

Revision, Distribution, Ecology,
and Ontogeny of the Ostracode
Subfamily Cyclasteropinae
(Myodocopina:
Cylindroleberididae)

LOUIS S. KORNICKER

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ABSTRACT

Kornicker, Louis S. Revision, Distribution, Ecology, and Ontogeny of the Ostracode Subfamily Cyclasteropinae (Myodocopina: Cyndroleberididae). *Smithsonian Contributions to Zoology*, number 319, 548 pages, 174 figures, 24 tables, 185 plates, 1981.—The subfamily Cyclasteropinae is revised using the Hennigian system for deriving the cladistics of suprageneric categories. The Cyndroleberididae is subdivided into 3 subfamilies: Cyndroleberidinae Müller, 1906; Cyclasteropinae Poulsen, 1965, and Asteropteroinae, new subfamily, of which the last 2 are treated herein. The Cyclasteropinae is divided into 3 tribes: Cycloleberidini Hartmann 1974, Cyclasteropini Poulsen, 1965, and Tetraleberidini, new tribe. The Cyclasteropini contains only 1 genus, *Cyclasterope* Brady, 1897. The Cycloleberidini contains 3 genera: *Cycloleberis* Skogsberg, 1920; *Leuroleberis*, new genus, and *Alphaleberis*, new genus. The Tetraleberidini contains 2 genera: *Tetraleberis*, new genus, and *Amboleberis*, new genus. The Asteropteroinae contains 7 genera: *Actinoseta* Kornicker, 1958; *Asteropella* Poulsen, 1965; *Asteropteroin* Skogsberg, 1920; *Microasteropteron* Poulsen, 1965; *Asteropterygion*, new genus; *Pteromeniscus*, new genus, and *Omegasterope*, new genus. The following new species are described and illustrated: *Leuroleberis sharpei*, *L. mackenziei*, *Alphaleberis alphathrix*, *Tetraleberis maddocksae*, *T. tanzania*, *Tetraleberis* species 1, *Amboleberis antyx*, *Actinoseta hummelincki*, *A. jonesi*, *A. nodosa*, *Asteropella trithrix*, *A. slatteryi*, *A. kaufmani*, *A. maclaughlinae*, *Asteropella* species 1, *Asteropterygion thomassini*, *A. romei*, *A. dayi*, *A. peterseni*, *Pteromeniscus intesi*, and *Microasteropteron bacescui*. In addition, many old species are redescribed and illustrated. At least 1 species in each genus is illustrated. Keys are presented for the identification of early growth stages as well as for the identification of subfamilies, tribes, genera, and species.

With few exceptions members of the Cyclasteropinae and Asteropteroinae are restricted to the continental shelf (0–200 m), and live mostly in the upper 100 m. All species are benthic, but occasionally specimens are collected above the bottom. Members of both subfamilies appear restricted to tropical and temperate waters. The genus *Asteropella* with 10 species, in addition to 2 left in open category, is endemic to American waters. The monotypic genera *Pteromeniscus* and *Omegasterope* have been collected only off west Africa. Species of *Microasteropteron* have been collected only in the Indo-Pacific Region. Faunal resemblances between regions are discussed.

The relationship between clutch size and carapace size in the Cyndroleberididae is similar to that in the Cypridinidae and Philomedidae. Ontogenetic development, sexual dimorphism, dimorphism between the adult and juvenile stage are investigated, and the comparative morphology of the various taxa under study is discussed in detail.

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Revision, Distribution, Ecology, and Ontogeny of the Ostracode Subfamily Cyclasteropinae (Myodocopina: Cyndroleberididae)

Louis S. Kornicker

Introduction

The only extant superfamily in the suborder Myodocopina (Phylum Crustacea: Subphylum Ostracoda: Class Myodocopa: Order Myodocopida) is the Cypridinacea, which is comprised of 5 families (Cypridinidae, Philomedidae, Sarsiellidae, Rutidermatidae, Cyndroleberididae). The Cyndroleberididae is separated from the other families by a large morphological gap. Despite the gap, the diversity within the Cyndroleberididae is much greater than within either of the remaining four families.

While conducting taxonomic studies of Ostracoda living within limited geographic areas, it became apparent that in order to clarify relationships within the Cyndroleberididae it would be necessary to study members of the subfamily Cyclasteropinae (sensu Poulsen, 1965) on a worldwide basis, and to reexamine older types.

Fortunately, a wealth of new material was available from the vicinity of Africa, Central and North America, Australia, and New Zealand. Also, many types were obtained from museums in Europe. The source of the material is noted in the text. New Zealand specimens have been de-

scribed elsewhere (Kornicker, 1979), but the results of that study are used herein.

Because many members of the Cyclasteropinae (sensu Poulsen, 1965) have ornate carapaces, complex hinges, and diverse bristles on the posterior infold, liberal use was made of the Scanning Electron Microscope in studying details only dimly visible with the light microscope.

In addition to studying the phylogeny, classification, and taxonomy of the Cyclasteropinae, the zoogeography and some aspects of the ecology and biology of the group were investigated.

Magnifications of SEM micrographs are those at which micrographs were taken; however, these were reduced for printing, percentage of reduction noted in legend.

In order to facilitate location of species descriptions in the text, each species has been numbered consecutively, and these numbers placed in front of each species name in keys to the species and in the Contents.

Most terms used throughout this paper are those used previously by Skogsberg (1920) or Poulsen (1965). In future papers I plan to follow the recommendation of Andersson (1977) in calling the rod-shaped organ, the organ of Bellonci.

ACKNOWLEDGMENTS.—I have attempted throughout the paper to acknowledge the source of specimens: in the station list for new material,

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and in the descriptive part for specimens borrowed from museums. I am grateful to all the individuals and institutions for the opportunity to work on the specimens, and also to the scientists, officers, and crews of the research vessels from which the ostracodes were collected. Specimens collected by Dr. Mihai Băcescu, Museum of Natural History "Grigore Antipa," Bucharest, Romania, from along the coast of Africa were received through Dr. Francisca Elena Caraion, Institute of Biological Sciences, Bucharest, to whom I am grateful.

I thank the following people for their help: Carolyn Gast for rendering the shaded drawings of the carapace; Kathryn Schroeder Brown for assisting in preparation and inking of appendage drawings; Martina Picciano for assisting in final preparation of plates and in assembling the manuscript; Thomas E. Bowman and Anne C. Cohen for reviewing all or parts of the manuscript; Donald R. Whitehead for assistance in the Hennigian analysis; Walter R. Brown and Mary J. Mann, Smithsonian Institution, who operated the scanning electron microscope; Mr. Roland Hower, Smithsonian Institution, who assisted in freeze-drying of specimens in preparation for the SEM; and Jack Korytowski for final editing and preparation of the manuscript for publication.

This paper is contribution number 43 of the Smithsonian Institution Investigations of Marine Shallow-Water Ecosystems Project.

DISPOSITION OF SPECIMENS.—Most of the specimens have been deposited at the National Museum of Natural History, Smithsonian Institution. These have been given USNM numbers in the text. The disposition of other specimens is given in the text in the appropriate section where the species is described.

Station List with Specimens Collected

EASTERN PACIFIC OCEAN

Alaska

A vial containing the label "Alaska, C640," and 1 ostracode collected by W. H. Dall was found

on the shelves of this museum. The sample number C640 could not be found in either the museum records or the field notes of Dall. The species locality moves north the northern limit of the subfamily Cyclasteropinae. Because the sample is not well documented in the records I consider the locality questionable, and therefore have questioned it where mentioned in the text and on locality maps.

Leuroleberis sharpei: 1 adult male, USNM 156775.

California

Pillar Point Harbor, Half Moon Bay. Collector: Michael P. Wilderman.

Sta 1C; 23–25 Jun 1975; 1.8 m.

Asteropella slatteryi: 11 specimens, USNM 156807.

Sta 5C; 23–25 Jun, 1975; 1.8 m.

Asteropella slatteryi: 5 specimens, USNM 156803.

Sta 1A; 10–11 Sep 1975; 1.8 m.

Asteropella slatteryi: 33 specimens, USNM 156808; 1 ovigerous female, USNM 156809.

Sta 1B; 10–11 Sep 1975; 1.8 m.

Asteropella slatteryi: 27 specimens, USNM 156804.

Sta 1A; 1–2 Dec 1975; 1.8 m.

Asteropella slatteryi: 32 specimens, USNM 156810.

Sta 1B; 1–2 Dec 1975; 1.8 m.

Asteropella slatteryi: 22 specimens, USNM 156805; 1 adult male, USNM 156806.

Sta 1C; 10–11 Sep 1975; 1.8 m.

Asteropella slatteryi: 22 specimens, USNM 156802.

Monterey Bay, northern part of bay. Collector: Peter N. Slattery.

Sta 1105, 10 Nov 1971, 36°51'N, 121°49'48"W, 16.5 m.

Asteropella slatteryi: 1 juvenile, USNM 156731.

Sta 1152, 36°54'48"N, 122°01'W, 36.0 m.

24 Nov 1971

Asteropella slatteryi: 2 ovigerous females, USNM 156726, 156727.

23 Aug 1972

Asteropella slatteryi: 1 ovigerous female, USNM 156748.

17 Nov 1972

Asteropella slatteryi: 1 ovigerous female, 1 juvenile, USNM 156746.

Sta 1153, 10 May 1972, 36°56'42"N, 121°59'12"W, 14.5 m.

Asteropella slatteryi: 1 juvenile, USNM 156770.

Sta 1156, 10 Nov 1971, 36°53'N, 121°55'W, 37.0 m.

Asteropella slatteryi: 1 A-1 female, USNM 156728.

Sta 1175, 36°50'12"N, 121°50'12"W, 36.5 m.

21 Aug 1971

Asteropella slatteryi: 1 A-1 female, USNM 156723; 1 ovigerous female, USNM 141553; 1 specimen returned to the Moss Landing Marine Laboratory, catalog number A 0420.

3 Feb 1972

Asteropella slatteryi: 2 ovigerous females, USNM 156750, 156771.

11 May 1972

Asteropella slatteryi: 1 ovigerous female, 2 juveniles, USNM 156747.

23 Aug 1972

Asteropella slatteryi: 1 ovigerous female, USNM 156748; 2 specimens, including 1 ovigerous female, returned to the Moss Landing Marine Laboratory, catalog number A 0225.

11 Nov 1972

Asteropella slatteryi: 1 ovigerous female returned to the Moss Landing Marine Laboratory.

Sta 1158, 36°55'06"N, 121°56'42"W, 25.5 m.

2 Feb 1972

Asteropella slatteryi: 1 ovigerous female, USNM 156751.

22 Aug 1972

Asteropella slatteryi: 1 ovigerous female returned to the Moss Landing Marine Laboratory.

Sta 1159, 36°57'06"N, 121°56'12"W, 16.0 m.

20 Aug 1971

Asteropella slatteryi: 1 A-2 female, USNM 156725; 1 juvenile, USNM 156730.

10 Nov 1971

Asteropella slatteryi: 2 ovigerous females, USNM 156724, 156729; 2 ovigerous females, USNM 156732.

2 Feb 1972

Asteropella slatteryi: 1 ovigerous female, 1 adult female, USNM 156745.

3 May 1972

Asteropella slatteryi: 1 ovigerous female, USNM 141554 (Holotype), 2 juveniles, USNM 156768, 156769.

22 Aug 1972

Asteropella slatteryi: 2 specimens returned to the Moss Landing Marine Laboratory.

Monterey Bay. Collector: Peter N. Slattery.

Watsonville outfall; sample 18, 21 Apr 1972; 75 mi (120.0 km) N of Watsonville sewage outlet; depth 14 m.

Leuroleberis sharpei: 1 specimen, USNM 156928.

Watsonville sewage outfall, sample 11, 14 Apr 1972, depth 14 m.

Leuroleberis sharpei: 1 specimen, USNM 156927.

Moss Landing Marine Laboratory, off South Jetty; sta KR- 3-2; 11 Dec 1971; depth 18 m, sand bottom.

Leuroleberis sharpei: 1 adult female, USNM 141552.

Moss Landing Marine Laboratory; sta 2-6; 1 Oct 1972.

Leuroleberis sharpei: 1 juvenile, USNM 156936.

Kaiser Trestle; sta 27-2; 11 Dec 1972.

Leuroleberis sharpei: 2 specimens, USNM 156937.

Moss Landing; 91.4 m off shore Marine Lab, Moss Landing; 19 Nov 1971; depth 6 m, sand.

Leuroleberis sharpei: 1 A-1 female, USNM 139286.

Monterey Bay, Watsonville, off Pajaro River; sta S10109AB; Apr 1975; depth 10 m. Collector: Brad Myers.

Leuroleberis sharpei: 1 specimen, USNM 156929.

Monterey Bay; Monterey Breakwater Study; 11 Feb 1971; Smith-McIntyre grab sampler; bottom sand or muddy sand. Collector: E. C. Haderlie.

Sta A-3; depth 6m.

Asteropella slatteryi: 1 specimen, USNM 143759.

PG and E station 2, Monterey Bay, ¾ mi (1.2 km) NW of Moss Landing Harbor entrance; depth 9 m. Collector: Peter N. Slattery.

Sample B-2; 29 Aug 1974.

Leuroleberis sharpei: 2 juveniles, USNM 156924.

Sample D-2; 29 Aug 1974.

