



Title	THE TINTINNOINEA FROM THE SEA OF OKHOTSK AND ITS NEIGHBORHOOD (With 23 Figures)
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# THE TINTINNOINEA FROM THE SEA OF OKHOTSK AND ITS NEIGHBORHOOD<sup>1)</sup>

By

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(With 23 Figures)

## INTRODUCTION

Previous notes on this common group of the pelagic ciliata in Japanese waters have been reported by OKAMURA (1907) on the plankton from the warm water current, the so-called "Kuroshio," and by HADA (1932) on two neritic species found in northern waters of Japan. The present investigation is based on the plankton in the Sea of Okhotsk and neighboring waters of Kamchatka generally tributary to the cold currents.

The materials dealt with in this work were collected with a plankton tow net from the upper layer of the sea-water by myself in July, 1929 at two stations in Taraika Bay, and by the Steamer "Oshoro-Maru" of the Fishery College of the Hokkaido Imperial University during July-August, 1930 at seventeen stations distributed in the above mentioned regions.

The following 23 species are here reported, including 7 which are new.

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### Family Codonellidae

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<sup>1)</sup> Contribution No. 31 from the Zoological Institute, Faculty of Science, the Hokkaido Imperial University, Sapporo.

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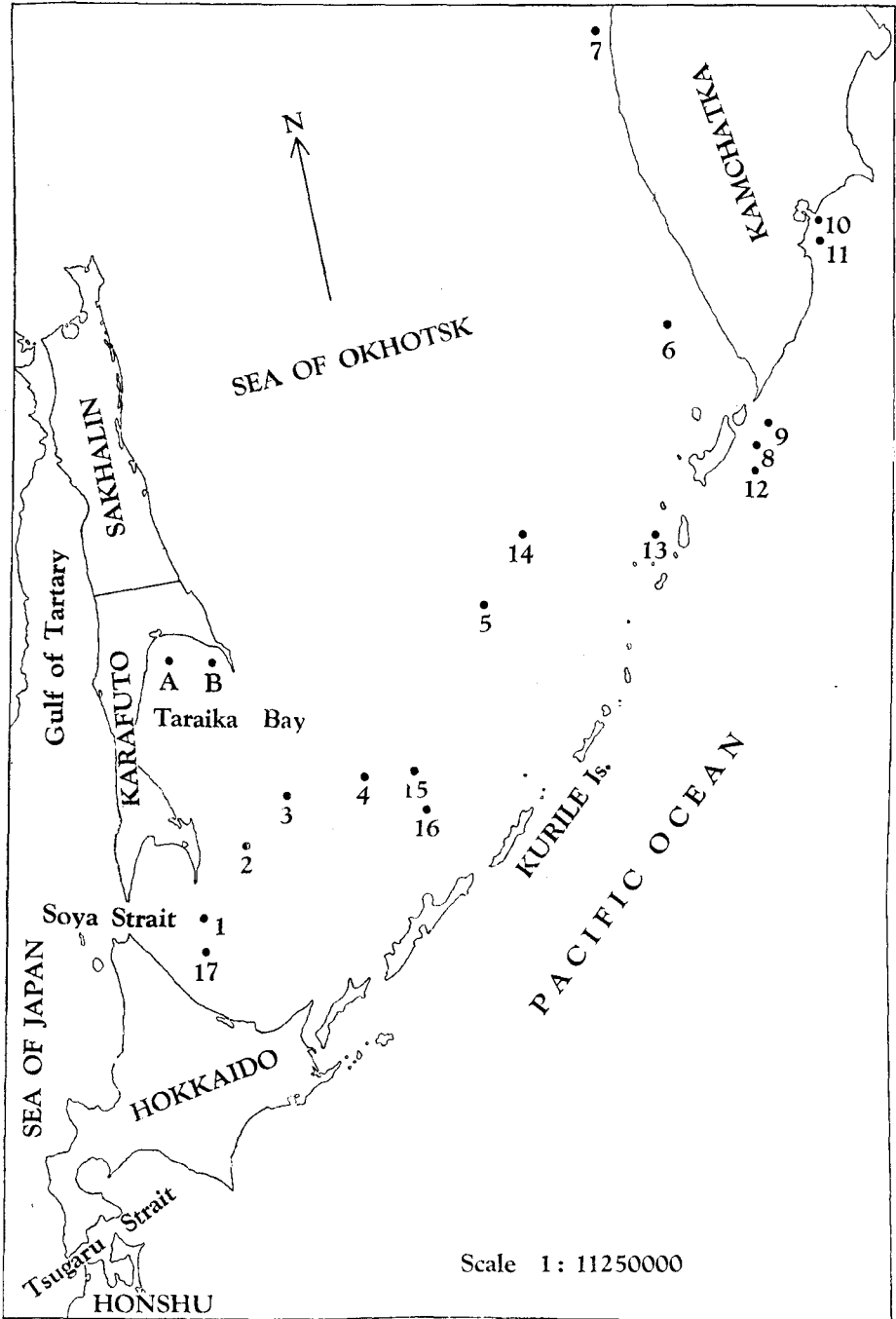
The detection of comparatively many species of the genus *Parafavella* certainly suggests the cold-temperate character of the sea where collection was made, and the frequent occurrence of the species in the genus *Tintinnopsis* indicates the neritic character of the plankton.

My hearty thanks are due to Professor Dr. C. A. KOFOID and Dr. A. S. CAMPBELL for their kind aid rendered me and for their verification of my identification of the species reported in this paper. It also gives me a great pleasure to record my indebtedness to Mr. K. ŌGAKI, Captain of the Steamer "Oshoro-Maru" for the collection of the materials.

TABLE OF STATIONS AT WHICH MATERIALS WERE  
OBTAINED.

