



Benthic Marine Cypridinacea
from Hawaii (Ostracoda)

LOUIS S. KORNICKER

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 231

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ABSTRACT

Kornicker, Louis S. Benthic Marine Cypridinacea from Hawaii (Ostracoda). *Smithsonian Contributions to Zoology*, number 231, 24 pages, 19 figures, 1 table, 1976.—A new genus and two new species in the family Sarsiellidae, and one new species in the family Cylindroleberididae, from a shallow lagoon between Paiko Peninsula and a fringing coral reef in Maunalua Bay on the southern coast of Oahu, Hawaii, are described and illustrated. Benthic Cypridinacea have not previously been recorded from Hawaii.

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Contents

	<i>Page</i>
Introduction	1
Acknowledgments	1
Station List with Specimens Collected	1
SARSELLIDAE Brady and Norman, 1896	2
<i>Sarsiella</i> Norman, 1869	2
<i>Sarsiella janiceae</i> , new species	2
<i>Ancohenia</i> , new genus	6
<i>Ancohenia hawaiiensis</i> , new species	7
CYLINDROLEBERIDIDAE Müller, 1906	15
CYCLASTEROPINAE Poulsen, 1965	15
<i>Microasteropteron</i> Poulsen, 1965	15
<i>Microasteropteron youngi</i> , new species	15
Literature Cited	24

Benthic Marine Cypridinacea from Hawaii (Ostracoda)

Louis S. Kornicker

Introduction

The present report on benthic myodocopid Ostracoda in the superfamily Cypridinacea from Hawaii is based on samples collected in February and April, 1975, in a shallow lagoon between the Paiko Peninsula and a fringing coral reef in Maunaloa Bay on the southern coast of Oahu. Collections were made by Anne Cohen, Janice Neill, and Richard Young. Three species were represented in both the February and April collections: *Ancohenia hawaiiensis*, new genus, new species, *Sarsiella janiceae*, new species, and *Microasteropteron youngi*, new species.

The only previous record of a cypridinid ostracode from Hawaii is the pelagic form *Cypridina sharpei* (Müller, 1912), which was collected by the Bureau of Fisheries Steamer *Albatross*, Station 3921, in 1902 from surface waters off Honolulu (Sharpe, 1908:427). Benthic Cypridinacea have not previously been recorded from Hawaii.

The new genus *Ancohenia* is monotypic and presently known only from Hawaii. The genus *Sarsiella* is widely distributed (Kornicker, 1975: 573), but the genus *Microasteropteron* has previously been found only in shallow water along the southeast coast of Thailand (Poulsen: 1965:222).

Note: Specimens located in the National Museum of Natural History, Smithsonian Institution, are indicated by the acronym "USNM" (=former United States National Museum).

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Station List with Specimens Collected

Seaward side of Paiko Peninsula, Maunaloa Bay, Oahu Island, Hawaii, between peninsula and outer reef; sample collected by dragging small net with 1 mm openings over substrate; collectors Anne Cohen, Janice Neill, Richard Young.

Sample 1, 15 February 1975; water depth 30–55 cm; no surf at time of sampling; substrate very silty sand.

Ancohenia hawaiiensis: 1 adult ♀, USNM 151920; 2 ovigerous ♀, USNM 151984, 151921; 2 adult ♂, USNM 151579, 151927; 29 specimens, USNM 153931.

Sarsiella janiceae: 2 ovigerous ♀, USNM 151922, 152457; 1 adult ♀, USNM 152456.

Microasteropteron youngi: 1 adult ♀, USNM 151580.

Sample 2, 19 April 1975; water depth 35–58 cm; sample from 6 or 7 places, some in mixed algal sand bottom, others in sand depression.

Ancohenia hawaiiensis: 4 specimens (no adult males or ovigerous females), USNM 153932.

Sarsiella janiceae: 1 ovigerous ♀ and 3 specimens, USNM 154195.

Microasteropteron youngi: 1 A-1 ♀, USNM 153933; 2 early instars, USNM 153934.

SARSIELLIDAE Brady and Norman, 1896

Sarsiella Norman, 1869

Sarsiella janiceae, new species

FIGURES 1-4

HOLOTYPE.—USNM 151922, ovigerous female in alcohol, and on slides.

TYPE-LOCALITY.—Seaward side of Paiko Peninsula, leeward of reef, Maunaloa Bay, Oahu Island, Hawaii.

ETYMOLOGY.—The species is named for Mrs. Janice Neill, one of the collectors.

PARATYPES.—Sample 1: USNM 152456, 1 adult female; USNM 152457, 1 ovigerous female. Sample 2: USNM 154195, 1 ovigerous female and 3 specimens including a very early instar.

DESCRIPTION OF ADULT FEMALE.—Carapace oval in lateral view with projecting caudal process and slight indentation in middle of anterior margin representing an incisur (Figures 1, 2*a*, 3*a-c*, 4*a*).

Ornamentation (Figures 1, 2): Carapace with a horizontal rib above and below middle of valve connected together at ventral and posterior ends to form oval; anterior part of lower rib with a rib forming a loop; anterior end of loop intersecting lower rib at its anterior end; posterior end of loop intersecting lower rib at point posterior to valve middle; dorsal rib present parallel to dorsal margin of valve (Figure 1); surface of valve with shallow fossae containing short truncate processes (Figure 2*c*); area between fossae with cauliflower-like low processes (Figure 2*c-e*); bristles emerging from closed pores scattered over valve surface and along anterior and ventral valve margins (Figure 2*d*); some pores with bristles with raised peripheral rim (Figure 2*f*).

Infold: Anterior infold slightly below valve middle with minute bristle near inner margin (Figure 4*a*); posterior infold with 2 setose bristles dorsal to caudal process (Figure 4*b*); caudal process with 4-13 minute bristles forming row plus 2 or 3 minute bristles near inner margin (Figures 3*b,c*, 4*b,c*).

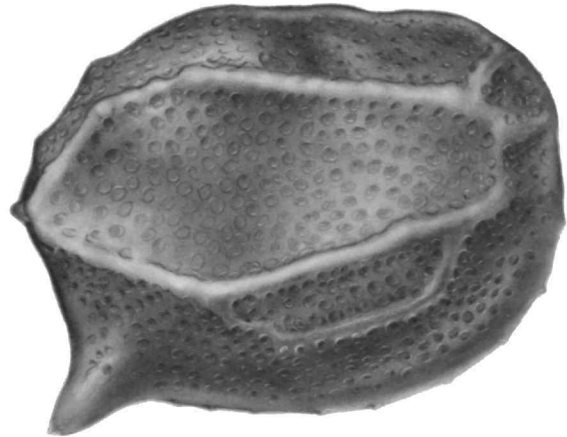


FIGURE 1.—*Sarsiella janiceae*, new species, USNM 151922, holotype, adult female, length 1.12 mm.

Selvage: Wide lamellar prolongation with smooth margin present long anterior, ventral, and posterior margins.

Central Adductor Muscle Scars (Figure 3*d-f*): Consisting of about 10 individual scars.

Size: USNM 152456, length 1.11 mm, height 0.87 mm; USNM 152457, length 1.13 mm, height 0.89 mm; USNM 151922, length 1.12 mm, height 0.88 mm.

First Antenna (Figure 4*d*): 1st joint bare; 2nd joint with 1 spinous dorsal bristle and few spines on lateral surface; 3rd joint fused to 4th, with 2 bristles, 1 ventral, 1 dorsal; 4th joint long with 2 bristles, 1 ventral, 1 dorsal; sensory bristle of 5th joint with 2 minute marginal filaments; 6th joint with small medial bristle near dorsal margin. Seventh joint: a-bristle about 3-times length of bristle of 6th joint; b-bristle bare, about twice length of a-bristle; c-bristle about same length as sensory bristle of 5th joint, with 3 minute marginal filaments. Eighth joint: d- and e-bristles bare, equal in length, slightly shorter than c-bristle; f- and g-bristles same length as c-bristle; f-bristle with 3 minute marginal filaments, g-bristle with 1. Right limb of USNM 152457 aberrant in having e-bristle branching from g-bristle near base (distance from base equal to length of bristle of 6th joint).

Second Antenna: Protopodite bare; endopodite 1-jointed with 2 short anterior bristles and small mound at middle of ventral margin (Figure 4*e*). Exopodite: terminal margin of 1st joint with small

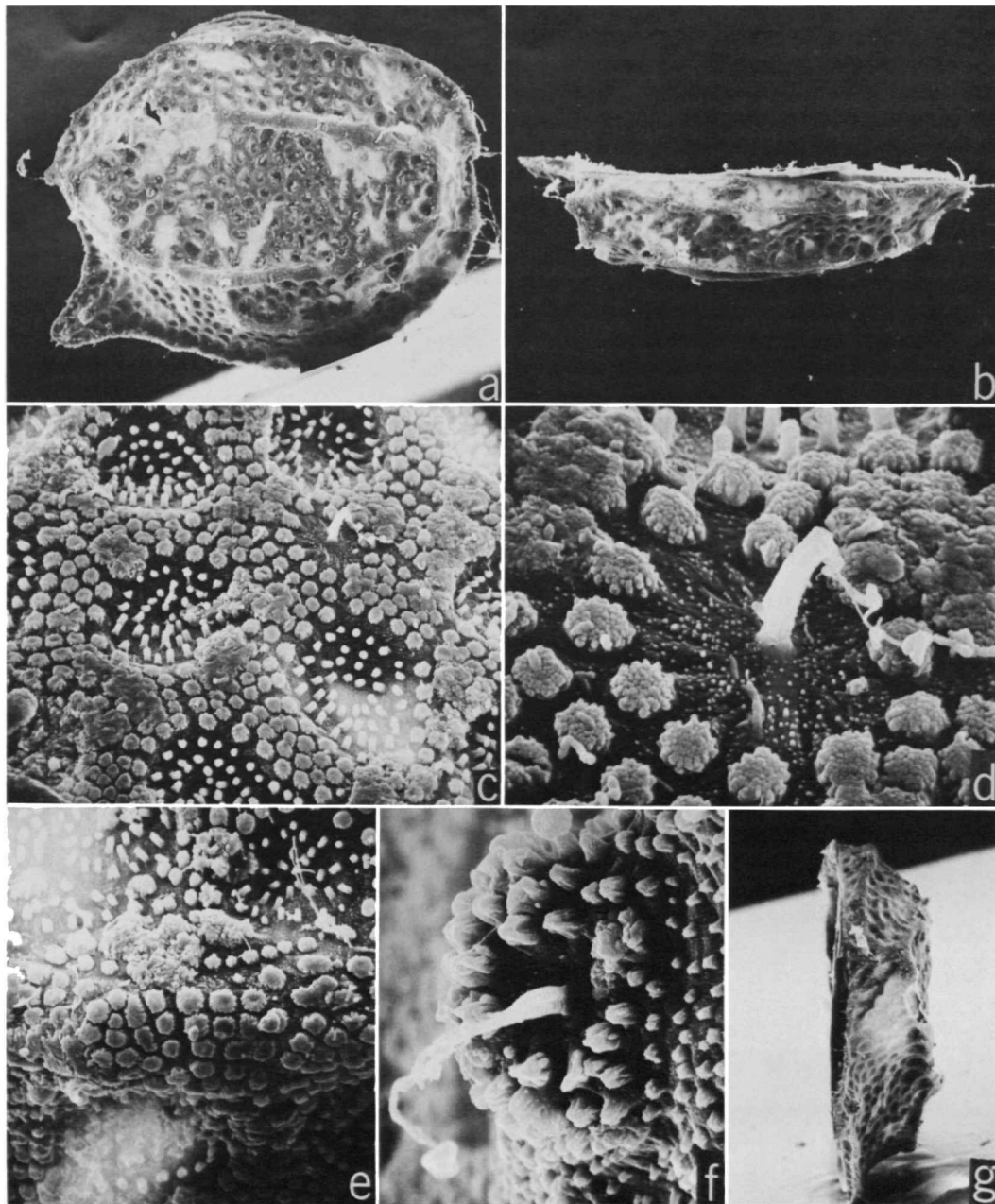


FIGURE 2.—*Sarsiella janiceae* new species, USNM 152457, paratype adult female, right valve, outside views: *a*, lateral view, $\times 87$; *b*, dorsal view, anterior to right, $\times 80$; *c*, surface fossae, pustules and bristles, from posterodorsal part of *a*, $\times 970$; *d*, bristles and pustules in upper right of *c*, $\times 3530$; *e*, detail of dorsal ridge shown in *b*, 1080; *f*, bristle on caudal process shown in *a*, $\times 1785$; *g*, posterior view of valve, $\times 85$. (Photos reduced to 75.5 percent for publication.)