Leuroleberis sharpei: 1 juvenile, USNM 156925.

Sample B-2; 24 Nov 1974.

Leuroleberis sharpei: 1 adult female and 11 juveniles, USNM 156926.

Sample A-1; 11 Jan 1975.

Leuroleberis sharpei: 1 juvenile, USNM 156922.

Sample A-2; 17 Jun 1975.

Leuroleberis sharpei: 1 juvenile and 1 adult female, USNM 156923.

Sample B-2; 17 Jun 1975.

Leuroleberis sharpei: 1 juvenile, returned to Mr. Slattery.

Sample A-2; 23 Jun 1975.

Leuroleberis sharpei: 3 juveniles, USNM 156921.

Sample B-2; 23 Jun 1975.

Leuroleberis sharpei: 4 juveniles, returned to Mr. Slattery.

Sta B-1; depth 2 m.

Leuroleberis sharpei: 1 adult male, USNM 143780.

Sunset Beach, Monterey Bay; 30 May 1972; depth 4 m; sand. Collector Stephenson. Received from Peter N. Slattery.

Leuroleberis sharpei: 1 adult female, USNM 156935.

Monterey Bay, N of Moss Landing harbor entrance; 36°48'N, 121°47'18"W; depth 8.9 m. Collector: Kathleen M. Mawn.

Leuroleberis sharpei: 1 ovigerous female returned to K. M. Mawn.

Huntington Beach; Sta 10, Feb 1976; from immediate vicinity of thermal discharge pipe from

Huntington Beach generating station, 50 m offshore; depth 7 m; pipe is approximately 2 miles (3.2 km) NW of Santa Ana River. Collector: Brad Myers.

Leuroleberis sharpei: 1 ovigerous female, USNM 156774 (specimen had been dry but was rehydrated in glycerin and alcohol by Myers).

Point Loma, San Diego Bay; sta A10; 16 Jan 1975; depth 30–48 m. Collector: Brad Myers.

Leuroleberis sharpei: 1 specimen, USNM 156916.

Point Loma, San Diego Bay; sta A10; 16 Jul 1975; depth 46 m. Collector: Richard Epipane, received from Brad Myers.

Leuroleberis sharpei: 1 juvenile, USNM 156919.

Near mouth of San Diego Bay; sta 1B; 25 Sep 1976; depth 5 m. Collected in Naval Undersea Center Survey; received from Brad Myers.

Leuroleberis sharpei: 3 juveniles, USNM 156920.

Alan Hancock Collection from off California. Received from Brad Myers and returned to him. All except last station collected aboard RV *Velero III*; last station by *Velero IV*.

Sta 1003–39; 18 Aug 1939; Bechers Bay; Santa Rosa Island 34°01'15"N, 120°00'30"W; to 34°01'45"N, 120°00'14"W; depth 25.6 m; dredge; sand shell.

Leuroleberis sharpei: 1 juvenile male.

Sta 1197–40; 31 Sep 1940; E of Gull Island, S of Santa Cruz Island; 33°57'15"N, 119°47'15"W to 33°57'30"N, 119°48'05"W; depth 11 m; dredge; sand.

Leuroleberis sharpei: 3 specimens.

Sta 1198–40; 31 Oct 1940; E of Gull Island, S of Santa Cruz Island; 33°57'30"N, 119°46'15"W to 33°57'30"N, 119°46'30"W; depth 32.9 m; dredge; coarse sand, shell.

Leuroleberis sharpei: 1 adult female.

Sta 1205–40; 24 Oct 1940; S side of San Nicolas Island, 33°12'45"N, 119°29'15"W to 33°12'40"N, 119°29'40"W; depth 42.1 m; dredge; green sand.

Leuroleberis sharpei: 1 adult female.

Sta 1232–41; 15 Dec 1940; 5 mi (8.0 km) SE of San Pedro breakwater; 33°38'15"N, 118°12'15"W to 33°38'25"N, 118°12'05"W; depth 32.9 m; dredge; coarse sand, shell.

Leuroleberis sharpei: 2 specimens.

Sta 1236–41; 16 Feb 1941; 6 mi (9.6 km) SW of Seal Beach; 33°36'30"N, 118°06'25"W to 33°36'45"N, 118°06'15"W; depth 47.5 m; dredge; green sand, mud.

Leuroleberis sharpei: 1 adult male.

Sta 1240–41; 23 Feb 1941, 9 mi (14.4 km) off San Diego; 32°34'50"N, 117°22' 05"W to 32°33'15"N, 117°22' 25"W; depth 146.3 m; dredge; green sand, pebbles; water temperature 58°F.

Leuroleberis sharpei: 1 adult female.

Sta 1241–41; 23 Feb 1941; 7 ½ mi (12.0 km) S of Point Loma; 32°33'10"N, 117°15'16"W to 32°32'16"N, 117°15'28"W, depth 56.7 m; dredge; coarse sand; water temperature 58°F.

Leuroleberis sharpei: 2 specimens.

Sta 1295–41; 12 Apr 1941; 1 mi (1.6 km) SE of Smugglers Cove, Santa Cruz Island; 34°00'25"N, 119°31'30"W to 34°00'35"N, 119°31'30"W; depth 36.6 m; dredge; coralline sand, pebbles.

Leuroleberis sharpei: 1 specimen.

Sta 7534–62; 18 Jan 1962; 25 mi (40.0 km) and 088 True North from Bechers Bay Pier; 34°00'45"N, 118° 22'12"W; bottom grab; depth 12.8–16.5 m; water temperature 11.5°C; bottom of sand, shells, and many *Chaetopterus* tubes. Collected by Alan Hancock Foundation personnel.

Leuroleberis sharpei: 10 specimens including 1 ovigerous female (in collection of Alan Hancock Foundation).

(Exact locality unknown); sta 1. Collector: G. E. MacGinitie.

Leuroleberis sharpei: 3 specimens, USNM 156938.

Santa Catalina Island; 1972; depth 9 m. Collector: Anthony Chess; received from Brad Myers.

Leuroleberis sharpei: 2 adult males, USNM 156917, 156918.

Santa Catalina Island. Collector: C. R. Orcutt.

Leuroleberis sharpei: 1 dry left valve, USNM 44317.

Mexico

Bahia de los Angeles. Collected by J. Laurens Barnard and John R. Grady using a Hayward orange-peel grab modified with a canvas skirt. See Barnard and Grady (1968, fig. 1) for station locality map.

Sta LA 39; 24 Apr 1962; depth 7 m; surface water temperature 21.6°C; gray medium sand.

Asteropella trithrix: 1 juvenile, USNM 156720.

Sta LA 102; 31 Oct 1963; depth 6 m; gray sand.

Asteropterygion oculitristis: 2 females, USNM 151162, 157300.

Sta LA 116; 24 Apr 1962; depth 6 m; surface water temperature 19.8°C; gray medium sand.

Asteropella trithrix: 1 adult female, USNM 157164; 2 specimens, USNM 156719.

Sta LA 130; 24 Apr 1962; depth 7 m; surface water temperature 19.8°C; gray coarse sand.

Asteropella trithrix: 2 ovigerous females, USNM 156721, 156722; 2 adult females, USNM 157158, 156718.

Sta LA 134; 22 Apr 1962; depth 38 m; surface water temperature 19.7°C; brown silty medium sand.

Asteropella trithrix: 1 adult female, USNM 156717.

Sta LA 212; 28 Apr 1962; depth 9–16 m; main west shore of bay.

Asteropella trithrix: 1 specimen, USNM 157159.

Asteropterygion oculitristis: 1 adult female, USNM 157301.

Ensenada, Baja California. Collector: C. R. Orcutt.

Leuroleberis sharpei: 1 dry left valve, USNM 44316.

Baja California, Mexico; U.S. Fisheries Commission Steamer *Albatross* and R/V *Velero IV*.

Sta 2834; 3 May 1888; 26°14'00"N, 113°13'00"W; depth 87.8 m; bottom temperature 12.7 C; yellow mud; large beam trawl.

Leuroleberis sharpei: 1 female, USNM 43780.

Sta 2835; 4 May 1888; 26°42'30"N, 113°34'15"W; depth 10 m; green mud; ship's dredge.

Leuroleberis sharpei: 1 dry left valve, USNM 44318.

Sta 2014–51; R/V *Velero IV*; 14 Apr 1951; Baja California Norte, west side of peninsula, Bahia San Quintin, inside bay, 30°22'50"N, 115°59'45"W; depth 4–8 m, boat dredge; bottom of sand, shells and shell fragments. Collector J. L. Barnard.

Leuroleberis sharpei: 2 specimens including 1 adult male (in collection of Alan Hancock Foundation).

Scammon Lagoon, Baja California Sur, Mexico; sta DB-5; depth 14 m; plankton. Collector: Unknown.

Leuroleberis sharpei: 1 adult male, USNM 156930; 5 adult males, USNM 156931; 1 adult male, USNM 156932.

Costa Rica

Costa Rica, collected by A. Child.

Sta 1566, 11 Aug 1972, Guanacaste, Playa del Coco, first beach S of town, sand beach with rocks and tidepools, 0–1 m.

Amboleberis americana: 1 specimen, USNM 156801.

Sta 1567, 12 Aug 1972, Puntarenas, Golfo de Nicoya, Isla Tolinga, sand beach with rock outcrops, 0–1 m.

Amboleberis americana: 1 specimen, USNM 156800.

Panama

Gulf of Panama, S of Estero Aguadulce on Bahia Parita; sta 20–2; 24 Apr 1971: intertidal and

subtidal depths. Collected by Meredith Jones.

Asteropella species indet.: 2 juveniles, USNM 157171.

Venado Beach; sta 23–2; 25 Apr 1971. Collected by Meredith Jones.

Actinoseta ?hummelincki: 1 juvenile, USNM 157317.

Naos Island; sta 24; 25 Apr 1971. Collected by Meredith Jones.

Asteropterygion oculitristis: 1 adult male, USNM 157302.

Beach between Naos Island and Culebra Island; sta 75; 15 Jan 1972. Collected by Meredith Jones.

Amboleberis americana: 1 juvenile male (retained by Herbert W. Kaufman).

Venado Beach, Sand-Rock spit E of main beach; sta 76; 16 Jan 1972. Collected by Meredith Jones.

Amboleberis americana: 1 ovigerous female, USNM 157200.

Naos Island; beach at Pilot House, SW side of Island; sta 83; 12 Apr 1972. collected by Meredith Jones.

Amboleberis americana: 1 ovigerous female, USNM 157168.

Half way between Changarm and Bruja Point; sta 150-B; 19 Apr 1973. Collected by Meredith Jones.

Asteropella kaufmani variety A: 1 ovigerous female (retained by H. W. Kaufman).

SE of Batele Point; 9 Nov 1973. Collected by Meredith Jones.

Sta 161-2

Actinoseta ?hummelincki: 1 juvenile, USNM 157316.

Asteropella kaufmani variety A: 3 ovigerous females, 2 juveniles, USNM 157170.

Asteropella species indeterminate: 3 juveniles, USNM 157172.

Asteropterygion oculitristis: 1 juvenile, USNM 157306.

Sta 161-3

Asteropterygion oculitristis: 3 juveniles, USNM 157305.

Naos Island, beach at Pilot House, SW side of island; 9 Mar 1974. Collected by Herbert W. Kaufman and Meredith Jones.

Sta 182-1; depth 1.2 m.

Replicate A

Amboleberis americana: 1 juvenile, USNM 157139.

Replicate B

Amboleberis americana: 1 juvenile, USNM 157138.

Replicate C

Asteropterygion oculitristis: 1 juvenile, USNM 157308.

Replicate E

Amboleberis americana: 1 juvenile, USNM 157140.

Sta 182-3; depth 10 cm.

Replicate B

Asteropella kaufmani variety A: 1 adult female USNM 156934.

Amboleberis americana: 2 juveniles, USNM 156933.

Replicate E

Amboleberis americana: 2 juveniles, USNM 157141.

Culebra Island, beach of southwest side of island along narrow neck connecting Naos and Culebra Islands, 10 Mar 1974. Collected by Herbert W. Kaufman and Meredith Jones.

Sta 183-1; depth 1.2 m.

Replicate A

Asteropella kaufmani variety A: 1 adult male, USNM 157155.

Asteropterygion oculitristis: 1 specimen, USNM 157311.

Amboleberis americana: 4 juveniles, USNM 157142.

Replicate B

Asteropella kaufmani variety A: 1 adult female, USNM 157153; 1 ovigerous female, USNM 157154.

Asteropterygion oculitristis: 3 specimens, USNM 157309.

Amboleberis americana: 5 juveniles, USNM 157143.

Replicate C

Asteropella kaufmani variety B: 1 juvenile, USNM 157152.

Asteropterygion oculitristis: 4 juveniles, USNM 157312.

Amboleberis americana: 1 juvenile, USNM 157144.

Replicate D

Asteropella kaufmani variety A: 1 ovigerous female, USNM 157151; variety B: 1 juvenile, USNM 157156.

Asteropterygion oculitristis: 11 juveniles, USNM 157307; 2 specimens, USNM 157310.

Amboleberis americana: 1 adult male, USNM 157145.

Sta 183-2; depth 0.6 m.

Replicate A

Asteropella kaufmani variety B: 1 juvenile female, USNM 157157.

Asteropterygion oculitristis: 1 ovigerous female, USNM 157313.

Amboleberis americana: 22 juveniles, USNM 157146.

