 129, 130, 133, 176-177, 444, 454; Okamura, 1907, p. 137, pl. 6, fig. 58; Jörgensen, 1924, pp. 7, 69, 70, 76.

*Tintinnopsis tubulosa*, *partim*, Brandt, 1906, p. 19, pl. 24, fig. 13 (for pl. 24, figs. 8, 10 see *Tps. tubulosoides*, and for pl. 24, figs. 5, 6, 11, 12, 14, 15 see *Tps. subacuta*); 1907, pp. 167-171, 444, 481 (see *Tps. subacuta*, *Tps. tubulosa*, and *Tps. tubulosoides*).

**Tintinnopsis baltica** Brandt

## Figure 50

*Diffugia* sp. Stein, 1867, p. 153.

*Codonella orthoceras*, Möbius, 1887, pp. 119-120, pl. 8, fig. 33.

*Tintinnopsis baltica* Brandt, 1896, pp. 55, 56, 65, 70; 1906, pp. 15, 16, pl. 15, figs. 6, 8, 9, 15, pl. 16, fig. 4; 1907, pp. 141-144, 455; Rossolimo, 1922, pp. 24, 33, pl. 2, fig. 3; Jörgensen, 1927, p. 16, fig. 31.

*Non Tintinnopsis baltica* var. *rotundata* Laackmann, 1906, p. 20, pl. 1, fig. 9 (see *Tps. everta*).

*Leprotintinnus balticus*, Bull. Plank., 1912, table 2.

*Ptychocyclus baltica*, Busch, 1920, p. 756.

[?] *Tintinnopsis tubulosa* forma *minor* Leegaard, 1920, pp. 28-29, figs. 27b, 28c.

**Tintinnopsis bermudensis** Brandt

## Figure 48

*Tintinnopsis bermudensis* Brandt, 1906, pp. 3-4, 14, 15, pl. 12, figs. 3-5; 1907, pp. 29, 38, 42, 126, 129, 130, 133, 143-144, 259, 455.

*Tintinnopsis bermudensis* var. *a* Brandt, 1906, pp. 14, 15, pl. 12, fig. 6, pl. 13, figs. 7-8; 1907, pp. 19, 129, 144, 455.

*Tintinnopsis bermudensis* var. *b* Entz, Jr., 1908, p. 103. *Nomen nudum*.

**Tintinnopsis beroidea** Stein emended Entz, Sr., emended Jörgensen

Figure 26

*Tintinnopsis beroidea* Stein, 1867, pp. 154-155; Bütschli, 1889, pp. 1735-1736, pl. 69, fig. 9, pl. 70, figs. 2, 2a; non Daday, 1887a, pp. 116, 183-185, pl. 2, fig. 9; 1887b, p. 547, pl. 19, figs. 2, 14 (see *Tps. rotundata*); non Brandt, 1896, pp. 56-57, pl. 3, fig. 4; 1906, p. 16, pl. 16, figs. 5, 7, 11 (see *Tps. parvula*); 1907, *partim*, pp. 135-138, 445, 447, 452, 455, 460, 476, 478 (see *Tps. parvula* and *Tps. plagiostoma*); Jörgensen, 1899, pp. 5, 23-24, 42, pl. 1, fig. 5; 1924, pp. 66-68, 100, 107, figs. 72a, b; 1927, p. 7, fig. 5; non Levander, 1900, p. 18, figs. 2, 3 (see *Tps. parvula*); non Laackmann, 1906, pp. 20-36, pl. 1, figs. 6-8, pl. 3, figs. 51, 52 (see *Tps. parvula*); Wright, 1907, pp. 11, 18, pl. 4, fig. 13; Fauré-Fremiet, 1908, p. 234, fig. 19; non Lohmann, 1911, p. 39, pl. 1, fig. 5 (see *Tps. parvula*); Entz, Jr., *partim*, 1908, pp. 10-135, pl. 1, fig. 11, pl. 13, figs. 27, 45; 1909b, pp. 99-216, pl. 8, fig. 11, pl. 20, figs. 27, 45, pl. 21, fig. 8 (for 1908, pl. 1, fig. 12, pl. 3, fig. 2, and 1909b, pl. 8, fig. 12, pl. 10, fig. 2 see *Tps. rotundata*); Merkle, 1909, pp. 334, 346, pl. 2, fig. 30; Meunier, 1910, p. 140, pl. 12, figs. 14-18; 1919, p. 27, pl. 22, figs. 28-30; Lecgaard, 1920, p. 27, fig. 26; non Rossolimo, 1922, pp. 23, 33, pl. 2, fig. 2, (see *Tps. parvula*); 1927, pp. 65, 74-75, fig. 1 last fifteen loricae (for first five loricae see *Tps. parvula*); non Wailes, 1925, p. 535, pl. 1, figs. 17-21 (see *Tps. parvula*); Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 383.

*Tintinnopsis*, Delage and Hérouard, 1896, p. 466, fig. 787.

*Tintinnopsis beroidea* var. b Brandt, 1906, p. 17, pl. 19, fig. 22 (for pl. 16, fig. 15 see *Tps. parvula*).

*Codonella beroidea*, *partim*, Entz, Sr., 1884, pp. 296, 411-412, pl. 24, figs. 2-9 (for pl. 24, fig. 1 see *Tps. plagiostoma*); non 1885b, p. 204, pl. 14, figs. 16, 17 (see *Tps. multirella*).

*Tintinnopsis (Codonella) beroidea*, Lang, 1901, p. 31, fig. 53.

*Codonella beroidea* var. *acuminata*, Aurivillius, 1896a, pp. 188, 198, 211.

*Tintinnus conicus* Dixon and Joly, 1898, pp. 749, 752, pl. 26, fig. 7.

*Tintinnus beroidea*, Ostenfeld, 1909, p. 72.

*Ptychocylis beroidea*, Busch, 1920, p. 756.

*Tintinnopsis beroidea* var. *acuminata* Daday, *partim*, 1887b, pp. 547, 554, pl. 19, figs. 4, 5 (for pl. 19, fig. 29 see *Tps. acuminata*); non Schweyer, 1909, pp. 135-189, pl. 10, figs. 2a, b, pl. 11, fig. 13b (see *Coellicella helix*).

*Tintinnopsis acuminata*, Meunier, 1919, pp. 22-23, pl. 22, figs. 19, 20.

*Tintinnopsis beroidea*, incl. var. *acuta* ("acuminata") Ostenfeld, 1909, p. 72.

*Tintinnopsis karajacensis*, Merkle, 1909, pp. 144, 152, pl. 2, fig. 14.

We follow Jörgensen (1912, 1927) in using Stein's *Tps. beroidea* as emended by Entz, Sr. (1884) as typical for this species. As figured by Entz, Sr. it has a lorica which is cylindrical throughout above the conical aboral end. We accordingly accept Jörgensen's *Tps. parvula* for loricae with the lorica contracted above a median expansion to a narrower cylinder and have distributed between *Tps. beroidea* and *Tps. parvula* all citations in literature which are accompanied by figures. All other citations must remain unassignable between the two species except as geographical distribution, in so far as it is determinable by figures, may indicate a probability of the allocation of the records.

**Tintinnopsis bornandi** (Daday)

Figure 72

*Codonella Bornandi* Daday, 1887*b*, pp. 515, 569, pl. 19, fig. 22; Brandt, 1907, pp. 11, 20, 144, 145, 461.

*Tintinnopsis dadayi* var. *c*, *partim*, Brandt, 1907, pp. 144-145, 456, 461 (see also *Tps. orientalis*).

**Tintinnopsis brandti** (Nordqvist) Levander

Figure 67

*Codonella Brandti* Nordqvist, 1890, p. 126, pl. 1, figs. 1, 2.

*Leptrotintinnus Brandtii*, Cleve, 1900*d*, p. 973, fig. [8].

*Tintinnopsis brandti*, Levander, 1900, p. 18; Brandt, 1906, pp. 18-19, pl. 22, figs. 3-10, pl. 24, figs. 7, 9; 1907, pp. 165, 166, 448; Merkle, 1909, pp. 153, 154, pl. 2, fig. 2.

*Tintinnus brandti*, Cleve, 1901*c*, p. 10.

*Tintinnopsis botnica* var. *Brandti*, Entz, Jr., 1908, p. 103.

**Tintinnopsis brasiliensis** sp. nov.

Figure 30

*Tintinnopsis* sp. Brandt, 1906, p. 16, pl. 16, fig. 8; 1907, p. 159.

Lorica stout, its length 1.5 oral diameters, flaring slightly in the anterior 0.6 of the total length; oral region without constriction or collar; aboral region conical ( $65^\circ$ ); aboral end blunt; wall thick. Length  $80\mu$ .

The type locality is Station Pl. 110 of the Plankton Expedition off the mouth of the Tocantins River.

Differs from *Tps. nucula* and *Tps. turbo* in lack of anterior constricted region and from *Tps. beroidea* in less tapering bowl.

**Tintinnopsis bütschlii** Daday

Figure 85

[?] "Animalecula rapidissime," *partim*, Baster, 1756, p. 32, pl. 4, fig. 1*c* (for fig. 1*a* see *Calanus* (Copepoda) and for fig. 1*b* see *Favella chrenbergii*).

*Tintinnopsis Bütschlii* Daday, 1887*b*, p. 556, pl. 20, figs. 4, 5; Brandt, 1907, pp. 11, 456; Entz, Jr., *partim*, 1908, p. 125, pl. 1, fig. 2; 1909*b*, p. 214, pl. 8, fig. 2 (for 1908, pl. 1, fig. 9 and 1909*b*, pl. 8, fig. 9 see *Tps. cyathus*); Fauré-Fremiet, 1924, pp. 93-97, fig. 30.

*Tintinnopsis campanula* var. *bütschlii*, *partim*, Brandt, 1907, pp. 151-152, 456 (see *Tps. cyathus*); *non* 1906, pl. 19, fig. 14, pl. 21, fig. 12 (see *Tps. cyathus*).

*Tintinnopsis campanula* var. *bütschlii*, Jörgensen, 1924, pp. 67, 69, fig. 76*a*; 1927, pp. 6, 7, fig. 2.

*Codonella Bütschlii*, Ostenfeld, 1913, p. 142.

*Codonella Bütschlii*, Aurivillius, 1898, p. 111.

*Tintinnopsis campanula*, *partim*, Rossolimo, 1922, pp. 25, 33, pl. 2, fig. 5 (for fig. 4 see *Tps. campanula* and for fig. 6 see *Tps. major*).

**Tintinnopsis campanula** (Ehrenberg) Daday emended

## Figure 87

*Tintinnus campanula* Ehrenberg, 1840, p. 201; Claparède and Lachmann, 1858, p. 207, pl. 8, fig. 9; Kent, 1882, p. 609, pl. 31, fig. 11; Herdman, 1906, p. 67, fig. 1, no. 7.

*Tintinnus intermedius* Mereschowsky, 1878, pp. 24, 143, 180, pl. 2, fig. 2 (an uncompleted lorica).

*Coniocyclus campanula*, Fol, 1881a, p. 22, pl. 1, fig. 5; 1881b, pp. 247-248, pl. 17, fig. 5.

*Codonella campanula*, Fol, 1884, p. 58, pl. 4, fig. 5, pl. 5, fig. 11; Entz, Sr., 1885b, p. 205, pl. 14, fig. 15; Möbius, 1887, p. 119, pl. 8, fig. 32.

*Codonella campanella* Haeckel, 1873, p. 567, pl. 28, figs. 11-14; 1899, pl. 3, fig. 1; Kent, 1882, pp. 616-617, pl. 31, figs. 34-37; Lankester, 1890, p. 32, fig. 23, no. 5; Keller, 1894, p. 511, fig. 214, no. 2; Hickson, 1903, p. 409, fig. 68; Fauré-Fremiet, 1908, pp. 212, 231, 232, 236, fig. 17; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 386 [486 on p. 99].

*Tintinnopsis campanella*, Daday, 1887b, p. 551, pl. 19, figs. 16, 18.

*Tintinnopsis cincta, partim*, Daday, 1887b, p. 557, pl. 20, figs. 7, 8 (for fig. 6 see *Tps. cincta*).

*Tintinnopsis campanula* var. *cincta*, Jörgensen, 1899, p. 22; 1924, p. 68; 1927, p. 6.

*Tintinnopsis campanula*, Daday, 1887b, p. 558, pl. 20, figs. 9, 11, 13, 15; Haeckel, 1899, pl. 3, fig. 4; Brandt, 1906, pp. 17-18, pl. 20, fig. 1, pl. 21, figs. 2, 4-11, pl. 22, fig. 1; 1907, *partim*, pp. 144-151, 457 (see *Tps. cincta*, *Tps. cyathus*, *Tps. infundibulum*, and *Tps. urniger*); Laackmann, 1906, pp. 21-36, pl. 1, figs. 15, 16, pl. 2, figs. 24-28, 30, 31-33, 36, pl. 3, figs. 40-42; Wright, 1907, pp. 11, 18, pl. 4, fig. 12; Entz, Jr., 1908, pp. 17, 25-129, pl. 1, figs. 3, 8, pl. 8, figs. 3, 4, 6, pl. 9, figs. 1, 8-12, pl. 10, fig. 14, pl. 13, figs. 46, 47, 49; 1909b, pp. 99-226, pl. 8, figs. 3, 8, pl. 15, figs. 3, 4, 6, pl. 16, figs. 1, 8-12, pl. 17, fig. 14, pl. 20, figs. 46-47, 49, pl. 21, figs. 2, 4, 13, 14; Merkle, 1909, pp. 151-152, 177, pl. 2, fig. 20; Schweyer, 1909, pp. 139-187, pl. 11, figs. 11, 14; Meunier, 1919, pp. 20-21, pl. 22, figs. 13-15; Rossolimo, *partim*, 1922, pp. 25, 33, pl. 2, fig. 4 (for fig. 5 see *Tps. bütschlii* and for fig. 6 see *Tps. major*); Fauré-Fremiet, 1924, pp. 90-93, fig. 29; Jörgensen, 1924, pp. 4, 5, 8, 68-70, figs. 1, 75; 1927, pp. 6, 18, figs. 1, 32.

*Tintinnopsis camplanata* Swarczewsky, 1912, p. 95.

*Ptychocyclus campanula*, Busch, 1920, p. 756.

**Tintinnopsis capulus** Brandt

## Figure 54

*Tintinnopsis capulus* Brandt, 1906, p. 15, pl. 15, figs. 11, 14, 16; 1907, pp. 140, 458.

**Tintinnopsis chyzeri** Daday

## Figure 63

*Tintinnopsis Chyzeri* Daday, 1887b, p. 555, pl. 20, fig. 1; Brandt, 1907, pp. 11, 20, 128, 458.

**Tintinnopsis cincta** (Claparède and Lachmann) Daday emended

## Figure 76

*Tintinnus cinctus* Claparède and Lachmann, 1858, p. 206, pl. 8, fig. 13; Kent, 1882, p. 608, pl. 31, fig. 10.

*Tintinnopsis cincta, partim*, Daday, 1887*b*, p. 557, pl. 20, fig. 6 (for pl. 20, figs. 7-8 see *Tps. campanula*); Brandt, 1906, p. 17, pl. 20, figs. 2-6; 1907, pp. 153-154, 458; non Entz, Jr., 1908, pp. 10-128, pl. 5, fig. 7; 1909*b*, pp. 95-215, pl. 12, fig. 7 (see *Tps. lindeni*).

*Codonella cincta*, Aurivillius, 1898, p. 111.

Non *Tintinnopsis campanula* var. *cincta*, Jörgensen, 1899, p. 22; 1924, p. 69; 1927, p. 6 (see *Tps. campanula*).

Non *Codonella annulata* Daday, 1886, p. 496, pl. 25, fig. 15 (see *Coxiella helix*).

Non *Codonella annulata* Clap. and Lach., Daday, 1887*a*, pp. 159-208, pl. 1, fig. 4; 1887*b*, pp. 571-572, pl. 20, fig. 21 (see *Codonellopsis orthoceras*).

*Tintinnopsis annulata* Daday, 1887*b*, p. 550, pl. 19, fig. 17; Brandt, *partim*, 1907, pp. 11, 216, 454 (see *Tps. annulata*).

*Tintinnopsis campanula, partim*, Brandt, 1907, pp. 144-151, 457 (see *Tps. campanula*, *Tps. cyathus*, *Tps. infundibulum*, and *Tps. urniger*).

**Tintinnopsis cochleata** (Brandt) Laackmann emended

## Figure 40

*Cyttarocyelis (Coxiella) helix* var. *b cochleata* Brandt, 1906, p. 21, pl. 33, fig. 1.

*Cyttarocyelis helix* var. *b cochleata* Brandt, 1906, p. 21, pl. 33, figs. 3, 6, 7; 1907, *partim*, pp. 169, 217, 220, 259, 459, 467 (see *Tps. pistillum*).

*Tintinnopsis helix* (forma *subrotundata*) var. *cochleata, partim*, Laackmann, 1913, pp. 8, 10, 25, 26, 43, pl. 2, fig. 33 (for pl. 3, figs. 45-47 see *Coxiella annulata*).

*Tintinnopsis helix* var. *cochleata, partim*, Laackmann, 1913, pp. 8, 10, 25-26 (see also *Coxiella annulata*).

Non *Amphorella cochleata*, Meunier, 1910, p. 131, pl. 10, fig. 7 (see *Coxiella meunieri*).

Non *Cyttarocyelis helix* var. *c* Brandt, 1906, p. 21, pl. 33, fig. 2; 1907, pp. 27, 169 (on p. 220 as var. *b*), (see *Tps. pistillum*).

Raised to status of species.

Lorica tubular, 3 oral diameters in length; oral rim irregular; cylindrical below; aboral end subhemispherical; wall laid up in 13 subequal spiral turns, fading out aborally, regularly and finely alveolar, with sparse agglomerations. Length 150-270 $\mu$ .

The type locality is the Kaiser Wilhelm Canal.

Differs from *Tps. pistillum* in the lack of aboral expansion.

**Tintinnopsis compressa** Daday

Figure 71

*Tintinnopsis beroidea* var. *compressa* Daday, 1887*b*, p. 548, pl. 19, figs. 7-9, 28; Calkins, 1902, p. 451; Brandt, 1907, pp. 136, 455, 460.

*Tintinnopsis compressa* Laackmann, 1913, pp. 14, 42, pl. 1, figs. 9-16; Jörgensen, 1924, pp. 67, 68, 107, figs. 74*a*, *b*.

*Codonella beroidea* var. *compressa*, Aurivillius, 1896*a*, pp. 188, 198, 211.

*Tintinnopsis nucula*, Daday, 1887*b*, p. 554, pl. 19, figs. 30, 31.

**Tintinnopsis coronata** nom. nov.

Figure 90

*Tintinnopsis davidoffi* var. *cylindrica* forma *annulata* Wailes, 1925, p. 6, pl. 2, fig. 3.

Non *Tintinnopsis annulata*, Brandt, 1907, pp. 169, 454 (see *Tps. annulata*).

Raised to status of species.

Lorica very tall chalice-shaped, 5.1 oral diameters in length; oral rim irregular, thickened, expanded to 1.25 diameters of the bowl; bowl cylindrical, 4.1 oral diameters in length; aboral region sub-conical, about 60°; aboral horn conical (10°), 1 oral diameter in length; tip open; wall with coarse particles on the surface. Length 250μ.

The type locality is the Strait of Georgia, British Columbia.

Differs from *Tps. cylindrica* in the irregularly expanded shape of the oral rim.

**Tintinnopsis cyathus** Daday emended

Figure 84

*Tintinnopsis cyathus* Daday, 1887*b*, p. 556, pl. 20, fig. 2.

*Tintinnopsis cyathus* var. *annulata* Daday, 1887*b*, p. 556, pl. 20, fig. 3; Markow, 1908, p. 665.

*Tintinnopsis campanula* var. *b. bütschlii*, Brandt, 1906, p. 17, pl. 19, fig. 14, pl. 21, fig. 12; 1907, *partim*, pp. 151-152, 456 (see also *Tps. bütschlii*). Doubtfully separated from *Tps. bütschlii* by lack of wide oral flare.

*Tintinnopsis campanula*, *partim*, Brandt, 1907, pp. 144-151, 457 (see *Tps. campanula*, *Tps. cineta*, *Tps. infundibulum*, and *Tps. urniger*).

*Tintinnopsis Bütschlii*, *partim*, Entz, Jr., 1908, p. 125, pl. 1, fig. 9; 1909*b*, p. 214, pl. 8, fig. 9 (for 1908, pl. 1, fig. 2 and 1909*b*, pl. 8, fig. 2 see *Tps. bütschlii*).

*Tintinnopsis campanula* var. *cyathus*, Jörgensen, 1924, p. 67, fig. 76*b*; 1927, p. 6, fig. 3.

**Tintinnopsis cylindrata** nom. nov.

Figure 34

*Tintinnopsis cylindrica* Daday, 1892, pp. 172, 173, 175, 185, 190, 192, 194, 198, 201, pl. 1, fig. 10; Entz, Jr., 1904a, pp. 9-10, figs. 2a, b; 1905, pp. 204-205, pl. 5, figs. 4-6; 1909a, pp. 204-207, pl. 3, figs. 4-6; [?] Ostenfeld, 1908, pp. 220-221, table III, figs. 1, 2; non Wright, 1907, p. 11 (see *Tps. cylindrica*); non Meunier, 1910, p. 140, pl. 12, figs. 12, 13 (see *Tps. spiralis*).

Non *Tintinnopsis Davidoffi* var. *cylindrica* Daday, 1887b, *partim*, p. 553, pl. 19, fig. 24 (see *Tps. cylindrica*).

*Codonella lacustris*, *partim*, Schermer, 1916, pp. 26, 27, pl. [1], fig. 9 (for figs. 1-7, 10-12 see *Codonella cratera* and for fig. 8 see *Codonella lariana*).

Lorica cylindrical, tube-shaped, 4 oral diameters in length; oral rim not everted, with a circle of small regular granules; bowl with no trace of spiral organization, and no change in diameter; aboral end hemispherical; no aboral point; wall with angular, rather coarse agglomerations of varied sizes. Length 40-50 $\mu$ .

The type locality is Mesö-Záher Lake, Hungary.

Differs from *Tps. minuta* in fresh-water habitat, smaller size, and absence of spiral structure.

A fresh-water species which we have frequently seen in Northern California lakes.

**Tintinnopsis cylindrica** Daday

Figure 96

*Tintinnopsis Davidoffi* var. *cylindrica* Daday, 1887b, *partim*, p. 553, pl. 19, fig. 24 (for pl. 19, fig. 25 see *Tps. radix*); Brandt, 1906, p. 19, pl. 25, figs. 1, 3-6, 8; 1907, *partim*, pp. 177-179 (see *Tps. radix*); Okamura, 1907, p. 138, pl. 6, figs. 60a, 60b; Wailes, 1925, p. 535, pl. 2, fig. 1.

*Tintinnopsis davidoffi* var. *cylindrica* forma *lata* Wailes, 1925, p. 6, pl. 2, fig. 2.

*Tintinnopsis davidoffi* var. a Brandt, 1907, pp. 179-180.

*Tintinnopsis davidoffi*, Wright, 1907, pp. 11, 18, pl. 4, fig. 14.

*Tintinnopsis davidoffi* var. *cylindrica*, Wright, 1907, p. 18, pl. 4, fig. 16.

*Tintinnopsis davidoffi* var. Wright, 1907, pp. 11, 18, pl. 4, fig. 15.

*Tintinnopsis cylindrica*, Wright, 1907, p. 11; non Daday, 1892, pp. 172, 173, 175, 185, 190, 192, 194, 198, 201, pl. 1, fig. 10; Entz, Jr., 1904a, pp. 9-10, figs. 2a, b; 1905, pp. 204-205, pl. 5, figs. 4-6; 1909a, pp. 204-207, pl. 3, figs. 4-6; [?] Ostenfeld, 1908, pp. 220-221, table III, figs. 1, 2 (see *Tps. cylindrata*); non Meunier, 1910, p. 140, pl. 12, figs. 12, 13 (see *Tps. spiralis*).

*Tintinnopsis radix*, *partim*, Jörgensen, 1924, pp. 69, 70, 77 (for fig. 77 see *Tps. radix*).

*Tintinnopsis bottnica*, Rossolimo, 1922, pp. 26, 33, pl. 2, fig. 10.



**Tintinnopsis dadayi** Kofoid

Figure 55

*Tintinnopsis dadayi* Kofoid, 1905, p. 289, pl. 26, figs. 3-5.**Tintinnopsis denticulata** sp. nov.

Figure 51

*Tintinnopsis baltica* var. a Brandt, 1906, p. 15, pl. 15, figs. 12, 13; 1907, pp. 143, 455.

Lorica with a spreading, flaring collar inclined  $40^\circ$  above the horizontal, with a few nearly erect, marginal, denticulate or spike-like teeth; bowl subcylindrical, widest at the distal third; aboral end bluntly pointed. Length  $60\mu$ .

The type locality is in the Atlantic, off the mouth of the Tocantins River.

Differs from *Tps. baltica* in more convex, less pointed aboral end and in the well developed oral denticles.

**Tintinnopsis ecaudata** sp. nov.

Figure 58

*Tintinnopsis campanula* var. a Brandt, 1906, pp. 17, 18, pl. 19, fig. 18, pl. 21, figs. 1, 14; 1907, pp. 149, 151, 457; Entz, Jr., 1908, p. 103; Merkle, 1909, p. 151.

Lorica campanulate, oral rim widely everted, oral diameter 0.65-0.81 total length; no nuchal shelf; bowl convex subconical (about  $30^\circ$ ), faintly spiraled; aboral end pointed or blunt. Length 100-150 $\mu$ .

The type locality is off the Norwegian Coast, "Princesse Alice" Station 931.

Differs from *Tps. campanula* in absence of aboral horn and from *Tps. bütschlii* in pointed rather than rounded aboral end.

**Tintinnopsis elongata** Daday emended

Figure 80

*Tintinnopsis vosmaeri* var. *elongata*, *partim*, Daday, 1887b, p. 550, pl. 19, fig. 15 (for fig. 13 see *Tps. vosmaeri*); Brandt, 1907, pp. 465, 484; Rossolimo, 1922, p. 25.

Raised to status of species.

Lorica 2.25 oral diameters in length; bowl cylindrical in anterior 0.6, conical ( $55^\circ$ ) posteriorly; aboral horn conical ( $22^\circ$ ), 0.3 oral diameter in length; wall thickly covered by agglomerated, irregular material. Length 162-198 $\mu$ .

The type locality is the Bay of Naples, Italy.

Differs from *Tps. vosmaeri* in the anterior cylinder, shorter horn, and in proportions.

**Tintinnopsis entzii** Daday

## Figure 22

*Tintinnopsis Entzii* Daday, 1892, pp. 190, 192, 194, 198, 200, 202, pl. 1, fig. 8.  
*Codonella lacustris* forma *lacvis*, *partim*, Entz, Jr., 1905, pp. 211, 213, 215, pl. 6, fig. 4, pl. 8, figs. 4, 8; 1909a, pp. 215, 218, 221, 224, 225, pl. 4, fig. 4, pl. 6, figs. 4, 8 (for 1905, pl. 6, figs. 1-3, 5-7, pl. 7, figs. 8-13, pl. 8, figs. 1-3, 5-7, 11 and 1909a, pl. 4, figs. 1-3, 5-7, pl. 5, figs. 8-13, pl. 6, figs. 1-3, 5-7, 11 see *Codonella cratera*).

A fresh-water species of doubtful status.

**Tintinnopsis everta** nom. nov.

## Figure 83

*Tintinnopsis ballica* var. *rotundata* Laackmann, 1906, p. 20, pl. 1, fig. 9.  
 Non *Tintinnopsis beroidea* var. *rotundata* Jörgensen, 1899, pp. 5, 24; 1900, p. lxxx; 1924, p. 68; 1927, p. 7; Brandt, 1907, p. 136 (see *Tps. rotundata*).

Raised to status of species.

Lorica tall campanulate, 1.33 oral diameters in length; oral rim roughened, 0.73 total length in diameter; suboral region for about 0.3 total length flaring, inverted concave conical ( $55^\circ$ ); tapering conical ( $10^\circ$ ); aboral end broadly rounded; wall clearly with 4 spiral turns in the oral half of the lorica, coarsely agglomerated. Length 65-81 $\mu$ .

The type locality is the Bay of Kiel.

Differs from *Tps. bütschlii* in less spread of the suboral region.

**Tintinnopsis fennica** sp. nov.

## Figure 70

*Cyttarocyclus* (*Coxiella*) *helix* var. a Brandt, 1906, pp. 20, 21, pl. 30, fig. 7, pl. 32, figs. 1, 2; 1907, p. 217; Entz, Jr., 1908, p. 100.

*Cyttarocyclus helix* var. a Brandt, 1907, pp. 219, 220, 467; Merkle, 1909, p. 160; Rossolimo, 1922, pp. 26, 28, 31.

*Tintinnopsis helix* var. a, Laackmann, 1913, p. 28, pl. 3, figs. 43, 44.

Lorica tall funnel-shaped, 2.5-3.0 oral diameters in length; oral rim ragged, sometimes incurved; subcylindrical in the suboral 0.3-0.6 of the total length, convex conical ( $45^\circ$ - $60^\circ$ ) below; aboral horn 0.50-0.85 oral diameter in length, subcylindrical, with pointed, blunt, or truncate end; wall faintly, if at all, spirally formed in the anterior region only, with scattered, irregular particles subuniformly distributed on the bowl and crowded on the aboral horn. Length 120-150 $\mu$ .

The type locality is the Gulf of Bothnia. Occurs also in the Baltic off Kiel, in the Adriatic, and in the Bay of Panama.

Differs from *Coxiella helix* in the feeble development of the spiral structure and in a tendency to a more conical shape, from *Tps. rapa* in lack of suboral flare and less convex outline, and from *Tps. elongata* in much smaller size.

**Tintinnopsis fimbriata** Meunier

Figure 49

*Tintinnopsis fimbriata* Meunier, 1919, p. 31, pl. 22, figs. 38, 39.

**Tintinnopsis fusiformis** Daday

Figure 25

*Tintinnopsis fusiformis* Daday, 1892, pp. 172, 173, 175, 194, 198, 201-202, pl. 1, fig. 11.

*Tintinnopsis cylindrica* var. *fusiformis*, Entz, Jr., 1909a, pp. 204-207.

A very variable fresh-water species.

**Tintinnopsis gracilis** sp. nov.

Figure 37

*Tintinnopsis karajacensis* var. a Brandt, 1906, p. 16, pl. 19, figs. 1, 2, 21; 1907, pp. 163, 468.

Lorica slender, 2.0-4.2 oral diameters in length; no oral flare; aboral end subconical ( $45^\circ$ ), contracting to a blunt point; wall thick, not spiraled. Length 110-135 $\mu$ .

The type locality is Schott (15-VI-92) off the West Coast of Borneo.

Differs from both *Tps. karajacensis* and *Tps. turgida* in more slender proportions and more pointed aboral end.

**Tintinnopsis illinoisensis** Hempel

Figure 27

*Tintinnopsis illinoisensis* Hempel, 1896, pp. 314-315, pl. 26, figs. 14-16.

A fresh-water species known only from the Illinois River and vicinity.

**Tintinnopsis incurvata** Meunier

Figure 64

*Tintinnopsis incurvata* Meunier, 1910, p. 146, pl. 13, fig. 29.

Not with certainty a tintinnid and possibly abnormal.

**Tintinnopsis infundibulum** Daday

Figure 86

*Tintinnopsis infundibulum* Daday, 1887*b*, p. 559, pl. 20, figs. 17, 18; Merkle, 1909, p. 151; Jörgensen, 1924, p. 69.

*Tintinnopsis campanula*, *partim*, Brandt, 1907, pp. 144-151, 457 (see *Tps. campanula*, *Tps. cineta*, *Tps. cyathus*, and *Tps. urniger*).

*Tintinnopsis campanula* var. *infundibulum*(?), Entz, Jr., 1909*b*, pp. 128, 199.

Differs from *Tps. campanula* in outer convexity of collar.

**Tintinnopsis karajacensis** Brandt

Figure 38

*Tintinnopsis karajacensis* Brandt, 1896, pp. 55-57, 64-65, 69, pl. 3, fig. 5; 1906, *partim*, p. 17, pl. 19, figs. 5, 10, 12, 19, pl. 26, fig. 3 (for pl. 19, fig. 7 see *Tps. lobiancoi* and for pl. 19, fig. 11 see *Tps. tubulosoides*); 1907, pp. 162-163; Vanhöffen, 1897, pp. 271, 291, pl. 5, fig. 28; Laackmann, 1906, pp. 21, 25, 36, pl. 1, figs. 12-14; Rossolimo, *partim*, 1927, pp. 67, 68, 74, 75, figs. 5 last 14 loricae, 6 (for fig. 5 first 16 loricae see *Tps. tubulosoides*); Wailes, 1925, pp. 536, 537, pl. 2, figs. 5, 6; Busch, 1925, pp. 186-187, figs. E, F; Jörgensen, 1927, pp. 5, 7.

*Tintinnopsis karajacensis* var. *lagenoides* Ostenfeld, 1910, p. 291, fig. 1.

**Tintinnopsis lata** Meunier

Figure 33

[?] *Tintinnopsis nucula*, *partim*, Brandt, 1906, pp. 15, 16, pl. 16, figs. 1, 9, 13, 14; 1907, pp. 158-160 (for pl. 16, figs. 10, 12 see *Tps. nucula* and for pl. 16, fig. 3 see *Tps. turbo*).

*Tintinnopsis lata* Meunier, 1910, p. 141, pl. 12, figs. 19-22; 1919, p. 25, pl. 22, fig. 24.

Non *Tintinnopsis davidoffi* var. *cylindrica* forma *lata* Wailes, 1925, pp. 533, 536, pl. 2, fig. 2 (see *Tps. cylindrica*).

Possibly a synonym of *Tps. subacuta*.

**Tintinnopsis levigata** nom. nov.

Figure 91

*Tintinnopsis davidoffi* var. *laevis* Wailes, 1925, pp. 533, 536, pl. 2, fig. 4.

Non *Tintinnopsis urniger* var. *laevis* Daday, 1887*b*, p. 552, pl. 19, fig. 19 (see *Tps. urniger*).

Raised to status of species.

Lorica cylindrical campanulate, 2.8 oral diameters in length; oral rim entire; cylindrical in the oral 0.66 of the total length; aboral region convex conical (75°); aboral horn conical (15°); aboral end blunt; wall with fine agglomerations. Length 50-70μ.

The type locality is the Strait of Georgia, British Columbia.

Differs from *Tps. coronata* and *Tps. platensis* in shorter cylinder and stouter aboral horn.

**Tintinnopsis lindeni** Daday

Figure 82

*Tintinnopsis Lindeni* Daday, 1887*b*, p. 560, pl. 20, fig. 23; Jörgensen, 1924, pp. 67, 70, 71, 76, figs. 80*a*, 80*b*.

*Cyrtarocydis orthoceras*, Entz, Jr., 1904*b*, pp. 125, 127, 133, figs. 10-23.

*Tintinnopsis helix*, Laackmann, 1913, pp. 24-25, 43, pl. 3, figs. 37-42.

*Cyrtarocydis (Coxiella) helix*, Brandt, *partim*, 1906, p. 20, pl. 30, fig. 2 (for pl. 29, figs. 4-12, pl. 30, figs. 1, 3-6, 8, 9, and pl. 31, figs. 1-32*a* see *Coxiella helix*); 1907, pp. 184, 187, 213-220, 467; Entz, Jr., *partim*, 1908, pp. 113, 127, 128, pl. 4, figs. 6-8, pl. 5, figs. 10-11; 1909*b*, pp. 199, 216, pl. 11, figs. 6-8, pl. 12, figs. 10, 11 (for 1908, pl. 3, fig. 3 and 1909*b*, pl. 10, figs. 3 see *Coxiella fasciata*).

*Tintinnopsis cineta*, Entz, Jr., 1908, pp. 40-128, pl. 1, fig. 1, pl. 5, fig. 7; 1909*b*, pp. 95-216, pl. 8, fig. 1, pl. 12, fig. 7.

Separated from *Tps. angulata* on the basis of Jörgensen's (1924) discussion and on the difference in size.

**Tintinnopsis lobiancoi** Daday

Figure 95

*Tintinnopsis Lobiancoi* Daday, 1887*b*, pp. 553-554, pl. 19, fig. 27; Cleve, 1900*a*, p. 17, fig. 4; Brandt, 1906, pp. 16, 17, 19, pl. 19, fig. 3, pl. 24, fig. 16, pl. 26, figs. 7, 8; 1907, pp. 160-161, 444; Okamura, 1907, p. 137, pl. 6, fig. 56; Wright, 1907, pp. 11, 18, pl. 4, fig. 17; Entz, Jr., *partim*, 1908, pp. 69, 104, 107, 113, 126, pl. 2, fig. 2, pl. 5, fig. 4 (for pl. 2, fig. 12 see *Tps. amphora*); 1909*b*, pp. 129, 195, 199, 215, 216, 225, pl. 9, fig. 2, pl. 12, fig. 4, pl. 21, fig. 6 (for pl. 9, fig. 12 see *Tps. amphora*); Merkle, 1909, pp. 153, 178, pl. 2, figs. 13, 24; Meunier, 1910, pp. 138-139, pl. 12, figs. 5-9; 1919, pp. 21-22, pl. 22, figs. 16-18; Rossolimo, 1922, pp. 26, 33, pl. 2, fig. 12.

*Codonella tubulosa* mihi (= *Codonella ventralis*[sic!] Nordquist) Levander, 1894*a*, p. 4.

*Codonella tubulosa* Levander, 1894*c*, p. 90, pl. 3, fig. 8.

Non *Tintinnopsis tubulosa* Levander, 1900*a*, p. 18, figs. 4, 5 (for fig. 4, forma *a* see *Tps. tubulosa* and for fig. 5, forma *b* see *Tps. subacuta*).

*Tintinnopsis karajacensis*, *partim*, Brandt, 1906, p. 17, pl. 19, fig. 7 (for pl. 19, figs. 5, 10, 12, 19, pl. 26, fig. 3 see *Tps. karajacensis* and for pl. 19, fig. 11 see *Tps. tubulosoides*); 1907, pp. 162-163.

*Tintinnopsis radix* var. *lobiancoi*, Laackmann, 1913, pp. 20, 23.

*Tintinnopsis radix* forma *subrotundata* Laackmann, 1913, p. 23, pl. 2, fig. 32.

*Tintinnopsis radix* forma *curta-subrotundata* Laackmann, 1913, p. 23, pl. 2, fig. 34.

*Tintinnopsis tubulosa* forma *lineata* Leegaard, 1920, pp. 28-29, fig. 28*a*.

**Tintinnopsis loricata** Brandt

Figure 60

*Tintinnopsis dadayi* var. *b loricata* Brandt, 1906, pp. 16, 17, pl. 19, fig. 4, pl. 20, fig. 11; 1907, pp. 130, 144-146, 470.

Raised to status of species.

Lorica tall campanulate, 1.7 oral diameters in length; oral rim ragged; suboral region forming a flaring collar, 0.18 total length in length, inverted conical ( $40^\circ$ ); cylindrical below; aboral region convex conical ( $100^\circ$ ); aboral end bluntly pointed; wall laid up of coarse fragments, with coarse primary alveoli. Length 160-170 $\mu$ .

The type locality is off the west coast of Borneo.

Differs from *Tps. caudata*, *Tps. meunieri*, *Tps. orientalis*, and *Tps. schotti* in longer bowl and better developed flaring collar.

**Tintinnopsis maculosa** Mansfeld

Figure 14

*Tintinnopsis maculosa* Mansfeld, 1923, pp. 118-120, figs. 10a, b, c.

Since the lorica is unknown, tentatively included in *Tintinnopsis*.

**Tintinnopsis magna** Merkle

Figure 69

*Tintinnopsis sacculus* var. *magna* Merkle, 1909, pp. 144, 156-157, 182, 186, pl. 2, figs. 1, 25.

Raised to status of species.

Lorica very stout, convex conical, changing from  $20^\circ$  in the oral region to  $130^\circ$  aborally; oral rim entire; no collar; aboral end broadly rounded; wall without spiral structure and with sparse agglomerations. Length 170-175 $\mu$ .

The type locality is Stavanger Fiord, Norway.

Differs from all other species except *Tps. plagiostoma* in the stout conical shape of the lorica and from that species in much larger size.

Possibly flattened specimens.

**Tintinnopsis major** Meunier

Figure 18

*Tintinnopsis major* Meunier, 1910, p. 138, pl. 12, fig. 1.

*Tintinnopsis campanula*, *partim*, Rossolimo, 1922, pp. 25, 33, pl. 2, fig. 6 (for fig. 4 see *Tps. campanula* and for fig. 5 see *Tps. bütschlii*).

**Tintinnopsis mayeri** Daday

Figure 78

*Tintinnopsis Mayeri* Daday, 1887*b*, p. 563, pl. 19, figs. 20, 21; Brandt, 1907, pp. 11, 17, 181.

**Tintinnopsis meunieri** nom. nov.

Figure 59

*Tintinnopsis* sp. Brandt, 1906, p. 16, pl. 17, figs. 4, 5, 7, pl. 18, fig. 10; 1907, pp. 180-181; Rossolimo, 1922, pp. 27, 31, 33, pl. 2, fig. 14; 1927, pp. 69, 74, 76, fig. 8.

*Tintinnopsis acuta* Meunier, 1910, p. 145, pl. 13, fig. 17; 1919, p. 31, pl. 23, fig. 3.

Non *Tintinnopsis karajacensis* var. *acuta* Paulsen, 1904, p. 24, fig. 12 (see *Tps. acuminata*).

Lorica very stout campanulate, 1.25 oral diameters in length; oral rim very ragged and irregular; collar flaring to the diameter of the bowl, inverted conical ( $90^\circ$ ); bowl globose; aboral region convex conical ( $90^\circ$ ); aboral horn subconical, 0.11 oral diameter in length; aboral end truncate; wall of rather coarse, subuniform secondary areas. Length  $75\mu$ .

The type locality is the Kaiser Wilhelm Canal.

Differs from *Tps. schotti* in having an antapical horn and less developed collar.

**Tintinnopsis minuta** Wailes

Figure 16

*Tintinnopsis karajacensis* var. *minutus* Wailes, 1925, p. 536, pl. 2, figs. 7, 8.

Raised to status of species.

Lorica short tubular, 2.3 oral diameters in length; oral rim entire; no collar; cylindrical below; aboral end hemispherical; wall with sparse agglomerations. Length  $25-30\mu$ .

The type locality is the Strait of Georgia, British Columbia.

Differs from *Tps. nana* in rounded rather than pointed aboral end.

**Tintinnopsis mortensenii** Schmidt

Figure 61

*Tintinnopsis Mortensenii* Schmidt, 1901, p. 186, fig. 3.

Non “(*Tps. mortensis?*)” Entz, Jr., 1908, p. 125; 1909*b*, p. 214, pl. 8, fig. 2, cited by Entz, Jr., as a doubtful synonym of *Tps. bütschlii*. *Lapsus pennae*.

*Tintinnopsis mortensenii*, Brandt, 1906, pp. 17, 18, pl. 21, figs. 13, 13*a*; 1907, pp. 152, 444, 472; Okamura, 1907, p. 138, pl. 6, fig. 65.

**Tintinnopsis mulctrella** sp. nov.

Figure 64 bis

*Codonella beroidea*, Entz, Sr., 1885*b*, p. 204, pl. 14, figs. 16, 17.

Lorica 1.00–2.26 oral diameters in length, with the form of a milk pitcher; oral aperture at an angle of 20°–60° to the long axis, undulating in outline; bowl parabolic in outline; aboral and rounded to pointed. Length 77 $\mu$ .

The type locality is the Bay of Naples, Italy. Discovered in the intestinal contents of *Salpa*.

Differs from *Tps. incurvata* in the lack of an annulate collar and from *Tps. chyzeri* in the regular bowl.

Possibly not belonging to the Tintinnoinea.

**Tintinnopsis nana** Lohmann

Figure 15

*Tintinnopsis nana* Lohmann, 1908, pp. 292–294, pl. 17, fig. 12; 1911, p. 29, pl. 1, fig. 5.

*Tintinnopsis fistularis* Meunier, 1919, pp. 23–24, pl. 22, fig. 21; non Cleve, 1900*a*, pp. 17, 36, fig. 3 (see *Coatiella helix*).

Non *Tintinnus fistularis* Möbius, 1887, pp. 120, 132, pl. 8, fig. 38 (see *Coatiella helix*).

*Tintinnopsis* sp. Van Breeman, 1905, p. 60, fig. 16.

**Tintinnopsis nitida** Brandt

Figure 52

*Tintinnopsis nitida* Brandt, 1896, pp. 55, 58, 64, 69, pl. 3, fig. 1; 1906, p. 15, pl. 15, figs. 5, 10; 1907, pp. 138–139, 473, 478; Vanhöffen, 1897; pp. 271, 272, 291, pl. 5, fig. 31; Wailes, 1925, p. 536, pl. 1, fig. 31, pl. 2, fig. 31; Rossolimo, 1927, pp. 65–66, 74–75, fig. 2.

*Tintinnopsis nitida* var. *sinuata*, Jörgensen, 1905, p. 143, pl. 18, fig. 116.

Non *Tintinnopsis nitida* var. *ovalis* Jörgensen, 1905, pp. 53, 56, 143, pl. 18, fig. 115 (see *Stenosemella nivalis*).

**Tintinnopsis nucula** (Fol) Brandt emended

Figure 47

*Codonella nucula* Fol, 1884, p. 60, pl. 5, fig. 13.

*Tintinnopsis nucula*, Brandt, *partim*, 1906, p. 16, pl. 16, figs. 10, 12; 1907, pp. 158–160 (for pl. 16, figs. 1, 9, 13, 14 see *Tps. lata* and for pl. 16, fig. 3 see *Tps. turbo*); Merkle, 1909, pp. 148–149, 177, 186, pl. 2, figs. 21, 29, pl. 3, fig. 71.

*Tintinnopsis ventricosa*, *partim*, Brandt, 1906, pp. 15–16, pl. 17, figs. 10, 11 (for pl. 17, fig. 9 see *Stenosemella ventricosa* and for pl. 17, fig. 2, pl. 18, figs. 1 [?], 2 see *S. steini*); 1907, pp. 154–158, 483 (see also *S. steini* and *S. ventricosa*).

*Stenosemella nucula*, *partim*, Jörgensen, 1924, pp. 95–96; 1927, pp. 8, 15, 17, 20, 21 (for 1924, figs. 108*a*, *b* and 1927, fig. 7 see *Stenosemella nivalis*, see also *S. avellana*, *S. oliva*, and *Codonella apicata*).

*Tintinnopsis* sp. Brandt, 1906, pp. 15, 16, pl. 15, fig. 7, pl. 17, fig. 12; 1907, p. 181.



**Tintinnopsis orientalis** sp. nov.

Figure 57

*Tintinnopsis dadayi*, Brandt, 1906, p. 16, pl. 18, figs. 3-7, 9, 11, 12.*Tintinnopsis dadayi* (var. c), *partim*, Brandt, 1907, pp. 144-145, 456, 461 (see also *Tps. bornandi*).

Lorica of the *Codonella* form but *Tintinnopsis* structure, with distinct collar and bowl; collar 0.25-0.33 length of the bowl in length, convex outwardly; oral diameter 1.04-1.10 greatest diameter of the bowl; bowl acorn-shaped, widest near or shortly below its middle; aboral end baggy, not flattened, with or without a faintly emergent point. Length 90-110 $\mu$ .

The type locality is off Bombay in the Arabian Sea.

Differs from *Tps. dadayi* in a convex instead of concave, widely flaring collar and less baggy, less flattened aboral end.

**Tintinnopsis ovalis** Daday

Figure 21

*Tintinnopsis ovalis* Daday, 1892, pp. 200-201, 207, pl. 1, fig. 9.*Codonella lacustris*, *partim*, Franc e, 1912, p. 35, fig. 38 [left], (for fig. 38 [right] see *Codonella cratera*).

A fresh-water species, so far as known recorded only by Daday in Hungarian Lakes, and not certainly a tintinnid.

**Tintinnopsis pallida** Brandt

Figure 23

*Tintinnopsis sacculus* var. *pallida* Brandt, 1906, p. 17, pl. 19, figs. 15-17; 1907, pp. 165, 475.

Raised to status of species.

Lorica tall goblet-shaped, 2.1 oral diameters in length; oral rim entire, slightly irregular; oral 0.33 of total length subcylindrical; expanding aborally to 1.2 oral diameters at about 0.5 oral diameter from the aboral end; aboral end rounded; wall thin, with subregular secondary structure. Length 80-85 $\mu$ .

The type locality is Station Pl. 33 of the Plankton Expedition off the Bermudas.

Differs from *Tps. sacculus* in the expanded aboral region.

**Tintinnopsis panamensis** sp. nov.

Figure 94

Lorica cylindrical anteriorly, 6.0 oral diameters in length; posterior expansion slight; spiral structure present throughout most of cylinder and expansion; aboral horn tapering; wall thin. Length 275–330 $\mu$ .

The type locality is the Bay of Panama.

Differs from *Tps. aperta* in its expansion and in dimensions.

**Tintinnopsis parva** Merkle

Figure 17

*Tintinnopsis parva* Merkle, 1909, pp. 150–151, pl. 2, figs. 9–11.

**Tintinnopsis parvula** Jörgensen

Figure 28

*Tintinnopsis parvula* Jörgensen, 1912, pp. 2–3; 1927, pp. 6–7.

*Tintinnopsis beroidea*, Brandt, 1896, pp. 56–57, pl. 3, fig. 4; 1906, p. 16, pl. 16, figs. 5, 7, 11; 1907, *partim*, pp. 135–138, 445, 447, 452, 455, 460, 476, 478 (see *Tps. beroidea*); Levander, 1900, p. 18, figs. 2, 3; Laeekmann, 1906, pp. 20–36, pl. 1, figs. 6–8, pl. 3, figs. 51, 52; Lohmann, 1911, p. 39, pl. 1, fig. 5; Rossolimo, 1922, pp. 24, 33, pl. 2, fig. 2; 1927, *partim*, pp. 65, 74–75, fig. 1 first five loricae (for last fifteen see *Tps. beroidea*); Wailes, 1925, p. 535, pl. 1, figs. 17–21.

*Tintinnopsis* sp. Van Breeman, 1905, p. 60, fig. 17; Brandt, 1907, pp. 137–138, 455, 478.

*Tintinnopsis fusus* Meunier, 1910, p. 141, pl. 12, figs. 25–28.

Close to *Tps. beroidea* Stein but separated in accordance with Jörgensen's (1912, 1927) discussion in which he includes in *Tps. parvula* all loricae having a slight expansion below a cylindrical anterior region, and a tapering pointed aboral end, as figured by Brandt (1906). The series of figures by Rossolimo (1922a) suggests the intergradation of *Tps. parvula* and *Tps. beroidea*.

**Tintinnopsis patula** Meunier

Figure 62

*Tintinnopsis* sp. Okamura, 1907, pp. 139, 151, pl. 6, fig. 64.

*Tintinnopsis patula* Meunier, 1910, p. 144, pl. 13, figs. 18, 19.

**Tintinnopsis pistillum** sp. nov.

Figure 41

*Cyrtarocyliis helix* var. c Brandt, 1906, p. 21, pl. 33, fig. 2; 1907, pp. 27, 169, on p. 220 as var. b; Entz, Jr., 1908, p. 100; Merkle, 1909, p. 155.

*Cyrtarocyliis helix* var. b *cochleata*, partim, Brandt, 1907, pp. 169, 217, 220, 259, 459, 467 (see also *Tps. cochleata*).

*Cyrtarocyliis* (*Coeliella*) *helix* var. *cochleata*, Rossolimo, 1922, pp. 29, 31, 33, pl. 2, fig. 21.

Lorica pestle-shaped, 3.6–4.7 oral diameters in length, cylindrical except for the aboral 0.12–0.28 of the total length; aboral region expanded, more or less globose, 1.1–1.4 oral diameters in diameter; aboral end flattened hemispherical; wall laid up in 15–17 spiral turns increasing in width aborally, minutely and regularly alveolar, 2–3 layers in thickness, with agglomerated fragments on the outer surface. Length 144 $\mu$ .

The type locality is the Kiel Fjord. Occurs also in the Black Sea.

Differs from *Tps. brandti* in lack of aboral flattening, from *Tps. subacuta* in absence of the aboral point, and from *Tps. turgida* in the presence of spiral structure.

**Tintinnopsis plagiostoma** Daday

Figure 68

*Codonella beroidea*, partim, Entz, Sr., 1884, pp. 411, 412, pl. 24, fig. 1 (for pl. 24, figs. 2–9 see *Tps. beroidea*).

*Tintinnopsis beroidea* var. *plagiostoma* Daday, 1887b, pp. 545, 548, 554, pl. 19, figs. 3, 6; Calkins, 1902, p. 451, fig. 47; 1926, p. 391, fig. 174c.

*Codonella beroidea* var. *plagiostoma*, Aurivillius, 1898, p. 368.

*Tintinnopsis beroidea*, partim, Brandt, 1907, pp. 135–138, 445, 447, 452, 455, 460, 476, 478 (see *Tps. beroidea* and *Tps. parvula*).

Raised to status of species.

Lorica broadly conical, 1 oral diameter in length; oral rim minutely ragged; no collar; convex conical below changing from 18° below the rim to 90° aborally; aboral end acute; wall with scattered rather coarse agglomerations. Length 50–60 $\mu$ .

The type locality is the Bay of Naples, Italy.

Differs from all other species in the broad conical form of the lorica. Perhaps only a flattened *Tps. beroidea* Stein.

**Tintinnopsis platensis** Cunha and Fonseca

Figure 89

*Tintinnopsis platensis* Cunha and Fonseca, 1917, pp. 140-141, figs. [1-2].**Tintinnopsis prowazeki** Faria and Cunha

Figure 88

*Tintinnopsis prowazeki* Faria and Cunha, 1917, p. 71, pl. 26, fig. 1.**Tintinnopsis radix** (Imhof) Brandt emended

Figure 93

*Codonella radix* Imhof, 1886a, p. 103; 1892, p. 4.

*Tintinnopsis Davidoffii* Daday, 1887b, p. 552, pl. 19, fig. 23; Calkins, 1902, pp. 415-416, fig. 48; 1926, p. 391, fig. 174F; Brandt, *partim*, 1907, pp. 177-179, *Tps. cylindrica*); non Wright, 1907, p. 18, pl. 4, fig. 14 (see *Tps. cylindrica*); Laackmann, 1913, pp. 23-24, pl. 2, figs. 35, 36; Rossolimo, 1922, pp. 26-27, pl. 2, fig. 13.

*Tintinnopsis Davidoffii* var. *cylindrica*, *partim*, Daday, 1887b, p. 553, pl. 19, fig. 25 (for pl. 19, fig. 24 see *Tps. cylindrica*).

*Tintinnopsis Davidoffii* var. *longicauda*, Daday, 1887b, pp. 545, 553, pl. 19, fig. 26.

*Tintinnopsis curvicauda* Daday, 1887b, pp. 554-555, pl. 19, fig. 33.

*Tintinnopsis curvicauda* forma *subrecta* Schmidt, 1901, p. 185.

*Tintinnopsis radix*, Brandt, 1907, pp. 20, 465, 477; Laackmann, 1913, pp. 17, 20-24, pl. 2, figs. 17-20, 27-28; Jörgensen, *partim*, 1924, pp. 69, 70, fig. 77 (see also *Tps. cylindrica*).

*Tintinnopsis radix* forma *typica* Laackmann, 1913, p. 22.

*Tintinnopsis radix* forma *tipica*, Teodoro, 1922, p. 19.

*Tintinnopsis radix* forma *curta* Laackmann, 1913, p. 23, pl. 2, figs. 21-24, 26.

*Tintinnopsis radix* forma *cylindrica*, Laackmann, 1913, p. 23, pl. 2, figs. 25, 29, 30, 31.

*Tintinnopsis fracta* Brandt, 1906, pl. 23, figs. 1, 3-5, 9-13, pl. 31, fig. 8; 1907, p. 174; Okamura, 1907, p. 137, pl. 6, fig. 57.

*Tintinnopsis* "fracta," Jörgensen, 1924, pp. 7, 69, 76.

*Cyrtarocydis subulatus*, Entz, Jr., 1904b, pp. 128-130, 133, figs. 7, 8.

**Tintinnopsis rapa** Meunier

Figure 24

*Tintinnopsis beroidea* var. a Brandt, 1906, p. 16, pl. 16, fig. 6; 1907, p. 138.

*Tintinnopsis rapa* Meunier, 1910, p. 141, pl. 12, figs. 29-35, pl. 13, figs. 14-16.

**Tintinnopsis reflexa** Kofoid

Figure 45

*Tintinnopsis reflexa* Kofoid, 1905, pp. 288-289, pl. 26, fig. 2; Brandt, 1907, pp. 20, 477.



**Tintinnopsis rotundata** Jörgensen

Figure 73

*Tintinnopsis beroidea*, Daday, 1887a, pp. 166, 183-185, pl. 2, fig. 9; 1887b, p. 547, pl. 19, figs. 2, 14; Entz, Jr., *partim*, 1908, pp. 10-135, pl. 1, fig. 12, pl. 3, fig. 2; 1909b, pp. 99-216, pl. 8, fig. 12, pl. 10, fig. 2 (for 1908, pl. 1, fig. 11 and 1909b, pl. 8, fig. 11 see *Tps. beroidea*).

*Tintinnopsis beroidea* var. *rotundata* Jörgensen, 1899, pp. 5, 24; 1900, p. lxxx; 1924, p. 68; 1927, p. 7; Brandt, 1907, p. 136.

*Tintinnopsis bermudensis* var. *rotundata*, Entz, Jr., 1908, p. 103.

Non *Tintinnopsis baltica* var. *rotundata* Laackmann, 1908, p. 20, pl. 1, fig. 9 (see *Tps. everta*).

Raised to status of species.

Lorica shaped like a short, stout, round-ended vial, 1.9 oral diameters in length; oral rim ragged; cylindrical to subconical ( $5^\circ$ ) below; aboral end hemispherical; wall coarsely agglomerated. Length 45-90 $\mu$ .

The type locality is off Wismer in the Baltic (see Jörgensen, 1899, p. 24 and Daday, 1887b, p. 547).

Differs from *Tps. beroidea* in rounded instead of pointed aboral end.

**Tintinnopsis sacculus** Brandt

Figure 32

*Tintinnopsis sacculus* Brandt, 1896, pp. 55-56, 64, 69, pl. 3, fig. 6; 1906, p. 17, pl. 19, figs. 6, 8, 13; 1907, pp. 20, 23, 27, 32, 34, 42, 44, 120, 129, 130, 133, 160, 164; Wailes, 1925, p. 537, pl. 2, fig. 9.

**Tintinnopsis schotti** Brandt

Figure 56

*Tintinnopsis dadayi* var. *a. schotti* Brandt, 1906, p. 18, pl. 22, fig. 2; 1907, pp. 145, 461, 468.

Raised to status of species.

Lorica very short campanulate, 1 oral diameter in length; oral rim erect, irregular; rim of collar subregular; collar inverted conical ( $70^\circ$ ), thickening basally; nuchal constriction a trifle more than the oral diameter in diameter; bowl subglobose; aboral end inverted convex conical ( $120^\circ$ ); aboral end bluntly pointed; wall of very coarse, irregular alveolar blocks. Length 100-110 $\mu$ .

The type locality is Station "Schott (15-VI-92)" off the west coast of Borneo.

Differs from *Tps. orientalis* in shorter, stouter bowl and more flaring collar.

**Tintinnopsis sinuata** Brandt

Figure 53

*Tintinnopsis sinuata* Brandt, 1896, p. 88, pl. 3, figs. 2, 3; Vanhöffen, 1897, p. 271, pl. 5, fig. 32; Brandt, 1906, p. 15, pl. 15, figs. 3, 4; 1907, pp. 139-140, 473; Meunier, 1910, p. 145, pl. 13, fig. 20.

**Tintinnopsis spiralis** nom. nov.

Figure 75

*Tintinnopsis cylindrica* Meunier, 1910, p. 140, pl. 12, figs. 12, 13; non Daday, 1892, pp. 172, 173, 175, 185, 190, 192, 194, 198, 201, pl. 1, fig. 10; Entz, Jr., 1904a, pp. 9-10, figs. 2a, b; 1905, pp. 204-205, pl. 5, figs. 4-6; 1909a, pp. 204-207, pl. 3, figs. 4-6; [?] Ostenfeld, 1908, pp. 220-221, table III, figs. 1, 2 (see *Tps. cylindrata*); non Wright, 1907, p. 11 (see *Tps. cylindrica*).

Lorica very tall inverted campanulate, 2.2-3.0 oral diameters in length; oral rim with adherent spicules, 1.3 diameters of the cylinder below in diameter; suboral region flaring for 0.15 oral diameter below the rim, inverted conical ( $70^\circ$ ); cylindrical below; aboral region convex conical ( $90^\circ$ ); aboral end blunt; wall with 10-12 equal spiral turns, aborally indistinct, with scanty agglomerations of foreign particles. Length 82-110 $\mu$ .

The type locality is the Barents Sea.

Differs from *Tps. loricata* in outwardly concave oral flare, prominent spiraling of the anterior part of the lorica, and thinner (?) wall.

**Tintinnopsis strigosa** Meunier

Figure 31

*Tintinnopsis strigosa* Meunier, 1919, p. 26, pl. 22, fig. 26; Jörgensen, 1927, p. 7. Smaller (85 $\mu$ ) than *Tps. campanula* (150-200 $\mu$ ).

**Tintinnopsis subacuta** Jörgensen

Figure 66

*Codonella ventricosa* forma b Nordqvist, 1890, p. 125, pl. [1], fig. 4 (for forma a, fig. 3 see *Tps. tubulosoides*).

Non *Codonella tubulosa* Levander, 1894, p. 90, pl. 3, fig. 8 (see *Tps. lobiancoi*).

*Codonella*, Peck, 1896, p. 359, pl. 66, fig. K [166 $\mu$ ?].

*Tintinnopsis subacuta* Jörgensen, 1899, p. 24, pl. 1, fig. 6.

*Tintinnopsis tubulosa* forma b Levander, 1900a, p. 19, fig. 5 (for fig. 4, forma a see *Tps. tubulosa*).

*Tintinnopsis tubulosa*, Brandt, *partim*, 1906, pp. 18-19, pl. 24, figs. 5, 6, 11, 12, 14, 15 (for figs. 8, 10 see *Tps. tubulosoides*, for fig. 13 see *Tps. aperta*); 1907, pp. 167-171, 444, 481 (see *Tps. aperta*, *Tps. tubulosa*, and *Tps. tubulosoides*); Okamura, 1907, pp. 138, 151, pl. 6, fig. 59; Merkle, *partim*, 1909, pp. 142, 144,

154-156, pl. 2, figs. 3, 4, 6, 7 (for figs. 5, 8 see *Tps. tubulosa*); Rossolimo, 1922, *partim*, pp. 26, 31, 33, pl. 2, fig. 11c (for fig. 11a see *Tps. tubulosa*); 1927, pp. 68-69, 74, fig. 7; Wailes, 1925, p. 537, pl. 2, fig. 10.

*Tintinnopsis* sp. Brandt, 1906, p. 16, pl. 17, figs. 1, 3; 1907, pp. 180-181.

*Tintinnopsis lohmanni* Laackmann, 1906, pp. 20, 25, 28, 32, 36, pl. 1, figs. 10, 11, pl. 2, fig. 23; Brandt, 1907, p. 20, 181, 470, 479.

*Ptychoeylis lohmanni*, Busch, 1920, p. 756.

*Tintinnopsis tubulosa* var. *subacuta* Jörgensen, 1927, pp. 6-7, fig. 4.

*Tintinnopsis tubulosa* var. *lohmanni*, Jörgensen, 1927, p. 17.

*Tintinnopsis macropus* Meunier, 1910, p. 138, pl. 12, figs. 2-4.

*Tintinnopsis tubulosa* forma *major, partim*, Leegaard, 1920, pp. 28-29, fig. 28b, at least the left-hand figure, the other three may be damaged loricae of *Tps. tubulosa* (for fig. 27a see *Tps. tubulosa*).

Differs from *Tps. tubulosa* Levander emended in the presence of an aboral point and from *Tps. tubulosoides* Meunier in having a marked aboral expansion. *Tps. lohmanni* Laackmann, *Tps. macropus* Meunier, and *Tps.* sp. Brandt are based on incomplete loricae.

#### ***Tintinnopsis tocaninensis* sp. nov.**

Figure 46

*Tintinnopsis aperta* var. a Brandt, 1906, p. 19, pl. 25, figs. 2, 7; 1907, pp. 129, 177.

Lorica with oral cylindrical and aboral bulbous parts subequal, the latter without spiral structure; aboral horn stout, about an oral diameter in length; wall thick. Length 85 $\mu$ .

The type locality is Station Pl. 108 of the Plankton Expedition off the mouth of the Tocantins River.

Differs from *Tps. aperta* in longer bulbous enlargement and stouter horn.

#### ***Tintinnopsis tubulosa* Levander emended**

Figure 39

*Tintinnopsis tubulosa* forma a Levander, 1900a, p. 18, fig. 4 (for fig. 5, forma b see *Tps. subacuta*).

Non *Codonella tubulosa* Levander, 1894c, p. 90, pl. 3, fig. 8 (see *Tps. lobiancoi*).

*Tintinnopsis tubulosa, partim*, Brandt, 1907, pp. 167-171, 444, 481 (see *Tps. aperta, Tps. subacuta*, and *Tps. tubulosoides*); Merkle, 1909, pp. 142, 144, 153, pl. 2, figs. 5, 8 (for pl. 2, figs. 3, 4, 6, 7 see *Tps. subacuta*); Rossolimo, 1922, pp. 26, 31, 33, pl. 2, fig. 11a (for fig. 11c see *Tps. subacuta*).

*Tintinnopsis tubulosa* forma *major, partim*, Leegaard, 1920, pp. 28-29, fig. 27a (for fig. 28b, at least in part, see *Tps. subacuta*).

Differs from *Tps. subacuta* Jörgensen and *Tps. tubulosoides* Meunier in absence of an aboral point.

**Tintinnopsis tubulosoides** Meunier

Figure 74

*Codonella ventricosa* forma a Nordqvist, 1890, p. 125, pl. [1], fig. 3 (for forma b, fig. 4 see *Tps. subacuta*).

*Tintinnopsis tubulosoides* Meunier, 1910, pp. 139-140, pl. 12, figs. 10, 11.

*Tintinnopsis karajacensis* Brandt, *partim*, 1906, p. 17, pl. 19, fig. 11; 1907, pp. 162-163 (for pl. 19, figs. 5, 10, 12, 19, pl. 26, fig. 3 see *Tps. karajacensis* and for pl. 19, fig. 7, see *Tps. lobiancoi*); Rossolimo, 1922, pp. 25, 31, 44, pl. 2, fig. 9; 1927, *partim*, pp. 67, 68, 74, 75, fig. 5, first 16 loricae (for fig. 5, last 14 loricae and fig. 6 see *Tps. karajacensis*).

*Tintinnopsis tubulosa*, *partim*, Brandt, 1906, pp. 18-19, pl. 24, figs. 8, 10 (for pl. 24, figs. 5, 6, 11, 12, 14, 15 see *Tps. subacuta* and for pl. 24, fig. 13 see *Tps. aperta*); 1907, pp. 167-171, 444, 481 (see *Tps. aperta*, *Tps. subacuta*, and *Tps. tubulosa*).

Differs from *Tps. tubulosa* and *Tps. subacuta* in the absence of marked aboral enlargement.

**Tintinnopsis turbo** Meunier

Figure 19

*Tintinnopsis(?) nucula*, *partim*, Brandt, 1906, p. 15, pl. 16, fig. 3; 1907, pp. 158-160 (for pl. 16, figs. 1, 9, 13, 14 see *Tps. lata* and for pl. 16, figs. 10, 12 see *Tps. nucula*).

*Tintinnopsis turbo* Meunier, 1919, p. 26, pl. 22, fig. 27; Jörgensen, 1927, p. 7.

**Tintinnopsis turgida** sp. nov.

Figure 65

*Tintinnopsis karajacensis* var. b Brandt, 1906, pp. 17, 19, pl. 19, figs. 9, 20, pl. 26, fig. 9; 1907, pp. 163, 469.

Lorica cylindrical or subcylindrical anteriorly, expanding aborally to as much as 1.3 oral diameters; aboral end broadly rounded, sometimes with a faint indication of a point. Length 80-110 $\mu$ .

The type locality is off Borneo. Occurs also in the Arabian Sea off Bombay and at Station Pl. 108 of the Plankton Expedition off the mouth of the Tocantins River.

Differs from *Tps. karajacensis* and *Tps. gracilis* in distended and rounded aboral region.

**Tintinnopsis undella** Meunier

Figure 35

*Tintinnopsis Undella* Meunier, 1910, p. 146, pl. 13, fig. 28.



**Tintinnopsis urniger** (Entz, Sr.) Daday

Figure 77

*Codonella Urniger* Entz, Sr., 1884, p. 412, pl. 24, fig. 23.*Tintinnopsis urniger*, Daday, 1887*b*, p. 551; Brandt, 1907, pp. 11, 20, 23, 128, 147, 457, 482.*Tintinnus urniger*, Hensen, 1887, p. 67; Lohmann, 1908, pp. 14, 15.*Tintinnopsis urniger* var. *laevis* Daday, 1887*b*, p. 552, pl. 19, fig. 19 [a lorica with annuli obscured].*Tintinnopsis campanula*, partim, Brandt, 1907, pp. 144-151, 457 (see *Tps. campanula*, *Tps. cineta*, *Tps. cyathus*, and *Tps. infundibulum*).*Tintinnopsis annulata*, Entz, Jr., 1908, pp. 103, 113, 125, pl. 1, fig. 4; 1909*b*, pp. 198, 199, 214, pl. 8, fig. 4.Differs from *Tps. campanula* in tapering posterior half of lorica and less oral flare.**Tintinnopsis urnula** Meunier

Figure 20

*Tintinnopsis* sp. Okamura, 1907, pp. 139, 151, pl. 6, fig. 63.*Tintinnopsis urnula* Meunier, 1910, pp. 145-146, pl. 13, figs. 21-24, [?] 25.**Tintinnopsis vasculum** Meunier

Figure 29

*Tintinnopsis vasculum* Meunier, 1919, p. 25, pl. 22, fig. 25; Jørgensen, 1927, p. 7.Differs from *Tps. baltica* in lack of an oral shelf.**Tintinnopsis vosmaeri** Daday

Figure 79

*Tintinnopsis Vosmaeri* Daday, 1887*b*, p. 549, pl. 19, figs. 10, 11; Brandt, 1907, pp. 11, 20, 22, 128, 129, 181, 484.*Tintinnopsis Vosmaeri* var. *curvicornis* Daday, 1887*b*, pp. 549-550, pl. 19, fig. 12; Brandt, 1907, pp. 460, 484; Rossolimo, 1922, p. 25; non Schweyer, 1909, pp. 140, 160, 168, 187, pl. 11, figs. 12, 13*a* (see *Coxiella helix*).*Tintinnopsis Vosmaeri* var. *elongata*, partim, Daday, 1887*b*, p. 550, pl. 19, fig. 13 (for fig. 15 see *Tps. elongata*).**Tintinnopsis wailesi** sp. nov.

Figure 44

*Tintinnopsis chrenbergii* Clap. and Lach., Wailes, 1925, p. 535, pl. 1, fig. 32.Non *Tintinnus chrenbergii* Claparède and Lachmann, 1858, p. 203, pl. 8, figs. 6, 7 (see *Favella chrenbergii*).

Lorica cylindrical in its anterior two-thirds, aboral third conical (55°); aboral end contracting into a short, solid, blunt horn deflected

45° (in the lorica figured); spiral structure evident in the anterior half with 6 subuniform spirals, posterior half with *Tintinnopsis* structure; wall thick. Length 75 $\mu$ , diameter 25 $\mu$ .

The type locality is the Strait of Georgia, British Columbia.

Differs from species of *Coxiella* in posterior *Tintinnopsis* structure and from *Favella chrenbergii* (Claparède and Lachmann) in much smaller size, extensive spiral structure, and *Tintinnopsis* structure of a part of the wall. Differs from *Tps. cincta* in absence of oral flare and smaller size.

### **Codonella** Haeckel emended Brandt emended Jörgensen

*Tintinnus*, *partim*, Claparède and Lachmann, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Coxiella*, *Favella*, *Parandella*, *Prolectella*, *Ptychoocylis*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*).

*Codonella* Haeckel, *partim*, 1873, pp. 564-567 (see also *Codonellopsis* and *Tintinnopsis*); Bütschli, 1889, p. 1736; Brandt, *partim*, 1907, pp. 73-126 (see also *Codonellopsis*); Jörgensen, 1924, pp. 5-8, 16, 32, 65, 90, 98-99.

*Diffugia*, Leidy, 1877, p. 307.

*Cyttarocylis* Fol, *partim*, 1884, p. 31 (see also *Cyttarocylis*); Entz, Sr., 1885*b*, p. 213; Daday, 1887*a*, p. 178; 1887*b*, *partim*, pp. 574-575 (see also *Coxiella*, *Epiplocylis*, and *Favella*).

*Dictyocysta*, *partim*, Entz, Sr., 1886, pp. 208-212 (see also *Dictyocysta*).

Codonellidae with lorica generally urn- to pot-shaped, sharply divided externally or internally into a collar and bowl; collar patterned, without distinct annuli and never with spiral structure; wall of both collar and bowl with an irregular *Cyttarocylis* structure, often with agglomerated material, and often with coccoliths; closing apparatus often present.

We designate as the type species *Codonella galca* Haeckel from the Straits of Messina, a well-known species of the genus.

Differs from *Tintinnopsis* in the sharper differentiation of the collar by a well defined nuchal constriction or an internal nuchal shelf.

Includes 35 species as follows:

<i>acerea</i> Jörg.	<i>australis</i> sp. nov.
<i>acuta</i> sp. nov.	<i>benquelenensis</i> sp. nov.
<i>acutula</i> sp. nov.	<i>brevicollis</i> (Daday) Bdt.
<i>amphorella</i> Biedermann	<i>eistellula</i> (Fol) Bdt.
<i>angusta</i> sp. nov.	<i>cratera</i> (Leidy) Vorec
<i>apicata</i> sp. nov.	<i>cuspidata</i> sp. nov.
<i>aspera</i> sp. nov.	<i>dadayi</i> sp. nov.

diomedae sp. nov.	olla sp. nov.
elongata sp. nov.	pacifica sp. nov.
galea Haeckel	perforata Entz, Sr.
inflata sp. nov.	poeculum sp. nov.
lagenula (Clap. and Lach.) Entz, Sr.	rapa sp. nov.
lariana Zacharias	recta sp. nov.
lata sp. nov.	relicta Minkiewitsch
laticollis (Daday)	robusta sp. nov.
mucronata sp. nov.	saccus sp. nov.
nationalis Bdt.	sphaerica Carazzi
oceanica Bdt.	tropica sp. nov.

### **Codonella acerca** Jörgensen

Figure 113

*Codonella nationalis* var. b Brandt, 1906, p. 12, pl. 5, figs. 11, 11a; 1907, pp. 80, 85, 93, 462.

*Codonella acerca* Jörgensen, 1924, pp. 12, 13, 91, fig. 103.

### **Codonella acuta** sp. nov.

Figure 104

Collar convex flaring; length 0.25 total length; nuchal constriction well defined; bowl broadly ovate; its greatest diameter about midway of its length; aboral end pointed. Length 80–105 $\mu$ .

The type locality is Station 4666 in the Peruvian Current. Occurs also widely distributed in the Eastern Tropical Pacific.

Differs from *C. galea* in deeper nuchal constriction and more pointed aboral end and from *C. cuspidata* in the absence of a differentiated aboral point.

### **Codonella acutula** sp. nov.

Figure 112

Lorica cylindrical in the anterior 0.6; no external nuchal constriction; oral margin minutely serrate; collar 0.2 total length; aboral end convex conical (95°), with short, stout conical point. Length 86 $\mu$ .

The type locality is Station 4640 in the Panamic Area.

Differs from *C. poculum* and *C. robusta* in having a conical, pointed aboral end and from the latter in having no external nuchal constriction.

**Codonella amphorella** Biedermann

Figure 132

*Codonella amphorella* Biedermann, 1893, pp. 16-17, pl. 2, fig. 1; Brandt, *partim*, 1906, p. 13, pl. 9, figs. 2, 3 (for pl. 10, fig. 8 see *C. rapa*); 1907, pp. 27, 100; Entz, Jr., 1909*b*, pp. 199, 215, pl. 9, fig. 1; Laackmann, 1909, p. 424, pl. 49, fig. 4; Jørgensen, *partim*, 1924, pp. 91, 93, 106, fig. 104 (see also *C. rapa*).

*Codonella Amphorella*, Entz, Jr., 1908, pp. 113, 126, pl. 2, fig. 1.

**Codonella angusta** sp. nov.

Figure 117

*Codonella cistellula* var. d Brandt, 1906, p. 14, pl. 10, fig. 1; 1907, p. 99.

Collar tall, outwardly convex, with a low shelf and gutter 0.25 width of collar below the oral margin; deep nuchal constriction with a low internal shelf at the cervix of the bowl; bowl subspheroidal with some distal inflation; no aboral point. Length 80-98 $\mu$ .

The type locality is Station Pl. 55 of the Plankton Expedition in the Sargasso Sea.

Differs from *C. cistellula* in smallness of the suboral shelf and convexity of the collar.

**Codonella apicata** sp. nov.

Figure 116

*Codonella perforata* var. a Brandt, 1906, p. 12, pl. 6, figs. 6, 7; 1907, pp. 79, 96.

*Codonella perforata*, Brandt, 1906, pp. 13, 14, pl. 6, figs. 3, 4, 8, pl. 10, fig. 11; 1907, pp. 26, 95-96; Entz, Jr., 1908, pp. 32-130, pl. 9, fig. 5; 1909*b*, pp. 121-219, pl. 16, fig. 5; Jørgensen, *partim*, 1924, pp. 91, 93, 105, 106, fig. 105 (see also *C. diomedae*, *C. galea*, and *C. perforata*).