Station	Date	Time	Surface Temp.
A	July 20, 1929	a.m. 10.30	14.8 °C
B	" 23, "	p.m. 3.30	16.4 "
1	July 6, 1930	a.m. 8.00	11.2 "
2	" " "	p.m. 0.30	12.3 "
3	" " "	" 8.00	11.2 "
4	" 7, "	a.m. 2.00	7.0 "
5	" " "	p.m. 8.00	8.5 "
6	" 9, "	a.m. 2.00	6.5 "
7	" 20, "	p.m. 8.00	10.0 "
8	August 5, "	a.m. 4.00	10.5 "
9	" 6, "	p.m. 8.00	11.2 "
10	" 8, "	a.m. "	10.0 "
11	" 12, "	p.m. "	11.8 "
12	" 13, "	" "	10.0 "
13	" 14, "	a.m. 2.00	6.2 "
14	" " "	p.m. "	10.0 "
15	" 15, "	a.m. 8.00	14.5 "
16	" " "	p.m. 2.00	" "
17	" 16, "	a.m. 8.00	16.5 "

CHART OF THE SEA WHERE COLLECTION WAS MADE.



SYSTEMATIC TREATMENT

Class CILIATA PERTY, 1852.

Order HETEROTRICHIDA STEIN, 1867.

Suborder TINTINNOINEA KOFOID and CAMPBELL, 1929.

Family TINTINNIDIDAE KOFOID and CAMPBELL, 1929.

Genus LEPROTINTINNUS JÖRGENSEN, 1899.

1. *Leprotintinnus pellucidus* (CLEVE) JÖRGENSEN.

Figure 1.

*Tintinnus pellucidus* CLEVE, 1899, p. 24, pl. 1, fig. 4; MEUNIER, 1910, p. 134, pl. 11, figs. 1-10.

*Leprotintinnus bottnicus*, JÖRGENSEN, 1899, p. 10; 1900, pl. 2, fig. 13.

*Leprotintinnus pellucidus*, JÖRGENSEN, 1901, p. 18; 1927, p. 8 fig. 8; KOFOID and CAMPBELL, 1929, p. 17, fig. 12.

*Tintinnopsis pellucida*, BRANDT, 1906, pl. 23, figs. 8, 14, 15; 1907, p. 127; MERKLE, 1909, p. 156, pl. 2, fig. 22.

Lorica elongate, tubular, 5.5 oral diameters in length; both apertural rims irregular; shaft slightly conical ( $2^{\circ}$ - $3^{\circ}$ ) towards the aboral end, constricted a little above the posterior end; aboral end flaring, 0.85 of the oral diameter in aboral diameter; wall thin, with a sparse agglomeration, numerous spiral turns usually appearing in the anterior part.

Length,  $220 \mu$ ; oral diameter,  $40 \mu$ .

Stations, 8, 14.

Differs from *Leprotintinnus bottnicus* (NORDQVIST) in more widened aboral region and from *L. simplex* SCHMIDT in having posterior constriction.



Fig. 1.

*Leprotintinnus pellucidus*  
(CLEVE) JÖRGENSEN.  $\times 300$ .

Family CODONELLIDAE KENT, 1882.

Genus TINTINNOPSIS STEIN, 1867.

2. *Tintinnopsis beroidea* STEIN.

Figure 2.

*Tintinnopsis beroidea* STEIN, \*1867; JÖRGENSEN, 1899, p. 23, pl. 1, fig. 5; ENTZ,

\* Indicates literature which I have not examined.

Jr. (part), 1909, pl. 8, fig. 11, pl. 20, figs. 27, 45, pl. 21, fig. 8; MERKLE, 1909, pp. 149, 177, pl. 2, fig. 30; MEUNIER, 1910, p. 140, pl. 12, figs. 14-18; JÖRGENSEN, 1927, pp. 6, 7, fig. 5; KOFOID and CAMPBELL, 1929, p. 28, fig. 26.

*Codonella beroidea* (part), ENTZ, Sr., 1884, p. 411, pl. 24, figs. 2-9.

*Tintinnopsis beroidea* var. *acuminata* (part), DADAY, 1887, p. 547, pl. 19, figs. 4, 5.

Lorica bullet-shaped, usually cylindrical in the anterior 0.6-0.7 of the total length, aborally conical ( $75^{\circ}$ - $85^{\circ}$ ), its length 1.5-2.1 oral diameters; oral rim ragged; aboral end bluntly pointed; wall rather coarse, 0.03-0.04 oral diameters in thickness, without spiral structure.

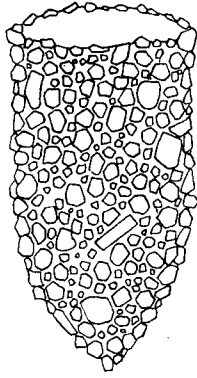


Fig. 2.

*Tintinnopsis beroidea*  
STEIN.  $\times 900$ .

Length, 48 (43-51)  $\mu$ ; oral diameter, 27 (26-30)  $\mu$ .

Stations, A, B, 10.

Differs from *Tintinnopsis acuminata* DADAY in stouter proportions and in the subacute aboral end, from *Tps. parvula* JÖRGENSEN in absence of an aboral expansion below the anterior subcylindrical region, and from *Tps. strigosa* MEUNIER in the aboral end.

### 3. *Tintinnopsis urnula* MEUNIER.

Figure 3.

*Tintinnopsis* sp. (*T. campanula* var. ?) OKAMURA, 1907, p. 139, pl. 6, fig. 63.

*Tintinnopsis urnula* MEUNIER, 1910, p. 145, pl. 13, figs. 21-25; KOFOID and CAMPBELL, 1929, p. 50, fig. 20.

Lorica campanulate, 1.5 oral diameters in length; oral rim ragged; bowl constricted at the suboral 0.3 of the total length, its narrowest transdiameter 0.8 oral diameters, sides concave in the anterior 0.6 of the lorica; aboral region an inverted cone of  $78^{\circ}$ ; aboral end subacute; wall more or less coarse, with very slight spiral organization in the suboral part.

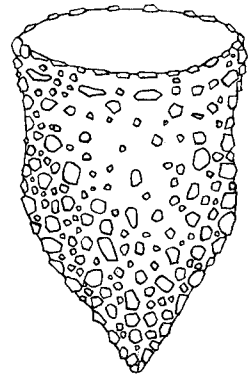


Fig. 3.

*Tintinnopsis urnula*  
MEUNIER.  $\times 800$ .