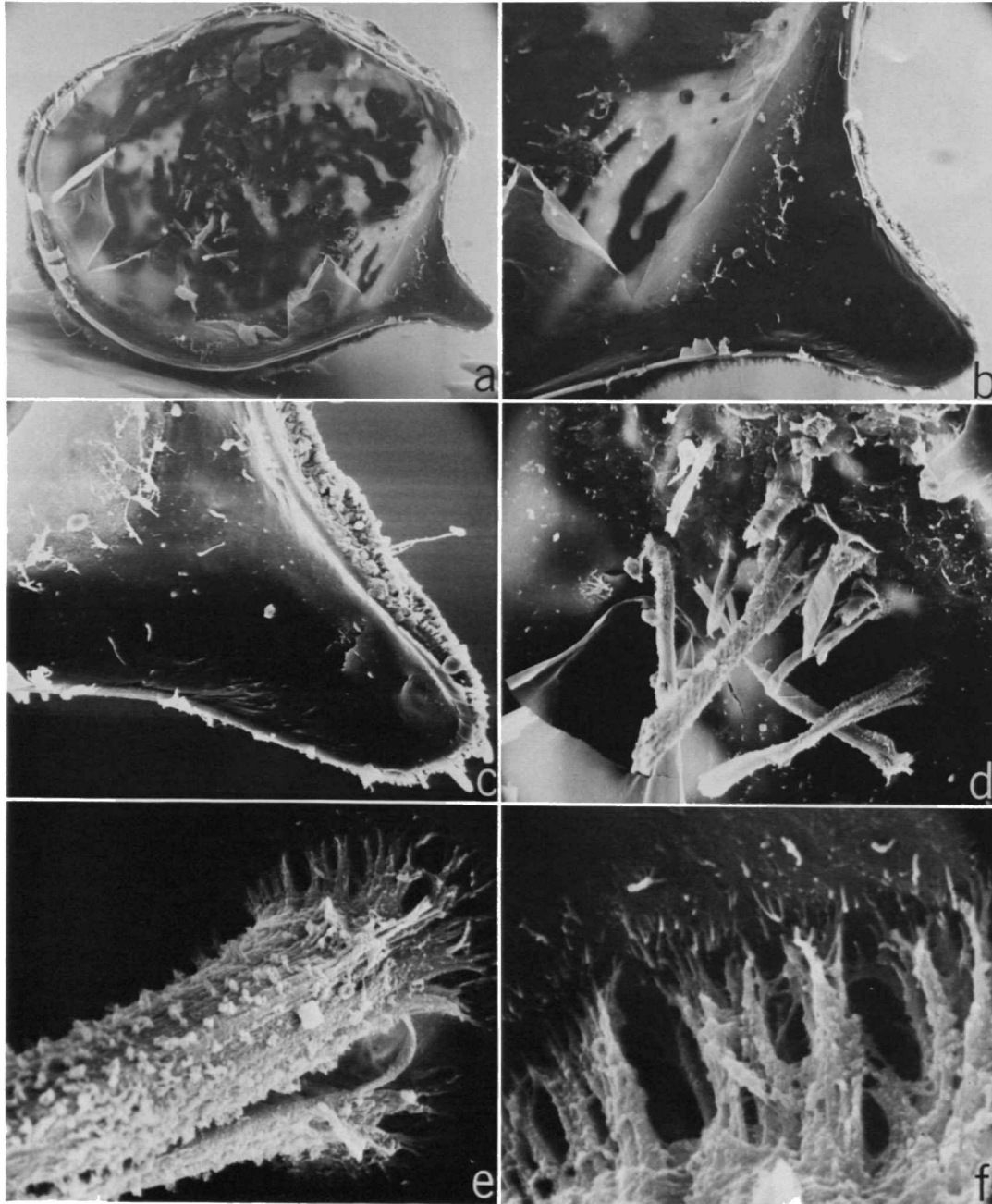


FIGURE 3.—*Sarsiaella janicea* new species, USNM 152457, ovigerous female, right valve, inside views: *a*, medial view, $\times 90$; *b*, caudal process, $\times 250$; *c*, detail showing tip of caudal process shown in *b*, $\times 440$; *d*, ends of central adductor muscles, from *a*, $\times 370$; *e*, muscle attachment in lower right of *d*, $\times 2625$; *f*, upper edge of muscle attachment in *e*, $\times 10,500$. (Photos reduced to 77 percent for publication.)



FIGURE 4.—*Sarsiella janiceae* new species, USNM 152457, paratype, adult female: *a*, medial view of anterior of right valve showing minute bristle on infold; *b*, caudal process of right valve, medial view; *c*, caudal process of left valve, medial view; *d*, left 1st antenna, medial view; *e*, endopodite and part of protopodite of right 2nd antenna, medial view; *f*, left mandible, medial view; *g*, right maxilla, medial view; *h*, tip of 5th limb; *i*, right 6th limb, medial view; *j*, tip of 7th limb; *k*, caudal process and anus, note posterior end of copepod emerging from anal opening; *l*, medial eye and rod-shaped organ, left lateral eye, upper lip; *m*, right genitalia and γ -sclerite. (USNM 152456: *a,b*; USNM 152457: *c-m*.)

medial bristle; bristle of 2nd joint with few proximal hairs on dorsal margin, about 23 spines on ventral margin, and then natatory hairs on both margins; bristles of joints 3–8 with ventral spines followed by natatory hairs on both margins; 9th joint with 3 bristles, 2 long with spines followed by natatory hairs, and 1 short, bare.

Mandible (Figure 4f): Coxale endite consisting of sharp spine; ventral margin of coxale hairs with base of hairs on lateral surface. Basale: medial surface with 4 bristles near ventral margin; dorsal margin with 1 midbristle and 1 subterminal bristle. Endopodite: medial surface of 1st joint with distal spines and 2 minute bristles near base of main claw; 2nd joint with minute subterminal bristle on dorsal margin and main claw on ventral margin; 3rd joint with small bristle near ventral and dorsal margins of base of main claw. Exopodite absent.

Maxilla (Figure 4g): Coxale with 1 short anterior bristle; endite I with 6 bristles; endite II with about 3 bristles; endite III with about 6 bristles; basale with 1 bristle near base of exopodite; exopodite with 2 bristles, inner bristle shorter than outer bristle. Endopodite: 1st joint with alpha and beta bristles with slender marginal spines; 2nd joint with 2 posterior a-bristles, 1 anterior c-bristle, and 5 pectinate terminal bristles.

Fifth Limb (Figure 4h): Epipodial appendage with 36 bristles; single endite present with 1 short bristle. Exopodite: 1st joint with 2 bristles; 2nd to 5th joints fused; 2nd joint with 3 bristles; 3rd to 5th joints with total of 6 bristles.

Sixth Limb (Figure 4i): Single endite present with 3 bristles; end joint with 11 or 12 slender bristles, either with short marginal spines or bare, followed by 2 stout hairs with long hairs on posterior half.

Seventh Limb (Figure 4j): Each limb with 8 bristles, 2 proximal, 1 on each side, and 6 terminal, 3 on each side; each bristle with 3–7 bells and no marginal spines; terminus with opposing combs, each with 4 or 5 opposing teeth.

Furca (Figure 4k): Each lamella with 5 claws; claw 1 continuous with lamella, others separated from lamella by suture; claws 1–4 with large and small teeth along posterior margins; left lamella with 2 spines following claw 5; medial hairs present near base of claw 1.

Eyes and Rod-shaped Organ (Figure 4l): Lateral eye small with 5 minute ommatidia; medial

eye bare, pigmented, larger than lateral eye; rod-shaped organ elongate, 1-jointed with rounded tip.

Upper Lip: Helmet shaped without hairs or spines (Figure 4l).

Anterior of Body: Triangular process present between medial eye and upper lip (Figure 4l).

Genitalia: Cuplike spermatophore present on USNM 152457 (Figure 4m).

Y-shaped Sclerite: Normal for family (Figure 4m).

Eggs: USNM 152457 with 7 eggs in marsupium.

Food: USNM 152457 with almost whole empty skeleton of a copepod partway out anus posterior end first (Figure 4k).

Comparisons: The new species *Sarsiella janiceae* differs from previously described species in the genus in having a looplike rib extending ventrally from the lower horizontal midrib.

Ancohenia, new genus

TYPE-SPECIES.—*Ancohenia hawaiiensis*, new species, monotypy.

ETYMOLOGY.—The genus is named after the principal collector, Anne Cohen, Smithsonian Institution. Gender: feminine.

DIAGNOSIS OF GENUS.—Carapace of female without incisor and with minute caudal process; infold of caudal process with few bare bristles; surface without ridges or ribs.

First Antenna: f- and g-bristles of 8th joint of female short, clawlike; these bristles on adult male clawlike proximally, bristle-like distally. New genus based primarily on the clawlike f- and g-bristles of the female.

Second Antenna: Endopodite of adult male 3-jointed.

Mandible: Adult male limb with well-developed hairs on exopodite; endopodite with stout claw on each joint; claw on 2nd joint with blunt tip.

Seventh Limb: Fairly well developed on adult male but with only distal bristles, and terminus bare.

Lateral Eyes: Present.

Rod-shaped Organ: Elongate but short.

Furca: Main Claws 1, 2, 4 joined to lamella; secondary claws 3, 5, and sometimes 6 separated from lamella by suture.

Comparisons: The new genus *Ancohenia* differs from most previously described genera in the fam-

ily in having clawlike f- and g-bristles on the 8th joint of the female 1st antenna. The distribution of claws on the furca resembles that of *Chelicopia*, Kornicker 1958, but that genus does not have clawlike f- and g-bristles. *Anscottiella crispata* (Scott, 1905) bears on the 1st antenna stout clawlike c-, f- and g-bristles and has only 4 furcal claws.

Ancohenia hawaiiensis, new species

FIGURES 5-13

HOLOTYPE.—USNM 151920, adult female on 3 slides and in alcohol.

TYPE-LOCALITY.—Seaward side of Paiko Peninsula, Maunaloa Bay, Oahu Island, Hawaii.

ETYMOLOGY.—The specific name is from the collecting area.

ALLOTYPE.—USNM 151927, from same sample as holotype, on 2 slides and in alcohol.

PARATYPES.—Sample 1: USNM 151984, 151921, 2 ovigerous females; USNM 151579, 1 adult male; USNM 153931, 29 specimens. Sample 2: USNM 153932, 4 specimens.

DESCRIPTION OF ADULT FEMALE (Figures 5-8).—Carapace oval in lateral view; slight anteroventral bulge present representing caudal process (Figures 5, 6a, 8a); anterior margin evenly rounded without indication of incisur.

Ornamentation: Surface with abundant shallow concave fossae with peripheral row of minute spines (Figures 6e, 7a); surface between fossae with minute processes and scattered short bristles (Figure 7a-c); additional longer bristles, some with broad ringed base, present along valve margins (Figures 6a, 7d).

Infold: Infold anterior to caudal process with 3 small bristles near inner margin of infold (Figures 7d,e, 8b); 2 flagellate bristles present dorsal to caudal process (Figures 7d,f, 8b).

Selvage: Wide lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins.

Central Adductor Muscle Scars: Consisting of numerous ovoid individual scars (Figure 5).

Size: USNM 151984, length 1.12 mm, height 0.91 mm; USNM 151920, separated left valve, length 1.19 mm, height 0.99 mm; USNM 151921, length 1.18 mm, height 0.97 mm.