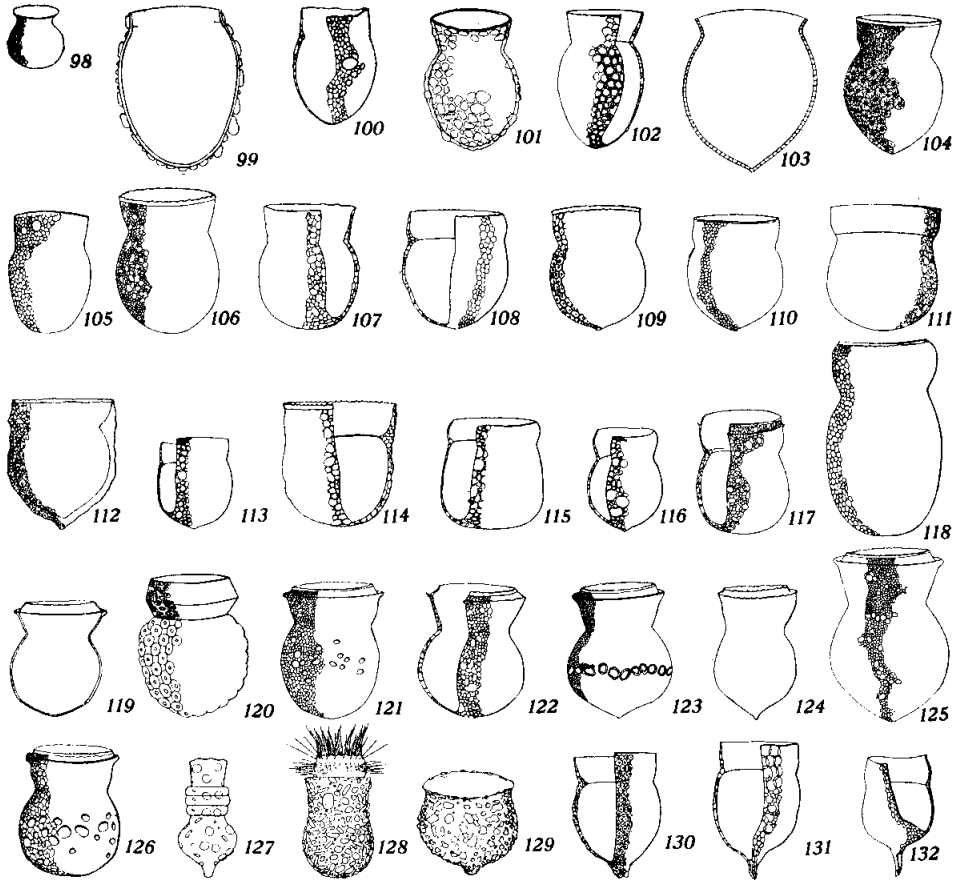
*Tintinnopsis nucula*, *partim*, Entz, Jr., 1908, p. 128, pl. 6, fig. 9; 1909*b*, p. 217, pl. 13, fig. 9 (for 1908, pl. 6, fig. 4 and 1909*b*, pl. 13, fig. 4 see *Stenosemella steini*).

*Stenosemella nucula*, *partim*, Jørgensen, 1924, pp. 95-96; 1927, pp. 8, 15, 17, 20, 21 (for 1924, figs. 108*a*, *b* and 1927, fig. 7 see *Stenosemella nivalis*, see also *S. avellana*, *S. oliva*, and *Tintinnopsis nucula*).

Lorica acorn-shaped, its length 1.75 oral diameters; collar rounded, not plainly angled near its widest part; bowl stout ovate, widest near its middle; aboral end acute, subconical, or faintly cuspidate. Length 52-94 $\mu$ .

The type locality is Station Pl. 83 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the Gulf Stream, Strait of Messina, Sargasso Sea, Bay of Bengal, and off New Pomerania; widely distributed in the Eastern Tropical Pacific.

Differs from *C. perforata* in smaller size, rounded collar, and more pointed aboral region.



Figs. 98-132. Species of *Codonella* Haeckel emended Brandt emended Jörgensen.  $\times 200$ .

Fig. 98. *C. lagunula* (Clap. and Lach.) Entz, Sr. emended after Claparède and Lachmann (1858, pl. 8, fig. 10) from off Copenhagen, Denmark.

Fig. 99. *C. brevicollis* (Daday) Bdt. after Daday (1887*b*, pl. 20, fig. 10) from the Bay of Naples.

Fig. 100. *C. saccus* sp. nov. after Brandt (1906, pl. 5, fig. 7) from Station Pl. 100 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 101. *C. aspera* sp. nov. after Fol (1884, pl. 5, fig. 14) from off Villefranche-sur-Mer in the Mediterranean.

Fig. 102. *C. clongata* sp. nov. after Brandt (1906, pl. 4, fig. 21) from off Santa Cruz, Azores.

Fig. 103. *C. laticollis* (Daday) after Daday (1887*b*, pl. 20, fig. 28) from the Bay of Naples, Italy.

Fig. 104. *C. acuta* sp. nov. from Station 4666 in the Peruvian Current.

Fig. 105. *C. pacifica* sp. nov. from Station 4574 in the California Current.

Fig. 106. *C. galca* Haeckel from Station 4583 in the Mexican Current.

Fig. 107. *C. nationalis* Bdt. after Brandt (1906, pl. 5, fig. 9) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Fig. 108. *C. inflata* sp. nov. after Brandt (1906, pl. 5, fig. 5) from off the Somali Coast, Indian Ocean.

**Codonella aspera** sp. nov.

Figure 101

*Codonella galea*, Fol, 1884, pp. 42, 61, pl. 5, fig. 14; Entz, Jr., *partim*, 1908, pp. 10-136, pl. 10, fig. 15; 1909*b*, pp. 99-224, pl. 17, fig. 15 (for 1908, pl. 2, figs. 8, 11, 17, 18 and 1909*b*, pl. 9, figs. 8, 11, 17, 18 see *C. elongata*, and for 1908, pl. 10, fig. 3, pl. 13, fig. 44 and 1909*b*, pl. 17, fig. 3, pl. 20, fig. 44 see *C. galea*); Jørgensen, *partim*, 1924, pp. 90-91 (see also *C. elongata* and *C. galea*).

Figs. 98-132. Species of *Codonella* Ilaeckel emended Brandt emended Jørgensen. × 200. (Concluded.)

- Fig. 109. *C. cuspidata* sp. nov. after Brandt (1906, pl. 7, fig. 1) from Station "Dahl, 18-11-97" off Ralum, New Pomerania in the Western Tropical Pacific.
- Fig. 110. *C. tropica* sp. nov. from Station 4594 in the Mexican Current.
- Fig. 111. *C. robusta* sp. nov. after Brandt (1906, pl. 4, fig. 10) from Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.
- Fig. 112. *C. acutula* sp. nov. from Station 4640 in the Panamic Area.
- Fig. 113. *C. acerca* Jørg. after Brandt (1906, pl. 5, fig. 11) from Station Pl. 35 of the Plankton Expedition in the Sargasso Sea.
- Fig. 114. *C. poculum* sp. nov. after Brandt (1906, pl. 9, fig. 1) from Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.
- Fig. 115. *C. olla* sp. nov. after Brandt (1906, pl. 7, fig. 2) from Station Pl. 86 of the Plankton Expedition in the South Equatorial Current of the Atlantic.
- Fig. 116. *C. apicata* sp. nov. after Brandt (1906, pl. 6, fig. 4) from Station Pl. 83 of the Plankton Expedition in the South Equatorial Current of the Atlantic.
- Fig. 117. *C. angusta* sp. nov. after Brandt (1906, pl. 10, fig. 1) from Station Pl. 55 of the Plankton Expedition in the Sargasso Sea.
- Fig. 118. *C. diomedae* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.
- Fig. 119. *C. australis* sp. nov. from Station 4680 in the South Equatorial Drift near the Peruvian Current.
- Fig. 120. *C. perforata* Entz, Sr. emended after Entz, Sr. (1884, pl. 24, fig. 12) from the Bay of Naples.
- Fig. 121. *C. benguelensis* sp. nov. from Station 4737 in the South Equatorial Drift near the Paumotu Islands.
- Fig. 122. *C. oceanica* Bdt. emended after Brandt (1906, pl. 8, fig. 2) from Station Pl. 121 of the Plankton Expedition in the Gulf Stream.
- Fig. 123. *C. mucronata* sp. nov. from Station 4669 in the Peruvian Current.
- Fig. 124. *C. dadayi* sp. nov. after Entz, Jr. (1908, pl. 6, fig. 3) from the Bay of Naples.
- Fig. 125. *C. cistellula* (Fol) Bdt. from Station 4583 in the Mexican Current.
- Fig. 126. *C. lata* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.
- Fig. 127. *C. lariana* Zach. after Zacharias (1905, p. 224 [fig.]) from Lago Lario, Italy.
- Fig. 128. *C. cratera* (Leidy) Vorce after Fauré-Fremiet (1924, p. 88, fig. 28) from fresh-water lakes in France.
- Fig. 129. *C. relicta* Minkiewitsch after Entz, Jr. (1909*a*, p. 220 [fig.]) from the Aral Sea.
- Fig. 130. *C. rapa* sp. nov. after Brandt (1906, pl. 7, fig. 4) from off Ralum, New Pomerania in the Western Tropical Pacific.
- Fig. 131. *C. recta* sp. nov. after Brandt (1906, pl. 10, fig. 3) from Station 16 (Schott) in the Agulhas Current.
- Fig. 132. *C. amphorella* Biedermann after Brandt (1906, pl. 9, fig. 2) from Station Pl. 36 of the Plankton Expedition in the Sargasso Sea.

*Codonella lagenula*, Entz, Sr., *partim*, 1884, p. 413, pl. 24, figs. 11, 15, 16; 1885*b*, pp. 203, 204, pl. 14, fig. 14 (see *C. lagenula*); Daday, *partim*, 1887*b*, pp. 570-571, pl. 20, figs. 12, 14, 16 (for fig. 10 see *C. brevicollis*); Bütschli, 1889, p. 1736, pl. 70, fig. 5; Delage and Hérouard, 1896, p. 467, fig. 790.

*Codonella galca* var. a Brandt, 1906, p. 12, pl. 4, fig. 22; 1907, pp. 81, 85, 90, 134, 466.

Lorica stout ovate; collar 0.91 width of bowl, flaring 15°, 0.24 total length in length, slightly convex outwardly; bowl rotund ovate; aboral end rather broadly rounded, or slightly contracted; no projecting aboral point; wall often includes coarse particles. Length 85-90 $\mu$ .

The type locality is off Villefranche-sur-Mer in the Mediterranean. Occurs also in the Strait of Messina, the Mediterranean, and the California Current, off San Diego.

Differs from *C. elongata* in more rotund bowl, less pointed aboral end, more convexity of the collar, and coarser particles included in the wall.

### *Codonella australis* sp. nov.

Figure 119

*Codonella cistellula* var. a *oceanica*, *partim*, Brandt, 1906, p. 14, pl. 10, fig. 2; 1907, p. 98 (for pl. 8, figs. 1, 2 see *C. oceanica*).

*Codonella cistellula*, *partim*, Jörgensen, 1924, p. 94 (see also *C. benguelensis*, *C. cistellula*, *C. dadayi*, *C. mucronata*, and *C. oceanica*).

Lorica 1.68 oral diameters in length; collar a truncated cone of 65°, with a deep trough and smooth oral rim forming 0.11 total length; nuchal diameter equalling the oral; anterior portion of bowl an inverted truncated cone of 65°, forming 0.17 total length; bowl proper elongate subspheroidal, with its greatest diameter 1.33 oral diameters located at 0.55 total length from the oral margin; aboral end pointed; wall, except in collar, subuniform (0.06 oral diameter) in thickness, thickest (0.1 oral diameter) at the nuchal constriction; secondary alveoli subuniform, about 40 across one side of bowl, a few tertiary (coccoliths?) in the equatorial region. Length 73 $\mu$ .

The type locality is Station Pl. 99 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also widely distributed in the Eastern Tropical Pacific.

Differs from *C. oceanica* in pointed aboral end, deeper trough with stouter ledge, and thicker wall.

**Codonella benguelensis** sp. nov.

Figure 121

*Codonella cistellula* var. c Brandt, 1906, p. 13, pl. 8, fig. 3; 1907, pp. 80, 86, 94, 459.

*Codonella cistellula*, partim, Jörgensen, 1924, p. 94 (see *C. australis*, *C. cistellula*, *C. dadayi*, *C. mucronata*, and *C. oceanica*).

Lorica stout, its length 1.56 oral diameters; neck not deeply constricted, its diameter equaling that of oral aperture and 1.25 or less that of bowl; collar convex rather than plane, ledge and trough strongly developed; bowl elongated spheroidal; aboral end hemispherical. Length 80–88 $\mu$ .

The type locality is Station Schott, f (3–VIII–92) in the Benguela Current. Occurs also in the South Equatorial Drift in the Pacific.

Differs from *C. angusta* in more convex collar and wider suboral ledge.

**Codonella brevicollis** (Daday) Brandt

Figure 99

*Cyttarocyclus brevicollis* Daday, 1887b, pp. 575, 576, pl. 20, fig. 24; Brandt, 1907, pp. 11, 88, 90, 182, 456, 466.

*Codonella brevicollis*, Brandt, 1907, pp. 23, 75, 88.

*Codonella galca* var. b Brandt, 1906, p. 12, pl. 5, fig. 6.

*Codonella galca* var. *brevicollis*, Brandt, 1907, pp. 19, 90, 456; Rossolimo, 1922, pp. 24, 32.

*Codonella lagenula*, partim, Daday, 1887b, pp. 570–571, pl. 20, fig. 10 (for figs. 12, 14, 16 see *C. aspera*).

**Codonella cistellula** (Fol) Brandt

Figure 125

*Cyttarocyclus cistellula* Fol, 1884, pp. 42, 56, 57, pl. 5, fig. 8; Daday, 1887a, pp. 159–208, pl. 1, fig. 14; 1887b, partim, pp. 482, 486, 572, 575, 578, pl. 20, fig. 32, pl. 21, figs. 2, 10, 15, 20 (for pl. 20, fig. 27 see *C. dadayi*); Haeckel, 1899, pl. 3, fig. 5.

*Codonella punctata* Daday, 1886, pp. 482, 495, pl. 25, fig. 13.

*Codonella cistellula*, Brandt, 1906, p. 13, pl. 8, fig. 4; 1907, pp. 19, 23, 26, 28, 30, 31, 42, 75–84, 86–88, 101, 201, 459, 477; Entz Jr., partim, 1908, pp. 10–131, pl. 1, fig. 14, pl. 6, fig. 2, pl. 10, fig. 10, pl. 13, figs. 37, 38, 40–43; 1909b, pp. 98–204, pl. 8, fig. 14, pl. 13, fig. 2, pl. 17, fig. 10, pl. 20, figs. 37, 38, 40–43 (for 1908, pl. 6, fig. 3 and 1909b, pl. 13, fig. 3 see *C. dadayi*); Jörgensen, partim, 1924, pp. 91, 94, 106, fig. 106 (see *C. australis*, *C. benguelensis*, *C. dadayi*, *C. mucronata*, and *C. oceanica*).

*Condella cistellula*, Entz, Jr., 1909b, p. 102. *Lapsus pennae*.



**Codonella cratera** (Leidy) Vorce

Figure 128

*Diffugia cratera* Leidy, 1877, p. 307; 1879, pp. 108, 109, pl. 12, figs. 19-21, pl. 16, fig. 35.

*Tintinnus cratera* Leidy, 1879, p. 109.

*Codonella cratera*, Vorce, 1881, p. 223; Kofoid, 1896, pp. 80, 82.

*Codonella acuminata* Imhof, 1886a, p. 103.

*Codonella lacustris* Entz, Sr., 1885b, pp. 196-200, pl. 13, figs. 10-16; Entz, Jr., *partim*, 1905, pp. 198-201, 205-216, 218; 1909a, pp. 197-198, 200, 207-222 (see *C. relicta* and *C. lariana*); Daday, 1887b, pp. 511, 514, 546, 562; Apstein, 1893a, pp. 95-98, fig. [1]; 1896, p. 154, fig. 58; Wesenberg-Lund, 1904, p. 146, pl. 1, fig. 8, pl. 2, fig. 16, pl. 4, fig. 46, pl. 10, figs. 114, 119; Seligo, 1907, p. 71, fig. 119; 1908, pp. 41-45, fig. 115; Francé, *partim*, 1912, p. 35, fig. 38 [right] (for fig. 38 [left] see *Tps. ovalis*); Schermer, *partim*, 1916, pp. 26, 27, pl. [1], figs. 1-7, 10-12 (for fig. 8 see *C. lariana* and for fig. 9 see *Tps. cylindrata*); Fauré-Fremiet, 1924, pp. 89, 90, fig. 28; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 385.

*Codonella lacustris* var. *insubrica* Zacharias, 1905a, pp. 213, 214, [2] figs.

*Codonella lacustris* forma *reticulata* Entz, Jr., 1905, pp. 211, 213, 216, pl. 7, figs. 1-7, pl. 8, fig. 10; 1908, pp. 14, 114; 1909a, pp. 214, 218, 222, 225, pl. 5, figs. 1-7, pl. 6, fig. 10.

*Codonella lacustris* forma *laevis*, *partim*, Entz, Jr., 1905, pp. 211, 213, 215, pl. 6, figs. 1-3, 5-7, pl. 7, figs. 8-13, pl. 8, figs. 1-3, 5-7, 11; 1909a, pp. 215, 218, 221, 224, 225, pl. 4, figs. 1-3, 5-7, pl. 5, figs. 8-13, pl. 6, figs. 1-3, 5-7, 11 (for 1905, pl. 6, fig. 4, pl. 8, figs. 4, 8 and 1909a, pl. 4, fig. 4, pl. 6, figs. 4, 8 see *Tps. entzii*).

*Codonella lacustris* forma *prolongata* Seligo, 1907, p. 71, fig. 120; 1908, pp. 41, 42, fig. 152.

*Tintinnopsis lacustris*, Brandt, 1906, p. 15, pl. 16, fig. 2, pl. 17, fig. 13; 1907, pp. 140, 141; Merkle, 1909, pp. 144, 172, 186, pl. 2, fig. 16; Entz, Jr., *partim*, 1909b, pp. 93-205 (see also *C. relicta*).

*Tintinnopsis lacustris* forma *laevis* Entz, Jr., 1909b, pp. 93-205.

*Tintinnopsis lacustris* forma *reticulata* Entz, Jr., 1909b, pp. 93-205.

**Codonella cuspidata** sp. nov.

Figure 109

*Codonella nationalis* var. a Brandt, 1906, p. 13, pl. 7, figs. 1, 1a; 1907, pp. 80, 85, 93, 472.

Lorica stout, its length 1.47 oral diameters; collar not much flaring distally, scarcely sigmoid outwardly; nuchal constriction localized; bowl widest below its middle; aboral end cuspidate with well defined, stout, blunt point. Length 82-92 $\mu$ .

The type locality is off Ralum, New Pomerania. Occurs also widely distributed in the Eastern Tropical Pacific.

Differs from *C. acuta* in the presence of a well defined, stout and blunt point at the aboral end and from *C. galea* in the less pronounced nuchal constriction.

**Codonella dadayi** sp. nov.

Figure 124

*Cyttarocyclus cistellula*, *partim*, Daday, 1887*b*, p. 578, pl. 20, fig. 27 (for pl. 21, figs. 2, 10, 15, 20, 32 see *C. cistellula*).

*Codonella cistellula*, *partim*, Entz, Jr., 1908, pp. 10-135, pl. 6, fig. 3; 1909*b*, pp. 99-224, pl. 13, fig. 3 (for 1908, pl. 1, fig. 14, pl. 6, fig. 2, pl. 10, fig. 10, pl. 13, figs. 37, 38, 40-43 and for 1909*b*, pl. 8, fig. 14, pl. 13, fig. 2, pl. 17, fig. 10, pl. 20, figs. 37, 38, 40-43 see *C. cistellula*); Jørgensen, 1924, pp. 91, 94, 106 (for fig. 106 see *C. cistellula*, see also *C. benguelensis*, *C. mucronata*, and *C. oceanica*).

Lorica elongated, 1.95 oral diameters in length; oral rim low, 0.1 oral diameters high; collar 0.4 oral diameters high, flaring 10°; bowl pointed ovate posteriorly, widest at its middle, its posterior 0.5 a wide cone of 90°. Length about 120 $\mu$ .

The type locality is in the Mediterranean, off Naples.

Differs from all other species of the *cistellula* group in the conical aboral end.

**Codonella diomedae** sp. nov.

Figure 118

*Dietyocysta polymorpha* Entz, Sr., *partim*, 1885*b*, pp. 205-208, pl. 14, fig. 2 (for pl. 14, figs. 3-5 see *C. galea* and for pl. 14, fig. 1 see *C. perforata*).

*Codonella perforata*, Jørgensen, *partim*, 1924, pp. 91, 93, 105, 106 (for fig. 105 see *C. apicata*, see also *C. galea* and *C. perforata*).

A large species, length 2.17 oral diameters, with inturned oral rim; collar very convex, 0.31-0.37 total length in length; bowl elongated, sac-like; aboral end somewhat flattened. Length 105-127 $\mu$ .

The type locality is Station 4681 in the South Equatorial Drift of the Pacific. Occurs also in the Galapagos and Easter Island eddies of the Eastern Tropical Pacific and in the Mediterranean.

Differs from *C. perforata* and *C. apicata* in the elongation of the bowl and flattened aboral end.

**Codonella elongata** sp. nov.

Figure 102

*Cyttarocyclus polymorpha*, Daday, 1887*a*, p. 178; 1887*b*, *partim*, pp. 487, 515, 575-577, pl. 20, fig. 29 (for pl. 20, figs. 25, 26, 30 see *C. galea*).

Non *Dietyocysta polymorpha* Entz, Sr., 1885*b*, pp. 205-208, pl. 14, figs. 1-5 (for pl. 14, fig. 2 see *C. diomedae*, for pl. 14, figs. 3-5 see *C. galea*, and for pl. 14, fig. 1 see *C. perforata*).

*Codonella polymorpha*, Biedermann, 1893, pp. 17, 20, pl. 2, fig. 2.

*Codonella galea*, Brandt, 1906, p. 12, pl. 4, figs. 20, 21, pl. 10, fig. 9; 1907, *partim*, pp. 88-90 (see also *C. galea*); Entz, Jr., *partim*, 1908, pp. 10-136, pl. 2, figs. 8, 11, 17, 18; 1909*b*, pp. 99-226, pl. 9, figs. 8, 11, 17, 18 (for 1908, pl. 10, fig. 3, pl. 13, fig. 44 and 1909*b*, pl. 17, fig. 3, pl. 20, fig. 44 see *C. galea*, and for 1908, pl. 10, fig. 15 and 1909*b*, pl. 17, fig. 15 see *C. aspera*); Jörgensen, *partim*, 1924, pp. 90-91, fig. 101 (see also *C. aspera* and *C. galea*).

*Codonella galea* var. e Laackmann, 1909, pp. 423-436.

*Codonella galea* var. f Laackmann, 1909, pp. 423-436.

*Codonella nationalis*, Jörgensen, *partim*, 1924, pp. 91, 92 (for fig. 102 see *C. nationalis*, see also *C. galea*).

Lorica elongated, length exceeding 1.5 diameters of bowl; collar flaring 30°; bowl elongate ovate, its length 1.25 diameters, contracting aborally; aboral end rounded or bluntly pointed. Length 85-117 $\mu$ .

The type locality is off Naples in the Mediterranean. Occurs also in the North Equatorial Current, Station 67 of the Plankton Expedition, and is widely distributed in the Tropical Atlantic, Mediterranean, Peruvian and California Currents in the Pacific.

Differs from *C. galea* and *C. nationalis* in more elongated, more pointed bowl and from *C. aspera* in less convex collar, more pointed aboral end, and more regular contents of the wall.

### *Codonella galea* Haeckel

#### Figure 106

*Codonella galea* Haeckel, 1873, pp. 51, 52, 53, pl. 28, figs. 8, 9; Kent, 1882, pp. 608, 616, 617, pl. 31, figs. 32, 33; Brandt, *partim*, 1907, pp. 88-90 (see also *C. elongata*); non 1906, p. 12, pl. 4, figs. 20, 21, pl. 10, fig. 9 (see *C. elongata*); Entz, Jr., 1908, *partim*, pp. 10-136, pl. 10, fig. 3, pl. 13, fig. 44; 1909*b*, pp. 99-224, pl. 17, fig. 3, pl. 20, fig. 44 (for 1908, pl. 10, fig. 15 and 1909*b*, pl. 17, fig. 15 see *C. aspera*, and for 1908, pl. 2, figs. 8, 11, 17, 18 and 1909*b*, pl. 9, figs. 8, 11, 17, 18 see *C. elongata*); Jörgensen, *partim*, 1924, pp. 65, 90, 91, 105, 106 (see also *C. aspera* and *C. elongata*).

*Petalotricha galea*, Haeckel, 1899, pl. 3, fig. 6.

[?] *Tintinnus galea*, Zacharias, 1906, p. 528.

*Codonella perforata*, *partim*, Entz, Sr., 1884, pp. 296, 406, 416, 437 (for pl. 24, figs. 12-14 see *C. perforata*, see also *C. diomedae*); Jörgensen, 1924, pp. 91, 93, 105, 106 (for fig. 105 see *C. apicata*, see also *C. diomedae* and *C. perforata*).

*Dictyocysta polymorpha*, *partim*, Entz, Sr., 1885*b*, pp. 205-208, pl. 14, figs. 3-5 (for pl. 14, fig. 2 see *C. diomedae* and for pl. 14, fig. 1 see *C. perforata*).

*Cytlarocylis polymorpha*, *partim*, Daday, 1887*a*, p. 178; 1887*b*, pp. 487, 515, 575-577, pl. 20, figs. 25, 26, 30 (for pl. 20, fig. 29 see *C. elongata*).

*Cytlarocylis Euplectella* Entz, Sr., 1885*b*, pp. 212-214, pl. 13, fig. 8.

*Codonella planctonis* Brandt, 1907, pp. 19, 23, 448, 472, 476. *Nomen nudum*.

*Codonella nationalis* Brandt, *partim*, 1906, pp. 3, 12, pl. 5, fig. 10, pl. 6, figs. 1, 2, pl. 10, fig. 10 (for pl. 5, fig. 9 see *C. nationalis*); 1907, pp. 91-93; Laackmann, 1909, pp. 427, 437; Jörgensen, *partim*, 1924, pp. 91, 92 (for fig. 102 see *C. nationalis*, see also *C. elongata*).

**Codonella inflata** sp. nov.

Figure 108

*Codonella nationalis* var. d Brandt, 1906, p. 12, pl. 5, fig. 5; 1907, p. 94.

Collar and bowl not separated externally by a deep nuchal constriction, but by a strong, internally projecting horizontal shelf; collar convex, with a little oral contraction, 0.25 total length in length; bowl spheroidal, widest at the upper 0.33; aboral end hemispherical with a slight elevation; wall with uniform secondary structure well marked. Length 80-85 $\mu$ .

The type locality is off the Somali Coast, Indian Ocean.

Differs from *C. galca* and *C. nationalis* in erect convex collar and more nearly spherical bowl.

**Codonella lagenula** (Claparède and Lachmann) Entz, Sr. emended

Figure 98

*Tintinnus lagenula* Claparède and Lachmann, 1858, p. 204, pl. 8, figs. 10, 11; Kent, 1882, p. 608, pl. 31, figs. 21, 22; Lankester, 1890, p. 32, fig. 23, no. 3; Hickson, 1903, p. 409, fig. 67.

*Codonella lagenula*, Brandt, 1907, pp. 120-122; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 384; Entz, Sr., *partim*, 1884, p. 413 (for pl. 24, figs. 11, 15, 16 see *C. aspera*).

*Dictyocysta millepora* Entz, Sr., 1885b, p. 208, pl. 14, fig. 9.

*Cyttarocylis millepora*, Daday, 1887b, p. 584.

*Codonellopsis lagenula*, *partim*, Jörgensen, 1924, pp. 100-101; 1927, p. 14 (for fig. 113a, b and 1927, fig. 26 see *Codonellopsis contracta*, for fig. 113d see *C. lata*, for fig. 113e see *C. pusilla*; see also *C. inornata*).

A species with a long and much involved history whose exact status, together with that of *Codonellopsis brasiliensis*, *C. contracta*, *C. caudata*, *C. lata*, *C. inornata*, and *C. pusilla*, must remain unsettled until further examination of material from many localities is much more completely made.

**Codonella lariana** Zacharias

Figure 127

*Codonella lacustris* var. *lariana* Zacharias, 1905a, pp. 219, 224, fig. [8].

*Codonella lacustris*, *partim*, Schermer, 1916, pp. 26, 27, pl. [1], fig. 8 (for figs. 1-7, 10-12 see *C. cratera* and for fig. 9 see *Tps. cylindrata*); Entz, Jr., 1905, pp. 205, 209; 1909a, pp. 207, 212, 213, 217 (see also *C. cratera*).

Raised to status of species.

Lorica tall top-shaped, 2.77 oral diameters in length; oral rim irregular; collar a segment of an inverted cone (14°), 0.6 oral diame-

ter in length; bowl divided into a nuchal region and bowl proper; anteriorly the nuchal region has 3 heavy rings 1.1 oral diameters in diameter and each 0.2 oral diameter in width below which is a short (0.3 oral diameter) conical ( $22^\circ$ ) extension of the bowl; bowl subglobose, 1.33 oral diameters in diameter; aboral horn stout conical ( $30^\circ$ ), 0.33 oral diameter in length; aboral end truncate; wall with scattered coarse agglomerations. Length  $120\mu$ .

The type locality is Lake Lario, Italy.

Differs from all other species in the peculiar annulations of the nuchal region.

**Codonella lata** sp. nov.

Figure 126

A stout species of the *cistellula* group, with wide collar, 1.03 diameters of bowl in width; nuchal groove deep, diameter of neck 0.72 diameter of the bowl; aboral end flattened. Length  $78-90\mu$ .

The type locality is Station 4681 in the South Equatorial Drift. It is also widely distributed in the Eastern Tropical Pacific.

Differs from *C. australis* in larger size and flattened aboral end.

**Codonella laticollis** (Daday)

Figure 103

*Cyttarocypris laticollis* Daday, 1887b, pp. 575, 576, pl. 20, fig. 28; Brandt, 1907, pp. 11, 88, 182, 469.

Lorica stout ovate, length 1.44 oral diameters; collar narrow, 0.20 (according to Daday's measurements, 0.09 in his figure) total length in length; oral margin strongly everted; bowl widest slightly above its middle; aboral end with a low but definite point; 20 membranelles. Length  $90\mu$ .

The type locality is the Bay of Naples, Italy.

Differs from *C. brevicollis* in more flaring collar and pointed aboral end.

**Codonella mucronata** sp. nov.

Figure 123

*Codonella cistellula*, partim, Jörgensen, 1924, p. 94 (see *C. australis*, *C. benguelensis*, *C. cistellula*, *C. dadayi*, and *C. oceanica*).

*Codonella cistellula* var. ♀ Brandt, 1906, p. 13, pl. 7, fig. 3; 1907, pp. 80, 86, 98, 459.

A stout, rather small species with deep nuchal groove, 1.6 oral diameters in length; collar flaring  $30^\circ$ , its height with oral rim 0.3

total length; bowl rotund, widest below the middle, as wide as, or wider than collar; aboral end with short blunt point. Length 75–89 $\mu$ .

The type locality is off Ralum, New Pomerania. It occurs widely distributed in the Eastern Tropical Pacific.

Differs from all other species in the *cistellula* group in the emergent aboral point, rotundity of the bowl, and prominence of the suboral ledge.

### **Codonella nationalis** Brandt

Figure 107

*Codonella nationalis*, Brandt, 1906, *partim*, p. 12, pl. 5, fig. 9 (for pl. 5, fig. 10, pl. 6, figs. 1, 2, pl. 10, fig. 10 see *C. galca*); 1907, pp. 91–93; Entz, Jr., 1908, pp. 19–131, pl. 10, fig. 12, pl. 13, fig. 39; 1909*b*, pp. 108–224, pl. 17, fig. 12, pl. 20, fig. 39; Jørgensen, *partim*, 1924, pp. 91, 92, fig. 102 (see also *C. galca* and *C. elongata*).

### **Codonella oceanica** Brandt emended

Figure 122

*Codonella cistellula* var. *oceanica*, *partim*, Brandt, 1906, p. 13, pl. 8, figs. 1, 2; 1907, pp. 80, 98 (for pl. 10, fig. 2 see *C. australis*).

[?] *Codonella cistellula* var. *oceanica*, Laackmann, 1909, pp. 424, 438.

*Codonella cistellula*, *partim*, Jørgensen, 1924, p. 94 (see *C. australis*, *C. dadayi*, *C. benguelensis*, *C. cistellula*, and *C. mucronata*).

Raised to status of species.

Lorica 1.6–1.7 oral diameters in length; diameter of rim of collar and of bowl subequal; suboral cone contracting 40°; collar flaring everted conical (50°); bowl globose, widest (1.27–1.37 oral diameters) at the middle; aboral end subhemispherical; wall with 24–36 subequal secondary polygons across the face of the widest part of the bowl. Length 70–95 $\mu$ .

The type locality is Station Pl. 121 of the Plankton Expedition in the Gulf Stream.

Differs from *C. mucronata* in the hemispherical instead of pointed aboral end.

### **Codonella olla** sp. nov.

Figure 115

*Codonella nationalis* var. *c* Brandt, 1906, p. 13, pl. 7, fig. 2; 1907, p. 93.

Lorica like that of *C. poculum* in form, except that the aboral region is expanded and the aboral end flattened; collar narrow, 0.25 oral diameter in height, convex outwardly; oral margin entire, incurved; nuchal constriction well marked; aboral end broadly flattened. Length 75–80 $\mu$ .

The type locality is Station Pl. 86 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Differs from *C. poculum* in narrower, more convex collar, more expanded, more aborally flattened bowl, and smaller size.

**Codonella pacifica** sp. nov.

Figure 105

Lorica stout vase-shaped, 1.6 oral diameters in length; collar very slightly flaring or vertical; nuchal constriction slight; bowl broadly oval; aboral end broadly rounded. Length 81–100 $\mu$ .

The type locality is Station 4574 in the California Current. Occurs also in Peruvian Current.

Differs from *C. saccus* in having erect or flaring collar and rounded instead of subconical aboral end.

**Codonella perforata** Entz, Sr. emended

Figure 120

*Codonella perforata*, *partim*, Entz, Sr., 1884, pp. 296, 406, 416, 437, pl. 24, figs. 12–14 (see also *C. diomedae* and *C. galea*); Jørgensen, 1924, pp. 91, 93, 105, 106 (for fig. 105 see *C. apicata*, see also *C. diomedae* and *C. galea*).

*Codonella perforata* var. b Brandt, 1906, p. 13, pl. 6, fig. 5; 1907, pp. 86, 96, 476.

*Dictyocysta polymorpha* Entz, Sr., *partim*, 1885b, pp. 205–208, pl. 14, fig. 1 (for pl. 14, fig. 2 see *C. diomedae* and for pl. 14, figs. 3–5 see *C. galea*); Brandt, 1907, p. 79.

**Codonella poculum** sp. nov.

Figure 114

*Codonella nationalis* var. c, *partim*, Brandt, 1906, p. 13, pl. 9, fig. 1 (for pl. 4, fig. 10 see *C. robusta*); 1907, p. 94 (see *C. robusta*).

Lorica pot-shaped; oral margin regularly denticulate; collar vertical, separated from bowl only *internally* by a horizontal shelf below which lies the closing apparatus; bowl dome-shaped; aboral end hemispherical. Length 80–92 $\mu$ .

The type locality is Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Differs from *C. acutula* in lack of nuchal constriction and lack of aboral spine and from *C. olla* in lack of the nuchal constriction.

**Codonella rapa** sp. nov.

Figure 130

*Codonella amphorella*, *partim*, Brandt, 1906, p. 14, pl. 10, fig. 8; 1907, p. 100 (for pl. 9, figs. 2, 3 see *C. amphorella*); Jørgensen, 1924, pp. 91, 93, 106 (for fig. 104 see *C. amphorella*).

*Codonella amphorella* var. b Brandt, 1906, p. 13, pl. 7, fig. 4; 1907, pp. 80, 86, 100, 453.

Lorica with deep nuchal constriction and wide shelf; collar scarcely flaring in anterior 0.66; bowl stout ovate; aboral region convex subconical; apical horn stout, its length about equaling its basal diameter. Length 96 $\mu$ .

The type locality is off Ralum, New Pomerania. Occurs also in the Peruvian Current, Galapagos Eddy, South Equatorial Current, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *C. recta* in less flaring collar, shorter bowl and stouter aboral horn.

**Codonella recta** sp. nov.

Figure 131

*Codonella amphorella* var. a Brandt, 1906, p. 14, pl. 10, fig. 3; 1907, p. 100.

Lorica with shallow nuchal constriction and narrow shelf; collar erect; bowl stout ellipsoidal; aboral end with tapering horn longer than its basal diameter; wall of collar and upper bowl with peculiar, large oval secondary structure. Length 95 $\mu$ .

The type locality is Station 16 (Schott) in the Agulhas Current.

Differs from *C. amphorella* in more erect collar and less rotund bowl and from *C. rapa* in slighter nuchal constriction.

**Codonella relictata** Minkiewitsch

Figure 129

*Codonella relictata* Minkiewitsch, 1905, pp. 43-46, fig. 1; Entz, Jr., 1905, pp. 198-201, 205-216, 218 [figs.]; 1909a, 197-198, 200, 207-222 [figs.]; Jørgensen, 1924, p. 95; 1927, p. 8.

*Codonella lacustris*, *partim*, Entz, Jr., 1905, pp. 198-201, 205-216, 218; 1909a, pp. 197-198, 200, 207-222 (see also *C. cratera*).

*Tintinnopsis ventricosa*, *partim*, Ostefeld, 1906, p. 66 (see *Stenosemella steini*).

*Tintinnopsis relictata*, Ostefeld, 1909, p. 73; 1916b, *partim*, pp. 147-148, 184 (see *Stenosemella steini*); Entz, Jr., *partim*, 1909b, pp. 93-205 (see also *C. cratera*).

*Tintinnopsis lacustris*, *partim*, Entz, Jr., 1909b, pp. 93-205 (see also *C. cratera*).



**Codonella robusta** sp. nov.

Figure 111

*Codonella nationalis* var. c, *partim*, Brandt, 1906, p. 12, pl. 4, fig. 10 (for pl. 9, fig. 1 see *C. poculum*); 1907, p. 94 (see *C. poculum*).

A short, stout species, length 1.12 oral diameters; with shallow nuchal constriction; collar 0.25 total length, with vertical sides; aboral end broadly rounded. Length 80–92 $\mu$ .

The type locality is Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic. Occurs also in the Sargasso Sea.

Differs from *C. poculum* and *C. acutula* in having an external nuchal constriction and from the latter in absence of an aboral point.

**Codonella saccus** sp. nov.

Figure 100

*Codonella galea* var. c Brandt, 1906, p. 12, pl. 4, fig. 9, pl. 5, fig. 7; 1906, p. 91; Laackmann, 1909, p. 437.

*Codonella galea* var. d Brandt, 1906, p. 12, pl. 5, fig. 8; 1906, p. 91; Laackmann, 1909, p. 437.

Lorica elongated, length 1.73–1.86 oral diameters; bowl and collar not clearly separated by an external nuchal constriction; collar 0.25 total length, contracting orally 10°; bowl elongate ovate, widest at the middle of the lorica; aboral region convex subconical contracting to a rounded aboral end. Length 75–90 $\mu$ .

The type locality is Station Pl. 100 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the Gulf Stream, Sargasso Sea, Guinea Current, and North Equatorial Current in the Atlantic.

Differs from *C. pacifica* in less separation of collar and bowl and more pointed aboral end.

**Codonella sphaerica** Carazzi

*Codonella sphaerica* Carazzi 1900, p. 1275; Carazzi and Grandori, 1912, p. 58 *Nomen nudum*.

**Codonella tropica** sp. nov.

Figure 110

Lorica stout, ovate, 1.34 oral diameters in length; collar convex, its length 0.20 total length; nuchal constriction moderately marked; bowl broadly ovate, its greatest diameter midway of its length; aboral end with a blunt protuberance. Length 77 $\mu$ .

The type locality is Station 4594 in the Mexican Current.

Differs from *C. acuta* in stouter proportions, less nuchal constriction, shorter bowl, and in the aboral protuberance.

## CODONELLOPSIDAE fam. nov.

Codonelliden, *partim*, Haeckel, 1873, pp. 564-565 (see also Codonellidae).  
Codonellidae, *partim*, Kent, 1882, p. 615 (see also Codonellidae).

Tintinnoinea with top-shaped lorica; oral rim entire, rarely toothed; collar hyaline, with annular or spiral structure; bowl patterned, generally short, ovate; aboral end closed, rounded, pointed, or with an aboral horn; wall of two types, hyaline with primary structure only, not patterned, except for fenestrae, in the collar, and with coarse secondary structure throughout the bowl. Marine only.

Differs from all other families in having a hyaline collar and a patterned bowl.

Includes three genera, *Codonellopsis* Jörg., *Stenosemella* Jörg., and *Laackmanniella* gen. nov.

**Stenosemella** Jörgensen

*Tintinnus*, *partim*, Claparède and Lachmann, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coziella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocylis*, *Salpingella*, *Steenstrupiella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*).

*Diffugia*, Dixon and Joly, 1898, pp. 748-749.

*Tintinnopsis*, Laackmann, 1906, pp. 18-19; Meunier, 1910, p. 43; 1919, *partim*, pp. 19-20 (see also *Codonellopsis*); Jörgensen, 1912, p. 3; Wailes, 1925, pp. 535-537.

*Codonella*, Fauré-Fremiet, 1908, p. 231.

*Stenosemella* Jörgensen, 1924, pp. 65, 97, 107; 1927, pp. 4, 7, 8, 23.

Codonellopsidae with short and wide lorica usually somewhat like an olive in shape, without any spiral structure in the bowl; oral aperture narrower than the bowl; collar low, sometimes with one or two

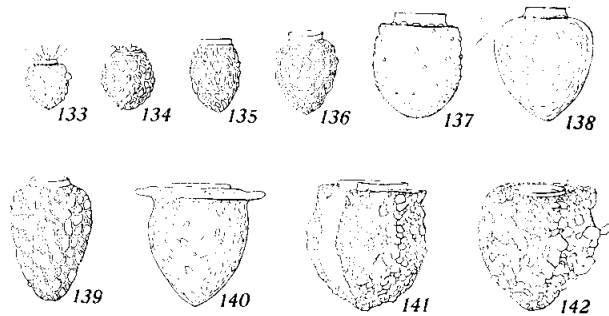
spiral turns, hyaline and thin, generally without particles; no distinct aboral pedicel; wall firm, densely covered with agglomerated material, or with a coarse reticulum.

We select as the type species *Stenosemella ventricosa* (Claparède and Lachmann) Jörgensen, a species of cosmopolitan, neritic distribution, the first one in Jörgensen's (1924) account of the species and the oldest species now in *Stenosemella*.

Differs from both *Codonellopsis* and *Lauckmanniella* in the very short collar with but one ring or at the most two or three turns.

Includes 10 species as follows:

<i>avellana</i> (Meunier)	<i>pacifica</i> nom. nov.
<i>expansa</i> (Wailes)	<i>producta</i> (Meunier)
<i>inflata</i> sp. nov.	<i>punctata</i> (Wailes)
<i>nivalis</i> (Meunier)	<i>steini</i> (Jörg.) Jörg.
<i>oliva</i> (Meunier)	<i>ventricosa</i> (Clap. and Lach.) Jörg.



Figs. 133-142. Species of *Stenosemella* Jörg.  $\times 200$ .

Fig. 133. *S. pacifica* nom. nov. after Wailes (1925, pl. 1, fig. 27) from the Strait of Georgia, British Columbia.

Fig. 134. *S. avellana* (Meunier) after Meunier (1919, pl. 22, fig. 37) from the Flemish Sea.

Fig. 135. *S. oliva* (Meunier) after Meunier (1910, pl. 13, fig. 9) from the Barents Sea.

Fig. 136. *S. nivalis* (Meunier) after Campbell (1926a, pl. 12, fig. 8) from San Francisco Bay, California.

Fig. 137. *S. inflata* sp. nov. after Wailes (1925, pl. 1, fig. 25) from the Strait of Georgia, British Columbia.

Fig. 138. *S. punctata* (Wailes) after Wailes (1925, pl. 1, fig. 23) from the Strait of Georgia, British Columbia.

Fig. 139. *S. producta* (Meunier) after Meunier (1919, pl. 22, fig. 34) from the Flemish Sea.

Fig. 140. *S. expansa* (Wailes) after Wailes (1925, pl. 1, fig. 33) from the Strait of Georgia, British Columbia.

Fig. 141. *S. steini* (Jörg.) Jörg. after Brandt (1906, pl. 17, fig. 2) from Kiel Fiord.

Fig. 142. *S. ventricosa* (Clap. and Lach.) Jörg. after Brandt (1906, pl. 17, fig. 9) from off Messina in the Mediterranean.

**Stenosemella avellana** (Meunier)

Figure 134

*Tintinnopsis avellana* Meunier, 1919, p. 30, pl. 22, fig. 37.*Stenosemella nucula, partim*, Jörgensen, 1924, pp. 95-96; 1927, pp. 8, 15, 17, 20, 21 (for 1924, figs. 108a, b and 1927, fig. 7 see *S. nivalis*, see also *Codonella apicata* and *Tintinnopsis nucula*).

Differs from all other species in having the greatest width of the bowl at or near the middle and in the long sloping shoulders.

**Stenosemella expansa** (Wailes)

Figure 140

*Tintinnopsis expansa* Wailes, 1925, pp. 533, 535, pl. 1, fig. 33.**Stenosemella inflata** sp. nov.

Figure 137

*Tintinnopsis punctata, partim*, Wailes, 1925, p. 536, pl. 1, figs. 24-26 (for pl. 1, fig. 23 see *S. punctata*).

Lorica 1.11-1.18 transdiameters in length; collar 0.56 transdiameter of bowl in diameter, outwardly sloping concave, with about 12 low, subsemicircular basal openings; bowl nearly cylindrical in its anterior half with square shoulder, widest a little above the middle; aboral end almost hemispherical; wall finely punctate with few scattered particles. Length, 65-75 $\mu$ .

The type locality is the Strait of Georgia, British Columbia (based on Wailes, 1925, figs. 24-26).

Differs from *S. punctata* in more squarish shoulders, cylindrical anterior bowl, and hemispherical instead of contracted aboral end.

**Stenosemella nivalis** (Meunier) emended

Figure 136

Non *Codonella nucula* Fol, 1884, p. 60, pl. 5, fig. 13 (see *Tps. nucula*).*Tintinnopsis ventricosa*, Daday, 1887b, p. 559, pl. 20, figs. 19, 20; Bresslau, pp. 260-261, figs. 1, 2 (58-62 $\mu$ ).Non *Tintinnopsis ovalis*, Daday, 1892, pp. 200-201, 207, pl. 1, fig. 9 (see *Tps. ovalis*).*Tintinnopsis nitida* var. *ovalis* Jörgensen, 1905, pp. 53, 56, 143, pl. 18, fig. 115 (43 $\mu$ ).*Tintinnopsis nucula*, Laackmann, *partim*, 1906, pp. 19, 20, 25, 34, pl. 1, fig. 4, pl. 3, figs. 48-50 (44-58 $\mu$ ), for pl. 1, fig. 5 see *S. oliva*; Campbell, *partim*, 1926a, pp. 179-236, pls. 12-15, text figs. A-G (see also *S. pacifica*); Rossolimo, 1922, pp. 25, 33, pl. 2, fig. 8; Wailes, 1925, p. 536, pl. 1, figs. 15, 16.*Codonella ventricosa* var. *minuta* Fauré-Fremiet, 1908, p. 212. *Nomen nudum*.

*Codonella ventricosa* var. *minor* Fauré-Fremiet, 1908, pp. 232, 236, fig. 18[a] (50 $\mu$ ); (for var. *major*, fig. 18[b] see *S. ventricosa*); 1924, p. 98.

Non *Codonella orthoceras* var. *f. minor* Brandt, 1906, p. 12, pl. 5, figs. 4, 12, pl. 11, figs. 3, 3a; 1907, pp. 105, 106, 113, 114, 115, 116, 471, 474 (see *Codonellopsis minor*).

*Codonella ventricosa*, Entz, Sr., 1884, pp. 296, 413, pl. 24, fig. 24 (55 $\mu$ ); Imhoff, 1886a, p. 103; 1891, pp. 1-4; Möbius, 1887, p. 119, pl. 8, figs. 30, 31 (45-56 $\mu$ ); Wright, 1907, pp. 11, 18, pl. 4, fig. 11 (text, 60 $\mu$ ; fig. 11, 40 $\mu$ ).

"*Codonella Galea* var. *ovata* Jörgensen," Entz, Jr., 1908, p. 97. *Lapsus pennac.*

*Tintinnopsis nivalis* Meunier, 1910, p. 143, pl. 13, figs. 26, 27 (40-43 $\mu$ ).

*Ptychocylis nucula*, Busch, 1920, p. 756. *Lapsus pennac.*

*Tintinnopsis glans* Meunier, 1919, pp. 29-30, pl. 13, figs. 35, 36 (30-44 $\mu$ ).

*Stenosemella nucula*, *partim*, Jörgensen, 1924, pp. 95-96, figs. 108a, b; 1927, pp. 8, 15, 17, 20, 21, fig. 7 (see also *Tps. nucula*, *S. avellana*, *S. oliva*, and *Codonella apicata*).

*Tintinnopsis ventricosa* var. *minor* Rossolimo, 1927, pp. 66-67, 74, fig. 4 (62-69 $\mu$ ). Homosynonym of Fauré-Fremiet, 1908; see above.

### ***Stenosemella oliva* (Meunier)**

Figure 135

*Tintinnopsis oliva* Meunier, 1910, p. 144, pl. 13, figs. 9-13, pl. 14, fig. 6 (46-48 $\mu$ ).

*Tintinnopsis nucula*, *partim*, Laackmann, 1906, pp. 19-34, pl. 1, fig. 5 (for pl. 1, fig. 4 and pl. 3, figs. 48-50 see *S. nivalis*), 61 $\mu$  based on fig. 5, text states 44-58 $\mu$ .

*Tintinnopsis Bornandi*, Entz, Jr., 1908, pp. 125, 126, pl. 1, fig. 5, pl. 2, figs. 6, 7; 1909b, p. 199, pl. 8, fig. 5, pl. 9, figs. 6, 7 (33-37 $\mu$  [?]).

*Stenosemella nucula*, *partim*, Jörgensen, 1924, pp. 95-96; 1927, pp. 8, 15, 17, 20, 21 (for 1924, figs. 108a, b and 1927, fig. 7 see *S. nivalis*, see also *S. avellana*, *Codonella apicata*, and *Tintinnopsis nucula*).

### ***Stenosemella pacifica* nom. nov.**

Figure 133

*Tintinnopsis punctata* forma *minor* Wailes, 1925, p. 536, pl. 1, figs. 27, 28.

Non *Codonella ventricosa* var. *minor* Fauré-Fremiet, 1908, pp. 232, 236, fig. 18 (see *S. nivalis*); nec *Tps. ventricosa* var. *minor* Rossolimo, 1927, pp. 66-67, 74, fig. 4 (see *S. nivalis*).

*Tintinnopsis nucula*, *partim*, Campbell, 1926a, p. 185 (for pls. 12-15, text figs. A-G see *S. nivalis*).

Lorica 1.07-1.44 transdiameters in length; collar about 0.5 greatest transdiameter of bowl in diameter, sides sloping outward, height about 0.25 oral diameter; with subsemicircular openings around its base; bowl widest near the middle, with squarish shoulder; aboral end sub-rounded, blunt, but not distinctly pointed. Length 35-40 $\mu$ .

The type locality is the Strait of Georgia, British Columbia (Wailes). Occurs also off San Diego, California (Kofoid and Campbell).

Differs from *S. punctata* in dimensions, proportions, squarish shoulder, aboral end, and coarser particles in the wall.

The specific name *minor* is preoccupied by *Tintinnopsis ventricosa* var. *minor* Fauré-Fremiet (1908), and by *Tps. ventricosa* var. *minor* Rossolimo (1927), both synonyms of *S. nivalis*.

### **Stenosemella producta** (Meunier)

Figure 139

*Tintinnopsis producta* Meunier, 1919, p. 25, pl. 22, fig. 34.

Differs from *S. ventricosa* in more sloping shoulder and more attenuate bowl.

### **Stenosemella punctata** (Wailes)

Figure 138

*Tintinnopsis punctata, partim*, Wailes, 1925, p. 536, pl. 1, fig. 23 (for pl. 1, figs. 24-26 see *S. inflata*).

### **Stenosemella steini** (Jørgensen) Jørgensen

Figure 141

*Codonella ventricosa*, Levander, 1894c, pp. 91-92, pl. 3, fig. 9 [with collar lacking].

*Tintinnopsis ventricosa, partim*, Brandt, 1906, pp. 15-16, pl. 17, fig. 2, pl. 18, fig. 1 [?], 2 (for pl. 17, fig. 9 see *S. ventricosa* and for pl. 17, figs. 10-11 see *Tps. nucula*); 1907, pp. 154-158, 483 (see also *S. ventricosa* and *Tps. nucula*); Ostensfeld, *partim*, 1906, p. 66 (see also *Codonella relicta*); 1909, p. 74; 1916, p. 40; Wailes, *partim*, 1925, p. 537, pl. 1, fig. 22 (for pl. 1, figs. 29, 30 see *S. ventricosa*).

*Tintinnopsis ventricosa* var. *Laackmann*, 1906, pp. 18-19, pl. 1, fig. 3.

*Tintinnopsis nucula, partim*, Entz, Jr., 1908, p. 128, pl. 6, fig. 4; 1909b, p. 217, pl. 13, fig. 4 (for 1908, pl. 6, fig. 9, and 1909b, pl. 13, fig. 9 see *Codonella apicata*).

*Tintinnopsis relicta, partim*, Ostensfeld, 1916b, pp. 147-148, 184 (see also *Codonella relicta*).

*Tintinnopsis steini* Jørgensen, 1912, p. 3; Ostensfeld, 1916b, pp. 144, 148.

*Stenosemella steini* Jørgensen, 1924, p. 95; 1927, pp. 8, 16, 17, fig. 31.

### **Stenosemella ventricosa** (Claparède and Lachmann) Jørgensen

Figure 142

*Tintinnus ventricosus* Claparède and Lachmann, 1858, p. 208, pl. 9, fig. 4; Kent, 1882, pp. 609, 611, pl. 31, fig. 31.

*Codonella ventricosa*, Föl, 1884, pp. 59-60, pl. 5, fig. 12; Linko, 1909, pp. 36, 139, 140, 215, 220, 222; non Nordqvist, 1890, pp. 90, 97, 125, pl. [1], figs. 3 forma a (see *Tps. tubulosoides*) and 4 forma b (see *Tps. subacuta*); non Levander, 1894c, pp. 91-92, pl. 3, fig. 9 (see *S. steini* with collar lacking); Brandt, 1907, p. 483.

Non "*Codonella tubulosa* mihi (= *Codonella ventralis* [sic!] Nordqvist)" Levander, 1894a, p. 4; *lapsus pennae* for *C. ventricosa*, Nordqvist, 1890 (see *Tps. lobianci*).

*Diffugia thalassia* Dixon and Joly, 1898, pp. 748-749, pl. 26, figs. 5 [?], 6, 8, 9.  
*Codonella ventricosa* var. *major* Fauré-Fremiet, 1908, pp. 232-233, fig. 18[b] (for var. *minor*, fig. 18[a] see *S. nivalis*).

*Tintinnopsis ventricosa*, non Daday, 1887b, p. 559, pl. 20, figs. 19, 20 (see *S. ovalis*); Brandt, *partim*, 1906, pl. 17, fig. 9 (for pl. 17, fig. 2, pl. 18, fig. 1 [?], 2 see *S. steini* and for pl. 17, figs. 10, 11 see *Tps. nucula*); 1907, pp. 154-158, 483 (see also *S. steini* and *Tps. nucula*); Entz, Jr., 1908, pp. 10-126, pl. 1, figs. 7, 10 [aberrant, possible conjugant?], pl. 13, fig. 48; 1909b, pp. 99-225, pl. 8, figs. 7, 10, pl. 9, fig. 19, pl. 20, fig. 48; Merkle, 1909, pp. 146-148, 176-177, pl. 2, figs. 26, 28, pl. 3, fig. 70; Meunier, 1919, pp. 28-31, pl. 22, figs. 31-33; Rossolimo, 1922, pp. 25, 33, pl. 2, fig. 7; 1927, pp. 66-67, 74-75, fig. 3; Fauré-Fremiet, 1924, pp. 95-97, fig. 31; Wailes, *partim*, 1925, p. 537, pl. 1, figs. 29, 30 (for pl. 1, fig. 22 see *S. steini*).

*Tintinnopsis ventricosoides* Meunier, 1910, p. 143, pl. 13, figs. 1-8; 1919, p. 28.  
*Stenosemella ventricosa*, Jörgensen, 1924, pp. 4, 95, 96, fig. 107; 1927, p. 8, fig. 6.

Brandt (1906, 1907) included in his *Tintinnopsis ventricosa* at least three distinct species. Only one of his figures (1906, pl. 17, fig. 9) is referable to *S. ventricosa* having the low, hyaline, narrow collar and the more rotund bowl tapering below the middle. Two of his figures (pl. 17, fig. 2 and pl. 18, fig. 2) are unquestionably *S. steini* having the wide suboral trough, although the latter figure has particles on the collar. It is less certain that a third lorica (pl. 18, fig. 1) belongs to *S. steini* since the suboral structure is obscure. The slope, structure, and height of the collar suggest those of *Tintinnopsis nucula* (*sensu strictu*). Two of Brandt's loricae (pl. 17, figs. 10, 11) have the shape, proportions, and structure of collar characteristic of *Tintinnopsis nucula* F'ol (1884, p. 60, pl. 5, fig. 13). They have the more slender, less rotund bowl, and contracting, agglomerated collar.

Wailes (1925) has apparently confused *S. steini* and *S. ventricosa*, figuring as the latter two types and sizes of loricae. The one type (his pl. 1, figs. 29, 30) represents a large lorica without suboral trough and shoulder, the other a smaller lorica with these structures well developed. The matter is still more confused by the fact that the dimensions cited in the text do not agree with those derived from his stated magnifications. For example, he states (p. 537) that the lorica of his figure 30 is  $74\mu$  in length but it measures  $94\mu$ . It is possible that  $74\mu$  should read  $94\mu$ . On the other hand his figure 22 which has the spreading collar and suboral trough of *S. steini*, at his stated magnification of 300 diameters measures only  $48\mu$ , whereas his text gives  $61\mu$  as the minimum size. If we assume that his magnification for his figure 22 is not 300 as stated, but is 200, the same as that of his other figures of *S. ventricosa*, the length of this lorica rises to  $72\mu$  which approximates the minimum length of *S. steini*.

### Codonellopsis Jörgensen

*Codonella* Haeckel, *partim*, 1873, pp. 564-567 (see also *Codonella* and *Tintinnopsis*); Jörgensen, 1899, p. 27; Cleve, 1900*d*, pp. 967-970; 1901*c*, p. 53; Schmidt, 1901, p. 187; Brandt, *partim*, 1907, pp. 73-126 (see also *Codonella*); Laackmann, *partim*, 1907, p. 239 (see also *Laackmanniella*).

*Amphorella*, *partim*, Daday, 1887*b*, pp. 535-536 (see also *Acanthostomella*, *Amphorella*, and *Bursaopsis*).

*Leprotintinnus*, *partim*, Laackmann, 1909, pp. 398-402 (see also *Laackmanniella* and *Leprotintinnus*).

*Tintinnopsis*, *partim*, Meunier, 1919, pp. 19-20 (see also *Stenosemella*).

*Codonellopsis* Jörgensen, 1924, pp. 7, 9, 32, 65, 97, 98; 1927, pp. 4, 14, 24.

Codonellopsidae with lorica divided into an annular collar and a bowl; collar set off distinctly in structure from bowl, often narrower than the bowl, hyaline, with spiral structure, or at least with one or two coiled bands, and even these sometimes obscured; bowl oval to spheroidal, with or without hollow antapical horn closed off from the bowl by a basal membrane; wall of bowl with primary, secondary, and tertiary structure, sometimes with "fenestrae"; agglomerating material often on wall, as *Tintinnopsis* structure.

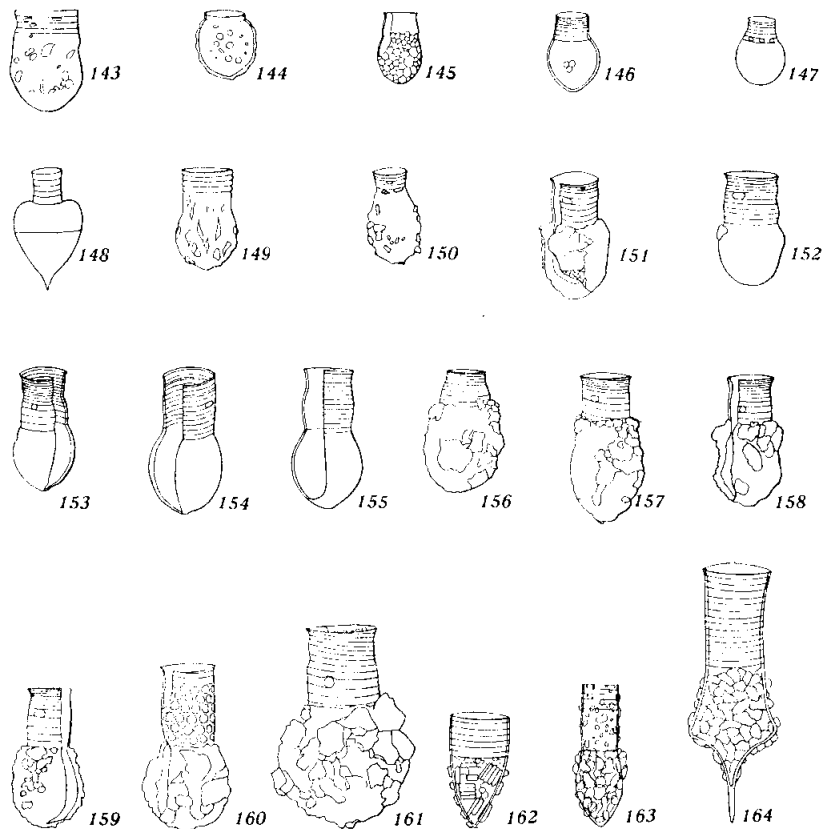
The type species selected by us is *Codonellopsis orthoceras* (Haeckel) Jörgensen from Messina, a widely distributed, euplagic, mainly subtropical species.

Differs from *Stenosemella* in the higher collar with more turns and from *Laackmanniella* in the closed instead of open aboral end.

Includes 39 species as follows:

<i>americana</i> sp. nov.	<i>minor</i> (Bdt.)
<i>biedermanni</i> (Bdt.)	<i>morehella</i> (Cleve) Jörg.
<i>brasiliensis</i> (Bdt.)	<i>obconica</i> sp. nov.
<i>brevicaudata</i> (Bdt.)	<i>orthoceras</i> (Haeckel) Jörg.
<i>bulbulus</i> (Meunier)	<i>ostenfeldi</i> (Schmidt)
<i>californiensis</i> sp. nov.	<i>ovata</i> Jörg.
<i>contracta</i> sp. nov.	<i>pacifica</i> (Bdt.)
<i>cordata</i> sp. nov.	<i>parva</i> sp. nov.
<i>caudata</i> (Bdt.)	<i>pura</i> (Bdt.)
<i>erythraensis</i> (Bdt.)	<i>pusilla</i> (Cleve)
<i>gaussi</i> (Laack.)	<i>robusta</i> sp. nov.
<i>glacialis</i> (Laack.)	<i>schabi</i> (Bdt.)
<i>globosa</i> sp. nov.	<i>speciosa</i> sp. nov.
<i>indica</i> sp. nov.	<i>tessellata</i> (Bdt.)
<i>inflata</i> sp. nov.	<i>tropica</i> sp. nov.
<i>inornata</i> (Bdt.)	<i>tuberculata</i> (Daday) Jörg.
<i>lata</i> sp. nov.	<i>turbinella</i> sp. nov.
<i>longa</i> sp. nov.	<i>turgescens</i> sp. nov.
<i>lusitania</i> Jörg.	<i>turgida</i> sp. nov.
<i>meridionalis</i> sp. nov.	





Figs. 143-181. Species of *Codonellopsis* Jörgensen.  $\times 200$ .

Fig. 143. *C. lata* sp. nov. after Entz, Jr. (1908, pl. 1, fig. 15) from the Bay of Naples, Italy.

Fig. 144. *C. tuberculata* (Daday) Jörg. after Jörgensen (1924, p. 99, fig. 114) from Station 172 of the "Thor" just outside the Bosphorus in the Black Sea.

Fig. 145. *C. inornata* (Bdt.) after Brandt (1906, pl. 20, fig. 7) from Station Pl. 10 of the Plankton Expedition in the Irminger Sea.

Fig. 146. *C. pusilla* (Cleve) after Jörgensen (1924, p. 99, fig. 113c) from Station 80 of the "Thor" in *Salpa* off the southwest coast of Ireland in the Atlantic.

Fig. 147. *C. contracta* sp. nov. from Station 4655 in the Peruvian Current.

Fig. 148. *C. cordata* sp. nov. from Station 4709 in the South Equatorial Drift of the Eastern Tropical Pacific.

Fig. 149. *C. bulbulus* (Meunier) after Meunier (1919, pl. 22, fig. 23) from the Flemish Sea.

Fig. 150. *C. ovata* (Jörg.) after Jörgensen (1905, pl. 28, fig. 117) from the west coast of Norway off Bergen.

Fig. 151. *C. erythraensis* (Bdt.) after Brandt (1906, pl. 14, fig. 4) from Station "Bruhn, I, 19-III-93" in the Red Sea.

Fig. 152. *C. robusta* sp. nov. from Station 4600 in the Mexican Current.

Fig. 153. *C. brasiliensis* (Bdt.) after Brandt (1906, pl. 13, fig. 6) from Station Pl. 113 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

**Codonellopsis americana** sp. nov.

Figure 159

[?] *Codonella morchella*, partim (globose forms only), Schmidt, 1901, p. 187 (see also *C. erythraensis*, *C. globosa*, *C. indica*, and *C. morchella*).

*Codonella morchella*, partim, Brandt, 1906, p. 15, pl. 13, fig. 2 (for pl. 13, fig. 1 see *C. obconica*, for pl. 13, fig. 3, pl. 14, fig. 3 see *C. indica*, and for pl. 15, fig. 1 see *C. globosa*); 1907, pp. 124-125 (see also *C. globosa*, *C. indica*, *C. morchella*, and *C. obconica*); Okamura, 1907, p. 137, pl. 6, fig. 54b (for fig. 54a see *C. morchella*).

*Codonellopsis morchella*, partim, Jörgensen, 1924, pp. 99, 100, fig. 111 (see *C. erythraensis*, *C. globosa*, *C. indica*, and *C. morchella*).

Lorica with bowl and collar subequal; collar nearly cylindrical with little oral eversion; shoulder moderately emergent; bowl rotund, but little longer than wide; aboral end hemispherical; wall thinner aborally than laterally; agglomerated particles often small. Length 76-111 $\mu$ .

The type locality is Station 4624, off Panama. Occurs also in the California and Mexican currents.

Differs from all other species in its more rotund bowl.

**Codonellopsis biedermani** (Brandt)

Figure 181

*Codonella biedermani* Brandt, 1906, p. 14, pl. 11, fig. 8, pl. 12, figs. 1a-1c; 1907, pp. 26, 28, 33, 38, 42, 74, 76, 81, 103, 104, 107, 108, 115, 117, 445.

Figs. 143-181. Species of *Codonellopsis* Jörgensen.  $\times 200$ . (Continued.)

Fig. 154. *C. caudata* (Bdt.) after Brandt (1906, pl. 13, fig. 5) from Station "Dahl, 13-I-97" off Ralum in the Western Tropical Pacific.

Fig. 155. *C. turgescens* sp. nov. from Station 4583 in the California Current.

Fig. 156. *C. obconica* sp. nov. after Brandt (1906, pl. 13, fig. 1) from off Zanzibar in the Indian Ocean.

Fig. 157. *C. schabi* (Bdt.) after Brandt (1906, pl. 14, fig. 5) from Station "Schab, 10-VI-93" off Monrovia in the Guinea Current.

Fig. 158. *C. indica* sp. nov. after Brandt (1906, pl. 14, fig. 3) from off Zanzibar in the Indian Ocean.

Fig. 159. *C. americana* sp. nov. from Station 4624 in the Panamic Area of the Pacific.

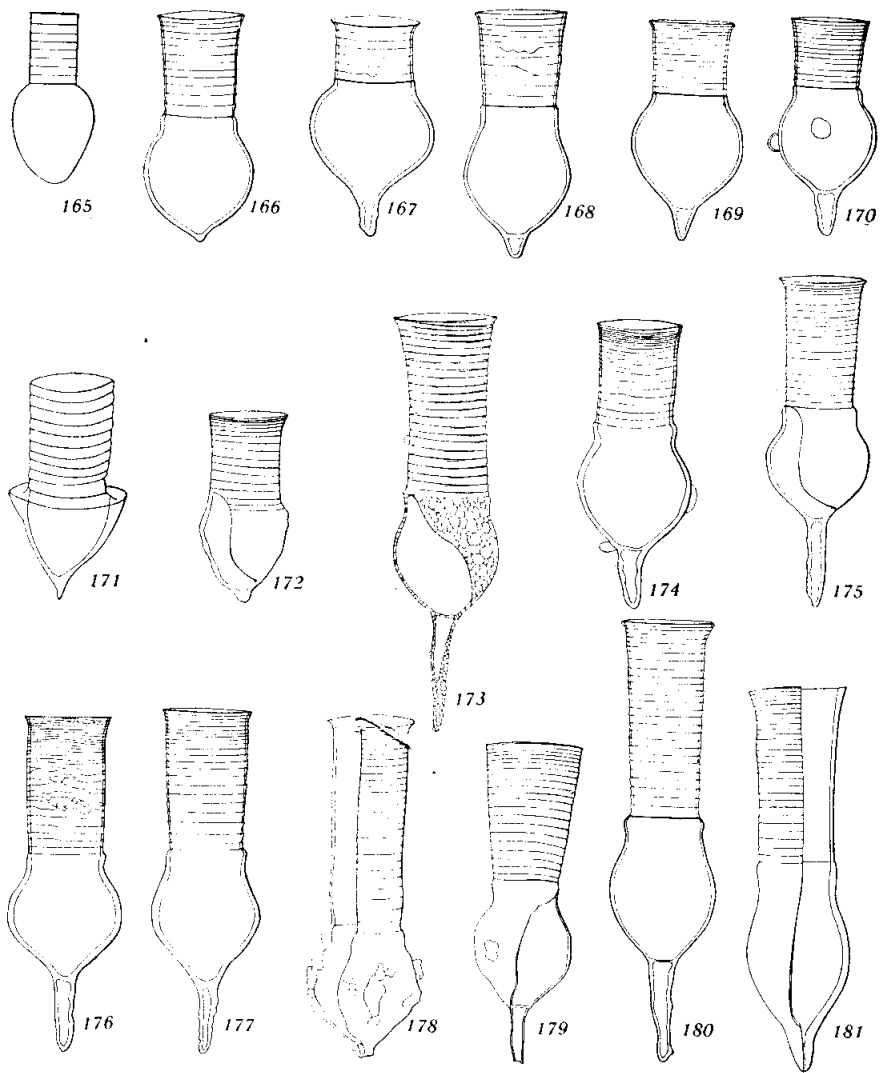
Fig. 160. *C. ostfeldi* (Schmidt) after Brandt (1906, pl. 14, fig. 2) from Station "Schott, 15-VI-93" off the west coast of Borneo.

Fig. 161. *C. globosa* sp. nov. after Brandt (1906, pl. 15, fig. 1) from Station "Freyrnadl 5" off Zanzibar in the Indian Ocean.

Fig. 162. *C. glacialis* (Laaek.) after Laackmann (1907, p. 238, fig. 13) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 163. *C. lusitanica* Jörg. after Jörgensen (1924, p. 99, fig. 112) from off Lisbon, Portugal.

Fig. 164. *C. gaussi* (Laaek.) after Laackmann (1907, p. 238, fig. 12) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.



Figs. 143-181. Species of *Codonellopsis* Jörgensen.  $\times 200$ . (Continued.)

Fig. 165. *C. morchella* (Cleve) Jörg. after Cleve (1900d, p. 970, fig. [2]) from the Caribbean Sea.

Fig. 166. *C. californiensis* sp. nov. from Station 4718 in the South Equatorial Drift of the Pacific.

Fig. 167. *C. turgida* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 168. *C. minor* (Bdt.) from Station 4673 in the Peruvian Current off Callao.

Fig. 169. *C. pura* (Bdt.) from Station 4728 in the South Equatorial Drift of the Pacific.

Fig. 170. *C. parva* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 171. *C. turbinella* sp. nov. after Entz, Jr. (1908, pl. 4, fig. 5) from the Bay of Naples.

**Codonellopsis brasiliensis** Brandt

Fig. 153

*Codonella ecaudata* var. *brasiliensis* Brandt, 1906, pp. 15, 17, pl. 13, figs. 4, 6, 6a, pl. 20, fig. 9; 1907, p. 119; Lohmann, 1920, pp. 230, 441, 487, 490, fig. 68.

Raised to status of species.

Lorica stout club-shaped, 2.6–2.7 oral diameters in length; collar and bowl subequal in length; collar constricted above the middle, flaring towards the oral rim and the bowl, with 13–15 spiral turns increasing in width towards the bowl; bowl broadly ovate; aboral region convex conical, 120° distally; aboral end blunt; wall with very unequal alveolar areas. Length 85–88 $\mu$ .

The type locality is Station Pl. 113 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Differs from *C. ecaudata* in the constriction of the collar and more pointed aboral end.

**Codonellopsis brevicaudata** (Brandt)

Figure 178

*Codonella brevicaudata* Brandt, 1906, pp. 12, 14, pl. 4, fig. 19, pl. 11, pl. 12, figs. 2, 2a; 1907, p. 118.

*Codonella brevirostris* Brandt, 1907, p. 81. *Lapsus pennae*.

*Codonella brevicauda*, Entz, Jr., p. 97. *Lapsus pennae*.

**Codonellopsis bulbulus** (Meunier)

Figure 149

*Tintinnopsis bulbulus* Meunier, 1919, p. 24, pl. 22, figs. 22, 23.

Figs. 143–181. Species of *Codonellopsis* Jörgensen.  $\times 200$ . (Concluded.)

Fig. 172. *C. tropica* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 173. *C. tessellata* (Bdt.) after Brandt (1906, pl. 9, fig. 4) from Station Pl. 37 of the Plankton Expedition in the Sargasso Sea.

Fig. 174. *C. speciosa* sp. nov. from Station 4617 in the Panamic Area of the Pacific.

Fig. 175. *C. pacifica* (Bdt.) from Station 4742 in the South Equatorial Current of the Pacific.

Fig. 176. *C. inflata* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 177. *C. meridionalis* sp. nov. from Station 4742 in the South Equatorial Current of the Pacific.

Fig. 178. *C. brevicaudata* (Bdt.) after Brandt (1906, pl. 12, fig. 2) from Station "Dahl, 6-XI-96" off Ralun in the Western Tropical Pacific.

Fig. 179. *C. orthoceras* (Haeckel) Jörg. after Brandt (1906, pl. 9, fig. 5) from Station Pl. 28 of the Plankton Expedition in the Sargasso Sea.

Fig. 180. *C. longa* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.

Fig. 181. *C. biedermanni* (Bdt.) after Brandt (1906, pl. 12, fig. 1) from Station "Bruhn 24-III-93, 3" in the Red Sea.

**Codonellopsis californiensis** sp. nov.

Figure 166

Lorica very stout, bowl and collar subequal; collar flaring throughout  $5^\circ$ , increasing at the oral rim, length 0.8 that of bowl; no nuchal constriction; neck short; bowl stout, rotund, scarcely subconical ( $100^\circ$ ) posteriorly; aboral horn reduced to a mere rudiment as a very short, stout, blunt point; no basal closing membrane noted at base of horn. Length 134–160 $\mu$ .

The type locality is Station 4718 in the South Equatorial Drift. Occurs also in the California and Mexican currents of the Pacific.

Differs from all other species of the *C. orthoceras* group in the minuteness of the aboral horn and the absence (?) of the basal membrane of the aboral horn.

**Codonellopsis contracta** sp. nov.

Figure 147

*Codonellopsis lagenula*, *partim*, Jørgensen, 1924, pp. 100–101, figs. 113a, b (for fig. 113c see *C. pusilla* and for fig. 113d see *C. lata*, see also *C. inornata* and *Codonella lagenula*); 1927, p. 14, fig. 26.

Lorica stout ovate; collar with 5–12 spiral turns, much shorter than the bowl, flaring aborally and merging gradually into the ovoidal bowl with one or more elliptical fenestrae in the lower part of the spiral; bowl widest near its middle; aboral end hemispherical; wall thin, with secondary structure and sometimes with coccoliths. Length 42–48 $\mu$ .

The type locality is Station 4655 in the Peruvian Current. Occurs also off Bergen and off the Balearic Islands.

Differs from *C. pusilla* in more inflated bowl and hemispherical aboral end.

**Codonellopsis cordata** sp. nov.

Figure 148

A curious species with a top-shaped lorica; collar short, cylindrical, 0.32 of the total length in length; shoulders wide; bowl cordate; aboral end sharp pointed with an aboral horn 0.35 length of the collar. Length 81 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from all other species in disproportion of collar and bowl and in cordate form of the bowl.

**Codonellopsis ecaudata** (Brandt)

Figure 154

- Codonella ecaudata* Brandt, 1906, p. 15, pl. 13, fig. 5; 1907, pp. 26, 118.  
 Non “*Codonella Orthoceras* [*ecaudata* ?],” Entz, Jr., 1908, pp. 18, 98, 113, 126, pl. 1, fig. 15 (see *C. lata*).  
 Non *Codonella orthoceras*, Entz, Jr., 1909*b*, p. 215, pl. 8, fig. 15 (see *C. lata*).  
*Codonella excaudata*, Bull. Plank., 1912, table 10. *Lapsus pennae*.

**Codonellopsis erythrænsis** (Brandt)

Figure 151

- Codonella morchella*, *partim*, Schmidt, 1901, p. 187 (see also *C. americana*, *C. globosa*, *C. indica*, and *C. morchella*).  
*Codonella morchella* var. *erythrænsis* Brandt, 1906, p. 15, pl. 14, fig. 4; 1907, p. 126.  
*Codonellopsis morchella*, *partim*, Jörgensen, 1924, p. 100 (for fig. 111 see *C. americana*, see also *C. globosa*, *C. indica*, and *C. morchella*).