Replicate B

Amboleberis americana: 1 ovigerous female, 2 juveniles, USNM 157147.

Replicate C

Amboleberis americana: 1 ovigerous female, USNM 157148.

Replicate D

Asteropella kaufmani variety A: 1 ovigerous female, USNM 157150.

Asteropterygion oculitristis: 5 juveniles, USNM 157314.

Amboleberis americana: 5 juveniles, USNM 157149.

Togolleri Island; sta 5; 17 Oct 1970. Collected by L. S. Kornicker and R. B. Manning.

Amboleberis americana: 1 juvenile, USNM 157198.

Panama City, Venada Beach; 18 Oct 1970. Collected by L. S. Kornicker and R. B. Manning.

Sta 6

Asteropterygion oculitristis: 2 specimens, USNM 157304.

Amboleberis americana: 1 juvenile, USNM 157199.

Sta 7

Asteropella kaufmani variety B: 1 ovigerous female, USNM 157202; 2 specimens, USNM 157315.

Asteropterygion oculitristis: 1 specimen, USNM 157303.

WESTERN ATLANTIC OCEAN INCLUDING
CARIBBEAN SEA

South Carolina

Continental shelf off northern part of South Carolina: R/V *G. W. Pierce*; box corer. Collected by K. Shaw, Texas Instruments Incorporated, Dallas, Texas, for the Bureau of Land Management, U.S.A. Specimens from stations 1B and 1D received from and returned to Marcia Bowen, Virginia Institute of Marine Science. Specimen from station 3A received from Dr. K. Shaw.

Sta 1B, sample 0716-5; 15 Aug 1977; 33°47'N, 78°21'W; water depth 15 m.

Asteropterygion oculitristis: 1 specimen.

Sta 1D, sample 0725-5; 16 Aug 1977; 33°20'N, 77°46'W; water depth 28 m.

Amboleberis americana: 2 specimens.

Sta 3A, sample 0163-2; 17 Feb 1977; 32°26'N, 80°14'W; water depth 14 m.

Asteropterygion oculitristis: 1 specimen, USNM 158350.

Georgia

Continental shelf; 21 Oct 1953; R/V *Gill*.

Sta 36; 31°31'N, 80°35'W, bottom depth 18 m; collected in Gulf III plankton net hauled at 0-10 m depth.

Amboleberis americana: 1 adult male (USNM 150296).

Continental shelf; 26 Feb 1977.

Sta 230-1 (5E); 31°03'N, 80°26'W; depth 33 m. Collected by Willis E. Pequegnat.

Amboleberis americana: 1 specimen (returned to W. E. Pequegnat).

Florida

Continental shelf off Jacksonville; R/V *G. W. Pierce*; box corer. Collected by Dr. K. Shaw, Texas Instruments Incorporated, Dallas, Texas, for the Bureau of Land Management, U.S.A. Specimens received from and returned to Marcia Bowen, Virginia Institute of Marine Science.

Sta 6B; sample 0862-4; 31 Aug 1977; about 30°20'N, 81°15'W; water depth 17 m.

Amboleberis americana: 2 specimens.

Continental shelf off Fort Pierce; Cruise 222, R/V *Gosnold*; Smith-MacIntyre Grab. Collectors: David K. Young Party.

Sta 0262b; 25 Feb 1974; 26°55'42"N, 79°59'30"W; depth 28 m; water temperature 22.5°C; salinity 35.0 parts per thousand.

Actinoseta chelisparsa: 1 specimen, USNM 152493.

Sta 0268b; 28 Feb 1974; 27°28'12"N, 80°15'30"W; depth 10 m; water temperature 18.1°C; salinity 34.5 parts per thousand.

Amboleberis americana: 1 specimen, USNM 156913.

Indian River; posthole digger. Collected by personnel of the Harbor Branch Foundation. (Specimens discussed in Kornicker, 1977a).

Sta 45e; St. Lucie County: Fort Pierce; 100 m W of channel markers 171-172 when they are lined up; 4 Jan 1974; 27°32'12"N, 80°20'36"W; depth 2 m; water temperature 20.0°C, salinity 27.0 parts per thousand.

Asteropterygion oculitristis: 1 specimen with 2nd antennae missing, USNM 152440.

Sta 81b; Brevard County; Sebastian just N of Sebastian Inlet, E side of river 150 m offshore; 15 Nov 1974; 27°51'30"N, 80°27'36"W; depth 40 cm; in *Halodule* grassflat; water temperature 23°C; salinity 34.0 parts per thousand.

Asteropterygion oculitristis: 1 adult male, USNM 153912.

Sta 190b; St. Lucie County; Link Port, 8 km N of Fort Pierce Inlet, W side of river, 100 m N of north jetty of Link Port Canal; 13 m offshore; 16 Jun 1976; 27°32'06"N, 80°20'54"W; depth 30 cm; water temperature 20°C; salinity 20.0 parts per thousand.

Asteropterygion oculitristis: 1 specimen, USNM 157203.

Card Sound; 13 Jan 1976; depth 2 m; mud and sand bottom with the algae *Batophora* and *Laurencia*; Ockleman Dredge. Collector: C. Q. Messing.

Actinoseta chelisparsa: 1 specimen, USNM 156714.

Virginia Key; 17 Feb 1976; NE shore facing Bear

Cut; tidal flat with rocks, green algae, *Caulerpa*, *Padina*; sample taken with small net in few centimeters of water from sediment between rocks. Collector: F. M. Bayer

Actinoseta hummelincki: 1 adult male, USNM 156736, 1 juvenile, USNM 157186.

Virginia Key; sta 1408A; 4 Sep 1963; NE shore; sand flat, rock, *Thalassia* and *Syringodium*; bottom depth 1.2-2 m. Collector: P. Wagenaar Hummelinck.

Actinoseta hummelincki: 12 specimens, USNM 157793; 3 adult females, USNM 150292, 150293, 150295.

NE of South Lake Worth Inlet, Palm Beach County; 31 Oct 1938; trapped in 12 m of water. Collector: F. B. Lyman.

Amboleberis americana: 3 specimens, USNM 81645.

Dry Tortugas. Reported by Tressler (1949).

Sta 31-30, 24 Jul 1930; from seaweed growing on rocks on E side of Loggerhead Key; rocks at low tide. Collector: Dr. W. L. Schmitt.

Amboleberis americana: 1 juvenile male, USNM 88842.

Sta 12-31; 30 Jun 1931; SW channel N of No. 2 Red Buoy; 16-18 m. Collector: Dr. W. L. Schmitt.

Amboleberis americana: 1 juvenile, USNM 88857.

Marker 754; 25 Jun 1931; from stomach of fish *Priacanthus cruentatus*, taken in gill net off Loggerhead key near marker 754. Collector: Dr. Harold W. Manter.

Amboleberis americana: 1 adult male, USNM 88848.

Sta 49-30; 9 Aug 1930; west side of White Shoal; 18-20 m. Collector: Dr. W. L. Schmitt.

Amboleberis americana: a juvenile male, USNM 88844.

Station unknown; 26 Jun 1931; cracked-up rock from W side of Loggerhead Key. Collector: Dr. W. L. Schmitt.

Amboleberis americana: 1 juvenile female, USNM 88851.

Bahama Islands

Sta 57; High Ridge Cay, Andros Island; 5 Mar 1966; 24°17'42"N, 77°45'12"W; depth less than 1 m; near-shore sand. Collected by Meredith Jones.

Actinoseta chelisparsa: 1 adult female, USNM 150283.

Cuba

Gulf of Batabano, 21 Mar 1969. Collected by Dr. Traian Marian Gomoiu, Romanian Institute of Marine Research Station Agigea. Received from Dr. Francisca Elena Caraion, Institute of Biological Sciences, Bucharest, Romania.

- Sta 11, sample 8; depth 4 m; sandy mud with slight odor of H₂S and small amount of *Thalassia* and *Gracillaria*.
Asteropella monambon: 2 adult males, USNM 157366A, 157366B.
- Sta 12, sample 6; depth 6 m; muddy sand with *Thalassia*.
Asteropella punctata: 1 adult female, USNM 157365; 1 A-1 female, USNM 157165.

Puerto Rico

- Sta 1423B, Bahia Fosforescente; 17 Sep 1963; depth 1–1.5 m; sand flat with *Thalassia*. Collected by P. Wagenaar Hummelinck.
Asteropella monambon: 1 ovigerous female, USNM 150285.

Bonaire

Binnenklip lagoon. Collector: P. Wagenaar Hummelinck.

- Sta 1560, entrance to lagoon; 20 m S of Cai; 25 Aug 1967; depth 8 m; sand.
Actinoseta chelisparsa: 1 ovigerous female, USNM 150294; 1 specimen, USNM 157795.
- Sta 1567; 900 m WSW Cai; 24 Aug 1967; depth 3 m; sand with some *Thalassia*.
Actinoseta chelisparsa: 1 ovigerous female and 1 juvenile, USNM 157794.

Curaçao

Piscadera Baai. Collector: P. Wagenaar Hummelinck.

- Sta 1453a, Boca east; 29 Dec 1963; depth 3.5 m; sandy pebbles.
Actinoseta chelisparsa: 1 ovigerous female, USNM 157797.
- Sta 1457, Boca east; 5 Jan 1964; depth 1.5–2 m; sandy pebbles.
Actinoseta chelisparsa: 1 ovigerous female, USNM 157796.
- Sta 1460, Boca west; 14 Dec 1963; *Rhizophora*.
Actinoseta chelisparsa: 1 specimen, USNM 157798.
- Sta 1460a, Boca west; 14 Dec 1963; sandy, *Rhizophora* (decaying), *Halimeda*.
Actinoseta chelisparsa: 1 specimen, USNM 157799.

Belize

Carrie Bow Cay; 16°48'N, 88°05'W; collected with aquarium net or plastic bag scraping surface of sand by Anne C. Cohen, G. Bretschko, K. Ruetzler, B. Kensley.

- Sta CBC 23.4.74; 23 Apr 1974; back reef just behind reef crest, half way between Carrie Bow Cay and Transect I; depth 1 m; with *Acropora palmata* rubble (plate-like), *Dictyota* algae covering.

- Actinoseta hummelincki*: 1 adult male, USNM 157183; 1 juvenile female, USNM 157187; 4 juveniles, USNM 157197.
- Sta AC-CBC-8; 10 May 1976; *Thalassia* zone of lagoon on Transect I; depth 1.5 m; bottom silty sand; water temperature about 28°C; collected near but not in *Thalassia*.
Asteropella monambon: 1 instar III, USNM 156995.
- Sta AC-CBC-16; 12 May 1976; sand and rubble zone of lagoon on Transect I; depth 1.5 m; bottom sandy with some *Thalassia*, staghorn coral, coral rubble; water temperature and sediment temperature 28°C.
Asteropella monambon: 1 instar I, USNM 157173.
- Sta AC-CBC-20; 14 May 1976; 300–400 m and 214°SW from Carrie Bow Cay; depth 9 m; silty sand bottom with *Thalassia* patches adjacent to patch reef; water temperature about 28°C.
Actinoseta chelisparsa: 1 adult male, USNM 157177.
- Sta AC-CBC-23; 14 May 1976; Transect I, patch reef zone of back reef; depth 1 m; sand, silty sand patches between coral heads and under coral rubble; water temperature about 28°C.
Actinoseta hummelincki: 2 juveniles, USNM 157192.
- Sta AC-CBC-24; 15 May 1976; sand trough zone of outer fore-reef on Transect I; depth 24 m; bottom silty sand; water temperature 28°C.
Asteropella monambon: 1 instar II, USNM 157167.
- Sta AC-CBC-26; 15 May 1976; Transect I, small sandy ledge on drop-off cliff of outer fore-reef; depth 18 m; water temperature 28°C.
Actinoseta chelisparsa: 1 juvenile, USNM 157175.
- Sta AC-CBC-30; 16 May 1976; Transect I, spur and groove zone of inner fore-reef; depth 6 m; sand grooves between spurs of coral; water temperature 28°C.
Actinoseta hummelincki: 1 juvenile, USNM 157189; 1 juvenile, USNM 157191; 1 adult male, USNM 157182.
- Sta AC-CBC-31; 16 May 1976; Transect I, spur and groove zone of inner fore-reef; depth 5 m; patch of silty sand under overhanging coral heads.
Actinoseta chelisparsa: 1 juvenile male, USNM 157185 (appendages without muscles, possibly a molted specimen, left valve missing).
- Sta AC-CBC-34; 17 May 1976; Transect I, small sandy ledge on drop-off cliff of outer fore-reef; depth 24 m; partly sheltered by coral head, on sand chute.
Actinoseta chelisparsa: 1 juvenile male, USNM 157176.
- Sta AC-CBC-43; 20 May 1976; Transect I, rubble and pavement zone of back-reef; depth about 80 cm; sand patches between coral heads.
Actinoseta chelisparsa: 1 juvenile, USNM 157181.
Actinoseta hummelincki: 2 juveniles, USNM 157196; 1 juvenile male, USNM 157194; 3 juveniles, USNM 157195, 157193, 157190.

Sta AC-CBC-47; 21 May 1976; Transect I; near bottom of inner reef slope of outer fore-reef, just above sand trough; bottom depth 24 m; sand patch surrounded by coral on slope; water temperature about 28°C.

Actinoseta chelisarsa: 3 juveniles, USNM 157180; 1 juvenile male, USNM 157184.