First Antenna (Figure 8c): First joint bare; 2nd

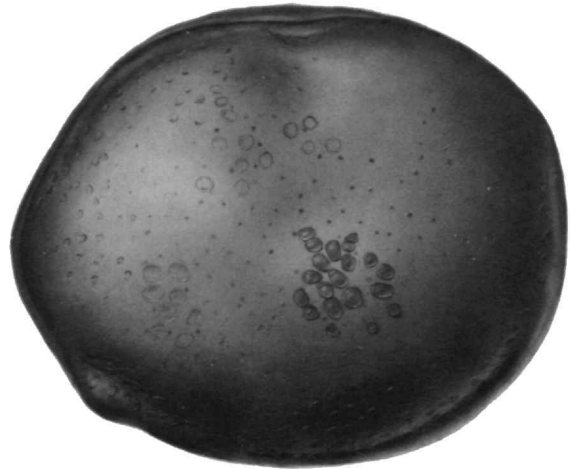


FIGURE 5.—*Ancohenia hawaiiensis*, new species, USNM 151921, paratype, ovigerous female, length 1.18 mm.

joint with 1 spinous dorsal bristle; 3rd joint short with 2 bristles, 1 dorsal, 1 ventral; 3rd joint not separated from 4th by suture; 4th joint long with 2 bristles, 1 dorsal, 1 ventral; sensory bristle of long 5th joint slender with minute terminal spine; medial bristle of 6th joint small with few marginal spines. A-bristle of 7th joint stouter and slightly longer than bristle of 6th joint; b-bristle about same size as bristle of 6th joint; c-bristle longer than sensory bristle of 5th joint, with 2 minute proximal filaments and terminal spine. Eighth joint: d- and e-bristles sensory without filaments, e-bristle stouter and almost twice length of d-bristle; f- and g-bristles claw-like, about same length as d-bristle, g-bristle slightly longer than f-bristle.

Second Antenna: Protopodite bare; endopodite with terminal thumblike process (2nd joint?) and 2 short proximal bristles (Figure 8d). Exopodite 9-jointed: 1st joint long with recurved medial terminal spine; 2nd joint about twice length of 3rd joint; joints 3-8 decreasing in size gradually; joint 9 less than twice size of joint 8; bristle of 2nd joint with 17 slender proximal ventral spines and natatory hairs distally; bristles of joints 3-8 with natatory hairs but without spines; 9th joint with 1 short bare bristle and 1 long bristle with proximal ventral spines and distal natatory hairs.

Mandible (Figure 8e): Coxale with long lateral hairs along ventral margin; endite consisting of

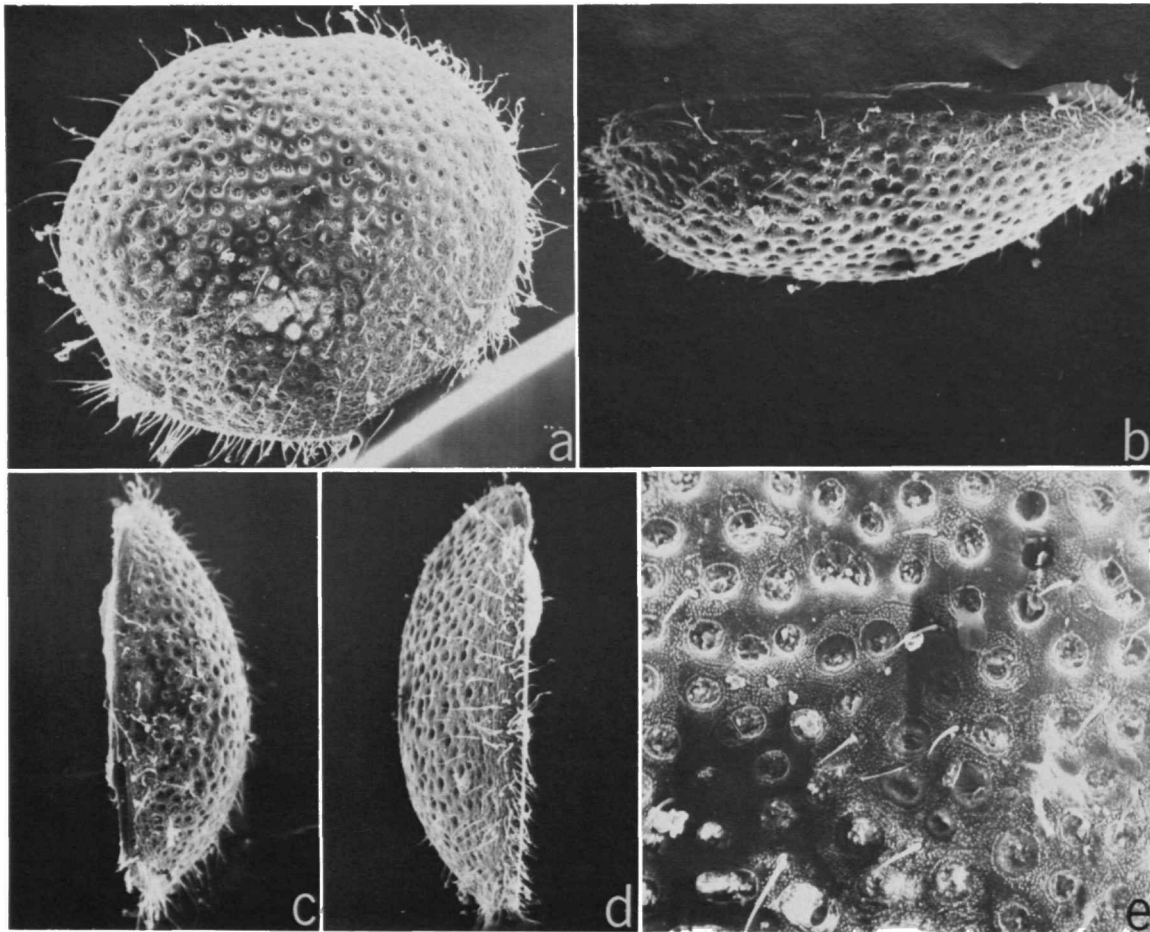


FIGURE 6.—*Ancohenia hawaiiensis*, new species, USNM 151920, holotype, adult female, right valve, outside views: *a*, lateral view, anterior to right, $\times 79$; *b*, dorsal view, anterior to right, $\times 90$; *c*, posterior view, $\times 75$; *d*, anterodorsal view, $\times 80$; *e*, fossae and hairs near middle of *a*, $\times 200$. (Photos reduced to 81 percent for publication.)

stout medial spine near ventral margin. Basale: medial surface near ventral margin with 3 small bristles; dorsal margin with 2 stout spines. Endopodite: 1st joint with medial spines and 1 stout ventral spine just proximal to main claw; 2nd joint with 1 stout dorsal spine and 1 minute ventral spine just proximal to main claw; 3rd joint minute, with dorsal spine and stout ventral spine, both at base of main claw.

Maxilla (Figure 8f,g): 3 endites present: endite I with about 5 bristles, endite II with about 4 bristles, endite III with 6 bristles. Coxale with 1 short anterior bristle; basale with 1 lateral bristle

near exopodite; exopodite with 3 bristles, 1 long, 2 short; 1st endopodite joint with spinous alpha- and beta-bristles; 2nd endopodite joint with 2 lateral, spinous, a-bristles, 1 medial b-bristle, and usual 5 pectinate terminal bristles.

Fifth Limb (Figure 8h): Epipodial appendage with 37 bristles; single endite with 1 short bristle. Exopodite joints fused: 1st joint with 1 or 2 bristles; 2nd joint with 3 or 4 bristles; 3rd joint with 1 short bristle on inner "lobe" and 2 on outer "lobe;" 4th and 5th joints with total of 1 to 3 bristles; surface of exopodite hirsute.

Sixth Limb (Figure 8i): 2 distinct endites pres-

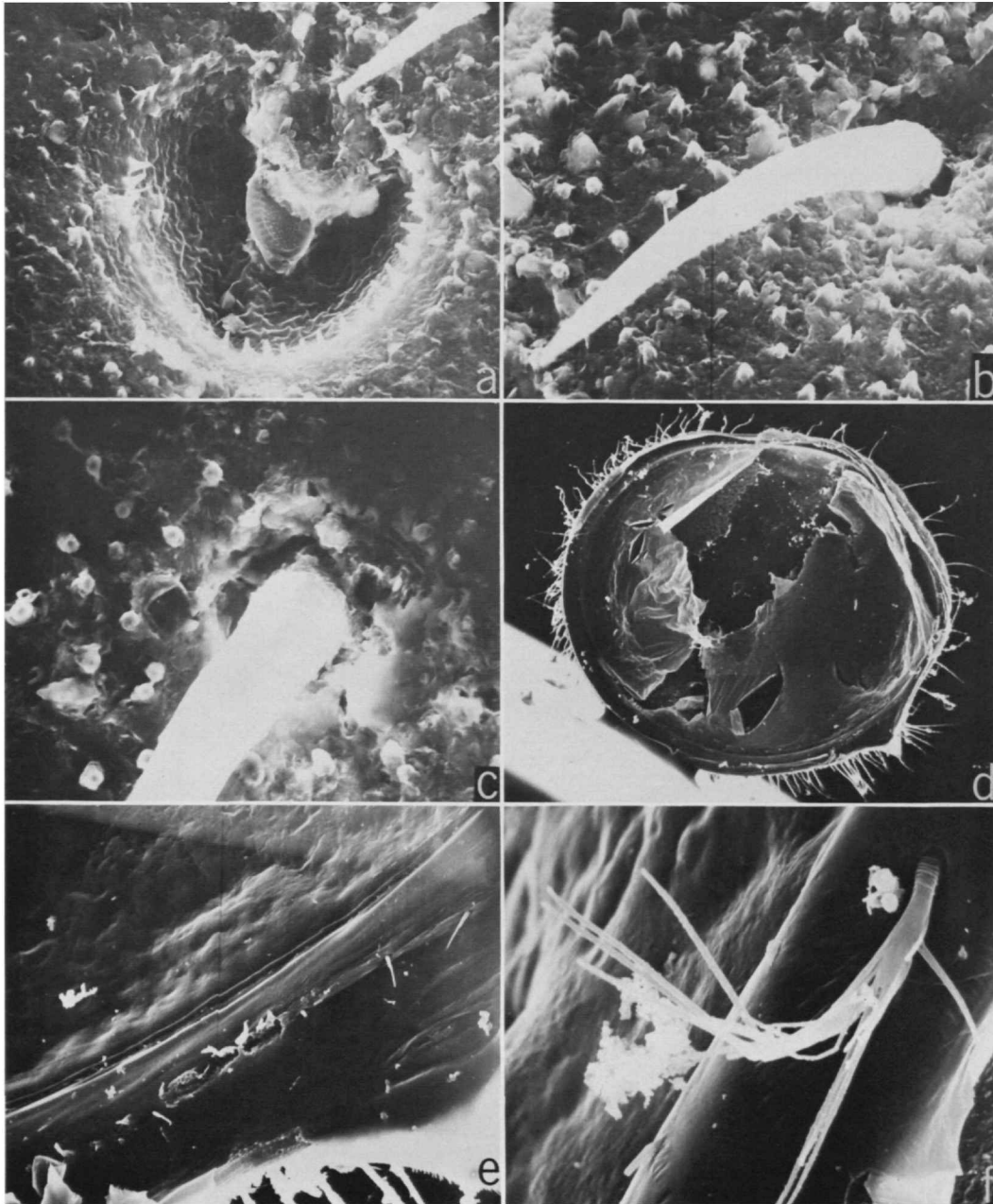


FIGURE 7.—*Ancohenia hawaiiensis*, new species, USNM 151920, holotype, adult female, right valve, outside views: *a*, fossa and peripheral spines shown in figure 6*e* (note diatom inside fossa), $\times 2300$; *b*, pustules and partly shown bristle in upper right of *a*, $\times 2400$; *c*, detail of base of bristle in lower left of figure 6*e*, $\times 3800$. Inside views: *d*, complete valve, anterior to left, $\times 74$; *e*, bristles on posteroventral infold, $\times 550$; *f*, 2 setose bristles on posterior infold, $\times 2000$. (Photos reduced to 74 percent for publication.)