Raised to status of species.

Lorica tall top-shaped, 2.6 oral diameters in length; collar 0.6 length of the bowl in length, flaring abruptly below the rim, and expanding below the constriction, 1 oral diameter in length; with 9 spiral turns widening towards the bowl; bowl acorn-shaped, with abrupt shoulder, widest (1.43 oral diameters) a little below the collar, orally an inverted convex cone ( $15^\circ$ ); aboral end subhemispherical; wall exceedingly thick, with primary, secondary, and tertiary structure. Length  $87\mu$ .

The type locality is the Red Sea.

Differs from *C. indica* in shape of collar and shorter bowl.

**Codonellopsis gaussi** (Laaekmann)

Figure 164

- Codonella gaussi* Laaekmann, 1907, p. 239, fig. 12; Brandt, 1907, pp. 444, 466.  
*Leprotintinnus gaussi* Laaekmann, 1909, pp. 406-409, pl. 47, figs. 1-4.

**Codonellopsis glacialis** (Laaekmann)

Figure 162

- Codonella glacialis* Laaekmann, 1907, p. 239, fig. 13; Brandt, 1907, pp. 444, 446.  
*Leprotintinnus glacialis* Laaekmann, 1909, pp. 408-409, pl. 47, figs. 5, 6, 8, pl. 48, fig. 4.  
*Leprotintinnus glacialis* forma *conica* Laaekmann, 1909, pp. 408-409, pl. 47, fig. 7.

**Codonellopsis globosa** sp. nov.

Figure 161

*Codonella morchella*, partim, Schmidt, 1901, p. 187 (see also *C. americana*, *C. erythraensis*, *C. indica*, and *C. morchella*); Brandt, 1906, p. 15, pl. 15, fig. 1 (for pl. 13, fig. 1 see *C. obconica*, for pl. 13, fig. 2 see *C. americana*, and for pl. 13, fig. 3, pl. 14, fig. 3 see *C. indica*); 1907, pp. 124-125 (see also *C. americana*, *C. indica*, *C. morchella*, and *C. obconica*).

*Codonellopsis morchella*, partim, Jörgensen, 1924, p. 100 (see also *C. americana*, *C. erythraensis*, *C. indica*, and *C. morchella*).

Lorica stout; collar 0.38 total length, flaring  $10^\circ$  orally; oral rim everted, concave laterally in the upper half, cylindrical below, with a few scattered fenestrae, with 13 turns, its length 3 oral diameters; bowl forming 0.62 total length, widest (1.9 oral diameters) at its middle; aboral end rounded; wall of bowl with very irregular and some very coarse particles. Length  $90\mu$ .

The type locality is Station Freymadl 5, off Zanzibar.

Differs from *C. americana* in the more globose bowl and longer and relatively narrower collar.

**Codonellopsis indica** sp. nov.

Figure 158

*Codonella morchella*, partim, Schmidt, 1901, p. 187 (see also *C. americana*, *C. erythraensis*, *C. globosa*, and *C. morchella*); Brandt, 1906, p. 15, pl. 13, fig. 3, pl. 14, fig. 3 (for pl. 13, fig. 1 see *C. obconica*, for pl. 13, fig. 2 see *C. americana*, for pl. 13, fig. 3, pl. 14, fig. 3 see *C. indica*, and for pl. 15, fig. 1 see *C. globosa*); 1907, pp. 124-125 (see also *C. americana*, *C. globosa*, *C. morchella*, and *C. obconica*).

*Codonellopsis morchella*, partim, Jörgensen, 1924, p. 100 (for fig. 111 see *C. americana*, see also *C. erythraensis*, *C. globosa*, and *C. morchella*).

Lorica rather short, bowl slightly longer than collar; collar everted orally, bulging near its middle; bowl ovate, widest in the lower third; aboral end subconical, feebly pointed; wall thick laterally, not aborally, coarsely and irregularly agglomerated. Length  $90\mu$ .

The type locality is off Zanzibar. Occurs also off Borneo.

Differs from *C. morchella* in ovate instead of abovate bowl and from *C. americana* in longer bowl.

**Codonellopsis inflata** sp. nov.

Figure 176

Lorica moderately stout; collar generally equaling or slightly exceeding the bowl in length, its oral rim decidedly everted; nuchal constriction well developed; bowl short, very rotund, expanded at

the equator subconical ( $90^\circ$ ) posteriorly; aboral horn slender, with little taper, 0.80–0.85 oral diameter in length. Length 130–224 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift. Occurs also in the Galapagos Eddy and South Equatorial Current of the Pacific.

Differs from all other species in the shape of the bowl, especially in its equatorial expansion.

### **Codonellopsis inornata** (Brandt)

Figure 145

*Codonella pusilla* var. *inornata* Brandt, 1906, p. 17, pl. 20, figs. 7, 8; 1907, p. 120.

*Codonellopsis lagenula*, *partim*, Jörgensen, 1924, p. 100 (for figs. 113a, b see *C. contracta*, for fig. 113d see *C. lata*, and for fig. 113e see *C. pusilla*, see also *Codonella lagenula*).

Raised to status of species.

Lorica flaring bag-shaped, 2.2–2.4 oral diameters in length; collar 0.5 length of the bowl in length, with a short abrupt oral flare, spreading to 1 oral diameter at junction with the bowl; spiral structure apparently lacking; bowl truncate ovate, widest (1.3–1.4 oral diameters) at its middle; aboral end subhemispherical; wall with unequal secondary structure. Length 49 $\mu$ .

The type locality is Station Pl. 10 of the Plankton Expedition in the Irminger Sea.

Differs from all species in the genus in the suppression of spiral structure in the collar.

### **Codonellopsis lata** sp. nov.

Figure 143

*Codonellopsis lagenula*, *partim*, Jörgensen, 1924, pp. 100–101, fig. 113d (for figs. 113a, b see *C. contracta*, for fig. 113e see *C. pusilla*, see also *C. inornata* and *Codonella lagenula*).

“*Codonella Orthoceras* [*ecaudata* [?]],” Entz, Jr., 1908, pp. 18, 98, 113, 126, pl. 1, fig. 15.

*Codonella orthoceras*, Entz, Jr., 1909b, p. 215, pl. 8, fig. 15.

Lorica stout; collar wide, non-spiral and low, separated by a single line from the wide, pot-like bowl; bowl shorter than wide; no shoulder; aboral end obscurely pointed; surface of collar and bowl covered by small, irregular flecks of material. Length 32 $\mu$ .

The type locality is Station 172, “Thor,” in the Black Sea.

Differs from all other species in the relative width of the bowl and from *C. tuberculata* in greater oral diameter.



**Codonellopsis longa** sp. nov.

Figure 180

*Codonella orthoceras* var. k Brandt, 1906, p. 12, pl. 4, fig. 18, pl. 9, figs. 7, 7a-c; 1907, pp. 105, 107, 108, 115, 118, 475.

*Codonella Orthoceras*, *partim*, Entz, Jr., 1908, pp. 125, 126, pl. 1, fig. 6 (for pl. 1, figs. 13, 16, pl. 13, figs. 18-22 see *C. speciosa*).

*Codonella orthoceras* var. (?) k, Laackmann, 1909, pp. 423, 435, 440, 441, 442.

*Codonella orthoceras*, *partim*, Entz, Jr., 1909b, pp. 214, 215, pl. 8, fig. 6 (for pl. 8, figs. 13, 16, pl. 20, figs. 18-22 see *C. speciosa*).

*Codonellopsis orthoceras*, *partim*, Jörgensen, 1924, pp. 98, 99, 100, 106, fig. 110a; 1927, p. 14, fig. 27a (for 1924, fig. 110b and 1927, fig. 27b see *C. speciosa*, see also *C. minor*, *C. orthoceras*, *C. pacifica*, *C. parva*, *C. pura*, and *C. tessellata*).

Lorica greatly elongated with collar exceeding bowl proper in length; collar very slightly flaring with a wide oral eversion; nuchal constriction pronounced with a convex expansion wider than the collar; bowl elongated, 1.75 oral diameters in length, subconical (80°) posteriorly; aboral horn long, slender, nearly equaling diameter of bowl in length; wall dense and opaque, secondary fields very small, regular and prominent, often masking the larger tertiary fields. Length 235-294 $\mu$ .

The type locality is Station 4681 in the South Equatorial Drift. Occurs also in the Peruvian and South Equatorial currents and Easter Island Eddy in the Pacific, and in the Indian Ocean and the Mediterranean.

Differs from *C. orthoceras* in less flaring collar, from *C. bieder-  
manni* in less tapering bowl, from *C. pacifica* in more elongated bowl, and from *C. speciosa* in longer bowl, collar, and horn.

**Codonellopsis lusitanica** Jörgensen

Figure 163

*Codonellopsis lusitanica* Jörgensen, 1924, pp. 99, 100, fig. 112.

**Codonellopsis meridionalis** sp. nov.

Figure 177

Lorica stout, collar and bowl proper subequal; collar uniformly flaring 5°, with abrupt oral eversion; nuchal constriction feeble, nuchal expansion above, slight; bowl rotund, widest below its middle, subconical (90°) posteriorly; aboral horn rather abruptly differentiated, tapering, usually about 0.3 diameter of bowl at base, and 0.6 (0.5-1.0) oral diameter in length. Length 197-245 $\mu$ .

The type locality is Station 4742 in the South Equatorial Current. Occurs also in the California, Mexican, Peruvian, South Equatorial and Equatorial Counter currents, South Equatorial Drift, and Pan-amic Area.

Differs from *C. biedermanni* in less tapering bowl, from *C. pacifica* in less rotund bowl, and from *C. longa* in less tapering bowl and shorter lorica.

### **Codonellopsis minor** (Brandt)

Figure 168

Non *Codonella orthoceras*, Möbius, 1887, pp. 119-120, pl. 8, fig. 33 (see also *Tps. baltica*).

*Codonella orthoceras* var. f. *minor* Brandt, 1906, p. 12, pl. 5, figs. 4, 12, pl. 11, figs. 3, 3a; 1907, pp. 105, 106, 113, 114, 115, 116, 471, 474.

*Codonellopsis orthoceras, partim*, Jörgensen, 1924, p. 98; 1927, p. 14 (see also *C. longa*, *C. orthoceras*, *C. pacifica*, *C. parva*, *C. pura*, and *C. speciosa*).

Raised to status of species.

Lorica tall top-shaped, 2.5-3.0 oral diameters in length; collar 0.16-0.25 length of the bowl in length, with slightly everted oral rim, with 12-15 spiral turns narrowest orally; bowl globose with slight shoulder below the collar, a short cylindrical neck 0.4 oral diameter in length; aboral horn conical ( $30^{\circ}$ - $35^{\circ}$ ); aboral end pointed; wall with very regular secondary structure. Length 125-207 $\mu$ .

The type locality is Station Pl. 100 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the North Equatorial Current and in the Pacific in the Peruvian Current off Callao.

Differs from *C. pura* and *C. turgida* in the longer bowl.

### **Codonellopsis morchella** (Cleve) Jörgensen emended

Figure 165

*Codonella morchella* Cleve, 1900d, p. 969, fig. [2]; Schmidt, *partim*, 1901, p. 187 (see also *C. americana*, *C. erythrænsis*, *C. globosa*, and *C. indica*); Okamura, *partim*, 1907, p. 137, pl. 6, fig. 54a (for fig. 54b see *C. americana*); Brandt, *partim*, 1907, pp. 124-125 (see also *C. americana*, *C. globosa*, *C. indica*, and *C. obconica*).

*Codonella (Tintinnopsis) morchella*, Laackmann, 1909, pp. 345, 421.

(*Tintinnopsis* ?) *morchella*, Laackmann, 1909, p. 413.

*Codonellopsis morchella, partim*, Jörgensen, 1924, pp. 99, 100 (for fig. 111 see *C. americana*, see also *C. erythrænsis*, *C. globosa*, and *C. indica*).

**Codonellopsis obconica** sp. nov.

Figure 156

*Codonella morchella*, partim, Brandt, 1906, p. 15, pl. 13, fig. 1 (for pl. 13, fig. 2 see *C. americana*, for pl. 13, fig. 3 and pl. 14, fig. 3 see *C. indica*, for pl. 15, fig. 1 see *C. globosa*); 1907, partim, pp. 124-125 (see also *C. americana*, *C. globosa*, *C. indica*, and *C. morchella*).

Lorica stout, bowl much longer than collar; collar conical ( $23^\circ$ ), its oral rim scarcely everted, slight median bulge; shoulder not emergent; bowl stout ellipsoidal, its length 1.1 its width, widest near its middle, aboral end broadly rounded; wall thick laterally, thin aborally, coarsely agglomerated. Length  $86\mu$ .

The type locality is off Zanzibar in the Indian Ocean.

Differs from all other species in its obconical collar.

**Codonellopsis orthoceras** (Haeckel) Jörgensen emended

Figure 179

*Codonella orthoceras* Haeckel, 1873, p. 567, pl. 28, fig. 10; Kent, 1882, p. 616, pl. 31, fig. 38; Brandt, 1906, pp. 13, 14, pl. 9, figs. 5, 5a, pl. 11, fig. 6; 1907, pp. 101-117; Schweyer, 1909, pp. 135, 138, 139, 142, 143, 149, 150, 186, pl. 10, figs. 3a, b; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 387.

*Tintinnopsis orthoceras*, Ostensfeld, 1906, p. 66; Brandt, 1907, p. 447.

Non *Cyttarocylis orthoceras*, Entz, Jr., 1904b, pp. 128, 130, figs. 10-23 (see *Tintinnopsis lindeni*).

*Codonellopsis orthoceras*, partim, Jörgensen, 1924, pp. 5, 98, 99, 100, 106; 1927, p. 14 (see also *C. longa*, *C. minor*, *C. pacifica*, *C. parva*, *C. pura*, *C. speciosa*, and *C. tessellata*).

*Codonella annulata*, Daday, 1887a, pp. 159-208, pl. 1, fig. 4; 1887b, pp. 571-572, pl. 20, fig. 21; Biedermann, 1893, pp. 15-19, pl. 3, fig. 12.

Non *Codonella annulata* Daday, 1886, p. 496, pl. 25, fig. 15 (see *Coziella helix*).

Non *Tintinnopsis annulata* Daday, 1887b, p. 550 (see *Tps. cincta*).

**Codonellopsis ostensfeldi** (Schmidt)

Figure 160

*Codonella ostensfeldi* Schmidt, 1901, p. 187, fig. 4; Brandt, 1906, pp. 15, 17, pl. 14, figs. 1, 2, pl. 15, fig. 2, pl. 20, fig. 10; 1907, pp. 122-124; Okamura, 1907, p. 137, pl. 6, figs. 53a, b.

*Codonella fenestrata* Cleve, 1901c, p. 53, pl. 7, fig. 15.

*Codonella morchella* var. *ostensfeldi*, Cleve, 1903b, p. 350.

*Tintinnopsis ostensfeldi*, Brandt, 1907, pp. 123, 125.

**Codonellopsis ovata** Jörgensen

Figure 150

*Codonella lagenula* var. *ovata* Jörgensen, 1899, p. 27; 1905, pp. 53, 65, 82, 143, pl. 18, fig. 117; 1924, p. 101.

*Codonellopsis pusilla* var. *ovata* Jörgensen, 1924, p. 98. [Length 68 $\mu$ ].

Raised to status of species.

Lorica flask-shaped, 3 oral diameters in length; collar 0.16 total length in length, subcylindrical, slightly flaring, with 2 turns; bowl elongate ovate, widest at 0.66 its length below the collar; aboral end hemispherical; wall coarsely agglomerated. Length 46 $\mu$ .

The type locality is off Bergen, Norway.

Differs from *C. inornata* in having a faint spiral in the collar.

**Codonellopsis pacifica** (Brandt) emended

Figure 175

*Codonella orthoceras* var. *c* Brandt, 1906, pp. 12, 14, pl. 4, fig. 13, pl. 11, figs. 5, 5a; 1907, pp. 80, 105, 106, 108, 110, 112, 474; Entz, Jr., 1908, p. 98.

*Codonella orthoceras* var. *1 pacifica* Brandt, 1906, p. 13, pl. 7, fig. 5; 1907, pp. 80, 105, 107, 108, 115, 116, 474.

*Codonella orthoceras* var. *b, partim*, Brandt, 1906, p. 13, pl. 8, fig. 6, pl. 9, figs. 6, 6a (for pl. 7, fig. 6, pl. 8, fig. 5 see *C. speciosa*).

*Codonella orthoceras*, Lühe, 1913, p. 177, fig. 169; Rhumbler, 1923, p. 261, fig. 267.

*Codonellopsis orthoceras, partim*, Jörgensen, 1924, p. 98; 1927, p. 14 (see also *C. longa*, *C. minor*, *C. orthoceras*, *C. parva*, *C. pura*, *C. speciosa*, and *C. tessellata*).

Raised to status of species.

Lorica elongated, 3.0-4.6 oral diameters in length; collar shorter than the bowl, 0.5-0.7 oral diameter in length, very slightly concave and slightly flaring throughout its length orally, with 18-24 spiral turns; bowl with cylindrical neck, 0.2 oral diameter in length, with scarcely any shoulder, globose below; aboral region convex conical (90°); aboral horn subcylindrical 0.4-1.1 oral diameters in length; tip truncated or blunt; wall with uniform structure, or with cocoliths. Length 195-270 $\mu$ .

The type locality is off New Pomerania in the Western Tropical Pacific.

Differs from *C. meridionalis* and *C. longa* in relatively smaller bowl.

**Codonellopsis parva** sp. nov.

Figure 170

*Codonella orthoceras* var. d Brandt, 1906, pp. 12, 14, pl. 4, fig. 14, pl. 11, figs. 1, 1a-c; 1907, pp. 105, 108, 112, 474.

*Codonella orthoceras* var. e Brandt, 1906, pp. 12-14, pl. 4, fig. 15, pl. 7, fig. 6a, pl. 10, figs. 5, 5a, b; 1907, pp. 106, 108, 112, 115, 474.

*Codonellopsis orthoceras*, partim, Jörgensen, 1924, p. 98; 1927, p. 14 (see also *C. longa*, *C. minor*, *C. orthoceras*, *C. pacifica*, *C. pura*, *C. speciosa*, and *C. tessellata*).

Lorica short, stout, collar shorter than the bowl; collar flaring  $7^\circ$ , oral rim abruptly everted; no nuchal constriction, or a slight one with slight nuchal roll; bowl with very short neck, rotund, with some aboral taper, its length 1.35 oral diameters; aboral horn stout, tapering, 0.65-0.80 oral diameter in length. Length 145-177 $\mu$ .

The type locality is Station 4724 in the South Equatorial Drift. Occurs also in the Equatorial Counter Current and South Equatorial Current, Panamic Area, Galapagos Eddy, and South Equatorial Drift of the Pacific; and the Florida Current, Sargasso Sea, and Northeast Trade Drift of the Atlantic.

Differs from *C. pura* in shorter, stouter, and narrower bowl and longer and more slender horn and from *C. inflata* and *C. minor* in more contracted aboral part of the bowl.

**Codonellopsis pura** (Brandt) emended

Figure 169

*Codonella orthoceras* var. g *pura* Brandt, 1906, pp. 12, 14, pl. 5, figs. 2, 3, pl. 10, figs. 4, 4a, b; 1907, pp. 105, 106, 107, 113, 114, 115, 116, 474, 477.

*Codonella orthoceras* var. h Brandt, 1906, pp. 12, 14, pl. 4, fig. 16, pl. 10, figs. 7, 7a; 1907, pp. 104, 106, 113, 114, 115, 117, 474.

*Codonella orthoceras* var. i Brandt, 1906, pp. 12, 14, pl. 4, fig. 17, pl. 5, fig. 1, pl. 11, fig. 4; 1907, pp. 81, 106, 108, 112, 113, 475.

*Codonellopsis orthoceras*, partim, Jörgensen, 1924, p. 98; 1927, p. 14 (see also *C. longa*, *C. minor*, *C. orthoceras*, *C. pacifica*, *C. parva*, *C. speciosa*, and *C. tessellata*).

Raised to status of species.

Lorica short and stout, 1.9-2.6 oral diameters in length; collar 0.4-0.6 length of bowl in length, flaring, inverted conical ( $7^\circ$ - $8^\circ$ ), with a little oral eversion; bowl without shoulder and without clearly differentiated nuchal region, truncate stout ovoidal; aboral region hemispherical; aboral horn conical ( $20^\circ$ ) to cylindrical, 0.2-0.6 oral diameter in length; tip blunt to pointed; wall with fine secondary alveolar structure, sometimes with larger clearer areas. Length 145-195 $\mu$ .

The type locality is Station 27 of the Plankton Expedition in the Florida Current. Occurs also in the Tropical Atlantic and Eastern Tropical Pacific generally.

Differs from *C. minor* in shorter, stouter collar, and from *C. parva* in less differentiation of the nuchal region.

### **Codonellopsis pusilla** (Cleve)

Figure 146

*Codonella pusilla* Cleve, 1900*d*, p. 970, fig. 13; 1901*a*, pp. 921, 936; 1901*d*, pp. 17, 105; 1902*b*, p. 13; Ostenfeld and Paulsen, 1904, pp. 168, 178, 182, 186, 190, 194, 198, 202, 206; Linko, 1904, p. 5; Brandt, 1907, p. 120.

*Codonellopsis lagenula*, *partim*, Jørgensen, 1924, pp. 100-101, fig. 113*c* (for figs. 113*a*, *b* see *C. contracta*, for fig. 113*d* see *C. lata*, see also *C. inornata* and *Codonella lagenula*).

### **Codonellopsis robusta** sp. nov.

Figure 152

Lorica, small, stout, with bowl 1.5 length of collar; collar short cylindrical with little oral flare, its length 0.4 total length; bowl broadly ellipsoidal, its width 0.9 its length; wall with small secondary fields, about 20 across the bowl. Length 75-84 $\mu$ .

The type locality is Station 4600 in the Mexican Current.

Differs from *C. ecaudata* in thicker collar, stouter bowl, and more abrupt shoulder.

### **Codonellopsis schabi** (Brandt)

Figure 157

*Codonella morehella* var. *schabi* Brandt, 1906, p. 15, pl. 14, figs. 5, 6; 1907, p. 125; Laackmann, 1909, pp. 413, 420.

Raised to status of species.

Lorica truncated subfusiform, 2.9-3.5 oral diameters in length; collar 0.5 length of the bowl in length, slightly constricted below the oral rim and spreading a little toward the bowl, with 9-10 spiral turns widening toward the bowl to twice the width at the rim; bowl truncate ovoidal, widest (1.4-2.0 oral diameters) a little below the middle; aboral region convex subconical (about 90°); aboral end bluntly rounded; wall with very large tertiary masses. Length 107-140 $\mu$ .

The type locality is Station "Schab 10-VI-93" off Monrovia in the Guinea Current.

Differs from *C. indica* in longer bowl.

**Codonellopsis speciosa** sp. nov.

Figure 174

*Codonella annulata*, Entz, Jr., 1904b, pp. 125, 126, 133, fig. 1.*Codonella orthoceras* var. b, *partim*, Brandt, 1906, p. 13, pl. 7, fig. 6, pl. 8, fig. 5; 1907, pp. 34, 81, 105, 106, 107, 111, 112, 114, 134 474 (for pl. 8, fig. 6, pl. 9, figs. 6, 6a see *C. pacifica*).*Codonella Orthoceras*, *partim*, Entz, Jr., 1908, pp. 125, 126, pl. 1, figs. 13, 16, pl. 13, figs. 18-22 (for pl. 1, fig. 6 see *C. longa*).*Codonella orthoceras*, *partim*, Entz, Jr., 1909b, pp. 2, 14, 215, pl. 8, figs. 13, 16, pl. 20, figs. 18-22 (for pl. 8, fig. 6 see *C. longa*).*Codonellopsis orthoceras*, *partim*, Jörgensen, 1924, pp. 98, 99, fig. 110b; 1927, p. 14, fig. 27b (for 1924, fig. 110a and 1927, fig. 27a see *C. longa*, see also *C. minor*, *C. orthoceras*, *C. pacifica*, *C. parva*, *C. pura*, and *C. tessellata*).

Lorica stout, elongate; collar long, with little oral eversion; nuchal constriction very slight; bowl long, with a long neck, subconical ( $75^{\circ}$ - $80^{\circ}$ ) posteriorly; aboral horn stout, tapering, with a blunt end. Length 181-215 $\mu$ .

The type locality is Station 4617 in the Panamic Area. Occurs also in the California Current, South Equatorial Drift and Current in the Pacific, in the Mediterranean, and in the Sargasso Sea.

Differs from *C. pacifica* in shorter collar, longer, stouter bowl, and shorter horn.

**Codonellopsis tessellata** (Brandt)

Figure 173

*Codonella orthoceras*, Daday, 1886, pp. 494-495, pl. 25, fig. 12.*Codonella orthoceras* var. a *tessellata* Brandt, 1906, pp. 12-14, pl. 4, figs. 11, 12, pl. 7, fig. 7, pl. 9, figs. 4, 4a, b, pl. 10, figs. 6, 6a, pl. 11, figs. 2, 2a; 1907, p. 110.*Codonellopsis orthoceras*, *partim*, Jörgensen, 1924, p. 100 (see also *C. longa*, *C. minor*, *C. orthoceras*, *C. pacifica*, *C. parva*, *C. pura*, and *C. speciosa*).

Raised to status of species.

Lorica greatly elongated, 3.9-4.2 oral diameters in length; collar 0.7 length of the bowl in length, concave conical ( $7^{\circ}$ ) orally, flaring slightly toward the bowl, with 25-30 spiral turns, subequal in width except for a few narrower turns below the rim; bowl stout ovate, with subcylindrical neck 0.2 oral diameter in length, with very slight shoulder; aboral region convex conical ( $90^{\circ}$ ); aboral horn cylindrical, 0.8-1.2 oral diameters in length; tip blunt or pointed; wall of bowl with subuniform secondary structure. Length 215-315 $\mu$ .

The type locality is Station Pl. 37 of the Plankton Expedition in the Sargasso Sea.

Differs from other species in the long and flaring collar and relatively long aboral horn.

**Codonellopsis tropica** sp. nov.

Figure 172

Lorica short, bowl and collar subequal in length and diameter; collar concave laterally throughout, increasing at oral rim; no nuchal constriction or roll; bowl slightly contracting at the junction with the collar, widest at the anterior 0.25 of the length, convex subconical ( $60^\circ$ ) in the posterior 0.75; aboral end with a stout, blunt point not so long as its basal diameter. Length  $125\mu$ .

The type locality is Station 4709 in the South Equatorial Drift of the Pacific.

Differs from *C. brevicaudata* in shorter concave collar, less globose bowl, and shorter aboral horn.

**Codonellopsis tuberculata** (Daday) Jörgensen

Figure 144

*Amphorella tuberculata* Daday 1887b, p. 541, pl. 18, fig. 20; Entz, Jr., 1908, pp. 68, 97.

*Tintinnus tuberculata*, Brandt, 1907, p. 413; Entz, Jr., 1909, pp. 131, 166, 200.

*Amphorella (Tintinnus) tuberculata*, Entz, Jr., 1909b, p. 166.

*Codonellopsis tuberculata*, Jörgensen, 1924, pp. 99, 101, fig. 114.

*Codonella lagenula*, Rossolimo, 1922, p. 24, pl. 22, fig. 1.

**Codonellopsis turbinella** sp. nov.

Figure 171

*Ptychocylis Orthoceras*, Entz, Jr., 1908, pp. 19, 98, 113, 127, pl. 4, fig. 5.

*Ptychocylis orthoceras*, Entz, Jr., 1909b, pp. 108, 130, 199, pl. 11, fig. 5.

Non *Codonella orthoceras* Haeckel, 1873, p. 567, pl. 28, fig. 10 (see *C. orthoceras*).

Lorica stout top-shaped; collar longer than bowl, flaring  $3^\circ$ , with no oral eversion; nuchal region abruptly flared into the bowl, with a shallow trough encircling the base of the collar; bowl shaped like the body of a top, widest anteriorly, its width 1.4 oral diameters, convex subconical ( $65^\circ$ ) posteriorly; aboral horn stout subconical ( $40^\circ$ ), pointed. Length (according to magnification as stated in 1908)  $135\mu$ ; stated in 1909, p. 130 to be  $200\mu$ .

The type locality is the Bay of Naples, Italy.

Differs from *C. cordata* in longer and wider collar and in the trough-like anterior end of the bowl. Possibly an abnormality.



**Codonellopsis turgescens** sp. nov.

Figure 155

Lorica with subequal bowl and collar; collar with everted lip and wide, bulging central region, 1.75–2.08 diameters of bowl in length; shoulder sloping; bowl elongate, its length 1.13 its greatest diameter which is at its middle; aboral end hardly subconical, scarcely pointed; wall thin. Length 88–100 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican Current, Galapagos Eddy, and South Equatorial Drift.

Differs from *C. ecaudata* in wide central bulge of collar, more rotund bowl, and more pointed aboral end.

**Codonellopsis turgida** sp. nov.

Figure 167

Lorica short, stout, with collar shorter than bowl; collar scarcely flaring, rarely more than an oral diameter in length; oral rim everted; nuchal constriction and roll generally absent; neck very short, not over 0.12 oral diameter long; bowl quite rotund, widest below the middle, stout ovate with a tendency to taper distally; aboral horn short and stout, tapering conical (20°–30°), 0.4–0.6 oral diameters in length. Length 143–170 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift. Occurs also in the South Equatorial Current and the Galapagos Eddy.

Differs from *C. pura* in larger, more tapering bowl and shorter, stouter aboral horn.

**Laackmanniella** gen. nov.

*Codonella, partim*, Laackmann, 1907, p. 239 (see also *Codonellopsis*).

*Leprotintinnus, partim*, Laackmann, 1909, pp. 398–402.

Codonellopsidae with a long lorica; collar tubular, spirally wound, hyaline; bowl tubular or inflated without spiral structure; aboral end contracted but always open; with the facies of *Codonellopsis*; adherent diatoms largely limited to the bowl.

We designate as the type species *Laackmanniella naviculaefera* (Laackmann) from the Antarctic.

Differs from both *Stenosemella* and *Codonellopsis* in the open aboral end.

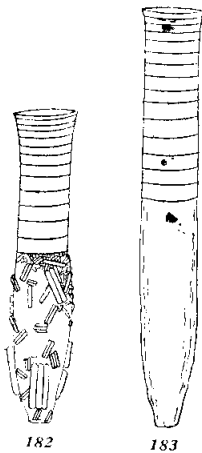
Includes but two species, *Laackmanniella naviculaefera* (Laackmann) and *L. prolongata* (Laackmann).

***Laackmanniella naviculaefera* (Laackmann)**

Figure 182

*Codonella naviculaefera* Laackmann, 1907, p. 239, fig. 10; Brandt, 1907, pp. 444, 473; Entz, Jr., 1908, p. 97.

*Leprotintinnus naviculaeferus* Laackmann, 1909, pp. 346, 348, 401, 402, 403, 404, 406, 414, 415, 416, 419, 421, 492, pl. 46, figs. 1-9, pl. 47, figs. 9-11.



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183

***Laackmanniella prolongata* (Laackmann)**

Figure 183

*Codonella prolongata* Laackmann, 1907, pp. 236, 239, fig. 11; Brandt, 1907, pp. 444, 476; Entz, Jr., 1908, p. 98.

*Leprotintinnus prolongatus* Laackmann, 1909, pp. 346, 348, 349, 396, 397, 398, 401, 403-406, 408, 414, 415, 416, 419, 421, 492, pl. 46, figs. 10-11, pl. 47, fig. 12, pl. 48, figs. 5-7.

*Leprotintinnus prolongatus* forma *ventricosa* Laackmann, 1909, pp. 404-406, pl. 46, figs. 13-15.

Figs. 182-183. Species of *Laackmanniella* gen. nov.  $\times 200$ .

Fig. 182. *L. naviculaefera* (Laack.) after Laackmann (1909, pl. 46, fig. 7) from Antarctic plankton.

Fig. 183. *L. prolongata* (Laack.) after Laackmann (1909, pl. 46, fig. 11) from Antarctic plankton.

Family COXLIPELLIDAE fam. nov.

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Cyttarocyclidae, Ptychocyclidae, Tintinnidae, Tintinnididae, Undellidae, and Xystonellidae).

Tintinninea with lorica with open or closed aboral end, if closed often irregular; with or without collar; always with coiled lamina forming the whole or part of the lorica; wall without agglomerated particles.

Differs from the Codonellidae, Cyttarocyclidae (except for supplemental turns in *Cyttarocylis*), Ptychocyclidae, Petalotrichidae (except for *Metacylis*), Rhabdonellidae, Xystonellidae, Undellidae, Dictyocystidae, and Tintinnidae in the presence of the spiral lamina in the lorica; from the Tintinnididae in the firmer texture and lack of agglomerations in the wall, and from the Codonellopsidae in the absence of secondary structure in the bowl.

Includes three genera, *Climacoeylis* Jörg., *Coxliella* Bdt. emended Laack., and *Helicostomella* Jörg. emended.

### Climacocyliis Jörgensen

*Cyttarocyliis, partim*, Brandt, 1907, pp. 181-188 (see also *Cozliella*, *Craterella*, *Cyttarocyliis*, *Favella*, *Parafavella*, *Porococcus*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*).

*Cozliella, partim*, Brandt, 1907, pp. 7, 259-272 (see also *Cozliella*).

*Climacocyliis* Jörgensen, 1924, pp. 7, 8, 76, 77.

*Climatocyliis*, Campbell, 1927, p. 445. *Lapsus pennae*.

Coxliellidae with lorica flaccid and translucent, generally tubular; oral margin entire; more or less well developed spiral structure extending out horizontally from wall from the oral rim posteriorly for the whole or part of the lorica; aboral end with or without an aboral skirt, often open posteriorly; wall composed of large secondary prisms or alveoles.

We designate as the type species *Climacocyliis scalaria* (Brandt) Jörgensen from the Tropical Pacific off Ralum, the first species included in the genus.

Differs from *Cozliella* in greater transparency and coarser alveolation of the wall, presence of the spiral shelf, and lack of a symmetrical aboral region, and from *Helicostomella* in the structure of the wall and presence of spiral shelf.

Includes five species as follows: *Climacocyliis digitula* sp. nov., *C. elongata* sp. nov., *C. scalaria* (Bdt.) Jörg., *C. scalaroides* sp. nov., and *C. siphon* (Bdt.).

#### **Climacocyliis digitula** sp. nov.

Figure 186

Lorica elongated, finger-shaped, 4.0-4.3 oral diameters in length, irregularly tapering to 0.50-0.75 oral diameter at the aboral end; oral rim entire; composed of 14-17 spiral turns, becoming wider aborally, 0.2-0.6 oral diameters in width; slight middle horizontal ridge in the oral 0.25-0.50 of lorica; aboral end squarely and irregularly truncate or partially closed; wall with single layer of prisms except in the ridge, 50 around the oral region and 50-55 from end to end. Length 140-145 $\mu$ .

The type locality is Station 4583 in the California Current.

Differs from all other species of the genus except *C. elongata* in that the spiral structure is continued to the aboral end and from that species in the very slight development of the spiral shelf.

***Climacocylis elongata* sp. nov.**

Figure 188

*Cyttarocylis (Coxiella) scalaris* var. b Brandt, 1906, p. 19, pl. 27, fig. 1; 1907, pp. 265-267, 478.

*Cyttarocylis scalaris* var. b Brandt, 1907, p. 267.

*Coxiella scalaris* var. b, Entz. Jr., 1908, p. 100. *Lapsus pennae*.

Lorica an elongated tube, subcylindrical, tapering, 6.3-6.7 oral diameters in length, composed of 17-21 spiral turns (sometimes interrupted), 0.24-0.54 oral diameter in width; spiral shelf well developed, at a right angle to the side, 0.14-0.29 oral diameter in width, fading out 3 turns from the aboral end; aboral end open, obliquely truncate; wall composed of prisms increasing in size aborally, 112 around the oral rim, 56 around the aboral end, 5-6 layers in the ledge in the oral region and 3 in the aboral. Length 355-455 $\mu$ .

The type locality is Station Pl. 123 of the Plankton Expedition in the Gulf Stream Drift. Occurs also in the California Current.

Differs from *C. digitula* in greater contrast in prisms at the two ends and in larger size.

***Climacocylis scalaria* (Brandt) Jørgensen**

Figure 185

*Cyttarocylis (Coxiella) scalaris* Brandt, 1906, pp. 7, 18, 19, pl. 21, fig. 15, pl. 26, figs. 4-6, pl. 27, figs. 2, 3; 1907, pp. 238, 264-267, 478.

*Coxiella scalaris* Brandt, 1907, pp. 33, 187, 236, 244; Entz, Jr., 1908, p. 100.

*Coxiella scalaria, partim*, Laackmann, 1909, pp. 392, 423, 425, 426, 430, 455; 1913, pp. 33, 34, pl. 5, fig. 65 (see also *Cl. scalaroides*).

*Cyttarocylis scalaris* Brandt, 1907, pp. 26, 27, 30, 38, 186, 201, 260, 262, 409.

*Climacocylis scalaria*, Jørgensen, 1924, pp. 77, 105, 106, fig. 88.

***Climacocylis scalaroides* sp. nov.**

Figure 187

*Cyttarocylis scalaris* var. a Brandt, 1907, pp. 266-267, 478.

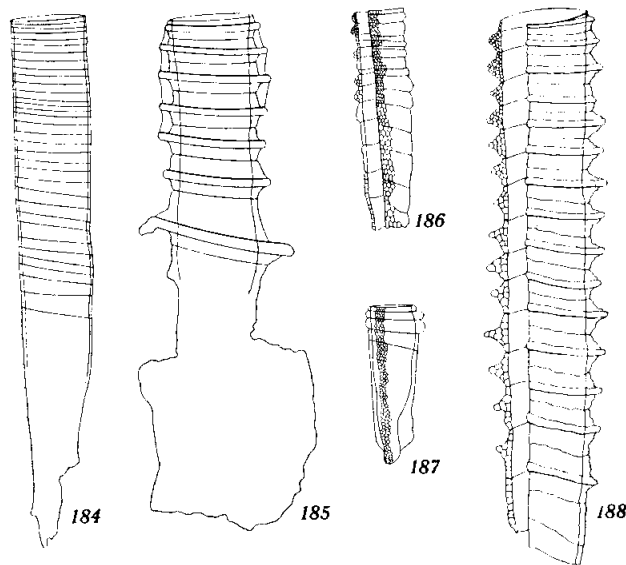
*Cyttarocylis (Coxiella) scalaris* var. a Brandt, 1907, pp. 265, 478.

*Coxiella scalaria, partim*, Laackmann, 1909, pp. 392, 423, 425, 426, 430, 455; 1913, pp. 33, 44 (for 1913, pl. 5, fig. 65 see *Cl. scalaria*).

*Coxiella scalaris*, Laackmann, 1913, pp. 3, 9.

Lorica short finger-shaped, tapering, 2.6-6.0 oral diameters in length, composed of 3-7 spiral turns and an undivided aboral section; spiral shelf reduced somewhat in size and extent in most loricae to a rounded ridge, rarely developed as a flat shelf, sometimes fading out in the first 3 oral turns, aboral 0.5-0.7 without spiral division; aboral

end usually closed with a small amount of local thickening, or with an irregular opening; wall composed of a single layer of prisms except in the spiral shelf and aboral thickening where there are 2-7 layers, 64 around the oral opening, and 7 vertically across the lowest turn. Length 110-127 $\mu$ .



Figs. 184-188. Species of *Climacocypris* Jörgensen.  $\times 200$ .

- Fig. 184. *C. siphon* (Bdt.) from Station 4583 in the Mexican Current.  
 Fig. 185. *C. scalaria* (Bdt.) Jörg. from Station 4574 in the California Current.  
 Fig. 186. *C. digitula* sp. nov. from Station 4583 in the California Current.  
 Fig. 187. *C. scalaroides* sp. nov. from Station 4583 in the California Current.  
 Fig. 188. *C. elongata* sp. nov. from Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

The type locality is Station 4583 in the California Current. Occurs also in the North Equatorial Current, Panamic Area and the South Equatorial Drift, southwest of Australia, in the Bay of Biscay, and in the Mediterranean.

Differs from *C. scalaria* in smaller size, fewer turns, and smaller aboral mass.

### ***Climacocypris siphon* (Brandt)**

Figure 184

*Cyttarocypris siphon* Brandt, 1906, p. 21, pl. 32, figs. 8, 8a, pl. 33, figs. 5, 5a; 1907, pp. 202-203, 478; Laackmann, 1909, p. 444.

## Coxliella Brandt emended Laackmann emended Jørgensen

*Tintinnus*, *partim*, Claparède and Lachmann, 1858, pp. 195-196 (see also *Acauthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocylis*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*).

*Codonella*, Daday, 1886, p. 496.

*Cyttarocylis*, Daday, *partim*, 1887b, pp. 574-575 (see also *Codonella*, *Epiptocylis*, and *Favella*); Kofoid, *partim*, 1905, pp. 292-296 (see also *Xystonellopsis*); Laackmann, *partim*, 1907, pp. 235-237 (see also *Cymatocylis*); Brandt, *partim*, 1907, pp. 181-188 (see also *Climacocylis*, *Craterella*, *Cyttarocylis*, *Favella*, *Parafavella*, *Porocus*, *Tintinnopsis*, *Xystonella*, and *Xystonellopsis*); Meunier, 1910, pp. 119-120.

*Coxliella* (subgenus and genus), *partim*, Brandt, 1907, pp. 7, 259-272 (see also *Climacocylis*).

*Coxliella*, Laackmann, 1909, pp. 346, 349, 392, 445, 454; 1913, p. 24; Jørgensen, 1924, pp. 7, 9, 25, 71, 76; 1927, pp. 4, 10, 12, 23, 24.

*Amphorella*, Jørgensen, 1899, pp. 17, 39, 42; Meunier, *partim*, 1910, pp. 130-131 (see also *Albatrossiella* and *Metacylis*).

Coxliellidae with lorica generally tall bowl- or vase-like; oral rim never regularly denticulate; without a well differentiated collar; wall double, usually with two laminae, with coarse, secondary structure; lorica formed throughout or in greater part by a single spiral band with superposed turns of varying heights.

We designate as the type species *Coxliella laciniosa* (Brandt) Brandt from the South Equatorial Current of the Atlantic, a typical and well-known species of the genus.

Differs from *Climacocylis* in greater firmness and opacity of the wall, absence of spiral shelf, and more symmetrical aboral end and from *Helicostomella* in the shorter, stouter lorica and fewer spiral turns.

Includes two subgenera, *Protocochliella* Jörg. and *Coxliella* nom. nov.

### Subgenus COXLIELLA nom. nov.

Subgenus *Cochliella* Jørgensen, 1924, p. 72.

*Coxliella* with wall with inner and outer laminae well developed throughout the whole lorica and with secondary prismatic structure.

The type species is that of the genus, *Coxliella laciniosa*.

Jørgensen (1924) divided the genus *Coxliella* into two subgenera, *Cochliella* and *Protocochliella*, omitting the use of the name *Coxliella*. This use is required by the rules of nomenclature. We therefore replace his subgenus *Cochliella* by *Coxliella*.

Differs from *Protocochliella* in having the inner and outer laminae of the wall very distinct and in having more highly developed secondary structure.

Includes 16 species as follows:

<i>calyptra</i> (Cleve) Bdt.	<i>laciniosa</i> (Bdt.) Bdt.
<i>cymatiocoides</i> sp. nov.	<i>longa</i> (Bdt.) Laack.
<i>decepiens</i> Jörg.	<i>meunieri</i> nom. nov.
<i>declivis</i> sp. nov.	<i>minor</i> (Laack.) Laack.
<i>fasciata</i> (Kofoid) Bdt.	<i>oviformis</i> Hensen
<i>frigida</i> (Laack.) Laack.	<i>pelagica</i> sp. nov.
<i>helix</i> (Clap. and Laeb.) Bdt.	<i>pseudannulata</i> (Jörg.) Bdt.
<i>intermedia</i> (Laack.) Laack.	<i>tubularis</i> (Meunier)

### ***Coxliella calyptra* (Cleve) Brandt**

Figure 189

*Tintinnus?* *calyptra* Cleve, 1899a, p. 24, pl. 1, fig. 2.

*Cyttarocyclus calyptra*, Cleve, 1901d, p. 108.

*Coxliella calyptra*, Brandt, 1907, p. 42.

*Cyttarocyclus pseudannulata* var. *calyptra*, Brandt, 1907, pp. 261, 270, 444, 456, 476.

*Coxliella pseudannulata, partim*, Jörgensen, 1924, p. 74 (see also *C. ampla* and *C. pseudannulata*).

This may be a radiolarian as suggested by Jörgensen (1924) and, if so, is a species of *Spirocyrtis*.

### ***Coxliella cymatiocoides* sp. nov.**

Figure 200

Lorica large, stout, bag-shaped, 3.7 oral diameters in length; oral rim very irregular; bowl subcylindrical with 6-7 spiral turns doubling in width aborally; aboral end irregularly rounded; wall with many short leiotropic plicae, which mainly originate from the lower margin of the band and extend obliquely upward over half of its surface. Length 195 $\mu$ .

The type locality is Union Bay, Alaska, from the collections of the U.S.S. "Albatross."

Differs from other species in having longitudinal striae of the *Cymatocyclus* type superimposed on *Coxliella* spiral structure, except from *Coxliella tubularis* from which it differs in proportions, length of striae, and shape of aboral end.

**Coxiella decipiens** Jörgensen emended

Figure 203

*Cyttarocyclus annulata*, Entz, Jr., 1908, pp. 12-27, pl. 3, fig. 5; 1909*b*, pp. 102, 215, pl. 10, fig. 5.

Non "*Cyttarocyclus* [*Coxiella*] *ampla* [?] Jörg. [*C. annulata* [?] Daday]," Entz, Jr., 1908, pp. 11-126, pl. 3, fig. 1 (see *C. annulata*).

Non *Cyttarocyclus* (*Coxiella*) *annulata* (= *C. ampla*?), Entz, Jr., 1909*b*, pp. 101-224, pl. 10, fig. 1 (see *C. annulata*).

*Coxiella decipiens* Jörgensen, *partim*, 1924, pp. 73-74, fig. 85 (not including Entz, Jr., 1909*b*, pl. 10, fig. 4, see *Favella arcuata*).

Jörgensen (1924) cites in his synonymy of this species created by him, "*Coxiella annulata* Entz jun. 1909 (p.p.), pl. 10, fig. 4 (? 5?)." This is obviously partly in error since only Entz's figure 5 is called by him *C. annulata*. His figure 4 is called "*Cyttarocyclus arcuata* oder *Cyttarocyclus serrata* var. *edentata* Brandt" (for which see *Favella ehrenbergii*).

**Coxiella declivis** sp. nov.

Figure 192

Lorica tapering subconical, 1.83-1.89 oral diameters in length; oral rim smooth, entire; suboral region not flaring; anterior 0.25 of total length cylindrical, thence convex conical, contracting aborally from 15° anteriorly to 60° above the aboral horn; aboral horn conical. 0.25-0.30 oral diameter in length with a minute blunt tip; 9-10 spiral turns, 5 and 6 the widest (0.33 oral diameter). Length 110μ.

The type locality is Station 4576 in the California Current. Occurs also in the Easter Island Eddy.

Differs from *C. laciniosa* in more tapering, less sharply set-off lorica, and more symmetrical aboral horn.

**Coxiella fasciata** (Kofoid) Brandt

Figure 205

*Cyttarocyclus fasciata* Kofoid, 1905, pp. 297-299, pl. 26, figs. 6, 7; Brandt, 1907, pp. 27, 38, 40, 260, 261, 268, 454, 465; Meunier, 1919, p. 13.

*Cyttarocyclus* (*Coxiella*) *fasciata*, Brandt, 1907, pp. 268, 465.

*Coxiella fasciata*, Brandt, 1907, pp. 42, 187; Laackmann, 1909, pp. 394, 427, 455, 456; Jörgensen, 1924, pp. 73, 75, 106, fig. 86.

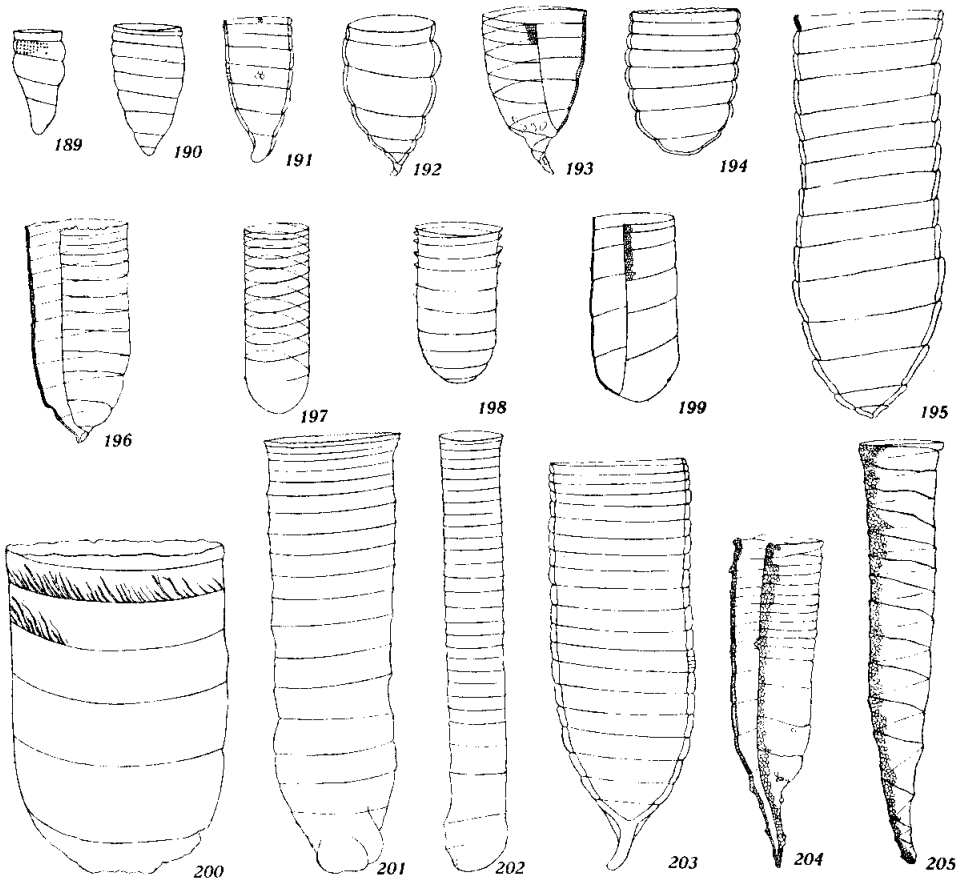
*Cyttarocyclus fasciata* var. *procera* Brandt, 1906, pp. 17, 20, pl. 20, fig. 12, pl. 28, figs. 7, 9; 1907, pp. 38, 260, 268-269, 465, 476.

*Coxiella fasciata* var. *procera*, Entz, Jr., 1908, p. 100; Laackmann, 1909, pp. 455-456.

(?) *Coxiella fasciata* var. *atlantica* Entz, Jr., 1908, p. 100. *Nomen nudum*.

*Coxiella procera*, Hensen, 1911, pp. 243, 244.





Figs. 189–205. Species of *Costiella* Bdt. emended Laeck.  $\times 200$ .

Figs. 189–193, 196–205. Subgenus, *Costiella* nom. subgen. nov.

Fig. 189. *C. caespitosa* (Cleve) Bdt. after Cleve (1899a, pl. 1, fig. 2) from the northern branch of the Gulf Stream, north of the White Sea.

Fig. 190. *C. pelagica* sp. nov. from Station 4711 in the South Equatorial Drift of the Pacific.

Fig. 191. *C. pseudannulata* (Jörg.) Bdt. after Jörgensen (1924, p. 73, fig. 8) from S.S. "Dronning Olga, 25-IV-10," far southeast of Nova Scotia.

Fig. 192. *C. declivis* sp. nov. from Station 4576 in the California Current.

Fig. 193. *C. laciniosa* (Bdt.) Bdt. after Brandt (1906, pl. 28, fig. 2) from Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

Fig. 196. *C. longa* (Bdt.) Laeck. after Brandt (1906, pl. 28, fig. 3) from Station "Dahl, 13-I-97" off Ralum in the Western Tropical Pacific.

Fig. 197. *C. tubularis* (Meunier) after Meunier (1910, pl. 11, fig. 18) from the Barents Sea.

Fig. 198. *C. meunieri* nom. nov. after Meunier (1910, pl. 10, fig. 7) from the Kara Sea.

Fig. 199. *C. intermedia* (Laeck.) Laeck. after Laeckmann (1909, pl. 45, fig. 7) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 200. *C. cymatiocoides* sp. nov. from Union Bay, Alaska, from the collections of the U. S. S. "Albatross."

*Cyttarocyclus (Coxiella) helix*, *partim*, Entz, Jr., 1908, pp. 12, 26, 27, 36, 48, 74, 84, 85, 112, 113, 127, pl. 3, fig. 3; 1909b, pp. 102, 114, 116, 125, 142, 215, 216, pl. 10, fig. 3 (for 1908, pl. 4, figs. 6-8, pl. 5, figs. 10, 11 and for 1909b, pl. 11, figs. 6-8, pl. 12, figs. 10, 11 see *Tintinnopsis lindeni*).

*Cyttarocyclus procera* Brandt, 1907, pp. 262, 263, 270.

*Xystonella procera*, Entz, Jr., 1908, p. 100.

*Coxiella pseudannulata*, Lühe, 1913, p. 176, fig. 168, no. 3.

### **Coxiella frigida** (Laaekmann) Laaekmann

#### Figure 201

*Cyttarocyclus frigida* Laaekmann, 1907, p. 237, fig. 6; Brandt, 1907, p. 444.

*Cyttarocyclus (Coxiella) frigida* Laaekmann, 1907, p. 236; Brandt, 1907, p. 466.

*Coxiella frigida* Laaekmann, 1909, pp. 346, 349, 354, 392-396, 414-416, 421, 491, 492, pl. 44, figs. 4-8, pl. 45, figs. 1, 2; Jörgensen, 1924, p. 72.

*Coxiella frigida* forma *typica* Laaekmann, 1909, pp. 491-492, pl. 44, figs. 1-3, pl. 45, figs. 3, 4.

### **Coxiella helix** (Claparède and Lachmann) Brandt emended

#### Figure 204

*Tintinnus Helix* Claparède and Lachmann, 1858, pp. 196, 206, pl. 8, fig. 8.

*Tintinnus helix*, Kent, 1882, p. 608, pl. 31, fig. 24.

*Codonella annulata* Daday, 1886, p. 496, pl. 25, fig. 15.

*Cyttarocyclus helix*, Jörgensen, 1899, pp. 5, 23, 38, 42; Laaekmann, 1906, pp. 15, 21, 22, 24-31, 34, 36, pl. 1, figs. 17-22, pl. 2, figs. 34, 35, pl. 3, figs. 37-39, 43-46; Brandt, 1907, pp. 15, 18, 21-23, 27, 30, 33, 34, 38, 42, 134, 142, 148, 149, 153, 169, 177-179, 185, 188, 204, 209, 213-220, 259, 260, 268, 375, 447, 454, 459, 461, 464, 465, 467, 469, 481, 483.

*Cyttarocyclus (Coxiella) helix*, Brandt, *partim*, 1906, p. 20, pl. 29, figs. 4-12, pl. 30, figs. 1, 3-6, 8, 9, pl. 31, figs. 1-3a (for pl. 30, fig. 2 see *Tintinnopsis lindeni*); 1907, pp. 184, 187, 213-220, 467; Chatton, 1919, p. 323; Rossolimo, 1922, pp. 28, 31, 33, pl. 2, fig. 20; *non* Entz, Jr., 1908, pp. 12-127, pl. 3, fig. 3, pl. 4, figs. 6-8, pl. 5, figs. 10, 11; 1909b, pp. 102-216, pl. 10, fig. 3, pl. 11, figs. 6-8,

Figs. 189-205. Species of *Coxiella* Bdt. × 200. (Concluded.)

Fig. 201. *C. frigida* (Laaek.) Laaek. after Laaekmann (1909, pl. 44, fig. 1) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 202. *C. minor* (Laaek.) Laaek. after Laaekmann (1909, pl. 45, fig. 12) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 203. *C. decipiens* Jörg. after Jörgensen (1924, p. 73, fig. 85) from the Bay of Naples.

Fig. 204. *C. helix* (Clap. and Lach.) Bdt. after Brandt (1906, pl. 30, fig. 1) from Kiel Fiord.

Fig. 205. *C. fasciata* (Kofoid) Bdt. after Kofoid (1905, pl. 26, fig. 6) from off San Diego, California.

Figs. 194-195. Subgenus, *Protocochiella* Jörg.

Fig. 194. *C. ampla* (Jörg.) Bdt. after Jörgensen (1924, p. 73, fig. 81) from the Puddefjord, Bergen, Norway.

Fig. 195. *C. annulata* (Daday) Bdt. after Jörgensen (1924, p. 73, fig. 84) from the Bay of Naples.

pl. 12, figs. 10, 11 (for 1908, pl. 3, fig. 3 and 1909b, pl. 10, fig. 3 see *Coxliella fasciata*, and for all other figures see *Tintinnopsis lindeni*).

*Coxliella helix*, Brandt, 1907, p. 188; Entz, Jr., 1908, p. 100; 1909b, pp. 123-199; Jörgensen, 1924, pp. 65, 70-73, 75, 76, 107, fig. 87; 1927, p. 13, fig. 20.

*Tintinnus fistularis* Möbius, 1887, pp. 120, 132, pl. 8, fig. 38.

*Cyrtarocydis fistularis*, Jörgensen, 1899, p. 23.

Non *Codonella urniger* Entz, Sr., 1884, pp. 412-413, pl. 24, fig. 23; Brandt, 1907, pp. 179, 213, 482-483 (see *Tintinnopsis urniger*).

Non *Tintinnopsis helix*, Laackmann, 1913, pp. 24-25, 43, pl. 3, figs. 37-42 (see *Tintinnopsis lindeni*).

*Tintinnopsis fistularis*, Cleve, 1900a, pp. 17, 36, fig. 3.

*Tintinnopsis Vosmaeri* var. *curvicornis*, Schweyer, 1909, pp. 140, 160, 168, 187, pl. 11, figs. 12, 13.

*Tintinnopsis beroidica* var. *acuminata*, Schweyer, 1909, pp. 135-189, pl. 10, figs. 2a, b, pl. 11, fig. 13b.

### ***Coxliella intermedia* (Laackmann) Laackmann**

Figure 199

*Cyrtarocydis intermedia* Laackmann, 1907, p. 238, fig. 8; Brandt, 1907, p. 444.

*Cyrtarocydis (Coxliella) intermedia*, Brandt, 1907, p. 468.

*Coxliella intermedia* Laackmann, 1909, pp. 394, 396, pl. 45, figs. 5-11; Jörgensen, 1924, p. 74.

*Amphorella fistula* Meunier, 1910, pp. 129-130, pl. 9, figs. 23-25, pl. 14, fig. 4.

### ***Coxliella laciniosa* (Brandt) Brandt emended**

Figure 193

*Cyrtarocydis (?) (Coxliella) ampla (?)* var. *a laciniosa* Brandt, 1906, p. 20, pl. 28, figs. 1, 2, 4, pl. 29, fig. 3; 1907, p. 3.

*Cyrtarocydis (Coxliella) laciniosa* Brandt, 1907, p. 3; Laackmann, 1913, p. 32.

*Cyrtarocydis ? (Coxliella) laciniosa Brandt*, 1907, pp. 3, 270-272, 453, 469.

*Cyrtarocydis ampla*, Ostefeld, 1916a, pp. 180-181.

*Cyrtarocydis (?) laciniosa* Brandt, 1907, pp. 27, 34, 38, 261, 262, 273.

*Cyrtarocydis laciniosa* Brandt, 1907, pp. 262-263, 273.

*Cyrtarocydis ? ampla* Jörgensen (?) var. *a laciniosa* Brandt, 1907, pp. 261, 270, 453, 469; Laackmann, 1913, p. 32.

*Coxliella laciniosa* Brandt, 1907, pp. 42, 187, 259; Laackmann, 1909, pp. 349-456; 1913, pp. 3, 7, 9, 32, 33, 44, pl. 5, fig. 64; Jörgensen, 1924, pp. 72, 73, 106, figs. 82a, b.

*Coxliella ampla* var. *a laciniosa*, Entz, Jr., 1908, p. 100; Laackmann, 1909, p. 456.

*Cyrtarocydis? ampla(?)* var. *b* Brandt, 1906, p. 20, pl. 28, fig. 5, pl. 29, fig. 2; 1907, pp. 271, 453, 469.

*Cyrtarocydis (?) laciniosa* var. *a lata* Brandt, 1907, pp. 271-272, 453.

*Coxliella ampla* var. *b*, Entz, Jr., 1908, p. 100.

**Coxiella longa** (Brandt) Laackmann

Figure 196

*Cyttarocyclus* (?) *ampla* (?) var. *e longa* Brandt, 1906, p. 20, pl. 28, fig. 3; 1907, pp. 272, 453, 470.

*Cyttarocyclus* (?) *laciniosa* var. *longa* Brandt, 1907, pp. 31, 262, 272, 453, 469, 470.

*Coxiella ampla* var. *e longa*, Entz, Jr., 1908, p. 100; Laackmann, 1909, p. 456.

*Coxiella laciniosa* var. *longa*, Laackmann, 1909, p. 456.

[*Cyttarocyclus*] *laciniosa* var. *longa*, Faria and Cunha, 1917, p. 72. *Lapsus pennae*.

Non *Cyttarocyclus laciniosa* var. *longa*, Rossolimo, 1927, pp. 71, 74, 76 fig. 9 (see *C. pseudannulata*).

[?] *Cyttarocyclus Ehrenbergii*, Entz, Jr., *partim*, 1908, pp. 6-123, pl. 3, fig. 6; 1909*b*, pp. 97-225, pl. 10, fig. 6 (for 1908, pl. 3, fig. 7 and 1909*b*, pl. 10, fig. 7 see *Favella adriatica*, and for 1908, pl. 5, fig. 5, pl. 6, figs. 5, 6, 12, pl. 8, figs. 1, 2, 5, 7, pl. 9, fig. 2, pl. 10, figs. 4-6, 9, 13, pl. 11, figs. 1-10, pl. 12, figs. 1-9, pl. 13, figs. 1-11, 28, 30-34 and for 1909*b*, pl. 12, fig. 5, pl. 13, figs. 5, 6, 12, pl. 15, figs. 1, 2, 5, 7, pl. 17, fig. 4-6, 9, 13, pl. 18, figs. 1-10, pl. 19, figs. 1-9, pl. 20, figs. 1-11, 28, 30-35, pl. 21, figs. 1, 3, 5, 10-12, 17 see *Favella ehrenbergii*).

Raised to status of species.

Lorica bullet-shaped, 2.1 oral diameters in length; oral rim irregularly denticulate; cylindrical in the oral 0.6 of the total length; aboral region convex conical, changing from 27° to 90°; aboral end with short, stout, curved point; wall with 13 turns of the spiral lamina widening threefold aborally. Length 130-135 $\mu$ .

The type locality is Station "Dahl, 13-I-97" off Ralum in the Western Tropical Pacific.

Differs from *C. intermedia* in more turns of the spiral and the presence of the aboral horn.

**Coxiella meunieri** nom. nov.

Figure 198

*Amphorella cochleata* Meunier, 1910, p. 131, pl. 10, fig. 7.

Non *Cyttarocyclus* (*Coxiella*) *helix* var. *b cochleata* Brandt, 1906, p. 21, pl. 33, fig. 1 (see *Tps. cochleata*).

Lorica tall thimble-shaped, 1.73 oral diameters in length; oral rim minutely denticulate, flaring to 1.1 diameters of the cylinder below; bowl cylindrical; aboral end hemispherical; wall with 10 spiral turns, with the oral margin everted in the first 3 turns. Length 103 $\mu$ .

The type locality is the Kara Sea.

Differs from all species of *Coxiella* except *C. frigida* and from *Tps. cochleata*, in the everted oral rim, and from these two species in outer bowl and eversion of the oral margin of the spiral lamina.

**Coxiella minor** (Laackmann) Laackmann

Figure 202

*Cyttarocyclus minor* Laackmann, 1907, p. 237, fig. 7; Brandt, 1907, p. 444.*Cyttarocyclus (Coxiella) minor*, Brandt, 1907, p. 471.*Coxiella minor* Laackmann, 1909, pp. 394, 397-398, pl. 45, figs. 12-15.**Coxiella oviformis** Hensen*Coxiella oviformis* Hensen, 1911, table 8. *Nomen nudum*.**Coxiella pelagica** sp. nov.

Figure 190

Lorica tapering bullet-shaped, 1.8 oral diameters in length; oral rim entire; slightly contracting in the suboral region, expanding to the oral diameter again at 0.25 total length from the oral rim, convex conical ( $35^\circ$ ), increasing to  $60^\circ$  aborally; aboral end bluntly pointed; 9 spiral turns of a distinct spiral lamina, widest in the third from the aboral end and half as wide in the oral region; wall exceedingly hyaline. Length  $76\mu$ .

The type locality is Station 4711 in the South Equatorial Drift.

Differs from *C. pseudannulata* in the stouter, more conical bowl, blunter aboral end, and greater differentiation in the spiral turns.

**Coxiella pseudannulata** (Jørgensen) Brandt

Figure 191

*Cyttarocyclus annulata*, Jørgensen, 1899, p. 36 (*vide* Jørgensen, 1901).*Cyttarocyclus pseudannulata* Jørgensen, 1901, pp. 15, 16, 28, 36, pl. 2, fig. 28; 1912, p. 2; Hensen, 1911, table 8; Brandt, 1907, pp. 27, 38, 260, 268, 447, 476.*Cyttarocyclus (Coxiella) pseudannulata*, Brandt, 1906, p. 20, pl. 28, fig. 8, pl. 29, fig. 1; 1907, pp. 21, 263, 269-270, 454, 476.*Coxiella pseudannulata*, Brandt, 1907, pp. 42, 187, 263; Jørgensen, *partim*, 1924, pp. 73-74, fig. 83; 1927, p. 13, fig. 22 (see also *C. ampla* and *C. calyptra*); *non* Lühe, 1913, p. 176, fig. 168, no. 3 (see *C. fasciata*).*Cyttarocyclus* sp. Meunier, 1910, p. 120, pl. 23, fig. 12 [elongated lorica].*Cyttarocyclus laciniosa* var. *longa*, Rossolimo, 1927, pp. 71, 74, 76, fig. 9.**Coxiella tubularis** (Meunier)

Figure 197

*Amphorella tubularis* Meunier, 1910, p. 130, pl. 9, figs. 26, 27, pl. 11, fig. 18.

Subgenus *PROTOCOCHLIELLA* Jörgensen

*Coxliella* with wall of the lorica simple, with the inner and outer laminae imperfectly separated, with faint and indistinct primary alveoli.

This subgenus as described by Jörgensen (1924) had but a single species, *Coxliella ampla*, which therefore becomes the type of *Protocochliella*.

Differs from subgenus *Coxliella* in the simpler structure of the wall.

Includes two species, *Coxliella ampla* (Jörg.) Bdt. and *C. annulata* (Daday) Bdt.

***Coxliella ampla* (Jörgensen) Brandt**

Figure 194

*Amphorella ampla* Jörgensen, 1899, pp. 17, 39, 42, pl. 1, figs. 4a, b.

*Amphorella* sp. Meunier, 1910, p. 130, pl. 11, fig. 19.

*Cyttarocyclus* (?) *ampla*, Brandt, 1907, pp. 38, 261, 262; Entz, Jr., 1905, p. 125; [?] Schweyer, 1909, pp. 138, 168, 188, pl. 11, figs. 16, 17; Ostenfeld, 1916a, pp. 180-181.

*Cyttarocyclus* (*Coxliella*) *ampla*, Brandt, 1907, pp. 18, 21, 184, 272-273, 446, 449, 453; [?] Entz, Jr., 1908, pp. 11-126, pl. 13, fig. 29; 1909b, pp. 101-224, pl. 20, fig. 29.

Non “*Cyttarocyclus* [*Coxliella ampla*] [?] Jörg. [*C. annulata* [?] Daday],” Entz, Jr., 1908, pp. 11-126, pl. 3, fig. 1 (see *C. annulata*).

Non “*Cyttarocyclus* (*Coxliella*) *annulata* (= *C. ampla*?),” Entz, Jr., 1909b, pp. 101-224, pl. 10, fig. 1 (see *C. annulata*).

Non *Cyttarocyclus annulata*, Entz, Jr., 1908, pp. 11-126, pl. 3, fig. 5; 1909b, pp. 101-224, pl. 10, fig. 5 (see *C. decipiens*).

*Coxliella pseudannulata, partim*, Jörgensen, 1924, p. 73 (see also *C. calyptra* and *C. pseudannulata*).

*Cyttarocyclus spiralis* Meunier, 1910, pp. 119-120, pl. 9, figs. 18-20, pl. 14, fig. 5; 1919, pp. 12-14, pl. 23, fig. 2.

*Coxliella ampla*, Brandt, 1907, pp. 42, 444; Jörgensen, 1924, pp. 72-73, fig. 81.

*Coxliella* (*Amphorella*) *ampla*, Laackmann, 1909, pp. 394, 395, 419, 421, 454, 456.

*Coxliella* (*Protocochliella*) *ampla*, Jörgensen, 1927, pp. 13, 17, fig. 21.

**Coxiella annulata** (Daday) Brandt

Figure 195

Non *Codonella annulata* Daday, 1886, p. 496, pl. 25, fig. 15 (see *C. helix*).

*Cyttarocyclus annulata* Daday, 1887b, pp. 582-583, pl. 21, fig. 6; Brandt, 1907, pp. 11, 27, 38, 183, 260, 261, 267-270, 393, 399; Entz, Jr., 1905, p. 125; Jørgensen, 1924, p. 74; non Kofoid, 1905, pp. 297-298, lapsus for *Cyttarocyclus annulifera* Ostenfeld and Schmidt (1901), (see *Metacyclus annulifera*) quoted as "*Cyttarocyclus annulifera* Kofoid, 1905" by Brandt (1906, p. 399); non Entz, Jr., 1908, pp. 11-126, pl. 3, fig. 1; 1909b, pp. 101-224, pl. 10, fig. 5 (see *C. decipiens*); Laackmann, 1913, pp. 31-32; Rossolimo, 1922, pp. 28, 31, 33, pl. 2, fig. 22.

"*Cyttarocyclus* [*Coxiella*] *ampla* [?] Jörg. [*C. annulata* [?] Daday]," Entz, Jr., 1908, pp. 11-126, pl. 3, fig. 1.

"*Cyttarocyclus* (*Coxiella*) *annulata* Daday (= *C. ampla*? Jörg.)," Entz, Jr., 1909b, pp. 101-224, pl. 10, fig. 1.

*Coxiella annulata*, Brandt, 1907, pp. 42, 184, 187; Laackmann, 1913, pp. 8, 32, 44, pl. 5, figs. 62-63; Jørgensen, 1924, pp. 73, 75, fig. 84.

*Tintinnus zonatus* Zacharias, 1906, pp. 524-525, fig. 11.

*Cyttarocyclus annulifera*, Entz, Jr., 1904b, pp. 126, 128-130, 133, fig. 9.

*Tintinnopsis helix* (forma *subrotundata*) var. *cochleata, partim*, Laackmann, 1913, p. 43, pl. 3, figs. 45-47 (for pl. 2, fig. 33 see *Tps. cochleata*).

*Tintinnopsis helix* var. *cochleata, partim*, Laackmann, 1913, pp. 8, 10, 25-26 (see also *Tps. cochleata*).

*Cyttarocyclus* (*Coxiella*) *helicoides* Faria and Cunha, 1917, p. 72, pl. 26, figs. 5, 6. *Lapsus pennac.*

**Helicostomella** Jørgensen emended

*Tintinnus*, Ehrenberg, 1834, p. 274; Brandt, *partim*, 1907, pp. 374-388 (see also *Amphorella*, *Brandliella*, *Dadayiella*, *Daturella*, *Metacyclus*, *Ormosella*, *Salpingacantha*, and *Tintinnus*); Laackmann, 1906, pp. 17-18.

*Amphorella*, Meunier, 1919, pp. 18-19; Fauré-Fremiet, 1924, pp. 108-110.

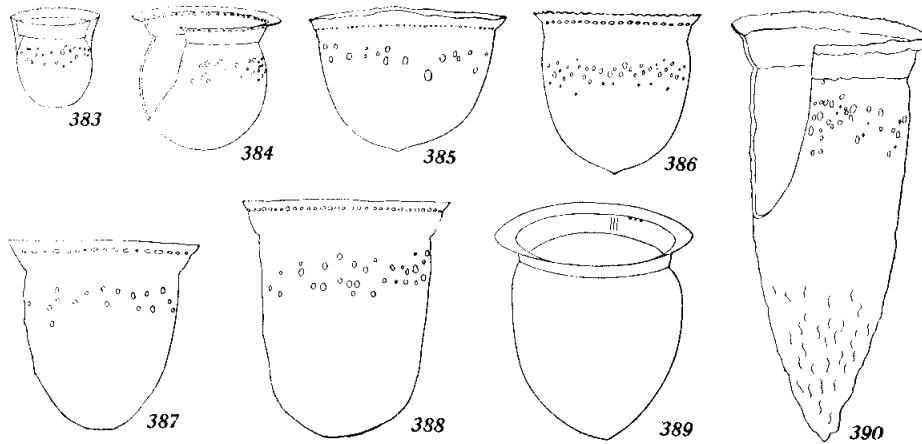
*Helicostomella* Jørgensen, 1924, pp. 9, 25; 1927, pp. 4, 10.

Coxiellidae with elongate, narrow lorica; suboral region cylindrical, formed at least in part by a spirally wound band of 3-60 turns; aboral region conical; aboral horn present; wall thin, with a fine uniform primary structure between the two lamellae; 2 micronuclei and 2 macronuclei. Marine.

We designate as the type species *Helicostomella subulata* (Ehrenberg) Jørgensen from off Norway, the oldest species in the genus.

Differs from *Climacocyclus* in the thin, hyaline, simple wall, and the very elongated form of the lorica, and from *Coxiella* in the extent of the spiral structure and greater elongation.

Includes five species as follows: *Helicostomella edentata* (Fauré-Fremiet), *H. fusiformis* (Meunier) Jörg., *H. kiliensis* (Laack.) Jörg., *H. longa* (Bdt.), and *H. subulata* (Ehrbg.) Jörg.



Figs. 383-390. Species of *Petalotricha* Kent emended Daday emended Brandt.  $\times 200$ .

Fig. 383. *P. entzi* Kofoid after Kofoid (1915, p. 67, fig. 4) from the Adriatic at Quarnero.

Fig. 384. *P. major* Jörg. after Brandt (1906, pl. 62, fig. 8) from Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Fig. 385. *P. pacifica* sp. nov. after Brandt (1906, pl. 62, fig. 16) from Station "Dahl 62" off Ralun in the Western Tropical Pacific.

Fig. 386. *P. serrata* sp. nov. after Brandt (1906, pl. 62, fig. 19) from Station "Schott f" in the Benguela Current.

Fig. 387. *P. capsa* Bdt. after Brandt (1906, pl. 62, fig. 10) from Station "Brühu 41" in the Bay of Bengal.

Fig. 388. *P. indica* sp. nov. after Brandt (1906, pl. 62, fig. 12) from Station "Brühu 41" in the Bay of Bengal.

Fig. 389. *P. ampulla* (Fol) Kent after Jörgensen (1924, p. 89, fig. 99) from Station 234 of the "Thor," in the Atlantic southwest of Portugal.

Fig. 390. *P. foli* sp. nov. from Station 4659 in the Peruvian Current.

### *Petalotricha ampulla* (Fol) Kent

#### Figure 389

*Tintinnus ampulla* Fol, 1881a, pp. 20-21, pl. 1, figs. 1-3; 1881b, pp. 247-248, pl. 17, figs. 1-3; 1884, p. 53, pl. 4, figs. 1-3, pl. 5, fig. 7.

*Petalotricha ampulla*, Kent, 1882, pp. 627, 629, figs. 1-2; Daday, 1887a, pp. 159-208, pl. 2, figs. 11-13, 15-16; 1887b, pp. 573-574, pl. 21, figs. 7, 11, 12, 14, 17-19; Brandt, 1907, pp. 341-342; Entz, Jr., 1904, *partim*, pp. 131-132, figs. 33-36 (for figs. 30-32 see *P. entzi*); 1908, p. 20, pl. 4, figs. 1-3, pl. 11, figs. 11-19; 1909b, p. 102, pl. 11, figs. 1-3, pl. 18, figs. 11-19; Kofoid, 1915, p. 66, figs. 7-8; Jörgensen, 1924, pp. 88, 89, fig. 99.

*Codonella ampulla*, Bütschli, 1889, p. 1736, pl. 69, fig. 9a; *non* Entz, Sr., 1884, pp. 414-415, pl. 24, fig. 10 (see *P. major*).

### *Petalotricha capsa* Brandt

#### Figure 387

*Petalotricha capsa* Brandt, 1906, p. 30, pl. 62, figs. 9, 10; 1907, pp. 342, 458; Entz, Jr., 1908, pp. 20, 101; Kofoid, 1915, p. 68.



**Petalotricha entzi** Kofoid

Figure 383

*Petalotricha ampulla*, *partim*, Entz, Jr., 1904b, pp. 131-132, figs. 30-32 (for figs. 33-36 see *P. ampulla*).

*Petalotricha entzi* Kofoid, 1915, pp. 66-68, figs. 4-6; Jörgensen, 1924, p. 89.

**Petalotricha foli** sp. nov.

Figure 390

Lorica elongate conical, length 2.40-3.77, rarely 1.78 oral diameters; bowl, 0.9 total length in length, subconical ( $30^{\circ}$ - $40^{\circ}$ ); oral shelf oblique ( $30^{\circ}$ - $50^{\circ}$ ), slightly narrower than the collar; collar spreading  $30^{\circ}$ - $40^{\circ}$  from the vertical, 0.17-0.25 oral diameter wide; nuchal diameter 0.86-0.96 oral diameter; aboral end bluntly rounded to pointed, often irregular; wall with subnuchal fenestrae variable in size, number, and location, occasionally present in the collar, no suboral fenestrae, interlamellar prisms distinct. Length 264-377 $\mu$ .