Sta AC-CBC-56; 19 May 1976; 750 m and 248°SW from Carrie Bow Cay; sandy patch inside patch reef; bottom depth about 4.6 m.

Actinoseta chelisarsa: 1 juvenile, USNM 157179.

Amboleberis americana: 3 specimens, USNM 156989.

Sta AC-CBC-58; 23 May 1976; Transect I, sandy ledge on drop-off cliff of outer fore-reef; depth 34 m; sand ledge under coral head; water temperature about 28°C.

Actinoseta chelisarsa: 1 juvenile, USNM 157174, 1 adult male, USNM 157178.

Sta AC-CBC-64; 24 May 1976; Transect I, patch reef zone of back reef; bottom depth 1.1 m; sand patches between coral rubble.

Actinoseta hummelincki: 1 juvenile, USNM 157188.

Sta AC-CBC-115; 22 Apr 1977; Transect 1, sand and rubble zone of lagoon, about 25 m from beginning of Transect (same locality as AC-CBC-16); bottom depth 1.5m; silty sand with a few pieces of coral rubble, conch shells, not far from *Thalassia* zone.

Asteropella monambon: 1 adult female, USNM 157646.

Sta 156; 3 Feb 1978; *Syringodium* bed near *Thalassia* in lagoon off S end of Carrie Bow Cay; water depth about 1 m; specimen obtained by washing algae.

Asteropella maclaughlinae: 1 adult female, USNM 157774.

Panama

Canal Zone, collected by Meredith Jones.

Sta 174, subsample C; 6 Mar 1974; in *Thalassia* bed in tide pool of reef-flat at Devil's Beach, just W of mouth of Limón Bay; depth less than 1 m; water temperature 33°C; salinity 32.0 parts per thousand.

Asteropella agassizii: 1 juvenile, USNM 157765.

Sta 179, subsample A; 7 Mar 1977; in *Thalassia* bed just inside of eastern breakwater of Limón Bay, Fort Randolph; depth less than 1 m; water temperature 29.0°C; salinity 30.0 parts per thousand.

Asteropella agassizii: 2 ovigerous females, USNM 150288A, B.

Sta 179, subsample B; same station data as subsample A.

Actinoseta chelisarsa: 1 juvenile female, USNM 157764.

Venezuela

W of Punta Charagato, Isla Cubaqua (S of Isla Margarita); sta M-9; 10°50'00"N, 64°09'36"W; 16 Feb 1977; transect from 1.5 m depth to shore; very fine, well-sorted sand; water temperature

22°C; water salinity 34.0 parts per thousand. Collected by Meredith Jones.

Actinoseta jonesi: 1 ovigerous female, USNM 157636; 4 adult females, USNM 157635, 157637, 157649, 157650; 11 specimens, 2 right valves, and 1 left valve, USNM 157700.

Actinoseta chelisarsa: 1 adult female, USNM 157648.

Turpialito (about 20 km E of ferry terminal, Cumaná); sta C-78-1-3; approximately 10°26'-30"N, 64°07'00"W; 16 Jan 1978; depth about 0.3 m; water temperature 28°C; salinity 34.0 parts per thousand.

Actinoseta hummelincki: 1 specimen, USNM 157808.

GULF OF MEXICO

Florida

Placida Harbor (near Charlotte Harbor). Collectors: R. F. Cressey and C. A. Child.

Sample 2; Jul 1974; off Bird Key; depth 1-3 m; Ockelman dredge.

Asteropterygion oculitristis: 1 adult male, USNM 144003.

Sample 3; 1 May 1974; off Bird Key; 2-3 m; Ockelman dredge tied to Otter trawl; mud washings.

Asteropella maclaughlinae: 1 juvenile, USNM 156655.

Tampa Bay; Jul 1965; 1/4 mi (0.4 km) from Egmont Key. Collector: Dr. Sylvia Earle.

Amboleberis americana: 1 ovigerous female, USNM 150290A; 1 juvenile, USNM 150290B.

Anclote Anchorage, west coast of Florida off Tarpon Springs, N of Tampa. Collected by Patsy A. McLaughlin. Grab samples, 15 cm × 15 cm sampler similar to post-hole digger, operated by hand; 5 replicates taken at each station. Trawl samples collected with trawl with 1 m opening and small bag with 1/4 in stretch mesh.

Sta 5, 1 Jul 1976, grab, replicate 5.

Asteropterygion oculitristis: 1 specimen, USNM 157576.

Sta 6.

8 Jan 1976, grab, depth 2.5 m, 15.0°C, replicate 4.

Asteropterygion oculitristis: 1 specimen, USNM 157081.

19 Jan 1976, night trawl, depth 1.25 m, 9.2°C, replicate 3.

Asteropterygion oculitristis: 2 specimens, USNM 157438.

Sta 9, 5 Jan 1976, grab, depth 1.5 m, 13.6°C, replicate 5.

Asteropterygion oculitristis: 1 specimen, USNM 157082.

Sta 14.

- 15 Mar 1976, day trawl, depth 1.5 m, 25.1°C, replicate 3.
Asteropella maclaughlinae: 1 specimen, USNM 157489.
 2 Jun 1976, grab, depth 1.5 m, 25.0°C, replicate 4.
Amboleberis americana: 1 juvenile, USNM 157587.
 Sta 15, 16 Jan 1976, night trawl, depth 2.0 m, 15.8°C, replicate 3.
Asteropterygion oculitristis: 1 specimen, USNM 157086.
 Sta 16, 7 Mar 1976, grab, depth 3.0 m, 23.9°C, replicate 4.
Asteropterygion oculitristis: 1 specimen, USNM 157085.
 Sta 21, 16 Jan 1976, night trawl, water depth 10.75 m, 16.9°C, replicate 2.
Asteropella maclaughlinae: 1 specimen, USNM 157516.
 Sta 22, 7 Mar 1976, grab, depth 1.75 m, 26.2°C, replicate 3.
Asteropterygion oculitristis: 1 specimen, USNM 157084.
 Sta 31.
 9 Jan 1976, grab, depth 0.75 m, 11.9°C, replicate 5.
Asteropterygion oculitristis: 1 specimen, USNM 157083.
 3 May 1976, grab, depth 1.0 m, 24.0°C, replicate 5.
Asteropella maclaughlinae: 1 specimen, USNM 157608.
 Sta 32.
 18 Jan 1976, night trawl, depth 1.75 m, 10.0°C, replicate 5.
Asteropterygion oculitristis: 1 specimen, USNM 157087.
 18 Mar 1976, night trawl, depth 1.0 m, 18.8°C, replicate 4A.
Asteropterygion oculitristis: 1 specimen, USNM 157088.

Alligator Harbor (near Lighthouse Point and Apalachee Bay), Franklyn County; exact date of collecting unknown, about 1957; precise depth and locality unknown. Collector: Darrell K. Jones.

- Sta I, 5-2.
Asteropterygion oculitristis: 1 adult male, USNM 149327.
 Sta II, 5-2.
Asteropella maclaughlinae: 1 juvenile, USNM 149326.
 Sta II, 2-2.
Asteropterygion oculitristis: 1 adult female, USNM 150281.

Panama City, about 2 mi (3.2 km) W of West Pass, which is entrance into St. Andrew Bay; plug sampler operated by hand, sampler dimensions 12.5 cm × 12.5 cm × 23 cm (height). Sediment washed through sieve with mesh of 0.701 mm². Collector: Carl H. Saloman, Southeast Fisheries Center, National Marine Fisheries Service, Panama City, Florida.

- Sta 4; borrow pit; about 610 m offshore; depth 12.8 m; sand substrate.
 21 Sep 1976
Asteropterygion oculitristis: 1 juvenile, USNM 157679.

- 4 Oct 1976
Asteropterygion oculitristis: 1 specimen, USNM 157682.
 1 Dec 1976
Asteropterygion oculitristis: 1 specimen, USNM 157691.
 2 Feb 1977
Asteropterygion oculitristis: 1 specimen, USNM 157678.
 1 Apr 1977
Asteropterygion oculitristis: 1 specimen, USNM 157690.
 Sta 30; about 610 m offshore and adjacent to sta 4; depth 9.1 m; sand substrate.
 16 July 1976
Asteropterygion oculitristis: 1 specimen, USNM 157657.
 3 Aug 1976
Asteropella maclaughlinae: 1 juvenile, USNM 157659.
 10 Aug 1976
Asteropterygion oculitristis: 2 specimens, USNM 157614.
 18 Aug 1976
Asteropterygion oculitristis: 1 specimen, USNM 157616.
 24 Aug 1976
Asteropterygion oculitristis: 6 specimens, USNM 157664,
Amboleberis americana: 1 juvenile, returned to C. H. Saloman.
 1 Sep 1976
Asteropterygion oculitristis: 4 specimens, returned to C. H. Saloman.
 8 Sep 1976
Asteropterygion oculitristis: 1 specimen, USNM 157620.
 21 Sep 1976
Asteropterygion oculitristis: 2 juveniles, USNM 157653.
 4 Oct 1976
Asteropterygion oculitristis: 2 specimens, USNM 157661.
 18 Oct 1976
Asteropterygion oculitristis: 2 specimens, USNM 157655.
 1 Dec 1976
Asteropterygion oculitristis: 1 specimen, USNM 157660.
 4 Oct 1977
Asteropterygion oculitristis: 1 specimen, USNM 157682.
 1 Dec 1977
Asteropterygion oculitristis: 2 specimens, USNM 157691.

TEXAS

Continental shelf off South Texas. Material collected aboard the R/V *Longhorn* by personnel of The University of Texas Marine Science Institute, Port Aransas Marine Laboratory, for the Bureau of Land Management "South Texas Outer Continental Shelf Study." The material was received from and returned to Richard D. Kalke of the Marine Science Institute.

- Sta 4, transect III; 26°58'N, 97°20'W, depth 15 m.
 Replicate 4, 2 Feb 1976.
Asteropella species 1: 1 specimen.

Replicate 5, 26 June 1976

Asteropterygion oculitristis: 1 specimen.

Replicate 3, 22 Sep 1976.

Asteropella species 1: 1 specimen.

Replicate 5, 22 Sep 1976

Asteropella maclaughlinae: 1 specimen.

Asteropella species 1: 1 specimen.

Sta 1, transect IV; 26°10'N, 97°01'W; 27 m.

Replicate 1, 20 Sep 1976.

Asteropella maclaughlinae: 1 specimen.

Sta 4, transect IV, 26°10'N, 97°08'W, depth 15 m.

Replicate 3, 26 Jun 1976.

Asteropella species 1: 1 specimen

Replicate 6, 26 Jun 1976.

Asteropterygion oculitristis: not counted (few).

Replicate 1, 30 Jan 1977

Asteropella species 1: 1 specimen

Replicate 4, 30 Jan 1977

Asteropterygion oculitristis: not counted (few).

Replicate 3, 25 May 1977

Asteropterygion oculitristis: not counted (few).

Continental shelf off Galveston; 1974; R/V *Gyre*; cruise 74-G-10, sta 16(2); 25°10'N, 94°18'W; depth 53.5 m; van Veen grab. Collected by personnel of Texas A&M University, received from David Gettleson.

Ambloberis americana: 1 specimen, USNM 157763.

EASTERN ATLANTIC OCEAN

Mauritania

Collected aboard R/V *Discovery*. Received from Martin Angel.

Sta 7810, 27 Feb 1972, 18°05'12"N, 16°32'00"W, 307 m, benthic trawl.

Pteromeniscus intesi: 1 adult male and 1 juvenile female, USNM 150287A and B.

Sta 7811, 27 Feb 1972, 18°07'36"N, 16°37'12"W, 681-699 m, benthic trawl.

Pteromeniscus intesi: 1 adult male, USNM 156610; 1 adult male and 1 juvenile male, USNM 150286B and C.

SOUTH AFRICA

Lambert's Bay. Collected by N. Christie using a diver-operated suction sampler.

LBT 8J; 29 Sep 1972; depth 0 m (L.W.S.); well-sorted fine sand.

Cycloleberis galathea: 1 A-3 male, USNM 157629; 2 juveniles, USNM 157631.

LBT 10B; 1 Feb 1972; depth 15 m; well-sorted fine sand.

Cycloleberis galathea: 1 adult male, USNM 150298.

LBT 82H; Jan 1972; depth 10² m; well-sorted fine sand.

Cycloleberis galathea: 1 juvenile, USNM 157632.

LBT 100F; Jan 1972; depth 10 m; well-sorted fine sand.

Cycloleberis galathea: 2 juveniles, USNM 157633.

Langebaan Lagoon. Collected by Nigel Christie, Except sta LB-209 and LB-218, which were collected by J. H. Day.

Sta LB-209; 26 Apr 1949; 33°12'S, 18°05'E; intertidal; muddy sand.

Asteropterygion dayi: 1 specimen, returned to J. H. Day.

Sta LB-218; 26 Apr 1949; 33°12'S, 18°05'E; intertidal; muddy sand.

Asteropterygion dayi: 1 specimen, returned to J. H. Day.

Sta LB-573Z; 16 Dec 1974; 33°17'00"S, 18°05'00"E; depth 2.2 m; fine sand.

Asteropterygion dayi: 4 specimens, USNM 157221.

Sta LB-579P; 15 Dec 1974; 33°07'00"S, 18°01'06"E; depth 4.5 m; fine sand.