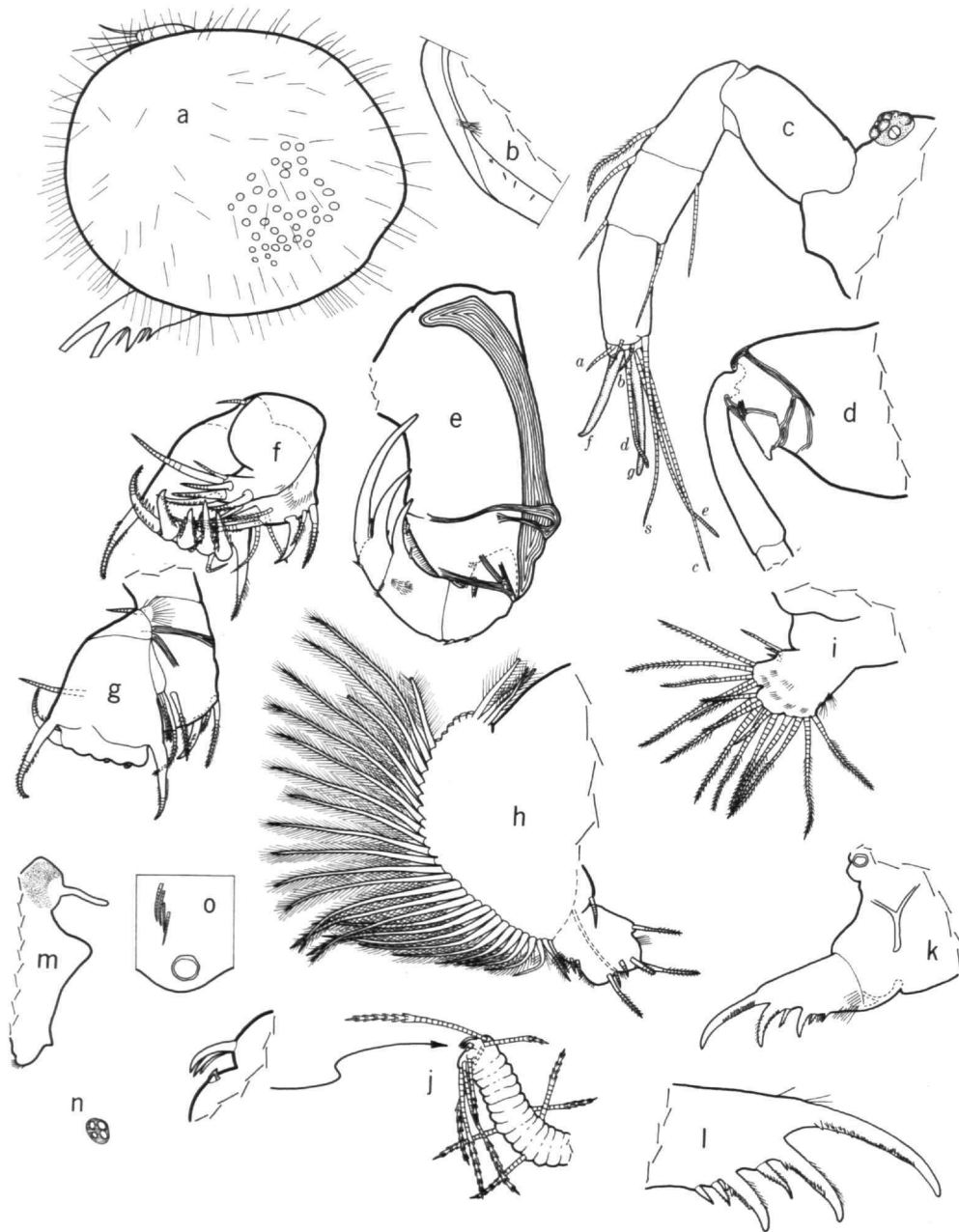


FIGURE 8.—*Ancohenia hawaiiensis*, new species, USNM 151920, holotype, adult female: *a*, complete specimen, anterior to left, not all fossae shown; *b*, infold of left valve showing 2 posterior setose bristle and posteroventral bristles; *c*, right lateral eye and medial view of right 1st antenna; *d*, endopodite and parts of protopodite and exopodite of right 2nd antenna, medial view; *e*, left mandible, medial view; *f*, right maxilla, medial view; *g*, left maxilla, lateral view; *h*, 5th limb; *i*, left 6th limb, lateral view; *j*, 7th limb; *k*, left lamella of furca, Y-sclerite, and genitalia, lateral view; *l*, right lamella of furca, lateral view; *m*, medial eye, rod-shaped organ, upper lip; *n*, right lateral eye; *o*, right brushlike organ and genitalia.



FIGURE 9.—*Ancohenia hawaiiensis*, new species, USNM 151579, paratype, adult male, length 0.88 mm.

ent: 1st endite with 3 bare bristles, 2 short, 1 long; 2nd endite with 5 spinous bristles. End joint with anterior lobe with 7 or 8 spinous bristles, and posterior lobe with 4 spinous bristles; limb hirsute. Anterior lobe of end joint could be interpreted as 3rd endite.

Seventh Limb (Figure 8j): Proximal group with 4 bristles, 2 on each side; distal group with 6 bristles, 3 on each side; each bristle with 3–6 bells and without marginal spines; terminus consisting of 3 long curved teeth opposing 2 or 3 small stout pointed processes forming row.

Furca (Figure 8k,l): Each lamella with 6 claws; claws 1, 2, 4 united to lamella; claws 3 and 5 separated from lamella by suture; claw 6 may be separated or joined to lamella (holotype with claw 6 separated on right lamella and joined on left lamella); claw 3 much shorter and more slender than claw 4; tips of claws 1, 2, 4 more rounded than tips of shorter claws; claws 1–5 with teeth along posterior margins; claws 2–5 with hairs along anterior margins; long hairs present on medial side of right lamella in vicinity of claw 1, on medial side of left lamella in vicinity of claws 4–6, and on lateral side of left lamella posterior to claws.

Eyes: Lateral eyes pigmented with 4 or 5 ommatidia (Figure 8n). Medial eye pigmented, about twice diameter of lateral eye (Figure 8m).

Rod-shaped Organ: Elongate, single jointed with rounded tip (Figure 8m).

Brushlike Organ: Consisting of about 4 minute ringed bristles dorsal to genitalia (Figure 8o).

Upper Lip: Simple curvature with hairs (Figure 8m); triangular process present above lip (Figure 8m).

Posterior of Body: Bare.

Y-shaped Sclerite: Typical for family (Figure 8k).

Eggs: USNM 151920 with 3 large unextruded eggs; USNM 151984 with 5 eggs in marsupium and also with unextruded eggs.

Food: USNM 151920 and 151984 with almost complete crustaceans in gut.

Organisms Attached to Carapace: USNM 151920 with diatoms attached (Figure 7a); USNM 151579 with attached foraminiferan.

DESCRIPTION OF ADULT MALE (Figures 9–13).—Carapace smaller and more elongate than that of female, with shallow incisur and truncate posterior (Figures 9, 10a); in dorsal view male valve slightly more convex than female (compare Figures 6b and 10b).

Ornamentation (Figures 10e,f, 11a,b,e): Similar to that of female.

Infold: Infold in front of narrow caudal process with 4 small bristles forming row near inner margin of infold (Figure 12b); infold behind shallow incisur with 1 minute bristle (Figure 12a).

Selvage: Similar to that of female.

Central Muscle Scars: Consisting of about 17 individual ovoid scars (Figure 12c).

Size: USNM 151927, length 0.93 mm, height 0.72 mm; USNM 151579, length 0.88 mm, height 0.70 mm.

First Antenna (Figure 12d): First joint bare; 2nd joint with 1 spinous dorsal bristle; 3rd joint short, not separated from 4th by suture, with 1 dorsal bristle; 4th joint long with 2 distal bristles, 1 ventral, 1 dorsal; 5th joint wedged between 4th and 6th; sensory bristle of 5th joint with abundant basal filaments ringed proximally; sensory bristle otherwise bare; 6th joint with 1 short, spinous, medial bristle. Seventh joint: a-bristle short, about twice length of bristle of 6th joint; b-bristle more slender than a-bristle but about same length; c-bristle reaching past tip of sensory bristle of 5th joint, with 5 short filaments. Eighth joint: d- and e-bristles bare, d-bristle shorter and more slender than e-bristle; e-bristle reaching tip of sensory bristle of 5th joint; f- and g-bristles clawlike proximally but bristlelike with rings distally, both about same

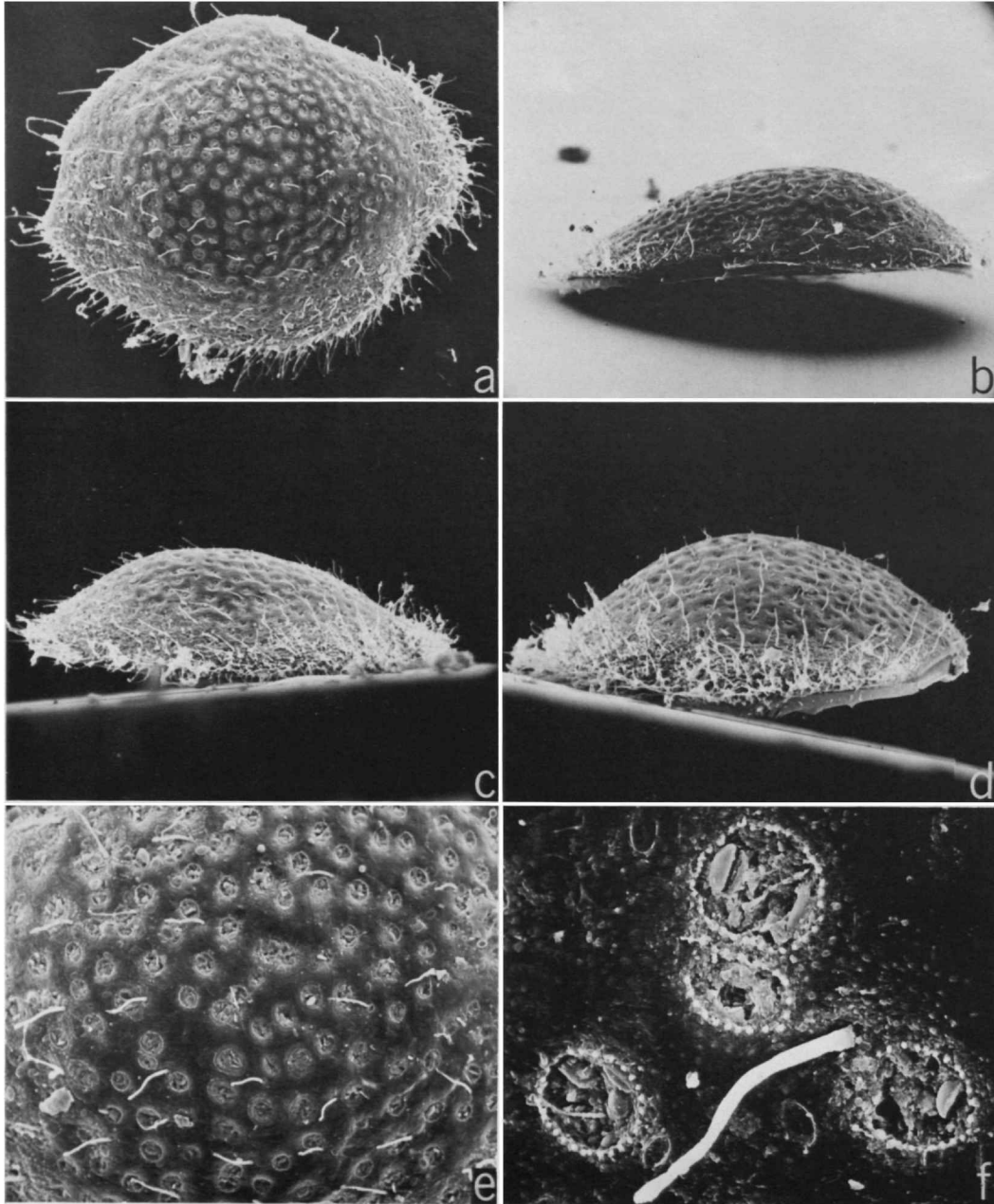


FIGURE 10.—*Ancohenia hawaiiensis*, new species, USNM 151927, allotype, adult male, right valve, outside views: *a*, lateral view, anterior to right, $\times 93$; *b*, dorsal view, anterior to left, $\times 93$; *c*, ventral view, anterior to right, $\times 93$; *d*, anterior view, venter to left, $\times 120$; *e*, fossae and bristles near middle of valve in vicinity of adductor muscle attachments, $\times 200$; *f*, fossae and bristle just below middle of *e*, note diatoms in fossae and diatom outline in epicuticle between fossae, $\times 1100$. (Photos reduced to 75.5 percent for publication.)