The type locality is Station 4659 in the Peruvian Current. Occurs also in the Mexican Current and the South Equatorial Drift.

Differs from all other species in the elongated conical bowl.

**Petalotricha indica** sp. nov.

Figure 388

*Petalotricha capsula* var. a Brandt, 1906, p. 30, pl. 62, figs. 11-12; 1907, p. 343.

Lorica large, stout sack-shaped, its length 1.23 oral diameters; slight nuchal groove; aboral end subhemispherical; 2-3 rows of subnuchal vertically elongated fenestrae. Length 150-160 $\mu$ .

The type locality is Station Brühn 41 in the Bay of Bengal.

Differs from *P. capsula* in greater elongation, broader fundus, and less nuchal constriction.

**Petalotricha major** Jörgensen

Figure 384

*Codonella ampulla*, Entz, Sr., 1884, p. 414, pl. 24, fig. 10.

*Petalotricha ampulla* var. b Brandt, 1906, p. 30, pl. 62, figs. 8, 8a, 13-15; 1907, pp. 341-342, 453; Entz, Jr., 1908, p. 101; Laackmann, 1909, pp. 423-430, 466.

*Petalotricha ampulla* var. *major* Jörgensen, 1924, p. 89, figs. 100a, 100b.

Raised to status of species.

Lorica kettle-shaped, 0.8 oral diameter in length; oral shelf nearly horizontal, slightly cupped, its rim wavy; collar an inverted cone

(55°) with straight sides; bowl truncate spherical, 0.86 oral diameter in diameter; wall with a single line of small fenestrae below the oral rim and a belt of several scattered rows above the equator of the bowl. Length 95–110 $\mu$ .

The type locality is Station Pl. 38 of the Plankton Expedition in the Sargasso Sea.

Differs from all other species in the spherical contour of the bowl.

***Petalotricha pacifica* sp. nov.**

Figure 385

*Petalotricha capsa* var. b Brandt, 1906, p. 30, pl. 62, fig. 16; 1907, p. 343; Entz, Jr., 1908, p. 101.

Lorica stout, pot-shaped, its length 1.05–1.30 oral diameters; oral shelf elevated 30°–40°; bowl rotund; aboral end subhemispherical to broadly subconical, with slight trace of a minute aboral point; one layer of prisms in wall, 2–4 subnuchal rows of subcircular fenestrae. Length 95–119 $\mu$ .

The type locality is off Ralum in the Western Tropical Pacific. Occurs also in the California and South Equatorial currents.

Differs from *P. capsa* in its short, rotund bowl and single layer of prisms.

***Petalotricha serrata* sp. nov.**

Figure 386

*Petalotricha ampulla* var. c Brandt, 1906, p. 30, pl. 62, fig. 17; 1907, pp. 341, 342; Entz, Jr., 1908, p. 101; Laackmann, 1909, pp. 424–429, 467.

*Petalotricha ampulla* var. d Brandt, 1906, p. 30, pl. 62, fig. 19; 1907, pp. 342, 453; Entz, Jr., 1908, p. 101; Laackmann, 1909, p. 467.

*Petalotricha ampulla* var. e Brandt, 1906, p. 30, pl. 62, fig. 18; 1907, pp. 431–432, 453.

Lorica globose, its length 1.1 oral diameters; nuchal constriction slight; oral shelf deeply and regularly serrate; aboral region convex subconical; aboral end acute; subnuchal fenestrae large, 2–4 rows. Length 105–120 $\mu$ .

The type locality is Schott, f (3–VIII–92) in the Benguela Current. Occurs also in the Labrador and Florida currents, the Sargasso Sea, off the Azores, and in the Austral Current off Australia and off New Zealand.

Differs from *P. ampulla* in deeper and more regular oral serrations and shallower nuchal constriction, from *P. major* in having an aboral point, and from *P. pacifica* in longer bowl and less nuchal constriction.

## Family RHABDONELLIDAE fam. nov.

Dictyocystidae, *partim*, Kent, 1882, p. 624 (see also Dictyocystidae, Petalotrichidae, and Rhabdonellidae).

Tintinnoinea with chalice-shaped to conical lorica; oral aperture never with teeth, often with a low gutter between the two laminae about the mouth; with or without a pedicel; aboral end usually closed, or with a minute aperture; ribs simple, branched or anastomosed, often with fenestrae (coecoliths?) between them; with one or two laminae, always with low, more or less vertical ribs reaching from the pedicel to the mouth; wall hyaline and structureless, or with one or more layers of primary or with primary and secondary structure; with 2 macronuclei and 2 micronuclei and 20 membranelles. Eupelagic. Marine only.

Differs from all other families in having longitudinal ribs on the bowl with fenestrae between them.

Includes three genera, *Protorhabdonella* Jörg., *Rhabdonella* Bdt. emended Laack. emended Jörg. emended, and *Rhabdonellopsis* gen. nov.

**Protorhabdonella** Jörgensen

*Cytlarocytlis*, Cleve, 1900d, *partim*, pp. 972-973 (see also *Epiplocytlis*, *Rhabdonella*, and *Rhabdonellopsis*); 1901a, p. 922; Schmidt, 1901, p. 189.

*Rhabdonella*, *partim*, Brandt, 1907, pp. 313-315; Laackmann, 1909, pp. 347, 358, 460, 461, 465, 466; Jörgensen, 1924, pp. 7-9, 16, 34, 57-58, 62 (see also *Rhabdonella* and *Rhabdonellopsis*).

*Protorhabdonella* Jörgensen, 1924, pp. 8, 57.

Rhabdonellidae with lorica short and stout; oral aperture never with teeth, always simple; bowl more or less conical; with few to many vertical or subvertical ribs; rarely with an aboral horn; wall single, usually hyaline or with primary prisms only.

We designate as the type species *Protorhabdonella simplex* (Cleve) Jörgensen from the Benguela Current, Sargasso Sea, and Florida Current, the oldest species included in the genus.

Differs from *Rhabdonella* Bdt. emended Laack. emended Jörg. emended in the absence of the oral gutter and from *Rhabdonellopsis* gen. nov. in the absence of pedicel and knob.

Includes five species as follows: *Protorhabdonella curta* (Cleve) Jörg., *P. mira* sp. nov., *P. simplex* (Cleve) Jörg., *P. striatura* nom. nov., and *P. ventricosa* (Schmidt).

**Protorhabdonella curta** (Cleve) Jörgensen

Figure 393

*Cyttarocyclus striata* forma  $\beta$  *curta* Cleve, 1901a, p. 922, fig. [3b]; Okamura, 1912, pp. 21, 35, pl. 5, fig. 100.

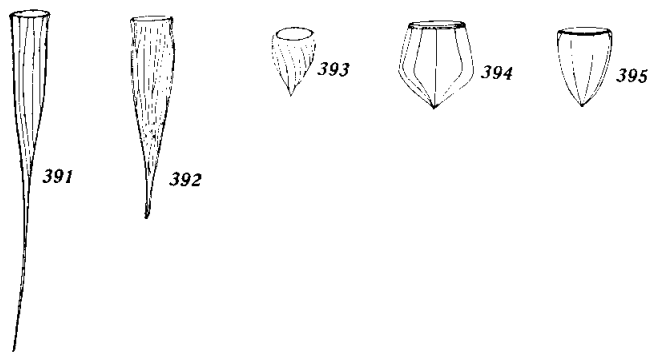
*Rhabdonella amor* var. *curta*, Brandt, 1907, pp. 315, 316, 328.

*Rhabdonella* (*Ptychocyclus*) *amor* var. Brandt, 1907, p. 460.

*Rhabdonella striata* var. *b curta*, Entz, Jr., 1908, p. 103.

*Protorhabdonella curta*, Jörgensen, 1924, pp. 57, 58, fig. 65.

*Rhabdonella amor* var. *simplex*, *partim*, Brandt, 1907, p. 331 (see also *P. simplex* and *Rhabdonella amor*); Jörgensen, 1924, p. 58.



Figs. 391-395. Species of *Protorhabdonella* Jörgensen.  $\times 200$ .

Fig. 391. *P. mira* sp. nov. from Station 4701 in the South Equatorial Drift of the Pacific.

Fig. 392. *P. striatura* nom. nov. from Station 4666 in the Peruvian Current.

Fig. 393. *P. curta* (Cleve) Jörg. from Station 4650 in the Peruvian Current.

Fig. 394. *P. ventricosa* (Schmidt) after Schmidt (1901, p. 189, fig. 5) from the Gulf of Siam.

Fig. 395. *P. simplex* (Cleve) Jörg. from Station 4666 in the Peruvian Current.

**Protorhabdonella mira** sp. nov.

Figure 391

Loricæ attenuate, chalice-shaped, its length 9.4 oral diameters; bowl subcylindrical in its anterior 0.7, conical ( $20^\circ$ ) aborally; pedicel very elongate, very slender and acute, longer than the bowl, 0.63 total length in length; ribs 12. Length  $235\mu$ .

The type locality is Station 4701 in the South Equatorial Drift.

Differs from all other species of the genus in its remarkable elongate pedicel. Resembles *Albatrossiella agassizi* in form but has longitudinal ribs.

**Protorhabdonella simplex** (Cleve) Jörgensen

Figure 395

*Cyttarocylis simplex* Cleve, 1900d, pp. 972-973, fig. [7].*Rhabdonella amor* var. *simplex*, *partim*, Brandt, 1907, pp. 43, 315-331, 453 (for p. 331 see *P. curta* and for p. 330 see *Rhabdonella amor*); Laackmann, 1909, pp. 461-465, pl. 48, fig. 13, pl. 49, fig. 15.*Rhabdonella simplex*, Entz, Jr., 1908, p. 102.*Protorhabdonella simplex*, Jörgensen, 1924, p. 67, fig. 64.**Protorhabdonella striatura** nom. nov.

Figure 392

*Cyttarocylis striata* forma *a elongata* Cleve 1901a, p. 922, fig. [3a]; Brandt, 1907, pp. 328-329.*Rhabdonella amor*, Brandt, 1907, pp. 316, 317, 327-329, 453, 465, 480.*Rhabdonella striata* var. *a elongata*, Entz, Jr., 1908, p. 103.Non "*Rhabdonella spiralis* var. *striata* (Biedermann)," Brandt, 1907, p. 326 (for *Tintinnus striatus* Biedermann, 1893, p. 29, pl. 3, figs. 13a, b see *Rhabdonella striata*).

Raised to status of species.

Lorica elongate, conical chalice-shaped, 4.88-5.69 oral diameters in length; pedicel inverted conical, slightly differentiated, cone of lower bowl and pedicel  $15^{\circ}$ - $24^{\circ}$  and  $6^{\circ}$ - $10^{\circ}$  respectively; ribs 24-28. Length 125-165 $\mu$ .

The type locality is in the South Atlantic. Occurs also in the Peruvian Current, Galapagos Eddy, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *P. mira* in its shorter pedicel, stouter bowl, and more numerous ribs.A new name is necessitated for the species originally described by Cleve (1901a) as *Cyttarocylis striata* forma *elongata*. Cleve separated his *C. striata* into two forms, *elongata* and *curta*. Brandt (1907, p. 465) transferred both forms to *Rhabdonella* as synonyms of *R. amor*. Later Jörgensen (1924) restored *curta* and elevated it to the rank of a species leaving untouched the question of the status of forma *elongata* and not including it in his synonymy of *R. amor*. We regard it as specifically distinct from *R. amor*, being much more elongated and much more tapering aborally.Biedermann (1893) described as *Tintinnus striatus* a species which Brandt (1907) placed in *Rhabdonella* as *R. spiralis* var. *striata*. This Jörgensen suppresses in the synonymy of *R. spiralis*. On the basis of our Pacific material we regard *R. striata* (Biedermann) Brandt as a

valid species. Since Brandt introduced both Biedermann's *striata* and Cleve's *striata* into *Rhabdonella* the latter becomes a homonym.

Cleve (1901a) did not observe the rules of nomenclature in subdividing his species *striata* into the two forms, hence his forma *a elongata* is a synonym of *striata* Cleve and not available. Since the name *striata* for Cleve's species had once passed into synonymy in *Rhabdonella* it is also not available for transfer to *Protorhabdonella*. We have therefore proposed the new specific name *striatura* for Cleve's (1901a, fig. 3a) *striata* forma *a elongata*.

### **Protorhabdonella ventricosa** (Schmidt)

Figure 394

*Cyttarocyclus ventricosa* Schmidt, 1901, p. 189, fig. 5.  
*Rhabdonella ventricosa*, Brandt, 1907, pp. 315, 328, 329, 483; Entz, Jr., 1908, p. 103.

### **Rhabdonella** Brandt Laackmann emended Jörgensen emended

*Tintinnus*, *partim*, Fol. 1881a, pp. 20-21 (see also *Petalotricha*); Entz, Sr., 1884, pp. 409-410 (see also *Dadayiella*); Biedermann, 1893, pp. 27-32 (see also *Stelidiella* and *Xystonellopsis*); Zacharias, 1906, pp. 519, 555 (see also *Epiplocyclus*).

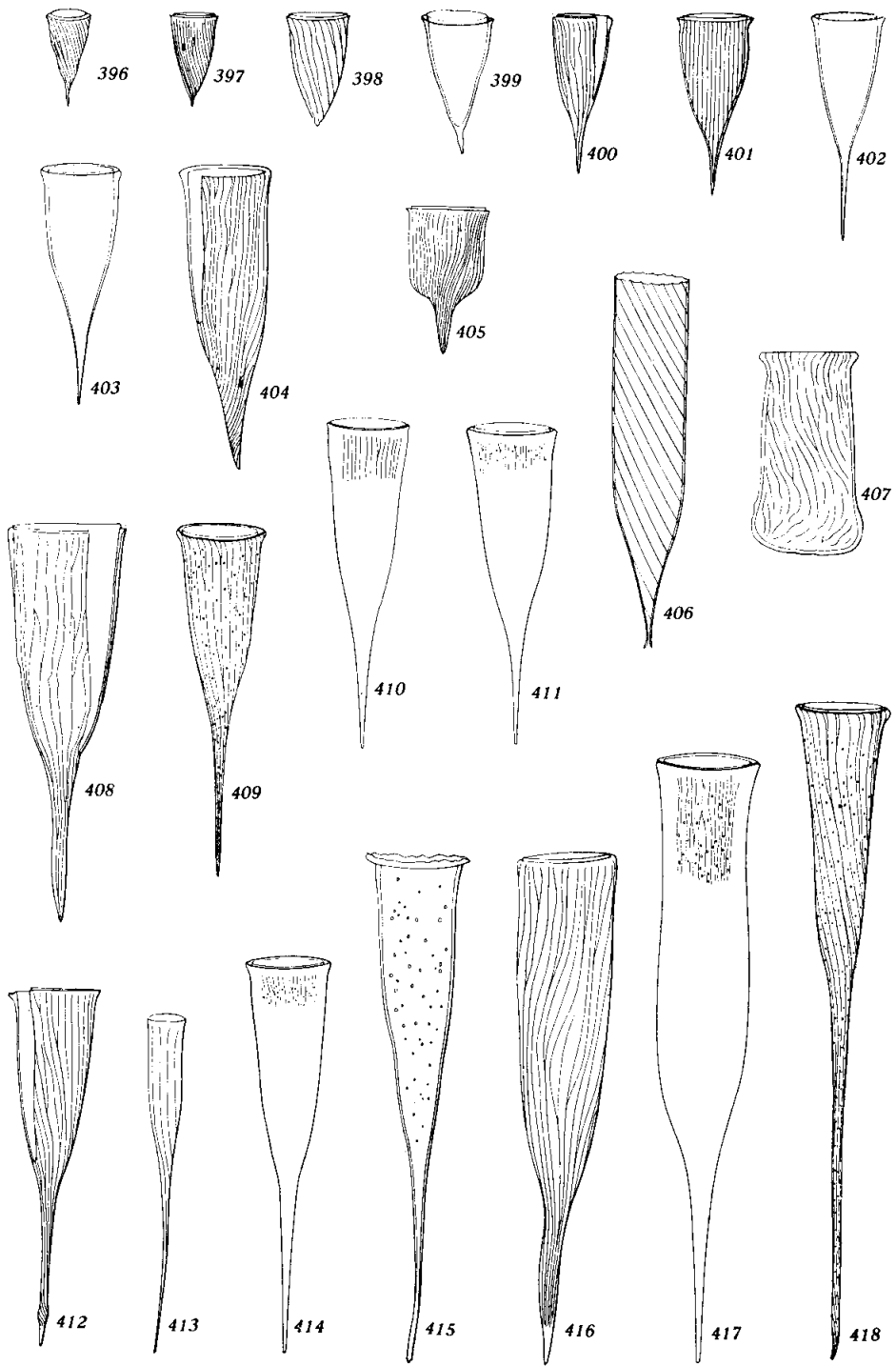
*Cyttarocyclus*, *partim*, Cleve, 1900d, pp. 970-971 (see also *Epiplocyclus*, *Protorhabdonella*, and *Rhabdonellopsis*); Ostenfeld and Schmidt, 1901, pp. 179-180 (see also *Epiplocyclus* and *Metaeyclus*).

*Rhabdonella* (subgenus and genus) Brandt, *partim*, 1907, pp. 313-315 (see also *Protorhabdonella* and *Rhabdonellopsis*).

*Rhabdonella*, *partim*, Laackmann, 1909, pp. 347, 358, 460, 461, 465, 466; Jörgensen, 1924, pp. 7-9, 16, 34, 57-58, 62 (see also *Protorhabdonella* and *Rhabdonellopsis*).

Rhabdonellidae usually with elongated chalice-shaped lorica; oral rim never with teeth, but usually with a gutter between the inner and outer laminae; pedical slender, more or less protracted, never with apophyses; ribs more or less vertical, simple or branched and sometimes with anastomoses, with few to many or no fenestrae between the ribs, usually in the suboral region; laminae well developed, especially toward the mouth, generally with one layer of primary prisms and usually a coarse *Cyttarocyclus* structure.

We designate as the type species *Rhabdonella spiralis* (Fol) Brandt emended from the Mediterranean off Villefranche, the oldest species included in the genus.



Figs. 396-418. Species of *Rhabdonella* Brandt emended Laackmann emended Jörgensen emended.  $\times 200$ .

Differs from *Protorhabdonella* Jörg. and *Rhabdonellopsis* gen. nov. in the presence of pedicel and knob.

Includes 23 species as follows:

aberrans sp. nov.	henseni (Bdt.) Bdt.
amor (Cleve) Bdt.	hydria Jörg.
anadyomene (Entz, Sr.)	indica Laack.
brandti nom. nov.	inflata sp. nov.
chavesi Bdt.	lohmanni sp. nov.
chiliensis sp. nov.	poeculum (Ost. and Schmidt) Bdt.
conica sp. nov.	quantula sp. nov.
cornucopia sp. nov.	spiralis (Fol) Bdt.
cuspidata (Zacharias) Bdt.	striata (Biedermann) Bdt.
elegans Jörg.	torta sp. nov.
exilis sp. nov.	valdestriata Bdt.
hebe (Cleve)	

Figs. 396-418. Species of *Rhabdonella* Brandt emended Laackmann emended Jörgensen emended.  $\times 200$ .

Fig. 396. *R. exilis* sp. nov. from Station 4721 in the South Equatorial Drift of the Pacific.

Fig. 397. *R. indica* Laack. after Laackmann (1909, pl. 49, fig. 12) from off New Amsterdam in the Southern Indian Ocean.

Fig. 398. *R. amor* (Cleve) Bdt. after Cleve (1900*d*, p. 971, fig. [4]) from the Tropical Atlantic.

Fig. 399. *R. cornucopia* sp. nov. from Station 4583 in the California Current.

Fig. 400. *R. brandti* nom. nov. after Brandt (1906, pl. 54, fig. 3) from Station Pl. 67 of the Plankton Expedition in the North Equatorial Current in the Atlantic.

Fig. 401. *R. elegans* Jörg. after Jörgensen (1924, p. 59, fig. 67) from Station 160 of the "Thor" near Rhodes in the Eastern Mediterranean.

Fig. 402. *R. quantula* sp. nov. from Station 4604 in the Mexican Current.

Fig. 403. *R. inflata* sp. nov. from Station 4676 in the Peruvian Current.

Fig. 404. *R. torta* sp. nov. from Station 4721 in the South Equatorial Drift of the Pacific.

Fig. 405. *R. poeculum* (Ost. and Schm.) Bdt. after Ostenfeld and Schmidt (1901, p. 179, fig. 27) from the Red Sea.

Fig. 406. *R. anadyomene* (Entz, Sr.) after Entz, Sr. (1884, pl. 24, fig. 19) from the Gulf of Naples.

Fig. 407. *R. hydria* Jörg. after Jörgensen (1924, p. 59, fig. 70*b*) from Station 152 of the "Thor" off Barka in the Western Mediterranean.

Fig. 408. *R. henseni* (Bdt.) Brandt after Brandt (1906, pl. 54, fig. 2) from Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 409. *R. hebe* (Cleve) from Station 4576 in the California Current off Lower California.

Fig. 410. *R. valdestriata* Bdt. from Station 4580 in the California Current off Lower California.

Fig. 411. *R. striata* (Biedermann) Bdt. from Station 4667 in the Peruvian Current.

Fig. 412. *R. chavesi* Bdt. after Brandt (1906, pl. 53, fig. 3) from off Santa Cruz, Azores.

Fig. 413. *R. chiliensis* sp. nov. from Station 4670 in the Peruvian Current.

Fig. 414. *R. spiralis* (Fol) Bdt. emended from Station 4585 in the California Current off Lower California.

Fig. 415. *R. aberrans* sp. nov. from Station 4580 in the California Current.

Fig. 416. *R. lohmanni* sp. nov. from Station 4679 in the South Equatorial Drift of the Pacific.

Fig. 417. *R. cuspidata* (Zach.) Bdt. from Station 4587 in the Mexican Current.

Fig. 418. *R. conica* sp. nov. from Station Pl. 25 of the Plankton Expedition in the margin of the Labrador and Florida currents.



**Rhabdonella aberrans** sp. nov.

Figure 415

Lorica very tall chalice-shaped, 7.4 oral diameters in length; bowl convex conical,  $5^{\circ}$ – $10^{\circ}$  above,  $20^{\circ}$  below, upper and lower sections of equal length, but little longer than pedicel; ribs 30, deficient on most of the bowl; fenestrae about 8–12 for an intercostal space. Length  $400\mu$ .

The type locality is Station 4580 in the California Current.

Differs from *R. conica* and *R. gigantea* in size, in convexity of bowl from the former and in shape of bowl from the latter.

**Rhabdonella amor** (Cleve) Brandt

Figure 398

*Cyttarocyclus Amor* Cleve, 1900*d*, pp. 970–971, fig. [4].

*Ptychocyclus (Rhabdonella) amor*, Brandt, 1906, p. 27, pl. 54, figs. 4–6, 12–15; 1907, pp. 21, 327–331, 453.

*Rhabdonella amor*, Brandt, 1907, pp. 327, 330, 331, 453; Laaekmann, 1909, *partim*, pp. 423, 463 (for pl. 49, fig. 11 see *R. elegans*); Jørgensen, *partim*, 1924, pp. 54, 59, fig. 66 (see *R. indica*, *R. valdestriata*, and *Protorhabdonella simplex*).

*Rhabdonella amor* var. *simplex*, *partim*, Brandt, 1907, p. 330 (see also *Protorhabdonella curta* and *P. simplex*).

*Ptychocyclus amor*, Lohmann, 1908, p. 163.

*Ptychocyclus (Rhabdonella) Amor*, Entz, Jr., 1908, pp. 20–126, pl. 2, fig. 15, pl. 5, fig. 2.

*Rhabdonella Amor*, Entz, Jr., 1909*b*, pp. 133, 215, pl. 9, fig. 15, pl. 12, fig. 2.

*Ptychocyclus (Rhabdonella) spiralis*, Entz, Jr., 1908, p. 135, pl. 13, fig. 36.

*Rhabdonella spiralis*, *partim*, Entz, Jr., 1909*b*, p. 224, pl. 20, fig. 36 (for fig. 12 see *R. spiralis*).

**Rhabdonella anadyomene** (Entz, Sr.)

Figure 406

*Tintinnus anadyomene* Entz, Sr., 1884, pp. 409–410, pl. 24, fig. 19; Lepsi, 1926*b*, pp. 79, 99, pl. 11, fig. 389. Apparently unrecognizable (*vide* Brandt, p. 334), but probably not *R. apophysata*.

**Rhabdonella brandti** nom. nov.

Figure 400

*Ptychocylis* (*Rhabdonella*) *amor* var. *a cuspidata* Brandt, 1906, p. 27, pl. 54, figs. 3, 10, 11; 1907, p. 327.

*Rhabdonella amor* var. *cuspidata* Brandt, 1907, pp. 315-320, 331-332, 453.

*Rhabdonella elegans*, *partim*, Jörgensen, 1924, pp. 59, 60 (see also *R. elegans* and *R. spiralis*).

*Cyttarocylis spiralis*, Ostenfeld and Schmidt, 1901, p. 180, fig. 29.

Non *Tintinnus cuspidatus* Zacharias, 1906, p. 519, figs. 7[*a, b*] (see *R. cuspidata*).

Raised to status of species.

Lorica short chalice-shaped, its length 2.72-3.53 oral diameters; angle of lower bowl and pedicel  $35^{\circ}$ - $40^{\circ}$ , and  $10^{\circ}$ - $15^{\circ}$  respectively; pedicel about 0.5 length of bowl; ribs 36-48. Length 95-180 $\mu$ .

The type locality is Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic. Occurs also off Messina, in the Florida Current, Sargasso Sea, Guinea and South Equatorial currents, Karajak Fiord, and in the Indian Ocean off Borneo.

Differs from *R. poculum* in more tapering bowl, is stouter than *R. valdestriata*, and has a longer pedicel than *R. amor*.

**Rhabdonella chavesi** Brandt

Figure 412

*Ptychocylis* (*Rhabdonella*) *spiralis* var. *b chavesi* Brandt, 1906, p. 27, pl. 53, figs. 3, 5; 1907, p. 479.

*Rhabdonella spiralis* var. *chavesi* Brandt, 1907, pp. 326, 458; Entz, Jr., 1908, p. 103; Laackmann, 1909, p. 462.

*Rhabdonella spiralis*, Lühe, 1913, p. 176, fig. 168, no. 6; Jörgensen, *partim*, 1924, p. 63 (for fig. 68 see *R. spiralis*, see also *R. cuspidata*, *R. elegans*, *R. hebe*, and *R. striata*).

Raised to status of species.

Lorica medium tall chalice-shaped, 3.7-4.4 oral diameters in length; oral rim 1.19 oral diameter in diameter, its channel shallow, concave; bowl 0.58-0.63 total length, subconical,  $7^{\circ}$ - $12^{\circ}$  above,  $35^{\circ}$ - $40^{\circ}$  below; pedicel 1.5-2.0 oral diameters in length with small, spirally striate, fusiform knob; fenestrae absent; ribs 36-48, slightly sinistral. Length 190-225 $\mu$ .

The type locality is off Santa Cruz, Azores, in the Atlantic.

Differs from *R. chiliensis* in lack of fenestrae, stouter proportions, knob, and more numerous ribs.

**Rhabdonella chiliensis** sp. nov.

Figure 413

Lorica medium tall chalice-shaped, its length 5.0–5.3 oral diameters; suboral shelf abruptly protuberant; bowl forming 0.5–0.6 total length, upper cone 6°–10°, lower 25°–28°; pedicel 2.0–2.8 oral diameters in length; knob both optically and structurally differentiated, slightly fusiform; fenestrae faint, 13–20 between ribs; ribs 48–60, subvertical, often branched and crowded. Length 270–296 $\mu$ .

The type locality is Station 4670 in the Peruvian Current. Occurs also in the California Current.

Differs from *R. chavesi* in having more ribs and is larger than *R. hebe*.

**Rhabdonella conica** sp. nov.

Figure 418

[?] *Cyttarocyclus spiralis*, Entz, Jr., 1904, p. 125, fig. 2.

*Ptychoocyclus* (*Rhabdonella*) *spiralis*, Brandt, 1906, p. 27, pl. 52, figs. 4, 7–9, 9a; 1907, *partim*, pp. 52, 323, 325, 330, 460, 470 (see *R. cuspidata*).

*Ptychoocyclus* (*Rhabdonella*) *spiralis* var. *striata*, Brandt, 1906, *partim*, p. 27, pl. 52, figs. 5, 6, 6a (for figs. 2, 10, 10a see *R. striata*); 1907, pp. 326, 327, 479, 480.

(*Ptychoocyclus*) *Rhabdonella spiralis* “typisch” Brandt, 1907, pp. 322–325, 479, with reference to a part of his material only.

*Rhabdonella spiralis* “typisch” Brandt, 1907, pp. 322–325 with reference to a part of his material only.

*Rhabdonella spiralis*, *partim*, Lanckmann, 1913, pp. 35–36, pl. 6, figs. 74, 75, 78–82 (for fig. 70 see *R. inflata*, for figs. 69, 71, 72, 73, 76, 77 see *R. spiralis*, and for fig. 83 see *Rhabdonellopsis triton*).

*Rhabdonella spiralis* var. *elongata* Jörgensen, 1924, pp. 36, 60, 61–68, fig. 69 (for figs. 70a–b, forma *hydria* see *R. hydria*).

*Rhabdonella spiralis* (var. *elongata*?) Jörgensen, 1924, p. 59, fig. 70d.

Non “*Rhabdonella striata* var. a *elongata* (Cleve),” Entz, Jr., 1908, p. 103 (see *Protorhabdonella striatura*).

*Cyttarocyclus Hebe*, Okamura, 1912, pp. 21, 35, pl. 5, fig. 101.

Lorica very tall chalice-shaped, 5.6–7.9 oral diameters in length; oral rim flaring abruptly; bowl tapering conical (upper 10°–28°, lower 30°–50°), about 0.5 total length in length; pedicel very long, subcylindrical, tapering distally; aboral end open; ribs 32–48, with sinistral deflection; fenestrae distinct, widely distributed. Length 290–470 $\mu$ .

The type locality is Station Pl. 25 of the Plankton Expedition in the margin of the Labrador and Florida currents. Occurs also in the Mediterranean Sea and in the California, Mexican, Peruvian, South

Equatorial, and the Equatorial Counter currents, and in the Panamic Area of the Pacific.

Differs from *R. spiralis* and *R. striata* in more conical form of the bowl and in more gradual transition between bowl and pedicel.

### ***Rhabdonella cornucopia* sp. nov.**

Figure 399

Lorica conical vase-shaped, its length 2.16–3.46 oral diameters; suboral shelf flaring; bowl conical ( $18^{\circ}$ – $30^{\circ}$ ); pedicel stout, 0.21–0.34 of the total length in length; knob faintly indicated; aboral end truncated, open; ribs 20–30, very faint, subvertical, inclined not more than  $10^{\circ}$  to the left; no fenestrae; wall hyaline, pedicel yellowish, prismatic structure very faint. Length 97–146 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican and South Equatorial currents, the Panamic Area, and the South Equatorial Drift.

Differs from *R. valdestriata* in stouter proportions, lack of fenestrae, and in its thick-walled pedicel.

### ***Rhabdonella cuspidata* (Zacharias) Brandt**

Figure 417

*Tintinnus cuspidatus* Zacharias, 1906, pp. 510, 519, 524, 531, 544, 545, 547, 566, 576, fig. 7[a, b].

*Pt. [choeylis] Rh. [donella] spiralis, partim*, Brandt, 1907, pp. 52, 323, 325, 330, 460, 479 (see also *R. conica*).

*Rhabdonella spiralis, partim*, Jörgensen, 1924, pp. 59–61 (for fig. 68 see *R. spiralis*, see also *R. chavesi*, *R. elegans*, *R. hebe*, and *R. striata*).

Non *Rhabdonella amor* var. *a cuspidata* Brandt, 1906, p. 27, pl. 54, figs. 3, 10, 11; 1907, pp. 316–318, 320, 322, 323, 329–332, 453, 460, 479 (see *R. brandti*).

### ***Rhabdonella elegans* Jörgensen emended**

Figure 401

“*Tintinnodee nouvelle*” Fol, 1884, p. 46, pl. 5, fig. 15.

*Undella spiralis, partim*, Daday, 1887b, pp. 565–566, *vide* Brandt, 1907, p. 460 (see also *R. striata*).

*Rhabdonella elegans, partim*, Jörgensen, 1924, pp. 59, 60, fig. 67 (see *R. brandti* and *R. spiralis*).

*Tintinnus inquilinus, partim*, Daday, 1887b, pp. 528–531 (for pl. 18, figs. 2, 10–13 see *Tintinnus apertus*, see also *T. tubulosus*, *Tdm. inquilinum*, and *Parafavella subrotundata*).

*Rhabdonella amor, partim*, Laackmann, 1909, pp. 423, 463, pl. 49, fig. 11 (see also *R. amor*).

*Rhabdonella spiralis, partim*, Jörgensen, 1924, pp. 7, 59, 60, 61, 62, 63, 64, 102, 105, 106 (for fig. 68 see *R. spiralis*, see also *R. chavesi*, *R. cuspidata*, *R. hebe*, and *R. striata*).

**Rhabdonella exilis** sp. nov.

Figure 396

Lorica small, spare, 2.22–2.60 oral diameters in length; bowl sub-conical, increasing from 10°–15° in the upper region to 35°–45° in the lower; pedicel feebly differentiated, about 0.5 oral diameter in length; ribs about 45, feebly developed; no fenestrae or alveoli visible; wall hyaline; laminae fused except in suboral region. Length 60–70 $\mu$ .

The type locality is Station 4721 in the South Equatorial Drift. Occurs also in the California and Peruvian currents.

Differs from *R. cornucopia* in much smaller size, more numerous ribs, and stouter proportions.

**Rhabdonella hebe** (Cleve)

Figure 409

*Cytlarocytilis Hebe* Cleve, 1900d, pp. 971–972, fig. [5, right]; non Ostenfeld and Schmidt, 1901, p. 179, fig. 26 (see *Rhabdonellopsis minima*).

*Ptychoeytilis (Rhabdonella) spiralis* var. a *hebe*, *partim*, Brandt, 1906, pp. 27, 33, pl. 53, figs. 1, 2, 4, 7, pl. 54, fig. 7, pl. 68, fig. 8 (for pl. 53, figs. 6, 11 see *Rhabdonellopsis minima*); 1907, pp. 325–326.

(*Ptychoeytilis*) *Rhabdonella spiralis* var. a *hebe*, Brandt, 1907, pp. 467, 479.

*Rhabdonella spiralis*, *partim*, Jörgensen, 1924, pp. 60, 61, 63 (for fig. 68 see *R. spiralis*, see also *R. chavesi*, *R. cuspidata*, *R. elegans*, and *R. striata*).

**Rhabdonella henseni** (Brandt) Brandt

Figure 408

*Ptychoeytilis (Rhabdonella) spiralis* var. e *henseni* Brandt, 1906, p. 27, pl. 52, fig. 3, pl. 54, figs. 2, 2a; 1907, p. 479.

*Rhabdonella spiralis* var. e *henseni* Brandt, 1907, pp. 315, 320–322, 327, 467, 477.

*Rhabdonella henseni* Brandt, 1907, pp. 315–322, 327, 467; Laackmann, 1909, pp. 347, 358.

**Rhabdonella hydria** Jörgensen

Figure 407

*Rhabdonella spiralis* var. *elongata* forma *hydria* Jörgensen, 1924, pp. 61, 62, 63, 64, figs. 70a, 70b.

*Rhabdonella spiralis hydria*, Campbell, 1927, p. 444.

Raised to status of species.

Lorica 2.5 oral diameters in length; oral rim flaring, lipped, margin with a deep channel; bowl saccular; aboral end truncated; wall with about 25 leiotropic ribs. Length 107–114 $\mu$ .

The type locality is Station 152 of the "Thor" off Barka in the Western Mediterranean.

Differs from all other species of *Rhabdonella* in the peculiar sacular aboral end.

Possibly unfinished loricae of *Rhabdonella*, but should be held *sub judice* pending other material.

### **Rhabdonella indica** Laackmann

Figure 397

*Rhabdonella amor* var. *indica* Laackmann, 1909, pp. 461, 464, 465, 493, pl. 49, fig. 12 (13, 14 doubtful).

*Rhabdonella amor*, *partim*, Jörgensen, 1924, p. 58 (see *R. amor*, *R. valdestrata*, and *Protorhabdonella simplex*).

Raised to status of species.

Lorica convex subconical, 1.86–2.16 oral diameters in length; suboral shelf horizontal, emergent; oral rim erect, thin; bowl convex, inverted subconical, changing from 15° suborally to 40° aborally; aboral horn scarcely differentiated, conical (20°), 0.16 oral diameter in length; ribs 36–42, delicate, leiotropic (15°); no fenestrae. Length 56–63 $\mu$ .

The type locality is off New Amsterdam in the Southern Indian Ocean. Occurs also in the Peruvian Current, South Equatorial Drift, and in the Galapagos Eddy of the Eastern Tropical Pacific.

Differs from *R. amor* in smaller size, more numerous ribs, and more spreading oral shelf.

### **Rhabdonella inflata** sp. nov.

Figure 403

[?] *Rhabdonella spiralis*, *partim*, Laackmann, 1913, pp. 35–36, 44, pl. 6, fig. 70 (for figs. 69, 71–73, 76, 77 see *R. spiralis*, for figs. 74, 75, 78–82 see *R. conica*, and for fig. 83 see *Rhabdonellopsis triton*.)

Lorica short, stout chalice-shaped, its length 3.0–4.1 oral diameters; suboral shelf scarcely protuberant; bowl forming 0.65–0.72 total length, upper cone 0°–7°, lower 30°–55°; pedicel 0.8–1.3 oral diameters in length; no knob; open tip; fenestrae small, faint, 18–26 between ribs; ribs 42–60, subvertical. Length 124–204 $\mu$ .

The type locality is Station 4676 in the Peruvian Current. Occurs also in the California and Mexican currents, the Panamic Area, the South Equatorial Drift, and the Adriatic Sea (Laackmann).

Differs from *R. spiralis* in smaller size and shorter bowl, and from *R. hebe* in lack of knob.

**Rhabdonella lohmanni** sp. nov.

Figure 416

Lorica tall chalice-shaped, 4.57–5.76 oral diameters in length; bowl 0.6 total length in length, cylindrical in the upper 0.66, conical below ( $30^{\circ}$ – $35^{\circ}$ ); pedicel 0.33–0.38 total length in length; ribs spirally oblique to the right, 30–48. Length 317–377 $\mu$ .

The type locality is Station 4679 in the South Equatorial Drift. Occurs also in the Peruvian Current.

Differs from *R. henseni* in obliquity of ribs, larger size, and stouter pedicel.

**Rhabdonella poculum** (Ostenfeld and Schmidt) Brandt

Figure 405

*Cyttarocyclus poculum* Ostenfeld and Schmidt, 1901, p. 179, fig. 27.

*Rhabdonella amor* var. *poculum*, Brandt, 1907, pp. 316, 322, 476.

*Ptychocyclus amor* var. *poculum*, Brandt, 1907, p. 329.

*Rhabdonella poculum*, Entz, Jr., 1908, p. 102.

**Rhabdonella quantula** sp. nov.

Figure 402

Lorica short, narrow chalice-shaped, its length 3.4–4.2 oral diameters; suboral shelf scarcely protuberant; bowl forming 0.56–0.65 total length, upper cone tapering convex ( $5^{\circ}$ – $13^{\circ}$ ), lower one narrower ( $35^{\circ}$ – $50^{\circ}$ ) than in *R. inflata*; pedicel 1.3–1.8 oral diameters in length, with terminal opening minute or obscure; fenestrae 6–8 in an intercostal space, distinct; ribs 36–54, subvertical, distinct. Length 138–172 $\mu$ .

The type locality is Station 4604 in the Mexican Current. Occurs also in the California, South Equatorial, Equatorial Counter, and North Equatorial currents, Panamic Area, Galapagos Eddy, and South Equatorial Drift.

Differs from *R. spiralis* in smaller size, from *R. inflata* in shorter, more tapering bowl, and from *R. cornucopia* in less tapering bowl and longer pedicel.

**Rhabdonella spiralis** (Fol) Brandt emended

## Figure 414

*Tintinnus spiralis* Fol, 1881a, p. 21, pl. 1, fig. 4; 1881b, pp. 247-248, pl. 17, fig. 4; 1884, pp. 33, 53-55, pl. 4, fig. 4; Keller, 1894, p. 511, fig. 214.

*Petalotricha spiralis*, Kent, 1882, pp. 628-629, fig. 3.

*Undella spiralis*, Schweyer, 1905, pp. 2, 4; Merkle, 1909, p. 148.

*Rhabdonella spiralis, partim*, Brandt, 1907, pp. 313-325, 479 (see also *R. cuspidata*, *R. hebe*, *R. striata*, and *Rhabdonellopsis minima*); Entz, Jr., 1909b, pp. 150-226, pl. 20, fig. 12 (for pl. 20, fig. 36 see *R. amor*); Laackmann, 1913, pp. 35-36, 44-45, pl. 6 figs. 69, 71, 72, 73, 76, 77 (for fig. 70 see *R. inflata*, for figs. 74-75, 78-82 see *R. conica*, and for fig. 83 see *Rhabdonellopsis triton*); Jørgensen, 1924, pp. 7, 59-64, 102, 105, 106, fig. 68 (see also *R. chavesi*, *R. cuspidata*, *R. elegans*, *R. hebe*, and *R. striata*).

*Ptychocylis (Rhabdonella) spiralis* var. *e indopacifica, partim*, Brandt, 1906, p. 27, pl. 53, figs. 8-10 (for pl. 52, fig. 1 see *R. striata*); 1907, pp. 332, 333, 479.

*Rhabdonella spiralis* var. *e indopacifica* Brandt, 1907, pp. 326, 468.

*Cyttarocylis spiralis*, Ostenfeld, 1907, p. 4.

*Ptychocylis spiralis*, Lohmann, 1908, p. 163.

*Ptychocylis (Rhabdonella) spiralis, partim*, Entz, Jr., 1908, pp. 20-136, pl. 13, fig. 12 (for fig. 36 see *R. amor*).

*Rhabdonella spiralis* var. *indopacifica*, Laackmann, 1909, pp. 423, 462-463.

*Rhabdonella elegans, partim*, Jørgensen, 1924, pp. 59, 60, fig. 67 (see also *R. brandti*).

**Rhabdonella striata** (Biedermann) Brandt emended

## Figure 411

[?] *Undella spiralis, partim*, Daday, 1887b, pp. 565-566, pl. 18, fig. 8 (see also *R. elegans*).

*Tintinnus striatus* Biedermann, 1893, p. 29, pl. 3, figs. 13a, b.

*Ptychocylis (Rhabdonella) spiralis* var. *d striata, partim*, Brandt, 1906, pp. 26, 27, pl. 52, figs. 2, 10, 10a (for pl. 52, figs. 5, 6, 6a see *R. conica*).

*Ptychocylis (Rhabdonella) spiralis* var. *e indopacifica, partim*, Brandt, 1906, p. 26, pl. 52, fig. 1 (for pl. 53, figs. 8, 9, 10 see *R. spiralis*).

(*Ptychocylis*) *Rhabdonella spiralis* var. *d striata*, Brandt, 1907, p. 479.

*Rhabdonella spiralis* var. *d*, Brandt, 1907, p. 322.

*Rhabdonella spiralis* var. *striata*, Brandt, 1907, pp. 315, 322, 326-327; Laackmann, 1909, p. 463.

*Rhabdonella spiralis* var. *d striata*, Brandt, 1907, p. 480.

*Ptychocylis (Rhabdonella) spiralis*, Schweyer, 1909, p. 138.

*Rhabdonella spiralis, partim*, Jørgensen, 1924, pp. 61, 63 (for fig. 68 see *R. spiralis*, see also *R. chavesi*, *R. cuspidata*, *R. elegans*, and *R. hebe*).

*Cyttarocylis denticulata* var. Okamura, 1912, pp. 21, 22, 35, pl. 5, fig. 102.



**Rhabdonella torta** sp. nov.

Figure 404

Lorica stout chalice-shaped, 3.98-4.22 oral diameters in length; suboral shelf very slight; bowl convex conical,  $5^{\circ}$ - $6^{\circ}$  above,  $28^{\circ}$ - $34^{\circ}$  below; pedicel slightly differentiated, stout; aboral end truncated, open; ribs 54-60, ascending spirally to the right, steepest ( $30^{\circ}$ - $40^{\circ}$ ) on upper pedicel, turning left below shelf; fenestrae distinct, 4-8 in intercostal space. Length 210-228 $\mu$ .

The type locality is Station 4721 in the South Equatorial Drift. Occurs also in the California Current.

Differs from all other species except *R. lohmanni* in right spiral of ribs and from it in smaller size.

**Rhabdonella valdestriata** Brandt

Figure 410

*Ptychocyclus* (*Rhabdonella*) *amor* var. *b valdestriata* Brandt, 1906, pp. 27, 33, pl. 54, figs. 1, 8, 9, 16-18, pl. 68, fig. 7.

(*Ptychocyclus*) *Rhabdonella amor* var. *valdestriata* Brandt, 1907, pp. 316, 327, 487.

*Rhabdonella amor* var. *valdestriata* Brandt, 1907, pp. 318, 332-333, 453.

*Rhabdonella amor*, *partim*, Jörgensen, 1924, p. 58 (see also *R. amor*, *R. indica*, and *Protorhabdonella simplex*).

Raised to status of species.

Lorica tall chalice-shaped, 2.75-3.60 oral diameters in length; oral region with shallow, angled channel, inner rim thick erect, outer lip scarcely emergent; bowl convex subconical, changing from  $10^{\circ}$ - $15^{\circ}$  in the suboral 0.5 of total length to  $40^{\circ}$ - $45^{\circ}$  for about an oral diameter above the pedicel; pedicel slightly concave conical ( $5^{\circ}$ - $10^{\circ}$ ); tip blunt or acute; wall with  $40^{\circ}$ - $55^{\circ}$  anastomosing vertical or slightly leiotropic ribs with numerous unequal fenestrae scattered throughout the length of the lorica. Length 150-225 $\mu$ .

The type locality is off Ralum in the Western Tropical Pacific. Occurs also widely distributed in the Tropical Pacific and Indian oceans, in the Red Sea, and in the West Wind Drift of the Atlantic.

Differs from *R. cuspidata* in longer bowl and from other species in the slighter development of the oral lip.

### **Rhabdonellopsis** gen. nov.

*Cyttarocyclus*, Cleve, *partim*, 1900*d*, pp. 971-972 (see also *Epiplocyclus*, *Protorhabdonella*, and *Rhabdonella*); Zacharias, 1906, pp. 519-520.

*Rhabdonella*, *partim*, Brandt, 1907, pp. 313-315; Laackmann, 1909, pp. 347, 358, 460, 461, 465, 466; Jørgensen, 1924, pp. 7-9, 16, 34, 57-58, 62 (see also *Protorhabdonella* and *Rhabdonella*).

Rhabdonellidae with elongate chalice-shaped lorica; oral rim without teeth and usually with a gutter between the inner and outer laminae; bowl subconical, at least aborally; pedicel very long, always with a more or less developed knob and lance; wall with more or less numerous, vertical ribs, simple, branched, and sometimes anastomosed, with few to many, or no, fenestrae between them; laminae well developed with primary structure and sometimes a coarse secondary structure.

We designate as the type species *Rhabdonellopsis apophysata* (Cleve) from the Atlantic, the oldest species included in the genus.

Differs from *Protorhabdonella* Jörg. in longer lorica, larger size, presence of the oral gutter, more ribs and better developed laminae; and from *Rhabdonella* Bdt. emended Laack. emended Jörg. emended in the presence of the knob or other differentiation at the junction of pedicel and lance.

Includes 6 species as follows:

apophysata (Cleve)	longicaulis sp. nov.
composita (Bdt.)	minima sp. nov.
intermedia sp. nov.	triton (Zacharias)

### **Rhabdonellopsis apophysata** (Cleve)

Figure 420

*Cyttarocyclus Hebe* var. *apophysata* Cleve, 1900*d*, pp. 971-972, fig. [5 left].

*Ptychocyclus (Rhabdonella) apophysata* var. b Brandt, 1906, p. 26, pl. 51, figs. 1, 2.

*Rhabdonella apophysata* var. b, Brandt, 1907, pp. 336, 454.

*Rhabdonella apophysata, partim*, Jørgensen, 1924, pp. 59, 62, 64, figs. 71*a-c* (for fig. 70*c* see *R. triton*, see also *R. composita* and *R. minima*).

**Rhabdonellopsis composita** (Brandt)

Figure 421

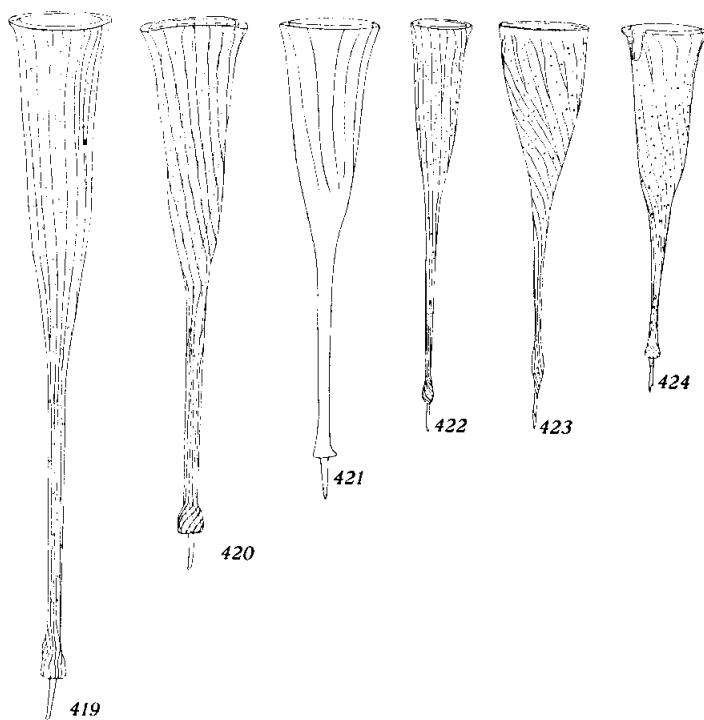
*Ptychocyclus* (*Rhabdonella*) *apophysata* var. *a composita* Brandt, 1906, p. 26, pl. 51, figs. 3, 4.

*Rhabdonella apophysata* var. *composita* Brandt, 1907, pp. 336, 454, 460.

*Rhabdonella apophysata*, *partim*, Jörgensen, 1924, pp. 59, 62, 64 (for fig. 70c see *R. triton* and for figs. 71a-c see *R. apophysata*, see also *R. minima*).

Raised to status of species.

Loricæ tall, slender chalice-shaped 4.66–5.25 oral diameters in length; oral rim symmetrically channeled, inner oral rim thin, erect,



Figs. 419–424. Species of *Rhabdonellopsis* gen. nov.  $\times 200$ .

Fig. 419. *R. longicaulis* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.

Fig. 420. *R. apophysata* (Cleve) after Brandt (1906, pl. 51, fig. 1) from Station Pl. 61 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 421. *R. composita* (Bdt.) after Brandt (1906, pl. 51, fig. 4) from Station Pl. 44 of the Plankton Expedition in the Sargasso Sea.

Fig. 422. *R. triton* (Zacharias) from Station 4665 in the Peruvian Current.

Fig. 423. *R. minima* sp. nov. from Station 4712 in the South Equatorial Drift near the Galapagos Eddy.

Fig. 424. *R. intermedia* sp. nov. from Station 4583 in the California Current.

outer lip thick, gradually and slightly emergent; bowl conical, changing from  $15^\circ$  in its oral 0.75 to  $20^\circ$ - $25^\circ$  aborally; pedicel very long, 2.5 oral diameters in length; knob small, 0.20-0.25 oral diameter in diameter, with skirt but no angles; lance conical ( $15^\circ$ ), 0.4 oral diameter in length; tip perforated; wall with 10-12 sublongitudinal ribs terminating at the base of the bowl. Length 280-330 $\mu$ .

The type locality is Station 44 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Florida and South Equatorial currents.

Differs from *R. apophysata* in the absence of ribs on the pedicel and in having fewer ribs.

#### ***Rhabdonellopsis intermedia* sp. nov.**

Figure 424

Length 4.72-6.08 oral diameters; bowl, pedicel and lance forming 0.51-0.41 and 0.08 of total length; pedicel 1.77-2.86 oral diameters in length; knob fusiform, rounded or truncated; ribs 16-25, subvertical to leiotropic ( $20^\circ$ ); prisms large, 50-55 across one face. Length 222-298 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican, Peruvian, and South Equatorial currents, the Panamic Area, and the Galapagos Eddy.

Differs from *R. apophysata* in smaller size, fewer striae, and in having fenestrae.

#### ***Rhabdonellopsis longicaulis* sp. nov.**

Figure 419

Length 7.00-8.66 oral diameters; bowl, pedicel, and lance forming 0.43, 0.53, and 0.05 of the total length respectively; pedicel stout cylindrical, 3.39-4.67 oral diameters in length; knob truncated, large, 0.34 oral diameter in diameter; ribs 16-32; prisms small, 65-100 across one face. Length 350-468 $\mu$ .

The type locality is Station 4681 in the South Equatorial Drift. Occurs also in the Peruvian and South Equatorial currents and the Easter Island Eddy.

Differs from other species in heavier knob, minute, sparse fenestrae, and longer pedicel.

**Rhabdonellopsis minima** sp. nov.

Figure 423

[?] *Cyttarocyclus Hebe*, Ostenfeld and Schmidt, 1901, p. 179, fig. 26.

*Ptychoocyclus (Rhabdonella) spiralis* var. *a hebe*, *partim*, Brandt, 1906, p. 27, pl. 53, figs. 6, 11 (for figs. 1, 2, 4, 7, pl. 54, fig. 7, pl. 68, fig. 8 see *Rhabdonella hebe*); 1907, pp. 325-326, 467, 479 (see also *Rhabdonella cuspidata*, *R. hebe*, *R. spiralis*, and *R. striata*).

*Rhabdonella apophysata*, *partim*, Jörgensen, 1924, pp. 59, 62, 64 (for fig. 70c see *R. triton* and for figs. 71a-c see *R. apophysata*, see also *R. composita*).

Length 2.95-4.85 oral diameters; bowl, pedicel, and lance forming 0.60, 0.34, and 0.06 of the total length respectively; pedicel slender tapering, its length 1.17-1.83 oral diameters; knob fusiform, 0.08-0.11 oral diameter in diameter; lance tapering, flaring at tip; ribs 16-25, subvertical; prisms small, 2 or more layers, 70-90 across one face. Length 177-254 $\mu$ .

The type locality is Station Pl. 35 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Florida Current, in the Mediterranean, off Madagascar, off New Zealand, and in the Easter Island and Galapagos eddies, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *R. intermedia* in smaller size and less evident prisms, in feebly developed knob, and bowl not always with striae.

**Rhabdonellopsis triton** (Zacharias)

Figure 422

*Cyttarocyclus triton* Zacharias, 1906, pp. 519-520, fig. 8.

*Ptychoocyclus (Rhabdonella) apophysata*, Brandt, 1906, p. 26, pl. 51, figs. 5-7b; 1907, pp. 333-335, 453, 454, 467.

("perhaps") *Rhabdonella apophysata*, Jörgensen, 1924, p. 59, fig. 70c.

*Rhabdonella spiralis*, *partim*, Laackmann, 1913, pp. 35-36, pl. 6, fig. 83 (for figs. 74, 75, 78-82 see *Rhabdonella conica*, for fig. 70 see *Rhabdonella inflata*, and for figs. 69, 71-73, 76, 77 see *Rhabdonella spiralis*).

*Rhabdonella apophysata*, *partim*, Jörgensen, 1924, pp. 59, 62, 64 (for figs. 71a-c see *R. apophysata*, see also *R. composita* and *R. minima*).

## Family NYSTONELLIDAE fam. nov.

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxliellidae, Cyttarocylidae, Ptychoeoylidae, Tintinnidae, Tintinnididae, and Undellidae).

Tintinnoinea with an elongated, chalice-shaped lorica, or with an upper cylinder and a lower cone; usually with long, narrow, slender, aboral pedicel; wall with primary prisms and secondary structure, the latter sometimes reduced or hyaline only, never with vertical ribs, or spiral structure; with 2 macronuclei, 2 micronuclei, and 16 membranelles. Marine only.

Differs from the Tintinnididae, Tintinnidae (in the main), Undellidae, and Ptychoeoylidae in the presence of secondary structure (except in a few species of *Parundella*); from the Dictyocystidae, Codonellidae, Codonellopsidae, and Petalotrichidae in the absence of a collar; from the Coxliellidae in the absence of a spiral lamina; from the Rhabdonellidae in the absence of ribs; and from the Cyttarocylidae in the chalice-shaped bowl, or absence of teeth on the oral rim.

Includes three genera, *Parundella* Jörg. emended, *Xystonella* Bdt. emended Laack. emended Jörg., and *Xystonellopsis* Jörg.

**Parundella** Jörgensen emended

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coxliella*, *Favella*, *Proplectella*, *Ptychoeoylis*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Ostenfeld, *partim*, 1899a, p. 63 (see also *Craterella*); Wailes, 1925, p. 538.

*Undella*, *partim*, Daday, 1887b, pp. 564-568 (see also *Undella*); Brandt, 1907, pp. 343-374 (see also *Amplectella*, *Cricundella*, *Undella*, *Undellopsis*, and *Xystonellopsis*); Jörgensen, 1924, pp. 37-50 (see also *Undella*).

*Parundella* (subgenus) Jörgensen, 1924, p. 46.

Xystonellidae with elongated lorica with an upper cylinder and a lower cone prolonged usually as a simple caudal lance; wall with a simple primary structure, or hyaline, its laminae separated but approximate, except at the aboral end where they fuse.

We designate as the type species *Parundella lachmanni* (Daday) from off Norway, the oldest species included in the genus.

Differs from *Xystonella* in the absence of the channeled oral rim and from *Xystonellopsis* in the thin, not flaring oral rim.

Includes 22 species as follows:

<i>aculeata</i> Jörg.	<i>lachmanni</i> (Daday)
<i>acuta</i> sp. nov.	<i>lagna</i> sp. nov.
<i>attenuata</i> sp. nov.	<i>lohmanni</i> Jörg.
<i>caudata</i> (Ost.)	<i>longa</i> Jörg.
<i>clavus</i> sp. nov.	<i>major</i> (Wailes)
<i>difficilis</i> sp. nov.	<i>messinensis</i> (Bdt.) Jörg.
<i>gigantea</i> sp. nov.	<i>minor</i> (Wailes)
<i>grandis</i> sp. nov.	<i>pellucida</i> (Jörg.)
<i>humerosa</i> sp. nov.	<i>praetenuis</i> sp. nov.
<i>inflata</i> sp. nov.	<i>spinosa</i> sp. nov. = <i>caudata</i> (Ost.)
<i>invaginata</i> sp. nov.	<i>translucens</i> (Wailes)

### ***Parundella aculeata* Jörgensen**

Figure 430

*Undella lachmanni* var. b *caudata* Brandt, 1906, p. 31, pl. 64, figs. 14, 24, 24a; 1907, pp. 368-369, 458, 459; Merkle, 1909, pp. 164-165, pl. 2, fig. 17.

*Undella (Parundella) aculeata* Jörgensen, 1924, pp. 39, 47, 48, fig. 52.

Non *Tintinnus caudatus* Ostenfeld, 1899b, p. 438, fig. 2c (see *P. caudata*).

*Undella caudata*, partim, Jörgensen, 1924, pp. 39, 46 (for fig. 51 see *P. caudata*, see also *P. grandis*, *P. lachmanni*, *P. lohmanni*, *P. messinensis*, and *P. pellucida*).

### ***Parundella acuta* sp. nov.**

Figure 434

Lorica stout, goblet-shaped, 2.35-2.56 oral diameters in length; a broad suboral ring present; bowl with slight aboral inflation; aboral end broadly conical ( $65^{\circ}$ - $75^{\circ}$ ), acute, without a terminal lance; wall thick, laminae heavy, intermediate layer wide, prismatic. Length 80-90 $\mu$ .

The type locality is Station 4722 in the South Equatorial Drift. Occurs also in the Peruvian Current and the Galapagos Eddy.

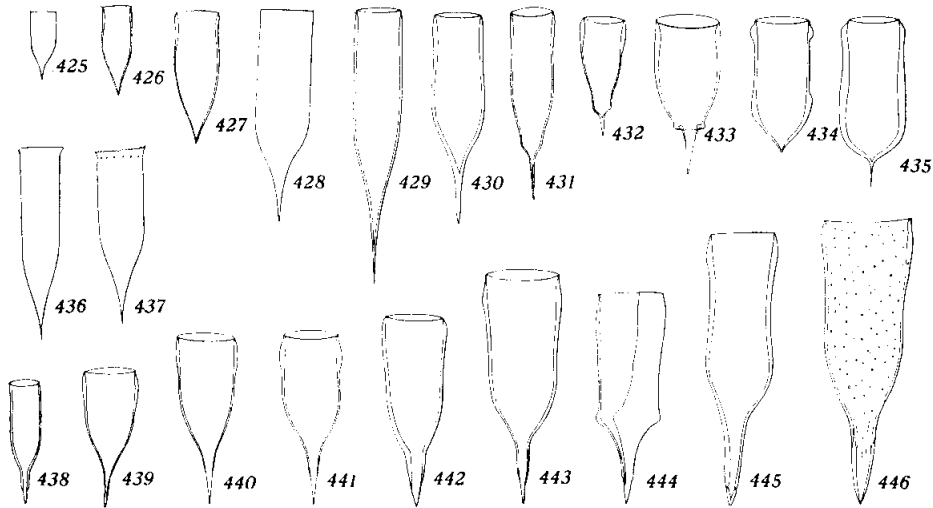
Differs from other species in lack of terminal lance. It lacks the acicular lance of *P. spinosa* which it otherwise closely resembles.

### ***Parundella attenuata* sp. nov.**

Figure 446

*Undella messinensis* var. a Brandt, 1906, p. 31, pl. 64, figs. 15, 28; 1907, pp. 369, 370, 471.

Lorica large, rather stout, chalice-shaped, its length 3.71-4.25 oral diameters; bowl subcylindrical above, laterally concave, subconical ( $30^{\circ}$ - $43^{\circ}$ ) below; distance from oral rim to lower end of cylindrical bowl 0.5 total length; lance very stout, striate. Length 155-205 $\mu$ .



Figs. 425-446. Species of *Parandella* Jörg. emended.  $\times 200$ .

Fig. 425. *P. minor* (Wailes) after Wailes (1925, pl. 2, fig. 16) from the Strait of Georgia, British Columbia.

Fig. 426. *P. grandis* sp. nov. after Brandt (1906, pl. 64, fig. 27) from Station Pl. 28 of the Plankton Expedition in the Florida Current.

Fig. 427. *P. lachmanni* (Daday) after Brandt (1906, pl. 64, fig. 26) from the margin of the Florida and Labrador currents.

Fig. 428. *P. major* (Wailes) after Wailes (1925, pl. 2, fig. 15) from the Strait of Georgia, British Columbia.

Fig. 429. *P. longa* Jörg. after Jörgensen (1924, p. 39, fig. 53) from Station 228 of the "Thor" in the western basin of the Mediterranean off Spain.

Fig. 430. *P. aculeata* Jörg. after Jörgensen (1924, p. 39, fig. 52) from Station 28 of the "Thor" in the western basin of the Mediterranean off Sardinia.

Fig. 431. *P. inflata* sp. nov. from Station 4685 in the South Equatorial Drift of the Pacific.

Fig. 432. *P. clavus* sp. nov. from Station 4697 in the Easter Island Eddy.

Fig. 433. *P. invaginata* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 434. *P. acuta* sp. nov. from Station 4722 in the South Equatorial Drift of the Pacific.

Fig. 435. *P. spinosa* sp. nov. from Station 4605 in the Mexican Current.

Fig. 436. *P. translucens* (Wailes) after Wailes (1925, pl. 2, fig. 13) from the Strait of Georgia, British Columbia.

Fig. 437. *P. lagena* sp. nov. from the Strait of Georgia, British Columbia.

Fig. 438. *P. pellucida* (Jörg.) after Jörgensen (1899, pl. 1, fig. 7) from the Byfjord, Norway.

Fig. 439. *P. practenusis* sp. nov. from Station 4646 in the Peruvian Current.

Fig. 440. *P. difficilis* sp. nov. from Station 4711 in the South Equatorial Drift of the Pacific.

Fig. 441. *P. humerosa* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 442. *P. caudata* (Ost.) after Jörgensen (1924, p. 39, fig. 51) from the coast of Norway off Bergen.

Fig. 443. *P. gigantea* sp. nov. from Station 4713 in the South Equatorial Current of the Pacific.

Fig. 444. *P. messinensis* (Bdt.) Jörg. after Brandt (1906, pl. 64, fig. 13) from off Messina in the Mediterranean.

Fig. 445. *P. lohmanni* Jörg. after Jörgensen (1924, p. 39, fig. 54) from Station 28 of the "Thor" in the western basin of the Mediterranean off Sardinia.

Fig. 446. *P. attenuata* sp. nov. from Station Pl. 71 of the Plankton Expedition in the South Equatorial Current of the Atlantic.



The type locality is Station Pl. 71 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the Mediterranean and in the Peruvian and South Equatorial currents, the Easter Island and Galapagos eddies, and the South Equatorial Drift.

Differs from *P. lachmanni* in larger size, in better defined pedicel and lance, and in striae on pedicel.

***Parundella caudata* (Ostenfeld)**

Figure 442

*Tintinnus caudatus* Ostenfeld, 1899a, p. 63; 1899b, p. 438, fig. 2c.

*Undella caudata*, Cleve, 1900c, p. 864; Jörgensen, *partim*, 1924, pp. 39, 46, fig. 51 (see also *P. aculeata*, *P. grandis*, *P. lachmanni*, *P. lohmanni*, *P. messinensis*, and *P. pellucida*).

*Undella pellucida*, *partim*, Jörgensen, 1899, p. 41, pl. 1, fig. 8 (for fig. 7 see *P. pellucida*).

Differs from *P. pellucida* in presence of fins at the junction of the bowl and lance.

***Parundella clavus* sp. nov.**

Figure 432

A small species shaped like a shoemaker's awl, 2.78–3.35 oral diameters in length; bowl tapering subconical ( $27^\circ$ ) with a median and an aboral expansion; lance slender, aciculate, 0.5–0.8 oral diameters in length; wall with secondary prisms only in the broad suboral band. Length 78–87 $\mu$ .

The type locality is Station 4697 in the Easter Island Eddy. Occurs also in the South Equatorial Drift.

Differs from *Xystonella brandti* in character of aboral end and from all species of *Parundella* in the greater relative stoutness of the lance.

***Parundella difficilis* sp. nov.**

Figure 440

Loricæ tapering chalice-shaped, its length 2.87–3.50 oral diameters; suboral wall thick; bowl subcylindrical in upper 0.5, 1.22–1.48 oral diameters in length; lower cone ( $31^\circ$ – $43^\circ$ ) quite tapering; lance about 1 oral diameter in length, thin-walled distally, sharp pointed. Length 111–133 $\mu$ .

The type locality is Station 4711 in the South Equatorial Drift. Occurs also in the Peruvian and South Equatorial currents and in the Galapagos and Easter Island eddies.

Differs from *P. praetenuis* in its wider cone and from *P. gigantea* in smaller size and lack of spiral fins on the lance.

***Parundella gigantea* sp. nov.**

Figure 443

Lorica stout chalice-shaped, 2.89–3.27 oral diameters in length; bowl with slight suboral expansion and cylindrical part 1.35–1.75 oral diameters in length, lower cone wide ( $47^{\circ}$ – $58^{\circ}$ ); lance 0.85 oral diameter in length, thin-walled in the distal 0.4, with dexiotropic striae on the thick-walled part. Length 127–157 $\mu$ .

The type locality is Station 4713 in the South Equatorial Current. Occurs also in the Panamic Area, Peruvian Current, and South Equatorial Drift.

Differs from *P. difficilis* in the wide angle of the lower cone, from *P. attenuata* in more slender lance, from *P. praetenuis* in the relatively much shorter bowl, from *P. caudata* in absence of aboral fins, from *P. pellucida* in less sharply set off lance and lack of suboral constriction, and from *P. lohmanni* in the lack of lateral concavity and shorter lance.

***Parundella grandis* sp. nov.**

Figure 426

*Undella lachmanni* var. a Brandt, 1906, p. 31, pl. 64, figs. 25, 27; 1907, pp. 368, 469.

*Undella* (*Parundella*) *caudata*, partim, Jörgensen, 1924, p. 46 (see also *P. aculeata*, *P. caudata*, *P. lachmanni*, *P. lohmanni*, *P. messinensis*, and *P. pellucida*).

Lorica stout, 3.5–4.5 oral diameters in length; bowl with diffuse suboral thickening, its cylindrical portion 0.75–0.80 total length in length, its lower cone  $38^{\circ}$ – $40^{\circ}$ ; lance not distinctly set off, about 0.5 oral diameter in length. Length 90 $\mu$ .

The type locality is Station Pl. 28 of the Plankton Expedition in the Florida Current.

Differs from *P. lachmanni* in size and lack of suboral constriction and from *P. lohmanni* in the lack of lateral concavity and shorter lance.

**Parundella humerosa** sp. nov.

Figure 441

Lorica stout chalice-shaped, 2.66–3.14 oral diameters in length; bowl with localized suboral thickening and cylindrical part 1.23–1.60 oral diameters in length, its lower cone very wide ( $48^{\circ}$ – $58^{\circ}$ ); lance gradually emerging from bowl, nearly 1 oral diameter in length, its distal 0.5 thin walled. Length 108–125 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. Occurs also in the Peruvian Current, Easter Island Eddy, and South Equatorial Drift.

Differs from *P. gigantea* in its shorter cylindrical part, more suboral differentiation, and less shoulder at base of lance.

**Parundella inflata** sp. nov.

Figure 431

Lorica small, stout, chalice-shaped, 3.68–4.34 oral diameters in length; bowl subcylindrical slightly inflated below its middle and again in the lower part of the cone ( $30^{\circ}$ – $40^{\circ}$ ); lance acicular, 0.88–1.24 oral diameters in length, abruptly set off from the bowl. Length 92–120 $\mu$ .

The type locality is Station 4685 in the South Equatorial Drift. Occurs also in the Easter Island and Galapagos eddies.

Differs from *P. aculeata* in the presence of two inflated regions and from *P. caudata*, *P. lachmanni*, *P. lohmanni*, and *P. pellucida* in the more slender lance.

**Parundella invaginata** sp. nov.

Figure 433

Lorica broad goblet-shaped, 2.27–2.77 oral diameters in length; bowl cup-shaped, cylindrical in the anterior 0.6, conical ( $50^{\circ}$ – $60^{\circ}$ ) below; base of the lance telescoped into the expanded pedicel; lance thin-walled, conical ( $10^{\circ}$ – $17^{\circ}$ ), 0.7 oral diameter in length. Length 100–122 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. Occurs also in the Panamic Area, Peruvian and South Equatorial currents, and the South Equatorial Drift.

Differs from *Cymatoecylis affinis* in structure of the wall and suboral region, being plainly a *Parundella*, and from *P. messinensis* in lack of suboral thickening and in shape of aboral region.

**Parundella lachmanni** (Daday)

Figure 427

*Tintinnus* sp. Claparède and Lachmann, *partim*, 1858, p. 210, pl. 9, fig. 5*b* (for pl. 9, fig. 5*a* see *Proplectella claparèdei*); Kent, 1882, pl. 31, fig. 23.

*Undella Lachmanni* Daday, 1887*b*, p. 568.

*Undella lachmanni*, Brandt, 1906, p. 31, pl. 64, fig. 26; 1907, pp. 366-369, 469; Wailes, 1925, p. 338, pl. 2, fig. 24.

*Undella* (*Parundella*) *lohmanni*, *partim*, Jörgensen, 1924, p. 48 (for fig. 54 see *P. lohmanni*, see also *P. messinensis*).

*Undella caudata*, *partim*, Jörgensen, 1924, p. 46 (see also *P. aculeata*, *P. caudata*, *P. grandis*, *P. lohmanni*, *P. messinensis*, and *P. pellucida*).

**Parundella lagena** sp. nov.

Figure 437

*Tintinnus translucens*, *partim*, Wailes, 1925, p. 538, pl. 2, fig. 14 (for pl. 2, figs. 11-13 see *P. translucens*).

Lorica 3.28 oral diameters in length, elongate flask-shaped, tubular in the anterior 0.42, contracted as a cone of  $42^\circ$  in the middle 0.26 and drawn out into a thin spine in the posterior 0.32, as a cone of  $12^\circ$ ; oral margin crenulated, with a distinct collar. Length  $76\mu$ .

The type locality is off British Columbia.

Differs from all other species in the crenulate oral margin and collar.

Possibly not a member of the genus *Parundella*.

**Parundella lohmanni** Jörgensen emended

Figure 445

*Undella messinensis*, *partim*, Brandt, 1906, p. 31, pl. 64, fig. 29; 1907, pp. 369, 471 (for pl. 64, figs. 13, 30 see *P. messinensis*).

*Undella* (*Parundella*) *lohmanni*, *partim*, Jörgensen, 1924, pp. 39, 48, fig. 54 (see also *P. lachmanni* and *P. messinensis*).

*Undella caudata*, *partim*, Jörgensen, 1924, pp. 39, 46 (see also *P. aculeata*, *P. caudata*, *P. grandis*, *P. lachmanni*, *P. lohmanni*, *P. messinensis*, and *P. pellucida*).

**Parundella longa** Jörgensen

Figure 429

*Undella* (*Parundella*) *aculeata* forma *longa* Jörgensen, 1924, p. 47, fig. 53.

Raised to status of species.

Lorica elongate, narrow, 6.0 oral diameters in length; cylindrical in anterior 0.48, posteriorly a cone ( $30^\circ$ ); aboral horn conical ( $10^\circ$ ), 2.0 oral diameters in length, spine-like; wall thickened at base of spine. Length  $191\mu$ .

The type locality is Station 228 of the "Thor" just inside the Strait of Gibraltar. Occurs also (?) in the Indian Ocean.

Differs from *P. aculeata* in the more protracted aboral cone, longer lance, and more slender proportions.

**Parundella major** (Wailes)

Figure 428

*Tintinnus translucens* var. *major* Wailes, 1925, p. 535, pl. 2, fig. 15.

Raised to status of species.

Lorica elongate bell-shaped, 4.2 oral diameters in length; bowl cylindrical in anterior 0.5, an inverted cone ( $50^\circ$ ) posteriorly; aboral horn conical ( $15^\circ$ ), 0.75 oral diameter in length. Length 132–155 $\mu$ .

The type locality is the Strait of Georgia, British Columbia. Occurs also off San Francisco in the California Current.

Differs from *P. minor* in much larger size and in relatively longer bowl.

**Parundella messinensis** (Brandt) Jörgensen emended

Figure 444

*Undella messinensis*, *partim*, Brandt, 1906, pp. 9, 31, pl. 64, figs. 13, 30; 1907, pp. 369–370, 444, 471 (for pl. 64, fig. 29 see *P. lohmanni*).

*Undella* (*Parundella*) *messinensis*, Jörgensen, 1924, pp. 39, 48, 49, 50, fig. 55.

*Undella caudata*, *partim*, Jörgensen, 1924, pp. 39, 46 (see also *P. aculeata*, *P. caudata*, *P. grandis*, *P. lachmanni*, *P. lohmanni*, and *P. pellucida*).

*Undella* (*Parundella*) *lohmanni*, *partim*, Jörgensen, 1924, pp. 39, 48 (for fig. 54 see *P. lohmanni*, see also *P. lachmanni*).

**Parundella minor** (Wailes)

Figure 425

*Tintinnus translucens* var. *minor* Wailes, 1925, p. 535, pl. 2, figs. 16–17.

Raised to status of species.

Lorica short, stout bell-shaped, its length 2.8–3.2 oral diameters; bowl with or without suboral flare, cylindrical in anterior 0.5, conical ( $45^\circ$ ) posteriorly; aboral horn conical ( $25^\circ$ ), about 0.5 oral diameter in length. Length 45–51 $\mu$ .

The type locality is the Strait of Georgia, British Columbia. Occurs also off San Francisco in the California Current.

Differs from *P. grandis* in smaller size, shorter aboral cone, and more distinct lance; and from *P. major* in smaller size and stouter proportions.

It is possible that fig. 17 represents a second species, with a flaring collar, larger size, and slightly differing proportions, or that fig. 16 represents an incomplete lorica.

***Parundella pellucida* (Jørgensen) emended**

Figure 438

*Undella pellucida, partim*, Jørgensen, 1899, p. 41, pl. 1, fig. 7 (for fig. 8 see *P. caudata*).

*Undella lachmanni* var. b *caudata, partim*, Brandt, 1907, pp. 368, 458, 469 (see also *P. aculeata* and *P. caudata*).

*Undella caudata, partim*, Jørgensen, 1924, p. 46 (see also *P. aculeata, P. caudata, P. grandis, P. lachmanni, P. lohmanni*, and *P. messinensis*).

***Parundella praetenuis* sp. nov.**

Figure 439

Lorica short, slender, chalice-shaped, its length 2.28–3.20 oral diameters; suboral thickening weak and diffuse; cylindrical part of bowl 0.90–1.14 oral diameters in length, lower cone narrow (42°–50°); lance merging into the lower cone, 0.6–1.0 oral diameter in length, thin-walled distally. Length 89–113 $\mu$ .

The type locality is Station 4646 in the Peruvian Current. Occurs also in the Panamic Area and South Equatorial Drift.

Differs from *P. difficilis, P. lachmanni, P. lohmanni*, and *P. gigantea* in relative shortness of the bowl and relative greater length of the lance.

***Parundella spinosa* sp. nov.**

Figure 435

Lorica stout subcylindrical, 2.81–3.77 oral diameters in length; suboral ring prominent; aboral end broadly rounded; lance acicular, 0.28–0.86 oral diameter in length; wall 0.16–0.20 oral diameter in thickness in suboral ring and widest part of bowl. Length 100–132 $\mu$ .

The type locality is Station 4605 in the Mexican Current. Occurs also in the Panamic Area, Peruvian Current, Easter Island and Galapagos eddies, and the South Equatorial Drift.

Differs from *P. acuta* in the presence of the acicular spine.

***Parundella translucens* (Wailes) emended**

Figure 436

*Tintinnus translucens, partim*, Wailes, 1925, p. 538, figs. 11–13 (for pl. 2, fig. 14 see *P. lagena*).