Asteropterygion dayi: 1 ovigerous female, USNM 151923.

Sta LB-582J; 20 Dec 1974; 33°05'24"S, 18°00'54"E; depth 4.5 m; silt and sand.

Asteropterygion dayi: 1 specimen, USNM 157219.

Sta LB-586S; 18 Dec 1974; 33°05'30"S, 18°00'30"E; depth 6.5 m; sand and gravel.

Asteropterygion dayi: 1 specimen, USNM 157220.

Sta LB-588H; 17 Dec 1974; 33°05'24"S, 18°00'00"E; depth 2.1 m; medium sand.

Asteropterygion dayi: 18 specimens, USNM 157218.

Sta LB-592M; 18 Feb 1975; 33°05'24"S, 18°00'54"E; depth 4.5 m; silt and sand.

Asteropterygion dayi: 1 ovigerous female and 1 adult female, USNM 157213.

Sta LB-593E; 18 Feb 1975; 33°05'00"S, 18°00'36"E; depth 6.5 m; sand and gravel.

Asteropterygion dayi: 1 female, USNM 157214.

Sta LB-595E; 18 Feb 1975; 33°05'12"S, 18°00'24"E; depth 7 m; sand and gravel.

Asteropterygion dayi: 1 juvenile, USNM 157211.

Sta LB-596E; 18 Feb 1975; 33°05'24"S, 18°00'00"E; depth 2.1 m; medium sand.

Asteropterygion dayi: 1 female, USNM 157208; 15 juveniles, USNM 157209.

Sta LB-600N; 17 Feb 1975; 33°06'54"S, 18°01'48"E; depth 4.5 m; fine sand.

Asteropterygion dayi: 1 female, USNM 157216.

Sta LB-601N; 17 Feb 1975; 33°07'00"S, 18°01'12"E; depth 3.5 m; fine sand.

Asteropterygion dayi: 1 ovigerous and 1 adult female, USNM 157215.

Sta LB-604P; 20 Feb 1975; 33°09'30"S, 18°04'24"E; depth 3.1 m; fine sand.

Asteropterygion dayi: 9 juveniles, USNM 157212.

Sta LB-605J; 20 Feb 1975; 33°09'36"S, 18°05'06"E; depth 2 m; fine sand.

Astropterygion dayi: 1 juvenile, USNM 157210.

Saldanha Bay. Collected by Nigel Christie with suction sampler.

Sta SB-410F; 12 Apr 1975; 33°00'21", 17°57'18"E, water depth 5 m; fine sand.

Astropterygion dayi: 1 specimen, USNM 157217.

WESTERN INDIAN OCEAN

Madagascar

Southwest Madagascar, Tuléar coral reef complex, 1969–1972. Collector: Bernard A. Thomasin. For description and map of area see Thomasin (1974).

Sta BT-135; 22 Aug 1969; Grand Récif (barrier reef); radial spur-and-groove system; outer slope; depth 18 m; sand in bottom of grooves.

Alpholeberis alphathrix: 1 female, USNM 157724.

Sta BT-172; 4 Sep 1969; Grand Récif; outer slope; "pylones" transect; depth 29 m; sediment area on the coral flagstone.

Astropterygion thomassini: 1 specimen, USNM 157264; 1 specimen sent to the Museum of Natural History, Paris.

Amboleberis antyx: 1 adult male, USNM 157728.

Sta BT-191; 14 Sept 1969; outer reef slope; off Ankaradanva region; depth 6 m; coarse sand.

Astropterygion thomassini: 1 juvenile, USNM 157235; 1 specimen, USNM 157269.

Sta BT-197; 17 Sep 1969; Grand Récif; outer slope; off Andetoky region; depth 18 m; patches of medium sand.

Alphaleberis alphathrix: 1 juvenile, USNM 157751.

Sta BT-212; 23 Sep 1969; Grand Récif; Grand Vasque (enclosed lagoon); depth 12 m; sandy-muddy tumuli-and-funnels field in the axis of the inner pass.

Tetraleberis maddocksae: 1 juvenile male, USNM 157747.

Sta BT-213; 26 Sep 1969; Ifaty Reef; off Southern "Grande Passe" outer slope; depth 12 m; sand in the bottom of a narrow groove.

Cyloleberis galathea: 1 ovigerous female, USNM 157409; 1 adult female, USNM 157630.

Sta BT-222; 28 Sep 1969; Grand Récif; outer slope; off Andetoky region; depth 24 m; bottom of nodules of "melobesians" or rhodoliths on the layer of coral flagstone.

Cyloleberis galathea: 2 juveniles, USNM 157739, 157735.

Amboleberis antyx: 2 specimens, USNM 157736; 1 specimen, USNM 157738.

Sta BT-224 and 224B; 1 Oct 1969; Grand Récif; outer slope; off "south corner"; depth 17 m; sediment with gravel.

Astropterygion thomassini: 1 specimen, USNM 157223; 1 specimen, USNM 157251.

Cyloleberis galathea: 2 juveniles, USNM 157732.

Sta BT-227; 2 Oct 1969; southern Grand Récif; outer slope; off "south corner"; depth 27 m; sedimentary pocket with nodules of "melobesians."

Astropterygion thomassini: 1 specimen, USNM 157265; 1 specimen sent to the Museum of Natural History, Paris.

Cyloleberis galathea: 1 adult female, USNM 157634.

Sta BT-228; 2 Oct 1969; Grand Récif; outer slope; off "south corner"; depth 17 m; sedimentary pocket at the base of the wave-beaten zone.

Astropterygion thomassini: 2 specimens, USNM 157268, 157284.

Sta BT-230; 3 Oct 1969; Grand Récif; outer slope; off "south corner"; depth 21 m; sedimentary layer on the coral flagstone.

Astropterygion thomassini: 2 specimens, USNM 157230, 157246.

Amboleberis antyx: 1 female (instar IV?), USNM 157625; 1 juvenile male, USNM 157726.

Cyloleberis galathea: 6 juveniles, USNM 157720, 157733, 157742.

Sta BT-231; 3 Oct 1969; Grand Récif; outer slope; off "south corner"; depth 24 m, sedimentary pocket with nodules of "melobesians" (higher levels).

Astropterygion thomassini: 1 juvenile, USNM 157226.

Cyloleberis galathea: 1 juvenile, USNM 157734.

Sta BT-236; 6 Oct 1969; Grand Récif; outer slope; off Ankaradanva region; depth 15 m; layer of coarse sediment with ripple marks at base of coral growths.

Astropterygion thomassini: 1 specimen, USNM 157247, 2 specimens, USNM 157286.

Cyloleberis galathea: 1 juvenile, USNM 157727.

Sta BT-240; 8 Oct 1969; Grand Récif; outer slope; "pylones" transect, depth 36 m; sedimentary pocket in the coral flagstone.

Astropterygion thomassini: 3 specimens including 1 ovigerous female, USNM 157224, 157255, 157288.

Sta BT-255; 15 Oct 1969; Beloza Reef; microatoll flats (generally in turbid zones); small amount of coarse sediment among coral patches.

Astropterygion thomassini: 2 specimens, USNM 157270, 157282.

Sta BT-256; 16 Oct 1969; same locality as sta 255.

Astropterygion thomassini: 1 juvenile, USNM 157227.

Sta BT-257; 18 Oct 1969; same locality as sta 255.

Astropterygion thomassini: 2 specimens, USNM 157260, 157267.

Sta BT-259; 19 Oct 1969; same locality as sta 255.

Astropterygion thomassini: 2 adult males, USNM 157228,

- 157231; 16 specimens, USNM 157229; ovigerous female, USNM 157232; 15 specimens, USNM 157253; 4 specimens, USNM 157258; 7 specimens, USNM 157261; 2 specimens, USNM 157274; 2 specimens, USNM 157276, 157241, 1 specimen, USNM 157408.
Cycloleberis galathea: 4 juveniles, USNM 157725, 157731, 157745, 157749.
- Sta BT-261; 22 Oct 1969; Grand Récif; outer slope; off Ankaradanva region; depth 26 m; grooves of sediment on the coral flagstone.
Astropterygion thomassini: 2 specimens, USNM 157243.
Cycloleberis galathea: 2 specimens, USNM 157737.
- Sta BT-262; 25 Oct 1969; Songoritelo Reef; microatoll flats (generally in turbid zones); small amount of coarse sediment among coral patches.
Astropterygion thomassini: 2 specimens, USNM 157238; 2 specimens USNM 157271.
- Sta BT-263; 26 Oct 1969; same locality as sta 262.
Astropterygion thomassini: 1 specimen, USNM 157277; 2 specimens sent to the Museum of Natural History, Paris.
- Sta BT-270; 30 Oct 1969; Sarodrano Reef; microatoll flats (generally in turbid zones); small amount of coarse sediment among coral patches.
Astropterygion thomassini: 6 specimens, USNM 157266; 3 specimens, USNM 157275, 157237, 157280.
- Sta BT-272; 30 Oct 1969; same locality as sta 270.
Astropterygion thomassini: 3 specimens, USNM 157239; 1 specimen, USNM 157279.
- Sta BT-274; 31 Oct 1969; same locality as sta 270.
Astropterygion thomassini: 2 specimens, USNM 157225; 2 specimens, USNM 157236; 2 specimens, USNM 157250, 157254.
- Sta BT-330; 2 Sep 1971; Grand Récif; outer slope; depth 60 m; (M. Pichon's dredging D. 11).
Astropterygion thomassini: 1 specimen, USNM 157281.
- Sta BT-600; 6 Apr 1972; Grand Récif; Ankaradanva region; inner slope; submerged hydraulic dune (accumulation of medium and fine well-sorted sand); depth 5–6 m.
Astropterygion thomassini: 1 specimen, USNM 157285.
- Sta BT-602; 7 Apr 1972; Grand Récif; Ankaradanva region; inner slope; depth 6 m; fine sand.
Alphaleberis alphathrix: 1 adult male, USNM 157411.
- Sta BT-616; Apr 1972; Tuléar Lagoon; behind Southern Pass; depth 12 m; coarse sand; dredging.
Astropterygion thomassini: 1 specimen, USNM 157256.
- Sta BT-617; 9 Apr 1972; same locality as sta 616.
Astropterygion thomassini: 1 specimen, USNM 157287.
- Sta BT-620; 11 Apr 1972; same locality as sta 616.
Alphaleberis alphathrix: 1 juvenile, USNM 157744.
- Sta BT-621; 11 Apr 1972; same locality as sta 616.
Astropterygion thomassini: 3 specimens, USNM 157252.
- Sta BT-622; 11 Apr 1972; same locality as sta 616.
Astropterygion thomassini: 1 specimen, USNM 157259.
- Alphaleberis alphathrix*: 1 adult male, USNM 150297.
Tetraleberis tanzania: 1 juvenile, USNM 157740.
- Sta BT-623; 11 Apr 1972; Tuléar Lagoon; behind Southern Pass area; south of Microbe reef; dredging.
Astropterygion thomassini: 2 specimens, USNM 157283, 157722.
- Tetraleberis tanzania*: 1 adult male, USNM 157721.
- Sta BT-678; 26 Apr 1972; Grand Récif; seagrass bed on reef flat, *Diarsis distorta* facies.
Astropterygion thomassini: 1 specimen, USNM 157289.
- Sta BT-691; 29 Apr 1972; Grand Récif; reef flat; zone of tumulus sand without seagrass.
Astropterygion thomassini: 1 specimen sent to the Museum of Natural History, Paris.
- Sta BT-693; 29 Apr 1972; same locality as sta 691, (with *Halophila*).
Astropterygion thomassini: 2 specimens, USNM 157249.
- Sta BT-712; 9 May 1972; Grand Récif; Petite Vasque 3 (residual pool 3); depth 8 m; coarse sand.
Astropterygion thomassini: 1 specimen, USNM 157222; ovigerous female, USNM 157169; 2 specimens sent to the Museum of Natural History, Paris.
- Sta BT-726; 20 May 1972; Tuléar Lagoon; behind Southern Pass area; depth 12 m; sand; slightly marshy.
Astropterygion thomassini: 1 specimen, USNM 157262.
- Sta BT-730; 23 May 1972; Tuléar Lagoon; behind Southern Pass area; depth 12 m; sand with scattered corals and Foraminifera.
Alphaleberis alphathrix: 1 adult male sent to the Museum of Natural History, Paris; 2 specimens, USNM 157729.
- Sta BT-734; 24 May 1972; Tuléar Lagoon; Southern Pass; sand; marshy-with-Foraminifera facies and free-living corals.
Astropterygion thomassini: 1 specimen, USNM 157257; 1 adult male, USNM 151161 (holotype).
- Alphaleberis alphathrix*: 1 juvenile, USNM 157741.
- Sta BT-737; 24 May 1972; same locality as sta 734 (greater abundance of corals).
Astropterygion thomassini: 2 specimens, USNM 157244.
- Sta BT-738; 25 May 1972; Tuléar Lagoon; Southern Pass; depth 12 m; sandy.
Astropterygion thomassini: ovigerous female, USNM 157233; 5 specimens, USNM 157234.
- Sta BT-740; 25 May 1972; Tuléar Lagoon; Southern Pass; depth 12 m; sand.
Tetraleberis tanzania: 2 juveniles, USNM 157748.
- Sta BT-761; 6 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); coarse sand and large pieces of coral.
Astropterygion thomassini: 1 specimen, USNM 157242.
- Sta BT-770; 6 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); depth 18 m; soft mud.
Tetraleberis maddocksae: 1 juvenile female, USNM 157626.
- Sta BT-771; 6 Jun 1972; Grand Récif; Grand Vasque

(enclosed lagoon); depth 17 m; muddy-sandy tumuli-funnels.