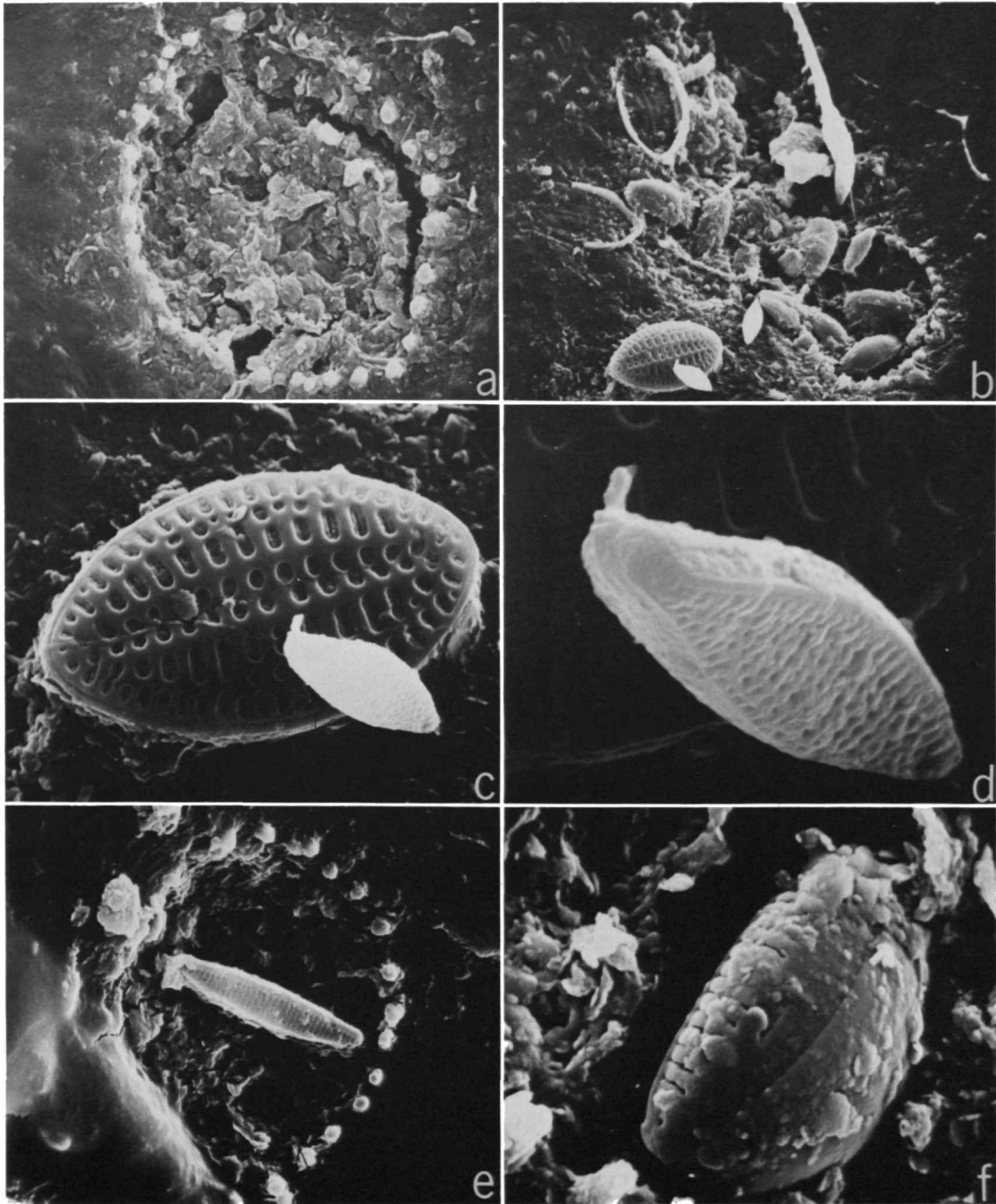


FIGURE 11.—*Ancohenia hawaiiensis*, new species, USNM 151927, allotype, adult male, right valve, outside views: *a*, fossa with peripheral spines from figure 10*e*, $\times 3400$; *b*, diatoms adhering to surface near dorsal margin of valve, $\times 1760$; *c*, detail of diatom in lower left of *b*, $\times 6800$; *d*, egg case? attached to diatom in *c*, $\times 17,600$; *e*, fossa and 2 diatoms, $\times 1760$; *f*, diatom in fossa, $\times 10,000$. (Photos reduced to 75 percent for publication.)

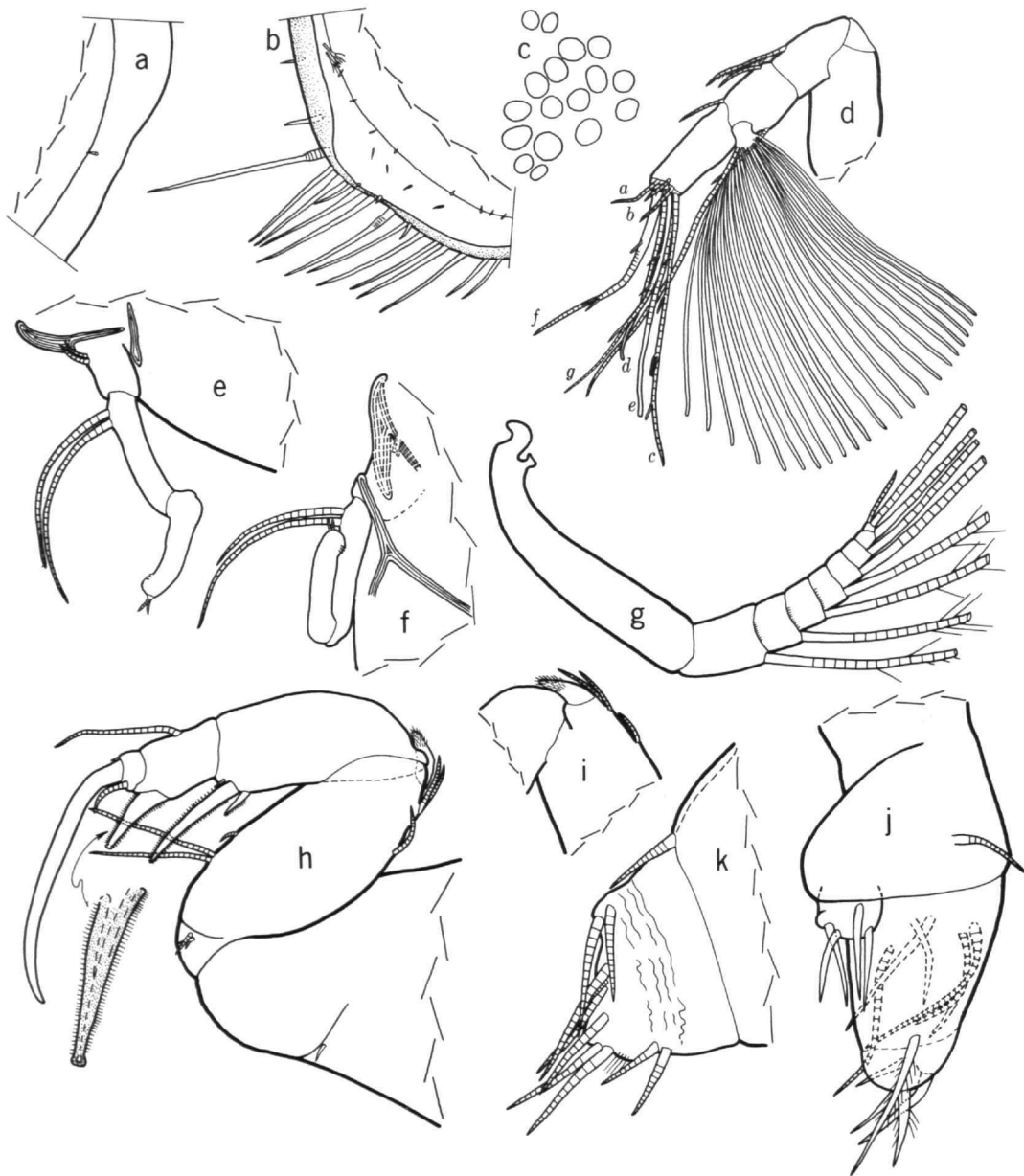


FIGURE 12.—*Anchoenia hawaiiensis*, new species, USNM 151927, allotype, adult male: *a*, anterior of left valve showing minute bristle on infold; *b*, 2 setose bristles on posterior infold and bristles on posteroventral infold of left valve; *c*, central adductor muscle attachment scars on left valve, medial view, anterior to right; *d*, right 1st antenna, medial view; *e*, endopodite and part of protopodite of right 2nd antenna, medial view; *f*, endopodite and part of protopodite of left 2nd antenna, lateral view; *g*, exopodite of left 2nd antenna, lateral view; *h*, right mandible, medial view; *i*, exopodite of left mandible, lateral view; *j*, tip of maxilla; *k*, tip of 5th limb.

length as e-bristle; f-bristle with 2 or 3 short filaments, 1 proximal, 1 or 2 distal; g-bristle with 3 or 4 short filaments.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 12e,f): 1st joint with 2 short proximal bristles; 2nd joint elongate with 2 long proximal bristles; 3rd joint elongate with 2 short terminal bristles and terminal ridges; 3rd joint capable of being reflexed. Exopodite with joint lengths similar to those of female exopodite (Figure 12g); bristle of 2nd joint with few proximal long natatory hairs followed by 9 slender spines and then more natatory hairs; bristles of joints 3–8 with natatory hairs; 9th joint with 1 short bristle with short marginal spines and 1 long bristle with natatory hairs; short faint spines forming row along lateral side of terminal margin of joints 2–4.

Mandible (Figure 12h,i): Coxale endite consisting of small medial spine near ventral margin. Basale: medial side with 3 short proximal bristles near ventral margin; ventral margin with 1 short and 2 long bristles near middle, all bare; dorsal margin with 3 medium length bristles. Exopodite consisting of well developed hirsute process (Figure 12i). Endopodite: ventral margin of 1st joint with 1 stout claw and 2 small bristles, stout claw with short marginal spines projecting vertically; ventral margin of 2nd joint with stout terminal claw with short marginal spines projecting vertically, tip of claw blunt, nozzle-like; a minute medial bristle may be present distal to base of claw; dorsal margin of 2nd joint with long midbristle; 3rd joint with long, bare, curved terminal claw, short ventral bristle, and minute dorsal bristle.

Maxilla (Figure 12j): Appendage reduced; coxale with short anterior bristle; exopodite with 3 bristles; endite and endopodite bristles weakly developed.

Fifth Limb (Figure 12k): Epipodite with 34 bristles; single endite with 1 short bristle. Endopodite hirsute, joints fused: 1st joint with 2 bristles; outer lobe of 3rd joint with 2 bristles; inner lobe of 3rd joint and 4th and 5th joints with total of 6 bristles. Limb smaller than that of female.