Length, 54–60  $\mu$ ; oral diameter, 37–40  $\mu$ .

Station, 7.

Differs from *Tintinnopsis beroidea* STEIN and *Tps. lata* MEUNIER in the presence of the suboral constriction, and from *Tps. compressa* DADAY in the widened oral aperture and in the tapering aboral end.

#### 4. *Tintinnopsis strigosa* MEUNIER.

Figures 4.

*Tintinnopsis strigosa* MEUNIER, \*1919; KOFOLD and CAMPBELL, 1929, p. 47, fig. 31.

Lorica stout bullet-shaped, 1.9 oral diameters in length; oral rim entire; bowl cylindrical, contracting posteriorly, changing from 80° in the aboral region to 38° in the distal end looking like an aboral horn; wall rather thin, with several faint spiral turns in the anterior half of the lorica.

Length, 55  $\mu$ ; oral diameter, 29  $\mu$ .

Station, 1.

Differs from *Tintinnopsis acuminata* DADAY in stouter proportions and from *Tps. beroidea* STEIN in having the more tapering aboral end.

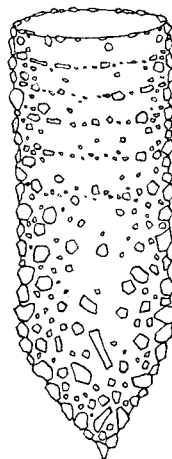


Fig. 5.

*Tintinnopsis tubulosoides*  
MEUNIER.  $\times 600$ .

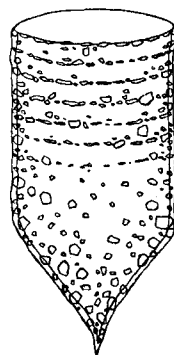


Fig. 4.

*Tintinnopsis strigosa*  
MEUNIER.  $\times 800$ .

#### 5. *Tintinnopsis tubulosoides* MEUNIER.

Figure 5.

*Tintinnopsis karajacensis*, BRANDT, (part), 1906, pl. 19, fig. 11; 1907, p. 162.

*Tintinnopsis tubulosa* (part), BRANDT, 1906, pl. 24, figs. 8, 10; 1907, p. 167.

*Tintinnopsis tubulosoides* MEUNIER, 1910, p. 139, pl. 12, figs. 10, 11; KOFOLD and CAMPBELL, 1929, p. 49, fig. 74.

Lorica elongate bullet-shaped, 2.0–3.3 oral diameters in length; oral rim more or less



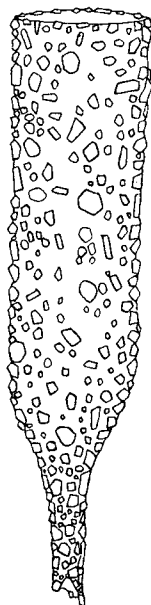


Fig. 6.

*Tintinnopsis kofoidi*  
HADA.  $\times 450$ .

(35–40)  $\mu$ ; length of the aboral horn, 38  
(32–43)  $\mu$ .

Stations, A, B, 10.

Family CODONELLOPSIDAE KOFOID  
and CAMPBELL, 1929.

Genus STENOSEMELLA JÖRGENSEN, 1924.

7. *Stenosemella ventricosa* (CLAPARÈDE  
and LACHMANN) JÖRGENSEN.

Figure 7.

*Tintinnus ventricosus* CLAPARÈDE and LA-  
CHMANN, \*1858; KENT, 1882, p. 609, pl.  
31, fig. 31.

*Codonella ventricosa*, JÖRGENSEN, 1899, p.  
26; CLEVE, 1902, p. 22; 1903, p. 31.

smooth; no collar; bowl cylindrical in the anterior 0.75 of the total length; aboral region contracting gradually, conical ( $58^{\circ}$ – $73^{\circ}$ ); aboral end generally acute, sometimes pointed bluntly; wall comparatively thin, with a few faint spiral turns in the suboral region, agglomerated particles somewhat sparse.

Length, 85 (71–110)  $\mu$ ; oral diameter 35 (34–37)  $\mu$ .  
Stations, 8, 10, 11.

Differs from *Tintinnopsis beroidea* STEIN in having spiral structure and in the long cylindrical bowl, from *Tps. strigosa* MEUNIER in its more slender lorica, and from *Tps. tubulosa* LEVANDER in the absence of the enlarged aboral region.

6. *Tintinnopsis kofoidi* HADA.

Figure 6.

*Tintinnopsis kofoidi* HADA, 1932, p. 210, figs. 2, 3.

Length, 171 (156–188)  $\mu$ ; oral diameter, 38

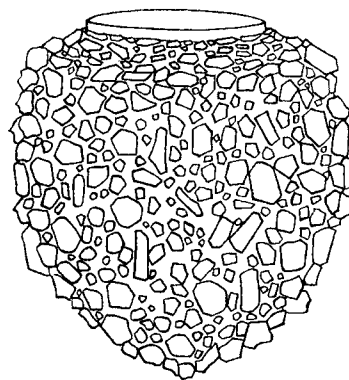


Fig. 7.

*Stenosemella ventricosa*  
(CLAPARÈDE and LACHMANN)  
JÖRGENSEN.  $\times 550$ .

*Tintinnopsis ventricosa*, CLEVE, 1900a, p. 17; 1900b, p. 19; BRANDT (part), 1906, pl. 17, fig. 9; 1907, p. 154; ENTZ, Jr. 1909, pl. 8, figs. 7, 10, pl. 9, fig. 19, pl. 20, fig. 48; MERKLE, 1909, pp. 146, 176, pl. 2, figs. 26, 28, pl. 3, fig. 70.

*Tintinnopsis ventricosoides* MEUNIER, 1910, p. 143, pl. 13, figs. 1-8.

*Stenosemella ventricosa*, JÖRGENSEN, 1927, p. 8, fig. 6; KOFOID and CAMPBELL, 1929, p. 71, fig. 142.