Tetraleberis maddocksae: 1 specimen, USNM 157750.

Sta BT-777A; 7 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); inner slope on the side of the outer reef front; depth 7 m.

Alphaleberis alphathrix: 1 juvenile, USNM 157746.

Sta BT-778; 7 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); inner slope on the side of the outer reef front; depth 10 m; rugged land with craters.

Astropterygion thomassini: 3 specimens, USNM 157240.

Sta BT-779; 7 Jun 1972; same locality as sta 778; depth 4 m, sand; top of sandy slope accumulation.

Astropterygion thomassini: 1 specimen, USNM 157248; 2 specimens, USNM 157273.

Sta BT-813; 18 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); depth 18.5 m; soft mud.

Tetraleberis maddocksae: 1 ovigerous female, USNM 157723.

Sta BT-814; 18 Jun 1972; Grand Récif; Grand Vasque (enclosed lagoon); south zone; depth 3-5 m; areas of sand with plants.

Astropterygion thomassini: 1 specimen, USNM 157263.

Sta BT-822D; 5 Jun 1972; Nosy Vé channel (between island and Anakao coast); inner reef slope; depth 7-8 m; medium sand.

Astropterygion thomassini: 3 specimens, USNM 157245.

Tetraleberis tanzania: 1 late juvenile, USNM 157730.

Sta BT-836; 4 Jul 1972; Grand Récif; Petite Vasque (residual pool).

Alphaleberis alphathrix: 1 juvenile, USNM 157743.

Sta BT-852; 13 Jul 1972; Nosy Vé Island; East Beach; infralittoral; coarse sand with crushed corals.

Alphaleberis alphathrix: 1 ovigerous female, USNM 157410.

Sta BT-876; 14 Jul 1972; Nosy Vé Island; West Beach; seagrass bed with marl behind beachrock; muddy coarse sand.

Astropterygion thomassini: 1 specimen, USNM 157278.

Sta BT-878; 14 Jul 1972; same locality as sta 876 (also with *Syringodium isoetifolium*).

Astropterygion thomassini: 2 specimens, USNM 157272.

Sta BT-880; 14 Jul 1972; same locality as sta 876 but with only *Diplanthera uninervis*.

Astropterygion thomassini: 2 specimens, USNM 157273.

Northwest Madagascar; sta BT-356; 7 Aug 1969; slope of outer submerged coral bank forming part of submerged barrier reef just in front of Nosy Bé Island; depth 38 m; coarse sand; collected with hydraulic air-sucker by Bernard A. Thomassin.

Cycloleberis galathea: 1 juvenile, USNM 157757.

Somalia

Sta 9-446; off Somalia; R/V *Anton Bruun*; 16 Dec 1964; 09°41'N, 51°03'E; depth about 65 m; Pierce dredge. Collector: E. L. Pierce.

Tetraleberis tanzania: 2 juveniles (probably instar II), USNM 157627, 175628.

Tetraleberis species 1: 1 juvenile (instar I), USNM 157416.

Tetraleberis species indeterminate: 2 juveniles (instar I), USNM 157699.

Zanzibar

Latham Island.

Sta LK-35; R/V *Anton Bruun*, ship at anchor; 19 Nov 1964; 6°54'S, 39°56'E; depth 20 m; sand bottom. Collector E.L. Pierce.

Tetraleberis species indeterminate; 1 juvenile (instar I), USNM 157698.

Tanzania

Tanzania. Collected by Dr. Mihai Băcescu aboard the R/V *Thalassa*. The *Thalassa* cruise was organized and supported by the Institut Scientifique et Technique de Pêche Maritime de France. I have incomplete data for many of the stations and some of the labels had decomposed, but have been informed that the majority of the stations were off East-Kunduchi in shallow water (littoral) and none deeper than 25 m, many collected in the vicinity of coral reefs. I received the specimens from Dr. Francisca Elena Caraion.

Sta 9M; 7 Dec 1973; off Kunduchi, net dredge in ponds with *Thalassia* during ebttide.

Astropterygion romei: 1 specimen, USNM 157710.

Sta 24; off Kunduchi; 24 Dec 1973; net dredge through *Syringodium* during ebttide; depth 0.71 m.

Astropterygion romei: 4 specimens, USNM 157715.

Sta 54; Mbudya Isle, East Kunduchi; 19 Jan 1974; depth 5-6 m; coral sand.

Astropterygion petersemi: 1 specimen, USNM 157717.

Astropterygion romei: 2 specimens, USNM 157711.

Sta 59; no station data.

Astropterygion romei: 1 A-1 male, USNM 157705.

Sta 64; no station data.

Astropterygion romei: 2 specimens, USNM 157714.

Sta 79; no station data.

Astropterygion romei: 1 specimen, USNM 157707.

Sta 80; no station data.

Asteropterygion romei: 2 specimens, USNM 157712; 1 ovigerous female, USNM 157506.

Tetraleberis tanzania: 1 female (adult or A-1 instar), USNM 157414.

Sta 81; off Kunduchi; 12 Jan 1974; net dredge during ebbitide; depth 0.5 m; sand and mollusks.

Asteropterygion romei: 1 specimen, USNM 157709.

Sta 105; off Kunduchi; coralligenous sand; 2 m.

Asteropterygion romei: 1 ovigerous female, USNM 157703.

Sta 107; Mbudya Isle, East Kunduchi; 7 Jan 1974; on sponges.

Asteropterygion peterseni: 1 specimen, USNM 157716.

Asteropterygion romei: 3 specimens, USNM 157708.

Sta 111?; no station data.

Asteropterygion romei: 1 adult male, USNM 157704.

Sta not designated; off Kunduchi; 17 Jan 1974; from *Syringodium*; exact water depth unknown, but probably about 0.5 m.

Asteropterygion peterseni: 2 ovigerous females, USNM 157701, 157702.

Station not designated; traverse off East Kunduchi.

Asteropterygion romei: 1 specimen, USNM 157713.

Tetraleberis tanzania: 1 adult male, USNM 157415.

Farquhar Group

North Island.

Sta LK 48; R/V *Anton Bruun*; 7 Dec 1964; 9°07'S, 51°11'50"E; in lagoon and near outer shore of island; in *Cymodocea* bed on fairly coarse sand; collected by scraping sediment surface. Collector: Louis S. Kornicker.

Actinoseta nodosa: 3 empty valves, USNM 157418.

Kenya

Andormache Reef, off Mombasa; R/V *Anton Bruun*. Collector: Louis S. Kornicker.

Sta LK 28; 14 May 1964; reef near south channel entrance to Mombasa Island; 4°4'53"S, 39°40'35"E; depth 1-4 m; thin sand with *Thalassia*.

Asteropterygion romei: 1 early instar, USNM 157718.

Sta LK 29; S of south channel off Mombasa Island; 15 Nov 1964; lagoon landward of reef flat; depth one-third to 1 m; thin sand with *Thalassia*.

Asteropterygion romei: 1 A-1? female, USNM 157413.

Bab el Mandeb (strait between Red Sea and Gulf of Aden)

Sta 103; 15 March 1977; R/V *Thalassa*; 12°18'00"N, 43°23'02"E; water depth 24 m; Charcot dredge; collected by Dr. M. Băcescu.

Microasteropteron basescui: 9 ovigerous females, USNM 157773, 157775, 157788.

Asteropterygion romei: 1 juvenile, USNM, 157804.

Cycloleberis species indet.: 9 juveniles, USNM 157800.

Tetraleberis species indet.: 4 juveniles, USNM 157801.

(This sample also contains 38 specimens of a new species of *Asteropterygion* that came to my attention too late for inclusion in this paper, USNM 157802, 157803, 157806.)

EASTERN INDIAN OCEAN

Maldive Islands

Between Imma and Hura Islands

Sta LK 17; R/V *Te Vega*; about 3 m from shore; 20 Mar 1964; depth one-third m; *Thalassia* flat on sand substrate; collected by scraping sediment surface. Collector: Louis S. Kornicker.

Actinoseta nodosa: 1 juvenile female, USNM 157417.

WESTERN PACIFIC OCEAN AND ADJACENT SEAS

Japan

Kagami-ga-ura Bay, Tateyama, Chiba Prefect; 26 Jul 1970; plankton net drawn 0-1 m below water surface at night; depth 3-6 m. Collected by Dr. F. I. Tsuji and Dr. Y. Haneda.

Tetraleberis species indeterminate: 1 juvenile (instar 1), USNM 134476 (referral considered questionable).

Enosima; collected prior to 1890; depth 2.19 m. Collected by Dr. Hilgendorf. This material is part of type-series.

Tetraleberis brevis: 14 specimens, Zoological Museum, Berlin, number 6909, identified originally by G. W. Müller.

Australia

New South Wales, sta III, dredge sta 903, 1.67 km E of Malabar outlet, Malabar, Sydney; 30 Aug 1973; 33°58'12"S, 151°17'07"E; depth 65.8 m. Australian Museum Shell Benthic Survey. I received the specimens from Patrick De Dekker.

Asteropterygion magnum: 1 female (probably A-1 instar), USNM 157762.

New South Wales, Belmont and Burwood beaches (near Newcastle); depth range 12–28 m; sandy bottom. Collected by Helen Fisher of the Australian Museum. I received these specimens from Patrick De Dekker.

Sta 2.06.02.02.04, 17 Mar 1975.

Leuroleberis mackenziei: 1 adult male, USNM 157622.

Sta 2.06.03.02.02, 17 Mar 1975.

Leuroleberis mackenziei: 1 juvenile female, USNM 157623.

Sta 2.09.01.02.01, 18 Mar 1975.

Leuroleberis mackenziei: 1 juvenile, USNM 157624.

New South Wales, I received from K. G. McKenzie 2 specimens without specific location data. The label contained only the information that they had been collected by K. Sheard. Both specimens may have been collected together, but of this I am not sure.

Leuroleberis mackenziei: 1 female, USNM 156967; 1 adult male, USNM 157127.

Species-Locality List

(Including records by other authors; asterisk indicates new records)

location/species	no. of stas.	depth (m)
EASTERN PACIFIC REGION		
Alaskan Coast (locality questionable, see "Station List")		
<i>Leuroleberis sharpei</i> *	1	?
California		
Half Moon Bay		
<i>Asteropella slatteryi</i> *	7	?
Monterey Bay		
<i>Leuroleberis sharpei</i> *	18	2–18
<i>Asteropella slatteryi</i> *	19	6–37
Huntington Beach		
<i>Leuroleberis sharpei</i> *	1	7
Continental Shelf including offshore islands, 32°34'–50"N to 34°01'15"N		
<i>Leuroleberis sharpei</i>	17	9–146.3
San Diego Bay		
<i>Leuroleberis sharpei</i>	5	5–48
Mexico, Baja California		
Ensenada		
<i>Leuroleberis sharpei</i>	1	?

Bahia San Quintin		
<i>Leuroleberis sharpei</i> *	1	4–8
Scammon Lagoon		
<i>Leuroleberis sharpei</i> *	1	14
<i>Asteropella scammonensis</i>	3	?–21
Continental Shelf off southern part of peninsula, 26°14'00"N to 26°42'–30"N		
<i>Leuroleberis sharpei</i> *	2	10–87.8
Bahia de los Angeles		
<i>Asteropella trithrix</i> *	5	6–38
<i>Asteropterygion oculitristis</i> *	2	6–16
San Salvador		
<i>Asteropella</i> species indet.	1	sublitoral
Costa Rica		
<i>Amboleberis americana</i> *	2	0–1
Panama		
Beaches and subtidal		
<i>Actinoseta ?hummelincki</i> *	2	0–1
<i>Asteropterygion oculitristis</i> *	12	0–1.2
<i>Amboleberis americana</i>	17	0–1.2
<i>Asteropella kaufmani</i> *	10	0–1
<i>Asteropella</i> species indet.*	2	0–1
San José Island, Pearl Islands, Gulf of Panama		
<i>Amboleberis americana</i>	1	9
Chile		
<i>Leuroleberis orbicularis</i>	2	12
<i>Asteropella rotundicostata</i>	1	12

WESTERN ATLANTIC REGION

Western Atlantic Ocean, Caribbean Sea, and Gulf of Mexico

South Carolina Continental Shelf		
<i>Amboleberis americana</i>	1	~28
<i>Asteropterygion oculitristis</i>	2	9–15
Georgia Continental Shelf		
<i>Amboleberis americana</i>	>3	5–37
<i>Asteropterygion oculitristis</i>	1	18
Florida		
Continental Shelf off Fort Pierce		
<i>Actinoseta chelisparsa</i>	1	28
<i>Amboleberis americana</i>	1	10
Indian River		
<i>Asteropterygion oculitristis</i>	3	0.3–2
Card Sound		
<i>Actinoseta chelisparsa</i> *	1	2
Northeast of South Lake Worth Inlet		
<i>Amboleberis americana</i> *	1	12