## **Xystonella** Brandt emended Laackmann emended Jørgensen

*Cyttarocyelis*, *partim*, Brandt, 1907, pp. 181–188 (see also *Climacocyelis*, *Coxiella*, *Craterella*, *Cyttarocyelis*, *Favella*, *Parafavella*, *Porococcus*, *Tintinnopsis*, and *Xystonellopsis*).

*Xystonella* (subgenus and genus) Brandt, *partim*, 1907, pp. 235–239 (see also *Xystonellopsis*).

*Xystonella*, Laackmann, 1909, pp. 445, 448, 465; Jørgensen, 1924, pp. 7, 9, 25, 32–37, 50, 64.

*Undella*, Hensen, 1911, p. 243.

Xystonellidae with lorica subconical, very long and narrow; oral margin thickened and channeled between the two lamellae, the outer more or less flaring, and an inner usually forming an erect collar; bowl elongate, vase-like or conical; prolonged aborally in a spine or in a pedicel with knob or apophyses; with or without terminal lance; wall with a single middle prismatic layer.

We designate as the type species *Xystonella treforti* (Daday) Laackmann from the Mediterranean, the oldest species included in the genus.

Differs from *Xystonellopsis* and *Parundella* in having the oral rim channeled.

Includes 9 species as follows:

acus (Bdt.) Bdt.	longicauda (Bdt.) Bdt.
clavata Jörg.	minusecula sp. nov.
coronata Hensen	scandens (Bdt.) Bdt.
lanecolata (Bdt.) Bdt.	treforti (Daday) Laack.
lohmanni (Bdt.) Bdt.	

### **Xystonella acus** (Brandt) Brandt

Figure 447

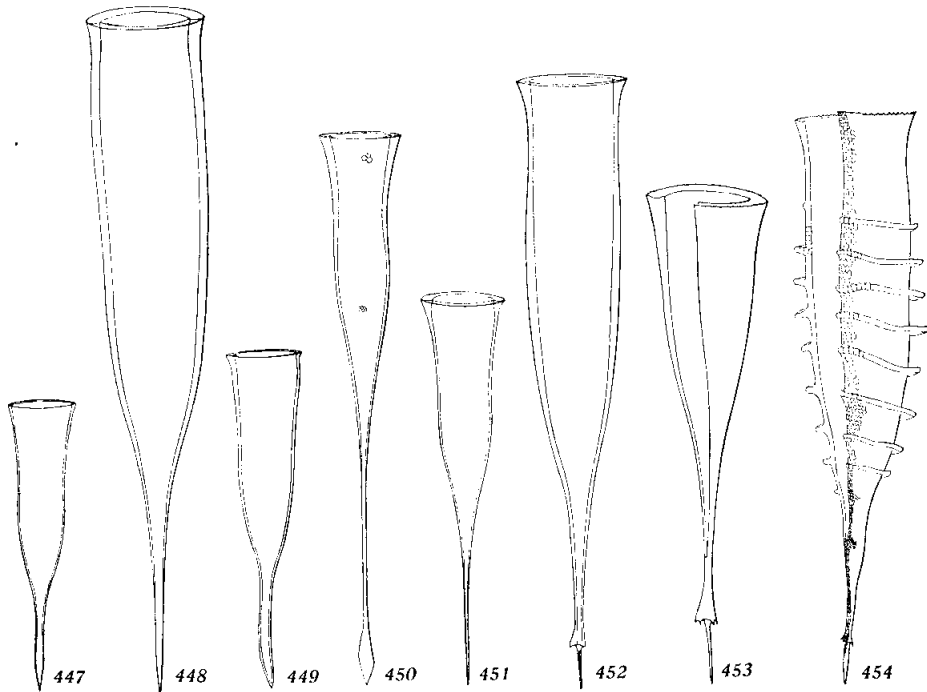
*Cyttarocyelis* (*Xystonella*) *acus* Brandt, 1906, pp. 6, 25, 26, pl. 45, figs. 4–6, pl. 50, figs. 7–9; 1907, pp. 244–247, 452, 481.

*Cyttarocyelis acus* Brandt, 1907, pp. 243, 245, 334.

*Cyttarocyelis treforti*, Cleve, 1901*d*, pp. 17, 113, *vide* Brandt, 1907, pp. 244, 481; Jørgensen, 1924, p. 34.

Non *Cyttarocyelis Treforti* Daday, 1887*b*, pp. 579–580, pl. 21, fig. 1 (see *X. treforti*).

*Xystonella acus* Brandt, 1907, pp. 28, 29, 184, 244–247; Jørgensen, 1924, p. 34.



Figs. 447-454. Species of *Xystonella* Bdt. emended Laackmann emended Jörgensen.  $\times 200$ .

Fig. 447. *X. acus* (Bdt.) Bdt. from Station 4689 in the South Equatorial Drift near the Easter Island Eddy.

Fig. 448. *X. lohmanni* (Bdt.) Bdt. after Jörgensen (1924, p. 33, fig. 38) from Station 234 of the "Thor" southwest of Portugal in the Atlantic.

Fig. 449. *X. lanceolata* (Bdt.) Bdt. after Jörgensen (1924, p. 33, fig. 41a) from Station 187 of the "Thor" off the Gulf of Taranto in the Mediterranean.

Fig. 450. *X. clavata* Jörg. after Jörgensen (1924, p. 33, fig. 40) from Station 152 of the "Thor" off the coast of Barka in the Eastern Mediterranean.

Fig. 451. *X. longicauda* (Bdt.) Brandt from Station 4689 in the South Equatorial Drift near the Easter Island Eddy.

Fig. 452. *X. treforti* (Daday) Laack. from Station 4713 in the Galapagos Eddy.

Fig. 453. *X. minuscula* sp. nov. from Station 4659 in the Peruvian Current.

Fig. 454. *X. scandens* (Bdt.) Bdt. from Station "Dahl, 18-II-97" off Ralun in the Western Tropical Pacific.

### ***Xystonella clavata* Jörgensen**

Figure 450

*Cyttarocypris* ? (*Xystonella*) *lanceolata* Brandt, *partim*, 1906, pp. 7, 24, pl. 42, fig. 8; 1907, pp. 258, 469 (for pl. 42, figs. 4-7 see *X. lanceolata*).

*Xystonella longicauda* var. *clavata* Jörgensen, 1924, pp. 33, 36, 37, fig. 40.

Raised to status of species.

Lorica very slender, very elongate, chalice-shaped, 6.0-8.7 oral diameters in length; oral region with a flaring, wide, horizontal



shelf, 1.5 oral diameters in diameter; bowl tapering, inverted conical, with two changes of slope,  $10^\circ$  in the oral 0.5 and  $15^\circ$  in the aboral 0.5 respectively; pedicel very long, 2.4–4.0 oral diameters in length, with a swollen angular lance about 1 oral diameter in length. Length 242–350 $\mu$ .

The type locality is off Messina, Italy. Occurs also in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *X. longicauda* in more slender proportions and in the presence of the posterior angular lance.

### **Xystonella coronata** Hensen

*Xystonella coronata* Hensen, 1911, p. 243. *Nomen nudum*.

### **Xystonella lanceolata** (Brandt) Brandt

Figure 449

*Cyttarocypris* ? (*Xystonella*) *lanceolata*, *partim*, Brandt, 1906, pp. 7, 24, pl. 42, figs. 4–7 (for pl. 42, fig. 8 see *X. clavata*).

(*Cyttarocypris* ?) *Xystonella lanceolata* Brandt, 1907, pp. 258, 469.

*Xystonella lanceolata* Brandt, 1907, pp. 28, 32, 45, 184, 237, 239, 258; Laackmann, 1909, p. 454, pl. 49, fig. 7; Jörgensen, 1924, pp. 33, 36, 37, fig. 41a.

[?] *Undella lanceolatus* Hensen, 1911, p. 243. *Nomen nudum*.

*Xystonella lanceolata* forma *clavigera* Jörgensen, 1924, p. 33, fig. 41b.

### **Xystonella lohmanni** (Brandt) Brandt

Figure 448

*Cyttarocypris* (*Xystonella*) *acus* var. *a lohmanni* Brandt, 1906, p. 26, pl. 50, figs. 5, 6; 1907, pp. 246, 452, 470.

*Xystonella acus* var. *lohmanni* Brandt, 1907, p. 246; Laackmann, 1909, p. 451, pl. 49, figs. 16, 17; Jörgensen, 1924, p. 34, fig. 38.

*Cyttarocypris denticulata* var. *gigantea* forma *edentata* Fauré-Fremiet, 1924, pp. 106–108, fig. 34, *vide* Jörgensen, 1924, p. 34.

Non *Tintinnus denticulatus* Ehrenberg, 1840, p. 201 (see *Favella denticulata*).

Raised to status of species.

Lorica 4.13–8.07 oral diameters in length; outer oral rim entire, channel shallow; bowl subcylindrical in anterior 0.6, usually contracted suborally to 0.75 oral diameter and widening near posterior cone to 0.85 oral diameter; aboral region contracting to  $25^\circ$ – $30^\circ$ ; posterior cone ( $25^\circ$ – $30^\circ$ ); pedicel slender, usually 2.0–2.5 oral diameters in length; no knob or lance; wall with regular hexagonal prisms about 25 in the circumference of the bowl, smaller suborally and posteriorly. Length 330–580 $\mu$ .

The type locality is off Messina. Occurs also in other parts of the Mediterranean, the Bay of Biscay, off New Amsterdam, and in the Benguela and Brazil currents.

Differs from *X. acus* in larger size, greater elongation, and narrower bowl and from *X. lanceolata* in narrower pedicel and larger size.

***Xystonella longicauda* (Brandt) Brandt<sup>?</sup> emended**

Figure 451

*Cyttarocyclus* (*Xystonella*) *acus* var. *b longicauda* Brandt, 1906, p. 26, pl. 50, figs. 1-4.

*Cyttarocyclus inflexa* Brandt, 1906, p. 20, pl. 31, figs. 4, 5; 1907, p. 247.

*Xystonella acus* var. *b longicauda*, Brandt, 1907, pp. 239, 246, 247, 452, 470.

*Xystonella longicauda*, Laackmann, 1909, p. 451; Jörgensen, 1924, pp. 33, 35-37, figs. 39a, b.

***Xystonella minuscula* sp. nov.**

Figure 453

*Cyttarocyclus* (*Xystonella*) *treforti*, *partim*, Brandt, 1906, p. 33, pl. 68, fig. 9 (for pl. 47, figs. 2, 3, 6, 7, 9 and pl. 48, fig. 1 see *X. treforti*); 1907, pp. 240-243, 481.

Lorica 4.24 (3.67-4.69) oral diameters in length; outer oral rim finely denticulate; bowl slightly concave anteriorly, contracting to 25°-35° posteriorly; pedicel slender, 0.92-1.77 oral diameters in length; knob variously skirted and toothed; lance slender, 0.17-0.58 oral diameters in length; wall with minute alveoli posteriorly. Length 268-350 $\mu$ .

The type locality is Station 4659 in the Peruvian Current. Occurs also in the Panamic Area, Easter Island and Galapagos eddies, the South Equatorial Drift, off New Zealand, and in the Black Current.

Differs from *X. treforti* in shorter, stouter conical bowl.

***Xystonella scandens* (Brandt) Brandt**

Figure 454

*Cyttarocyclus* (*Xystonella*) *scandens* Brandt, 1906, pp. 6, 25, pl. 47, fig. 8, pl. 48, fig. 2; 1907, pp. 243, 244, 260, 265, 478.

*Cyttarocyclus scandens* Brandt, 1907, p. 30.

*Xystonella scandens* Brandt, 1907, pp. 28, 29, 42, 236, 238, 239, 243-244.

**Xystonella treforti** (Daday) Laackmann

Figure 452

*Cyrtarocydis Treforti* Daday, 1887*b*, pp. 515, 579, pl. 21, fig. 1; Kofoid, 1905, p. 291; Brandt, 1907, p. 240.

Non *Cyrtarocydis treforti*, Cleve, 1901*d*, pp. 17, 113 (see *X. acus*), *fide* Brandt, 1907, pp. 244, 481 and Jörgensen, 1924, p. 34.

*Cyrtarocydis quadridens* Kofoid, 1905, pp. 290, 293, pl. 27, figs. 8-11, pl. 28, fig. 18.

*Cyrtarocydis (Xystonella) treforti*, Brandt, *partim*, 1906, p. 25, pl. 47, figs. 2, 3, 6, 7, 9, pl. 48, fig. 1; 1907, pp. 240-243, 481 (for pl. 68, fig. 9 see *X. minuscula*).

*Cyrtarocydis (Xystonella) Treforti*, Entz, Jr., 1908, p. 126, pl. 2, fig. 3.

*Cyrtarocydis (Xystonella) Trefortii*, Entz, Jr., 1908, p. 113; 1909*b*, p. 215, pl. 9, fig. 3.

*Xystonella treforti*, Laackmann, 1909, p. 449; Jörgensen, 1924, pp. 33, 34, fig. 37.

*Xystonella Trefortii*, Entz, Jr., 1909*b*, p. 199.

**Xystonellopsis** Jörgensen

*Tintinnus, partim*, Biedermann, 1893, pp. 27-32 (see also *Rhabdonella* and *Stelidiella*).

*Undella, partim*, Cleve, 1900*d*, pp. 974-975 (see also *Craterella* and *Favella*); Brandt, 1907, pp. 343-374 (see also *Amplectella*, *Cricundella*, *Parundella*, *Undella*, and *Undellopsis*); Laackmann, 1909, pp. 467-479 (see also *Albatrossiella*, *Amplectella*, *Undella*, and *Undellopsis*).

*Cyrtarocydis, partim*, Kofoid, 1905, pp. 292-296 (see also *Coxiella*); Brandt, *partim*, 1907, pp. 181-188 (see also *Climacocydis*, *Coxiella*, *Craterella*, *Cyrtarocydis*, *Favella*, *Parafavella*, *Porococcus*, *Tintinnopsis*, and *Xystonella*).

*Xystonella, partim*, Brandt, 1907, pp. 235-239 (see also *Xystonella*).

*Xystonellopsis* Jörgensen, 1924, pp. 7, 8, 25, 37, 46, 50, 64; Campbell, 1927, p. 430.

Xystonellidae with lorica elongated and usually narrow, chalice-shaped; oral rim thinning to sharp edge without a gutter; bowl vase-shaped or conical; pedicel very elongated, often with skirt; terminal lance usually present; wall with three well developed lamellae, the middle one of numerous small prismatic alveoli.

We designate as the type species *Xystonellopsis paradoxa* (Cleve) Jörgensen from the Atlantic off the Azores, the oldest species included in the genus by its founder.

Differs from *Xystonella* in the absence of the channel in the oral rim and from *Parundella* in having an abruptly flared oral margin.

Includes 31 species as follows:

abbreviata sp. nov.	hastata (Biedermann)
acuminata sp. nov.	heroica sp. nov.
armata (Bdt.)	heros (Cleve)
brandti (Laack.) Jörg.	inaequalis sp. nov.
clevei sp. nov.	krämeri (Bdt.)
conicaecauda sp. nov.	laticincta sp. nov.
constricta sp. nov.	mascarensis sp. nov.
crassispinosa sp. nov.	ornata (Bdt.)
cyclas sp. nov.	paradoxa (Cleve) Jörg.
cymatica (Bdt.) Jörg.	pinnata sp. nov.
dahli (Bdt.)	pulehra (Kofoid)
dicymatica (Bdt.)	scyphium Jörg.
dilatata (Bdt.)	spicata (Bdt.) Jörg.
epigrus sp. nov.	tenuirostris (Bdt.)
favata (Bdt.) Jörg.	torta (Kofoid)
gaussi (Laack.)	

***Xystonellopsis abbreviata* sp. nov.**

Figure 468

Lorica 4.88–5.63 oral diameters in length; three suboral rings, nearly equidistant; suboral band 1.02–1.44 oral diameters in height, often thickened between rings; pedicel 1.82–2.26 oral diameters in length, its torsion restricted. Length 275–336 $\mu$ .

The type locality is Station 4571 in the California Current.

Differs from *X. pulchra* in its narrower suboral band and shorter pedicel.

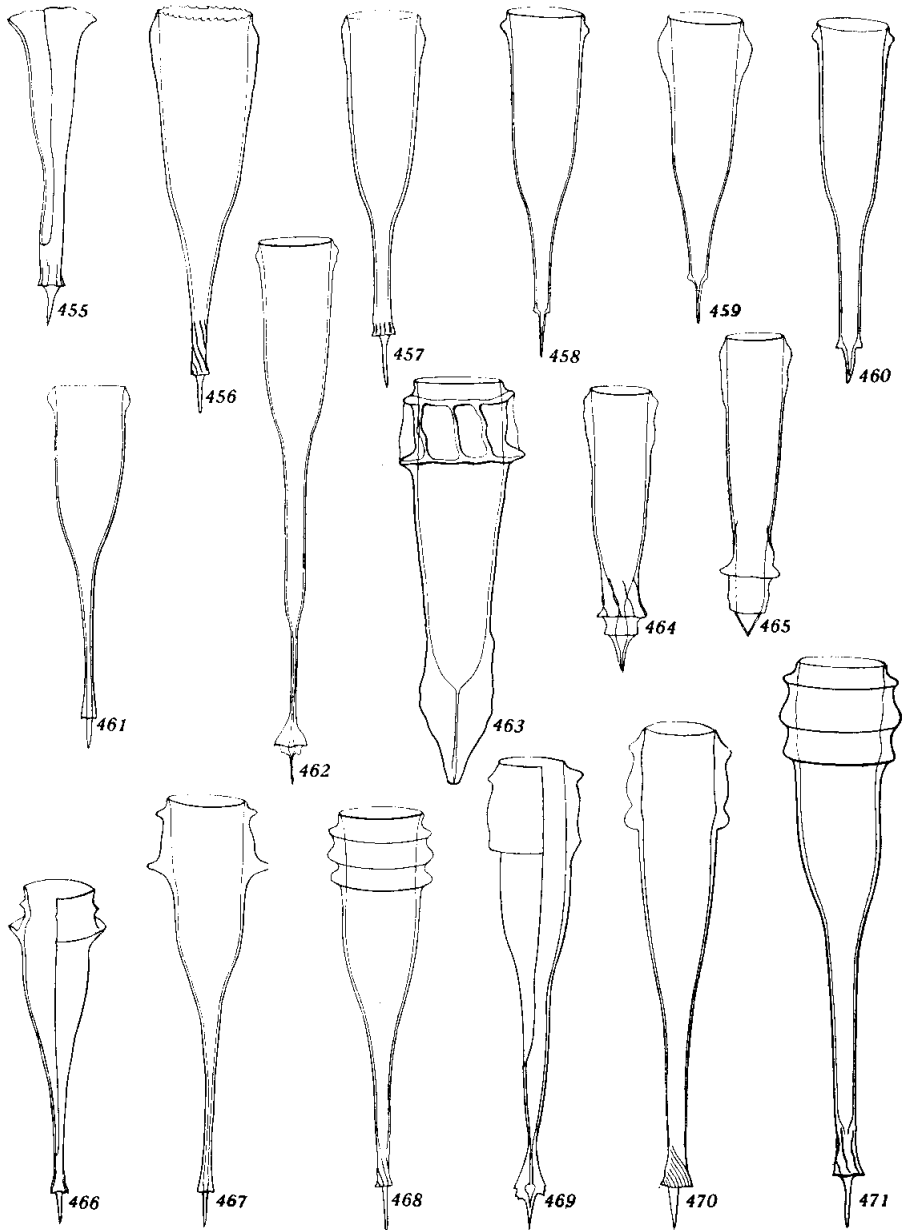
***Xystonellopsis acuminata* sp. nov.**

Figure 482

Lorica stout and short, subconical, 5.62–6.00 oral diameters in length; bowl subcylindrical above, tapering, conical ( $13^{\circ}$ ) from its middle to the slightly differentiated skirt; lance slender, conical, 0.5 oral diameter in length. Length 354–414 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican Current.

Differs from *X. gaussi* in absence of differentiated pedicel and from *X. dahli* in the more fully developed skirt.



Figs 455-471; 472-485. Species of *Xystonellopsis* Jörg.  $\times 200$ .

Figs. 455-471.

Fig. 455. *X. dilatata* (Bdt.) from Brandt (1906, pl. 47, fig. 1) from Station Pl. 65 of the Plankton Expedition in the North Equatorial Current.

Fig. 456. *X. hastata* (Biedermann) from Station 4707 in the South Equatorial Drift of the Pacific.

**Xystonellopsis armata** (Brandt)

Figure 481

*Undella armata* Brandt, 1906, p. 9; 1907, p. 373; Laackmann, 1909, p. 490, pl. 48, fig. 9.

*Undella* ? (*Xystonella*) *armata* Brandt, 1906, p. 24, pl. 43, figs. 4, 5, 5a.

*Undella* ? (*Xystonella*) *armata* var. a Brandt, 1906, p. 24, pl. 43, figs. 6, 7.

*Undella armata* var. a Brandt, 1907, pp. 350-351, 371, 373, 455; Laackmann, 1909, pp. 477-478.

*Xystonella armata*, Steuer, 1910, p. 202, fig. 117; Lühe, 1913, p. 176, fig. 168, Nos. 4 4a.

Non *Cyrtarocyclus armata*, Entz, Jr., 1908, p. 113 *vide* p. 127. *Lapsus pennae* for *C. arcuata* (see *Favella chrenbergii*).

**Xystonellopsis brandti** (Laackmann) Jörgensen

Figure 474

*Undella heros* var. c Brandt, 1907, p. 373; Laackmann, 1909, pp. 476, 478.

*Undella heros*, Entz, Jr., 1908, pp. 114, 128, pl. 6, fig. 7; 1909b, pp. 195, 217, pl. 13, fig. 7.

*Undella tenuirostris* var. *brandti* Laackmann, 1909, pp. 478, 479, pl. 50, figs. 1, 2.

*Xystonellopsis brandti*, Jörgensen, 1924, pp. 51, 53, fig. 60.

*Undella* (*Xystonella*) *heros*, Entz, Jr., 1908, pp. 106, 134, pl. 13, figs. 13, 14.

*Undella* (*Xystonella*) *heros*, Entz, Jr., 1909b, pp. 223, pl. 20, figs. 13, 14.

Figs. 455-471; 472-485. Species of *Xystonellopsis* Jörg. × 200.

Figs. 455-471. (*Concluded.*)

Fig. 457. *X. cyelas* sp. nov. from Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 458. *X. cymatica* (Bdt.) Jörg. from Station 4689 in the South Equatorial Drift near the Easter Island Eddy.

Fig. 459. *X. spicata* (Bdt.) Jörg. from Station 4676 in the Peruvian Current.

Fig. 460. *X. crassispinosa* sp. nov. from Station 4711 in the South Equatorial Drift of the Pacific.

Fig. 461. *X. mascarensis* sp. nov. after Laackmann (1909, pl. 49, fig. 6) from "Gauss" Station in the Mascarene Current.

Fig. 462. *X. clevei* sp. nov. from Station 4699 in the Easter Island Eddy.

Fig. 463. *X. ornata* (Bdt.) from Station 4571 in the California Current.

Fig. 464. *X. paradoxa* (Cleve) Jörg. from Station 4583 in the California Current.

Fig. 465. *X. conicacauda* sp. nov. from Station 4685 in the South Equatorial Drift of the Pacific.

Fig. 466. *X. inaequalis* sp. nov. after Brandt (1906, pl. 45, fig. 3) from Station Pl. 77 of the Plankton Expedition in the South Equatorial Current.

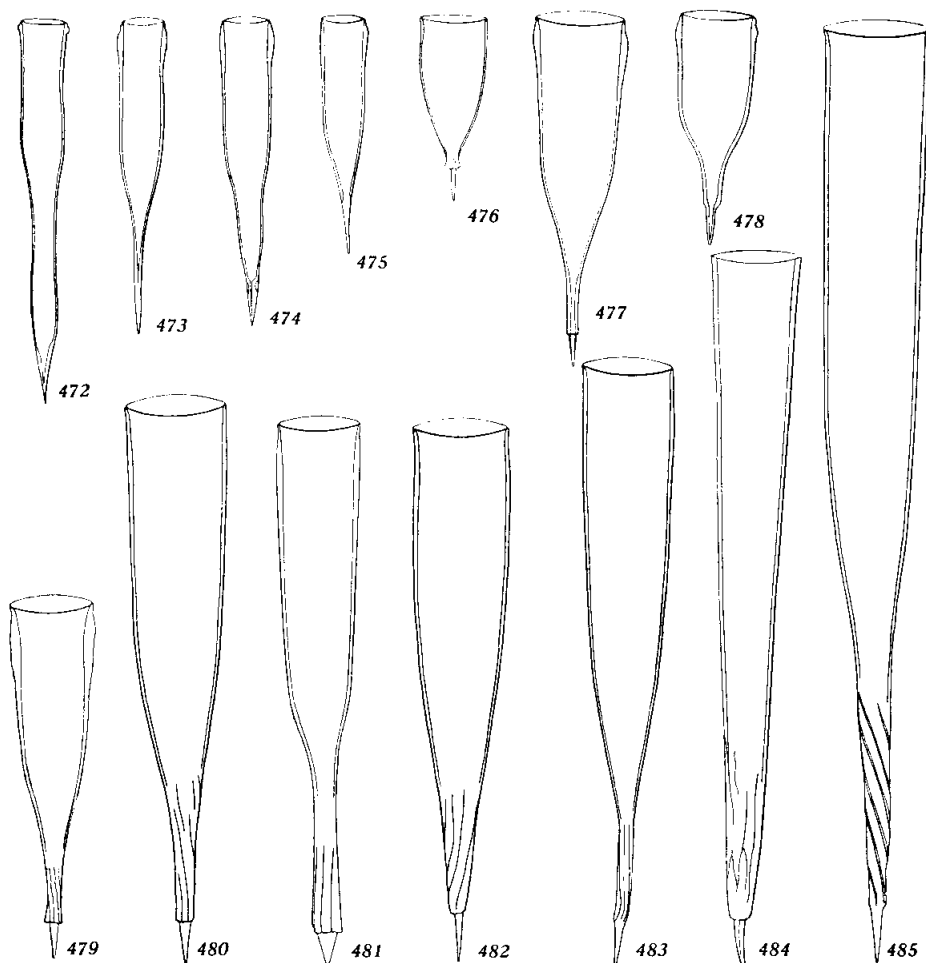
Fig. 467. *X. dieymatica* (Bdt.) from Station 4722 in the South Equatorial Drift of the Pacific.

Fig. 468. *X. abbreviata* sp. nov. from Station 4571 in the California Current.

Fig. 469. *X. laticincta* sp. nov. from Station 4707 in the South Equatorial Drift of the Pacific.

Fig. 470. *X. torta* (Kofoid) after Kofoid (1905, p. 128, fig. 16) from off San Diego in the California Current.

Fig. 471. *X. pulchra* (Kofoid) from Station 4571 in the California Current.



Figs. 472-485. Species of *Xystonellopsis* Jörg.  $\times 200$ . (Continued.)

Fig. 472. *X. constricta* sp. nov. from Station 4699 in the Easter Island Eddy.

Fig. 473. *X. heroica* sp. nov. from Station 4671 in the Peruvian Current.

Fig. 474. *X. brandti* (Laack.) Jörg. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 475. *X. pinnata* sp. nov. from Station 4717 in the South Equatorial Drift of the Pacific.

Fig. 476. *X. epigrus* sp. nov. from Station 4734 in the South Equatorial Drift of the Pacific.

Fig. 477. *X. favata* (Bdt.) Jörg. from Station 4679 in the South Equatorial Drift on the boundary of the Peruvian Current.

Fig. 478. *X. scyphium* Jörg. after Jörgensen (1924, p. 51, fig. 56b) from Station 184 of the "Thor" in the Gulf of Corinth.

Fig. 479. *X. tenuirostris* (Bdt.) from Station 4717 in the South Equatorial Drift near the Galapagos Eddy.

Fig. 480. *X. gaussi* (Laack.) from Station 4574 in the California Current off San Diego.

**Xystonellopsis clevei** sp. nov.

Figure 462

Lorica exceedingly elongate, 6.54–7.50 oral diameters in length; suboral ring single; suboral band lacking or feebly developed; bowl chalice-shaped, a bit longer than the upper pedicel; pedicel very elongate (167–213 $\mu$ ) slender, serially duplicated with wider upper and narrower lower sections; knob wide, subquadrangular with smaller serially duplicated lower section; lance 0.26–0.49 oral diameter in length. Length 323–580 $\mu$ .

The type locality is Station 4699 in the Easter Island Eddy. Occurs also in the South Equatorial Drift.

Differs from *X. laticincta* in larger size, longer pedicel, and in having one instead of two rings.

**Xystonellopsis conicacauda** sp. nov.

Figure 465

Lorica 4.66–5.15 oral diameters in length, subconical (15°); not constricted at pedicel; 4 to 12 spiral ridges above the knob; knob duplicated, distance between its rings about 0.5 oral diameter; lance conical (60°), its length less than its basal diameter with wide cavity extending to its aboral tip. Length 188–229 $\mu$ .

The type locality is Station 4685 in the South Equatorial Drift. Occurs also in the Easter Island Eddy.

Differs from *X. paradoxa* in stout, short lance, and more slender bowl.

**Xystonellopsis constricta** sp. nov.

Figure 472

Lorica very elongated, 7.18–9.07 oral diameters in length, very slender chalice-shaped; oral region slightly concave above the slight aboral ring; suboral band thin; bowl subcylindrical; pedicel very

Figs. 472–485. Species of *Xystonellopsis* Jörg.  $\times$  200. (Concluded.)

Fig. 481. *X. armata* (Brandt) from Station 4679 in the South Equatorial Drift near the margin of the Peruvian Current.

Fig. 482. *X. acuminata* sp. nov. from Station 4583 in the California Current.

Fig. 483. *X. dahli* (Bdt.) from Station 4617 in the Panamie Area of the Pacific.

Fig. 484. *X. heros* (Cleve) after Cleve (1900*d*, p. 974, fig. 11) from the Sargasso Sea.

Fig. 485. *X. krämeri* (Bdt.) from Station 4683 in the South Equatorial Drift of the Pacific.



long, 2.13–3.27 oral diameters in length, very stout, 0.5 oral diameter in diameter; no knob; deep constriction above the slender, conical ( $12^\circ$ ) lance, with prominent prismatic lists in the constriction. Length 210–248 $\mu$ .

The type locality is Station 4699 in the Easter Island Eddy. Occurs also in the South Equatorial Drift.

Differs from *X. brandti* in greater differentiation of pedicel and lance and from all species in the relatively great diameter of the pedicel.

***Xystonellopsis crassispinosa* sp. nov.**

Figure 460

Lorica elongated, 5.3–5.6 oral diameters in length, chalice-shaped; suboral ring distinct; bowl and pedicel subequal in length; pedicel very stout, 0.4 oral diameter in diameter; lance stout, conical ( $19^\circ$ – $28^\circ$ ), its basal diameter about 0.5 of its length. Length 244–265 $\mu$ .

The type locality is Station 4711 in the South Equatorial Drift. Occurs also in the Peruvian Current and the Galapagos Eddy.

Differs from *X. cyclas* in wider, stouter pedicel and much stouter lance.

***Xystonellopsis cyclas* sp. nov.**

Figure 457

*Cyrtarocydis* (*Xystonella*) *cymatica* var. b Brandt, 1906, p. 25, pl. 44, fig. 6, pl. 45, fig. 1; 1907, p. 460.

*Xystonella cymatica* var. b Brandt, 1907, pp. 249, 252.

Lorica stout chalice-shaped, 5.00–5.74 oral diameters in length; suboral ring distinct; bowl almost twice the length of the pedicel, subconical ( $8^\circ$ ), contracting rather abruptly to the pedicel; pedicel stout, its diameter nearly 0.3 oral diameter; knob with flaring skirt and short striae; lance slender, tapering at base, 0.75 oral diameter in length. Length 238–249 $\mu$ .

The type locality is Station Pl. 67 of the Plankton Expedition, in the North Equatorial Current of the Atlantic. Occurs also in the Panamic Area, Peruvian Current, Easter Island Eddy, and the South Equatorial Drift of the Pacific.

Differs from *X. crassispinosa* in being less robust and in having a pedicel and a more slender, more elongated lance.

**Xystonellopsis cymatica** (Brandt) Jörgensen emended

Figure 458

*Cyttarocyclus* (*Xystonella*) *cymatica* Brandt, 1906, pp. 6, 25, pl. 44, figs. 3, 4; 1907, pp. 251, 252, 476.

*Cyttarocyclus cymatica* Brandt, 1907, p. 30.

*Xystonella cymatica* Brandt, 1907, pp. 247-252; Laackmann, *partim*, 1909, pp. 423, 430, 449, 452, 453, 479, 492 (for pl. 49, fig. 5 see *X. spicata*).

*Cyttarocyclus* (*Xystonella*) *cymatica* var. a Brandt, 1906, p. 25, pl. 44, fig. 5, pl. 45, fig. 2; 1907, p. 460.

*Xystonella cymatica* var. a Brandt, 1907, pp. 249, 251.

*Xystonellopsis cymatica*, *partim*, Jörgensen, 1924, pp. 50, 51, 52, figs. 57a, 57b (see also *X. spicata*).

**Xystonellopsis dahli** (Brandt)

Figure 483

*Undella* ? (*Xystonella*) *heros* var. b *dahli* Brandt, 1906, p. 24, pl. 43, figs. 1-3.

*Undella heros* var. b *dahli* Brandt, 1907, p. 371-373, 461, 467; Laackmann, 1909, pp. 476, 479.

Raised to status of species.

Lorica elongate, chalice-shaped, 6.53-7.29 oral diameters in length; oral rim thinning on the inner face to a sharp oral edge; bowl with upper 0.6 subcylindrical, lower 0.4 subconical ( $7^{\circ}$ - $12^{\circ}$ ), slightly concave; without a differentiated knob; pedicel 1.5 oral diameters in length, with 6-7 leiotropic lists extending to the lower part of the aboral cone; wall minutely prismatic, becoming coarser in the pedicel. Length 396-444 $\mu$ .

The type locality is Station "Dahl, 6-IX-96," off Ralun in the Western Tropical Pacific. Occurs also in the Mexican, Peruvian, and South Equatorial currents, Panamic Area, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *X. krämeri* in smaller size, less aboral concavity, and less differentiated aboral region and from *X. gaussi* and *X. acuminata* in entire lack of skirt.

**Xystonellopsis dicymatica** (Brandt)

Figure 467

*Cyttarocyclus* (*Xystonella*) *dicymatica* Brandt, 1906, pp. 6, 25, 33, pl. 46, figs. 1, 2, pl. 68, fig. 10; 1907, pp. 252-254, 462, 476.

*Cyttarocyclus dicymatica*, Brandt, 1907, p. 30.

*Xystonella dicymatica*, Brandt, 1907, pp. 27, 28, 184, 237, 239, 248-251, 255; Laackmann, *partim*, 1909, pp. 452-453 (for pl. 49, fig. 6 see *X. mascarensis*).

**Xystonellopsis dilatata** (Brandt)

Figure 455

*Cyttarocypris* ? (*Xystonella*) *dilatata* Brandt, 1906, pp. 7, 25, pl. 47, fig. 1; 1907, pp. 259, 462.

*Xystonella dilatata* Brandt, 1907, pp. 27, 241.

**Xystonellopsis epigrus** sp. nov.

Figure 476

Lorica elongate goblet-shaped 2.86–2.87 oral diameters in length; bowl with convex sides, subcylindrical in anterior 0.5, subconical ( $43^\circ$ ) aborally; contracting into a short, stout, striate pedicel; lance slender, its length 0.5 oral diameter. Length 123–126 $\mu$ .

The type locality is Station 4734 in the South Equatorial Drift. Occurs also in the Easter Island Eddy.

Differs from *X. scyphus* in its shorter, non-fusiform pedicel and in the presence of striae on the pedicel.

**Xystonellopsis favata** (Brandt) Jörgensen

Figure 477

*Cyttarocypris* ? (*Xystonella*) *favata* Brandt, 1906, pp. 7, 25, pl. 44, fig. 2, pl. 47, fig. 5; 1907, pp. 259, 465.

*Xystonella favata*, Brandt, 1907, pp. 28, 241.

*Xystonellopsis favata*, Jörgensen, 1924, p. 51.

**Xystonellopsis gaussi** (Laackmann)

Figure 480

*Undella heros* var. *gaussi* Laackmann, 1909, pp. 429, 468, 476–478, 493, pl. 49, figs. 23, 24.

Raised to status of species.

Lorica relatively short and stout, 5.62–6.58 oral diameters in length; no suboral ring; bowl 0.75 total length in length, inverted subconical ( $3^\circ$ ) anteriorly; aboral cone contracting more rapidly ( $20^\circ$ – $22^\circ$ ), 1.0 oral diameter in length; pedicel 0.6–1.0 oral diameter in length; terminating in a squarely truncate skirt without expansion; with 6–8 dextrotropic lists on pedicel and lower part of cone; lance slender, conical ( $15^\circ$ ), 0.4–0.5 oral diameter in length. Length 371–470 $\mu$ .

The type locality is the South Equatorial Current of the Atlantic. Occurs also in the Guinea Current of the Atlantic and in the California Current.

Differs from *X. dahl*i in having a skirt.

**Xystonellopsis hastata** (Biedermann)

Figure 456

*Tintinnus hastatus* Biedermann, 1893, p. 27, pl. 2, fig. 3.

*Cyrtarocydis* (*Xystonella*) *hastata*, Brandt, 1906, p. 26, pl. 49, figs. 1, 2; 1907, pp. 239-240, 467.

*Cyrtarocydis hastata*, Brandt, 1907, p. 30.

*Xystonella hastata*, Brandt, 1907, pp. 27, 236, 239, 241.

**Xystonellopsis heroica** sp. nov.

Figure 473

Lorica very slender, very elongated, chalice-shaped, its length 6.21-7.39 oral diameters; suboral thickening slight; bowl with slight median zone of lateral constriction, subconical ( $24^{\circ}$ - $28^{\circ}$ ) in its lower third; no lists; lance very long, 1.72-2.68 oral diameters in length. Length 174-218 $\mu$ .

The type locality is Station 4671 in the Peruvian Current.

Differs from *X. pinnata* and *X. heros* in greater length of bowl and lance.

**Xystonellopsis heros** (Cleve)

Figure 484

*Undella heros* Cleve, 1900d, p. 974, fig. [11]; Brandt, 1907, pp. 370-372, 467.

*Undella* ? (*Xystonella*) *heros*, Brandt, 1906, p. 24, pl. 42, figs. 1-2.

*Xystonella heros*, Brandt, 1907, p. 184; Laackmann, 1909, pp. 476-479.

**Xystonellopsis inaequalis** sp. nov.

Figure 466

*Cyrtarocydis* (*Xystonella*) *dicymatica* var. a Brandt, 1906, p. 25, pl. 45, figs. 3, 3a.

*Xystonella dicymatica* var. a Brandt, 1907, pp. 248, 249, 253.

Lorica 4.63-5.75 oral diameters in length; lower suboral ring wider than upper, its diameter 1.32-1.56 oral diameters, length of suboral band 0.68-0.86 oral diameter; bowl short, less than pedicel in length, contracting gradually ( $20^{\circ}$ ) into the pedicel; pedicel long, slender 0.09-0.18 oral diameter in diameter; knob quadrangular; lance very slender, 0.37-0.67 oral diameters in length. Length 246-305 $\mu$ .

The type locality is Station Pl. 77 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the

Peruvian and South Equatorial currents, Galapagos Eddy, and the South Equatorial Drift.

Differs from *X. dicymatica* in its wider lower suboral ring and thicker suboral band.

### ***Xystonellopsis krämeri* (Brandt)**

Figure 485

*Undella* ? (*Xystonella*) *heros* var. a *krämeri* Brandt, 1906, p. 24, pl. 42, figs. 3, 3a, 3b.

*Undella* (*Xystonella*) *Heros* var. a *Krämeri*, Entz, Jr., 1908, p. 106.

*Undella heros* var. *krämeri* Brandt, 1907, pp. 345-351, 356, 371-372, 467, 469; Laeckmann, 1909, p. 476.

Raised to status of species.

Lorica attenuate awl-shaped, 7.76-8.83 oral diameters in length; oral rim thinning to a sharp edge; bowl as a whole forming a cone of 7°, subconical (1°-2°) in the anterior 0.66 of its length and more sloping (10°-15°) below; pedicel cylindrical, 0.6 oral diameter in length; with 5-8 slightly leiotropic lists; skirt feebly developed; lance conical (20°), 0.55 oral diameter in length; wall soft and delicate with minute prisms becoming coarser in the pedicel and horn. Length 535-618 $\mu$ .

The type locality is Station "Krämer, 16-XI-93" from off the Tonga Islands in the Western Tropical Pacific. Occurs also in the Peruvian Current, Easter Island Eddy, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *X. dahl*i in larger size and greater differentiation of skirt.

### ***Xystonellopsis laticincta* sp. nov.**

Figure 469

Lorica elongate chalice-shaped, 6.37-7.00 oral diameters in length; two suboral rings including between them a thickened suboral band; bowl shorter than the pedicel, contracting abruptly; pedicel elongated, serially duplicated with wider upper (0.25 oral diameter) and narrower, shorter lower (0.12 oral diameter) section; knob widely flaring, toothed with smaller, serially duplicated lower section; lance very slender, 0.41-0.42 oral diameter in length. Length 304-343 $\mu$ .

The type locality is Station 4707 in the South Equatorial Drift.

Differs from *X. clevei* in its two suboral rings and included suboral band and in its relatively shorter pedicel.

**Xystonellopsis mascarensis** sp. nov.

Figure 461

*Xystonella dicymatica*, *partim*, Laackmann, 1909, pp. 452-453, pl. 49, fig. 6 (see *X. dicymatica*).

Lorica elongated, 4.8 oral diameters in length; suboral ring single, distinct; bowl and pedicel subequal, the former subcylindrical in its anterior 0.6, convex conical ( $33^\circ$ ) posteriorly, merging gradually into the pedicel; pedicel tapering, 0.1 oral diameter in diameter; knob skirted, quadrangular; lance slender, 0.6 oral diameter in length. Length  $275\mu$ .

The type locality is "Gauss" Station (15-V-03) in the Mascarene Current.

Differs from *X. cymatica* in the narrow posterior cone and in its shorter length and from *X. dicymatica* in having only a single suboral ring.

**Xystonellopsis ornata** (Brandt)

Figure 463

*Cyttarocyclus* (*Xystonella*) *ornata* Brandt, 1906, pp. 6, 26, pl. 49, figs. 3-5; 1907, pp. 254-256, 474.

*Cyttarocyclus ornata* Brandt, 1907, p. 30.

*Xystonella ornata* Brandt, 1907, pp. 237, 254, 255.

**Xystonellopsis paradoxa** (Cleve) Jörgensen

Figure 464

*Undella paradoxa* Cleve, 1900d, pp. 974-975, fig. [12].

*Cyttarocyclus* ? (*Xystonella*) *paradoxa*, Brandt, 1906, pp. 25, 26, pl. 48, figs. 3-6; 1907, pp. 256-258, 475; Entz, Jr., 1908, pp. 113, 127, 135, pl. 5, fig. 1, pl. 13, figs. 15-17; 1909b, pp. 216, 223, pl. 12, fig. 1, pl. 20, figs. 15-17.

*Xystonella paradoxa*, Brandt, 1907, pp. 27, 237-239, 254, 255; Laackmann, 1909, p. 453, pl. 49, fig. 8.

*Cyttarocyclus paradoxa*, Brandt, 1907, p. 30.

*Xystonellopsis paradoxa*, Jörgensen, 1924, pp. 51, 52; 1927, fig. 59.

**Xystonellopsis pinnata** sp. nov.

Figure 475

Lorica small, slender chalice-shaped, its length 5.54-5.68 oral diameters; suboral thickening slight; bowl cylindrical for 0.5 total length, contracting in the next quarter to a lower cone ( $30^\circ$ ); lance 1.43-1.50 oral diameters long, with salient lists at its junction with the bowl. Length  $155-159\mu$ .

The type locality is Station 4717 in the South Equatorial Drift. Occurs also in the Panamic Area.

Differs from *X. heroica* in shorter bowl, much shorter lance, and less lateral concavity.

### **Xystonellopsis pulchra** (Kofoid)

Figure 471

*Cyttarocyllis pulchra* Kofoid, 1905, pp. 292-296, pl. 28, figs. 19-23; Brandt, 1907, pp. 30, 236, 248, 253-254, 476.

*Cyttarocyllis (Xystonella) pulchra, partim*, Brandt, 1906, p. 25, pl. 46, figs. 3-4 (for pl. 46, fig. 5 see *X. torta*); 1907, pp. 21, 253, 254, 476.

*Xystonella pulchra*, Brandt, 1907, pp. 27, 28, 42, 237, 238, 239, 248, 249, 250. *Coxiella (Cyttarocyllis) pulchra*, Campbell, 1927, p. 445.

### **Xystonellopsis scyphium** Jörgensen

Figure 478

*Xystonellopsis scyphium* Jörgensen, 1924, pp. 50, 51, figs. 56a, 56b.

### **Xystonellopsis spicata** (Brandt) Jörgensen

Figure 459

*Cyttarocyllis (Xystonella) cymatica* var. *e spicata* Brandt, 1906, p. 25, pl. 47, fig. 4; 1907, pp. 461, 479.

*Xystonella cymatica* var. *e spicata* Brandt, 1907, pp. 237, 249, 250, 252, 374.

*Xystonella cymatica* var. *spicata*, Laackmann, 1909, p. 479.

*Xystonella spicata* Brandt, 1907, p. 252.

*Xystonella cymatica, partim*, Laackmann, 1909, pp. 423, 430, 449, 452, 453, 479, 492, pl. 49, fig. 5 (see also *X. cymatica*).

*Xystonellopsis cymatica, partim*, Jörgensen, 1924, pp. 50-52 (for figs. 57a and 57b see *X. cymatica*).

*Xystonellopsis cymatica* var. *spicata*, Jörgensen, 1924, pp. 51-52, fig. 58.

### **Xystonellopsis tenuirostris** (Brandt)

Figure 479

*Undella? (Xystonella) tenuirostris* Brandt, 1906, pp. 9, 24, 25, pl. 43, fig. 8, pl. 44, fig. 1.

*Undella tenuirostris* Brandt, 1907, pp. 21, 27, 43, 238, 344, 345, 347, 350, 351, 371, 373, 374, 481; Laackmann, 1909, pp. 476, 478, 479.

### **Xystonellopsis torta** (Kofoid)

Figure 470

*Cyttarocyllis torta* Kofoid, 1905, pp. 295-296, pl. 27, figs. 12-15, pl. 28, figs. 16, 17; Brandt, 1907, pp. 236, 237, 248, 254, 476, 481.

*Cyttarocyllis pulchra* var. *torta*, Brandt, 1907, pp. 476, 481.

*Cyttarocyllis pulchra, partim*, Brandt, 1906, p. 25, pl. 46, fig. 5 (for pl. 46, figs. 3, 4 see *X. pulchra*).

## Family UNDELLIDAE fam. nov.

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxliellidae, Cytтарыcyllidae, Ptychoeyllidae, Tintinnidae, Tintinnididae, and Xystonellidae).

Tintinnoinea with goblet-shaped lorica; suboral region variously diversified; with or without rings and with or without aboral expansion; aboral end closed; wall trilamellate, the intermediate zone without secondary structure; with 2-4 macronuclei, 1-4 micronuclei and 20 membranelles. Eupelagic and marine.

Differs from all other families in the peculiar goblet- or bowl-shaped loricae and in the structure of the wall which has very distinct and thickened inner and outer laminae and an intermediate zone with only a fine primary structure entirely without secondary pattern.

Includes six genera as follows: *Amplectella* gen. nov., *Amplectellopsis* gen. nov., *Cricundella* gen. nov., *Proplectella* gen. nov., *Undella* Daday emended, and *Undellopsis* gen. nov.

***Amplectella* gen. nov.**

*Undella*, *partim*, Brandt, 1907, pp. 343-374 (see also *Cricundella*, *Parundella*, *Undella*, *Undellopsis*, and *Xystonellopsis*); Laackmann, 1909, pp. 467-479 (see also *Albatrossiella*, *Undella*, *Undellopsis*, and *Xystonellopsis*).

Undellidae with lorica consisting of an anterior cylinder and an aborally expanded bowl; no suboral ledge, oral margin thinning out gradually; one or more rings present on cylinder and bowl formed by an outward buckling of the wall; aboral end generally broadly rounded.

We select as the type species *Amplectella collaria* (Brandt) (1906, typical) from the Sargasso Sea.

Differs from *Undella* and *Proplectella* in having rings, from *Cricundella* in having an expanded bowl, from *Undellopsis* in the absence of the suboral ledge, and from *Amplectellopsis* in the absence of buckling of the wall.

Includes 7 species as follows:

<i>ampla</i> sp. nov.	<i>occidentalis</i> sp. nov.
<i>collaria</i> (Bdt.)	<i>praecauta</i> sp. nov.
<i>insignis</i> (Bdt.)	<i>quadricollaria</i> sp. nov.
<i>monocollaria</i> (Lauck.)	



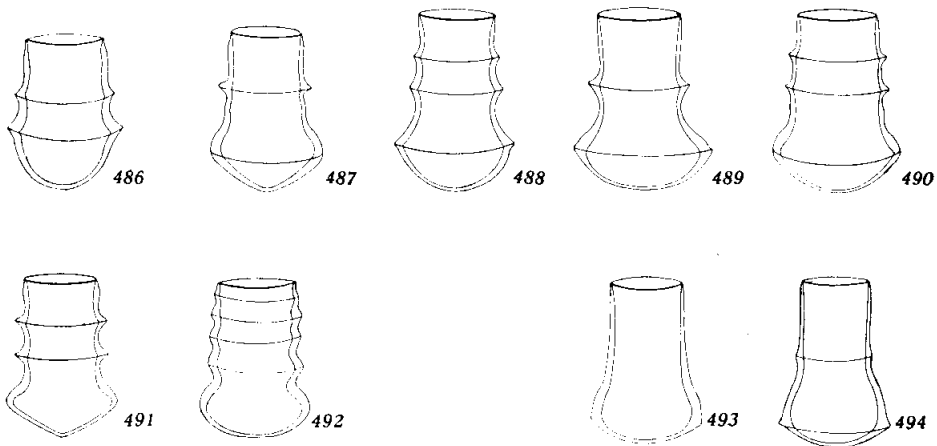
**Amplectella ampla** sp. nov.

Figure 490

*Undella collaria* var. a Brandt, 1906, p. 30, pl. 63, figs. 10, 10a; 1907, pp. 346, 361, 470.

*Undella collaria*, partim, Jörgensen, 1924, p. 45 (for fig. 49 see *A. collaria*).

Lorica 2.3 oral diameters in length with the cylinder 0.63 total length in length; the two rings 0.24 and 0.41 total length below the oral margin, their diameters 1.32 and 1.42 oral diameters respectively, their outer contours right-angular or greater, in section; bowl rotund, 0.37 total length in length, widest (1.69 oral diameters) slightly above its middle; aboral part of bowl flattened subhemispherical, its vertical



Figs. 486-492. Species of *Amplectella* gen. nov.  $\times 200$ .

Fig. 486. *A. insignis* (Bdt.) after Brandt (1906, pl. 63, fig. 11) from Station Pl. 53 of the Plankton Expedition in the Sargasso Sea.

Fig. 487. *A. occidentalis* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 488. *A. collaria* (Bdt.) from Station 4701 of the South Equatorial Drift of the Pacific.

Fig. 489. *A. monocollaria* (Laack.) after Laackmann (1909, pl. 49, fig. 20) from the Brazil Current.

Fig. 490. *A. ampla* sp. nov. from Station 4697 in the Easter Island Eddy.

Fig. 491. *A. pracacuta* sp. nov. from Station 4695 in the Easter Island Eddy.

Fig. 492. *A. quadricollaria* sp. nov. from Station 4705 in the South Equatorial Drift of the Pacific.

Figs. 493-494. Species of *Amplectellopsis* gen. nov.  $\times 200$ .

Fig. 493. *A. angularis* sp. nov. from Station 4685 in the South Equatorial Drift of the Pacific.

Fig. 494. *A. biedermanni* sp. nov. from Station 4701 in the South Equatorial Drift of the Pacific.

radius 0.36–0.42 its greatest transdiameter; aboral end broadly rounded; wall only slightly undulating in the formation of the rings, thickest (0.18 oral diameter) in the widest part of the bowl and thinning anteriorly. Length 119 $\mu$ .

The type locality is Station 4697 in the Easter Island Eddy of the Eastern Tropical Pacific. Occurs also in the South Equatorial Drift of the Pacific and in the Sargasso Sea.

Differs from *A. collaria* in shorter, stouter cylinder and from *A. monocollaria* in having two rings on the cylinder.

### ***Amplectella collaria* (Brandt)**

Figure 488

*Undella collaria* Brandt, 1906, pp. 8, 30, pl. 63, fig. 12, pl. 64, fig. 21; 1907 pp. 360–361, 460; Jørgensen, *partim*, 1924, p. 45, fig. 49 (see also *A. ampla*).

### ***Amplectella insignis* (Brandt)**

Figure 486

*Undella collaria* var. *b. insignis* Brandt, 1906, p. 30, pl. 63, fig. 11; 1907, pp. 361, 468.

*Undella collaria* var. *insignis* Brandt, 1906, p. 30, pl. 64, fig. 22.

Raised to status of species.

Lorica 1.74–2.00 oral diameters in length; with a long anterior cylinder, 0.52–0.59 total length in length; with a very slight suboral ledge 1.15–1.18 oral diameters in diameter, 0.12 oral diameter below oral rim; with a ring having a diameter 1.19–1.22 oral diameters, 0.37–0.41 total length below oral margin; bowl 0.48–0.51 total length in length, divided into an anterior section 0.14–0.21 total length in length and a sack-like section, with a ring at the junction, 1.41–1.48 oral diameters in diameter, 0.64–0.67 total length from oral margin; lower section of bowl flattened, subangular; wall 0.10–0.11 oral diameter thick in suboral ledge. Length 108–111 $\mu$ .

The type locality is Station Pl. 53 of the Plankton Expedition in the Sargasso Sea. Occurs also in the South Equatorial Drift and Easter Island Eddy of the Eastern Tropical Pacific.

Differs from *A. ampla* in narrower bowl and from *A. collaria* in having the second ring on the bowl.

### ***Amplectella monocollaria* (Laackmann)**

Figure 489

*Undella monocollaria* Laackmann, 1909, p. 470, pl. 49, fig. 20.

**Amplectella occidentalis** sp. nov.

Figure 487

Lorica 2.35 (2.22–2.54) oral diameters in length, with cylinder 0.57 (0.54–0.63) total length in length, expanding aborally in a cone of 8°; one ring on the cylinder 0.34 (0.28–0.39) total length below the oral margin, 1.36 (1.32–1.45) oral diameters in diameter, with subequal sides and blunt edge; bowl 0.43 (0.37–0.46) total length in length, widest (1.50 (1.35–1.62) oral diameters) a little above its middle, its aboral part convex conical (115°–120°); aboral end bluntly pointed, or slightly protuberant. Length, 101–107 $\mu$ .

The type locality is Station 4724 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from all species except *A. praeacuta* in the subconical, pointed aboral end and from it in having but a single ring on the cylinder instead of two.

**Amplectella praeacuta** sp. nov.

Figure 491

Lorica 2.24 oral diameters in length, with the cylinder 0.64 total length in length and antero-posteriorly compressed bowl; the two rings 0.26 and 0.47 the total length respectively below the oral margin, their diameters 1.29 and 1.33 oral diameters respectively, their outer contour almost right-angled in section; bowl 0.36 total length in length, widest near its middle, its vertical radius 0.27 its greatest transdiameter; aboral half of bowl inverted subconical (150°), slightly convex; aboral end bluntly pointed; the wall slightly undulating in the formation of the rings, 0.1 oral diameter in mean thickness. Length 105 $\mu$ .

The type locality is Station 4695 in the Easter Island Eddy of the Eastern Tropical Pacific.

Differs from all species in the genus except *A. occidentalis* in its pointed aboral end, and from that species in having two rings instead of one on the cylinder.

**Amplectella quadricollaria** sp. nov.

Figure 492

Lorica 2.2 oral diameters in length, with the cylinder 0.62 total length and antero-posteriorly compressed bowl; the four rings 0.10, 0.23, 0.34, 0.54 total length from the oral margin, their diameters 1.14,

1.22, 1.22, and 1.24 oral diameters respectively, their outer surfaces broadly and equally rounded in each ring; bowl 0.38 total length in length, widest (1.42 oral diameters) in the middle, its vertical radius 0.33 of its greatest transdiameter; aboral end broadly convex; the wall notably undulating in the formation of the rings, 0.12 oral diameter in thickness. Length, 101 $\mu$ .

The type locality is Station 4705 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from all other species in having four rings.

### **Amplectellopsis** gen. nov.

Undellidae with no suboral ledge; with expanded bowl; with or without a ring on the cylinder; wall with bilamellate inner and outer lamellae.

The type species is *Amplectellopsis biedermanni* sp. nov. from Station 4701 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *Proplectella* in the absence of the inner collar, from *Undella* and *Cricundella* in the expansion of the bowl, from *Amplectella* in the absence of rings or of internal bulging, and from *Undellopsis* in the absence of the suboral ledge.

Includes only two species, *Amplectellopsis angularis* sp. nov. and *A. biedermanni* sp. nov.

### **Amplectellopsis angularis** sp. nov.

Figure 493

Lorica 2.36 (2.20-2.53) oral diameters in length; suboral region thinning gradually for 0.5 oral diameter below the oral rim to a sharp oral rim; cylinder forming 0.56-0.62 of the total length, without any ring, slightly concave outwardly, increasing to 1.02-1.03 oral diameters in diameter at upper limit of the bowl; bowl 0.38-0.44 total length in length, expanding in a cone of 32°-50° to a broadly rounded to bluntly angled, ring-like region located at 0.80-0.87 total length from the oral rim, with a diameter of 1.56 (1.47-1.67) oral diameters; aboral region convex, in section subtending an arc of 95°-100°, sometimes a trifle flattened; no aboral point; wall subuniform in thickness (0.08 oral diameter) in the cylinder from 0.5 oral diameter below the

oral rim, thickest (0.17 oral diameter) at the angle of the bowl, and less than half as thick at the bottom of the bowl. Length 109–119 $\mu$ .

The type locality is Station 4685 in the South Equatorial Drift of the Eastern Tropical Pacific. Occurs also in the Easter Island Eddy.

Differs from *A. biedermanni* in absence of ring and rather shorter lorica.

#### ***Amplectellopsis biedermanni* sp. nov.**

Figure 494

Lorica 2.37–2.51 oral diameters in length; suboral region thinning abruptly to a sharp oral rim; cylinder forming 0.62 total length, increasing in diameter posteriorly to 1.03 oral diameters, with a slight ring formed by an external thickening, without internal bulge, located 0.38–0.41 total length from the oral margin, and expanding to 1.1 oral diameters; bowl 0.38 total length in length, expanding in a cone of 37°–39° to a prominent rounded angle at 0.69–0.73 of the total length from the oral margin, to a diameter of 1.4–1.6 oral diameters; aboral region convex, in optical section an arc subtending an angle of 90°–95°; no aboral point; wall subuniform in thickness (0.09–0.15) from about 0.3 oral diameter below the oral margin to the widest part of the bowl where it abruptly thickens (0.11–0.17 oral diameter). Length 107–113 $\mu$ .

The type locality is Station 4701 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *A. angularis* in presence of a definite ring on the cylinder.

#### ***Cricundella* gen. nov.**

*Undella*, partim, Brandt, 1907, pp. 343–374 (see also *Amplectella*, *Parundella*, *Undella*, *Undellopsis*, and *Xystohellopsis*).

Undellidae with lorica cylindrical or subcylindrical, with rings but without suboral ledge or expanded bowl.

We designate as the type species *Cricundella tridivisa* (Brandt) from the South Equatorial Current of the Atlantic.

Differs from *Undellopsis* in the absence of the suboral ledge, from *Undella* and *Proplectella* in the absence of rings, and from *Amplectella* and *Amplectellopsis* in the absence of the aboral expansion into a bowl.

Includes three species as follows: *Cricundella quadricincta* sp. nov., *C. quadridivisa* sp. nov., and *C. tridivisa* (Bdt.).

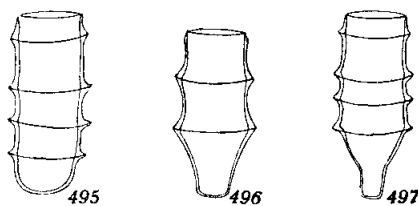
***Cricundella quadricincta* sp. nov.**

Figure 495

Lorica 2.46 (2.18–2.97) oral diameters in length, elongated thimble-shaped, nearly cylindrical, with an inverted dome-shaped aboral end; the four rings unequally spaced, about 0.12, 0.35, 0.57, 0.79 total length from the oral margin, the first smaller (1.20 oral diameters) than the others (1.32, 1.33, 1.29 oral diameters respectively); aboral region 0.21–0.26 (0.23) total length in length, broadly dome-shaped; aboral end hemispherical to flattened convex; wall expanded slightly in the rings. Length 96.7 (85–119) $\mu$ .

The type locality is Station 4701 in the South Equatorial Drift of the Eastern Tropical Pacific. Occurs also in the Easter Island Eddy.

Differs from *C. tridivisa* and *C. quadridivisa* in the absence of the tubular extension on the aboral end.



Figs. 495–497. Species of *Cricundella* gen. nov.  $\times 200$ .

Fig. 495. *C. quadricincta* sp. nov. from Station 4701 in the South Equatorial Drift of the Pacific.

Fig. 496. *C. tridivisa* (Bdt.) after Brandt (1906, pl. 64, fig. 23) from Station Pl. 100 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 497. *C. quadridivisa* sp. nov. from Station 4699 in the Easter Island Eddy.

***Cricundella quadridivisa* sp. nov.**

Figure 497

Lorica 2.74 (2.66–3.22) oral diameters in length, subcylindrical, with a contracted aboral tubular extension; the four rings unequally spaced, about 0.11, 0.32, 0.47, and 0.63 total length from oral margin respectively, the first smaller (1.19 oral diameters) than the others (1.29, 1.30, 1.27 oral diameters respectively); aboral region 0.37–0.47 total length in length, contracting immediately below the fourth ring into an inverted, convex subconical ( $60^\circ$ ) section, 0.18 total length in length which is abruptly narrowed into a slender, subconical

(16°–20°), tubular extension 0.19–0.29 total length in length; aboral end 0.33 oral diameter in diameter, flattened, slightly convex. Length 108–133 $\mu$ .

The type locality is Station 4699, in the Easter Island Eddy of the Eastern Tropical Pacific. Occurs also in the South Equatorial Drift.

Differs from *C. tridivisa* in having four instead of three rings.

### ***Cricundella tridivisa* (Brandt)**

Figure 496

*Undella tridivisa* Brandt, 1906, pp. 8, 31, pl. 64, fig. 23; 1907, pp. 362, 481.

### **Undella Daday emended**

*Undella, partim*, Daday, 1887b, pp. 565–568 (see also *Parundella*); Brandt, 1907, pp. 343–374 (see also *Amplectella*, *Cricundella*, *Parundella*, *Undellopsis*, and *Xystonellopsis*); Laackmann, 1909, pp. 467–479 (see also *Albatrossiella*, *Amplectella*, *Undellopsis*, and *Xystonellopsis*); Jörgensen, 1924, pp. 37–50 (see also *Parundella*).

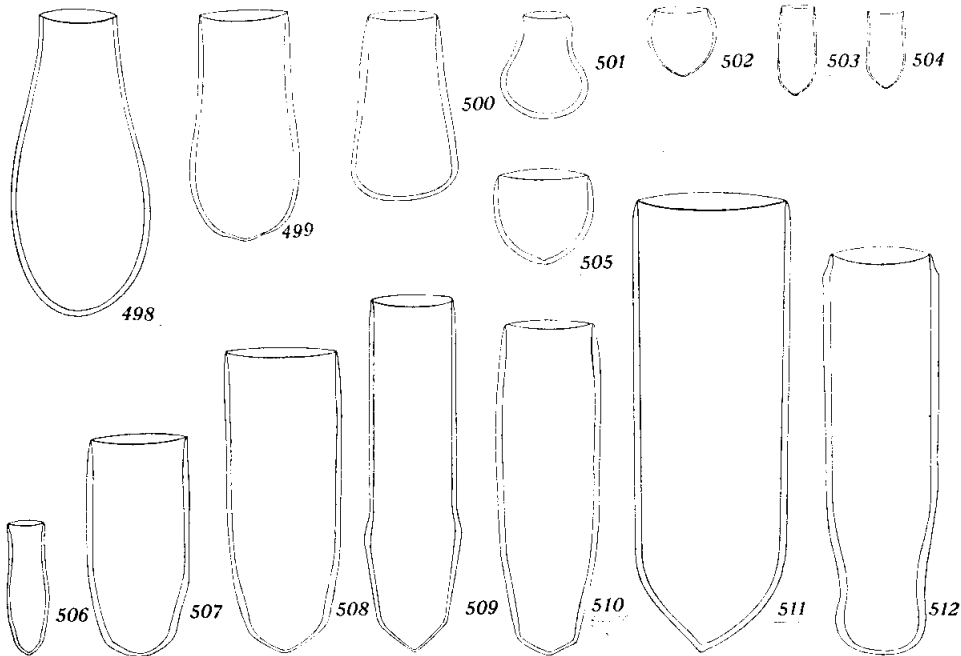
Undellidae with lorica with the suboral region tapering in section to a thin oral margin; without suboral ledge or inner collar; bowl cylindrical or nearly so anteriorly, never greatly or abruptly expanded aborally, without rings; aboral end rounded, angled, pointed, or flattened; wall bilaminar, without reticulations and without prismatic structure.

We designate as the type species *Undella hyalina* Daday from off Naples, Italy, with page priority in his paper.

Differs from *Undellopsis* in the absence of the suboral ledge, from *Cricundella* and *Amplectella* in the absence of rings, from *Proplectella* in the absence of the inner collar, and from *Amplectellopsis* in the absence of expansion of the bowl.

Includes 16 species as follows:

<i>attenuata</i> Jörg.	<i>hyalina</i> Daday
<i>bullata</i> sp. nov.	<i>hyalinella</i> sp. nov.
<i>californiensis</i> sp. nov.	<i>ostenfeldi</i> sp. nov.
<i>elevci</i> Jörg.	<i>parva</i> sp. nov.
<i>declivis</i> sp. nov.	<i>peruana</i> sp. nov.
<i>dilatata</i> sp. nov.	<i>pistillum</i> sp. nov.
<i>dohrnii</i> Daday	<i>pusilla</i> Paulsen
<i>hemispherica</i> Laack.	<i>turgida</i> sp. nov.



Figs. 498-512. Species of *Undella* Daday emended.  $\times 200$ .

Fig. 498. *U. dohrnii* Daday after Daday (1887*b*, pl. 18, fig. 22) from the Bay of Naples.

Fig. 499. *U. dilatata* sp. nov. after Brandt (1906, pl. 64, fig. 19) from Station Pl. 66 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 500. *U. pistillum* sp. nov. from Station 4580 in the California Current.

Fig. 501. *U. californiensis* sp. nov. from Station 4847 U.S.S. "Albatross" off Point Conception in the California Current.

Fig. 502. *U. turgida* sp. nov. from Station 4705 in the South Equatorial Drift of the Eastern Tropical Pacific.

Fig. 503. *U. clevei* Jörg. after Jörgensen (1924, p. 39, fig. 44) from Station 186 of the "Thor" in *Salpa* from the Ionian Sea.

Fig. 504. *U. ostentfeldi* sp. nov. from Station 4701 in the South Equatorial Drift of the Pacific.

Fig. 505. *U. hemispherica* Laack. after Laackmann (1909, pl. 49, fig. 22) from Station "Gauss" 7-IX-03 in the boundary of the Guinea and South Equatorial currents.

Fig. 506. *U. hyalinella* sp. nov. from Station 4571 off San Diego in the California Current.

Fig. 507. *U. declivis* sp. nov. after Brandt (1906, pl. 63, fig. 4) from Station Pl. 27 of the Plankton Expedition in the Florida Current.

Fig. 508. *U. parva* sp. nov. after Brandt (1906, pl. 63, fig. 1) from off the Tonga Islands, Western Tropical Pacific.

Fig. 509. *U. peruana* sp. nov. from Station 4679 in the South Equatorial Drift of the Pacific near the edge of the Peruvian Current.

Fig. 510. *U. attenuata* Jörg. after Jörgensen (1924, p. 39, fig. 45*b*) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 511. *U. hyalina* Daday after Daday (1887*b*, pl. 18, fig. 17) from the Bay of Naples.

Fig. 512. *U. bulla* sp. nov. from Station 4580 in the California Current.



**Undella attenuata** Jörgensen emended

Figure 510

*Undella hyalina* forma *attenuata*, partim, Jörgensen, 1924, pp. 42-43, fig. 45b (for *U. hyalina* var. a Brandt, 1906, p. 30, pl. 63, figs. 1-3 see *U. parva*).

Raised to status of species.

Lorica 3.85 oral diameters in length, cylindrical with angular, contracted aboral region; suboral region thinning abruptly from the outer side to a sharp oral rim, triangular in section; bowl subcylindrical, slightly convex outwardly, forming 0.72 of the total length; aboral region consisting of two inverted cones, the upper forming 0.16 total length, truncated, subconical ( $25^\circ$ ), slightly concave outwardly, the lower forming 0.12 total length, scarcely concave, forming a complete cone of  $127^\circ$ ; aboral end broadly pointed; wall 0.05 oral diameter in thickness below the suboral region, nearly doubled in thickness near the middle of the first aboral cone, thinnest at the aboral point. Length  $172\mu$ .

The type locality is Station 152 of the "Thor" Expedition in the Eastern Mediterranean west of Greece.

Differs from *U. bulla* in biconical, pointed aboral region instead of subglobose, from *U. parva* in longer lorica and more aboral contraction, and from *U. declivis* in larger size and in proportions.

**Undella bulla** sp. nov.

Figure 512

Lorica 3.9 oral diameters in length, cylindrical, with bulbous aboral region; suboral region contracting outwardly for 0.22 oral diameter below the blunt oral rim, slightly thickened basally (1.1 oral diameters); cylinder forming 0.6 total length, then contracting into a truncated, inverted cone ( $27^\circ$ ) for 0.25 total length; aboral region 0.15 total length in length with the constricted region 0.85 oral diameter in diameter, and 0.90 at the widest part; aboral end flattened; wall thickest (0.13 oral diameter) in the suboral region, subuniform (0.11) elsewhere except in the aboral end (0.05). Length  $266\mu$ .

The type locality is Station 4580 in the California Current.

Differs from all other species in the genus in the bulbous aboral region.

**Undella californiensis** sp. nov.

Figure 501

Lorica 2.6 oral diameters in length, stout flask-shaped; suboral region abruptly thinning on the outer side only to a sharp oral rim; cylinder forming about 0.35 total length, expanding aborally in a cone of 13°, without ring; bowl subspheroidal, its greatest diameter (2 oral diameters) at 0.62 total length below the oral rim; aboral region almost hemispherical; aboral end with a trace of flattening, no aboral point; wall subuniform in thickness (0.15 oral diameter) except in the suboral region, inner and outer lamellae each almost as thick as the central lamella. Length 70 $\mu$ .

One lorica contained the animal with two macronuclei and two micronuclei.

The type locality is Station 4847, U.S.S. "Albatross" off Point Conception, in the California Current.

Differs from *U. dohrnii* in shorter cylinder, shorter lorica, and more abruptly expanded, more spheroidal bowl.

**Undella clevei** Jörgensen

Figure 503

*Undella subacuta*, partim, Cleve, 1901a, p. 923, fig. 4b (for fig. 4a see *Proplectella subacuta*).

*Undella clevei* Jörgensen, 1924, pp. 39, 41, 43, fig. 44.

*Undella claparedei* var. a *subacuta*, partim, Brandt, 1907, pp. 346, 348-349, 363, 459, 480 (see also *Proplectella subacuta*).

**Undella declivis** sp. nov.

Figure 507

*Undella hyalina* var. b Brandt, 1906, p. 30, pl. 63, figs. 4-6, pl. 64, fig. 18; 1907, pp. 345, 346, 349, 360, 468.

*Undella hyalina*, partim, Jörgensen, 1924, pp. 42-43, 106 (see also *U. parva*).

Lorica 2.69 (2.53-2.82) oral diameters in length, subcylindrical, contracting anteriorly, rounded sub-biconical aborally; suboral region 0.15-0.20 oral diameter, thinning on outer or both sides to a thin sharp oral rim with no localized suboral thickening; cylinder forming 0.62-0.72 total length, expanding posteriorly to 1.04-1.13 oral diameters at 0.62-0.73 total length, to the upper end of the first aboral cone; aboral region with two cones, the upper 0.20-0.25 total length,

subconical ( $9^{\circ}$ – $23^{\circ}$ ) slightly concave outwardly but quite variable, the second forming 0.07–0.21 total length, broadly conical ( $108^{\circ}$ – $129^{\circ}$ ) to convexly rounded; aboral end from bluntly pointed to broadly rounded; wall subuniform from below the suboral region, 0.04–0.10 oral diameter in thickness, often thicker (0.07–0.11) in the first aboral cone, and thinnest in the aboral end. Length, 147 (138–178)  $\mu$ .

The type locality is Station Pl. 27 of the Plankton Expedition in the Florida Current.

Differs from *U. attenuata* in stouter proportions, from *U. peruana* in the absence of expansion of the first aboral cone, and from other species of the *U. hyalina* group in the conical form of the cylinder.

### ***Undella dilatata* sp. nov.**

Figure 499

*Undella hyalina* var. c Brandt, 1906, p. 31, pl. 64, fig. 19; 1907, pp. 346, 348, 349, 351, 359, 360, 468.

*Undella dohrni* forma ? Jørgensen, 1924, pp. 39, 43, fig. 46.

Lorica 2.80 (2.50–3.33) oral diameters in length, subcylindrical, expanding posteriorly to slightly inflated, faintly angular aboral region; suboral region not expanded beyond the diameter of the bowl, narrowing in a sigmoid curve on the outer face for 0.1–0.2 oral diameter below the rounded oral rim; cylinder with constant diameter for 0.6–0.7 total length, then bulging to 1.11–1.36 oral diameters at about 0.68–0.77 total length, the upper slope of the bulge varying in length and convexity but not distinctly angular; aboral end subconical ( $125^{\circ}$ – $150^{\circ}$ ), broadly to acutely pointed; wall subuniform in thickness (0.1 oral diameter) in the cylinder, thickest in lower part of the bulge (0.15) and thinnest (0.05) in the aboral point. Length 144 (130–160)  $\mu$ .

The type locality is Station 66 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Differs from other species of the *U. hyalina* group in the dilated aboral region and from *U. dohrni* in the lack of anterior contraction of the bowl.

**Undella dohrnii** Daday

Figure 498

*Undella Dohrnii* Daday, 1887*b*, p. 566, pl. 18, fig. 22.*Undella claparedci* var. *dohrni*, Ostenfeld and Schmidt, 1901, p. 182.*Undella claparedci* [*sic*], var. *dohrni*, Brandt, 1906, p. 28, pl. 55, fig. 8; 1907, pp. 364, 459, 462.*Undella dohrni*, Jörgensen, 1924, p. 43.Non *Undella dohrni* forma ? Jörgensen, 1924, pp. 39, 42-43 (see *U. dilatata*).**Undella hemispherica** Laackmann

Figure 505

*Undella hemispherica* Laackmann, 1909, pp. 468, 471, 472-473, 493, pl. 49, fig. 22.*Undella Claparedci*, Okamura, 1912, pp. 22, 35, pl. 5, fig. 98.Non *Tintinnus Claparèdii* Entz, Sr., 1885, pp. 202-203, pl. 14, figs. 10, 11 (see *Proplectella claparèdii*).**Undella hyalina** Daday

Figure 511

*Undella hyalina* Daday, 1887*a*, pp. 159-208, pl. 1, fig. 7; 1887*b*, pp. 564-565, pl. 18, fig. 17; Brandt, 1906, p. 30, pl. 64, fig. 16; 1907, pp. 358-359, 467; Jörgensen, *partim*, 1924, p. 42, fig. 45*a* (for Brandt, 1906, var. *a* see *U. parva* and for var. *b* see *U. declivis*).*Undella hyalina* var. *a* Brandt, 1906, p. 28, pl. 55, fig. 9 [abnormal].**Undella hyalinella** sp. nov.

Figure 506

Lorica 2.9 (2.6-3.2) oral diameters in length, elongated goblet-shaped with nuchal constriction; suboral region about 0.15 oral diameter in length, thinning on both faces to a thin oral rim; bowl anteriorly an inverted, truncated cone ( $12^{\circ}$ - $18^{\circ}$ ) forming 0.20-0.25 total length, diameter at the nuchal constriction 0.80-0.93 oral diameter, posteriorly increasing to a maximum diameter of 1.1-1.2 oral diameters at 0.55-0.70 total length below the oral rim; aboral region convex, contracting for 0.20-0.25 the total length and abruptly contracting in an inverted aboral cone ( $75^{\circ}$ - $88^{\circ}$ ) with slightly convex sides, forming 0.1-0.2 total length; aboral end broadly bluntly pointed; wall thickest (0.10-0.12 oral diameter) in the nuchal constriction, thinning to about half this in the widest part of the bowl and thickening again in the aboral region. Length 76-88 $\mu$ .

The type locality is Station 4571 off San Diego in the California Current.

Differs from *U. clevei* in the presence of the nuchal constriction.

**Undella ostenfeldi** sp. nov.

Figure 504

Lorica 1.91–2.17 oral diameters in length, goblet-shaped; suboral region forming 0.15–0.19 total length, flaring slightly, thinning on both faces or the inner only to a sharp oral rim; bowl expanding slightly to 1.09–1.11 oral diameters at 0.33–0.55 total length from the oral rim; aboral region convex, contracting to an acutely pointed or blunt aboral end; wall thickest (not over 0.14 oral diameter) at the lower level of the suboral region and thinnest (0.05) at the aboral end. Length 46–51 $\mu$ .

The type locality is Station 4701 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *U. hyalinella* and *U. clevei* in stouter proportions and from *Proplectella ostenfeldi* in absence of anterior contraction.

**Undella parva** sp. nov.

Figure 508

*Undella hyalina* var. a Brandt, 1906, pp. 28, 30, 31, pl. 63, figs. 1–3, pl. 64, fig. 17; 1907, pp. 346, 348–349, 359, 468.