Sixth Limb (Figure 13a): Limb with 2 endites: 1st endite with 3 bristles; 2nd endite with 5 hirsute bristles; end joint with 11 hirsute bristles. Limb differs from that of female in bristles on 2nd endite and end joint being hirsute and longer.

Seventh Limb (Figure 13b): Long with 4 ter-

minial bristles, 2 on each side; each bristle with 5 or 6 bells but without marginal spines; terminus blunt with slight depression in middle.

Furca (Figure 13c): Each lamella with 6 claws as on female furca; differs from that of female in having 6th claw separated from both lamellae by suture and in having short spine following 6th claw; left lamella with long hairs medially following 6th claw.

Eyes (Figure 13d): Lateral eye about twice diameter of eye of female, with 7–9 ommatidia. Medial eye pigmented, slightly larger than that of female, larger than lateral eye.

Rod-shaped Organ: Short, expanding distally, with tip roughly rounded (Figure 13d).

Upper Lip: Not observed, but probably similar to that of female.

Posterior of Body: Bare.

γ-Sclerite: Similar to that of female (Figure 13f).

Copulatory Organ (Figure 13e,f): Complex clasping organ hanging down on each side of penis; each clasper consisting of about 3 lobes; main lobe terminating in sclerotized hook; small medial sclerotized process present proximal to tip of hook near 2 short bristles; posterior proximal lobe with 2 short bristles.

Organisms Attached to Carapace: Diatoms abundant on USNM 151927 (Figures 10f, 11b,c,e,f), which also bore a diatom with attached unknown object, possibly an egg case (Figure 11b-d).

CYLINDROLEBERIDIDAE Müller, 1906

CYCLASTEROPINAE Poulsen, 1965

Microasteropteron Poulsen, 1965

TYPE-SPECIES.—*Microasteropteron parvum* Poulsen, 1965.

The only species previously referred to this genus is the type-species, which was collected off Thailand at depths of 9 m and 18 m.

Microasteropteron youngi, new species

FIGURES 14–19

HOLOTYPE.—USNM 151580, adult female on slides and in alcohol.

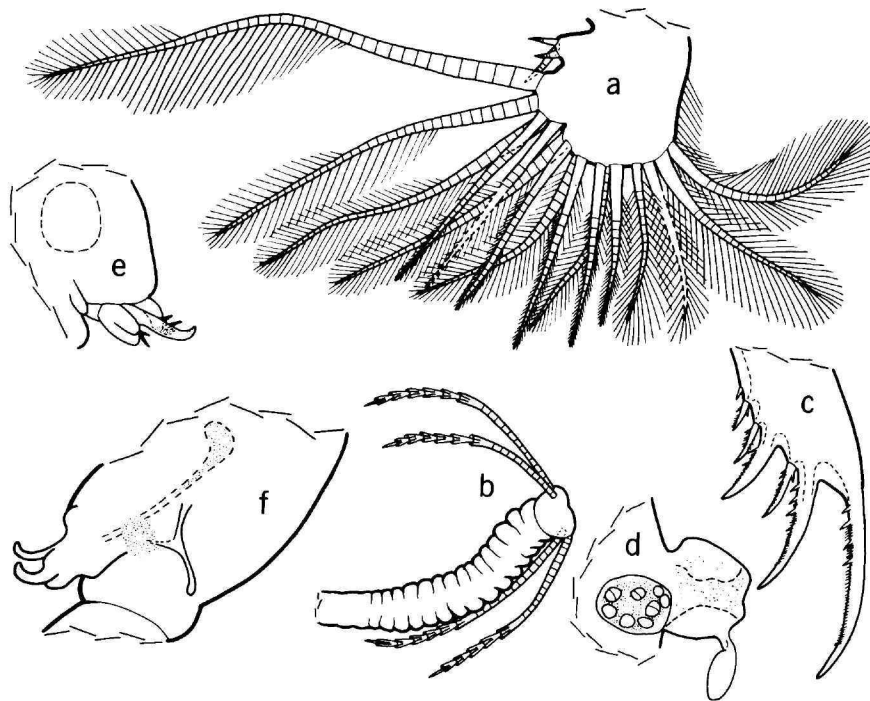


FIGURE 13.—*Ancohenia hawaiiensis*, new species, USNM 151927, allotype, adult male: a, 6th limb; b, 7th limb; c, right lamella of furca; d, right lateral eye, medial eye and rod-shaped organ; e, copulatory organ, anterior to right; f, posterior of body showing copulatory organ and left Y-sclerite, anterior to left.

TYPE-LOCALITY.—Sample 1, between reef and Paiko Peninsula, Maunaloa Bay, Oahu, Hawaii.

ETYMOLOGY.—The species is named after one of the collectors, Dr. Richard Young.

PARATYPES.—USNM 153933, 1 A-1 female, and USNM 153934, 2 very early instars, all from sample 2, same locality as holotype.

DESCRIPTION OF ADULT FEMALE (Figures 14–19).—Carapace oval in lateral view with small shallow incisur and slightly overhanging rostrum (Figures 14, 15a); 2 lateral low ribs present, 1 near dorsal margin, other near ventral margin; these terminate posteriorly in small rounded process; a convex low vertical rib with small rounded process near middle connects with posterior ends of horizontal ribs forming together with them a U-shaped ridge; a small rounded process present in posterodorsal corner of valve dorsal to small process at posterior end of upper rib; middle of each valve with sinus

in dorsal half; carapace widest posteriorly in vicinity of processes at ends of lower horizontal ribs; carapace longest and highest at middle.

Ornamentation: Surface with numerous shallow dish-bottomed fossae (Figures 15, 16b,c); minute pustulae, less abundant within fossae, visible with SEM magnifications (Figures 15f, 16).

Pores: Long bristles emerging from open pores with low lip, sparsely distributed over valve surface (Figures 15e,f, 16a); small pore present near base of some of these bristles (Figure 16a); smaller bristles emerging from closed pores also sparsely distributed; some minute pores without bristles also present (Figure 16e).

Infold: Posteroventral infold with 2 stout easily visible bristles (Figures 17a,b,d,f, 19 b,c); 1 flagellate bristle present just proximal and dorsal to base of each stout bristle (Figures 17c–e, 18a, 19b,c); a 3rd flagellate bristle with more numerous and

slender branches present dorsal to uppermost stout bristle (Figures 17*b,c*, 19 *b,c*); upper stout bristle with 1 minute bristle just outward from base, lower stout bristle with 2 minute bristles just outward from base (Figure 17*e*); 11 minute bristles forming groups of 1 to 4 bristles present on posteroventral infold (Figure 19*b*); infold above shallow incisur with 8 long bristles forming row parallel to anterodorsal margin (Figure 19*a*).

Selvage: Wide lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins of valves.

Central Muscle Scars (Figures 15*d*, 17*a*, 18 *b-d*): Consisting of cluster of about 12 individual oval scars; scar area reflected on outside of each valve by boss with 12 round fossae (Figure 15*d*).

Size: USNM 151580, length 0.73 mm, height 0.52 mm.

First Antenna (Figure 19*d-f*): First joint with short, distal, medial spines near ventral margin and long hairs laterally near ventral margin; 2nd joint with dorsal and ventral hairs and 2 spinous dorsal bristles; 3rd joint short with 2 short spinous dorsal bristles and 1 minute ventral bristle (not seen with certainty); 4th joint with 2 terminal spinous bristles, 1 short dorsal, 1 long ventral; 4th joint with 2 long hairs ventrally; 5th joint with long hairs on lateral surface and long bare sensory bristle; sensory bristle with strong widely spaced rings proximally, weak narrowly spaced rings distally, with conelike tip; 6th limb with minute, terminal, medial bristle. Seventh joint: a- and b-bristles bare about same length as sensory bristle of 5th joint; c-bristle bare, slightly longer than sensory bristle. Eighth joint: d-bristle absent; e-bristle bare, bristlelike, about same length as a-bristle but more slender; f-bristle bare, with proximal part oriented slightly dorsal, about same length as a-bristle; g-bristle bare, slightly longer than other bristles of joints 7 and 8.

Second Antenna (Figure 19*g*): Protopodite with medial hairs near dorsal margin and with long distal medial bristle; endopodite consisting of slight bulge without bristles. Exopodite 9-jointed: 1st joint with minute, medial, terminal spine; bristles of joints 2 and 3 with proximal slender ventral spines and distal natatory hairs; bristles of joints 4-8 with natatory hairs; 9th joint very small, with single natatory bristle.

Mandible (Figure 19*h,i*): Coxale endite with

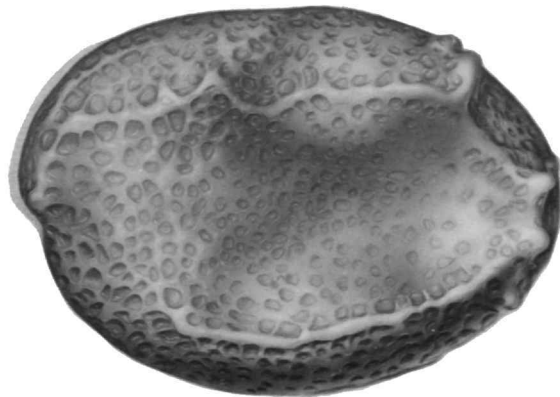


FIGURE 14.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, length 0.73 mm.

few minute spines near base of ventral branch (Figure 19*h*); ventral branch with about 4 oblique rows of spines and 3 small terminal teeth; ventral margin of dorsal branch with small tooth just distal to tip of ventral branch, and 1 single and 2 double teeth proximal to small main spine; tip of dorsal branch hirsute and truncate with 2 spinous bristles, 1 near middle, 1 at dorsal edge; dorsal margin of branch serrate distally. Basale: endite with 3 pectinate end bristles, 1 dwarf bristle, and 1 triaenid bristle with 10 pairs of teeth distal to about 8 pairs of smaller teeth; ventral margin of basale with 1 triaenid bristle similar to that on endite and 1 long spinous bristle, both near middle of margin; dorsal margin with 2 terminal bristles; medial surface with proximal spines near dorsal margin. Exopodite very short with 2 terminal bristles, 1 short, 1 extending past distal margin of 1st endopodial joint. Endopodite: ventral margin of 1st joint with 3 long spinous bristles; dorsal margin of 2nd joint with 5 bristles, 1 proximal, 4 terminal; medial surface with long spines forming rows; end joint with 5 bristles, 4 long, 1 short; medial surface with spines forming rows.

Maxilla (Figure 19*j*): Tip of epipodite missing on specimen examined; dorsal margin of basale with 1 long bristle with few long marginal hairs; ventral margin of basale with 1 minute bristle near middle and 1 long spinous terminal bristle. Endopodite: 1st joint spinous, with long bare beta-bristle; 2nd joint with 3 long bare terminal bristles.