Virginia Key		
<i>Actinoseta hummelincki</i>	2	0-2
Dry Tortugas		
<i>Amboleberis americana</i>	4	low tide-20
Bahama Islands		
<i>Actinoseta chelisarsa</i>	8	1-15
<i>Amboleberis americana</i>	6	3-10
<i>Asteropella monambon</i>	15	3-20
Cuba		
<i>Asteropella monambon</i> *	1	4
<i>Asteropella punctata</i> *	1	6
Virgin Islands		
<i>Asteropella punctata</i>	1	25-30
<i>Asteropella mortenseni</i>	8	20-40
Puerto Rico		
<i>Asteropella monambon</i> *	1	1-1.5
Bonaire		
<i>Actinoseta chelisarsa</i> *	2	3-8
Belize		
<i>Actinoseta hummelincki</i> *	5	0.8-6
<i>Actinoseta chelisarsa</i> *	8	0.8-34
<i>Asteropella monambon</i> *	4	1.5-24
<i>Asteropella maclaughlinae</i> *	1	1
<i>Amboleberis americana</i> *	1	4.6
Panama		
<i>Asteropella agassizi</i> *	2	<1
<i>Actinoseta chelisarsa</i> *	1	<1
Venezuela		
<i>Actinoseta chelisarsa</i> *	1	0-1.5
<i>Actinoseta jonesi</i> *	1	0-1.5
<i>Actinoseta hummelincki</i> *	1	0.3
Curaçao		
<i>Actinoseta chelisarsa</i>	4	1.5-3.5
Brazil		
Pernambuco		
<i>Amboleberis americana</i>	1	?(pelagic)
Coast of southern Brazil		
<i>Asteropella agassizi</i>	1	?
Argentina		
Continental shelf, 37°56'-24''S to 38°05'00''S		
<i>Leuroleberis poulseni</i>	?	10-22
Continental shelf, 40°11'S to 40°32'S		
<i>Asteropterygion hulingsi</i>	1	44
<i>Asteropella species A</i>	2	44-57
<i>Gulf of Mexico</i>		
Florida		
Placida Harbor (part of Charlotte Harbor)		
<i>Asteropterygion oculitristis</i> *	1	1-3
<i>Asteropella maclaughlinae</i> *	1	2-3

Tampa Bay		
<i>Amboleberis americana</i> *	1	shallow
Anclote Anchorage, north of Tampa		
<i>Asteropterygion oculitristis</i> *	10	0.75-3
<i>Asteropella maclaughlinae</i> *	3	1-10.75
<i>Amboleberis americana</i> *	1	1.5
Alligator Harbor		
<i>Asteropterygion oculitristis</i> *	1	?
<i>Asteropella ?maclaughlinae</i> *	1	?
Panama City, continental shelf		
<i>Asteropterygion oculitristis</i> *	17	9.1-12.8
<i>Asteropella maclaughlinae</i> *	1	9.1
<i>Amboleberis americana</i> *	1	9.1
Texas		
Galveston, continental shelf		
<i>Amboleberis americana</i> *	1	53.5
South Texas, continental shelf		
<i>Asteropella maclaughlinae</i> *	1	15
<i>Asteropella species 1</i> *	2	15
<i>Asteropterygion oculitristis</i> *	2	15

EASTERN ATLANTIC MEDITERRANEAN REGION

East Atlantic Ocean and Mediterranean Sea

Mediterranean Sea		
<i>Cycloleberis lobiancoi</i>	several	10-30
Spanish Sahara		
<i>Cycloleberis squamiger</i>	1	53
Mauritania, continental shelf		
<i>Cycloleberis squamiger</i>	several	20-96; 1100?
<i>Asteropterygion setiferum</i>	1	1100?
<i>Omegasterope upsilon</i>	2	35-82
<i>Pteromeniscus intesi</i>	3	270-699
Ivory Coast, continental shelf		
<i>Cycloleberis squamiger</i>	11	10-40
<i>Asteropterygion setiferum</i>	6	10-80
São Thomé Island (lagoon)		
<i>Cycloleberis squamiger</i>	1	surface
Angola, continental shelf		
<i>Asteropterygion aff. setiferum</i>	1	shallow
South Africa		
Lambert's Bay		
<i>Cycloleberis galathea</i> *	4	0-15
Saldanha Bay and Langebaan Lagoon		
<i>Cycloleberis christiei</i>	39	0-24
<i>Asteropterygion dayi</i> *	16	0-7
False Bay		
<i>Cycloleberis galathea</i>	1	20
<i>Asteropterygion nodulosum</i>	1	20

INDO-WEST-PACIFIC REGION

Central Pacific Ocean

Western Indian Ocean			Central Pacific Ocean		
Madagascar			Hawaii		
<i>Alphaleberis alphathrix</i> *	13	6-18	<i>Microasteropteron youngi</i>	2	30-58 cm
<i>Amboleberis antyx</i> *	3	21-29	Western Pacific Ocean including Adjacent Seas		
<i>Tetraleberis maddocksae</i> *	4	12-18.5	Japan		
<i>Tetraleberis tanzania</i> *	4	7-12	<i>Tetraleberis brevis</i>	1?	21.9
<i>Cycloleberis galathea</i> *	10	12-38	<i>Tetraleberis</i> species indet.*	1	3-6
<i>Asteropterygion thomassini</i> *	42	0-60	<i>Cyclasterope hilgendorffii</i>	1	21.9
Zanzibar Island			<i>Asteropteron fuscum</i>	several	18
<i>Tetraleberis</i> species indet.*	1	20	Thailand		
North Island, Farquhar Group			<i>Cyclasterope bisetosa</i>	1	50
<i>Actinoseta nodosa</i> *	1	1-2	<i>Cyclasterope fascigera</i>	1	50
Somalia (continental shelf, 09°41'N, 51°03'E)			<i>Microasteropteron parvum</i>	3	9-18
<i>Tetraleberis tanzania</i> *	1	65	<i>Asteropterygion thailandicum</i>	6	8-28
<i>Tetraleberis</i> species 1*	1	65	Malayan Archipelago		
<i>Tetraleberis</i> species indet.*	1	65	<i>Asteropterygion hirsutum</i>	1	30
Kenya (in vicinity of Mombasa)			Java Sea		
<i>Asteropterygion romei</i> *	2	0.3-4	<i>Cyclasterope fascigera</i>	1	0-8.3
<i>Asteropterygion skogsbergi</i>	2	33-40	<i>Cyclasterope hilgendorffii</i>	1	69-291
<i>Asteropterygion spinosum</i>	1	33	<i>Tetraleberis similis</i>	1	14.6
Tanzania (continental shelf)			Banda Sea		
<i>Asteropterygion romei</i> *	12	0.5-6	<i>Cyclasterope hilgendorffii</i>	1	90
<i>Asteropterygion peterseni</i> *	2	0.5-6	Zulu Archipelago		
<i>Asteropterygion skogsbergi</i>	1	eulitoral	<i>Cyclasterope hilgendorffii</i>	1	14
<i>Tetraleberis tanzania</i> *	1	<25	Bismark Archipelago		
Biera, Mozambique			<i>Cyclasterope arthuri</i>	1	110-128
<i>Cycloleberis christiei</i> (questionable identity)	1	20	Australia		
South Africa			Western Australia, Swann River, near Perth		
Knysna Estuary			<i>?Cyclasterope albomaculata</i>	1	?
<i>Asteropterygion dayi</i> *	1	shallow	Northwestern Australia, Dundas Strait		
Bab el Mandeb (strait between Red Sea and Gulf of Aden)			<i>?Cyclasterope albomaculata</i>	1	31.1
<i>Microasteropteron bacescui</i> *	1	24	Northwestern Australia, Port Darwin		
<i>Asteropterygion romei</i> *	1	24	<i>?Cyclasterope albomaculata</i>	1	21.9
<i>Cycloleberis</i> species indet.*	1	24	Coral Sea, northeast of Australia		
<i>Tetraleberis</i> species indet.*	1	24	<i>Tetraleberis brevis</i>	1	38
<i>Asteropterygion</i> species (undescribed)	1	24	<i>Leuroleberis mackenziei</i>	1	50
Eastern and North Central Indian Ocean			Torres Strait, in bay of Thursday Island		
Sumatra			<i>Asteropterygion liguriae</i>	1	4
Padang Harbor			Moreton Bay, Brisbane		
<i>Cyclasterope bisetosa</i>	1	?	<i>Leuroleberis mackenziei</i>	1	22
India			New South Wales, continental shelf		
Madras Harbor			<i>Asteropterygion magnum</i>	4	65-100
<i>Cyclasterope hendersoni</i>	1	7.3-9.1	<i>Leuroleberis mackenziei</i>	4	12-28
Male Atoll, Maldives			New Zealand		
<i>Actinoseta nodosa</i> *	1	0.3	Tasman Bay		
			<i>Leuroleberis zealandica</i>	5	14

Menzies Bay		
<i>Leuroleberis zealandica</i>	1	?
Lyttleton Harbor		
<i>Leuroleberis zealandica</i>	2?	1-9.1
Between North and South Islands		
<i>Leuroleberis zealandica</i>	1	91
Northeast coast of North Island		
<i>Leuroleberis zealandica</i>	4	5.5-7.4
Shelf of southeastern end of South Island		
<i>Leuroleberis zealandica</i>	1	14
Stewart Island		
<i>Leuroleberis zealandica</i>	?	Rock pools
Colville Channel		
<i>Leuroleberis zealandica</i>	1	65

Discussion of Regional Distribution

WESTERN ATLANTIC REGION (Table 1, Figure 1).—In this region the subfamilies range from about 33°N to about 40°S, a range extending from subtropical in the North to temperate in the

South. The northern limit approximates the northern boundary of the Caribbean Province (see Briggs, 1974:61). The southern limit approximates both the boundary between warm and cold temperate zones (Briggs, 1974:164) and the northern edge of the Subantarctic boundary (Kornicker, 1975a:34).

Collections in the western Atlantic are uneven, with fewest records from South America. Three species (*Leuroleberis poulsenii*, *Asteropterygion hulingsi*, *Asteropella* species A) have been reported from Argentina and appear to be endemic. Two species have been reported from Brazil: *Amboleberis americana* and *Asteropella agassizii*. The former species is fairly widespread, occurring in the Atlantic as far north as South Carolina, in the Gulf of Mexico, and also in the eastern Pacific. The latter species also has been collected in Panama and Brazil. A species (*Asteropella rotundicostata*) closely related to *A. agassizii*, and possibly conspecific with it, has been collected off Chile.

The endemic species, *Actinoseta jonesi*, has been

TABLE—1. Distribution of the Cylasteropinae and Asteropteroninae, West Atlantic Region

Species	Atlantic Ocean		Gulf of Mexico		West Indies				Central America			South America		
	Georgia, S. C.	Florida	Florida	Texas	Bahama Islands	Cuba	Virgin Islands	Puerto Rico	Bonaire	Belize	Panama	Venezuela	Brazil	Argentina
<i>Amboleberis americana</i>	+	+	+	+	+	-	-	-	-	+	-	-	+	-
<i>Leuroleberis poulsenii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+
<i>Asteropterygion oculitristis</i>	+	+	+	+	-	-	+	-	-	-	-	-	-	-
<i>A. hulingsi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+
<i>Asteropella monambon</i>	-	-	-	-	+	+	-	+	-	+	-	-	-	-
<i>A. macLaughlinae</i>	-	-	+	+	-	-	-	-	-	+	-	-	-	-
<i>A. punctata</i>	-	-	-	-	-	+	+	-	-	-	-	-	-	-
<i>A. mortenseni</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-
<i>A. agassizii</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-
<i>Asteropella</i> species A	-	-	-	-	-	-	-	-	-	-	-	-	-	+
<i>Asteropella</i> species 1	-	-	-	+	-	-	-	-	-	-	-	-	-	-
<i>Actinoseta chelisarsa</i>	-	+	-	-	+	-	-	-	+	+	+	+	-	-
<i>A. hummelincki</i>	-	+	-	-	-	-	-	-	-	+	-	+	-	-
<i>A. jonesi</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-