*Undella hyalina*, partim, Jörgensen, 1924, p. 42 (for fig. 45a see *U. hyalina*, see also *U. declivis*).

*Undella hyalina* forma *attenuata*, partim, Jörgensen, 1924, pp. 42–43 (for fig. 45b see *U. parva*).

Lorica 2.17–2.81 oral diameters in length, cylindrical, with angular aboral region; suboral region thinning abruptly on the inner surface to a sharp oral rim with convex inner surface; cylinder forming 0.63–0.72 total length, quite uniform in diameter, or decreasing slightly; aboral region with two cones, the first forming 0.15–0.18 total length, inverted, truncated, subconical ( $28^{\circ}$ – $30^{\circ}$ ), convex outwardly; the terminal aboral cone forming 0.13–0.19 total length, inverted subconical ( $101^{\circ}$ – $122^{\circ}$ ), with outwardly convex surface; aboral end bluntly pointed; wall 0.05 oral diameter in thickness below the suboral region, thinning (0.03) in the lower cylinder, thickening noticeably (0.08) in the upper cone and very thin in the aboral point. Length 145–205 $\mu$ .

The type locality is off the Tonga Islands, Western Tropical Pacific (Brandt, 1906, pl. 63, fig. 1).

Differs from *U. hyalina* in the angular aboral region, from *U. declivis* in lack of posterior flare of cylinder, from *U. attenuata* in stouter proportions, and from *U. dilatata* and *U. peruana* in absence of aboral expansion.

**Undella peruana** sp. nov.

Figure 509

Lorica 3.76 (3.20-4.60) oral diameters in length, elongate cylindrical with elongate, subangular aboral region; suboral region 0.14 oral diameter in length with concave outer surface, narrowing to a thin edge; cylinder forming 0.59-0.71 total length, of equal diameter throughout; aboral region dilated by expansion of lumen and by thickening of the wall abruptly at the upper end of the upper aboral cone to 1.12-1.16 oral diameters; the upper cone ( $16^{\circ}$ - $22^{\circ}$ ) forming 0.19-0.28 total length, with slightly convex outer surface; terminal cone ( $95^{\circ}$ - $113^{\circ}$ ) forming 0.07-0.09 total length; aboral end bluntly pointed; wall subuniform in thickness (0.05-0.09 oral diameter) in the cylinder, thicker (0.10-0.13) in the upper cone, and thinnest (0.03-0.08) in the aboral end. Length 163-215 $\mu$ .

The type locality is Station 4679 in the South Equatorial Drift of the Pacific near the edge of the Peruvian Current.

Differs from *U. dilatata* in having more angularity in the aboral dilation and is more elongated than *U. declivis* and *U. parva*.

**Undella pistillum** sp. nov.

Figure 500

Lorica 2.0-2.62 oral diameters in length, suboral region thinning abruptly to a sharp oral rim; cylinder truncated, subconical ( $15^{\circ}$ ), not separated from the bowl, forming about 0.6-0.7 of the total length and increasing evenly in diameter posteriorly to a maximum of 1.25-1.50 oral diameters at about 0.5 oral diameter from the aboral end, with a little distal lateral concavity; bowl without ring or angle; aboral end convex, flattened subhemispherical; no aboral point; wall thickest (0.12 oral diameter) about 0.5 oral diameter below the oral rim, thinner posteriorly. Length 103 (90-120)  $\mu$ .

The type locality is Station 4580 in the California Current. Occurs also in the Peruvian Current.

Differs from species of *Amplectellopsis* in absence of ring-like expansion on the bowl, and from *U. californiensis* and *U. dohrnii* in relatively less expansion of the bowl.

**Undella pusilla** Paulsen

*Undella pusilla* Paulsen, 1904, p. 25. *Nomen nudum*.

**Undella turgida** sp. nov.

Figure 502

Lorica 1.19 (1.11–1.31) oral diameters in length, globose; oral margin contracting to a thin lip 0.05–0.08 total length in length, 0.5 the thickness of the wall below, slightly everted; bowl globose, expanding abruptly below the collar to a slight shoulder, widest (1.10–1.31 oral diameters) at this level, contracting aborally into a slightly elongated subhemispherical aboral region; aboral end rounded or faintly bluntly pointed; wall thickest (0.06 oral diameter) just below the lip, thinning to about half this thickness elsewhere. Length 42.8 (41–44)  $\mu$ .

The type locality is Station 4705 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *U. hemispherica* in the entire absence of any contracted oral lip, in thicker wall, and in stouter proportions.

**Undellopsis** gen. nov.

*Undella, partim*, Brandt, 1907, pp. 347–374 (see also *Amplectella, Cricundella, Parundella, Undella*, and *Xystonellopsis*); Laackmann, 1909, pp. 467–479 (see also *Albatrossiella, Amplectella, Undella*, and *Xystonellopsis*).

Undellidae with lorica having a distinct suboral ledge, differing from the rings (when present) below it in having a more or less distinct collar above the ledge, usually more or less cylindrical below the ledge, with or without rings, and with or without expansion into a bowl; aboral end hemispherical, rounded, flattened, or umbilicated.

We designate as the type species *Undellopsis marsupialis* (Brandt) emended from the North Equatorial Current of the Atlantic.

Differs from *Amplectella, Amplectellopsis, Cricundella*, and *Undella* in the presence of the suboral ledge, and from *Proplectella* in the absence of the inner collar.

Includes two subgenera, *Undellopsis* subgen. nov. and *Undellericos* subgen. nov.

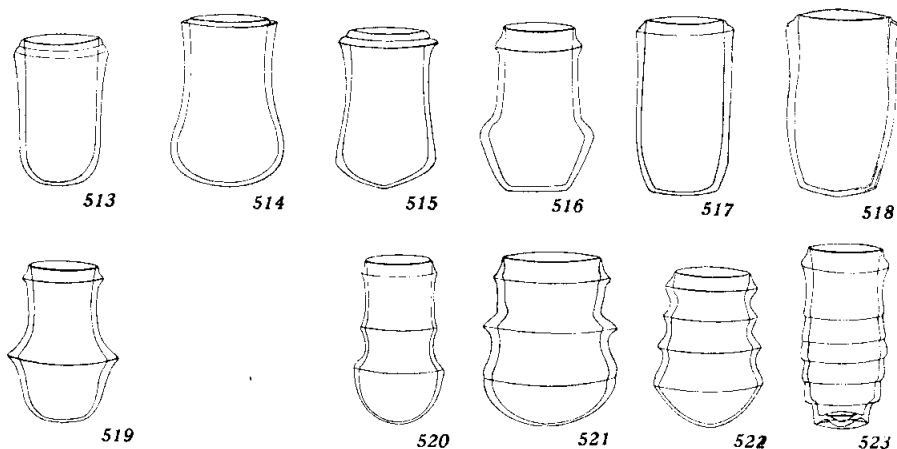
## Subgenus UNDELLOPSIS subgen. nov.

*Undellopsis* with no rings on the lorica below the suboral ledge. The type species is *Undellopsis marsupialis* (Brandt) emended from the North Equatorial Current of the Atlantic.

Differs from *Undellicricos* in the absence of rings below the suboral ledge.

Includes 7 species as follows:

<i>cubitum</i> sp. nov.	<i>marsupialis</i> (Bdt.)
<i>entzi</i> sp. nov.	<i>pacifica</i> sp. nov.
<i>insignata</i> sp. nov.	<i>subangulata</i> (Jörg.)
<i>lineata</i> sp. nov.	



Figs. 513-523. Species of *Undellopsis* gen. nov.  $\times 200$ .

Figs. 513-519. Subgenus *Undellopsis* subgen. nov.

Fig. 513. *U. pacifica* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.

Fig. 514. *U. lineata* sp. nov. after Brandt (1906, pl. 63, fig. 7) from Station N. 154 of the Plankton Expedition in the Guinea Current of the Tropical Atlantic.

Fig. 515. *U. marsupialis* (Bdt.) after Brandt (1906, pl. 63, fig. 8) from Station Pl. 65 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 516. *U. entzi* sp. nov. from Station 4679 in the South Equatorial Drift of the Pacific.

Fig. 517. *U. cubitum* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 518. *U. subangulata* (Jörg.) after Jörgensen (1924, p. 39, fig. 48) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 519. *U. insignata* sp. nov. from Station 4583 in the California Current.

Figs. 520-523. Subgenus *Undellicricos* subgen. nov.

Fig. 520. *U. amularius* sp. nov. from Station 4699 in the Easter Island Eddy.

Fig. 521. *U. bicollaria* sp. nov. after Brandt (1906, pl. 63, fig. 9) from Station Pl. 27 of the Plankton Expedition in the Florida Current.

Fig. 522. *U. tricollaria* (Laack.) after Laackmann (1909, pl. 49, fig. 18) from the Brazil Current.

Fig. 523. *U. umbilicata* sp. nov. from Station 4695 in the Easter Island Eddy.



**Undellopsis cubitum** sp. nov.

Figure 517

Lorica 2.4 oral diameters in length, stout cylindrical; collar very low, contracted, scarcely protuberant; aboral region contracted at 0.12-0.28 of total length from the aboral end into a truncated cone of  $15^{\circ}$ - $20^{\circ}$ ; aboral end angled, flattened to an arc whose radius is approximately 0.5 the length of the lorica; wall thickest at the collar and aboral angle (0.12 oral diameter) and thinnest aborally. Length 117-123 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy of the Eastern Tropical Pacific.

Differs from *Udps. entzi* in the shorter aboral cone, more rounded aboral end, and lack of aboral expansion, and from *Udps. subangulata* in more slender lorica, less suboral expansion, longer aboral cone, and absence of terminal point.

**Undellopsis entzi** sp. nov.

Figure 516

Lorica 2.21-2.42 oral diameters in length, saltcellar-shaped; suboral ledge 1.2 oral diameters in diameter; subcylindrical below the ledge for nearly 0.4 total length, bowl-shaped below, expanding above in a truncated cone ( $34^{\circ}$ - $44^{\circ}$ ) to a rounded angle and contracting below in an inverted cone of  $25^{\circ}$ - $35^{\circ}$ ; greatest diameter (1.7 oral diameters) of bowl 1.5-1.7 oral diameters below the oral margin; aboral end squarely truncate equaling the oral diameter. Length 108-115 $\mu$ .

The type locality is Station 4679 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *Udps. insignata* in truncate instead of rounded aboral end and less concave sides of the cylinder and from *Udps. anularius* in absence of the ring on the cylinder.

**Undellopsis insignata** sp. nov.

Figure 519

Lorica 2.48 oral diameters in length, saltcellar-shaped with rounded bottom; suboral ledge 1.24 oral diameters in diameter; region below the ledge deeply concave laterally, 0.43 total length in length;

bowl with an anterior slope of  $45^\circ$  and a posterior one of about  $35^\circ$ ; greatest diameter of the bowl (1.76 oral diameters in diameter) at 1.4 oral diameters below the oral rim; aboral end subhemispherical with its altitude 0.33 its greatest diameter. Length  $104\mu$ .

The type locality is Station 4583 in the California Current.

Differs from all other species in the relatively great diameter of the bowl, from *Udps. anularius* in absence of the ring on the cylinder, and from *Udps. entzi* in rounded aboral end.

### **Undellopsis lineata** sp. nov.

Figure 514

*Undella marsupialis*, partim, Brandt, 1906, pp. 8, 30, 31, pl. 63, fig. 7 (for pl. 63, fig. 8 and pl. 64, fig. 20 see *Undellopsis marsupialis*).

Lorica about 2 oral diameters in length; anterior half subcylindrical, slightly concave outwardly, the diameter at the ledge being 1.06 that at the narrowest region near the middle; suboral ledge not protuberant, but deeply channeled with a V-shaped trough; aboral region expanded to 1.43 oral diameters and 1.17 that at the ledge, widest at 0.25 of the total length from the aboral end; aboral end broadly rounded but much flattened; wall 0.11 oral diameter in thickness, uniform except in the fundus where it thins to nearly 0.3 this thickness. The two laminae together are scarcely equal in thickness to that of the intermediate zone. Length  $108\mu$ .

The type locality is Station N. 154 of the Plankton Expedition in the Guinea Current of the Tropical Atlantic.

Differs from *Udps. marsupialis* in the V-shaped suboral trough, more broadly rounded and relatively wider suboral expansion, and flattened instead of subangled aboral end.

### **Undellopsis marsupialis** (Brandt) emended

Figure 515

*Undella marsupialis*, partim, Brandt, 1906, pp. 8, 30, 31, pl. 63, fig. 8, pl. 64, fig. 20; 1907, pp. 343-358 (for pl. 63, fig. 7 see *Udps. lineata*); Entz, Jr., 1908, pp. 106, 114, 126, pl. 2, fig. 5; 1909b, pp. 130, 195, 200, 215, pl. 9, fig. 5; Laackmann, 1909, pp. 467-469; Jørgensen, 1924, pp. 37, 43-45, 106, fig. 47.

**Undellopsis pacifica** sp. nov.

Figure 513

Lorica 2.13 (1.86–2.23) oral diameters in length, subcylindrical with slight lateral concavity, and little or no aboral expansion; diameter of suboral ledge 1.23 (1.20–1.27) oral diameters, slightly protuberant, with flattened sigmoid surface and erect or incurved collar with rounded rim, its height less than 0.1 oral diameter; least diameter of the lorica near or below its middle; bowl cylindrical or slightly tapering below the collar, or with a slight expansion widest at 0.25–0.40 oral diameter above the aboral end, its width not exceeding 1.07 that of the ledge; aboral end rounded, flattened, with a faint trace of lateral angularity in some individuals; wall generally about 0.1 oral diameter in thickness, but slightly thinner in the aboral region. Length 108.5 (103–122)  $\mu$ , oral diameter 52 (48–55)  $\mu$ .

The type locality is Station 4681 in the South Equatorial Drift. Generally distributed in the Eastern Tropical Pacific.

Differs from *Udps. marsupialis* in less lateral concavity, less aboral inflation, and less pointed aboral end.

**Undellopsis subangulata** (Jørgensen)

Figure 518

*Undella marsupialis* forma *subangulata* Jørgensen, 1924, pp. 39, 44–45, fig. 48.

Raised to status of species.

Lorica stout cask-shaped, 2.05 oral diameters in length; collar very low, protuberant; suboral ledge 1.3 oral diameters in diameter; bowl contracting below the ledge for 0.25 of an oral diameter, subcylindrical below for 0.66 total length; aboral region contracting as a segment of an inverted cone ( $32^\circ$ ); aboral end a wide, inverted cone of  $155^\circ$ ; wall thickest in suboral ledge, thinning gradually to 0.75 the suboral thickness, in the aboral end. Length 77 $\mu$ .

The type locality is Station 152 of the "Thor" off Barka in the Mediterranean.

Differs from *Udps. cubitum* in stouter lorica, more suboral expansion, larger aboral contraction, and in having an angular aboral end and from *Udps. marsupialis* in the angular aboral end.

## Subgenus UNDELLICRICOS subgen. nov.

Undellopsis with one or more rings on the lorica below the suboral ledge. The type species is *Undellopsis bicollaria* sp. nov. from the Florida Current.

Differs from *Undellopsis* in the presence of one or more rings below the suboral ledge.

Includes four species as follows: *Undellopsis anularius* sp. nov., *U. bicollaria* sp. nov., *U. tricollaria* (Laack.), and *U. umbilicata* sp. nov.

**Undellopsis anularis** sp. nov.

Figure 520

Lorica 2.44–2.68 oral diameters in length, with the form of a two-ringed salteellar; suboral ledge 1.15–1.18 oral diameters in diameter, clearly defined but thin; cylinder below the ledge with straight sides, 0.52–0.59 total length in length with one faint ring 0.37–0.41 total length below the oral margin; anterior section of bowl a short cone ( $45^\circ$ ) only 0.12–0.18 total length, posterior section an inverted cone ( $38^\circ$ – $43^\circ$ ) 0.30–0.49 total length in length; aboral end variously rounded. Length 108–111 $\mu$ .

The type locality is Station 4699 in the Easter Island Eddy. Occurs also in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *Udps. insignata* and *Udps. entzi* in having a ring on the cylinder and from *Udps. bicollaria* in shorter lorica, more conical lower bowl, and more flattened aboral end.

The specific name is derived from *anularius*, the ring-maker.

**Undellopsis bicollaria** sp. nov.

Figure 521

*Undella collaria* var. *c* Brandt, 1906, p. 30, pl. 63, fig. 9; 1907, pp. 346, 348–349, 360–362, 460; Entz, Jr., 1908, p. 106; Laackmann, 1909, p. 461.

*Undella tricollaria*, *partim*, Laackmann, 1909, p. 470, pl. 49, fig. 19 (for pl. 49, fig. 18 see *Udps. tricollaria*).

Lorica 2.4 oral diameters in length, with two rings and hemispherical bowl; suboral ledge 1.24 oral diameters in diameter; cylinder slightly expanding posteriorly, doubly concave because of a single

median ring; bowl anteriorly conical ( $45^\circ$ ), hemispherical in its posterior part, the posterior a little longer than the anterior, with a ring at the widest part 1.5 oral diameters in diameter, located 1.6 oral diameters below the oral rim; aboral end nearly hemispherical; wall relatively thick (0.05–0.20 oral diameter). Length 102–113 $\mu$ .

The type locality is Station Pl. 27 of the Plankton Expedition in the Florida Current. Occurs also elsewhere in the Tropical Atlantic and in the South Equatorial Drift of the Pacific.

Differs from *Udps. tricollaria* in having but one ring instead of two on the cylinder and from *Udps. anularius* in shorter cylinder and more rounded bowl and aboral end.

### **Undellopsis tricollaria** (Laackmann) emended

Figure 522

*Undella tricollaria, partim*, Laackmann, 1909, pp. 425–426, 468–471, 493, pl. 49, fig. 18 (for pl. 49, fig. 19 see *Udps. bicollaria*); Jörgensen, 1924, pp. 39, 46, fig. 50.

### **Undellopsis umbilicata** sp. nov.

Figure 523

Lorica 2.10–2.27 oral diameters in length, cylindrical, with 3 (3–5) rings produced by annular expansions of the wall increasing in prominence distally; suboral ledge 1.17 oral diameters in diameter; aboral region with a narrower, short, basal aboral section having an introverted umbilicated center. Length 106–119 $\mu$ .

The type locality is Station 4695 in the Easter Island Eddy of the Eastern Tropical Pacific. Occurs also in the South Equatorial Drift.

Differs from all other species in the larger number of rings and the umbilicated aboral region.

### **Proplectella** gen. nov.

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195–196 (see *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coeliella*, *Favella*, *Parundella*, *Ptychocyclus*, *Salpingella*, *Steenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Entz, Sr., 1885, p. 202.

*Undella*, Cleve, 1901a, p. 923; Wailes, 1925, p. 538.

Undellidae with a more or less distinct inner collar formed by the thickening of the wall of the lorica in the suboral region projecting inwardly rather than outwardly with a resulting inverted, truncated suboral region; no suboral ledge; no rings on the bowl; aboral end pointed, rounded, or flattened.

The type species is *Proplectella claparèdei* (Entz, Sr.) from the food of *Salpa* taken in the Atlantic Ocean.

Differs from *Amplectella*, *Amplectellopsis*, *Cricundella*, *Undella*, and *Undellopsis* in the presence of the inner collar.

Includes 23 species as follows:

<i>acuta</i> (Jörg.)	<i>ovata</i> (Jörg.)
<i>amphora</i> sp. nov.	<i>parva</i> sp. nov.
<i>angustior</i> (Jörg.)	<i>pentagona</i> (Jörg.)
<i>biangulata</i> sp. nov.	<i>perpusilla</i> sp. nov.
<i>claparèdei</i> (Entz, Sr.)	<i>praelonga</i> sp. nov.
<i>columbiana</i> (Wailes)	<i>subacuta</i> (Cleve)
<i>cuspidata</i> sp. nov.	<i>subangulata</i> sp. nov.
<i>ellipsoida</i> sp. nov.	<i>subcaudata</i> (Jörg.)
<i>fastigata</i> (Jörg.)	<i>tenuis</i> sp. nov.
<i>globosa</i> (Bdt.)	<i>tumida</i> sp. nov.
<i>grandis</i> (Laack.)	<i>urna</i> sp. nov.
<i>ostenfeldi</i> sp. nov.	

### ***Proplectella acuta* (Jörgensen)**

Figure 545

*Undella subacuta* forma *acuta* Jörgensen, 1924, pp. 39-41, fig. 43a.

Raised to status of species.

Lorica slender goblet-shaped, 2.1 oral diameters in length; oral region but little contracted; throat 0.85 oral diameter in diameter; bowl suborally a truncated segment of a cone ( $12^\circ$ ) with a length of 0.50 total length and a basal diameter of 1.2 oral diameters; aboral region contracting as a slightly convex, inverted cone ( $50^\circ$ ); aboral end pointed, without projection; tip blunt; wall slightly thickened at throat, thinning one-half aborally. Length 57-60 $\mu$ .

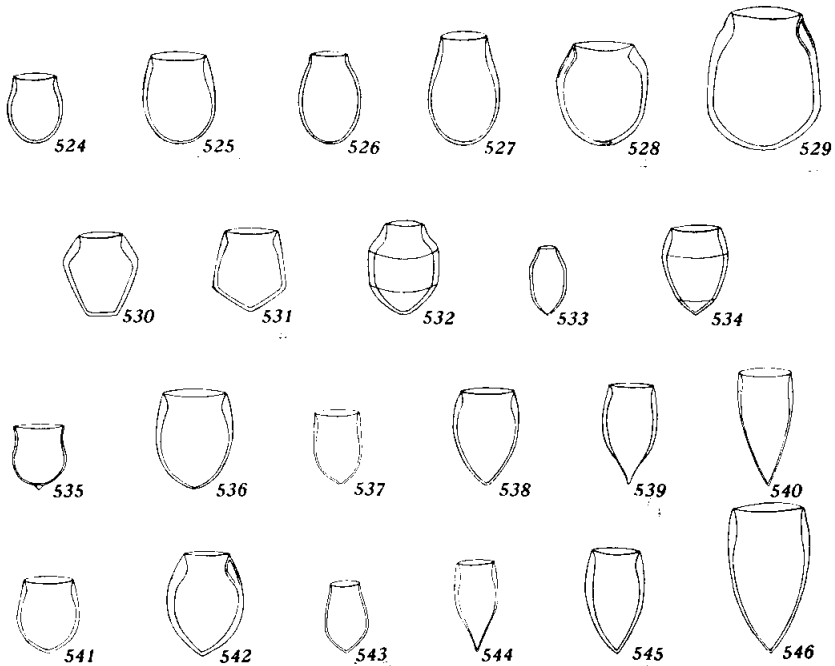
The type locality is Station 206 of the "Thor" Expedition in the Mediterranean off the Balearic Islands.

Differs from *P. subacuta* in less contraction of the lorica anteriorly, more tapering aboral end, and thicker wall.

### ***Proplectella amphora* sp. nov.**

Figure 530

Lorica 1.93-2.10 oral diameters in length, outwardly unequally biconical, truncated, the anterior cone ( $50^\circ$ - $55^\circ$ ) forming 0.26-0.29 total length, the posterior ( $35^\circ$ - $43^\circ$ ) the longer; inner collar deep, its length 0.18-0.21 total length, its surface straight in section forming an inverted cone of  $23^\circ$ - $25^\circ$ , its lower diameter 0.74-0.85 the oral;



Figs. 524-546. Species of *Proplectella* gen. nov.  $\times 200$ .

Fig. 524. *P. perpusilla* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 525. *P. claparèdei* (Entz, Sr.) from Station 4717 in the South Equatorial Drift near the Galapagos Eddy.

Fig. 526. *P. tumida* sp. nov. from Station 4706 in the South Equatorial Drift of the Pacific.

Fig. 527. *P. praelonga* sp. nov. from Station 4673 in the Peruvian Current.

Fig. 528. *P. fastigata* (Jörg.) after Jörgensen (1924, p. 39, fig. 42b) from Station 16 of the "Thor" near Cephalonia in the Eastern Mediterranean.

Fig. 529. *P. ovata* (Jörg.) after Jörgensen (1924, p. 39, fig. 422) from Station 184 of the "Thor" in the Gulf of Corinth.

Fig. 530. *P. amphora* sp. nov. from Station 4679 in the South Equatorial Drift of the Pacific.

Fig. 531. *P. pentagona* (Jörg.) after Jörgensen (1924, p. 39, fig. 43c) from Station 156 of the "Thor" off Northwestern Egypt in the Mediterranean.

Fig. 532. *P. biangulata* sp. nov. from Station 4679 in the South Equatorial Drift of the Pacific.

Fig. 533. *P. urna* sp. nov. from Station 4696 in the Easter Island Eddy.

Fig. 534. *P. subangulata* sp. nov. from Station 4574 in the California Current.

Fig. 535. *P. columbiana* (Wailes) after Wailes (1925, pl. 2, fig. 30) from the Strait of Georgia, British Columbia.

Fig. 536. *P. tenuis* sp. nov. after Brandt (1906, pl. 64, fig. 5) from Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 537. *P. ostentfeldi* sp. nov. from Station 4689 in the Easter Island Eddy.

Fig. 538. *P. ellipsoida* sp. nov. from Station 4699 in the Easter Island Eddy.

Fig. 539. *P. subcaudata* (Jörg.) after Jörgensen (1924, p. 39, fig. 43b) from Station 83 of the "Thor" off Western Portugal in the Atlantic.

Fig. 540. *P. cuspidata* sp. nov. from Station 4648 in the Panama Area of the Pacific.

bowl 0.79–0.82 total length in length below the inner collar, widest (1.56–1.73 oral diameters) 0.26–0.29 below the oral rim, its lumen, owing to changing thickness of the wall, forming anteriorly a truncated cone of  $71^{\circ}$ – $90^{\circ}$  and posteriorly an inverted, truncated cone of  $31^{\circ}$ – $43^{\circ}$ ; aboral end abruptly truncated, slightly convex, with slightly rounded margin; wall thickest (0.2 oral diameter) at the base of the inner collar, thinning to a sharp edge orally and to 0.1 or less posteriorly. Length 57–60 $\mu$ .

The type locality is Station 4679 in the South Equatorial Drift. Occurs also in the Easter Island Eddy.

Differs from all other species of *Proplectella* in its truncated aboral end and in the prominence of the anteriorly located shoulder.

### ***Proplectella angustior* (Jørgensen)**

Figure 542

*Undella claparèdei* var. d Brandt, 1906, p. 31, pl. 64, figs. 8, 9, 33; 1907, pp. 364–365, 459.

*Undella claparèdei* var. *angustior* Jørgensen, 1924, pp. 38–40, fig. 42*d*.

Raised to status of species.

Lorica 1.52–2.09 oral diameters in length, contracting orally; oral rim quite sharp; throat 0.81–0.84 oral diameter in diameter; bowl expanding as a convex cone of  $30^{\circ}$ – $40^{\circ}$ , about 0.5 total length in length, and a basal diameter of 1.7 oral diameters; contracting aborally as an inverted, very convex cone (distally  $80^{\circ}$ – $90^{\circ}$ ) 0.5 total length in length; aboral end without projection; tip acute or blunt; wall 0.13–0.24 oral diameter in thickness at throat, thinning gradually to the aboral end. Length 50–62 $\mu$ .

The type locality is Station Schott (8-VIII-02) in the South Atlantic. Occurs also in the Mediterranean and in the Eastern Tropical Pacific.

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Figs. 524–546. Species of *Proplectella* gen. nov.  $\times 200$ . (Concluded.)

Fig. 541. *P. globosa* (Bdt.) from Station 4637 in the Panamic Area of the Pacific.

Fig. 542. *P. angustior* (Jörg.) after Jørgensen (1924, p. 39, fig. 42*d*) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 543. *P. subacuta* (Cleve) after Cleve (1901*a*, p. 923, fig. 4*a*) from the South Atlantic Current.

Fig. 544. *P. parva* sp. nov. from Station 4634 in the Panamic Area of the Pacific.

Fig. 545. *P. acuta* (Jörg.) after Jørgensen (1924, p. 39, fig. 43*a*) from Station 206 of the "Thor" off the Balearic Islands in the Western Mediterranean.

Fig. 546. *P. grandis* (Laack.) after Laackmann (1909, pl. 49, fig. 21) from the Brazil Current.



Differs from *P. claparèdei* in narrower oral margin and more pointed aboral end, and from *P. fastigata* in less angular bowl, pointed aboral end, and in proportions.

**Proplectella biangulata** sp. nov.

Figure 532

Lorica 1.90–2.44 oral diameters in length, with two lateral angles on each side in optical section; consisting of an anterior truncated cone of  $45^{\circ}$ – $55^{\circ}$ , 0.24–0.28 total length in length, 1.42–1.78 oral diameters in basal diameter, a central subcylindrical section 0.35–0.44 of the total length in length, slightly expanding posteriorly, and a posterior convex inverted, subconical ( $70^{\circ}$ – $100^{\circ}$ ) region; inner collar clearly defined, its length 0.14–0.17 total length, its inner face slightly flaring anteriorly, slightly convex, its lower angle more or less clearly defined; bowl 0.83–0.86 total length in length, its lumen less angular than its exterior; aboral region contracting to a more or less bluntly rounded end; wall thickest (0.24 oral diameter) at the base of the inner collar, thinnest aborally. Length 62–66 $\mu$ .

The type locality is Station 4679 in the South Equatorial Drift of the Eastern Tropical Pacific. Occurs also in the Easter Island Eddy.

Differs from *P. ovata* (Jørgensen) in more pronounced angularity, less posterior expansion, more pointed aboral end, and smaller size.

**Proplectella claparèdei** (Entz, Sr.)

Figure 525

*Tintinnus* sp., *partim*, Claparède and Lachmann, 1858, pp. 210, 479, pl. 9, fig. 5a (for pl. 9, fig. 5b see *Parundella lachmanni*); Kent, 1882, p. 610, pl. 31, fig. 30.

*Tintinnus Claparèdii* Entz, Sr., 1885, pp. 202–203, pl. 14, figs. 10, 11.

*Undella Claparèdei*, Daday 1887b, pp. 179, 180, 181, 197, 198, 202, pl. 19, fig. 1; *non* Entz, Jr., 1908, pp. 10–128, pl. 6, fig. 1; 1909b, pp. 99–217, pl. 13, fig. 1 (see *P. subacuta*); Jørgensen, 1924, pp. 38–42, fig. 42a; *non* Okamura, 1912, pp. 22, 35, pl. 5, fig. 98 (see *Undella hemispherica*).

*Undella claparèdei*, Brandt, 1906, p. 30, pl. 64, figs. 1, 2, 31; 1907, pp. 362–363, 459.

**Proplectella columbiana** (Wailes)

Figure 535

*Undella columbiana* Wailes, 1925, p. 8, pl. 2, figs. 29, 30.

**Proplectella cuspidata** sp. nov.

Figure 540

Lorica 2.5 (2.2-2.6) oral diameters in length, subcylindrical anteriorly, elongated, tapering, pointed; inner collar not sharply differentiated, its length up to the thickest region 0.10-0.14 total length, inverted truncated conical ( $25^{\circ}$ - $35^{\circ}$ ) with inwardly convex wall, its basal diameter 0.90-0.95 oral diameter, the thickening of the wall tapering gradually in the bowl; bowl subcylindrical in anterior 0.33 to 0.50 of the total length, subconical ( $38^{\circ}$ - $46^{\circ}$ ) posteriorly with slightly convex sides, sometimes slightly abruptly contracted midway of the cone, and more strictly conical ( $45^{\circ}$ ), widest (not over 1.1 oral diameters) between 0.25-0.35 total length below the oral rim; aboral end pointed; wall 0.12 oral diameter in thickness at the base of the inner collar. Length 80-92 $\mu$ .

The type locality is Station 4648 in the Panamic Area. Occurs also in the Mexican and Peruvian currents, Galapagos Eddy, and in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *P. grandis* in more slender, less convex aboral part of the lorica and from *P. parva* in larger size.

**Proplectella ellipsoidea** sp. nov.

Figure 538

Lorica 1.75-2.14 oral diameters in length, truncated subellipsoidal; inner collar generally very distinct, its length 0.12-0.16 total length, inverted truncated conical ( $20^{\circ}$ - $40^{\circ}$ ), its lower diameter 0.85-0.95 oral diameter, its face nearly straight, with variable angularity at its lower margin; bowl 0.84-0.88 total length, its greatest diameter (1.24-1.65 oral diameters) at 0.36-0.46 total length from the oral margin; aboral region convex subconical ( $75^{\circ}$ - $90^{\circ}$ ); aboral end bluntly pointed; wall thickest (0.13 oral diameter) at lower margin of collar, subuniform elsewhere. Length 55-66 $\mu$ .

The type locality is Station 4699 in the Easter Island Eddy. It is also widely distributed in the Peruvian Current, in the Galapagos Eddy, and in the South Equatorial Drift.

Differs from *P. praelonga* and *P. tumida* in the presence of an aboral point, from *P. subangulata* in the absence of lateral angulation, from *P. subacuta* in greater length and thicker wall, and from *P. ostenfeldi* in shorter, stouter lorica.

**Proplectella fastigata** (Jørgensen) emended

Figure 528

*Undella claparèdei* var. f Brandt, 1906, p. 31, pl. 64, figs. 11, 11a; 1907, pp. 348, 349, 365, 459.

*Undella claparèdei* forma *fastigata*, partim, Jørgensen, 1924, pp. 38–40, fig. 42b (for Brandt's *U. claparèdei* var. e see *P. tenuis* and for Brandt's *U. claparèdei* var. e *globosa* see *P. globosa*).

Raised to status of species.

Lorica 1.96 (1.94–2.07) oral diameters in length, stout globose; inner collar very distinct, its length 0.18–0.21 total length, its inner face straight forming an inverted truncated cone of 20°–27°, its lower diameter 0.89–0.94 oral diameter; bowl 0.79–0.82 total length in length, globose, widest (1.65–1.82 oral diameters) at 0.31–0.38 total length from oral rim, anteriorly somewhat flattened into a cone of 90°–102°; aboral region subhemispherical; aboral end broadly rounded; wall thickest (0.23 oral diameter) at base of the inner collar. Length 69–82 $\mu$ .

The type locality is Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

Differs from all species of the *P. claparèdei* group in the thicker wall of the collar. It is less expanded posteriorly than *P. perpusilla* and stouter than *P. tenuis*.

**Proplectella globosa** (Brandt)

Figure 541

*Undella claparèdei* var. e *globosa* Brandt, 1906, pp. 30, 31, pl. 64, figs. 4, 10, 32, 34; 1907, pp. 346–349, 365, 459, 466; Laackmann, 1909, pp. 425, 468, 472.

*Undella claparèdei* var. *globosa*, Entz, Jr., 1908, p. 106.

*Undella claparèdei* forma *fastigata*, partim, Jørgensen, 1924, p. 38 (for Brandt's *U. claparèdei* var. e see *P. tenuis* and for Brandt's *U. claparèdei* var. f see *P. fastigata*).

Raised to status of species.

Lorica globose, 1.50–1.62 oral diameters in length, oral margin sharp; diameter at throat 0.88 oral diameter; bowl anteriorly a truncated cone (40°–50°) with slightly convex sides, a basal diameter of 1.4–1.5 oral diameters, and a length of 0.35–0.40 total length; aboral region nearly hemispherical; no aboral projection; wall at throat 0.2 oral diameter in thickness, thinning gradually to the equator. Length 62–70 $\mu$ .

The type locality is Station Pl. 47 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Mediterranean and in the Eastern Tropical Pacific.

Differs from *P. claparèdei* in the globose bowl and from *P. ovata* in less angularity of bowl.

***Proplectella grandis* (Laackmann)**

Figure 546

*Undella claparèdei* var. *grandis* Laackmann, 1909, pp. 427, 468, 472, 493, pl. 49, fig. 21.

Raised to status of species.

Lorica elongate cornucopia-like, 2.03 oral diameters in length; diameter at throat 0.90 oral diameter; bowl anteriorly a short cone ( $35^\circ$ ) with a basal diameter of 1.1 oral diameters and a length of 0.1 of the total length, below which it is an inverted convex cone ( $35^\circ$ ), 0.9 of the total length in length; aboral end pointed; wall 0.12 oral diameter in thickness suborally, thinning gradually aborally to a uniform thickness. Length  $112\mu$ .

The type locality is the Brazil Current of the South Atlantic (Gauss 26-VII-03).

Differs from *P. cuspidata* in stouter, more convex aboral end and from *P. parva* in larger size.

***Proplectella ostenfeldi* sp. nov.**

Figure 537

Lorica 1.42-1.95 oral diameters in length, short and stout, tending to be cylindrical anteriorly; inner collar always somewhat thickened but never angular, the thickening prolonged below its lower level, its length 0.18-0.26 total length, its lower diameter 0.81-0.94 oral diameter, inverted truncated subconical ( $20^\circ$ - $27^\circ$ ), with concave surface; bowl 0.74-0.82 total length in length, widest at 0.33-0.55 total length below the oral margin; aboral region quite convex subconical ( $85^\circ$ - $105^\circ$ ); aboral end bluntly to acutely pointed, often with a small protuberance less than the thickness of its wall in projection; wall relatively thin, thickest (0.11 oral diameter) at the lower level of the inner collar. Length 43-55 $\mu$ .

The type locality is Station 4689 in the Easter Island Eddy of the Eastern Tropical Pacific. Occurs also in the South Equatorial Drift.

Differs from *P. acuta* in stouter lorica and less tapering aboral region.

**Proplectella ovata** (Jørgensen)

Figure 529

*Undella claparèdei* var. g Brandt, 1906, p. 31, pl. 64, figs. 12, 35; 1907, pp. 348, 349, 365, 459.

*Undella claparèdei* forma *ovata* Jørgensen, 1924, pp. 38–39, fig. 42c.

Raised to status of species.

Lorica wide, baggy, subangular, 1.50–1.91 oral diameters in length; oral margin sharp; bowl expanding from oral margin as a truncate cone of  $55^\circ$  with straight sides, with a basal diameter of 1.28–1.35 oral diameters, and a length of 0.25 total length; changing below to  $10^\circ$ , with slightly convex sides, and continuing for 0.5–0.6 total length with a basal diameter of 1.28 oral diameters; aboral end flattened subhemispherical; wall 0.2 oral diameter in thickness at the throat, thinning within 0.5 oral diameter to half this thickness. Length 63–70 $\mu$ .

The type locality is Station 152 of the "Thor" off Barka, North Africa, in the Mediterranean.

Differs from *P. globosa* in more angular bowl and from *P. angustior* in lack of aboral point.

**Proplectella parva** sp. nov.

Figure 544

Lorica 2.14 (1.63–2.49) oral diameters in length, subcylindrical anteriorly, conical posteriorly, widest near the middle; inner collar not sharply delimited, about 0.1 total length in length, inverted truncated conical ( $30^\circ$ – $42^\circ$ ) with inwardly quite convex surface, its basal diameter about 0.9 oral diameter; bowl in the anterior half subcylindrical to conical ( $18^\circ$ – $20^\circ$ ), widest (1.07–1.23 oral diameters) at 0.45–0.60 total length below the oral rim, conical ( $45^\circ$ – $65^\circ$ ) in the posterior half; aboral end sharply pointed; wall thickest (0.18 oral diameter) at the base of the inner collar, and noticeably thick in the upper half of the bowl, often with included coccoliths. Length 44–63 $\mu$ .

The type locality is Station 4634 in the Panamic Area. Occurs also in the California Current and widely distributed throughout the Eastern Tropical Pacific.

Differs from *P. grandis* and *P. cuspidata* in the greater thickness of the wall, in the extent of the thickened area, and in its smaller size.

**Proplectella pentagona** (Jørgensen)

Figure 531

*Undella subacuta* var. *pentagona* Jørgensen, 1924, pp. 39, 41, fig. 43c.

Raised to status of species.

Lorica wide, pentagonal in outline, 2.14 oral diameters in length; throat 0.82 oral diameter in diameter aborally; bowl expanded as a truncated cone of  $22^\circ$  with straight sides, 0.75 of the total length in length, and 1.5 oral diameters in diameter at the base; aboral region an inverted cone of  $105^\circ$ ; aboral end blunt; wall 0.14 oral diameter in thickness at throat, thinning to uniformity aborally within 0.3 oral diameter. Length 51–53 $\mu$ .

The type locality is Station 156 of the "Thor" northwest of Egypt in the Mediterranean.

Differs from *P. amphora* in the level at which the lorica attains its greatest diameter and in the wider mouth, and from *P. biangulata* in having a wider mouth.

**Proplectella perpusilla** sp. nov.

Figure 524

Non *Undella pusilla* Paulsen, 1904, p. 25. *Nomen nudum*.

Lorica 1.20–1.95 oral diameters in length, elongate pouch-shaped, expanding aborally; inner collar diffused, without angular delimitation, length to the narrowest constriction 0.19–0.25 total length from the oral margin, at which the diameter is 0.84–0.90 oral diameter; bowl 0.75–0.81 total length in length, expanding posteriorly from near, or even above the level of the inner collar, to a diameter of 1.1–1.4 oral diameters near (0.42) or even below (0.70) total length from the oral margin; aboral region hemispherical to subhemispherical; aboral end rounded, with no trace of point; wall thin except at inner collar (0.1 oral diameter in thickness). Length 41–50 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. It is also widely distributed in the Eastern Tropical Pacific.

Differs from *P. subacuta* in absence of aboral point and from *P. praelonga* in shorter lorica and less anterior narrowing.

**Proplectella praelonga** sp. nov.

Figure 527

Lorica 1.70–2.59 oral diameters in length, stout bag-shaped, or broadly ovate with a subvertical to slightly everted suboral region; inner collar well developed, its length 0.17–0.21 total length, its basal diameter 0.60–0.87 oral diameter, strongly flaring outwardly as a slightly concave inverted cone of  $25^{\circ}$ – $32^{\circ}$ , not separated from the bowl by a distinct angle; bowl 0.79–0.83 total length in length; widest (1.15–1.76 oral diameters) at 0.50–0.57 total length from the oral margin; aboral region subhemispherical; aboral end rounded, in a few cases with faintest suggestion of a blunt point; wall thickest (0.15 oral diameter) at, or a little below the base of the inner collar. Length 56–76 $\mu$ .

The type locality is Station 4673 in the Peruvian Current. It is also widely distributed in the subsurface plankton of the Eastern Tropical Pacific.

Differs from *P. claparèdei* in greater elongation, from *P. ellipsoida* in lack of an aboral point, from *P. subangulata* in the absence of angulation at the widest part of the bowl, and from *P. ostenfeldi* in greater anterior contraction.

**Proplectella subacuta** (Cleve) emended

Figure 543

*Undella subacuta*, partim, Cleve, 1901a, p. 923, fig. 4a (for fig. 4b see *Undella clevei*); non Jörgensen, 1924, pp. 40–41, figs 43a, b, c (see *P. acuta*, *P. subcaudata*, and *P. pentagona*).

*Undella claparèdei* var. *a subacuta*, Brandt, 1906, p. 30, pl. 64, fig. 3; 1907, partim, pp. 346, 348, 349, 363, 459, 480 (see also *Undella clevei*).

*Undella Claparèdei*, Entz, Jr., 1908, pp. 10–128, pl. 6, fig. 1; 1909b, pp. 99–217, pl. 13, fig. 1.

**Proplectella subangulata** sp. nov.

Figure 534

Lorica 1.83 (1.62–1.95) oral diameters in length, subangular, truncate ellipsoidal; inner collar moderately developed, 0.13–0.14 total length in length, inverted conical ( $30^{\circ}$ – $34^{\circ}$ ), its lower diameter 0.85–0.94 oral diameter, its face nearly flat, gradually merging into the bowl; bowl divisible into three regions by rounded angles, the anterior truncated conical ( $32^{\circ}$ – $39^{\circ}$ ), 0.22–0.32 total length in length; the middle part inverted truncated conical ( $10^{\circ}$ – $28^{\circ}$ ), widest (1.23–1.30

oral diameters) at the anterior shoulder, 0.53-0.55 total length in length; the aboral 0.13-0.25 total length inverted subconical ( $81^{\circ}$ - $90^{\circ}$ ) with convex sides; aboral end bluntly pointed; wall thickest (0.12 oral diameter) at the lower end of the inner collar, thinning posteriorly. Length 58-62 $\mu$ .

The type locality is Station 4574 in the California Current. Occurs also in the Galapagos Eddy and the South Equatorial Drift.

Differs from *P. ellipsoidea* and *P. ostenfeldi* in the angulation and from *P. praelonga* and *P. tumida* in the presence of the aboral point.

### **Proplectella subcaudata** (Jørgensen)

Figure 539

*Undella subacuta* var. *subcaudata* Jørgensen, 1924, pp. 39-41, fig. 43b.

Raised to status of species.

Lorica small vase-shaped, 2.29 oral diameters in length; throat 0.84 oral diameter in diameter; in the oral 0.5 of the bowl a cone of  $20^{\circ}$ , with a basal diameter of 1.3 oral diameters; contracting rapidly below as a cone of  $70^{\circ}$  with convex sides; aboral end projecting as a short blunt cone ( $35^{\circ}$ ), 0.4 oral diameter in length; wall scarcely thickened at throat, thinning gradually aborally to a thinness unusual in the genus. Length 60-62 $\mu$ .

The type locality is Station 68 of the "Thor" in the Atlantic southwest of England.

Differs from *P. subacuta* in longer, more narrowly conical aboral end with thinner wall aborally.

### **Proplectella tenuis** sp. nov.

Figure 536

*Undella claparedei* var. e Brandt, 1906, p. 31, pl. 64, figs. 5, 6, 7; 1907, pp. 348, 349, 363, 364, 459.

*Undella claparedei* forma *fastigata*, partim, Jørgensen, 1924, p. 38 (for Brandt's *U. claparedei* var. e *globosa* see *P. globosa* and for his *U. claparedei* var. f see *P. fastigata*).

Lorica 1.85 (1.67-2.33) oral diameters in length, elongate ovate, truncated anteriorly; inner collar well developed, 0.15-0.21 total length in length, inverted truncated conical ( $31^{\circ}$ - $37^{\circ}$ ) with slightly convex wall, 0.84-0.88 oral diameter in diameter at base diameter; bowl broadly subovate, sometimes with slight lateral flattening, widest (1.21-1.35 oral diameters) at 0.31-0.53 of the total length below the



oral margin; aboral region less than hemispherical, scarcely subconical; aboral end barely with a trace of angularity; wall thickest (0.18 oral diameter), but variable, at base of collar. Length 63–70 $\mu$ .

The type locality is Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Differs from *P. ostenfeldi* in being less pointed and in having a more flaring collar and from *P. ellipsoidea* in having the greatest width farther posterior.

### **Proplectella tumida** sp. nov.

Figure 526

Lorica 2.54 oral diameters in length, truncate ovate, slightly extended anteriorly; inner collar scarcely defined, 0.09 total length in length, without clearly defined angle, its least diameter 0.85 oral diameter; bowl ovate below collar, its greatest diameter 1.76 oral diameters at 0.53 total length below the oral margin; aboral region contracting ellipsoidal with rounded aboral end; wall thin, 0.1 oral diameter in the inner collar. Length 61 $\mu$ .

The type locality is Station 4706 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from *P. urna* in stouter proportions and from *P. praelonga* in less clearly defined anterior extension and thinner wall in the collar region.

### **Proplectella urna** sp. nov.

Figure 533

Lorica 4.4 oral diameters in length, stout amphora-shaped; inner collar sharply defined, 0.12 total length in length, its inner face almost vertical; bowl 0.88 total length in length, elongate ovoidal, its greatest diameter 2.46 oral diameters at 0.44 total length below the oral margin; aboral end convex conical (97°), definitely pointed; wall thickest (0.23 oral diameter) at base of inner collar. Length 46 $\mu$ .

The type locality is Station 4696 in the Easter Island Eddy of the Eastern Tropical Pacific.

Differs from all other species except *P. tumida* in the marked contraction of the oral region, and from it in having a pointed instead of a rounded aboral end.

## Family DICTYOCYSTIDAE Haeckel emended

Dictyocystiden, *partim*, Haeckel, 1873, pp. 562-564 (see also *Cyttarocylidae*).

Dictyocystidae (Peritricha), *partim*, Kent, 1882, p. 624 (see also *Cyttarocylidae*, *Petalotrichidae*, and *Rhabdonellidae*).

Tintinnoina in which the lorica is short and wide, more or less inverted bell-shaped; collar cylindrical with a single or double row of beams, enclosing large windows; bowl swollen, rounded, often with mesh structure and a fine reticulation of primary prisms; no aboral appendage; no spiral structure; macronuclei 3-11; membranelles 18-20; 4(?) longitudinal rows of cilia; closing apparatus of 10-16 blades. Eupelagic, marine only.

Differs from all other families in having the collar with one or two rows of quadrangular fenestrae.

Contains but a single genus, *Dictyocysta* Ehrbg.

**Dictyocysta** Ehrenberg emended

"Zierliches Körperchen" J. Müller, 1843, p. 233.

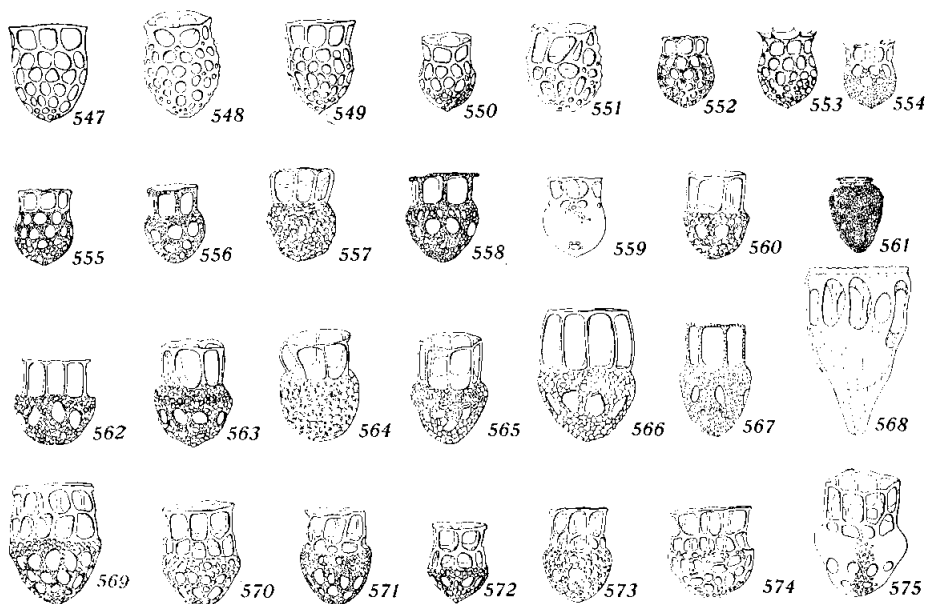
*Dictyocysta Ehrenberg*, 1854a, p. 71; 1854b, *partim*, pp. 238-239 (see also *Cyttarocylis*); Haeckel, *partim*, 1873, pp. 562-564 (see also *Cyttarocylis*); Fol, 1881, pp. 22-23; 1884, pp. 57, 58; Kent, 1882, p. 624; Entz, Sr., *partim*, 1886, pp. 208-212 (see also *Codonella*); Daday, 1887b, pp. 584-588; Bütschli, 1889, p. 1737; Biedermann, 1893, pp. 6-13; Delage and Hérouard, 1896, p. 467; Brandt, 1907, pp. 48-73; Laackmann, 1909, pp. 430-434; Jörgensen, 1924, pp. 7, 81, 85.

Dictyocystidae with lorica with a tall cylindrical collar with beams surrounding large windows in one to several rows; bowl rounded, inflated; wall with coarse and fine reticulations and often with included coccoliths.

We designate as the type species *Dictyocysta elegans* Ehrenberg emended from off Newfoundland, one of the oldest species included in the genus.

Includes 30 species as follows:

ampla sp. nov.	fenestrata sp. nov.	nidulus sp. nov.
apiculata Wailes	fundlandica Ehrbg.	obtusa Jörg.
atlantica Herdman, Thompson, and Scott	grandis Bdt.	occidentalis sp. nov.
californiensis sp. nov.	inaequalis sp. nov.	ovalis Daday ?
dilatata Bdt.	lata sp. nov.	pacifica sp. nov.
duplex Bdt.	lepida Ehrbg.	polygonata sp. nov.
elegans Ehrbg.	magna sp. nov.	reticulata sp. nov.
entzi Jörg.	mexicana sp. nov.	speciosa Jörg.
extensa sp. nov.	minor Jörg.	spinosa sp. nov.
	mitra Haeckel	tiara Haeckel
	mülleri (Imhof) Jörg.	



Figs. 547-575. Species of *Dietyocysta* Ehrenberg.  $\times 200$ .

Fig. 547. *D. obtusa* Jörg. after Brandt (1906, pl. 1, fig. 3) from Station "Schott 16" in the Agulhas Current.

Fig. 548. *D. mitra* Haeckel after Brandt (1906, pl. 1, fig. 1) from Station Pl. 25 of the Plankton Expedition at the boundary of the Florida and Labrador currents.

Fig. 549. *D. dilatata* Bdt. after Brandt (1906, pl. 1, fig. 4) from Station Pl. 25 of the Plankton Expedition at the boundary of the Florida and Labrador currents.

Fig. 550. *D. minor* Jörg. after Brandt (1906, pl. 1, fig. 5) from Station Pl. 25 of the Plankton Expedition at the boundary of the Florida and Labrador currents.

Fig. 551. *D. fenestrata* sp. nov. from Station 4675 in the Peruvian Current.

Fig. 552. *D. californiensis* sp. nov. from Station 4583 in the California Current.

Fig. 553. *D. spinosa* sp. nov. from Station 4681 in the South Equatorial Drift of the Pacific.

Fig. 554. *D. extensa* sp. nov. after Brandt (1906, pl. 3, fig. 6) from Station 55 of the Plankton Expedition in the Sargasso Sea.

Fig. 555. *D. pacifica* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 556. *D. occidentalis* sp. nov. from Station 4701 in the South Equatorial Drift of the Pacific.

Fig. 557. *D. polygonata* sp. nov. from Station 4663 in the Peruvian Current.

Fig. 558. *D. lepida* Ehrbg. after Brandt (1906, pl. 3, fig. 1) from Station "Bruhn 44" south of Madagascar.

Fig. 559. *D. entzi* Jörg. emended after Jörgensen (1924, p. 82, fig. 96) from Station 26 of the "Thor" in the Tyrrhenian Sea.

Fig. 560. *D. reticulata* sp. nov. after Brandt (1906, pl. 3, fig. 8) from Station "Schott, 11-VII-92" south of Madagascar.

Fig. 561. *D. ovalis* Daday after Daday (1886, pl. 25, fig. 14) from the Bay of Naples.

Fig. 562. *D. lata* sp. nov. after Brandt (1906, pl. 4, fig. 1) from Station Pl. 37 of the Plankton Expedition in the Sargasso Sea.

**Dictyocysta ampla** sp. nov.

Figure 573

*Dictyocysta elegans* var. *e* Brandt, 1906, p. 11, pl. 2, fig. 1; 1907, *partim*, pp. 49, 67, 464 (see *D. mülleri*).

*Dictyocysta elegans*, *partim*, Jörgensen, 1924, pp. 81, 82, 83; 1927, pp. 14, 15 (see also *D. elegans*, *D. fundlandica*, *D. magna*, and *D. speciosa*).

Lorica 1.62–1.66 oral diameters in length; collar 0.86 length of bowl in length; with 7 upper and 8–9 lower windows; bowl a little longer than a hemisphere, its height 0.77 its greatest diameter; aboral end rounded, scarcely pointed; a postequatorial row of 9–10 unequal fenestrae and an aboral row of 7–8, rest of bowl unevenly reticulate. Length 62–66 $\mu$ .

The type locality is off Messina, Italy. Occurs also in the California Current.

Differs from *D. magna* in relatively longer and fuller bowl and fewer and less regular equatorial fenestrae.

Figs. 547–575. Species of *Dictyocysta* Ehrenberg.  $\times 200$ . (*Concluded.*)

Fig. 563. *D. mexicana* sp. nov. from Station 4583 in the California Current.

Fig. 564. *D. duplex* Bdt. after Brandt (1906, pl. 2, fig. 9) from Station Pl. 25 of the Plankton Expedition at the boundary of the Florida and Labrador currents.

Fig. 565. *D. nidulus* sp. nov. after Brandt (1906, pl. 3, fig. 7) from Station N. 42 of the Plankton Expedition in the margins of the Florida and Labrador currents.

Fig. 566. *D. grandis* Bdt. after Brandt (1906, pl. 3, fig. 4) from Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

Fig. 567. *D. tiara* Haeckel after Laackmann (1909, pl. 49, fig. 1) from off New Amsterdam southwest of Australia in the Southern Ocean.

Fig. 568. *D. apiculata* Wailes after Wailes (1925, pl. 1, fig. 1) from the Strait of Georgia, British Columbia.

Fig. 569. *D. magna* sp. nov. after Brandt (1906, pl. 1, fig. 9) from Station Pl. 25 of the Plankton Expedition in the margins of the Florida and Labrador currents.

Fig. 570. *D. elegans* Ehrbg. after Brandt (1906, pl. 1, fig. 8) from Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

Fig. 571. *D. inaequalis* sp. nov. after Brandt (1906, pl. 2, fig. 3) from Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 572. *D. mülleri* (Imhof) Jörg. after Brandt (1906, pl. 2, fig. 5) from Station "Schott f" in the Benguela Current.

Fig. 573. *D. ampla* sp. nov. after Brandt (1906, pl. 2, fig. 1) from off Messina, Italy.

Fig. 574. *D. fundlandica* Ehrbg. after Brandt (1906, pl. 2, fig. 8) from Station "Schott, 11-VII-92" south of Madagascar.

Fig. 575. *D. speciosa* Jörg. after Jörgensen (1924, p. 82, fig. 93) from off Naupoktos in the Mediterranean.

**Dictyocysta apiculata** Wailes

Figure 568

*Dictyocysta apiculata* Wailes, 1925, pp. 533, 534, pl. 1, fig. 1. Possibly a distorted lorica.

**Dictyocysta atlantica** Herdman, Thompson, and Scott

*Dictyocysta atlantica* Herdman, Thompson, and Scott, 1897, p. 58. *Nomen nudum*.

**Dictyocysta californiensis** sp. nov.

Figure 552

Lorica 1.45–1.66 oral diameters in length; oral rim minutely denticulate; collar cylindrical, 0.33 oral diameter in height with 6 windows, its length about 0.25 that of the bowl; bowl very stout ovate, its greatest diameter 1.30–1.36 oral diameters; aboral end bluntly pointed; 6 rows of fenestrations, with fine, subuniform reticulations filling the mesh. Length 48–53 $\mu$ .

The type locality is Station 4583 in the California Current.

Differs from *D. mitra* and *D. pacifica* in the greater rotundity of the bowl and from the latter in more regularly graded fenestrae.

**Dictyocysta dilatata** Brandt

Figure 549

*Dictyocysta mitra* var. *a dilatata* Brandt, 1906, p. 11, pl. 1, fig. 4; 1907, pp. 64, 462, 472.

*Dictyocysta mitra* forma *dilatata*, Jörgensen, 1924, p. 87.

Raised to status of species.

Lorica 1.4 oral diameters in length; oral margin undulating; collar 0.23 of total length in length, an inverted segment of a cone of 25°, with 8 closed, squarish windows; bowl as long as wide, broadly subovoidal; aboral region slightly convex conical (90°); aboral end pointed, with a slight spine-like tip; fenestrae covering the entire bowl, subequal, rounded to subrectangular, in 7 rows decreasing in size aborally. Length 58–70 $\mu$ .

The type locality is Station Pl. 25 of the Plankton Expedition in the margin of the Labrador and Florida currents. Occurs also in the Sargasso Sea and in the Peruvian Current.

Differs from *D. mitra* in the distinct set-off of the more flaring collar and more acutely pointed aboral end.

**Dictyocysta duplex** Brandt emended

Figure 564

*Dictyocysta templum* var. *c duplex* Brandt, 1906, pp. 11-12, pl. 2, fig. 9; 1907, pp. 72, 481.

*Dictyocysta templum* var. *d* Brandt, 1906, p. 11, pl. 2, fig. 10, pl. 4, fig. 7; 1907, pp. 71-72, 481.

*Dictyocysta templum* var. *h* Laackmann, 1909, p. 434, pl. 49, fig. 3.

*Dictyocysta coccolitholega* Lohmann, 1912*a*, pp. 27-28, fig. 3, nos. 1, 2; 1912*b*, p. 205, fig. 5, nos. 1, 2; 1920, p. 230; Stiasny, 1913, p. 115, fig. 68.

*Dictyocysta lepida* var. *coccolitholega*, Jörgensen, 1924, pp. 84-86.

Raised to status of species.

Lorica 1.60-2.31 oral diameters in length; oral margin undulating; collar 0.3-0.5 total length in length, with a single row of 7 tall rectangular windows whose length is 1.2 their width; bowl subglobular, or rarely wider (0.84 length of bowl) than long, set off by distinct shoulder from the bowl; aboral region subhemispherical; no aboral point; wall of bowl with large, subuniform, coarse, rounded, and overlapping meshes and with smaller ones intermingled, formed by included coccoliths (*Coccolithophora* spp.) Length 60-75 $\mu$ .

The type locality is Station Pl. 25 of the Plankton Expedition in the boundary between the Labrador and Florida currents. Occurs also in the South Equatorial Current, Benguela, and Brazil currents of the Atlantic, commonly in the Mediterranean, and in the Peruvian Current, and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from all other species in the extensive coccolith inclusions and duplex nature of the wall structure.

**Dictyocysta elegans** Ehrenberg emended

Figure 570

*Dictyocysta elegans* Ehrenberg, *partim*, 1854*a*, p. 71; 1854*b*, pp. 238-239; 1867, p. 203 (for 1854*c*, p. 5 of explanation of plate, pl. 35*A*, fig. 24*d* see *D. mitra*); Möbius, *partim*, 1887, p. 119, pl. 8, fig. 28 (for fig. 29 see *D. speciosa*); Brandt, *partim*, 1906, p. 11, pl. 1, fig. 8, pl. 2, fig. 12; 1907, pp. 65-66, 464; 1910, pp. 3-6 (for pl. 1, fig. 7 see *D. speciosa*); Swarczewsky, 1912, pp. 94-102, 176, pl. 6, figs. 1-16; Laackmann, *partim*, 1913, pp. 2, 5-11, 42, pl. 1, figs. 1-3, 7 (for pl. 1, figs. 4-6 see *D. mülleri*); Jörgensen, *partim*, 1924, pp. 81-86, 105, 107; 1927, *partim*, pp. 14-15, fig. 28 (see also *D. ampla*, *D. fundlandica*, *D. magna*, and *D. speciosa*); Biedermann, *partim*, 1893, pp. 11-13, pl. 1, fig. 1, pl. 3, fig. 4 (for pl. 1, fig. 2 see *D. speciosa* and for pl. 3, fig. 3 see *D. mitra*); Wailes, 1928, p. 40, pl. 12, fig. 29; non Entz, Jr., 1908, pp. 12-126, pl. 2, figs. 13, 16; 1909*b*, pp. 102-215, pl. 9, figs. 13, 16 (see *D. speciosa*).

"Varietäten resp. Zwischenformen von *Dictyocysta elegans* pp. Möbius resp. *Dictyocysta templum* Haeckel," Biedermann, *partim*, 1893, p. 10, pl. 3, figs. 6, 8-11 (for fig. 7 see *D. speciosa*).

*Dictyocysta elegans* forma *varians* Jörgensen, 1924, p. 82, fig. 92.

*Dictyocysta templum* var. *disticha*, *partim*, Jörgensen, 1899, p. 40; 1900, pp. lxiv, lxxx; 1905, pp. 53, 56, 59, 65, 68, 82, 145; Brandt, 1907, pp. 51, 60, 65, 462, 464, 481; 1910, p. 3 (see also *D. speciosa*).

*Dictyocysta templum* var. *dysticha*, Linko, 1915, p. 17.

Jörgensen (1899) cited a group of figures from Möbius (1887) and Biedermann (1893) and gave an inadequate description as the basis of his *D. templum* var. *disticha*. In 1924 he redescribes all of these except one of Biedermann's figures (Biedermann, 1893, pl. 1, fig. 1) as *D. elegans* var. *speciosa*. He left unstated what this figure should be. His silence leaves it as *D. templum* var. *disticha*. This figure, however, conforms neatly to his *D. elegans* var. *varians* and this latter name and *disticha* alike fall into the synonymy of *D. elegans*.

Biedermann (1893) caused no small amount of confusion by his quite inadequate treatment of this genus in his doctorate foray in this field. He described as *D. elegans* what we regard as three distinct species, his pl. 1, fig. 1, and pl. 3, fig. 4, being *D. elegans*, his pl. 1, fig. 2 being *D. speciosa* and pl. 3, fig. 3 being *D. mitra*. To this complex he added a group of so-called intermediate varieties between *D. elegans* and *D. templum*, which, on the basis of his crude figures, may be tentatively referred as follows, pl. 3, fig. 7 to *D. speciosa*, and figs. 6, 8-11 to *D. elegans*.

In 1927 Jörgensen reproduced in his fig. 28, what appears to be the lorica he figured in 1924 (fig. 92) as *D. elegans* forma *varians*. This figure in turn is very close to that of Brandt's (1906, pl. 2, fig. 12) typical *D. elegans*. We, therefore, include *D. templum* var. *disticha* Jörg. and *D. elegans* forma *varians* Jörg. in *D. elegans sensu strictu*. This leaves a substantial content in *D. elegans* after the removal of *D. speciosa* and leaves as *D. elegans* those loricae which conform most nearly to Ehrenberg's (1854a) original description, and at the same time somewhat resemble his figure (1854b, pl. 35A, fig. 24d). This figure, however, must be assigned to *mitra*. The grounds of this assignment are that Ehrenberg's figure has, as in *D. mitra*, the entire lorica fenestrate and no shoulder at the junction of collar and bowl, and not the slight shoulder and interrupted and reduced fenestrae as on the bowl of *D. elegans*, which result in a double row of fenestrae on the differentiated collar characteristic of *D. elegans* and *D. speciosa*.

**Dictyocysta entzi** Jörgensen emended

Figure 559

*Dictyocysta* Mitra, Entz, Sr., 1885*b*, p. 211, pl. 14, fig. 22.*Dictyocysta entzi* Jörgensen, *partim*, 1924, pp. 82, 85-86, fig. 96 (see also *D. extensa*).**Dictyocysta extensa** sp. nov.

Figure 554

*Dictyocysta templum* var. *g* Brandt, 1906, p. 12, pl. 3, fig. 6; 1907, pp. 31, 49, 73, 481.*Dictyocysta entzi*, *partim*, Jörgensen, 1924, pp. 82, 85-86 (for fig. 96 see *D. entzi*).

Lorica 1.39 oral diameters in length, stout baggy; oral rim distinctly spinous, with about 10 unequal spines; collar with 7 square windows; bowl 1.13 oral diameters in diameter below its middle; aboral end with a projecting point; wall of bowl with an anterior row of 7 rounded windows and an incomplete equatorial row; remainder of surface with a subuniform reticulum of polygons, about 25 across one face on the equator of the bowl. Length 45 $\mu$ .

The type locality is Station Pl. 55 of the Plankton Expedition in the Sargasso Sea.

Differs from *D. spinosa* in the shape of the bowl and in the smaller number of fenestrae on it. Jörgensen's opinion that this species is an "optical delusion" (*sic!*) can hardly be true in the light of our spinulate material and Brandt's distinct figure.

**Dictyocysta fenestrata** sp. nov.

Figure 551

Lorica 1.38 oral diameters in length; collar not set off from bowl by shoulder, with 9 windows; bowl subhemispherical, its height 0.65 its greatest diameter; aboral end rounded; two major rows of 11 and 9 fenestrae each on the bowl, with a cluster of smaller fenestrae over the aboral end. Length 56 $\mu$ .

The type locality is Station 4675 in the Peruvian Current.

Differs from *D. mitra* and *D. minor* in its rounded aboral end.

**Dictyocysta fundlandica** Ehrenberg

Figure 574

*Dictyocysta lepidae*  $\beta$  *fundlandica* Ehrenberg, 1854*b*, p. 239.*Dictyocysta elegans* var. *b* Brandt, 1906, pp. 11-12, pl. 2, fig. 8, pl. 4, fig. 4; 1907, pp. 67, 464.*Dictyocysta elegans*, *partim*, Jörgensen, 1924, p. 81 (see also *D. ampla*, *D. elegans*, *D. magna*, and *D. speciosa*).



Raised to status of species.

Lorica very short and stout, 1.15 oral diameters in length; oral margin very slightly undulating; collar 0.5 total length in length, with two rows of windows, the anterior with 7 squarish windows, the posterior with 9 smaller more rounded windows; bowl hemispherical, without shoulder; fenestrae subellipsoidal, in two major rows, an equatorial row of 12 and a postequatorial one of 12 smaller ones, with a few additional fenestrae interpolated or in the aboral region; a pre-equatorial line and an aboral group of small reticulations. Length 60 $\mu$ .

The type locality is off Newfoundland.

Differs from all other species with two rows of windows in having the broadly hemispherical bowl without shoulder.

"In alio servato specimine margo aperturæ anterioris amplæ parvas cellulas gerit magnis impositas. Forsan hæc tertia huius tipi species est. Varietas *D. lepidae*  $\beta$  *fundlandica* dicatur." Brandt's (1906) specimens both came from Station Pl. 123 in the Gulf Stream Drift. Brandt's (1906) figures agree with Ehrenberg's description in having fenestrae of two sizes in the collar, and the subglobose bowl. Furthermore, the proportions of Brandt's *D. elegans* var. b (his pl. 2, fig. 8 and pl. 4, fig. 4) are not unlike those of his *D. lepida* (his pl. 3, figs. 1-3), hence Ehrenberg's allocation as "varieties" of *lepida* and his suggestion that this may be a third species conform to Brandt's data on the species concerned.

### **Dictyocysta grandis** Brandt

Figure 566

*Dictyocysta templum* var. *c grandis* Brandt, 1906, p. 12, pl. 3, figs. 4, 5, pl. 4, fig. 6; 1907, pp. 49, 70, 71, 467, 481.

*Dictyocysta lepida*, *partim*, Jörgensen, 1924, pp. 83-85; 1927, pp. 14-15 (see also *D. lata*, *D. lepida*, *D. mexicana*, *D. nidulus*, and *D. reticulata*).

*Dictyocysta lepida grandis*, *partim*, Kofoid, 1915, p. 65, on p. 66 as "var. *g grandis*" (*lapsus* for *c grandis*, see *D. tiara*).

Raised to status of species.

Lorica 1.58 oral diameters in length; oral margin slightly undulating; collar 0.44 total length in length, with a single row of 8 elongated rectangular windows whose length is nearly twice their width, sometimes with an oblique cross-connection below the middle, forming a partial secondary row; bowl convex, subconical (90°), its length 0.65-0.73 of its width; fenestrae large, irregularly ovoidal, in a single

or at the most a double row around the middle of the bowl; surface covered with fine, subuniform reticulations. Length 90-95 $\mu$ .

The type locality is Station Pl. 123 of the Plankton Expedition in the Gulf Stream.

Differs from *D. reticulata* in taller collar, more windows, and in wider bowl.

### ***Dictyocysta inaequalis* sp. nov.**

Figure 571

*Dictyocysta elegans* var. d Brandt, 1906, p. 11, pl. 2, fig. 3; 1907, pp. 49, 67, 464.

Lorica 1.62 oral diameters in length; collar shorter (0.83) than bowl, with 7 upper and 9 very small, irregular lower windows; bowl with distinct shoulder, longer than a hemisphere, its height 0.7 its greatest diameter; aboral end broadly rounded; one postequatorial row of 10-12 unequal fenestrae and one aboral row of 6-7 unequal fenestrae. Length 64-66 $\mu$ .

The type locality is Station Pl. 116 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Differs from *D. ampla* in fuller bowl, smaller and less regular lower row of windows, and fainter and finer reticulations; otherwise close to that species.

### ***Dictyocysta lata* sp. nov.**

Figure 562

*Dictyocysta templum* var. a Brandt, 1906, p. 12, pl. 4, figs. 1 [flattened], 2, 5; 1907, pp. 70, 481.

*Dictyocysta lepida*, *partim*, Jørgensen, 1924, p. 83 (see also *D. grandis*, *D. lepida*, *D. mexicana*, *D. nidulus*, and *D. reticulata*).

Lorica 1.51 oral diameters in length; collar much shorter (0.67) than the bowl, with 8 high rectangular windows about half as wide as high; bowl longer than a hemisphere, its height 0.77 its greatest diameter, with a bulge below the collar; aboral end broadly rounded; one row of 6 large, subequal, postequatorial fenestrae. Length 57-62 $\mu$ .

The type locality is Station Pl. 37 of the Plankton Expedition in the Sargasso Sea.

Differs from *D. grandis* in fuller bowl, relatively shorter collar, and 6 instead of 8 postequatorial fenestrae and from *D. reticulata* in greater irregularity of reticulations on the bowl and more broadly rounded aboral end.

**Dictyocysta lepida** Ehrenberg emended

Figure 558

*Dictyocysta lepida* Ehrenberg, 1854*b*, p. 239; Jörgensen, *partim*, 1924, pp. 81-87, 105, 106, fig. 95; 1927, pp. 14-15, fig. 30 (see also *D. grandis*, *D. lata*, *D. mexicana*, *D. nidulus*, and *D. reticulata*).

*Dictyocysta templum* Haeckel, 1873, p. 564, pl. 27, fig. 6; 1899, pl. 3, fig. 3; Kent, 1882, pp. 625-626, pl. 32, fig. 27; Föl, 1884, pp. 57-58, pl. 5, fig. 9; Entz, Sr., 1885*b*, pp. 208-211, pl. 14, figs. 18-21, 23; Brandt, 1906, p. 11, pl. 2, fig. 13, pl. 3, figs. 1-3; 1907, pp. 11, 19, 22, 29, 35, 36, 48-64, 66-73, 80, 98, 123, 444, 447, 469, 480; Okamura, 1907, p. 136, pl. 6, figs. 55*a*, *b*; Entz, Jr., 1909*b*, *partim*, pp. 99-224, pl. 9, fig. 14 (for pl. 11, fig. 4, pl. 17, fig. 8 and pl. 20, figs. 25, 26 see *D. nidulus*); Laackmann, *partim*, 1909, p. 432 (see also *D. polygonata*); 1913, p. 2.

Non *Dictyocysta templum*, Daday, 1887*a*, pp. 167, 178-180, pl. 1, fig. 6; 1887*b*, pp. 585-586, pl. 21, figs. 8, 9 (see *D. reticulata*); Zacharias, 1906, pp. 510, 520, 521, 526, fig. 9 (see *D. reticulata*); Entz, Jr., 1904, pp. 129-132, figs. 24-29 (for figs. 24, 26, 28, 29 see *D. speciosa* and for figs. 25, 27 see *D. nidulus*); Okamura, 1912, p. 22, pl. 5, fig. 99 (see *D. tiara*).

*Dictyocysta* "templum," Jörgensen, 1924, pp. 83, 85.

*Dictyocysta lepida templum*, Kofoid, 1915, p. 65.

Non "Varietäten resp. Zwischenformen von *Dictyocysta elegans* p.p. Möbius resp. *Dictyocysta templum* Haeckel," Biedermann, 1893, p. 10, pl. 3, figs. 6-11 (for figs. 6, 8-11 see *D. elegans* and for fig. 7 see *D. speciosa*).

*Dictyocysta Templum*, *partim*, Entz, Jr., 1908, pp. 10-135, pl. 2, fig. 14 (for pl. 10, fig. 8 and pl. 13, figs. 25, 26 see *D. nidulus*).

**Dictyocysta magna** sp. nov.

Figure 569

*Dictyocysta elegans* var. *a* Brandt, 1906, p. 11, pl. 1, fig. 9, pl. 2, figs. 4, 7; 1907, pp. 49, 66, 72, 464.

*Dictyocysta elegans*, *partim*, Jörgensen, 1924, p. 81 (see also *D. ampla*, *D. elegans*, *D. fundlandica*, and *D. speciosa*).

Lorica 1.57-1.70 oral diameters in length; oral margin with a list; collar 0.83-0.90 length of bowl, with 7-8 upper and 8-9 lower windows, the two series subequal, the windows quadrangular or pentagonal; bowl low acorn-shaped, with distinct bulge below the collar, with slight shoulder; aboral end convex conical (90°) contracting to a very blunt point; a postequatorial row of 10 large, subequal fenestrae and a second row of 6-10 below this. Length 75-95 $\mu$ .

The type locality is Station Pl. 25 of the Plankton Expedition in the margins of the Florida and Labrador currents. Occurs also in the Florida Current.

Differs from all other species in its larger size and from *D. ampla* and *D. inaequalis* in more pointed bowl and in equality of the upper and lower series of windows.

**Dictyocysta mexicana** sp. nov.

Figure 563

*Dictyocysta lepida*, *partim* (on basis of occurrence), Jörgensen, 1924, p. 85 (see also *D. grandis*, *D. lata*, *D. lepida*, *D. nidulus*, and *D. reticulata*).

Lorica 1.40–1.57 oral diameters in length; collar about 0.75 bowl in length, with 7 rectangular windows in one row, their width 0.57 of their height; bowl stout, short acorn-shaped, with a wide bulge below the collar, with straight sides making an inverted cone ( $38^\circ$ ); aboral end abruptly contracting in an inverted cone ( $123^\circ$ ) with a blunt projecting terminal eminence; an equatorial belt of 25 small fairly uniform fenestrae, and 8 large subequal postequatorial ones, and several aboral ones. Length 57–66 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican Current and the Panamic Area.

Differs from *D. lepida* in longer collar and from *D. nidulus* in greater angularity, more localized fenestrae, and more projecting aboral point.

**Dictyocysta minor** Jörgensen

Figure 550

*Dictyocysta mitra* var. *c* Brandt, 1906, p. 11, pl. 1, figs. 5, 6; 1907, pp. 49–64, 73, 472; Laackmann, 1909, pp. 428, 431, 432.

*Dictyocysta mitra* var. *minor* Jörgensen, 1924, pp. 82, 87, fig. 98.

Raised to status of species.

Lorica small, stout, 1.38–1.51 oral diameters in length; oral margin quite undulating, smooth or spinose with 20 minute teeth; collar cylindrical or flaring ( $20^\circ$ ), with 6–7 large squarish subequal, closed fenestrae, whose width often exceeds slightly their height; bowl broadly ovoidal, its greatest diameter 1.15 oral diameter; aboral region contracted to a low, broadly rounded convex cone ( $110^\circ$ ); aboral end with blunt point; fenestrae large, covering the entire bowl, subregular in first three rows, irregular, and with many smaller ones in aboral third, 10–11, 12–13 in number respectively. Length 47–53 $\mu$ .