Lorica ovate, 1.7-2.0 oral diameters in length; collar very low, hyaline, without windows; shoulder sloping outwardly; bowl ovoidal, aborally convex conical ( $95^{\circ}$ - $110^{\circ}$ ), its greatest transdiameter 1.5-1.7 oral diameter; aboral end more or less blunt; wall coarsely agglomerated.

Length, 84 (80-86)  $\mu$ ; oral diameter, 46 (42-49)  $\mu$ ; transdiameter of the bowl, 72 (71-75)  $\mu$ .

Station, 7.

Differs from *Stenosemella steini* (JÖRGENSEN) in its lower collar and in the structure of the shoulder which is square in *S. steini*, but in this species sloping smoothly with rounded edges.

#### Genus CODONELLOPSIS JÖRGENSEN, 1924.

##### 8. *Codonellopsis frigida* n. sp.

Figure 8.

Lorica stout top-shaped, 2.16 oral diameters in length, consisting of a subspherical bowl and a tubular collar separated from the former by the distinct conjunction; collar sub-cylindrical, usually with 5 spiral turns, 0.36 of the total length in length, constricted slightly below its oral flare; bowl globose, widest near the upper one-third of its length, 1.46-1.58 oral diameters in greatest transdiameter, provided with the comparatively smooth surface; aboral end hemispherical; wall of the bowl rather uniform in thickness, generally without agglomerated particles.

Length, 56  $\mu$ ; oral diameter, 26  $\mu$ ; greatest transdiameter of the bowl, 38-41  $\mu$ .

Stations, 6, 13.

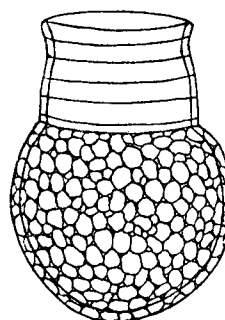


Fig. 8.

*Codonellopsis frigida*  
n. sp.  $\times 700$ .

Differs from *Codonellopsis contracta* KOFOID and CAMPBELL in the subcylindrical collar without posterior flaring region and in lack of fenestration on the basal part of the collar.

Family COXLIPELLIDAE KOFOID and CAMPBELL, 1929.

Genus HELICOSTOMELLA JÖRGENSEN, 1924.

9. *Helicostomella fusiformis* (MEUNIER) JÖRGENSEN.

Figure 9.

*Amphorella sublata*, MEUNIER, 1910, p. 131, pl. 10, figs. 14, 15.

*Amphorella fusiformis* MEUNIER, \*1919.

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

*Helicostomella fusiformis*, KOFOID and CAMPBELL, 1929, p. 105, fig. 207.



Fig. 9.

*Helicostomella fusiformis*  
(MEUNIER)  
JÖRGENSEN.  $\times 500$ .

Lorica elongated fusiform, 6.4–7.8 oral diameters in length; oral rim somewhat flaring, dentate with about 24 short teeth; bowl cylindrical with 10–22 suboral turns in the anterior one-third of the lorica, dilated slightly in the posterior half of the bowl, widest near the middle of the total length, its greatest transdiameter 1.00–1.13 oral diameters; aboral region convex conical ( $25^{\circ}$ – $38^{\circ}$ ), sometimes with a few, irregularly curved striae running into an aboral horn 0.12–0.17 of the total length in length.

Length, 160 (148–180) $\mu$ ; oral diameter, 23 $\mu$ .  
Station, 10.

Differs from *Helicostomella subulata* (EHRENBERG) in its shorter lorica and in an aboral bulge.

10. *Helicostomella subulata* (EHRENBERG) JÖRGENSEN.

Figure 10.

*Tintinnus subulatus* EHRENBERG, \*1833; KENT, 1882, p. 605, pl. 31, fig. 5; BRANDT, 1896, p. 52; LAACKMANN, 1906, p. 17, pl. 3, fig. 47; BRANDT. (part), 1906, pl. 65, figs. 1–4; 1907, p. 393.

*Tintinnus Ussowi* MERESCHKOWSKY, 1879, p. 160, pl. 10, fig. 40; KENT, 1882, p. 609, pl. 31, fig. 4.

*Amphorella subulata*, DADAY, 1887, p. 534, 536, pl. 18, fig. 7; CLEVE, 1900b, p. 18; 1902, p. 21; 1903, p. 31.

*Helicostomella subulata*, JÖRGENSEN, 1927, p. 10, fig. 14; KOFOID and CAMPBELL, 1929, p. 107, fig. 209; KOFOID, 1930, fig. 17 (No. 209).

Lorica elongated, slender pipette-shaped, 9.1–11.3 oral diameters in length; oral rim more or less flaring, denticulate with about 30 short teeth; bowl cylindrical in the anterior half of the lorica; aboral region conical (15°–20°), tapering distally into a long, somewhat oblique aboral horn with a pointed tip; suboral bands 10–20 in number, denticular, fading posteriorly, but most prominent on some one of the more anterior bands.

Length, 238 (210–260)  $\mu$ ; oral diameter, 23–24  $\mu$ .

Stations, A, 13.

Differs from *Helicostomella edentata* (FAURÉ-FREMIET) in presence of dentation of the oral margin and from *H. kiliensis* (LAACK-MANN) in more gradually contraction of the aboral region.



Fig. 10.

*Helicostomella subulata*  
(EHRENBERG)  
JÖRGENSEN.  $\times 500$ .

Family CYTTAROCYLIDAE KOFOID and CAMPBELL, 1929.

Subfamily FAVELLINEAE KOFOID and CAMPBELL, 1929.

Genus FAVELLA JÖRGENSEN, 1924.

### 11. *Favella taraikaensis* n. sp.

Figure 11.