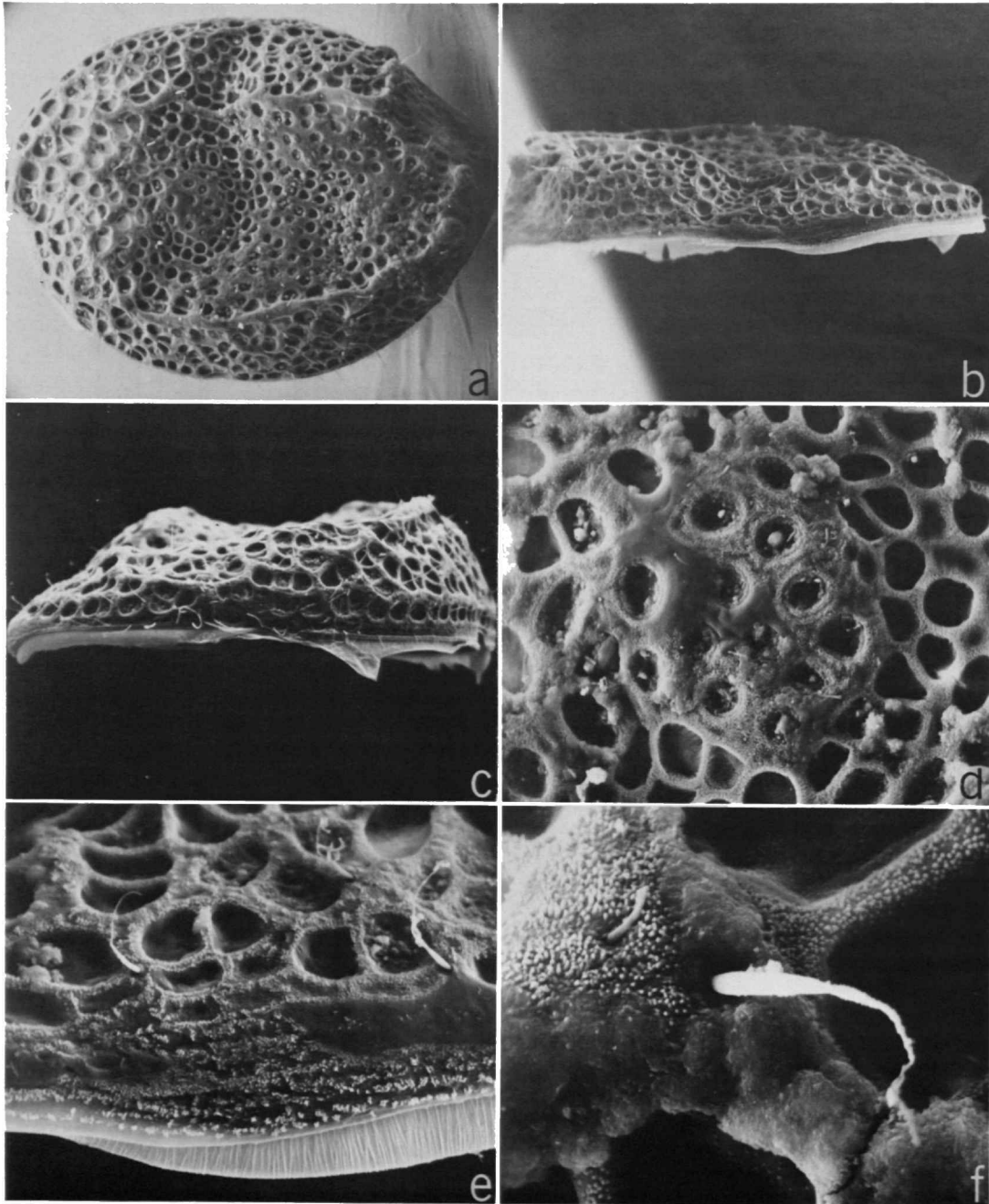


FIGURE 15.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, left valve, outside views: *a*, lateral view, $\times 150$; *b*, dorsal view, anterior to right, $\times 150$; *c*, anterior view, venter to right, $\times 200$; *d*, adductor muscle scar area, from *a*, $\times 635$; *e*, dorsal margin just anterior to middle, from *b*, $\times 730$; *f*, surface bristles, from *a*, $\times 2100$. (Photos reduced to 77:5 percent for publication.)

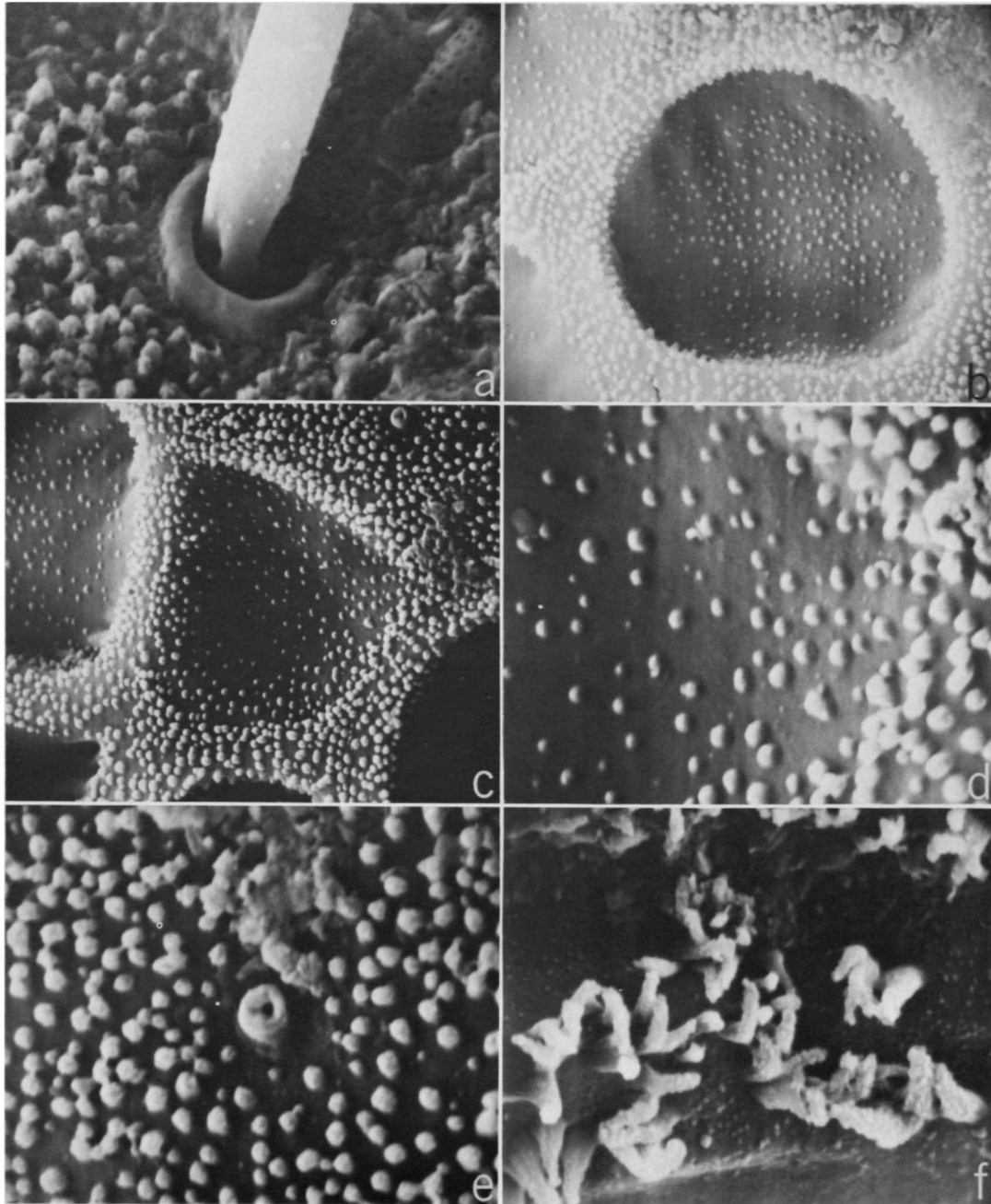


FIGURE 16.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, left valve, outside views: *a*, bristle and pore on valve surface (note hole in bristle near base), $\times 11,000$; *b*, *c*, fossae near bottom of figure 15*d*, $\times 3750$; *d*, pustules near middle of fossae in *c*, $\times 11,000$; *e*, pore and bristle in upper right of *c*, $\times 11,000$; *f*, elongate pustules near dorsal margin of valve, from figure, 12*e*, $\times 10,000$. (Photos reduced to 77 percent for publication.)

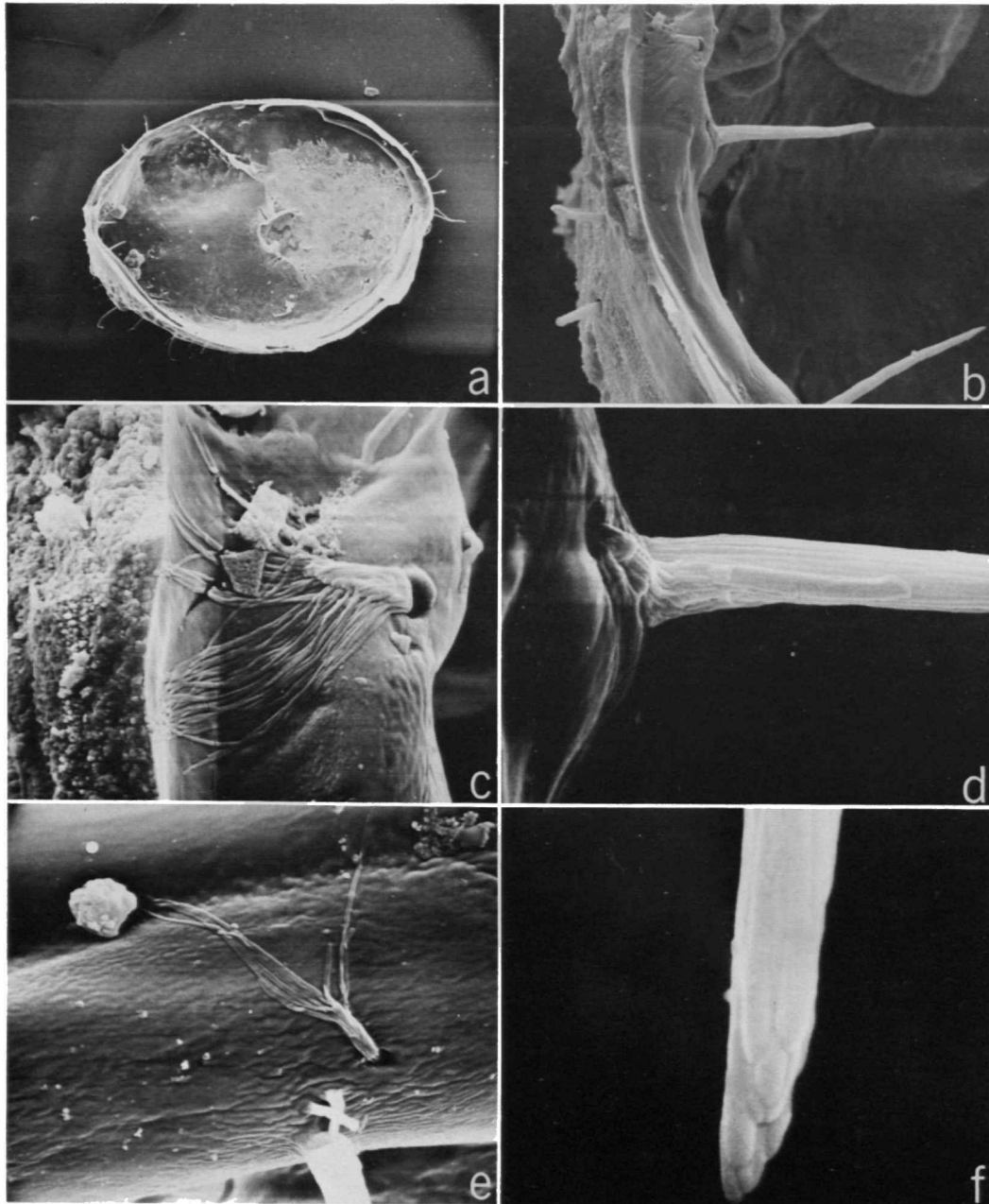


FIGURE 17.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, left valve, inside views: *a*, medial view, $\times 100$; *b*, posterior infold, from *a*, $\times 1000$; *c*, upper setose bristle near top of infold shown in *b*, $\times 4000$; *d*, base of upper bristle in *b*, note tubular bristle in front of main bristle, $\times 5000$; *e*, short tubular bristles and setose bristle near base of lower bristle in *b*, venter in photo towards left, $\times 3500$; *f*, tip of lower bristles in *b*, note numerous tubes forming bristle, $\times 17,600$. (Photos reduced to 74 percent for publication.)