The type locality is Station Pl. 25 of the Plankton Expedition in the boundary between the Labrador and Florida currents. Occurs also off Corsica, in the English Channel, and in the California and Peruvian currents, South Equatorial Drift, and Galapagos Eddy of the Eastern Tropical Pacific.

Differs from *D. mitra* in shorter, relatively wider lorica, and in the unequal aboral fenestrae and from *D. dilatata* in the lack of aboral spine, in less flaring collar, and stouter proportions.

**Dictyocysta mitra** Haeckel emended

## Figure 548

*Dictyocysta elegans* Ehrenberg, 1854c, p. 5 of explanation of the plate, pl. 35A, fig. 24d; *partim*, 1854a, p. 71; 1854b, pp. 236, 238, 239; 1867, p. 203 (see *D. elegans*); Fol, 1881, pp. 18, 23; Daday, 1887b, p. 586; Möbius, 1887, p. 119; Jörgensen, 1899, p. 40.

*Dictyocysta mitra* Haeckel, 1873, p. 563, pl. 27, figs. 4, 5; Kent, 1882, pp. 625-626, pl. 32, figs. 25, 26; Daday, 1886, pp. 482, 497-498, pl. 25, fig. 16; Brandt, 1906, p. 11, pl. 1, figs. 1-2, pl. 2, fig. 11; 1907, pp. 29, 35, 49-64, 67, 444, 464, 471, 472; Entz, Jr., 1908, pp. 12-128, pl. 2, figs. 9, 10, pl. 5, figs. 9, 12; 1909b, pp. 102-215, pl. 9, figs. 9, 10, pl. 12, figs. 9, 12; Jörgensen, 1924, pp. 81, 82, 86-88, 105, 106; Lepsi, 1926b, pp. 78, 99, pl. 11, fig. 37; *non* Entz, Sr., 1885, p. 211, pl. 14, fig. 22 (see *D. entzi*).

*Dictyocysta elegans, sensu strictu, partim*, Biedermann, 1893, pp. 11-13, pl. 3, fig. 3 (for pl. 1, fig. 1, pl. 3, fig. 4 see *D. elegans* and for pl. 1, fig. 2 see *D. speciosa*).

*Tintinnus mitra*, Grimm, 1877, p. 76, pl. 2, fig. 9 [?] not seen; Mereschkowsky, 1878, pp. 24-25.

The status and synonymy of this species are confused by the differences of opinion between Brandt (1906, 1907) and Jörgensen (1899, 1924) and the differences between the latter's earlier (1899) and later (1924) papers. The difficulties are still more accentuated by the differences of opinion between the two over the interpretation of Ehrenberg's (1854c, pl. 35A, fig. 26d) figure. Ehrenberg calls this *D. elegans* but, as Brandt (1907, p. 11) notes, Ehrenberg's descriptions (1854a) and his figure are not in agreement. We conclude that Brandt exercised his privilege as revisor in interpreting this discrepancy and we follow his decision in assigning Ehrenberg's figure to *D. mitra*.

**Dictyocysta mülleri** (Imhof) Jörgensen emended

## Figure 572

"Sehr zierliches Körperchen von der Form einer Kanzel," J. Müller, 1843, p. 233, pl. 6, fig. 6.

*Dictyocysta templum* var. *Mülleri* Imhof, 1886a, p. 103; Brandt, 1907, pp. 65, 67, 464, 472, 481.

*Dictyocysta elegans* var. *e mülleri* Brandt, 1906, pp. 11-12, pl. 2, figs. 2, 5, 6, pl. 4, fig. 3; 1907, pp. 49, 56, 67, 68, 73, 464, 472.

*Dictyocysta elegans* var. *e, partim*, Brandt, 1907, p. 67 (see *D. ampla*); *non* Brandt, 1906, p. 11, pl. 2, fig. 1 (see *D. ampla*).

*Dictyocysta elegans* var. *mülleri*, Laackmann, 1909, p. 432.

*Dictyocysta elegans, partim*, Laackmann, 1913, pp. 2, 5-9, 11-12, 42, pl. 1, figs. 4-6 (for pl. 1, figs. 1-3, 7 see *D. elegans*).

*Dictyocysta mülleri*, Jörgensen, 1924, pp. 11-83, fig. 94; 1927, pp. 14-15.

Brandt (1907) has given a series of different decisions as to this species. Imhof (1886*a*) gave the name to Müller's (1843) figure, basing it on this and on specimens from the Venetian lagoons. The Venetian material Brandt assigns tentatively to his *D. elegans* var. *c*, and in the same page uses the name *D. elegans* var. *e mülleri* tentatively for Müller's figure and for material drawn widely from the Tropical Atlantic. Müller's specimen came from the gut of *Pentacrinus* from St. Thomas.

On page 464 Brandt (1907) writes "*D. elegans* Ehr. var. *e mülleri* n. Bdt." The designation "n" he employs elsewhere for new species or new varieties. To complicate the matter still further Brandt (1907, p. 471) later refers Imhof's *D. elegans* var. *mülleri* tentatively to *D. elegans*.

If "*mülleri*" of Brandt (1906, 1907) is not Imhof's Venetian species Brandt's name is a homonym; if it is Imhof's, then the name is Imhof's. In any event Imhof expressly included Müller's figure in his *D. templum* var. *mülleri* and Laackmann (1913, pl. 1, figs. 4-6) figures from the Adriatic as *D. elegans*, loricae which are referable to "*mülleri*" as figured by Brandt (1906). We therefore credit the name to Imhof, include the Venetian material in *D. mülleri*, and exclude it from Brandt's *D. elegans* var. *c* which we describe as *D. ampla* sp. nov.

Jørgensen (1924, 1927) raises the var. *mülleri* to specific status, includes in it only Brandt's *D. elegans* var. *e mülleri*, makes no reference to Imhof (1886*a*) or Laackmann (1913), and assigns the species to Brandt.

### ***Dictyocysta nidulus* sp. nov.**

Figure 565

*Dictyocysta templum*, *partim*, Entz, Jr., 1904*b*, pp. 129-132, figs. 25, 27 (for figs. 24, 25, 28, 29 see *D. speciosa*); 1909*b*, pp. 99-224, pl. 11, fig. 4, pl. 17, fig. 8, pl. 20, figs. 25-26 (for pl. 9, fig. 14 see *D. lepida*).

*Dictyocysta templum* var. *f* Brandt, 1906, p. 12, pl. 3, fig. 7; 1907, pp. 49, 72, 481.

*Dictyocysta Templum*, *partim*, Entz, Jr., 1908, pp. 10-135, pl. 4, fig. 4, pl. 10, fig. 8, pl. 13, figs. 25-26 (for pl. 13, fig. 26 see *D. lepida*).

*Dictyocysta lepida*, *partim*, Jørgensen, 1924, p. 83 (see also *D. grandis*, *D. lata*, *D. lepida*, *D. mexicana*, and *D. reticulata*).

Raised to status of species.

Lorica 1.65 oral diameters in length; collar 0.69 of bowl in length, with a single row of rectangular windows, their width 0.53 of their height; bowl low acorn-shaped with moderate bulge below the collar,

its height 0.84 its greatest diameter, inverted convex conical, increasing from  $55^\circ$  to  $103^\circ$ ; aboral end bluntly pointed; an irregular equatorial belt of coccoliths (*Syracusasphaera*) and a postequatorial belt of 10–12 unequal fenestrae. Length  $75\mu$ .

The type locality is Station N. 42 of the Plankton Expedition in the margins of the Florida and Labrador currents.

Differs from *D. grandis* in less angular, longer bowl and type of reticulations, and from *D. reticulata* in slenderer proportions, longer bowl, and in lack of large subregular fenestrae.

### **Dictyocysta obtusa** Jörgensen

Figure 547

*Dictyocysta mitra* var. b Brandt, 1906, pp. 11–12, pl. 1, fig. 3, pl. 4, fig. 8; 1907, pp. 64, 472.

*Dictyocysta mitra* forma *obtusa* Jörgensen, 1924, pp. 82, 87, fig. 97.

Raised to status of species.

Lorica 1.25–1.65 oral diameters in length; oral margin slightly undulating; collar 0.2 total length in length, cylindrical, with scarcely any flare, with a single row of 7 (8) oblong, closed windows; bowl as long as wide, subglobular with a broadly convex conical ( $116^\circ$ – $120^\circ$ ) aboral region; aboral end blunt or sometimes pointed; fenestrae completely covering the bowl, in 6 rows, subcircular, subequal in anterior 3 rows, smaller and irregular in the posterior 3 rows. Length  $65$ – $74\mu$ .

The type locality is Station "Schott 16 (13–XII–91)" in the Agulhas Current. Occurs also in the Mediterranean, especially in the Ionian Sea, off the Balearic Islands, and in the Catalanian Sea.

Differs from *D. mitra* in stouter proportions and broader aboral region and from *D. dilatata* in lack of set-off between collar and bowl as well as in proportions.

### **Dictyocysta occidentalis** sp. nov.

Figure 556

Lorica very symmetrical, 1.42–1.67 oral diameters in length; collar relatively short, 0.63 of bowl in length, with 6–7 subquadrangular windows, their width 0.79 of their height; bowl globular, shoulder rounded, its height 0.69 of its greatest width; aboral region hemispherical; an equatorial zone of 8–10 subequal fenestrae, a postequatorial of 6–8, and an aboral group, often with coccoliths. Length  $55$ – $62\mu$ .

The type locality is Station 4701 in the South Equatorial Drift. Occurs also in the California and Mexican currents, Panamic Area, and the Easter Island Eddy.

Differs from all other species in the very globose bowl. Its fenestration suggests *D. mitra* and the collar *D. lepida*. It differs from *D. polygonata* in the presence of large fenestrae.

#### **Dictyocysta ovalis** Daday

Figure 561

*Dictyocysta ovalis* Daday, 1886, pp. 482, 496, pl. 25, fig. 14; 1887*b*, pp. 585, 588; Brandt, 1907, pp. 11, 475.

This is possibly an aberrant *Codonella* (*vide* Brandt, 1907), comparable in structure of its low windowed collar to *Tintinnopsis punctata* Wailes (1925, fig. 23), to which it is similar in dimensions and proportions. The latter species, however, has not been described as utilizing coccoliths in its wall, as in Daday's (1886) species.

#### **Dictyocysta pacifica** sp. nov.

Figure 555

Lorica of the proportions of *D. mitra*, 1.35–1.65 oral diameters in length; oral rim sparsely and minutely denticulate; collar merging with bowl, 0.33–0.40 of bowl in length, with one row of 6–7 squarish windows; bowl broadly ovoidal, widest near its middle; aboral region convex conical ( $106^\circ$ ); aboral end pointed; one or two rows of sub-uniform fenestrae, 10 in the first, 12–13 in the second, the aboral region with coarse, often variable polygons, sometimes with coccoliths. Length 41–52 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. Occurs also in the California, Mexican, and Peruvian currents, Panamic Area, and South Equatorial Drift.

Differs from *D. minor* in the absence of large fenestrae on the aboral half of the bowl and *D. spinosa* in having many denticles instead of few oral spines.

#### **Dictyocysta polygonata** sp. nov.

Figure 557

*Dictyocysta templum*, *typ., partim*, Laackmann, 1909, p. 433, "Strukturvariation" (see also *D. lepida*).

Lorica 1.34 oral diameters in length; collar 0.39 of the length of the bowl in length, with 7 rectangular windows, their width 0.68 of their length; bowl globose, its length 0.87 of its greatest diameter;



aboral end hemispherical; mesh on bowl composed of subuniform, polygonate reticulations, about 32 around the equator, with no large fenestrae. Length  $58\mu$ .

The type locality is Station 4663 in the Peruvian Current. Occurs also in the Mexican Current, Panamic Area, Galapagos Eddy, and the South Equatorial Drift, and in the South Equatorial Current of the Atlantic.

Differs from all other species except *D. duplex* in the absence of fenestrae and from that species in the more globose bowl and absence (?) of coccoliths.

### **Dictyocysta reticulata** sp. nov.

Figure 560

*Dictyocysta Templum*, Daday, 1887a, pp. 167, 178–180, pl. 1, fig. 6; 1887b, pp. 585–586, pl. 21, figs. 8, 9; Zacharias, 1906, pp. 510, 520, 521, 526, fig. 9.

*Dictyocysta templum* var. b Brandt, 1906, p. 12, pl. 3, figs. 8, 9; 1907, pp. 49, 70, 481.

*Dictyocysta lepida* Ehrenberg var. Kofoid, 1915, pp. 65–66, figs. 2, 3.

*Dictyocysta lepida*, partim, Jörgensen, 1924, p. 83 (see also *D. grandis*, *D. lata*, *D. lepida*, *D. mexicana*, and *D. nidulus*).

Lorica 1.33–1.57 oral diameters in length; collar 0.4 of bowl in length, with one row of rectangular windows, their width 0.6 of their height; bowl short acorn-shaped with marked sloping shoulder not concaved below, inverted subconical, changing from  $42^{\circ}$ – $47^{\circ}$  to  $115^{\circ}$ – $120^{\circ}$ ; aboral end bluntly pointed; one postequatorial, submedian row of large subequal fenestrae, the bowl elsewhere covered with small, uniform polygonate reticulations often with coccoliths. Length  $55$ – $62\mu$ .

The type locality is Station “Schott (11–VII–92)” south of Madagascar. Occurs also in the Agulhas Current of the Atlantic and widely throughout the Eastern Tropical Pacific.

Differs from *D. grandis* in smaller size and longer bowl, has no projecting aboral point as in *D. mexicana*, and from *D. lata* in more angled bowl.

### **Dictyocysta speciosa** Jörgensen

Figure 575

*Dictyocysta elegans*, Möbius, 1887, p. 119, pl. 8, fig. 29 (for fig. 28 see *D. elegans*); Biedermann, partim, 1893, pp. 11–13, pl. 1, fig. 2 (for pl. 1, fig. 1, pl. 3, fig. 4 see *D. elegans* and for pl. 3, fig. 3 see *D. mitra*); Brandt, 1906, partim, p. 11, pl. 1, fig. 7 (for pl. 1, fig. 8 and pl. 2, fig. 12 see *D. elegans*); 1907, pp. 11, 14, 29, 35, 36, 49, 50–68, 71–73, 306, 445, 447, 462, 464, 471, 472, 480, 481; Entz, Jr., 1908, pp. 12–126, pl. 2, figs. 13–16; 1909b, pp. 102–215, pl. 9, figs. 13, 15;



Lühe, 1913, p. 176, fig. 168, no. 1; Jörgensen, *partim*, 1924, pp. 81, 82, 83; 1927, pp. 14, 15 (see also *D. ampla*, *D. elegans*, *D. fundlandica*, and *D. magna*).

*Dictyocysta templum* var. *disticha*, *partim*, Jörgensen, 1899, p. 40; 1900, pp. lviv, lxxx; 1905, pp. 53, 56, 59, 65, 68, 82, 145; Brandt, 1907, pp. 51, 60, 65, 462, 464, 481; 1910, p. 3 (see also *D. elegans*).

“Varietäten resp. Zwischenformen von *Dictyocysta elegans*, p.p. Möbius resp. *Dictyocysta templum*,” Biedermann, *partim*, 1893, p. 10, pl. 3, fig. 7 (for figs. 6, 8–11 see *D. elegans*).

*Dictyocysta templum*, *partim*, Entz, Jr., 1905, pp. 129–132, figs. 24, 26, 28, 29 (for figs. 25, 27 see *D. nidulus*); 1908, pp. 10–135, pl. 13, fig. 26; 1909*b*, pp. 99–224, pl. 17, fig. 26 (for 1908, pl. 2, fig. 14 and 1909*b*, pl. 9, fig. 14 see *D. lepida* and for 1908, pl. 11, fig. 4 and 1909*b*, pl. 17, fig. 25 see *D. nidulus*).

*Dictyocysta elegans* var. *speciosa* Jörgensen, 1924, p. 81, fig. 93; 1927, pp. 14–15, fig. 29.

Raised to status of species.

Lorica large, 1.34–1.53 oral diameters in length; oral rim undulating, without spinules; collar with straight sides, equaling the bowl in length, with two rows of windows, 8 rectangular ones in the upper row and 9 small round-angled ones in the lower row; bowl stout acorn-shaped, with rounded, flowing shoulders, concave below, its aboral half subhemispherical; aboral end broadly rounded; one submedian row of 8 large fenestrae, and an aboral row of 4–5, with small uniform reticulations elsewhere. Length 66–79 $\mu$ .

The type locality is off Naupaktos in the Mediterranean.

Differs from all other species of the *D. elegans* group in larger size and constricted bowl.

For a discussion of the synonymy of this species see that of *D. elegans*.

### ***Dictyocysta spinosa* sp. nov.**

Figure 553

Lorica 1.36 oral diameters in length, of the *D. mitra* type; oral rim with a spreading acicular spinule on the middle of the arch above each window; collar flaring ( $9^\circ$ ), 0.4 of the length of the bowl in length, with 7 rounded quadrangular windows; bowl broadly ovoidal, without shoulder, widest at its middle; aboral end with or without a blunt point; with seven irregular rows of uneven fenestrae with 6–7, 9–10, 12–13, 13–15, 12–15, 12–13, and 6–10 fenestrae respectively. Length 42–46 $\mu$ .

The type locality is Station 4681 in the South Equatorial Drift. Occurs also in the Panamic Area and the Galapagos Eddy.

Differs from *D. extensa* in less baggy bowl and entirely different type of fenestration.

**Dictyocysta tiara** Haeckel

Figure 567

*Dictyocysta tiara* Haeckel, 1873, p. 564, pl. 27, fig. 7; 1899, pl. 3, fig. 2; Kent, 1882, p. 626, pl. 32, fig. 28; Bütschli, 1889, p. 1737, pl. 70, fig. 6; Kofoid, 1915, pp. 63-66, fig. 1.

*Dictyocysta*, Allman, 1875, p. 170, pl. 118, fig. 4.

*Dictyocysta templum* var. *tiara*, Brandt, 1906, p. 12, pl. 2, fig. 14; 1907, pp. 11, 49, 51, 52, 73, 481.

*Dictyocysta lepida grandis*, Kofoid, *partim*, 1915, p. 65, on p. 66 as "var. *g. grandis*" (*lapsus* for *e. grandis*, see also *D. grandis*).

*Dictyocysta templum* var. *indica* Laackmann, 1909, pp. 433-434, pl. 49, figs. 1, 2.

*Dictyocysta templum*, Laackmann, 1909, p. 492; Okamura, 1912, p. 22, pl. 5, fig. 99.

*Dictyocysta tiara* Haeckel was founded on a distorted specimen. No one has seen it since its original describer. Its relationship to *D. lepida grandis* was suggested by Kofoid (1915). It is more like Laackmann's (1909) *D. indica*, however, in proportions, especially in aboral taper, and has the fenestration on the bowl even more similar to that of *D. indica* than to that of *D. grandis*. On the basis of this similarity we refer Laackmann's variety to Haeckel's species.

Family TINTINNIDAE Claparède and Laackmann emended  
Claus emended

Tintinnodea, *partim*, Claparède and Laackmann, 1858, pp. 192-195 (see also Tintinnoinca).

Tintinnidae, *partim*, Claus, 1876, p. 178 (see also Tintinnoinca).

Tintinnodae, *partim*, Kent, 1882, p. 603 (see also Codonellidae, Codonellopsidae, Coxliellidae, Cytarocylidae, Ptychocylidae, Tintinnididae, Undellidae, and Xystonellidae).

Tintinnoinca with rigid loricae variously formed; oral region usually flaring (except in *Bursaopsis*); aboral end open or closed; wall hyaline, and usually without secondary structure; with 2, 4, or 8 macronuclei and micronuclei, and 16-24 membranelles. Marine, with 1 species from brackish water.

Differs from the Codonellidae, Codonellopsidae, Ptychocylidae, Rhabdonellidae, Xystonellidae (except for some species of *Parundella*), and the Dictyocystidae in the absence of secondary structure in the wall; from the Tintinnididae in the rigid, non-agglomerating wall; from the Petalotrichidae in the non-cup-shaped lorica; from the Undellidae in the absence of or feeble development of inner and

outer lamellae; from the Coxliellidae in the absence of spiral bands; and from the Cyttarocyliidae in absence of secondary structure, or in the type of oral differentiation (except for *Cymatocylis* and *Protocymatocylis* which approach this family in structure).

Includes three subfamilies, the Amphorellineae subfam. nov., the Stelidiellineae subfam. nov., and the Tintinnineae subfam. nov.

#### Subfamily AMPHORELLINEAE subfam. nov.

Tintinnidae with flaring collar without a distinct nuchal groove or a suboral ledge; aboral end closed.

Differs from the Stelidiellineae in the absence of the nuchal groove or suboral ledge and from the Tintinnineae in the closed instead of open aboral end.

Includes 8 genera as follows

Albatrossiella gen. nov.	Canthariella gen. nov.
Amphorella Daday emended	Dadayiella gen. nov.
Jørgensen emended	Odontophorella gen. nov.
Amphorellopsis gen. nov.	Steenstrupiella gen. nov.
Bursaopsis gen. nov.	

#### **Bursaopsis** gen. nov.

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Codonella*, *Coxliella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocylis*, *Salpingella*, *Steenstrupiella*, *Stenosomella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Ryder, 1887, p. 241; Brandt, *partim*, 1896, p. 54 (see also *Acanthostomella*); Laackmann, 1907, p. 236.

Amphorellineae with short tubular, or vial-shaped lorica; oral rim usually entire; bowl sack-like, tubular with sides nearly parallel 0.8-0.9 total length in length; antapex hemispherical or subconical.

The type species by our designation is *Bursaopsis striata* (Daday) from off Naples in the Mediterranean, one of the oldest and best known species in the genus.

Differs from all other Amphorellineae in the absence of a flaring collar.

Includes 7 species as follows:

✗ bursa (Cleve)	quinquealata (Laack.) → <i>Amphorella</i>
✗ fergusonii (Ryder)	striata (Daday)
✗ obliqua (Clap. and Lach.)	vitrea (Bdt.) × → <i>Tintinnus</i>
punctostriata (Daday)	

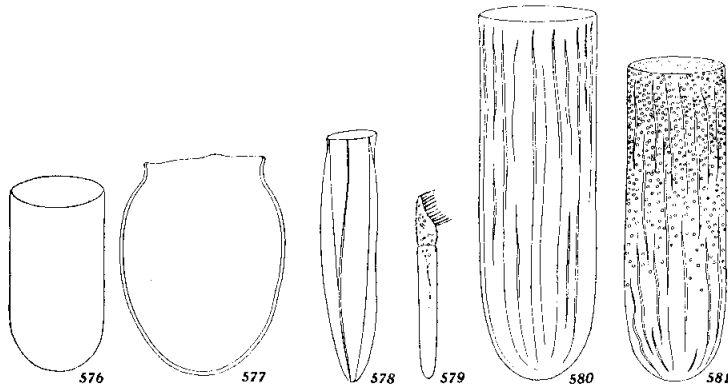
**Bursaopsis bursa (Cleve)**

## Figure 577

*Amphorella bursa* Cleve, 1900*d*, p. 969, fig. [1].

*Tintinnus vitreus* var. *a bursa*, Brandt, 1906, p. 33, pl. 66, fig. 6; 1907, p. 439.

*Tintinnus bursa*, Laackmann, 1913, p. 3.



Figs. 576-581. Species of *Bursaopsis* gen. nov.  $\times 200$ .

Fig. 576. *B. vitrea* (Bdt.) after Brandt (1906, pl. 66, fig. 7) from Station "Vanhöffen, March, 1893" from the Karajak Fiord, North Greenland.

Fig. 577. *B. bursa* (Cleve) after Cleve (1900*d*, p. 969, fig. [1]) from off the Azores.

Fig. 578. *B. quinquealata* (Laack.) after Laackmann (1909, pl. 47, fig. 14) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

Fig. 579. *B. obliqua* (Clap. and Laeb.) after Claparède and Laemann (1858, pl. 9, fig. 1) from off Copenhagen.

Fig. 580. *B. striata* (Daday) after Daday (1887*b*, pl. 18, fig. 16) from the Bay of Naples.

Fig. 581. *B. punctostriata* (Daday) after Daday (1887*b*, pl. 18, fig. 19) from the Bay of Naples.

***Bursaopsis fergusonii* (Ryder)**

*Tintinnus Fergusonii* Ryder, 1887, p. 241.

"*Tintinnus*, tubular subulate test to the inside of which the stalk of the inhabitant was attached, at one side, about halfway up from its base. The open, or mouth, end of the perfectly hyaline test was very strongly toothed, or serrate. The species may be named *Tintinnus Fergusonii*."

Since this species is not figured, its allocation is purely tentative. Possibly a *Parafavella*.

**Bursaopsis obliqua** (Claparède and Lachmann)

Figure 579

*Tintinnus obliquus* Claparède and Lachmann, 1858, p. 198, pl. 9, fig. 1; Kent, 1882, p. 606, pl. 31, fig. 26; Wright, 1907, pp. 10, 18, pl. 4, fig. 9.

**Bursaopsis punctostriata** (Daday)

Figure 581

*Amphorella punctostriata* Daday, 1887*b*, p. 540, pl. 18, fig. 19.

*Tintinnus punctostriatus*, Brandt, 1907, p. 477.

**Bursaopsis quinquealata** (Laackmann)

Figure 578

*Tintinnus quinquealatus* Laackmann, 1907, p. 236, fig. 1; 1909, pp. 412, 413, pl. 47, figs. 13-14, pl. 48, fig. 8.

**Bursaopsis striata** (Daday)

Figure 580

*Amphorella striata* Daday, 1887*b*, p. 538, pl. 18, fig. 16.

*Tintinnus striatus*, Brandt, 1907, p. 479.

**Bursaopsis vitrea** (Brandt)

Figure 576

*Tintinnus vitreus* Brandt, 1896, p. 54, pl. 3, figs. 8, 9; 1906, p. 32, pl. 66, fig. 7; 1907, pp. 438, 484.

Non *Amphorella vitrea*, Meunier, 1910, pp. 128, 129, pl. 9, figs. 21, 22, pl. 14, figs. 1-3 (see *Metacylis vitreoides*).

**Canthariella** gen. nov.

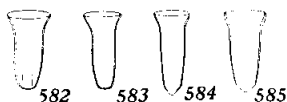
*Amphorella, partim*, Jörgensen, 1924, pp. 15-16, 37, 57 (see also *Amphorella, Amphorellopsis, Craterella, Dadayiella, Ormosella, and Steenstrupiella*).

Amphorellineae with small capsular lorica, 1.72-2.20 oral diameters in length; collar conical, flaring 25°-28° with definite nuchal angle; oral margin entire; bowl subcylindrical, aboral end truncate, angular or acute; no fins.

The type species by our designation is *Canthariella brevis* sp. nov. from Station 4722 in the South Equatorial Drift of the Pacific.

Differs from *Bursaopsis* in the presence of a flaring collar; from *Albatrossiella* and *Dadayiella* in the absence of the aboral horn; from *Odontophorella* in the absence of teeth; from *Amphorella* and *Amphorellopsis* in the absence of well developed fins; and from *Steenstruپیella* in stouter, shorter bowl, more angular aboral end, and almost entire absence of striae.

Includes four species as follows: *Canthariella brevis* sp. nov., *C. pyramidata* (Jörg.), *C. septinaria* sp. nov., and *C. truncata* sp. nov.



Figs. 582-585. Species of *Canthariella* gen. nov.  $\times 200$ .

Fig. 582. *C. septinaria* sp. nov. from Station 4717 in the South Equatorial Drift of the Pacific.

Fig. 583. *C. truncata* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 584. *C. brevis* sp. nov. from Station 4722 in the South Equatorial Drift of the Pacific.

Fig. 585. *C. pyramidata* (Jörg.) after Jörgensen (1924, p. 17, fig. 17) from Station 186 of the "Thor" in *Salpa* off the Gulf of Taranto in the Mediterranean.

#### ***Canthariella brevis* sp. nov.**

Figure 584

Bowl slender, subcylindrical, 2.0-2.2 oral diameters in length; nuchal diameter 0.75 oral diameter; collar flaring  $27^\circ$ ; bowl aborally contracted; antapex angular. Length 47-54 $\mu$ .

The type locality is Station 4722 in the South Equatorial Drift of the Pacific.

Differs from *C. truncata* in the sharply angular posterior end.

#### ***Canthariella pyramidata* (Jörgensen)**

Figure 585

*Amphorella pyramidata* Jörgensen, 1924, p. 20, fig. 17.

**Canthariella septinaria** sp. nov.

Figure 582

Lorica 1.72–1.79 oral diameters in length; collar flaring  $25^\circ$ ; bowl stout, with 7–8 faint facets; wall with very slight nuchal thickening. Length 50–52 $\mu$ .

The type locality is Station 4717 in the South Equatorial Drift of the Pacific.

Differs from *C. truncata* in having 7–8 facets, a stouter bowl, and less flaring collar.

**Canthariella truncata** sp. nov.

Figure 583

Lorica 1.75–1.92 oral diameters in length; collar flaring  $28^\circ$ ; bowl slender, contracting squarely, truncated. Length 42–54 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift of the Pacific.

Differs from *C. brevis* and *C. septinaria* in the squarely truncated aboral end and proportionately slender bowl.

**Amphorella** Daday emended Jörgensen emended

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195–196 (see also *Acanthostomella*, *Bursaopsis*, *Codonella*, *Cozliella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocyclus*, *Salpingella*, *Stenstrupiella*, *Stenosemella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Brandt, *partim*, 1907, pp. 374–388 (see also *Brandtiella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Metacyclus*, *Ormosella*, *Salpingacantha*, and *Tintinnus*); Laackmann, 1909, pp. 486, 488.

*Amphorella* Daday, *partim*, 1887b, pp. 535–536 (see also *Acanthostomella*, *Bursaopsis*, and *Codonellopsis*); Jörgensen, 1899, p. 12; 1924, *partim*, pp. 15–16, 37, 57 (see also *Amphorellopsis*, *Canthariella*, *Cratrella*, *Dadayiella*, *Ormosella*, and *Stenstrupiella*).

Amphorellineae with vase-like lorica; oral margin always entire and circular; collar a low and widely flaring funnel, or a tall and less flaring one; bowl vase-like or funnel-like, its length 0.50–0.88 of the total length, usually inflated; antapex truncated or blunt, with 3–4 longitudinal ridges, angles or fins.

We designate as the type species *Amphorella quadrilineata* (Claparède and Lachmann) Daday from the coast of Norway, an old and the best-known species included in the genus.

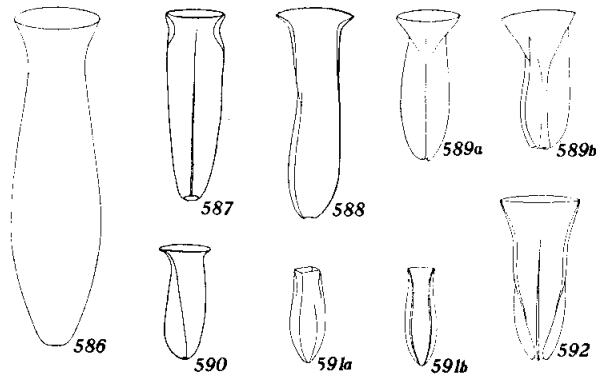


Differs from *Albatrossiella* and *Dadayiella* in the absence of the aboral horn; from *Odontophorella* in the absence of teeth on the fins; from *Bursaopsis* in the presence of the flaring collar; from *Canthariella* and *Steenstrupiella* in the presence of prominent angles or fins; and from *Amphorellopsis* in the truncate aboral end.

Includes 7 species as follows:

*amphora* (Clap. and Lach.)  
*brandti* Jörg.  
*calida* sp. nov.  
*infundibulum* sp. nov.

*laackmanni* Jörg.  
*minor* Jörg.  
*quadrilineata* (Clap. and Lach.)  
 Daday



Figs. 586-592. Species of *Amphorella* Daday emended Jörgensen emended.  $\times 200$ .

Fig. 586. *A. amphora* (Clap. and Lach.) after Claparède and Lachmann (1858, pl. 8, fig. 3) from off Copenhagen, Denmark.

Fig. 587. *A. quadrilineata* (Clap. and Lach.) Daday from Station 4707 in the South Equatorial Drift of the Pacific.

Fig. 588. *A. brandti* Jörg. after Brandt (1906, pl. 69, fig. 6) from Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 589a. *A. infundibulum* sp. nov. after Brandt (1906, pl. 69, fig. 3) from Station Pl. 33 of the Plankton Expedition off the Bermuda Islands.

Fig. 589b. *A. infundibulum* sp. nov. after Brandt (1906, pl. 69, fig. 4) from Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Fig. 590. *A. minor* Jörg. from Station 4583 in the southern end of the California Current.

Fig. 591. *A. laackmanni* Jörg. after Jörgensen (1924, p. 17, fig. 14) from Station 186 of the "Thor" in *Salpa* from off the west coast of Greece in the Adriatic. Two views.

Fig. 592. *A. calida* sp. nov. after Brandt (1906, pl. 69, fig. 5) from Station "Bruhn 44" off Madagascar.

**Amphorella amphora** (Claparède and Lachmann)

Figure 586

*Tintinnus amphora* Claparède and Lachmann, 1858, p. 199, pl. 8, fig. 3; Kent, 1882, p. 606, pl. 31, fig. 12; Bütschli, 1889, pp. 1734-1735, pl. 70, fig. 4; Delage and Hérouard, 1896, p. 467, fig. 793; Brandt, *partim*, 1907, pp. 433-434, 454 (see also *A. brandti*); *non* Brandt, 1906, p. 33, pl. 69, fig. 6 (see *A. brandti*).

**Amphorella brandti** Jörgensen

Figure 588

*Tintinnus amphora*, Brandt, 1906, p. 33, pl. 69, fig. 6; 1907, *partim*, pp. 433-434, 454 (see also *A. amphora*).

*Amphorella quadrilineata* var. *brandti* Jörgensen, 1924, p. 18.

Raised to status of species.

Lorica 2.72 oral diameters in length, collar widely flaring, a low funnel ( $93^\circ$ ), 0.23 oral diameter in height; bowl cylindrical, narrowest (0.6 oral diameter) below the collar; aboral end flattened, with 3 flat, blade-like fins, 0.5 total length in length; wall 0.05 oral diameter in thickness suborally, with fine primary prismatic and coarser secondary structure suborally. Length (*vide* Jörgensen, 1924, p. 18) 145-190 $\mu$ .

The type locality is Station Pl. 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Differs from *A. amphora* in widely flaring, short collar and in the longer fins.

The structure of the wall is wholly different from that of most other Tintinnidae in the presence of secondary structure. The allocation of this species in *Amphorella* is tentative. It may represent a distinct genus.

**Amphorella calida** sp. nov.

Figure 592

*Tintinnus amphora* var. *c* Brandt, 1906, p. 33, pl. 69, figs. 5, 8; 1907, pp. 435, 453.

Lorica with a funnel-like, flaring collar and a wide, inverted conical bowl, with 4 fins 0.5 total length in length. Length 100 $\mu$ .

The type locality is Bruhn's Station 44, off Madagascar.

Differs from *A. infundibulum* in number of fins and shape of bowl.

**Amphorella infundibulum** sp. nov.Figure 589*a, b**Tintinnus amphora* var. *a quadrilineata*, Brandt, 1906, p. 33, pl. 69, figs. 3, 4, 7.Non *Tintinnus quadrilineatus* Claparède and Lachmann, 1858, p. 201, pl. 9, fig. 3 (see *A. quadrilineata*).*Tintinnus amphora* var. *quadrilineata*, Brandt, *partim*, 1907, pp. 434, 453 (see also *A. quadrilineata*); Merkle, 1909, pp. 164, 186, pl. 2, fig. 18.

Lorica with a wide, funnel-like collar; bowl very narrow and tubular with 3 wide blade-like fins, 0.8 total length in length. Length 100 $\mu$ .

The type locality is Station 67 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

Differs from *A. amphora* in the character of the collar, bowl, and in the fins.

**Amphorella laackmanni** Jörgensen

Figure 591

*Tintinnus amphora* var. *dadayi*, Laackmann, 1909, pp. 486-487, 493, pl. 50, fig. 12.Non *Amphorella dadayi* Jörgensen, 1905, p. 142 (see *A. quadrilineata*).*Amphorella laackmanni* Jörgensen, 1924, p. 19, fig. 14.**Amphorella minor** Jörgensen

Figure 590

*Amphorella quadrilineata* var. *minor* Jörgensen, 1924, p. 18, figs. 12*a, 12b*.*Amphorella quadrilineata*, "small, deviating form" Jörgensen, 1924, p. 17, fig. 13.

Raised to status of species.

Lorica vase-like, 1.7-3.3 oral diameters in length; collar widely flaring, low, a truncated cone of 62°-92°; bowl inflated in posterior 0.2-0.3; antapex broadly truncated, with 4 vertical angles, at least 0.6 total length in length. Length 75-130 $\mu$ .

The type locality is Station 26 of the "Thor" Expedition in the Mediterranean off Naples.

Differs from *A. quadrilineata* in being shorter, in having the inflation more posteriorly located, and in the set-off of the collar.

**Amphorella quadrilineata** (Claparède and Lachmann) Daday

Figure 587

- Tintinnus quadrilineatus* Claparède and Lachmann, 1858, p. 201, pl. 9, fig. 3; Kent, 1882, p. 606, pl. 31, fig. 13.
- Amphorella quadrilineata*, Daday, 1887*b*, pp. 484, 514, 534, 535, 536, pl. 18, fig. 5; Jörgensen, 1899, pp. 4, 12-14, pl. 1, fig. 2; 1924, pp. 17-19, figs. 11*a*, 11*b*; 1927, pp. 1, 2, 10, 16-19, fig. 12; Fauré-Fremiet, 1924, pp. 110, 111, 112, fig. 36.
- Amphorella dadayi* Jörgensen, 1905, p. 142.
- Tintinnus Amphora*, Entz, Sr., 1884, pp. 296, 410, 442, 444, pl. 24, fig. 20.
- Tintinnus amphora*, Lepsi, 1926*b*, pp. 79, 99, pl. 11, fig. 388.
- Tintinnus amphora* var. *dadayi*, Brandt, 1907, pp. 434, 435, 453, 477.
- Tintinnus amphora* var. *quadrilineata*, Brandt, *partim*, 1907, pp. 434-436, 453 (see *A. infundibulum*); Entz, Jr., 1908, p. 104.
- Non *Tintinnus amphora* var. *a quadrilineata*, Brandt, 1906, p. 33, pl. 69, figs. 3, 4, 7 (see *A. infundibulum*).
- Tintinnus amphora* var. *brasiliensis* Laackmann, 1909, pp. 413, 427, 480, 485, 487, 493, pl. 48, fig. 14, pl. 50, fig. 11; Jörgensen, 1924, p. 18.
- Amphorella quadrilineata* "main species," Jörgensen, 1924, pp. 17, 18-19.
- Amphorella amphora*, Daday, 1887*a*, pp. 159-208, pl. 1, fig. 3; 1887*b*, pp. 534, 535, 559, pl. 18, fig. 4.

**Steenstrupiella** gen. nov.

*Tintinnus, partim*, Claparède and Lachmann, 1858, pp. 195-196 (see also *Acanthostomella, Amphorella, Bursaopsis, Codonella, Cozliella, Favella, Parundella, Proplectella, Ptychocylis, Salpingella, Stenosemella, Tintinnidium, Tintinnopsis*, and *Tintinnus*).

*Stichtotricha*, Entz, Sr., 1884, p. 380.

*Amphorella, partim*, Jörgensen, 1924, pp. 15-16, 37, 57 (see also *Amphorella, Amphorellopsis, Canthariella, Craterella, Dadayiella*, and *Ormosella*).

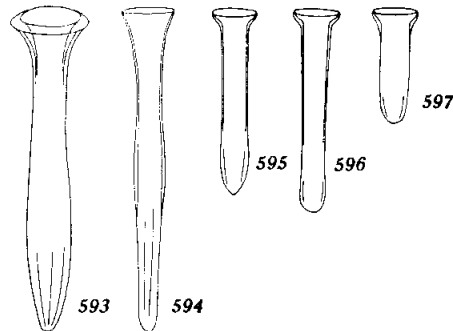
Amphorellinae with lorica from peg- to stout nail-shaped; oral brim always entire, sometimes everted; collar funnel-like, sometimes double; bowl stout or elongated, cylindrical anteriorly, sometimes with a median inflation or contraction, posteriorly a blunt, angular, usually inflated region, sack-like or pyramidal; with 4-6 vertical, decurrent posterior folds 0.11-0.30 total length in length.

We designate as the type species *Steenstrupiella steenstrupii* (Claparède and Lachmann) from off the coast of Norway, the oldest species included in the genus.

Differs from *Albatrossiella* and *Dadayiella* in the absence of an aboral horn; from *Bursaopsis* in having a flaring collar; from *Odontophorella* in the absence of teeth on the fins; from *Amphorella* in rounded instead of truncated antapex; from *Amphorellopsis* in

blunter aboral end and restriction of fins or striae to the aboral region; and from *Canthariella* in longer lorica and proportions of collar and bowl.

Includes five species as follows: *Steenstrupiella entzii* nom. nov., *S. gracilis* (Jörg.), *S. intumescens* (Jörg.), *S. robusta* sp. nov., and *S. steenstrupii* (Clap. and Lach.).



Figs. 593-597. Species of *Steenstrupiella* gen. nov.  $\times 200$ .

Fig. 593. *S. entzii* nom. nov. after Entz, Sr. (1884, pl. 24, fig. 22) from the Bay of Naples.

Fig. 594. *S. intumescens* (Jörg.) after Jörgensen (1924, p. 17, fig. 18) from Station 156 of the "Thor" off northwestern Egypt.

Fig. 595. *S. robusta* sp. nov. from Station 4711 in the South Equatorial Drift of the Pacific.

Fig. 596. *S. steenstrupii* (Clap. and Lach.) from Station 4721 in the South Equatorial Drift.

Fig. 597. *S. gracilis* (Jörg.) after Jörgensen (1924, p. 17, fig. 19) from Station 187 of the "Thor" off the Gulf of Taranto in the Eastern Mediterranean.

### ***Steenstrupiella entzii* nom. nov.**

#### Figure 593

*Stichotricha Inquilinus* Entz, Sr., 1884, p. 380, pl. 24, fig. 22.

*Amphorella inquilinus*, Daday, 1887b, pp. 542-543.

*Tintinnus steenstrupi*, partim, Brandt, 1907, pp. 437-438, 468 (see also *S. steenstrupii*).

Lorica stout trumpet-shaped, 4 oral diameters in length; oral margin entire; collar flaring to 2 nuchal diameters within 0.5 oral diameter of the oral margin, double with the inner collar 0.75 diameter of the outer; bowl subcylindrical, expanding at the aboral 0.25 of the total length to 0.58 oral diameter; aboral end contracting to a truncated antapex less than 0.25 oral diameter in diameter; wall thick-

ened in nuchal region, with 8 striae or feeble fins (?) on the aboral 0.3 of the total length. Length  $160\mu$ .

The type locality is the Bay of Naples, Italy.

Differs from all other species in the double collar and feeble development of the fins.

The animal figured by Entz, Sr. (1884) in the lorica is probably a *Stichotricha* but the lorica, as he suggests, is of the tintinnid type.

According to Art. 36 of the Rules of Nomenclature, Brandt's transfer of *Stichotricha inquilinus* to *Tintinnus* compels the rejection of the specific name *inquilinus* as a homonym; hence we propose the new specific name *entzi*.

### ***Steenstrupiella gracilis* (Jørgensen)**

Figure 597

*Amphorella gracilis* Jørgensen, 1924, p. 21, fig. 19.

### ***Steenstrupiella intumescens* (Jørgensen)**

Figure 594

*Amphorella intumescens* Jørgensen, 1924, p. 21, fig. 18.

### ***Steenstrupiella robusta* sp. nov.**

Figure 595

*Amphorella steenstrupii*, *partim*, Daday, 1887*b*, pp. 537, 538, pl. 18, figs. 9, 21 (see also *S. steenstrupii*); Jørgensen, 1899, pp. 15, 16 (for pl. 1, fig. 3 see *S. steenstrupii*); 1924, p. 20; 1927, p. 10 (for 1924, fig. 16 and 1927, fig. 13 see *S. steenstrupii*).

*Tintinnus steenstrupi*, Brandt, 1906, *partim*, p. 33, pl. 69, fig. 1 (for figs. 2, 9 see *S. steenstrupii*); 1907, pp. 437, 439, 479; Laackmann, 1909, p. 488.

Lorica medium-sized, phial-shaped, its length 3.3-4.3 oral diameters; oral margin entire; collar a low truncate funnel of  $50^\circ$ , forming 0.1 total length, its sides slightly convex; bowl elongated tubular anteriorly, posteriorly a blunt low pyramid of  $75^\circ$ ; with 6 low fins, 0.33 total length in length. Length 107-133 $\mu$ .

The type locality is Station 4711 in the South Equatorial Drift. Occurs also in the California and Mexican currents and the Panamic Area.

Differs from *S. gracilis* in greater length, and is stouter than *S. steenstrupii*.

**Steenstrupiella steenstrupii** (Claparède and Lachmann)

Figure 596

*Tintinnus steenstrupii* Claparède and Lachmann, 1858, p. 200, pl. 8, fig. 5; Kent, 1882, p. 606, pl. 31, fig. 20.

*Amphorella steenstrupii*, *partim*, Daday, 1887*b*, pp. 537, 538 (for pl. 18, figs. 9, 21 see *S. robusta*); Jörgensen, 1899, pp. 15, 16, pl. 1, fig. 3; 1924, pp. 17, 20, fig. 16; 1927, p. 10, fig. 13 (see also *S. robusta*).

*Tintinnus steenstrupii*, *partim*, Brandt, 1906, p. 33, pl. 69, figs. 2, 9 (for fig. 1 see *S. robusta*); 1907, pp. 337, 338, 479 (see also *S. entzi*).

*Tintinnus acuminatus*, Wright, 1907, pp. 10, 18, pl. 4, fig. 8.

**Amphorellopsis** gen. nov.

*Amphorella*, Schmidt, 1901, pp. 184-185; Jörgensen, *partim*, 1924, pp. 15-16, 37, 57 (see also *Amphorella*, *Canthariella*, *Craterella*, *Dadayiella*, *Ormosella*, and *Steenstrupiella*).

Amphorellinae with lorica in the form of an anteriorly truncated spindle; flaring orally, subcylindrical or elongate-ovoidal; oral brim usually entire; collar flaring, usually about 0.09-0.20 total length in length, with a slightly constricted throat, sometimes with a suboral bulge as in *A. turbineae*; bowl saecular, elongate-ovoidal, or fusiform, 0.80-0.91 total length in length; antapex a sharply acute or blunt cone, with or without a posterior spinule; 3-5 vertical blade-like fins 0.55-1.00 total length in length, or 3-6 comparable angles. Length 66-155 $\mu$ .

The type species by our designation is *Amphorellopsis acuta* (Schmidt) from the Gulf of Siam, the oldest species included in the genus.

Differs from *Amphorella* in pointed instead of truncated aboral end; from *Albatrossiella* and *Dadayiella* in the lack of an aboral horn; from *Odontophorella* in the absence of teeth on the fins; from *Bursaopsis* in having a flaring collar; from *Canthariella* in having prominent fins or angles; and from *Steenstrupiella* in the shorter bowl, full length fins, and pointed aboral end.

Includes 7 species as follows:

acantharus sp. nov.	tetragona (Jörg.)
acuta (Schmidt)	tropica sp. nov.
laevis sp. nov.	turbinea sp. nov.
quadrangula sp. nov.	

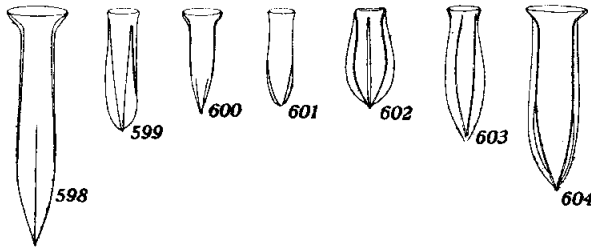
***Amphorellopsis acantharus* sp. nov.**

Figure 600

Lorica small, stout, trumpet-shaped, 2.5 oral diameters in length; collar a flaring funnel of  $38^\circ$ , its length 0.18 of the total length; bowl subcylindrical in the anterior 0.66, contracting posteriorly in a cone of  $32^\circ$ ; antapex minutely truncated, with 6 longitudinal angles, 0.33 of the total length in length. Length  $67\mu$ .

The type locality is Station 4655 in the Peruvian Current.

Differs from *A. acuta* in having 6 angles and in lacking median inflation.



Figs. 598-604. Species of *Amphorellopsis* gen. nov.  $\times 200$ .

Fig. 598. *A. acuta* (Schmidt) after Schmidt (1901, p. 185, fig. 2) from the Red Sea.

Fig. 599. *A. quadrangula* sp. nov. from Station 4621 in the Panamic Area of the Pacific.

Fig. 600. *A. acantharus* sp. nov. from Station 4655 in the Peruvian Current.

Fig. 601. *A. tropica* sp. nov. from Station 4740 in the South Equatorial Drift of the Pacific.

Fig. 602. *A. turbinata* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 603. *A. laevis* sp. nov. from Station 4637 in the Panamic Area of the Pacific.

Fig. 604. *A. tetragona* (Jörg.) after Jörgensen (1924, p. 17, fig. 15) from Station 206 of the "Thor" off the Balearic Islands in the Western Mediterranean.

***Amphorellopsis acuta* (Schmidt)**

Figure 598

*Amphorella acuta* Schmidt, 1901, pp. 184, 185, figs. 2a-c; Jörgensen, 1924, p. 21.

*Tintinnus acutus*, Brandt, 1906, p. 33, pl. 70, figs. 6, 7; 1907, pp. 435, 452.



**Amphorellopsis laevis** sp. nov.

Figure 603

Lorica vase-shaped, 3.23–4.20 oral diameters in length; collar flaring  $20^\circ$ , a low funnel; bowl short, fusiform, its greatest diameter 1.2 oral diameters at 0.5 of the total length; with 5 well-developed blade-like fins, 0.98 total length in length; antapex acute. Length 77–125 $\mu$ .

The type locality is Station 4637 in the Panamic Area of the Pacific.

Differs from *A. laackmanni* in having 5 fins instead of 8 plicae.

**Amphorellopsis quadrangula** sp. nov.

Figure 599

Lorica minute, 3.67 oral diameters in length, subcylindrical; collar flaring  $34^\circ$ , its length 0.07 total length; bowl cylindrical anteriorly, rounded posteriorly; antapex with a blunt peg-like projection; with 4 leiotropic fins, 0.9 total length in length. Length 81 $\mu$ .

The type locality is Station 4621 in the Panamic Area of the Pacific.

Differs from *A. laevis* in having 4 fins instead of 5.

**Amphorellopsis tetragona** (Jørgensen)

Figure 604

*Amphorella tetragona* Jørgensen, 1924, p. 19, fig. 15.

**Amphorellopsis tropica** sp. nov.

Figure 601

Lorica minute, subtubular, 3.26 oral diameters in length; collar nearly tubular, flaring  $10^\circ$ ; bowl subcylindrical anteriorly, convex subconical ( $33^\circ$ ) antapically; 4 subvertical posterior blade-like fins, 0.55 total length in length. Length 85 $\mu$ .

The type locality is Station 4740 in the South Equatorial Drift in the Pacific.

Differs from other species in having the least differentiated collar.

**Amphorellopsis turbinea** sp. nov.

Figure 602

Lorica elongate-ovoidal, 3.59 oral diameters in length; collar a low convex funnel  $20^{\circ}$ - $30^{\circ}$ ; bowl inflated to 1.83 oral diameters midway; antapex with a tiny spinule; with 3 broad blade-like fins the whole length of the lorica. Length  $68\mu$ .

The type locality is Station 4724 in the South Equatorial Drift of the Pacific.

Differs from other species in its broad fins which extend the whole length of the lorica and in the bulging collar divided in two regions.

**Odontophorella** gen. nov.

Amphorellineae with lorica amphora-shaped; oral brim toothed; collar flaring; bowl with 5 subvertical fins each with lateral spines; antapex closed.

We designate as the type species *Odontophorella serrulata* sp. nov. from the South Equatorial Drift.



Differs from all other Amphorellineae in having teeth on the fins.

Includes only a single species, *Odontophorella serrulata* sp. nov.

Fig. 605. Species of *Odontophorella* gen. nov.  $\times 200$ .

Fig. 605. *O. serrulata* sp. nov. from Station 4721 in the South Equatorial Drift of the Pacific.

**Odontophorella serrulata** sp. nov.

Figure 605

Lorica 3.37-4.91 oral diameters in length; oral brim with 16-18 teeth; oral flare  $25^{\circ}$ ; bowl widest 2.0-2.5 oral diameters below the brim; fins 5, subvertical, running from suboral constriction to the pointed aboral end; with 3-13 tapering, recurved lateral spines in a group on the lower 0.3 of each fin, secondary structure in the wall prominent. Length  $120-153\mu$ .

The type locality is Station 4721 in the South Equatorial Drift. Occurs also in the South Equatorial and Peruvian currents.

**Albatrossiella** gen. nov.

*Undella*, partim, Laackmann, 1909, pp. 467-479 (see also *Amplectella*, *Undella*, *Undellopsis*, and *Xystoncellopsis*).

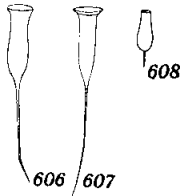
*Amphorella*, partim, Meunier, 1910, p. 133 (see also *Corliella* and *Metacylis*).

Amphorellineae with goblet-shaped lorica; collar low, a truncated cone; bowl flaring, subcylindrical, contracting posteriorly to a very long aciculate spine 0.6-0.7 total length; no fins or striae.

The type species by our designation is *Albatrossiella filigera* (Laackmann) from the South Equatorial Current of the Atlantic, the oldest species included in the genus.

Differs from *Dadayiella* in the more slender, acicular form of the aboral horn and from all other Amphorellineae in having an aboral horn.

Includes three species, *Albatrossiella agassizi* sp. nov., *A. filigera* (Laack.) and *A. minutissima* (Meunier).



Figs. 606-608. Species of *Albatrossiella* gen. nov.  $\times 200$ .

Fig. 606. *A. agassizi* sp. nov. from Station 4742 in the Equatorial Counter Current of the Pacific.

Fig. 607. *A. filigera* (Laack.) after Laackmann (1909, pl. 49, fig. 9) from the South Equatorial Current of the Atlantic.

Fig. 608. *A. minutissima* (Meunier) after Meunier (1910, pl. 10, fig. 27) from the Barents Sea.

***Albatrossiella agassizi* sp. nov.**

Figure 606

Lorica an elongated goblet, 5.95 oral diameters in length; collar flaring  $20^\circ$ ; bowl inflated, aborally contracting to the posterior spine which is 0.6 total length in length. Length  $119\mu$ .

The type locality is Station 4742 in the Equatorial Counter Current of the Pacific.

Differs from *A. filigera* in the absence of the shoulder between the collar and the bowl and from *A. minutissima* in larger size.

***Albatrossiella filigera* (Laackmann)**

Figure 607

*Undella filigera* Laackmann, 1909, pp. 474, 492, pl. 48, fig. 12, pl. 49, fig. 9.

***Albatrossiella minutissima* (Meunier)**

Figure 608

*Amphorella minutissima* Meunier, 1910, p. 133, pl. 10, fig. 27.

### Dadayiella gen. nov.

*Tintinnus*, partim, Entz, Sr., 1884, p. 409 (see also *Rhabdonella*); Brandt, 1907, pp. 374-388 (see also *Amphorella*, *Brandtiella*, *Daturella*, *Helicostomella*, *Metacyclis*, *Ormosella*, *Salpingacantha*, and *Tintinnus*).

*Amphorella*, partim. Jörgensen, 1924, pp. 15-16, 37, 57 (see also *Amphorella*, *Amphorellopsis*, *Canthariella*, *Craterella*, *Ormosella*, and *Stecstrupiella*).

Amphorellineae with an elongated goblet-shaped lorica, 2.56-5.80 oral diameters in length; oral rim crenulated or entire; collar with 9-18 oblong facets; bowl campanulate, usually contracting posteriorly to an elongated conical or cylindrical pedicel with or without an aboral knob; and with or without a pointed aboral tip.

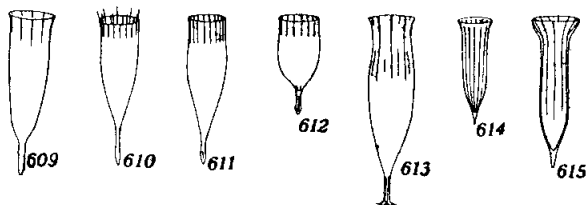
We designate as the type species *Dadayiella ganymedes* (Entz, Sr.) from off Naples in the Mediterranean, the oldest species included in the genus.

Differs from *Albatrossiella* in having a stouter aboral horn and from all other Amphorellineae in having an aboral horn.

Includes 7 species as follows:

*acuta* (Jörg.)  
*bulbosa* (Bdt.)  
*curta* sp. nov.  
*cuspis* sp. nov.

*ganymedes* (Entz, Sr.)  
*jörgenseni* sp. nov.  
*pachytoceus* (Jörg.)



Figs. 609-615. Species of *Dadayiella* gen. nov.  $\times 200$ .

Fig. 609. *D. acuta* (Jörg.) after Jörgensen (1924, p. 17, fig. 22d) from Station 218 of the "Thor" off Algeria in the Western Mediterranean.

Fig. 610. *D. ganymedes* (Entz, Sr.) from Station 4640 in the southwestern end of the Panamic Area.

Fig. 611. *D. bulbosa* (Bdt.) from Station 4650 in the northern end of the Peruvian Current.

Fig. 612. *D. curta* sp. nov. from Station 4571 in the California Current.

Fig. 613. *D. jörgenseni* sp. nov. after Jörgensen (1924, p. 17, fig. 22c) from Station 26 of the "Thor" in the English Channel off La Hogue.

Fig. 614. *D. cuspis* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 615. *D. pachytoceus* (Jörg.) after Jörgensen (1924, p. 17, fig. 20) from Station 186 of the "Thor" in the Adriatic.

**Dadayiella acuta** (Jørgensen)

Figure 609

*Amphorella ganymedes* var. *a tenuicauda* forma *acuta* Jørgensen, 1924, p. 22.  
*Amphorella ganymedes* forma *acuta* Jørgensen, 1924, p. 17, fig. 22*d*.

Raised to status of species.

Lorica tall chalice-shaped, 3.45 oral diameters in length; collar flaring, a short inverted segment of a cone ( $50^\circ$ ); suboral facets 9, extending for 0.5 oral diameter below rim; bowl tall, campanulate ( $10^\circ$ , changing to  $30^\circ$  aborally); pedicel subcylindrical, 0.29 total length in length, without a bulb; aboral tip pointed; wall hyaline. Length  $75\mu$ .

The type locality is Station 218 of the "Thor" off Algeria in the Western Mediterranean.

Differs from *D. bulbosa* in lack of bulb and in fewer oral facets.

**Dadayiella bulbosa** (Brandt)

Figure 611

*Tintinnus bulbosus* Brandt, 1906, p. 33, pl. 70, figs. 3-5; 1907, pp. 412-413, 456; Entz, Jr., 1908, pp. 10-138, pl. 6, fig. 10; 1909*b*, pp. 95-215, pl. 13, fig. 10.  
*Amphorella ganymedes* var. *bulbosa*, *partim*, Jørgensen, 1924, pp. 17, 22, 23, fig. 22*b* (for fig. 22*c* see *D. jørgenseni*).

**Dadayiella curta** sp. nov.

Figure 612

Lorica minute, 2.56-2.58 oral diameters in length; collar flaring  $5^\circ$ ; oral facets 14-18 extending 0.24-0.30 total length; bowl campanulate; pedicel 0.25-0.30 total length; with or without a bulb. Length 64-68 $\mu$ .

The type locality is Station 4571 in the California Current. Occurs also in the Panamic Area and South Equatorial Drift of the Eastern Tropical Pacific.

Differs from other species in its shorter lorica.

**Dadayiella cuspis** sp. nov.

Figure 614

Lorica minute, 2.91-3.10 oral diameters in length; collar flaring  $12^\circ$ ; facets 11-13 on both collar and bowl extending to the pedicel; bowl subcylindrical conical posteriorly; pedicel short, 0.12-0.18 total length. Length 67-93 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift of the Pacific.

Differs from *D. pachytoecus* in having facets extending to the tip of the spine.

**Dadayiella ganymedes** (Entz, Sr.)

Figure 610

*Tintinnus Ganymedes* Entz, Sr., 1884, p. 409, pl. 24, figs. 17, 18.

*Amphorella ganymedes*, Daday, 1887b, pp. 539, 540, pl. 18, fig. 18; Jörgensen, 1924, pp. 17, 22, 23, fig. 22a.

*Amphorella ganymedes* var. *a tenuicauda* forma *obtusa* Jörgensen, 1924, p. 22.

*Tintinnus ganymedes*, Brandt, 1906, p. 33, pl. 70, fig. 2; 1907, pp. 409, 412, 466; Lepsi, 1926b, pp. 79, 99, pl. 11, fig. 391 [as fig. 291 on p. 99].

**Dadayiella jörgenseni** sp. nov.

Figure 613

*Amphorella ganymedes* var. *bulbosa*, *partim*, Jörgensen, 1924, pp. 17, 22, 23, fig. 22c (for fig. 22b see *D. bulbosa*).

Lorica with about 9 suboral facets; bowl inflated toward the middle; pedicel with bulb with lateral spikes; no spinule below the bulb. Length 80 $\mu$ .

The type locality is Station 26 of the "Thor" in the English Channel, off La Hague.

Differs from other species in having lateral spikes on bulb.

**Dadayiella pachytoecus** (Jörgensen)

Figure 615

*Amphorella pachytoecus* Jörgensen, 1924, p. 21, fig. 20.

Subfamily STELIDIELLINAE subfam. nov.

Tintinnidae with a collar made up of a suboral band and set off by a nuchal groove or a ledge and with a closed aboral end.

Differs from the Amphorellinae in the presence of a distinct collar set off by a nuchal groove or by a suboral ledge and from the Tintinninae in the closed aboral end.

Includes three genera: *Ormosella* gen. nov., *Brandtiella* gen. nov., and *Stelidiella* gen. nov.

### Ormosella gen. nov.

*Tintinnus*, partim, Brandt, 1907, pp. 374-388 (see also *Amphorella Brandtiella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Mctacylis*, *Salpingacantha*, and *Tintinnus*).

*Amphorella*, partim, Jörgensen, 1924, pp. 15-16, 37, 57 (see also *Amphorella*, *Amphorellopsis*, *Canthariella*, *Craterella*, *Dadayiella*, and *Stenstrupiella*).

Stelidiellineae with lorica goblet- or bell-shaped, 2.00-3.21 oral diameters in length; collar entire, a distinct low cylinder or truncated cone; nuchal constriction deep; bowl subconical, pyramidal, or subcylindrical anteriorly, and contracted posteriorly, striated or faceted; aboral end acute, blunt or with a spinule.

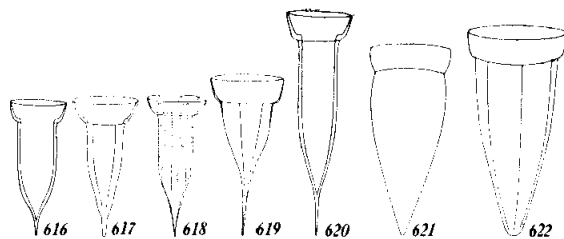
We designate as the type species *Ormosella cornucopia* nom. nov. from Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic, the oldest species included in the genus.

Differs from *Brandtiella* in the absence of the gelatinous sheath and the suboral ledge and from *Stelidiella* in the absence of the nuchal cone.

Includes 7 species as follows:

apsteini sp. nov.  
bresslaui sp. nov.  
cornucopia nom. nov.  
haeckeli sp. nov.

schmidti sp. nov.  
schweyerei sp. nov.  
trachelium (Jörg.)



Figs. 616-622. Species of *Ormosella* gen. nov.  $\times 200$ .

Fig. 616. *O. bresslaui* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 617. *O. haeckeli* sp. nov. from Station 4662 in the Peruvian Current.

Fig. 618. *O. trachelium* (Jörg.) after Jörgensen (1924, p. 17, fig. 21) from Station 206 of the "Thor" off the Balearic Islands in the Western Mediterranean.

Fig. 619. *O. schweyerei* sp. nov. from Station 4711 in the South Equatorial Drift of the Pacific.

Fig. 620. *O. apsteini* sp. nov. from Station 4634 in the Panamic Area of the Pacific.

Fig. 621. *O. cornucopia* nom. nov. after Brandt (1906, pl. 69, fig. 10) from Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic.

Fig. 622. *O. schmidti* sp. nov. from Station 4679 in the Peruvian Current.

**Ormosella apsteini** sp. nov.

Figure 620

Lorica an elongated goblet, 2.38-3.21 oral diameters in length; collar sharply set off from bowl, flaring  $15^\circ$ , a truncated cone 0.38 oral diameter in height; bowl elongated, subpyramidal with 7 facets; aborally contracted to a long spine. Length 100-136 $\mu$ .

The type locality is Station 4634 in the Panamic Area of the Eastern Tropical Pacific. Occurs also in the South Equatorial Drift and the Galapagos Eddy.

Differs from other species in the more elongated bowl.

**Ormosella bresslaui** sp. nov.

Figure 616

Lorica minute, goblet-shaped, 2.00-2.57 oral diameters in length; collar flaring  $28^\circ$ , a truncated cone, 0.4 oral diameter in height, set off by a shoulder; bowl subcylindrical above, with 12 faint facets; contracting abruptly to an acute spine. Length 56-85 $\mu$ .

The type locality is Station 4724 in the South Equatorial Drift of the Eastern Tropical Pacific.

Differs from other species in its small size and its acute spine.

**Ormosella cornucopia** nom. nov.

Figure 621

*Tintinnus conicus* Brandt, 1906, p. 33, pl. 69, fig. 10; 1907, pp. 413, 460; non Dixon and Joly, 1898, pp. 749, 752, pl. 26, fig. 7 (see *Tps. beroidea*).

Lorica cornucopia-shaped, 2.41 oral diameters in length; collar sharply set off from bowl, flaring ( $25^\circ$ ) below, 0.25 oral diameter in height; bowl elongate, conical ( $32^\circ$ ), expanding from below collar to a diameter of 0.99 oral diameter at a level 0.5 total length and contracting evenly to the pointed aboral end; no facets. Length 125-130 $\mu$ .

The type locality is Station Pl. 85 of the Plankton Expedition in the South Equatorial Current of the Atlantic. Occurs also in the Guinea Current.

Differs from *O. schmidti* in the lack of facets, smaller size, and pointed aboral end.



**Ormosella haeckeli** sp. nov.

Figure 617

Lorica tapering, campanulate, 2.10–2.56 oral diameters in length; collar a truncated cone, 0.38 oral diameter high, flaring  $20^\circ$ ; bowl subcylindrical, becoming concave-subconical ( $25^\circ$ ); with 12 facets; aboral region tapering sharply. Length 80–92 $\mu$ .

The type locality is Station 4662 in the Peruvian Current. Occurs also in the Galapagos Eddy and the South Equatorial Drift.

Differs from *O. trachelium* in relatively larger, more flaring collar, more abrupt and less subcylindrical bowl, and more tapering aboral cone.

**Ormosella schmidti** sp. nov.

Figure 622

Lorica tapering campanulate, 2.14–2.45 oral diameters in length; collar a cylinder, 0.26 oral diameters high; bowl subpyramidal, with 7 facets; aboral end blunt, with or without a minute spinule. Length 125–140 $\mu$ .

The type locality is Station 4679 in the Peruvian Current. Occurs also in the Panamic Area, the Galapagos and Easter Island eddies, and the South Equatorial Drift.

Differs from *O. cornucopia* in larger average size and in its rounded aboral end.

**Ormosella schweyeri** sp. nov.

Figure 619

Lorica short, stout goblet-shaped, 1.75–2.50 oral diameters in length; collar a truncated cone about 0.25 oral diameter in length, set off by a wide shoulder; bowl short, contracting from the nuchal ledge aborally in the upper 0.27,  $14^\circ$ , in the cone,  $30^\circ$ , decreasing to  $8^\circ$  in the spine; 7 facets; posterior spine much elongated. Length 70–113 $\mu$ .

The type locality is Station 4711 in the South Equatorial Drift. Occurs also in the Peruvian Current.

Differs from *O. apsteini* in shorter collar and bowl, relatively longer spine, and no median inflation.

**Ormosella trachelium** (Jørgensen)

Figure 618

*Amphorella trachelium* Jørgensen, 1924, p. 22, fig. 21.

### Brandtiella gen. nov.

*Tintinnus, partim*, Brandt, 1907, pp. 374-388 (see also *Amphorella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Metacylis*, *Ormosella*, *Salpingacantha*, and *Tintinnus*).

Stelidiellineae with lorica with collar divided into a suboral ring and a horizontal, angular ledge; antapex purse-like, longitudinally ridged; the lorica with a gelatinous outer coating; wall of lorica proper with a fine prismatic structure.

We designate as the type species *Brandtiella palliata* (Brandt) from Station Pl. 29 of the Plankton Expedition in the Florida Current of the Atlantic.

Differs from *Ormosella* and *Stelidiella* in the presence of the gelatinous sheath (normal?) and in having a suboral ledge.

Because of the shape of the suboral region and the prismatic structure of the wall, this genus is tentatively allocated in the Tintinnidae.

Includes only a single species, *Brandtiella palliata*.

#### *Brandtiella palliata* (Brandt)

Figure 623

*Tintinnus palliatus* Brandt, 1906, p. 33, pl. 70, fig. 1; 1907, pp. 436, 475; Laackmann, 1909, p. 488.

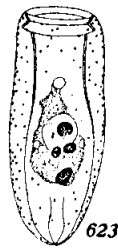


Fig. 623. Species of *Brandtiella* gen. nov.  $\times 200$ .

Fig. 623. *B. palliata* (Bdt.) from Station 4732 in the South Equatorial Drift of the Pacific.

### Stelidiella gen. nov.

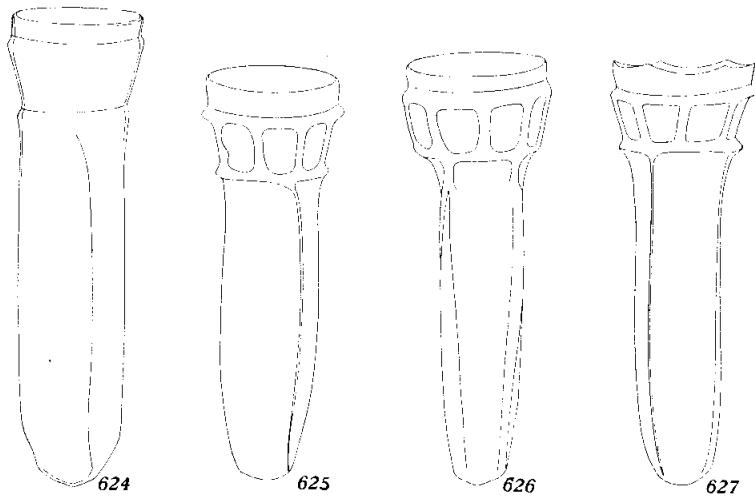
*Tintinnus*, Biedermann, *partim*, 1893, pp. 27-32 (see also *Rhabdonella* and *Xystoncellopsis*).

Stelidiellinae with a stout, scabbard-shaped lorica; collar truncated, subconical, smooth or fenestrated; with a toothed or entire suboral band and smooth or fenestrated nuchal cone; nuchal cone with quadrilateral fenestrae in 1 or 2 rows enclosed by surrounding lattice; bowl quadrangular; antapex blunt; 4 longitudinal fins.

We designate as the type species *Stelidiella stelidium* (Biedermann) from Station N 150 of the Plankton Expedition from the North Equatorial Current of the Atlantic (Brandt, 1906), the oldest species included in the genus.

Differs from *Brandtiella* in the absence of the gelatinous sheath and the suboral ledge and from *Ormosella* in having the collar divided into a suboral band and a nuchal cone.

Includes four species as follows: *Stelidiella fenestrata* sp. nov., *S. phialia* sp. nov., *S. simplex* sp. nov., and *S. stelidium* (Biedermann).



Figs. 624-627. Species of *Stelidiella* gen. nov.  $\times 200$ .

Fig. 624. *S. phialia* sp. nov. from Station 4662 in the Peruvian Current.

Fig. 625. *S. simplex* sp. nov. from Station 4740 in the South Equatorial Drift of the Pacific.

Fig. 626. *S. fenestrata* sp. nov. from Station 4637 in the Panamic Area of the Pacific.

Fig. 627. *S. stelidium* (Biedermann) after Brandt (1906, pl. 69, fig. 11) from Station N150 of the Plankton Expedition in the North Equatorial Current of the Atlantic.

**Stelidiella fenestrata** sp. nov.

Figure 626

Lorica scabbard-shaped, 2.7-3.2 oral diameters in length. Nuchal cone with a double circle of fenestrae. Length 268-310 $\mu$ .

The type locality is Station 4637 in the Panamic Area. Occurs also in the Mexican and Peruvian currents, the Galapagos Eddy, and the South Equatorial Drift.

Differs from the other species in having a double row of fenestrae.

**Stelidiella phialia** sp. nov.

Figure 624

Lorica scabbard-shaped, 3.57 oral diameters in length; nuchal cone without fenestrae; bowl not expanded. Length 300 $\mu$ .

The type locality is Station 4662 in the Peruvian Current.

Differs from other species in lack of fenestrae.

**Stelidiella simplex** sp. nov.

Figure 625

Lorica scabbard-shaped, 2.79-3.10 oral diameters in length; nuchal cone with a single circle of 8 fenestrae; bowl inflated near or below the middle. Length 264-274 $\mu$ .

The type locality is Station 4740 in the South Equatorial Drift. Occurs also in the Peruvian Current.

Differs from *S. stelidium* in lacking oral serrations.

**Stelidiella stelidium** (Biedermann)

Figure 627

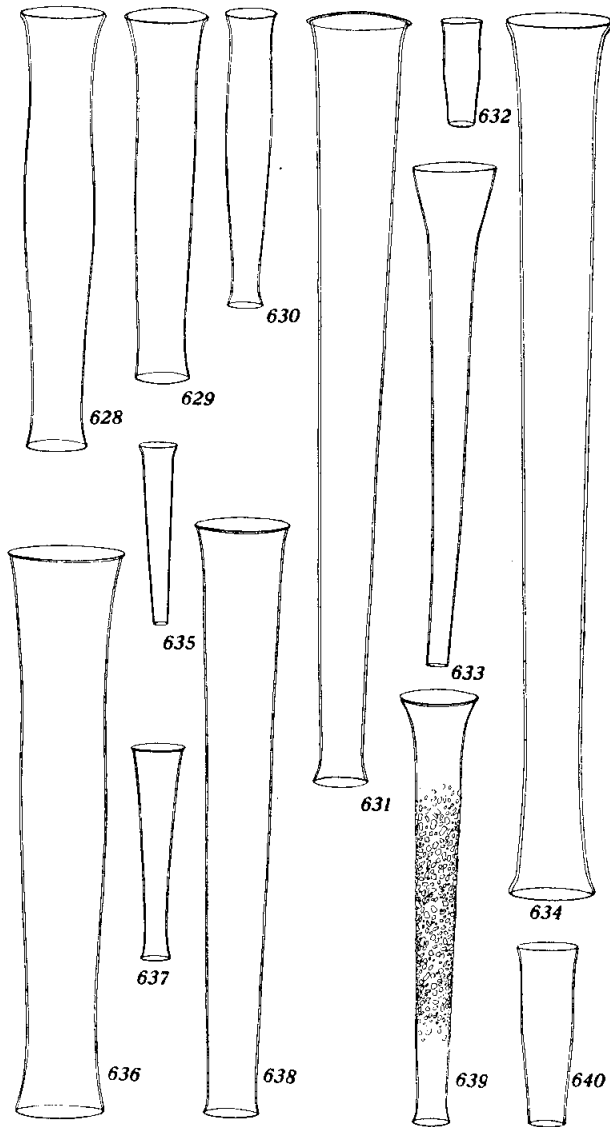
*Tintinnus stelidium* Biedermann, 1893, pp. 31-32, pl. 3, fig. 14; Brandt, 1906, p. 33, pl. 69, fig. 11; 1907, pp. 414, 479.

## Subfamily TINTINNINEAE subfam. nov.

Tintinnidae with lorica with open aboral end.

Differs from the Amphorellinae and the Stelidiellinae in the open instead of closed aboral end.

Includes five genera as follows: *Epicranella* gen. nov., *Daturella* gen. nov., *Salpingacantha* gen. nov., *Salpingella* Jörg. emended, and *Tintinnus* Schrank emended Jörg. emended.



Figs. 628-640; 641-656. Species of *Tintinnus* Sehrank emended Jörgensen emended.  $\times 200$ .

Figs. 628-640.

Fig. 628. *T. brandti* sp. nov. from Station 4571 in the California Current off San Diego.

Fig. 629. *T. medius* sp. nov. from Station 4576 in the California Current.

Fig. 630. *T. elegans* Jörg. after Jörgensen (1924, p. 10, fig. 3) from Station 28 of the "Thor" in the Bay of Naples.

Fig. 631. *T. elongatus* Jörg. after Jörgensen (1924, p. 12, fig. 5b) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 632. *T. pacificus* sp. nov. from Station 4722 in the South Equatorial Drift of the Pacific.

Fig. 633. *T. attenuatus* sp. nov. after Brandt (1906, pl. 65, fig. 12) from Station "Dahl 29-I-97" off Ralun in the Western Tropical Pacific.

## Tintinnus Schrank emended Jörgensen emended

*Tintinnus Schrank*, 1803, p. 317; Claparède and Lachmann, *partim*, 1858, pp. 195-196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coziella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocylis*, *Salpingella*, *Stecnstrapiella*, *Stenosemella*, *Tintinnidium*, and *Tintinnopsis*); Kent, 1882, pp. 603-604; Daday, 1887b, pp. 525-526; Bütschli, 1889, p. 1734; Brandt, *partim*, 1907, pp. 374-388 (see also *Amphorella*, *Brandtiella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Metacylis*, *Ormosella*, and *Salpingacantha*); Jörgensen, *partim*, 1924, pp. 9-13 (see also *Daturella*).