Lorica tall goblet-shaped, 3.2–3.7 oral diameters in length; oral rim entire, but not quite smooth; oral region a low funnel of 20°–35°

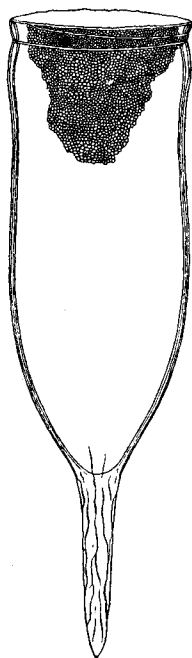


Fig. 11.  
*Favella taraiikaensis*  
n. sp.  $\times 300$ .

with 1-2 spiral turns, its length 0.11 of the oral diameter; bowl bell-shaped, slightly expanding below the nuchal constriction, widest near the posterior 0.4 of the bowl, contracting aborally into a conical aboral end of  $60^{\circ}$ - $75^{\circ}$ ; aboral horn nearly circular in cross section, more or less longitudinally rugose on the surface, conical ( $7^{\circ}$ - $13^{\circ}$ ), 0.24-0.30 of the total length in length, tip bluntly pointed; wall finely prismatic, more in the oral region than in the bowl.

Length, 283 (260-314)  $\mu$ ; oral diameter, 83 (80-86)  $\mu$ .

Stations, A, B.

Differs from *Favella ehrenbergii* (CLAPARÈDE and LACHMANN) in lack of fins appendicular to the aboral horn, from *P. franciscana* KOFOID and CAMPBELL in having the entire oral rim instead of oral denticulation, and from *F. panamensis* KOFOID and CAMPBELL in size, in proportions, and in absence of wings of the aboral horn.

#### Genus PARAFAVELLA KOFOID and CAMPBELL, 1929.

##### 12. *Parafavella jørgenseni* n. sp.

Figure 12.

*Cyttarocyllis denticulata* var. *calycina* forma *acuta* (part) JØRGENSEN, 1901, pp. 7, 10, pl. 1, fig. 5.

*Cyttarocyllis hemifusus* (part) MEUNIER, 1910, p. 117, pl. 8, fig. 19.

*Parafavella acuta* (part), KOFOID and CAMPBELL, 1929, p. 158.

Lorica tall bell-shaped, 2.1-2.4 oral diameters in length; oral margin denticulated with 38 (32-42) short triangular teeth; bowl subcylindrical aboral end conical ( $40^{\circ}$ - $55^{\circ}$ ), without an aboral horn.

Length, 105 (91-125)  $\mu$ ; oral diameter, 45 (43-47)  $\mu$ .

Stations, 7, 9-11, 13.

Differs from *Parafavella acuta* (JÖRGENSEN) in stouter proportions, from *P. greenlandica* KOFOID and CAMPBELL in the longer lorica and in the pointed aboral end instead of a blunt tip, from *P. parumdentata* (BRANDT) in having no aboral horn, and from *P. obtunsangula* (OSTENFELD) in the contour of the aboral region which is not so much abruptly contracted in this species as in the last.

13. *Parafavella pacifica* n. sp.

Figure 13.

Lorica elongated goblet-shaped, 2.1-3.0 oral diameters in length; oral rim flaring very slightly, denticulated with about 25 teeth 0.013-0.034

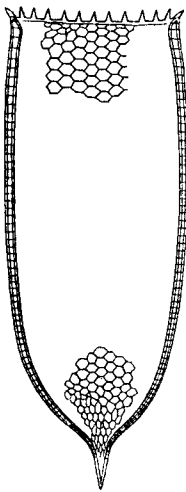


Fig. 13.

*Parafavella pacifica*  
n. sp.  $\times 500$ .

of the total length in length; bowl almost dilated near the middle of the bowl, its greatest trans-diameter 1.04-1.17 oral diameters, gradually contracting aborally and merging distally into a convex conical ( $80^{\circ}$ - $120^{\circ}$ ) aboral region; aboral horn short, conical ( $17^{\circ}$ - $34^{\circ}$ ), 0.08-0.12 of the total length in length, tip pointed.

Length, 123 (105-150)  $\mu$ ; oral diameter 46 (43-50)  $\mu$ .

Stations, 15-17.

Differs from *Parafavella obtunsangula* (OSTENFELD) and from *P. parumdentata* (BRANDT) in the more broadly conical postmedian region, in fewer teeth of the oral rim, and in the more rotund lateral contour.

14. *Parafavella parumdentata* (BRANDT) KOFOID and CAMPBELL.

Figure 14.

*Cyttarocytilis edentata* var. *parumdentata* BRANDT, 1906, pl. 37, figs. 6-8, 7a, 8a; 1907, pp. 231, 232; MERKLE, 1909, p. 158; BUSCH, 1920, p. 756, fig. 1.

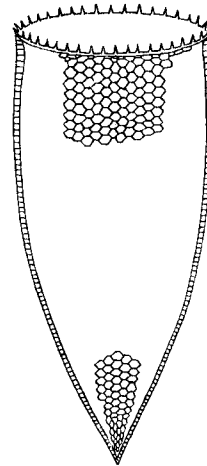


Fig. 12.

*Parafavella jorgenseni*  
n. sp.  $\times 500$ .

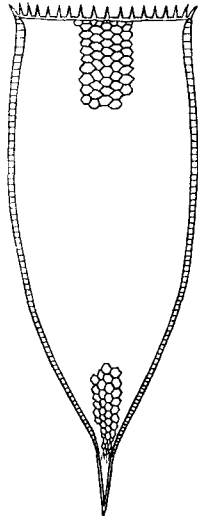


Fig. 14.

*Parafavella parumdentata*  
(BRANDT) KOFOID and  
CAMPBELL.  $\times 450$ .

*Cyttarocyclus hemihusus* (part), MEUNIER, p. 117,  
pl. 8, figs. 8, 21.

*Parafavella parumdentata*, KOFOID and CAMP-  
BELL, 1929, p. 168, fig. 306.

Lorica elongate goblet-shaped, 3 oral diameters in length; oral rim somewhat flaring, denticulate with about 35 teeth; bowl subcylindrical and subconical ( $5^\circ$ ) in suboral part, tapering aborally ( $50^\circ$ ); aboral horn conical ( $10^\circ$ ), 0.15 of the total length in length, with an acute tip.

Length,  $50 \mu$ ; oral diameter,  $50 \mu$ .

Station, 10.

Differs from *Parafavella pacifica* n. sp. in the more tapering aboral end and from *P. obtusangula* (OSTENFELD) in possessing the more differentiated aboral horn.