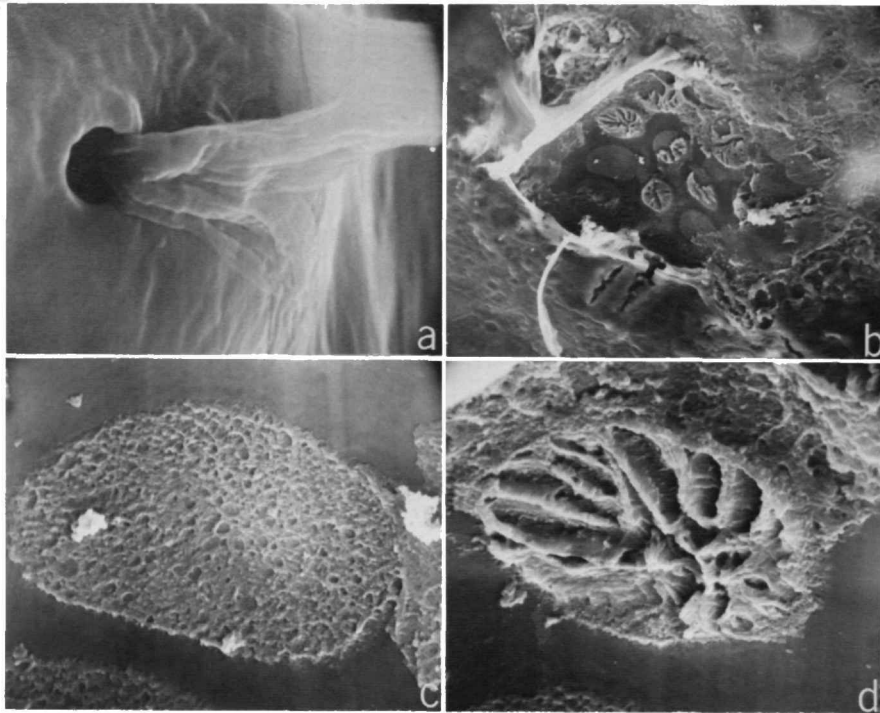


FIGURE 18.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, left valve, inside views: *a*, base of tubular bristle shown in figure 17*d*, $\times 9800$; *b*, central adductor muscle attachments, from figure 17*a*, $\times 55$; *c*, detail of individual muscle attachment near middle *b*, $\times 4160$; *d*, cross-section of muscle near attachment, from *b*, $\times 4160$. (Photos reduced to 62 percent for publication.)

cles. Endite could be construed as 1 lobe with 5 bristles, but slight separation between proximal 2 and distal 3 bristles suggests the presence of 2 endites.

Fifth Limb (Figure 19*k*): Epipodite with about 49 bristles; hirsute exopodial bristle not reaching end of comb; 1 short bristle present proximal and dorsal to base of exopodial bristle; about 21 bristles present along ventral margin of comb; dorsal half of tip of comb with long hairs.

Sixth Limb (Figure 19*l*): Anterior margin with 3 bristles, 1 proximal, 1 near middle, 1 distal; anteroventral corner with 3 or 4 hirsute bristle; lateral flap hirsute but without bristles; ventral margin of limb with 9 bristles, some hirsute, some with long proximal and short distal spines; posteroventral corner indistinct on specimen examined, either bare or with 2 short bristles; limb hirsute.

Seventh Limb (Figure 19*m*): Each limb with 8

bristles, 6 proximally, 3 on each side, and 2 terminally, 1 on each side; each bristle with 3 or 4 bells; terminus with 2 large processes and proximally to these 8 spinous teeth, 4 on each side; microstructure of processes could not be resolved with light microscope.

Furca (Figure 19*n*): Each lamella with 7 claws; claws 1–3 separated by space from claws 4–7; claws taper distally to fine point; claws 1–4 about same width at base; claws 5–7 narrower at base than claw 4.

Eyes: Small darkly pigmented lateral eye without ommatidia (Figure 19*o*); medial eye pigmented, about 3 times diameter of lateral eye (Figure 19*d*).

Rod-shaped Organ: Elongate widening distally, with abundant spines on proximal half, tip rounded (Figure 19*d*).

Posterior of Body: Thumblike spinous dorsum

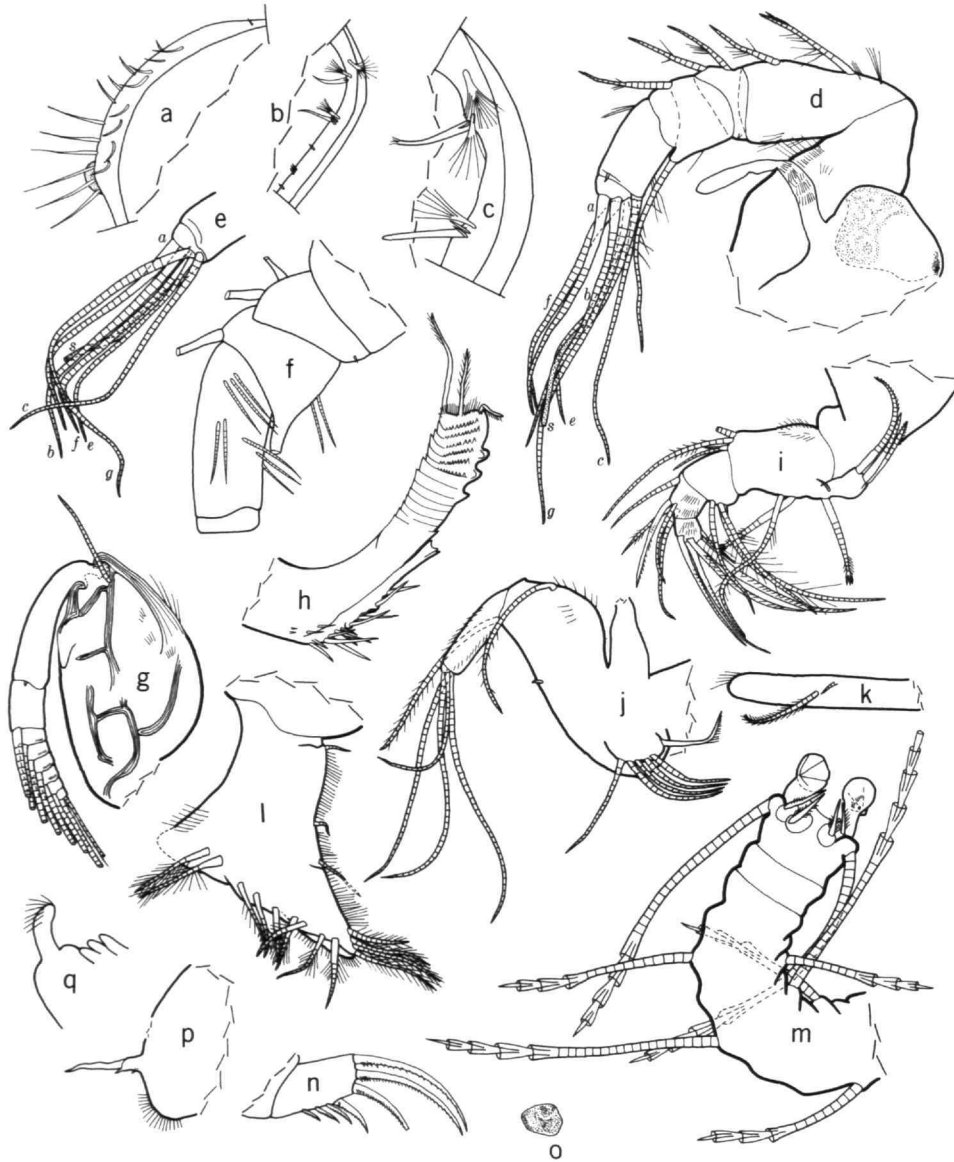


FIGURE 19.—*Microasteropteron youngi*, new species, USNM 151580, holotype, adult female, right valve, inside views: *a*, anterior margin showing bristles on infold and along margin; *b*, posterior infold showing bristles; *c*, detail of *b*. Appendages: *d* medial eye, rod-shaped organ, and medial view of right 1st antenna; *e*, tip of left 1st antenna, lateral view; *f*, distal end of left 1st antenna showing bases of some bristles and long hairs, lateral view; *g*, right 2nd antenna, medial view, tips of exopodial bristles not shown; *h*, coxale endite of mandible; *i*, right mandible, lateral view, coxale endite not shown; *j*, right maxilla, medial view; *k*, comb of left 5th limb showing exopodial bristles, lateral view; *l*, left 6th limb, medial view, morphology of posteroventral corner uncertain; *m*, 7th limb; *n*, right lamella of furca; *o*, lateral eye; *p*, anterior lobe of upper lip, anterior to left; *q*, thumblike dorsum on posterior of animal and tips of 3 gill-like structures.

TABLE 1.—Comparison of morphological characters of *Microasteropteron parvum* Poulsen, 1965, and *M. youngi*, new species

Morphological character	<i>M. parvum</i>	<i>M. youngi</i>
First antenna: length of e-bristle of 8th joint relative to length of a-bristle of 7th joint	2/3	same
Bristle of 6th joint present or absent	absent	present
Second antenna: Number of bristles on endopodite	2	0
Dorsal hairs present or absent on protopodite	absent	present
Mandible: Number of bristles on 2nd endopodial joint	10	5
Maxilla: Number of bristles on last endopodial joint	4	3
Sixth limb: Number of bristles on anterior margin	2	3
Seventh limb: Number of bristles	6	8
Lateral eyes present or absent	absent	present
Rod-shaped organ spinous or bare	bare?	spinous
Upper lip, anterior process present or absent	absent	present

present (Figure 19q).

Gill-like Structures: Small (Figure 19q).

Upper Lip: Consisting of single anterior lobe with large process with few marginal spines (Figure 19p), and posterior hirsute lateral flap on each side of mouth.

DESCRIPTION OF A-1 FEMALE.—Carapace similar to that of adult female. Size: USNM 153933, length 0.60 mm, height 0.42 mm.

Appendages: Not examined in detail but in

general similar to those of adult female. Furca with only 6 claws on each lamella.

Comparisons: The new species *M. youngi* is compared in Table 1 with the only other species in the genus, *Microasteropteron parvum* Poulsen, 1965. Easily discernible differences are the presence of a lateral eye in *M. youngi*, the absence of bristles on the endopodite of the 2nd antenna of *M. youngi*, and the presence of 8 rather than 6 bristles on the 7th limb of *M. youngi*.

Literature Cited

- Brady, G. S., and A. M. Norman.
1896. A Monograph of the Marine and Fresh Water Ostracoda of North-Western Europe. *The Scientific Transactions of the Royal Dublin Society*, 5(2):621-684, plates L-LXVIII.
- Kornicker, L. S.
1958. Ecology and Taxonomy of Recent Marine Ostracodes in the Bimini Area, Great Bahama Bank. *Publications of the Institute of Marine Science (The University of Texas)*, 5:194-300, 89 figures.
1975. Antarctic Ostracoda (Myodocopina) [in two parts]. *Smithsonian Contributions to Zoology*, 163 (2):375-720, figures 241-432, plates 1-9.
- Müller, C. W.
1906. Die Ostracoden der Siboga-Expedition. Number 30 In *Uitkomsten op Zoologisch, Botanisch, Oceanographischen en Geologische Gebied versameld in Nederlandsch Oost-Indie, 1899-1900*, 40 pages, 9 plates. Leiden: E. J. Brill.
1912. Ostracoda. Volume 31 in *Das Tierreich*. 434 pages, 92 figures. Berlin: Verlag R. Friedlander und Sohn.
- Norman, A. M.
1869. Shetland Final Dredging Report, Part II: On the Crustacea, Tunicata, Polyzoa, Echinodermata, Actinozoa, Hydrozoa, and Porifera. Pages 247-336 in *Report of the Thirty-Eighth Meeting of the British Association for the Advancement of Science*. Norwich.
- Poulsen, E. M.
1965. Ostracoda-Myodocopa, 2: Cypridiniformes—Rutidematidae, Sarsiellidae and Asteropidae. Volume 65 in *Dana Report*. 484 pages, 156 figures. Copenhagen: Carlsberg Foundation.
- Scott, Andrew
1905. Report on the Ostracoda Collected by Professor Herdman at Ceylon in 1902. Pages 365-384 in Volume XXII of *Ceylon Pearl Oyster Fisheries, Supplementary Reports*.
- Sharpe, R. W.
1908. A Further Report on the Ostracoda of the United States National Museum. *Proceedings of the United States National Museum*, 35:399-430, plates L-LXV.

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