*Vaginicola*, *partim*, Dujardin, 1841, pp. 561-562 (see also *Peritricha* and *Cothurnia*).

Tintinnineae with lorica in the form of a truncated cone or cylinder open at both ends; wall homogeneous, hyaline, rarely externally wrinkled, never with spiral structure.

We designate as the type species *Tintinnus lusus-undae* Entz, Sr., from the Mediterranean off Naples, a widely distributed pelagic species, the first one included by Jörgensen in his redefinition of the genus.

Differs from all other genera of the Tintinnineae in the lack of all structural differentiations of the oral and aboral ends, except those produced by eversion, by the thickening of the margins into a brim, and by the presence of teeth.

Includes 29 species as follows:

angustatus Daday	lusus-undae Entz, Sr.	rectus Wailes
apertus sp. nov.	macilentus Jörg.	rugosus sp. nov.
attenuatus sp. nov.	maculatus Bdt.	stramentus sp. nov.
birictus sp. nov.	medius sp. nov.	tenuis sp. nov.
brandti sp. nov.	mirabilis sp. nov.	tubiformis sp. nov.
colligatus sp. nov.	pacificus sp. nov.	tubulosus Ost.
elegans Jörg.	pectinis nom. nov.	tubus Stokes
elongatus Jörg.	perminutus sp. nov.	turgescens sp. nov.
frankóii Daday	pinguis sp. nov.	turris sp. nov.
latus Jörg.	procurrrens sp. nov.	

Figs. 628-640; 641-656. Species of *Tintinnus* Schrank emended Jörgensen emended.  $\times 200$ .

Figs. 628-640. (*Continued.*)

Fig. 634. *T. birictus* sp. nov. from Station 4574 in the California Current.

Fig. 635. *T. stramentus* sp. nov. from Station 4583 in the California Current.

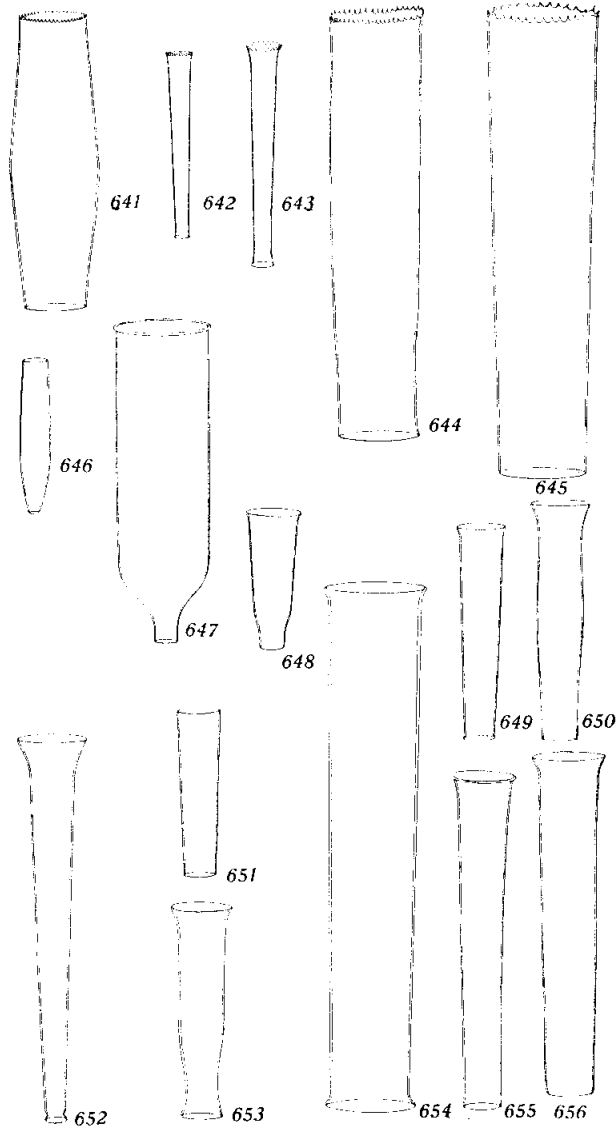
Fig. 636. *T. latus* Jörg. after Jörgensen (1924, p. 12, fig. 6) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 637. *T. macilentus* Jörg. emended after Jörgensen (1924, p. 10, fig. 4) from Station 182 of the "Thor" off the east coast of Greece near Skyro in the Aegean Sea.

Fig. 638. *T. frankóii* Daday after Jörgensen (1924, p. 12, fig. 5a) from Station 152 of the "Thor" off Barka in the Eastern Mediterranean.

Fig. 639. *T. maculatus* Bdt. after Brandt (1906, pl. 65, fig. 18) from Station "Dahl 18-1-97" from off Ralum in the Western Tropical Pacific.

Fig. 640. *T. pinguis* sp. nov. from Station 4583 in the California Current.



Figs. 641-656. Species of *Tintinnus* Schrank emended Jörgensen emended.  
 × 200. (Continued.)

Fig. 641. *T. mirabilis* sp. nov. from Nome Bay, Alaska, U. S. S. "Albatross."

Fig. 642. *T. turris* sp. nov. from Nome Bay, Alaska, U. S. S. "Albatross."

Fig. 643. *T. pectinis* nom. nov. after Kofoid (1905, pl. 26, fig. 1) from the California Current off San Diego.

Fig. 644. *T. rugosus* sp. nov. from Station 4675 in the Peruvian Current.

Fig. 645. *T. rectus* Wailes after Wailes (1925, pl. 2, fig. 23) from the Strait of Georgia, British Columbia.

Fig. 646. *T. tubus* Stokes after Stokes (1893, pl. 5, fig. 3) from Coney Island, New York.

Fig. 647. *T. angustatus* Daday after Daday (1887b, pl. 18, fig. 15) from the Bay of Naples.

**Tintinnus angustatus** Daday

Figure 647

*Tintinnus angustatus* Daday, 1887*b*, pp. 531-532, pl. 18, fig. 15.**Tintinnus apertus** sp. nov.

Figure 648

*Tintinnus inquilinus*, Claparède and Lachmann, *partim*, 1858, pp. 196-198, pl. 8, fig. 2 (see also *T. tubulosus*); Kent, *partim*, 1882, pp. 604-605 (for pl. 31, fig. 15 see *Parafavella rotundata*, see also *Tdm. fluviatile*); Mereschkowsky, *partim*, 1878, pp. 20-21; 1879, pp. 216, 245 (for 1878, pl. 1, fig. 12 and for 1879, pl. 10, fig. 12 see *Tdm. inquilinum*, see also *Tdm. fluviatile*, *T. tubulosus*, and *Parafavella rotundata*); Daday, 1887*a*, pp. 164-205, pl. 2, fig. 8; 1887*b*, *partim*, pp. 528-531, pl. 18, figs. 2, 10-13 (see also *T. tubulosus*, *Tdm. fluviatile*, *Tdm. inquilinum*, *Parafavella rotundata*, and *Rhabdonella elegans*); Famintzin, 1889, pp. 2-6, pl. 1, figs. 1-5; Möbius, 1887, p. 120, pl. 8, fig. 36; Brandt, *partim*, 1907, pp. 378, 468, 471 (see also *T. tubulosus*, *Tdm. inquilinum*, *Tdm. fluviatile*, and *Parafavella rotundata*); Entz, Jr., 1908, pp. 11-128, pl. 6, fig. 11; 1909*b*, pp. 107-217, pl. 13, fig. 11; Schweyer, *partim*, 1909, pp. 135-187, pl. 10, figs. 6-8 (for fig. 5 see *T. tubulosus*); Jörgensen, 1924, *partim*, p. 12, figs. 7*a*, *b* (see also *T. tubulosus*, *Tdm. inquilinum*, and *Tdm. fluviatile*); 1927, pp. 9, 22, figs. 10, 33; Lepsi, 1926*b*, pp. 79, 99, pl. 11, fig. 390.

Lorica 2.2-3.2 oral diameters in length, chalice-shaped; oral region slightly if at all flaring; bowl subconical ( $15^{\circ}$ - $20^{\circ}$ ) anteriorly, slightly concave laterally; aboral region contracting abruptly to 0.31-0.60 oral diameter; aboral end truncated, open. Length 89-108 $\mu$ . Often with laterally attached pelagic diatoms.

The type locality is Bergen Fiord, Norway, where Claparède and Lachmann, the first to figure this species, obtained their material.

Differs from *T. angustatus* in a wider aboral region.

For the nomenclatural history of this species see *Tintinnidium inquilinum*.

Figs. 641-656. Species of *Tintinnus* Schrank emended Jörgensen  
emended.  $\times 200$ .

Figs. 641-656. (Concluded.)

Fig. 648. *T. apertus* sp. nov. from Station 4634 in the Panamic Area of the Pacific.

Fig. 649. *T. perminutus* sp. nov. from Station 4719 in the South Equatorial Drift of the Pacific.

Fig. 650. *T. turgescens* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 651. *T. tubulosus* Ostenfeld after Jörgensen (1924, p. 10, fig. 2) from Station 79 of the "Thor" off Cape Finistere in the Atlantic.

Fig. 652. *T. colligatus* sp. nov. from Station 4705 in the South Equatorial Drift.

Fig. 653. *T. procurrerens* sp. nov. from Station 4690 in the Easter Island Eddy.

Fig. 654. *T. tubiformis* sp. nov. from Station 4723 in the South Equatorial Drift of the Pacific.

Fig. 655. *T. tenue* sp. nov. from Station 4580 in the California Current off Lower California.

Fig. 656. *T. lusus-undae* Entz, Sr. after Jörgensen (1924, p. 10, fig. 1) from Station 16 of the "Thor" off the coast of Aearnia, Western Greece.



**Tintinnus attenuatus** sp. nov.

Figure 633

*Tintinnus lusus-undae* var. *c* Brandt, 1906, *partim*, p. 32, pl. 65, fig. 12 (for pl. 65, fig. 19 see *T. tenue*); 1907, pp. 422-423, 470.

*Tintinnus franknoi* var. *c* Brandt, 1906, p. 32, pl. 65, fig. 20; 1907, *partim*, pp. 424, 466 (see also *T. macilentus*).

*Tintinnus lusus-undae* var. *macilentus*, *partim*, Jörgensen, 1924, p. 11 (see also *T. macilentus*, *T. tenue*, *Daturella angusta*, and *D. emarginata*).

*Tintinnus franknoi*, *partim*, Jörgensen, 1924, pp. 9, 11, 105, 106 (for fig. 5a see *T. franknoi*, see also *T. latus*).

Lorica 5.4-5.6 oral diameters in length with clearly defined suboral funnel (30°), 0.77 oral diameter in length; shaft tapering 4°-5°; aboral end without clearly defined flare. Length 310-335 $\mu$ .

The type locality is off Ralum (Dahl, 29-I-97) in the Western Tropical Pacific. Occurs also in the North Equatorial Current of the Atlantic.

Differs from other species in the *T. lusus-undae* group in the wide anterior funnel and slender habitus, and from *T. franknoi* in absence of definite aboral flare.

**Tintinnus birictus** sp. nov.

Figure 634

Lorica very long and slender, tubular, its length 6.3-10.6 oral diameters; with ends flaring, anteriorly more gradually than posteriorly; both oral and aboral margins with a slight brim. Length 377-650 $\mu$ .

The type locality is Station 4574 in the California Current. Occurs also in the Peruvian Current, Easter Island Eddy, and the South Equatorial Drift.

Differs from *T. elongatus* in larger average size and in less flaring suboral region.

**Tintinnus brandti** sp. nov.

Figure 628

*Tintinnus franknoi* var. *a*, *partim*, Brandt, 1906, p. 31, pl. 65, fig. 10 (for fig. 13 see *T. franknoi* and for fig. 16 see *T. macilentus*); appeared in 1907 as follows:

*Tintinnus franknoi* var. *b* Brandt, 1907, pp. 43, 424, 465.

Lorica an inverted, elongated, truncated cone (4°-5°), length 3.67-5.63 oral diameters; shaft with a distinct premedian bulge 0.35-0.45 total length below oral rim; oral and aboral ends with prominent

flare; both oral and aboral openings with brims, the aboral less developed. Length 205–339 $\mu$ .

The type locality is Station 4571 in the California Current off San Diego. Occurs also in the Sargasso Sea, off Ceylon, near New Zealand and Sunday Island, in the Mexican and Peruvian currents, and South Equatorial Drift.

Differs from *T. latus* in smaller size and more anterior bulge; from *T. lusus-undae*, *T. turgescens*, and *T. pinguis* in the presence of aboral flare; and from *T. elegans* in the larger size and more anterior bulge.

#### **Tintinnus colligatus** sp. nov.

Figure 652

Lorica much elongated and slender, very tapering, as a whole 6°–9°, its length 4.8–5.8 oral diameters; oral funnel rather widely flaring (20°–35°); shaft tapering, narrow, abruptly constricted immediately above the low aboral funnel; oral margin only with a brim. Length 260–295 $\mu$ .

The type locality is Station 4705 in the South Equatorial Drift. Occurs also in the Panamic Area and the Galapagos Eddy.

Differs from *T. perminutus* in deeper aboral constriction and in proportions and from all other species in the measure of this constriction.

#### **Tintinnus elegans** Jörgensen

Figure 630

*Tintinnus lusus-undae* var. *elegans* Jörgensen, 1924, p. 11, fig. 3.

Raised to status of species.

Lorica slender, with median bulge, 6 oral diameters in length; oral funnel flaring without a brim; cylinder tapering throughout; aboral end flaring and without a brim. Length 147–190 $\mu$ .

The type locality is "Thor" Station 28 off Naples in the Mediterranean Sea.

Differs from *T. brandti* in having a brim as well as in its proportions.

**Tintinnus elongatus** Jörgensen

Figure 631

*Tintinnus fraknoi* forma *elongata* Jörgensen, 1924, pp. 11, 12, fig. 5b.

Raised to status of species.

Lorica very long and slender, 7.5 oral diameters in length; oral margin with a brim; both ends flaring, anteriorly more gradually than posteriorly; shaft an inverted cone ( $3^\circ$ ). Length  $493\mu$ .

The type locality is Station 152 of the "Thor" off Barka in the Mediterranean.

Differs from *T. birictus* in smaller size, more flaring anterior region, and in lack of an aboral brim.

**Tintinnus fraknoi** Daday

Figure 638

*Tintinnus Fraknoi* Daday, 1887b, pp. 526, 528, 530, pl. 18, fig. 1; Schweyer, 1909, pp. 147-188, pl. 11, fig. 18; Fauré-Fremiet, 1924, pp. 98-101, fig. 32.

*Tintinnus fraknoi* var. a, *partim*, Brandt, 1906, p. 32, pl. 65, fig. 13 (for fig. 10 see *T. brandti* and for fig. 16 see *T. macilentus*); *non* 1907, pp. 423-424, 465 (see *T. medius*).

*Tintinnus fraknoi*, Brandt, 1906, p. 32, pl. 65, fig. 9; 1907, p. 423; Entz, Jr., 1908, pp. 10-131, pl. 9, fig. 3, pl. 10, fig. 7; 1909b, pp. 99-220, pl. 16, fig. 3, pl. 17, fig. 7; Okamura, *partim*, 1907, p. 140, pl. 6, fig. 67b (for fig. 67a see *T. perminutus*).

*Tintinnus fraknoi*, Lohmann, 1908, pp. 163, 169; 1920, pp. 228, 467.

*Tintinnus Fraknoi*, Chatton, 1919, p. 323.

*Tintinnus fraknoi*, *partim*, Jörgensen, 1924, pp. 9, 11, 105, 106, fig. 5a (see also *T. attenuatus* and *T. latus*).

**Tintinnus latus** Jörgensen

Figure 636

*Tintinnus fraknoi* var. *latus* Jörgensen, 1924, pp. 11-12, fig. 6.

*Tintinnus fraknoi*, *partim*, Jörgensen, 1924, pp. 9, 11, 105, 106 (for fig. 5a see *T. fraknoi*, see also *T. attenuatus*).

Raised to status of species.

Lorica moderately stout, tubular, 4.92 oral diameters in length; with both ends flaring, the anterior more gradually than the posterior; oral aperture with a brim; shaft tubular, very slightly bulging in the middle. Length  $353-404\mu$ .

The type locality is Station 152 of the "Thor" off Barka in the Mediterranean.

Differs from *T. macilentus* in larger size and median bulge.

**Tintinnus lusus-undae** Entz, Sr.

Figure 656

*Tintinnus lusus-undae* Entz, Sr., 1885*b*, p. 202, pl. 14, fig. 12.*Tintinnus lusus-undae*, Daday, *partim*, 1887*b*, pp. 527-528, 530 (for pl. 18, figs. 3, 14 see *T. tubulosus*, see also *T. perminutus*); Zacharias, *partim*, 1906, pp. 510-566 (for fig. 6 see *T. tenuis*, see also *T. turgescens*); Brandt, 1906, p. 32, pl. 65, fig. 11; 1907, *partim*, pp. 420-426, 444, 448, 470, 481 (see also *T. tenuis*, *T. tubulosus*, and *T. turgescens*); Entz, Jr., 1908, pp. 11-131, pl. 9, figs. 4, 6, 7; 1909*b*, pp. 101-226, pl. 16, figs. 4, 6, 7, pl. 21, figs. 7, 15, 16; Laackmann, 1909, pp. 354-355, 399, 400, 425, 429, 430, 480-483, 493, pl. 50, fig. 3.*Tintinnus lusus-undae* "main species," Jörgensen, 1924, pp. 10, 16, fig. 1 [b].*Tintinnus lusus-undae* forma *longa* Jörgensen, 1924, p. 10.**Tintinnus macilentus** Jörgensen emended

Figure 637

*Tintinnus fraknoi* var. *a*, *partim*, Brandt, 1906, p. 32, pl. 65, fig. 16 (for fig. 10 see *T. brandti* and for fig. 13 see *T. fraknóii*).*Tintinnus fraknoi* var. *c*, *partim*, Brandt, 1907, pp. 424, 466 (see also *T. attenuatus*).*Tintinnus fraknóii* var. *macilentus*, *partim*, Jörgensen, 1924, pp. 10, 11, fig. 4 (see also *T. attenuatus*, *T. tenuis*, *Daturella angusta*, and *D. emarginata*).

Raised to status of species.

Lorica a short truncated cone ( $6^{\circ}$ - $9^{\circ}$ ), 3.6-5.0 oral diameters in length; oral margin with a brim; shaft flaring ( $18^{\circ}$ - $29^{\circ}$ ) anteriorly, contracting as a cone ( $3^{\circ}$ - $5^{\circ}$ ) toward the aboral end to a least diameter, 0.5 oral diameter, at a level 1.0 oral diameter from the aboral end; flaring aborally ( $30^{\circ}$ ). Length 136-290 $\mu$ .

The type locality is Station "Krämer, 17-III-94" off New Zealand. Occurs also in the Atlantic southwest of England and widely in the Eastern Tropical Pacific.

Differs from *T. fraknóii* in much smaller size and greater contraction of shaft and from *T. elongatus* in size, proportions, and wider oral flare.**Tintinnus maculatus** Brandt

Figure 639

*Tintinnus fraknoi* var. *maculata* Brandt, 1906, p. 32, pl. 65, figs. 17, 17*a*, 18 18*a*; 1907, pp. 424, 466.

Raised to status of species.

Lorica 4.66-5.25 oral diameters in length; oral end a flaring funnel ( $35^{\circ}$ ), 0.6 oral diameter in length; shaft tapering, subconical ( $3^{\circ}$ - $5^{\circ}$ );

aboral end very slightly flaring; wall with agglomerated, irregular patches of alveoles(?) confined to a zone in the middle 0.67 of the shaft or distributed. Length  $204\mu$ .

The type locality is "Dahl, 29-I-97" off Ralum in the Western Tropical Pacific. Occurs also off New Zealand.

Differs from all other species of *Tintinnus* in the irregular patchwork on the shaft, a condition paralleling *Tintinnopsis*.

### ***Tintinnus medius* sp. nov.**

Figure 629

*Tintinnus franknoi* var. a Brandt, 1907, pp. 43, 424, 465; non Brandt, 1906, p. 32, pl. 65, figs. 10, 13, 16 (for fig. 10 see *T. brandti*, for fig. 13 see *T. franknoi*, and for fig. 16 see *T. macilentus*).

Lorica a stout, moderately bulging, relatively short, truncated cone of  $3^{\circ}$ – $5^{\circ}$ , its length 3.69–4.77 oral diameters; oral margin only with a brim; anterior end a tall funnel; aboral end with an abrupt flare. Length 192–254 $\mu$ .

The type locality is Station 4576 in the California Current. Occurs also in the Peruvian Current, Easter Island Eddy, and South Equatorial Drift of the Pacific, on the margin of the Florida and Labrador currents, Sargasso Sea, and North Equatorial Current, in the Atlantic, and in the Bay of Bengal.

Differs from *T. lusus-undae* in the flaring aboral funnel and median bulge.

### ***Tintinnus mirabilis* sp. nov.**

Figure 641

Lorica 4.4 oral diameters in length, swollen very slightly below the middle, forming a truncated segment of a cone of  $10^{\circ}$  in the upper 0.5, and an inverted cone of  $15^{\circ}$  in the lower 0.5; oral aperture with 40 low, triangular teeth; aboral aperture without teeth; surface of lorica smooth, no irregularities and no local eversions. Length 194 $\mu$ .

The type locality is Nome Bay, Alaska, from the collections of U.S.S. "Albatross."

Differs from *T. turris* in having 40 instead of 24 teeth and from *T. rugosus* in form of cylinder and in smooth surface.

**Tintinnus pacificus** sp. nov.

Figure 632

Lorica very short, subconical, hyaline, a truncated cone of  $6^{\circ}$ - $9^{\circ}$ , frequently with the appearance of a slight median bulge due to a postmedian contraction, its length 2.30-2.37 oral diameters; oral brim very slight. Length 67-71 $\mu$ .

The type locality is Station 4722 in the South Equatorial Drift.

Differs from *T. tubulosus* in length and proportions and in having a median bulge and from *T. pinguis* in smaller size.

**Tintinnus pectinis** nom. nov.

Figure 643

*Tintinnus serratus* Kofoid, 1905, pp. 287-288, pl. 26, fig. 1; Wailes, 1925, pp. 337-538, pl. 2, figs. 25, 26; non Möbius, 1887, pp. 110, 120, pl. 8, fig. 40 (see *Favella serrata*).

Lorica tubular, 6.0 oral diameters in length; oral rim with 20 triangular teeth; collar flaring ( $50^{\circ}$ ) as a short funnel, 0.4 oral diameter in length; shaft a truncated, inverted segment of a cone ( $3^{\circ}$ ); aboral end a flaring, inverted cone ( $47^{\circ}$ ), 0.4 oral diameter in length. Length 150 $\mu$ .

The type locality is off San Diego in the California Current.

Differs from *T. turris* in proportions, size, aboral flare, and in having fewer teeth.

**Tintinnus perminutus** sp. nov.

Fig. 649

*Tintinnus lusus-undae*, *partim*, Daday, 1887b, pp. 527, 528, 530 (see also *T. lusus-undae* and *T. tubulosus*).

*Tintinnus fraknoi*, *partim*, Okamura, 1907, p. 140, pl. 6, fig. 67a (for fig. 67b see *T. fraknoi*).

Lorica a short, inverted, truncated cone of  $3^{\circ}$ - $6^{\circ}$  with very slight median bulge, 4.25-5.40 oral diameters in length; each end with an abruptly flaring funnel, the oral funnel only with a brim. Length 140-183 $\mu$ .

The type locality is Station 4719 in the South Equatorial Drift of the Pacific. Occurs also in the Peruvian Current, off Japan, and in the Mediterranean.

Differs from *T. macilentus* in its median bulge.

**Tintinnus pinguis** sp. nov.

Figure 640

Lorica stout, subconical with a median bulge, its length 2.6–3.8 oral diameters; oral aperture only with a slight but indefinite brim. Length 114–161 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican Current.

Differs from *T. pacificus* in having slenderer proportions, a better developed median bulge, and larger size.

**Tintinnus procurrerens** sp. nov.

Figure 653

Lorica very wide, a truncated cone of 3°–6° with a submedian bulge, 3.20–4.45 oral diameters in length; each end a flaring, truncate funnel; the oral one with a well defined brim. Length 138–206 $\mu$ .

The type locality is Station 4690 in the Easter Island Eddy. Occurs also in the South Equatorial Drift of the Pacific.

Differs from *T. brandti* and *T. perminutus* in greater length, in being stouter, and in having a more pronounced bulge.

**Tintinnus rectus** Wailes emended

Figure 645

*Tintinnus lusus-undae* var. *rectus* Wailes, 1925, p. 537, pl. 2, fig. 22.

*Tintinnus lusus-undae*, Wailes, 1925, p. 537, pl. 2, fig. 23.

Raised to status of species.

Lorica a stout regular tube, or a tapering segment of a cone (8°), 4.0–6.0 oral diameters in length; oral aperture with 22–26 sharp, triangular, erect teeth. Length 176–255 $\mu$ .

The type locality is the Strait of Georgia, British Columbia. Occurs also off the coast of California near San Francisco in the California Current.

Differs from *T. rugosus* in its thinner, hyaline wall and fewer teeth.

**Tintinnus rugosus** sp. nov.

Figure 644

Lorica subeylindrical anteriorly, subconical ( $2^{\circ}$ - $5^{\circ}$ ) in the posterior 0.5, its length 4.6 oral diameters; oral margin with 44 triangular, sharply pointed erect teeth; aboral margin entire, very slightly flaring, surface of the lorica with many short, irregular, longitudinal rugae. Length  $275\mu$ .

The type locality is Station 4675 in the Peruvian Current.

Differs from all other species except *T. tubiformis* in its rugose outer surface, in this character resembling *Salpingella ricta*; and from *T. tubiformis* in having teeth.

**Tintinnus stramentus** sp. nov.

Figure 635

Lorica a long, very slender, hyaline, inverted truncated cone of  $4^{\circ}$ - $6^{\circ}$ , its length 4.4-6.0 oral diameters; oral end with a low, definite brim. Length 115-174 $\mu$ .

The type locality is Station 4583 in the California Current. Occurs also in the Mexican Current, Panamic Area, and South Equatorial Drift of the Pacific.

Differs from *T. lusus-undae* in being more slender and more widely conical and in lack of suboral flare.

**Tintinnus tenue** sp. nov.

Figure 655

*Tintinnus lusus-undae*, *partim*, Zacharias, 1906, pp. 510-566, fig. 6 (see also *T. lusus-undae* and *T. turgescens*); Brandt, 1907, pp. 420-426, 444, 448, 470, 481 (see also *T. lusus-undae*, *T. tubulosus*, and *T. turgescens*); Pavillard, 1916, pp. 44-45, figs. 5a, b.

*Tintinnus lusus-undae* var. *c* Brandt, 1906, *partim*, p. 32, pl. 65, fig. 19 (for fig. 12 see *T. attenuatus*); 1907, pp. 416, 422-423, 470, 475.

*Tintinnus lusus-undae* var. *macilentus*, *partim*, Jørgensen, 1924, p. 11 (see also *T. attenuatus*, *T. macilentus*, *Daturella angusta*, and *D. emarginata*).

Lorica 4.3-6.1 oral diameters in length, with tapering shaft of  $2^{\circ}$ - $6^{\circ}$ ; oral end abruptly flaring into a horizontal brim; aboral end without flare. Length 179-238 $\mu$  (290 $\mu$ ).

The type locality is off Ralum (Dahl, 29-I-97).

Differs from *T. lusus-undae* in its more slender shaft and more gradual anterior flare of the shaft.



**Tintinnus tubiformis** sp. nov.

Fig. 654

Lorica stout, slightly conical ( $3.0^{\circ}$ – $3.5^{\circ}$ ), its length 4.4–6.2 oral diameters; flaring abruptly orally and aborally; wall heavy, with an irregular, rugose outer surface. Length 323–414 $\mu$ .

The type locality is Station 4723 in the South Equatorial Drift of the Pacific. Occurs also in the California and South Equatorial currents.

Differs from *T. rugosus* in lacking teeth and in having the marked suboral flare.

**Tintinnus tubulosus** Ostenfeld

Figure 651

*Vaginicola inquilina*, Dujardin, 1841, pp. 561–562, pl. 16 bis, fig. 5.

*Tintinnus lusus undae*, Daday, 1887a, pp. 159–208, pl. 1, fig. 1; 1887b, *partim*, pp. 527–528, 530, pl. 18, figs. 3, 14 (see also *T. lusus-undae* and *T. perminutus*); Brandt, *partim*, 1907, pp. 420–426, 444, 448, 470, 481 (see also *T. lusus-undae*, *T. tenue*, and *T. turgescens*).

Non *Tintinnus Lusus-undae* Entz, Sr., 1885b, p. 202, pl. 14, fig. 12 (see *T. lusus-undae*).

*Tintinnus tubulosus* Ostenfeld, 1899b, p. 439, fig. 2f; Brandt, 1907, pp. 417, 421–422, 470, 475, 481.

*Tintinnus lusus-undae* var. *a tubulosa*, Brandt, 1906, p. 32, pl. 65, fig. 14; 1907, pp. 43, 416, 417, 419, 421–422, 448, 470, 475, 481.

*Tintinnus lusus-undae* var. *tubulosus*, Jörgensen, 1924, pp. 10, 106, fig. 2.

*Tintinnus lusus-undae* var. *tubulosa*, Jörgensen, 1927, p. 9, fig. 9.

*Tintinnus inquilinus*, *partim*, Claparède and Lachmann, 1858, pp. 196–198 (for pl. 8, fig. 2 see *T. apertus*); Mereschkowsky, 1878, pp. 20–21; 1879, pp. 216, 245 (for 1878, pl. 1, fig. 12 and 1879, pl. 10, fig. 12 see *Tdm. inquilinum*, see also *Tdm. fluviatile*, *T. apertus*, and *Parafavella rotundata*); Daday, 1887b, pp. 528–531 (for pl. 18, figs. 2, 10–13 see *T. apertus*, see also *Tdm. fluviatile*, *Tdm. inquilinum*, *Parafavella rotundata*, and *Rhabdonella elegans*); Brandt, 1907, pp. 378, 468, 471 (see *T. apertus*, *Tdm. fluviatile*, *Tdm. inquilinum*, and *Parafavella rotundata*); Schweyer, 1909, pp. 135–187, pl. 10, figs. 5a, b (for figs. 6–8 see *T. apertus*); Jörgensen, 1924, p. 12 (for figs. 7a, b see *T. apertus*, see also *Tdm. fluviatile* and *Tdm. inquilinum*).

*Tintinnus tubulatus*, Entz, Jr., 1909b, p. 194.

In its early history this species has been entangled with *Tintinnidium inquilinum* and Fauré-Fremiet (1908) in his clarification of that species complex does not include *T. tubulosus* in his review. The first published figures referable on the basis of structure and dimensions to *T. tubulosus* are those of Dujardin (1841, pl. 16 bis, fig. 5) who figures two loricae which are conical-tubular with open(?) aboral end, lack the oral flare of *T. lusus-undae* and also the aboral contrac-

tion of *Tdm. inquilinum*. Their length ( $100\mu$ ) approximates that of *T. tubulosus* ( $120-150\mu$ , Ostenfeld, 1899;  $94-150\mu$ , Jörgensen, 1924). One possible objection to the assignment of Dujardin's specimens to *Tintinnus tubulosus* is the fact that he reports them as found on algae, a feature not as yet reported for *T. tubulosus* but often seen in *T. apertus* (on diatoms) and several other species. In view of this habit of attachment in some species of the genus it might be expected occasionally in this closely related species.

Brandt (1906), Schweyer (1909), and Jörgensen (1924) have published the only other figures of this species and these are in agreement with those of Dujardin. Jörgensen (1924) assigns Brandt's (1906, pl. 65, fig. 14) specimen to *Tintinnus inquilinus*. We dissent from this because Brandt's figure lacks the distinct aboral contraction of *T. inquilinus*. It has the length ( $105\mu$ ) of *T. tubulosus*, not that of *T. lusus-undae* ( $170-220\mu$ , *fide* Brandt, 1907), although Brandt draws its oral region with a slight flare. Jörgensen's figure agrees closely with Dujardin's.

See also *Tintinnidium inquilinum* for a discussion of the synonymy of this species.

### **Tintinnus tubus** Stokes

Figure 646

*Tintinnus tubus* Stokes, 1893, p. 300, pl. 5, fig. 5.

A rare brackish-water species from Coney Island, N. Y.

### **Tintinnus turgescens** sp. nov.

Figure 650

*Tintinnus lusus-undae*, *partim*, Zacharias, 1906, pp. 510-566 (for fig. 6 see *T. tenue*, see also *T. lusus-undae*); Brandt, 1907, pp. 420-426, 444, 448, 470, 481 (see also *T. lusus-undae*, *T. tenue*, and *T. tubulosus*).

*Tintinnus lusus-undae* var. b Brandt, 1907, pp. 416, 422, 470, 475; Laackmann, 1909, pp. 480, 482-483.

Lorica 3.2-4.4 oral diameters in length, with subconical shaft of  $5^{\circ}-8^{\circ}$  with gradual submedian bulge; oral end gradually flaring  $20^{\circ}-35^{\circ}$  to a slightly emergent brim; no aboral flare. Length  $155-193\mu$ .

The type locality is Station 4713 in the Galapagos Eddy of the Pacific. Occurs also in the California, Mexican, and Peruvian currents and in the Sargasso Sea, Brazilian Current, off New Zealand, and off Sunday Island.

Differs from *T. lusus-undae* in the median expansion of the shaft.

**Tintinnus turris** sp. nov.

Figure 642

Lorica 5.5 oral diameters in length, oral end slightly flaring as a very low segment of an inverted, truncated, and outwardly concave funnel of  $29^\circ$ ; oral rim with 24 sharp, outwardly projecting teeth, each tooth about 0.2 of the oral diameter in length; shaft smooth, a tapering truncated cone of  $3^\circ$ ; aboral end entire, but everted, brimless, and toothless. Length  $122\mu$ .

The type locality is Nome Bay, Alaska.

Differs from *T. pectinis* in having more teeth and having aboral flare and from *T. rugosus* in fewer teeth, smooth wall, and proportions.

**Daturella** gen. nov.

*Tintinnus, partim*, Brandt, 1907, pp. 374-388 (see also *Amphorella*, *Brandtiella*, *Dadayiella*, *Helicostomella*, *Metacylis*, *Ormosella*, *Salpingacantha*, and *Tintinnus*); Jørgensen, 1924, pp. 9-13 (see also *Tintinnus*).

Tintinnineae with lorica an elongated cone of 3.58-8.60 oral diameters open at both ends; with longitudinal, ribbon-like fins or with striae; wall very soft and delicate with more or less distinct alveolar structure.

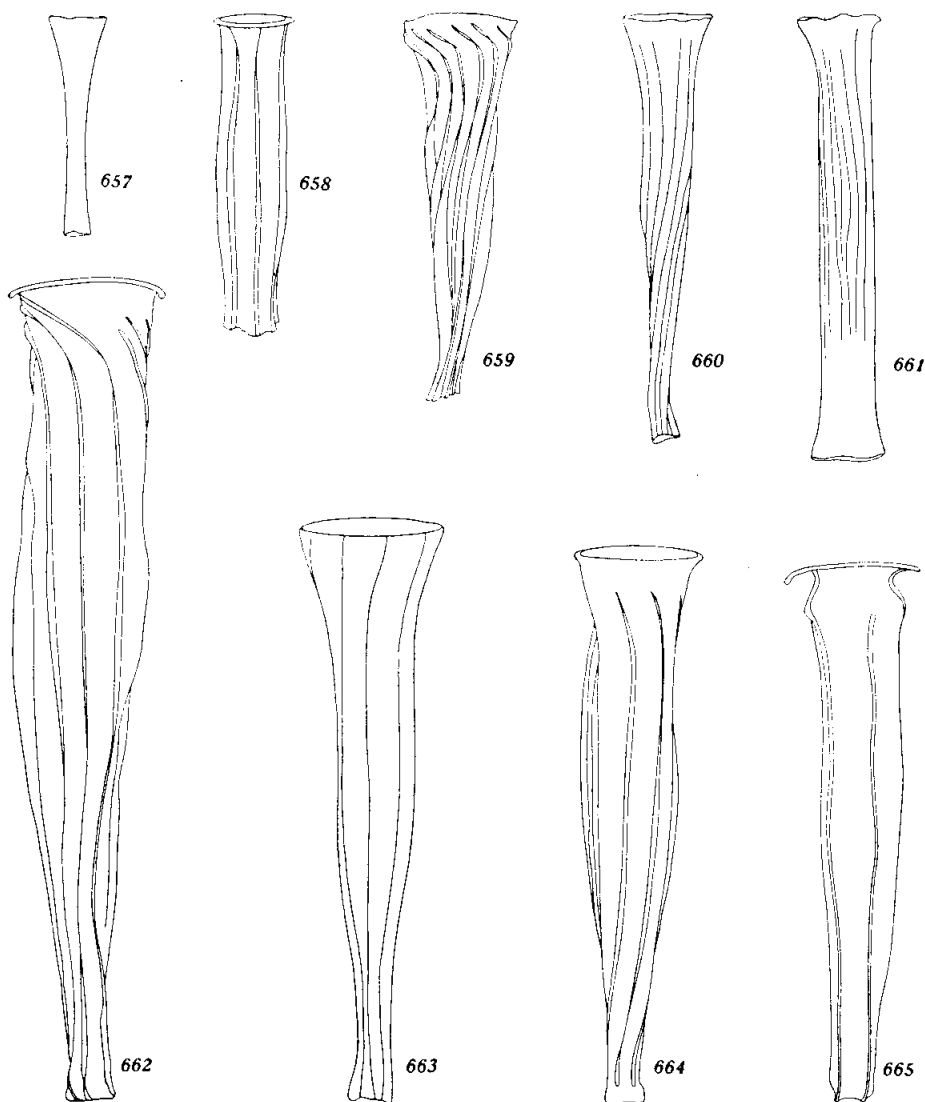
We designate as the type species *Daturella datura* (Brandt) emended from the Tropical Atlantic, Mediterranean, and Western Tropical Pacific, the oldest species included in the genus.

Differs from all other Tintinnineae in the flaccidity of the lorica and the full length, in the main, of the longitudinal striae; from *Salpingella* and *Salpingacantha* in lack of oral funnel, less aboral taper, and absence of the aboral cylinder; and from *Epicranella* in the absence of suboral arches.

Includes 9 species as follows:

angusta sp. nov.  
datura (Bdt.)  
emarginata (Bdt.)  
gaussi sp. nov.  
magna sp. nov.

ora sp. nov.  
recta sp. nov.  
stramonium sp. nov.  
striata sp. nov.



Figs. 657-665. Species of *Daturella* gen. nov.  $\times 200$ .

Fig. 657. *D. angusta* sp. nov. after Brandt (1906, pl. 65, fig. 15) from Station Pl. 36 of the Plankton Expedition in the Sargasso Sea.

Fig. 658. *D. recta* sp. nov. from Station 4717 in the South Equatorial Drift of the Pacific.

Fig. 659. *D. datura* (Bdt.) after Brandt (1906, pl. 66, fig. 1) from Station Pl. 69 of the Plankton Expedition in the Guinea Current.

Fig. 660. *D. striata* sp. nov. from Station 4571 in the California Current.

Fig. 661. *D. emarginata* (Bdt.) after Brandt (1906, pl. 65, fig. 21) from Station Pl. 69 of the Plankton Expedition in the Guinea Current.

Fig. 662. *D. magna* sp. nov. from Station 4571 in the California Current.

Fig. 663. *D. gaussi* sp. nov. after Laackmann (1909, pl. 50, fig. 4) from the margin of the Guinea Current.

Fig. 664. *D. stramonium* sp. nov. from Station 4587 in the Mexican Current.

Fig. 665. *D. ora* sp. nov. from Station 4724 in the South Equatorial Drift of the Atlantic.

**Daturella angusta** sp. nov.

Figure 657

*Tintinnus emarginatus* var. a Brandt, 1907, pp. 426, 465.*Tintinnus emarginatus* var. b Brandt, 1906, p. 32, pl. 65, fig. 15; 1907, pp. 426, 465.*Tintinnus lusus-undae* var. *macilentus*, partim, Jörgensen, 1924, p. 11 (see also *Tintinnus attenuatus*, *T. macilentus*, *T. tenue*, and *D. emarginata*).

Lorica very elongate spool-shaped, 3.75 oral diameters in length; oral rim irregularly undulating, contracting below the middle to 0.35 oral diameter, anteriorly an inverted cone ( $40^\circ$ ), posteriorly sub-conical ( $14^\circ$ ); aboral end truncate, somewhat irregularly expanded. Length 150–270 $\mu$ .

The type locality is Station Pl. 36 of the Plankton Expedition in the Sargasso Sea. Occurs also in the Labrador, Florida, North and South Equatorial currents, and off Messina.

Differs from *D. emarginata* in narrower lorica, less aboral differentiation, and lack of distinct striae.

**Daturella datura** (Brandt) emended

Figure 659

*Tintinnus datura* Brandt, 1906, pp. 10, 32, pl. 65, figs. 22, 23, pl. 66, fig. 1; 1907, pp. 461, 481.*Tintinnus tubiflora* Brandt, 1907, pp. 26, 32, 40, 43, 376, 377, 417–420, 427, 461, 481.**Daturella emarginata** (Brandt)

Figure 661

*Tintinnus emarginatus* Brandt, 1906, p. 32, pl. 65, figs. 12a, 21; 1907, pp. 425, 426, 465; Entz, Jr., 1908, pp. 10–138, pl. 6, fig. 8, pl. 13, fig. 24; 1909b, pp. 95–215, pl. 13, fig. 8, pl. 20, fig. 24.*Tintinnus lusus-undae* var. *macilentus*, partim, Jörgensen, 1924, p. 11 (see also *T. attenuatus*, *T. macilentus*, *T. tenue*, and *D. angusta*).**Daturella gaussi** sp. nov.

Figure 663

*Tintinnus datura*, Laackmann, 1909, p. 484, pl. 48, figs. 10, 11, pl. 50, fig. 4; non Brandt, 1906, pp. 10, 32, pl. 65, figs. 22, 23, pl. 66, fig. 1 (see *D. datura*).

Lorica trumpet-shaped, 3.75 oral diameters in length; oral region flaring  $20^\circ$  from vertical within 0.5 oral diameter of the oral opening; contracting to 0.5 oral diameter at 1 oral diameter below the rim and

to 0.25 oral diameter at 0.25 oral diameter above the aboral ring with slight postmedian bulge; aboral rim irregular and asymmetrically oblique; wall with about 8 subvertical, equally spaced striae, with slight dextrotropic curvature below the oral rim. Length  $400\mu$ .

The type locality is the margin of the Guinea Current.

Differs from *D. datura* in fewer striae and in their dextrotropic rather than leiotropic deflection.

***Daturella magna* sp. nov.**

Figure 662

Lorica elongated, somewhat trumpet-shaped, 5.2 oral diameters in length; bulging midway; with 10 (11) fins, strongly leiotropic anteriorly; wall thick. Length  $540\mu$ .

The type location is Station 4571 in the California Current.

Differs from *D. recta* in having 10 fins, and in lacking an oral brim.

***Daturella ora* sp. nov.**

Figure 665

Lorica elongated, slightly subconical, 4.0 oral diameters at the brim in length; oral brim everted, slightly recurved; suboral constriction marked; fins 4, subvertical, decurrent below the suboral constriction; aboral end abruptly contracted. Length  $310\mu$ .

The type locality is Station 4724 in the South Equatorial Drift of the Pacific.

Differs from other species in having only four fins.

***Daturella recta* sp. nov.**

Figure 658

Lorica elongated, tubular, only slightly subconical, 3.7 oral diameters in length; oral margin with a definite horizontal brim, slight flare below; no bowl-like expansion below; median bulge 0.75 oral diameter; fins 7, vertical, equidistant, low, continued to the brim. Length  $215\mu$ .

The type locality is Station 4717 in the South Equatorial Drift of the Pacific.

Differs from *D. ora* in having 7 fins.

**Daturella stramonium** sp. nov.

Figure 664

Lorica elongated, subconical, 4.3–5.9 oral diameters in length; oral margin with a narrow brim; shaft with suboral bowl-like convexity and elongated bulge posterior to the upper 0.35 of the total length, prolonged uniform taper below; with a slight short aboral enlargement. Length 369–470 $\mu$ .

The type locality is Station 4587 in the Mexican Current. Occurs also in the Peruvian and South Equatorial currents, Panamic Area, in the Easter Island and Galapagos eddies, and in the South Equatorial Drift.

Differs from other species in proportions and from *D. gaussi* in having high fins instead of striae.

**Daturella striata** sp. nov.

Figure 660

Lorica 3.70–5.67 oral diameters in length; aboral diameter 0.4–0.9 oral diameter; shaft with 12–16 striae at the aboral margin, extending 0.95–0.98 total length, vertical or leiotropic; aboral margin slightly crenulate or entire; wall very delicate. Length 190–280 $\mu$ .

The type locality is Station 4571 in the California Current. Occurs also in the Mexican Current and the South Equatorial Drift.

Differs from *D. emarginata* in proportions and size and from the other species in having striae instead of fins.

**Salpingella** Jörgensen emended

*Tintinnus*, Claparède and Lachmann, *partim*, 1858, pp. 195–196 (see also *Acanthostomella*, *Amphorella*, *Bursaopsis*, *Codonella*, *Coziella*, *Favella*, *Parundella*, *Proplectella*, *Ptychocytilis*, *Steenstrupiella*, *Stenoscmella*, *Tintinnidium*, *Tintinnopsis*, and *Tintinnus*); Brandt, 1896, p. 50; Laackmann, 1909, p. 479.

*Amphorella*, Entz, Jr., 1908, p. 32.

*Salpingella*, *partim*, Jörgensen, 1924, pp. 7–8, 13–15 (see also *Salpingacantha*).

Tintinnineae with lorica usually elongated, nail-, brad- or trumpet-shaped; always with an entire, circular or polygonal oral margin; collar usually a funnel, sometimes merging gradually in the shaft; shaft tapering throughout, or anteriorly cylindrical and posteriorly a cone with or without an aboral cylinder; always open posteriorly, with 4–9 fins.

We designate as the type species *Salpingella acuminata* (Claparède and Lachmann) Jörg. emended from the coast of Norway, the oldest species included in the genus.

Differs from *Tintinnus* in having the aboral end contracted, usually to a small terminal cylinder and in having aboral striae; from *Salpingacantha* in the absence of teeth in the oral margin; from *Daturella* in the rigidity of the lorica and greater aboral taper and contraction; and from *Epicranelia* in the absence of suboral arches.

Includes two subgenera, *Salpingella* subgen. nov. and *Rhabdosella* subgen. nov.

RHABDOSELLA subgen. nov.

*Salpingella* with faceted lorica without differentiated fins and never with external suboral ridges.

The type species is *Salpingella octogenata* sp. nov. from Station 4730 in the South Equatorial Drift of the Pacific.

Differs from the subgenus *Salpingella* in the presence of facets.

Includes two species, *S. cuneolata* sp. nov. and *S. octogenata* sp. nov.

• ***Salpingella cuneolata* sp. nov.**

Figure 667

Lorica a slender trumpet, 4.6–7.1 oral diameters in length; collar with 18–20 facets about 0.15 of the total length in length, flaring 32°–38°; bowl subcylindrical in the anterior 0.6, with 18–20 facets in the upper portion and tapering posteriorly; with 6 fins 0.4 total length in length; aboral end with faintly differentiated terminal cylinder. Length 163–266 $\mu$ .

The type locality is Station 4617 in the Panamic Area. Occurs also in the Mexican Current, Easter Island Eddy, and the South Equatorial Drift.

Differs from *S. octogenata* in having 18–20 facets.

***Salpingella octogenata* sp. nov.**

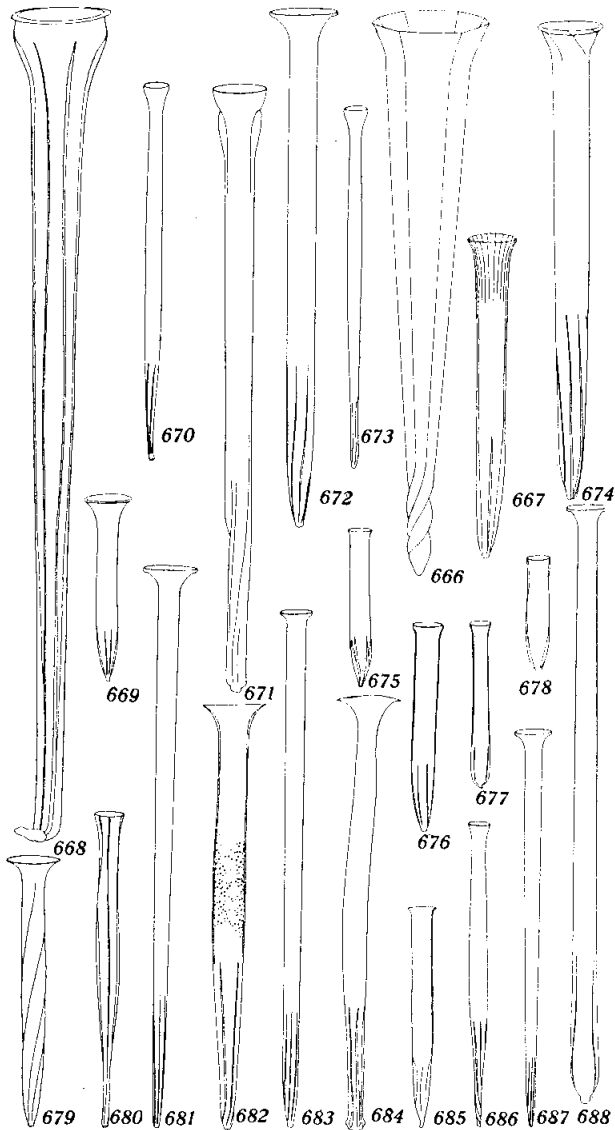
Figure 666

Lorica a wide trumpet, 4.48 oral diameters in length; collar flaring 50°, octagonal in cross-section; bowl an inverted pyramid of 10°, octagonal in cross-sections; with 8 longitudinal angles, vertical anteriorly and dextrotropic posteriorly; antapical region slightly swollen. Length 310 $\mu$ .

The type locality is Station 4730 in the South Equatorial Drift.

Differs from *S. cuneolata* in having 8 ridges.





Figs. 666–688. Species of *Salpingella* Jörgensen emended.  $\times 200$ .

Figs. 666–667. Subgenus *Rhabdosella* subgen. nov.

Fig. 666. *S. octogenata* sp. nov. from Station 4730 in the South Equatorial Drift.

Fig. 667. *S. cuncolata* sp. nov. from Station 4617 in the Panamic Area.

Figs. 668–688. Subgenus *Salpingella* subgen. nov.

Fig. 668. *S. regulata* (Bdt.) after Brandt (1906, pl. 68, fig. 6) from Station N 168 of the Plankton Expedition in the Guinea Current.

Fig. 669. *S. minutissima* sp. nov. from Station 4571 in the California Current.

Fig. 670. *S. laeckmanni* nom. nov. after Laeckmann (1909, pl. 50, fig. 8) from "Gauss" Station off Kaiser Wilhelm II Land in the Antarctic.

## SALPINGELLA subgen. nov.

*Salpingella* with lorica with a circular cross-section, with or without suboral ridges but no longitudinal facets. The type species is *S. acuminata* (Clap. and Lach.) Jörg. emended.

Differs from *Rhabdosella* in absence of facets.

Includes 21 species as follows:

<i>acuminata</i> (Clap. and Lach.) Jörg.	<i>gracilis</i> sp. nov.
<i>acuminatoides</i> (Laack.)	<i>jugosa</i> sp. nov.
<i>alata</i> sp. nov.	<i>laackmanni</i> ncm. nov.
<i>altiplicata</i> Merkle	<i>lineata</i> (Entz, Sr.)
<i>attenuata</i> Jörg.	<i>minutissima</i> sp. nov.
<i>costata</i> (Laack.)	<i>regulata</i> (Bdt.)
<i>curta</i> sp. nov.	<i>rieta</i> sp. nov.
<i>decurtata</i> Jörg.	<i>rotundata</i> sp. nov.
<i>expansa</i> sp. nov.	<i>secata</i> (Bdt.)
<i>faurei</i> sp. nov.	<i>subconica</i> sp. nov.
<i>glockentögeri</i> (Bdt.) Jörg.	

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Figs. 668-688. Subgenus *Salpingella* subgen. nov. (Concluded.)

Fig. 671. *S. expansa* sp. nov. from Station 4699 in the Easter Island Eddy.

Fig. 672. *S. rieta* sp. nov. from Station 4707 in the South Equatorial Drift of the Pacific.

Fig. 673. *S. acuminatoides* (Laack.) after Laackmann (1909, pl. 50, fig. 6) from off St. Helena in the South Atlantic Drift.

Fig. 674. *S. jugosa* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 675. *S. curta* sp. nov. from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 676. *S. subconica* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 677. *S. rotundata* sp. nov. from Station 4730 in the South Equatorial Drift of the Pacific.

Fig. 678. *S. lineata* (Entz, Sr.) from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 679. *S. altiplicata* (Merkle) after Merkle (1909, pl. 2, fig. 12) from the North Sea in the Gulf Stream off Norway.

Fig. 680. *S. costata* (Laack.) after Laackmann (1909, pl. 50, fig. 10) from "Gauss" Station Kaiser Wilhelm II Land in the Antarctic.

Fig. 681. *S. gracilis* sp. nov. from Station 4707 in the South Equatorial Drift of the Pacific.

Fig. 682. *S. acuminata* (Clap. and Lach.) Jörg. emended after Brandt (1906, pl. 67, fig. 1) from Station "Dahl 18-II-97" off Ralun in the Western Tropical Pacific.

Fig. 683. *S. secata* (Bdt.) from Station 4590 in the Mexican Current.

Fig. 684. *S. alata* sp. nov. after Branät (1906, pl. 67, fig. 14) from Station N 42 of the Plankton Expedition in the margins of the Labrador and Florida currents.

Fig. 685. *S. decurtata* Jörg. after Jörgensen (1924, p. 15, fig. 10) from Station 10 of the "Thor" off the Gulf of Taranto in the Eastern Mediterranean.

Fig. 686. *S. faurei* sp. nov. from Station 4571 in the California Current.

Fig. 687. *S. attenuata* Jörg. from Station 4571 in the California Current off San Diego.

Fig. 688. *S. glockentögeri* (Bdt.) Jörg. from Station 4638 in the southern end of the Panamic Area.

**Salpingella acuminata** (Claparède and Lachmann) Jörgensen  
emended

Figure 682

*Tintinnus acuminatus* Claparède and Lachmann, 1858, p. 199, pl. 8, fig. 4; Kent, 1882, p. 606, pl. 31, fig. 14; Daday, 1887*a*, pp. 170, 171, pl. 1, fig. 2; 1887*b*, *partim*, pp. 480, 481, 514, 526, 532 (for pl. 18, fig. 6 see *S. glockentögeri*); Hensen, 1887, pp. 68-70, 93, 95, pl. 14, fig. 22; Möbius, 1887, p. 120, pl. 8, fig. 37; Brandt, 1906, p. 32, pl. 66, figs. 2-4, pl. 67, figs. 1, 9; 1907, pp. 376, 378-382, 392, 415, 430, 444, 445, 446, 447, 451, 466, 472, 478, 479; Jörgensen, 1899, pp. 7, 8, 10, 42, 43, 44, 95, pl. 1, fig. 1; Okamura, 1907, pp. 140, 151, pl. 6, fig. 68; Entz, Jr., 1908, pp. 104-127, pl. 5, fig. 3; 1909*b*, pp. 121-216, pl. 12, fig. 3; Meunier, *partim*, 1910, pp. 133, 134, pl. 10, figs. 16-17 [18 abnormal?], (for fig. 19 see *Salpingacantha undata*); Lühe, 1913, p. 176, fig. 168, no. 5; Wailes, 1925, p. 537, pl. 2, figs. 27, 28.

*Tintinnus secatus*, *partim*, Jörgensen, 1924, p. 13 (see *S. scoata*).

*Tintinnus Möbii* Brandt, 1896, p. 50.

*Amphorella acuminata*, Entz, Jr., 1908, p. 32.

*Tintinnus acuminatoides*, *partim*, Jörgensen, 1924, p. 13 (see *S. acuminatoides*).

*Salpingella acuminata*, Jörgensen, 1924, pp. 12, 13, 15; 1927, pp. 9, 10, fig. 11.

**Salpingella acuminatoides** (Laaekmann)

Figure 673

*Tintinnus acuminatoides* Laaekmann, 1909, p. 480, pl. 50, fig. 6; Jörgensen, *partim*, 1924, p. 13 (see *S. acuminata*).

**Salpingella alata** sp. nov.

Figure 684

*Tintinnus acuminatus* var. b Brandt, 1906, p. 32, pl. 67, figs. 14, 14*a*; 1907, pp. 390, 452.

Lorica 7 oral diameters in length; collar funnel-shaped, a low inverted cone ( $82^\circ$ ), outwardly concave; bowl cylindrical, with 6 posterior fins 0.33 total length in length, each with posteriorly located triangular ( $135^\circ$ ) wing; aboral end without terminal cylinder. Length  $290\mu$ .

The type locality is Station N. 42 of the Plankton Expedition in the margins of the Labrador and Florida currents.

Differs from all other species in the distal angular wings on the fins.

**Salpingella altiplicata** (Merkle)

Figure 679

*Tintinnus acuminatus* var. *altiplicatus* Merkle, 1909, p. 163, pl. 2, fig. 12.

Raised to status of species.

Lorica moderately stout trumpet-shaped, 4.8 oral diameters in length; collar funnel-like, a wide inverted cone ( $90^\circ$ ) outwardly concave; bowl elongated, cylindrical in anterior 0.75 total length, conical ( $10^\circ$ ) posteriorly; aboral end with a terminal cylinder; with 8 much elevated, dextrotropic fins extending as far as the oral funnel. Length 150–160 $\mu$ .

The type locality is the North Sea off Norway.

Differs from *S. costata* in the broader funnel, fewer fins, and in having a terminal cylinder.**Salpingella attenuata** Jörgensen

Figure 687

*Tintinnus acuminatus*, Entz, Sr., 1885b, p. 201, pl. 14, fig. 13.*Tintinnus acuminatus* var. *c. glockentögeri*, partim, Brandt, 1906, p. 32, pl. 68, figs. 2–4; 1907, pp. 390–391, 452 (for pl. 68, figs. 1, 5, 5a see *S. glockentögeri*).*Salpingella acuminata* subsp. *glockentögeri* var. *attenuata* Jörgensen, 1924, p. 14, fig. 9.

Raised to status of species.

Lorica very much elongated, its length 8.86–10.00 oral diameters; collar a funnel of  $55^\circ$ – $60^\circ$ , 0.6 oral diameter in length; bowl cylindrical in the anterior 0.76–0.86 total length, posteriorly a cone ( $6^\circ$ – $10^\circ$ ) with unevenly contracting sides; no aboral cylinder; fins 5–7, low blades, 0.18–0.36 total length in length, usually subvertical or dextrotropic ( $5^\circ$ ). Length 248–313 $\mu$ .

The type locality is the Bay of Naples. Occurs also off Ralum in the Western Tropical Pacific and widespread in the Eastern Tropical Pacific.

Differs from *S. faurei* in lack of expanded bowl, larger size, and fewer fins.**Salpingella costata** (Laackmann)

Figure 680

*Tintinnus costatus* Laackmann 1909, p. 414, pl. 50, figs. 9, 10.

**Salpingella curta** sp. nov.

Figure 675

*Tintinnus steenstrupii*, Lohmann, 1911, p. 39, pl. 1, fig. 5, pl. 5, fig. 14.

Lorica small, like a stout test-tube, 5.6–7.7 oral diameters in length; collar a very low funnel of  $47^\circ$ ; shaft cylindrical in the anterior 0.65 of the total length, posteriorly a short, truncated, slightly convex cone of  $33^\circ$ ; with a low aboral cylinder; 6–7 blade-like fins, 0.35 total length in length. Length 79–93 $\mu$ .

The type locality is the Baltic Sea off Kiel. Occurs also in the Galapagos Eddy and the South Equatorial Drift.

Differs from *S. rotundata* in having a longer posterior cone, blade-like fins, and in range of proportions.

**Salpingella decurtata** Jörgensen

Figure 685

*Salpingella decurtata* Jörgensen, 1924, p. 15, fig. 10.**Salpingella expansa** sp. nov.

Figure 671

Lorica moderately stout, its length 11.6 oral diameters; collar a bowl-like funnel of  $45^\circ$ ; without a brim; with longitudinal suboral fins twice the length of the collar; shaft subcylindrical, stout, somewhat inflated just above the short, wide aboral cylinder; fins 6–7, 0.43 total length in length. Length 346 $\mu$ .

The type locality is Station 4699 in the Easter Island Eddy.

Differs from *S. regulata* in having the wing-like suboral fins not extending to the oral margin, in lacking a brim, and in length.

**Salpingella faurei** sp. nov.

Figure 686

Lorica elongated, narrow, brad-like, its length 7.6–12.5 oral diameters; collar low; shaft tubular in the anterior 0.64 total length, tapering posteriorly; with 7–9 very narrow fins, 0.36 of the total length in length. Length 130–205 $\mu$ .

The type locality is Station 4571 in the California Current. Occurs also in the Mexican Current, Panamic Area, Easter Island Eddy, and South Equatorial Drift.

Differs from *Salpingacantha exilis* in having an entire oral margin.

**Salpingella glockentögeri** (Brandt) Jörgensen

Figure 688

*Tintinnus acuminatus*, *partim*, Daday, 1887*b*, p. 532, pl. 18, fig. 6 (see also *S. acuminata*).

*Tintinnus acuminatus* var. *c. glockentögeri*, *partim*, Brandt, 1906, p. 32, pl. 67, figs. 7, 8, pl. 68, figs. 1, 5, 5*a*; 1907, pp. 390, 466 (for pl. 68, figs. 2-4 see *S. attenuata*).

*Tintinnus glockentögeri*, Laackmann, 1909, p. 480.

*Salpingella acuminata* subsp. *glockentögeri*, Jörgensen, 1924, p. 14, fig. 8.

**Salpingella gracilis** sp. nov.

Figure 681

Lorica very slender, elongated, and delicate, 9.8-13.3 oral diameters in length; collar a low, very widely flaring funnel of 98°-110°, with recurved margin; shaft narrow, tapering; with 7-9 low aboral fins, 0.36-0.44 total length in length. Length 320-434 $\mu$ .

The type locality is Station 4707 in the South Equatorial Drift.

Differs from *S. glockentögeri* in its widely flaring collar, narrow shaft, and 7-9 fins.

**Salpingella jugosa** sp. nov.

Figure 674

Lorica moderately stout, its length 7.0-14.2 oral diameters; collar very distinctly bowl-shaped with a brim, 53°, its surface with 6-7 leucopropic ridges; shaft subcylindrical in the anterior 0.67, more tapering posteriorly; without an aboral cylinder; with 6-7 fins 0.4 total length in length. Length 312-396 $\mu$ .

The type locality is Station 4724 in the South Equatorial Drift of the Pacific. Occurs also in the Panamic Area and the Easter Island Eddy.

Differs from *S. acuminata* in having suboral ridges.

**Salpingella laackmanni** nom. nov.

Figure 670

*Tintinnus acuminatoides* var. *secata* Laackmann, 1909, p. 409, pl. 50, figs. 7, 8. Non *Tintinnus secatus* Brandt, 1896, p. 69, pl. 3, fig. 12 (see *S. secata*).

Lorica small, slender, 15.4 oral diameters in length; collar inflated, convex bowl-like; bowl swollen slightly below the middle; fins 0.2 oral diameter long, four in number; aboral cylinder present. Length 230-250 $\mu$ .

The type locality is "Gauss" Station in the Antarctic off Kaiser Wilhelm II Land.

Differs from *S. acuminatoides* in having a well developed aboral cylinder.

**Salpingella lineata** (Entz, Sr.)

Figure 678

*Tintinnus inquilinus* var. *lineatus* Entz, Sr., 1884, p. 411, pl. 24, fig. 21.

*Tintinnus lineatus*, Möbius, 1887, p. 120; Brandt, 1907, p. 469.

**Salpingella minutissima** sp. nov.

Figure 669

Lorica depauperate, its length 3.3 oral diameters; with a widely flaring ( $90^\circ$ ) everted brim and thickened collar; bowl tapering in the posterior 0.37 total length in length; with 6 fins. Length  $112\mu$ .

The type locality is Station 4571 in the California Current.

Differs from *S. decurtata* in smaller size and in its wider collar.

**Salpingella regulata** (Brandt)

Figure 668

*Tintinnus regulatus* Brandt, 1906, pp. 32, 37, pl. 67, fig. 13, pl. 68, fig. 6; 1907, pp. 392, 477.

**Salpingella ricta** sp. nov.

Figure 672

Lorica trumpet-shaped, its length 6.2–8.0 oral diameters; collar very widely flaring,  $75^\circ$ – $90^\circ$ ; bowl narrow, tapering throughout; with 7 fins; with short, longitudinal linear striations on the surface; aboral end with an aboral cylinder. Length 338–400 $\mu$ .

The type locality is Station 4707 in the South Equatorial Drift. Occurs also in the Panamic Area and the Galapagos Eddy.

Differs from other species in having the surface rugose (omitted in fig. 672).

**Salpingella rotundata** sp. nov.

Figure 677

Lorica small, test-tube-like, inflated posteriorly, 7.0–8.8 oral diameters in length; bowl cylindrical; with 6–7 low, ridge-like fins on the posterior 0.29–0.34 of the total length; aboral cylinder present. Length 92–160 $\mu$ .

The type locality is Station 4730 in the South Equatorial Drift of the Pacific.

Differs from *S. curta* in proportions and heavier fins.

**Salpingella secata** (Brandt)

Figure 683

*Tintinnus secatus* Brandt, 1896, p. 69, pl. 3, fig. 12; Vanhöffen, 1887, p. 271, pl. 5, fig. 27; Jörgensen, *partim*, 1924, p. 13 (see *S. acuminata*).

*Tintinnus acuminatus* var. *a secata*, Brandt, 1906, p. 32, pl. 66, fig. 5; 1907, pp. 389, 452, 478.

**Salpingella subconica** sp. nov.

Figure 676

Lorica stout, brad-shaped, 5.4–8.8 oral diameters in length; collar a steep funnel; shaft cylindrical in the anterior 0.66–0.75, posteriorly a truncated cone of 15°–17°; 7 (8) fins, 0.33–0.40 total length in length. Length 105–220 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. Occurs also in the Mexican and Peruvian currents, the Panamic Area, and the South Equatorial Drift.

Differs from *Salpingacantha crenulata* in having an entire oral margin.

**Salpingacantha** gen. nov.

*Tintinnus*, Jörgensen, 1899, pp. 6–8; Brandt, 1907, *partim*, pp. 374–388 (see also *Amphorella*, *Brandtiella*, *Dadayiella*, *Daturella*, *Helicostomella*, *Metacylis*, *Ormosella*, and *Tintinnus*).

*Salpingella*, *partim*, Jörgensen, 1924, pp. 7–8, 13–15 (see also *Salpingella*).

Tintinnineae with lorica elongated, attenuated posteriorly, generally a nail-shaped, posteriorly truncated, tapering tube; oral margin with blunt or sharp, triangular, flaring, erect or incurved teeth; collar usually funnel-like or formed only by the swollen base of the teeth; bowl elongated cylindrical or slightly tapering, usually uniform, sometimes swollen in the middle, posteriorly a narrow, truncated cone; with 5–8 decurrent, low, blade-like fins; antapex with or without a distinct terminal cylinder.

We designated as the type species *Salpingacantha undata* (Jörgensen) from the Norwegian fiords, figured first by Brandt (1906) from the Irminger Sea, the oldest species included in the genus.

Differs from all other Tintinnineae in the presence of teeth in the oral margin.

Includes 7 species as follows:

<i>ampla</i> sp. nov.	<i>simplex</i> nom. nov.
<i>crenulata</i> sp. nov.	<i>undata</i> (Jörg.)
<i>exilis</i> sp. nov.	<i>unguiculata</i> (Bdt.)
<i>perea</i> sp. nov.	



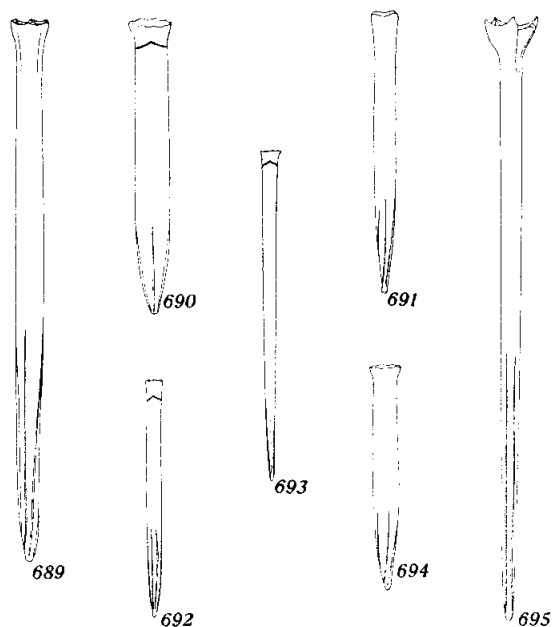
**Salpingacantha ampla** sp. nov.

Figure 689

Lorica stout, 10.7–13.2 oral diameters in length; oral brim with (7) 8 incurved teeth; collar a convex funnel of  $50^\circ$ , with 4 or 6 longitudinal plications; bowl with 5 fins, 0.4 total length; a short aboral cylinder present. Length 306–358 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift of the Pacific.

Differs from *S. undata* in having a shorter and stouter lorica.



Figs. 689–695. Species of *Salpingacantha* gen. nov.  $\times 200$ .

Fig. 689. *S. ampla* sp. nov. from Station 4709 in the South Equatorial Drift of the Pacific.

Fig. 690. *S. perca* sp. nov. from Station 4709 in the South Equatorial Drift.

Fig. 691. *S. simplex*, nom. nov. after Laackmann (1909, pl. 50, fig. 5) from Station 18-IX-03 of the German South Polar Expedition in the South Equatorial Current of the Atlantic.

Fig. 692. *S. unguiculata* (Bdt.) from Station 4724 in the South Equatorial Drift of the Pacific.

Fig. 693. *S. exilis* sp. nov. from Station 4648 in the Peruvian Current.

Fig. 694. *S. crenulata* sp. nov. from Station 4713 in the Galapagos Eddy.

Fig. 695. *S. undata* (Jörg.) from Station 4681 in the South Equatorial Drift on the margin of the Peruvian Current.

**Salpingacantha crenulata** sp. nov.

Figure 694

Lorica brad-shaped, 6.4–10.3 oral diameters in length; oral brim with 7–12 pointed teeth; collar a low, flaring funnel of  $37^{\circ}$ – $40^{\circ}$ ; bowl cylindrical in the anterior 0.65 of the total length, posteriorly a truncated inverted cone ( $18^{\circ}$ ); with (5) 7 fins, 0.35–0.40 total length in length; no aboral cylinder. Length 145–197 $\mu$ .

The type locality is Station 4713 in the Galapagos Eddy. Occurs also in the South Equatorial Drift.

Differs from *Salpingella subconica* in the crenulate collar, in having 7 fins, and in the lower collar.

**Salpingacantha exilis** sp. nov.

Figure 693

Lorica very slender, subcylindrical, 10.0–13.6 oral diameters in length; collar low, flaring  $35^{\circ}$ , with 12 outwardly flaring teeth; bowl a tapering tube in the anterior 0.18 total length and posteriorly a truncated cone of  $6^{\circ}$ – $7^{\circ}$ ; with 7 (8) fins, 0.2 total length in length; minute terminal cylinder present. Length 147–219 $\mu$ .

The type locality is Station 4648 in the Peruvian Current.

Differs from *Salpingella faurei* in having teeth on the collar and from other species of *Salpingacantha* in having more teeth.

**Salpingacantha perca** sp. nov.

Figure 690

Lorica small and stout, its length 6.9 oral diameters; oral brim with 10 sections formed by longitudinal folds; bowl with 5 fins, 0.3 total length in length; no terminal cylinder. Length 90 $\mu$ .

The type locality is Station 4709 in the South Equatorial Drift.

Differs from other species in having creases around the oral margin.

**Salpingacantha simplex** nom. nov.

Figure 691

*Tintinnus undatus*, Laackmann, 1909, p. 481, pl. 50, fig. 5.

Non *Tintinnus acuminatus* var. *undatus* Jørgensen, 1899, pp. 95, 110 (see *S. undata*).

Lorica stout, 11.4 oral diameters in length; collar scarcely flaring, without definite teeth, its margin undulating; bowl with 6–7 fins on the aboral third; aboral cylinder swollen. Length 192–205 $\mu$ .

The type locality is Station 18-IX-03 of the German South Polar Expedition in the South Equatorial Current of the Atlantic.

Differs from *S. undata* in reduction of teeth and collar and in stouter lorica.

**Salpingacantha undata** (Jørgensen)

Figure 695

*Tintinnus acuminatus* var. *undatus* Jørgensen, 1899, pp. 95, 110; Brandt, 1907, pp. 380, 383, 452, 482.

*Tintinnus undatus*, Brandt, 1906, p. 32, pl. 67, figs. 3, 4, 10; non Laackmann, 1909, p. 481, pl. 50, fig. 5 (see *S. simplex*).

*Salpingella acuminata* forma *undata*, Jørgensen, 1924, p. 14.

*Tintinnus acuminatus*, partim, Meunier, 1910, pp. 133, 134, pl. 10, fig. 19 (for figs. 16-18 see *Salpingella acuminata*).

**Salpingacantha unguiculata** (Brandt)

Figure 692

*Tintinnus undatus* var. *unguiculatus* Brandt, 1906, p. 32, pl. 67, figs. 2, 5, 6, 6a; 1907, p. 392.

*Tintinnus unguiculatus* Brandt, 1907, p. 381.

**Epicranella** gen. nov.

Tintinnineae with lorica faceted, with strong suboral differentiation of ridges in the form of arches.

The type species is *Epicranella prismatica* sp. nov. from the Peruvian Current.

Differs from *Salpingella* in the presence of suboral arches.

Includes two species, *E. bella* sp. nov. and *E. prismatica* sp. nov.

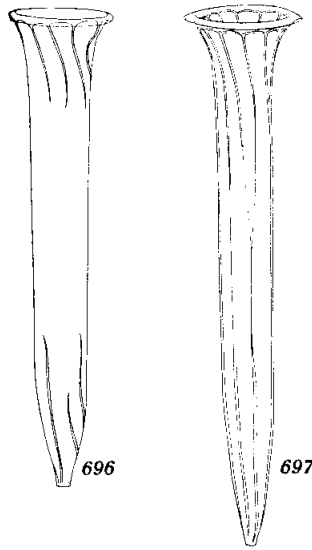
**Epicranella bella** sp. nov.

Figure 696

Lorica large and stout, its length 3.36 oral diameters; oral margin everted and recurved; collar flaring  $65^{\circ}$ - $68^{\circ}$ , its surface with 12 leiotropic ridges connecting above with suboral arches; bowl tubular without(?) facets in the anterior 0.66 and tapering in the posterior quarter; with 8 subvertical fins on the aboral 0.35 of the total length; wall with strongly developed secondary structure. Length  $235\mu$ .

The type locality is Station 4715 in the Galapagos Eddy.

Differs from *E. prismatica* in shorter lorica, suboral arching of the ridges, and absence of distinct facets on the bowl.



Figs. 696-697. Species of *Epicranella* gen. nov.  $\times 200$ .

Fig. 696. *E. bella* sp. nov. from Station 4715 in the Galapagos Eddy.

Fig. 697. *E. prismatica* sp. nov. from Station 4673 in the Peruvian Current.

***Epicranella prismatica* sp. nov.**

Figure 697

Lorica elongated trumpet-shaped, 4.21-4.52 oral diameters in length; oral rim everted and recurved; collar flaring  $70^\circ$ , with 12 leiotropic ridges terminating on the angles of the facets, on the anterior 0.28 of the lorica; bowl almost uniform in the anterior 0.66 of its length with 10 (decreasing to 8) longitudinal facets, tapering inverted pyramidal ( $15^\circ$ ) in the aboral third; aboral end with short terminal cylinder. Length 312-348 $\mu$ .

The type locality is Station 4673 in the Peruvian Current. Occurs also in the South Equatorial Drift and Current.

Differs from *E. bella* in greater length and in having distinct facets on the bowl.

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Citations such as 1907*c* entered in the absence of citations of 1907*a* and *b* signify that two other papers by the same author dealing with the Tintinnoinea were published in 1907, but are not used in this conspectus. All papers, etc., cited here, with two exceptions, have been examined by us.

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#### ERRATA

- Page 29. For *Leptrotintinnus*, read *Leprotintinnus*.  
 Pages 30, 199. For *Mereschowsky*, read *Mereschkowsky*.  
 Page 100. For *Schweyer*, read *Schweyer*.  
 Page 113. For *Stethocephalus*, read *Sethocephalus*.  
 Page 189. For *Cytarrocylis*, read *Cyttarocylis*.  
 Page 246. For *scyphus*, read *scyphium*.  
 Page 271. For *anularis*, read *anularius*.

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## SYSTEMATIC INDEX

In the following index all systematic names of families, subfamilies, genera, subgenera, species, subspecies, and forms are included. New names in these several categories are in bold face. In the case of all new species the genus or genera in which the new specific name is used are in bold face. Pages on which the description, synonymy, and figure occur are also in bold face.

Variations in spelling due to errors in accent of names of French or Hungarian origin, to variations in the use of "i" or "ii," to the capitalization of proper names, and to endings of specific names not in agreement with the gender of the generic name, are omitted in the index, the page citation of their use being combined with that of the specific or other name in the form used by us.

Misspelled names are indexed and indicated by the asterisk. All *nomina nuda* are indicated by the dagger. We have also marked by the dagger certain misspelled and misconceived names which differ considerably from the name from which they are variants.

Synonyms and homonyms are in italics. The name of the author using the name as a synonym or homonym follows the specific or generic name subject to such use. In case the user is also the authority for the name in question no comma is placed between the specific name and that of the authority. The presence of the comma indicates that the investigator's name following the italicized name is not that of its author.

Throughout the index we have followed the policy of citing in italics all names in all cases in which we have divided a species as published by an investigator. The division by us may be based on his figures, or on his text, but more often on his synonymic bibliography. In our synonymic bibliographies such citations are indicated by "*partim*" and our distribution of the species complex follows. In all such cases the name in question with the citation of the pertinent page appears in the index in both roman and italics.

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