#### 15. *Parafavella dentiulata* (EHRENBERG) KOFOID and CAMPBELL.

Figure 15.

*Tintinnus denticulatus* EHRENBERG, \*1840; KENT, 1882 p. 607, pl. 31, figs. 18, 19.

*Cyttarocyclus denticulata*, DADAY, 1887, pp. 575, 583; BRANDT, 1896, pp. 60, 62; JÖRGENSEN (part), 1899, p. 31; 1901, p. 4; CLEVE, 1899, p. 21; 1900a, p. 15; 1900b, p. 18; 1902, p. 22; 1903, p. 31; BRANDT (part), 1907, p. 220; MERKLE, 1909, pp. 157 (part), 179, pl. 3, figs. 39-61.

*Cyttarocyclus denticulata* var.  $\alpha$  *typica* JÖRGENSEN (part), 1899, p. 31, pl. 2, figs. 13, 15.

*Cyttarocyclus denticulata* var. *typica*, JÖRGENSEN, 1901, pp. 8, 9, 12; BRANDT (part), 1906, pl. 37, figs. 9, 10, 15-17; 1907, pp. 220 (part), 232; MERKLE, 1909, pp. 158, 168, pl. 2, fig. 27, pl. 3, figs. 31-38, 68, 72, 73.

*Favella denticulata*, JÖRGENSEN 1927, pp. 10, 11.

*Parafavella denticulata*, KOFOID and CAMPBELL, 1929, p. 163, fig. 310.

Lorica elongated bell-shaped, 33-37 oral diameters in length; oral rim denticulated with 50-60 teeth 0.095 of the total length in length; bowl cylindrical, 1.08 oral diameters in the widest trans-diameter; aboral region contracting gradually ( $50^\circ$ - $67^\circ$ ); aboral

horn usually straight and conical ( $14^{\circ}$ – $20^{\circ}$ ), occasionally curved, 0.13–0.16 of the total length in length, its tip pointed.

Length, 226 (208–234)  $\mu$ ; oral diameter, 63 (62–64)  $\mu$ .

Stations, 1, 3.

Differs from *Parafavella gigantea* (BRANDT) in size and dimensions of the lorica and in the shorter aboral horn.

16. *Parafavella gigantea* (BRANDT)

KOFOID and CAMPBELL.

Figure 16.

*Cyttarocyclus gigantea* (part) BRANDT, 1896, p. 63, pl. 3, figs. 21, 24; MEUNIER, 1910, p. 109, pl. 8, figs. 1, 3–5, 8–11.

*Cyttarocyclus denticulata* var.  $\delta$  *gigantea*, JÖRGENSEN, 1899, p. 35, pl. 3, figs. 26–28.

*Cyttarocyclus denticulata* var. *gigantea*, CLEVE, 1899, p. 21; JÖRGENSEN, 1901, pp. 9, 14, pl. 2, fig. 21; BRANDT (part), 1906, pl. 38, figs. 3, 8, 8a, 9; 1907, p. 233.

*Cyttarocyclus denticulata* var. *elongata* JÖRGENSEN, 1901, pp. 8, 14, pl. 3, figs. 23, 24.

*Cyttarocyclus cuspidata* (part) MEUNIER, 1910, p. 113, pl. 10, figs. 8, 9.

*Parafavella gigantea*, KOFOID and CAMPBELL, 1929, p. 165, fig. 311.

Lorica elongated tubular, 5.3–8.1 oral diameters in length; oral margin denticulated with about 45 teeth as long as 0.013–0.018 of the length in length; bowl nearly cylindrical, somewhat expanding in the suboral part, its greatest transdiameter 1.02–1.11 oral diameters, constricted slightly at the middle; aboral region convex conical ( $45^{\circ}$ – $60^{\circ}$ ), tapering into a long slender horn; aboral horn straight or more or less curved, 0.25–0.33 of the total length in length, with a pointed tip.

Length, 445 (340–576)  $\mu$ ; oral diameter 66 (63–71)  $\mu$ .

Stations, 1–4, 8, 10.

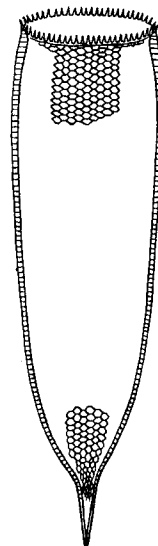


Fig. 15.

*Parafavella denticulata*  
(EHRENBERG) KOFOID and  
CAMPBELL.  $\times 320$ .



Differs from *Parafavella denticulata* (EHRENBERG) in larger size and in elongation of the aboral horn and from *P. robusta* (JÖRGENSEN) in the more slender contour of the lorica.

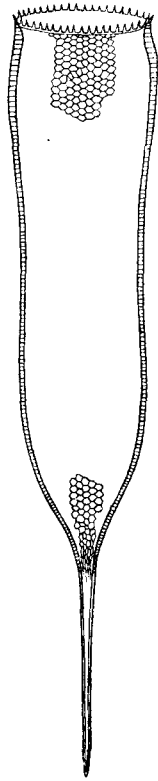


Fig. 16.  
*Parafavella gigantea*  
(BRANDT) KOFOID and  
CAMPBELL.  $\times 250$ .

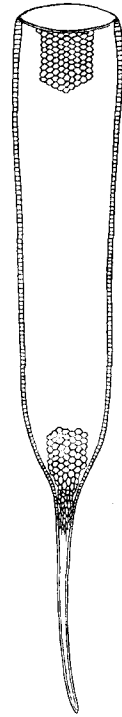


Fig. 17.  
*Parafavella brandti*  
n. sp.  $\times 210$ .

### 17. *Parafavella brandti* n. sp.

Figure 17.

*Cyttarocyclus gigantea* (part) BRANDT, 1896, p. 63, pl. 3, figs. 22, 23.

*Cyttarocyclus denticulata* var. *gigantea* (part), BRANDT, 1906, pl. 38, figs. 2, 2a;  
1907, p. 233.

*Parafavella subedentata*, KOFOID and CAMPBELL (part), 1929, p. 170.

Lorica elongated goblet-shaped, 5.2–7.0 oral diameters in length; oral rim entire without dentation; bowl subcylindrical, widened slightly in the suboral region; aboral region an inverted cone of  $50^{\circ}$ – $58^{\circ}$ ; aboral horn long, sometime more or less curved, 0.26–0.28 of the total length in length.

Length, 360–437  $\mu$ ; oral diameter, 63–68  $\mu$ .

Station, 7.

Differs from *Parafavella edentata* (BRANDT) and *P. subedentata* (JÖRGENSEN) in the longer bowl and in the elongate aboral horn, and from *P. gigantea* (BRANDT) in absence of oral teeth on the oral margin.

18. *Parafavella promissa* n. sp.

Figure 18.

Lorica elongate, consisting of a tubular bowl and a very long aboral horn, its length 7.3 oral diameters; oral rim slightly flaring, denticulated with about 22 long teeth strongly curved outwardly; bowl nearly cylindrical, more or less expanding at the anterior 0.12 and at the posterior 0.31 of the bowl, contracting aborally, ( $45^{\circ}$ ); aboral horn much elongated, slender, somewhat curved irregularly, 0.46 of the total length, in length, provided with a discoidal appendage at the tip.

Length, 334  $\mu$ ; oral diameter, 46  $\mu$ .

Station, 16.

Differs from *Parafavella denticulata* (EHRENBERG) and *P. gigantea* (BRANDT) in long curved teeth of the oral rim and in its remarkable elongated aboral horn.

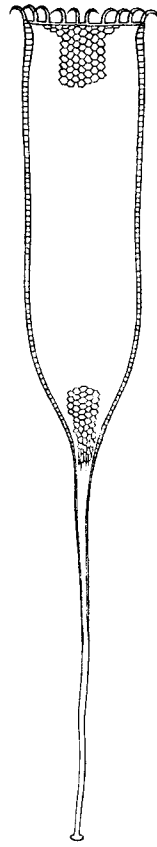


Fig. 18.

*Parafavella promissa*  
n. sp.  $\times 300$ .

19. *Parafavella subrotundata* (JÖRGENSEN) KOFOID and CAMPBELL.

Figure 19.

*Cyttarocyclus denticulata* var.  $\gamma$  *subrotundata* JÖRGENSEN, 1899, p. 34, pl. 2, figs. 20, 21.

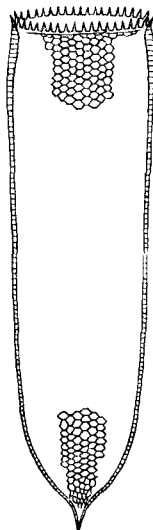


Fig. 19.

*Parafavella subrotundata*  
(JÖRGENSEN) KOFOID and  
CAMPBELL.  $\times 300$ .

*Cyttarocyclus denticulata* var. *subrotundata* JÖRGENSEN, 1901, pp. 8, 13; MERKLE, 1909, p. 159.

*Parafavella subrotundata*, KOFOID and CAMPBELL, 1929, p. 170, fig. 316.

Lorica elongate, tubular, 3.0–4.3 oral diameters in length; oral rim denticulated with about 50 teeth; bowl cylindrical, slightly conical ( $5^{\circ}$ – $7^{\circ}$ ) towards the aboral end, its widest transdiameter 1.03–1.05 oral diameters; more or less abruptly contracting aborally ( $65^{\circ}$ – $85^{\circ}$ ); aboral horn short, 0.05–0.11 of the total length in length, conical ( $20^{\circ}$ – $35^{\circ}$ ).

Length, 223 (191–271)  $\mu$ ; oral diameter 63 (63–65)  $\mu$ .

Stations, 3, 13.

Differs from *Parafavella cylindrica* (JÖRGENSEN) in smaller size and in the slightly conical bowl, from *P. denticulata* (EHRENBURG) in the short horn, and from *P. dilatata* (JÖRGENSEN) in less conical feature of the lorica.

20. *Parafavella subcylindrica* n. sp.

Figure 20.

Lorica short figure-shaped, 2.7 oral diameters in length; oral margin denticulate with many small triangular teeth (about 60); bowl subcylindrical, dilated slightly in the suboral 0.16 of the total length, gradually contracting aborally, convex conical ( $8^{\circ}$ ) in the posterior 0.3 of the lorica; aboral end nearly hemispherical, somewhat subacute, without an aboral horn.

Length, 169  $\mu$ ; oral diameter, 63  $\mu$ .

Station, 9.

Differs from *Parafavella digitalis* KOFOID and CAMPBELL in having the denticulate oral rim, from *P. hemifusus* (MEUNIER) in numerous oral teeth and in the rounded aboral end, and from *P. rotundata* (JÖRGENSEN) in smaller size and in stouter proportions.

Family PTYCHOCYLIDAE KOFOID and  
CAMPBELL, 1929.

Genus PTYCHOCYLIS BRANDT, 1896.

21. *Ptychocylis obtusa* BRANDT.

Figure 21.

*Ptychocylis obtusa* BRANDT, 1896, p. 59, pl. 3, fig. 15; CLEVE (part), 1899, p. 23, 1903, p. 32; BRANDT, 1906, pl. 57, fig. 8; 1907, p. 311; KOFOID and CAMPBELL, 1929, p. 188, fig. 349. *Ptychocylis urnula* var. *obtusa*, JÖRGENSEN, 1901,

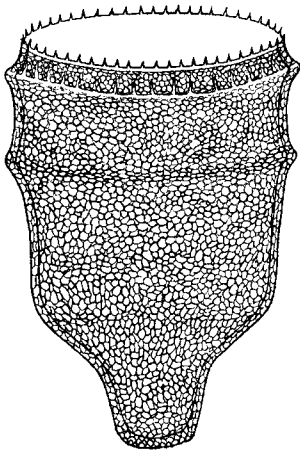


Fig. 21.

*Ptychocylis obtusa*  
BRANDT  $\times 500$ .

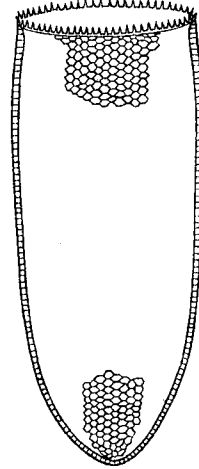


Fig. 20.

*Parafavella subcylindrica*  
n. sp.  $\times 250$ .

p. 18, pl. 3, fig. 32. *Ptychocylis urnula* var. *digitalis* (part) JÖRGENSEN, 1901, p. 17, pl. 2, figs. 29. *Ptychocylis obtusa* var. *drygatskyi* (part), BRANDT, 1906, pl. 56, fig. 4; 1907, p. 312. *Ptychocylis Drygalskii*, MEUNIER, 1910, p. 126, pl. 8, figs. 23, 26, 29-31, pl. 9, figs. 8-10, 12-14. *Ptychocylis media* MEUNIER, 1910, p. 127, pl. 9, fig. 11, pl. 10 fig. 4. *Ptychocylis ampla* MEUNIER, 1910, p. 127, pl. 12, fig. 36. *Ptychocylis glacialis* (part), MEUNIER, 1910, p. 124, pl. 8, fig. 27, pl. 10, fig. 6. *Ptychocylis* sp. MEUNIER, 1910, p. 123, pl. 8, fig. 28. *Ptychocylis duplicata* MEUNIER, 1910, p. 126, pl. 10, figs. 2, 5.

Lorica stout bell-shaped, 1.50–1.85 oral diameters in length; oral rim denticulate; bowl contracting very slightly towards the aboral end, with two anterior expansions and a very weakly developed aboral dilation; posterior region abruptly conical ( $90^{\circ}$ – $102^{\circ}$ ), with an inverted truncated cone ( $27^{\circ}$ – $40^{\circ}$ ) as long as 0.15–0.20 of the total length in length; wall rugged in the aboral end, 0.045 oral diameters in thickness.

Length, 108(91–120) $\mu$ ; oral diameter 63(60–71) $\mu$ .

Stations, 5, 7, 10, 11, 13.

Differs from *Ptychocylis acuta* BRANDT in stouter proportions and in the broadly rounded aboral end and from *P. drygalskii* BRANDT in the shape of the aboral region having a definite aboral cone.

Family PETALOTRICHIDAE KOFOID and CAMPBELL, 1929.

Subfamily CRATERELLINAE KOFOID and CAMPBELL, 1929.

Genus ACANTHOSTOMELLA JÖRGENSEN, 1927.

22. *Acanthostomella norvegica* (DADAY) JÖRGENSEN.

Figure 22.

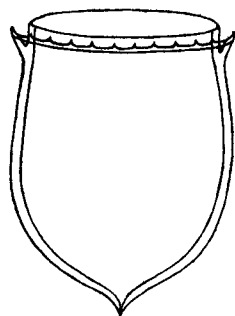


Fig. 22.  
*Acanthostomella  
norvegica*  
(DADAY)  
JÖRGENSEN.  $\times 900$ .

*Tintinnus* sp., KENT, 1882, pl. 31, fig. 17.

*Amphorella norvegica* DADAY, 1887, p. 543; CLEVE, 1902, p. 21; MEUNIER (part), 1910, p. 131, pl. 10, figs. 20–26.

*Tintinnus norvegicus* BRANDT, 1896, p. 54; 1907, pp. 401, 405; MERKLE, 1909, p. 164, pl. 2, fig. 15.

*Tintinnus norvegicus* var. *b minutus* BRANDT, 1906, pl. 62, fig. 6.

*Cyttarocylis norvegica*, JÖRGENSEN, 1899, p. 28, pl. 1, fig. 10.

*Cyttarocylis norvegica* var. *minuta*, JÖRGENSEN, 1901, p. 15, pl. 2, fig. 27.

*Acanthostomella norvegica*, JÖRGENSEN, 1927, p. 13, fig. 23; KOFOID and CAMPBELL, 1929, p. 193, fig. 363.

Lorica stout bell-shaped, 1.3–1.6 oral diameters in length, inner collar high; outer collar

flaring, 1.17–1.23 oral diameters in transdiameter, denticulated with about 25 low triangular teeth; bowl conical ( $15^{\circ}$ – $20^{\circ}$ ) in the anterior half, widened gradually towards the middle part of the total length, its greatest transdiameter 1.13–1.24 oral diameters; aboral region hemispherical, provided with a short aboral spine tip sharply pointed.

Length, 40 (36–43)  $\mu$ ; inner oral diameter, 26 (25–27)  $\mu$ .

Stations, 5–7, 10, 14.

Differs from *Acanthostomella gracilis* (BRANDT) in having an aboral expansion and the acute aboral end.

Family TINTINNIDAE CLAPARÈDE  
and LACHMANN, 1858.

Subfamily TINTINNINEAE KOFOID  
and CAMPBELL, 1929.

Genus TINTINNUS SCHRANK, 1803.

23. *Tintinnus rectus* WAILES.

Figure 23.

*Tintinnus lusus-undae* var. *rectus* WAILES, \*1925.

*Tintinnus rectus*, KOFOID and CAMPBELL, 1929. p. 338,  
fig. 645.

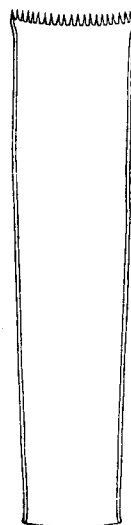


Fig. 23.

*Tintinnus rectus*  
WAILES.  $\times 300$ .

Lorica tubular, subcylindrical with a very slight median dilation, its length 4.5–5.0 oral diameters; anterior end a low, inverted, truncated cone of  $27^{\circ}$ – $40^{\circ}$ , with 44–50 sharp triangular teeth 0.023 of the total length in length; posterior region very slightly flaring, aboral diameter 0.75–0.85 oral diameters.

Length, 235 (223–254)  $\mu$ ; oral diameter, 50 (49–54)  $\mu$ .

Station, 10.

Differs from *Tintinnus rugosus* KOFOID and CAMPBELL in the smooth instead of the rugose surface.

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