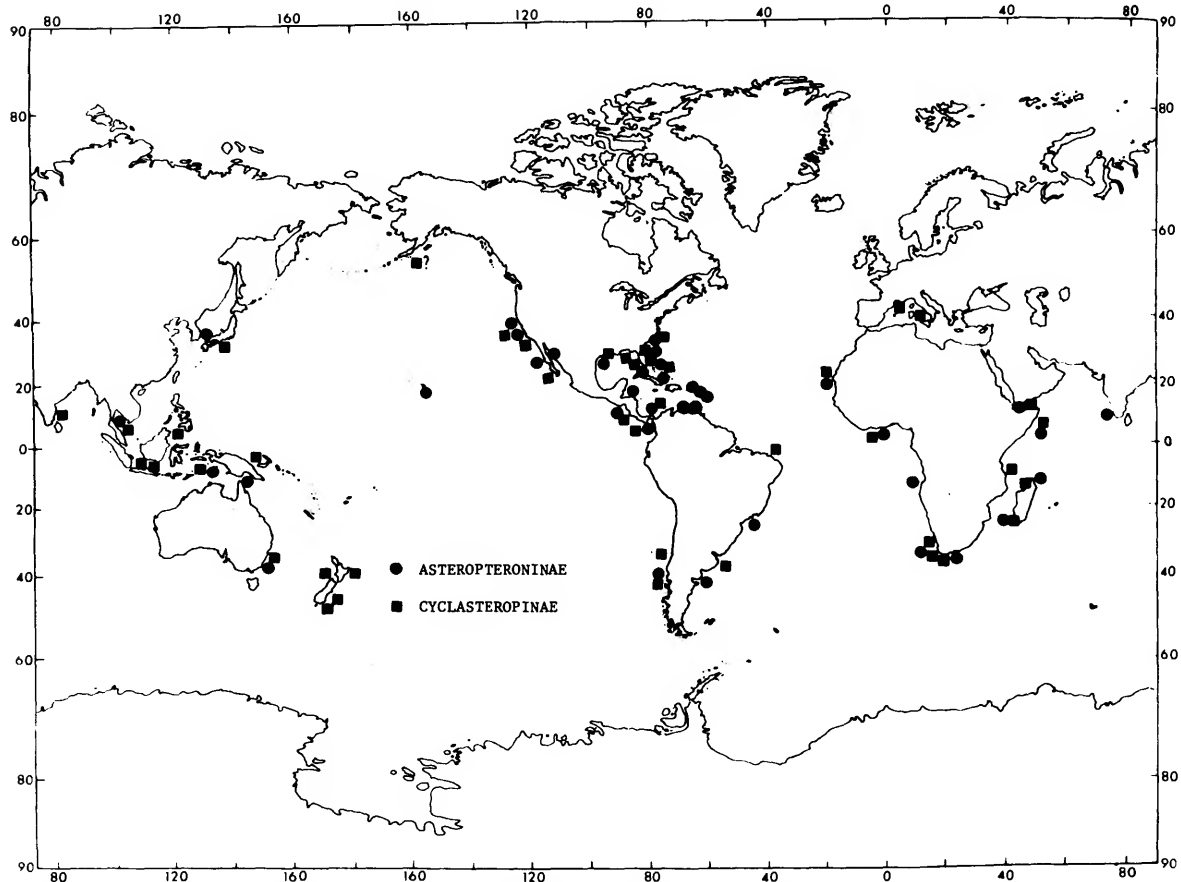


FIGURE 1.—Distribution map of the Asteropteroninae and Cyclasteropinae.

collected off Venezuela, and also *A. chelisparsa* and *A. hummelincki*.

Collections in Central America from Belize and Panama contained 7 species, none endemic. Of the 7, 3 were collected also along the eastern coast of Florida, 3 in the West Indies, and 2 in the Gulf of Mexico.

Five species have been reported from one or more islands of the West Indies (Bahama Islands, Cuba, Virgin Islands, Puerto Rico, Bonaire). *Actinoseta chelisparsa* was collected off Curaçao. *Asteropella punctata* and *A. mortenseni* are endemic. Two of the remaining species have been reported from the eastern coast of Florida and 3 from Central America.

The Gulf of Mexico contains 1 endemic species, *Asteropella* species 1 from off Texas. The Gulf

contains 3 additional species: *Asteropella maclaughlinae*, also collected off Belize; the widespread *Amboleberis americana*; and *Asteropterygion oculitristis*, which was also collected in the Atlantic along the coasts of South Carolina, Georgia, and Florida. The last 2 species have also been collected in the eastern Pacific.

EASTERN PACIFIC REGION (Table 2).—With the exception of a single male *Leuroleberis sharpei* from a poorly recorded sample labeled "Alaska," and which probably should be ignored until the waters of Alaska are better known, the northernmost records of the subfamilies are from the vicinity of Half Moon Bay and Monterey Bay, California, a latitude about 37°N. The southern limit is off Chile at about 42°S. The northern limit approximates the boundary between mild and warm

temperate marine climates. Although Point Conception is recognized as a northern boundary for many groups, some warm-temperate species of fish range to Monterey Bay (Briggs, 1974:227), and for at least one genus a more pronounced barrier occurs between 36°-38°N (Briggs, 1974:228). The southern limit of the Cyclasteropinae and Asteropteroninae, at about 42°S, approximates the northern boundary of the Subantarctic region (Kornicker, 1975a:38).

Only 2 species have been collected along the Californian coast, *Asteropella slatteryi*, which appears to be endemic, and *Leuroleberis sharpei*, which has been collected as far south as Baja California, and is questionably recorded from Alaska.

The western coast of Baja California has in addition to *Leuroleberis sharpei*, 1 endemic species, *Asteropella scammonensis*.

The Gulf of California has 1 endemic species,

Asteropella trithrix, and also *Asteropterygion oculitristis*, a species collected as far south as Panama, and which is also present in the Western Atlantic Region.

Central America (Costa Rica, Panama) has 1 endemic species, *Asteropella kaufmani*, and 3 additional species also collected in the Western Atlantic Region (*Amboleberis americana*, *Actinoseta ?hummelincki*, *Asteropterygion oculitristis*).

South America is represented by only 2 species (*Leuroleberis orbicularis*, *Asteropella rotundicostata*), both endemic; however, *A. rotundicostata* must be considered extremely closely related to, and possible conspecific with, *Asteropella agassizi*, a species collected in the Western Atlantic Region (Brazil, Panama).

EASTERN ATLANTIC REGION (Table 3).—The Mediterranean Sea contains only 1 species (*Cycloleberis lobiancoi*), but the species is closely related

TABLE 2.—Distribution of the Cyclasteropinae and Asteropteroninae, Eastern Pacific Region

Species	Alaska	California	Baja California	Gulf of California	San Salvador	Costa Rica	Panama	Chile
<i>Amboleberis americana</i>	-	-	-	-	-	+	+	-
<i>Leuroleberis sharpei</i>	+	+	+	-	-	-	-	-
<i>L. orbicularis</i>	-	-	-	-	-	-	-	+
<i>Asteropterygion oculitristis</i>	-	-	-	+	-	-	+	-
<i>Asteropella slatteryi</i>	-	+	-	-	-	-	-	-
<i>A. scammonensis</i>	-	-	+	-	-	-	-	-
<i>A. trithrix</i>	-	-	-	+	-	-	-	-
<i>A. kaufmani</i>	-	-	-	-	-	-	+	-
<i>A. rotundicostata</i>	-	-	-	-	-	-	-	+
<i>Asteropella</i> species indet.	-	-	-	-	+	-	+	-
<i>Actinoseta ?hummelincki</i>	-	-	-	-	-	-	+	-

TABLE 3.—Distribution of the Cyclasteropinae and Asteropteroninae, Eastern Atlantic-Mediterranean Region

Species	Mediterranean	Spanish Sahara	Mauritania	Ivory Coast	São Thomé Island	Angola	South Africa
<i>Cycloleberis lobiancoi</i>	+	-	-	-	-	-	-
<i>C. squamiger</i>	-	+	+	+	+	-	-
<i>C. galathea</i>	-	-	-	-	-	-	+
<i>C. christiei</i>	-	-	-	-	-	-	+
<i>Asteropterygion setiferum</i>	-	-	+	+	-	+	-
<i>A. dayi</i>	-	-	-	-	-	-	+
<i>A. nodulosum</i>	-	-	-	-	-	-	+
<i>Omegasterope epsilon</i>	-	-	+	-	-	-	-
<i>Pteromeniscus intesi</i>	-	-	+	-	-	-	-

to 2 west African species (*C. squamiger*, and *C. galathea*) and could be conspecific with them. *C. lobiancoi* has been collected only in the eastern Mediterranean (Gulf of Naples, Gulf of Marseille). In the Atlantic Ocean, the Cyclasteropinae has been collected no farther north than Spanish Sahara, and the Asteropterinae no farther north than Mauritania. Two monotypic genera are endemic to Mauritania, *Pteromeniscus intesi* and *Omegasterope epsilon*, the former has been collected only at slope depths.

The known range of *Cycloleberis squamiger* is from Spanish Sahara to the Ivory Coast. It has also been reported from the lagoon of São Thomé Island, Gulf of Guinea. *Asteropterygion setiferum* has been collected from Mauritania, the Ivory Coast, and possibly off Angola, where a specimen has been referred herein to *A. aff. setiferum*.

None of the species along the Atlantic coast of South Africa have been collected along the coast farther north. *Cycloleberis galathea* has been collected in Lambert's Bay and False Bay, South Africa, and also in Madagascar. *Cycloleberis christiei*, which is abundant in Saldanha Bay and Langebaan Lagoon, has been questionably identified near Biera, Mozambique. *Asteropterygion dayi* not only lives in Saldanha Bay and Langebaan Lagoon but also in the Knysna Estuary along the southeastern coast of South Africa. *Asteropterygion nodulosum* has been reported only from False Bay. The last 2 species appear endemic to South Africa.

INDO-WEST-PACIFIC REGION (Table 4).—*Western Indian Ocean*: Madagascar supports a diverse assemblage of the subfamilies under study (5 genera, 6 species). Endemic to Madagascar is a monotypic genus (*Alphaleberis*) and 3 species in 3 different genera (*Tetrableberis maddocksaе*, *Amboleberis antyx*, and *Asteropterygion thomassini*). One Madagascan species, *Tetrableberis tanzania*, was also collected in the vicinity of Tanzania and Somalia. Another Madagascan species, *Cycloleberis galathea*, has been reported from South Africa.

One species, designated herein, *Tetrableberis* species 1, was collected only off Somalia. Of 3 species of *Asteropterygion* collected off Kenya, in the vicin-

ity of Mombasa, 1 (*A. spinosum*) is endemic, and 2 (*A. romei*, *A. skogsbergi*) have also been collected off Tanzania. One species, *Asteropterygion peterseni*, appears endemic to Tanzania.

The only representative of the genus *Actinoseta* in the Indian Ocean (*A. nodosa*) is present in the Farquhar Group in the western Indian Ocean, and in the Maldiv Islands in the eastern Indian Ocean. No other species were collected in both the eastern and western parts of the Indian Ocean. One species of *Microasteropteron* (*M. bacescui*) has been collected from Bab el Mandeb.

Eastern and North Central Indian Ocean: Only 3 species have been collected in this part of the Indian Ocean: *Actinoseta nodosa* from the Maldiv Islands, *Cyclasterope hendersoni* from Madras Harbor, India, and *Cyclasterope bisetosa*, from Padang Harbor, Sumatra. The last species has also been collected in the vicinity of Thailand.

Western Pacific Ocean (including adjacent seas): Two species have been reported from the vicinity of Japan; the monotypic genus *Asteropteron fuscum* appears endemic, whereas, *Tetrableberis brevis* has also been reported in the Coral Sea northeast of Australia.

The seas in the vicinity of Australia have 5 species. One of these, *T. brevis*, as mentioned above, has been collected near Japan; the remaining 4 (*Leuroleberis mackenziei*, *?Cyclasterope albomaculata*, *Asteropterygion liguriae*, *A. magnum*) are endemic.

Only the endemic species *Leuroleberis zealandica* is known from New Zealand.

The seas in the vicinity of Indonesia contain many species in the subfamilies under study. The seas appear to be the main locality for species of *Cyclasterope* (*C. bisetosa*, *C. fascigera*, *C. hilgendorffii*, *C. arthuri*). The species *Microasteropteron parvum* from Thailand has already been mentioned. Additional species endemic to the area are *Asteropterygion thailandicum* from Thailand, *A. hirsutum* from the Malayan Archipelago, and *Tetrableberis similis* from the Java Sea. Most species of *Cyclasterope* are not well known and some may eventually prove conspecific.

Central Pacific Ocean: *Microasteropteron youngi* col-

TABLE 4.—Distribution of the Cyclasteropinae and Asteropteroinae, Indo-West-Pacific Region

Species	Western Pacific and adjacent seas						
	Western Indian Ocean	Eastern Indian Ocean	Central Pacific Ocean	Japan	vicinity of Indonesia	vicinity of Australia	vicinity of New Zealand
<i>Alphaleberis alphathrix</i>	+	-	-	-	-	-	-
<i>Amboleberis antyx</i>	+	-	-	-	-	-	-
<i>Cycloleberis galathea</i>	+	-	-	-	-	-	-
<i>C. christiei</i>	+?	-	-	-	-	-	-
<i>Tetraleberis tanzania</i>	+	-	-	-	-	-	-
<i>T. maddocksae</i>	+	-	-	-	-	-	-
<i>T. brevis</i>	-	-	-	+	-	+	-
<i>T. similis</i>	-	-	-	-	+	-	-
<i>Tetraleberis</i> species 1	+	-	-	-	-	-	-
<i>Tetraleberis</i> species indet.	+	-	-	+	-	-	-
<i>Leuroleberis mackenziei</i>	-	-	-	-	-	+	-
<i>L. zealandica</i>	-	-	-	-	-	-	+
<i>Cyclasterope bisetosa</i>	-	+	-	-	+	-	-
<i>C. hendersoni</i>	-	+	-	-	-	-	-
<i>C. fascigera</i>	-	-	-	-	+	-	-
<i>C. hilgendorfi</i>	-	-	-	-	+	-	-
<i>C. arthuri</i>	-	-	-	-	+	-	-
? <i>Cyclasterope albomaculata</i>	-	-	-	-	-	+	-
<i>Actinoseta nodosa</i>	+	+	-	-	-	-	-
<i>Asteropterygion thomassini</i>	+	-	-	-	-	-	-
<i>A. romei</i>	+	-	-	-	-	-	-
<i>A. skogsbergi</i>	+	-	-	-	-	-	-
<i>A. spinosum</i>	+	-	-	-	-	-	-
<i>Asteropterygion</i> species	+	-	-	-	-	-	-
<i>A. dayi</i>	+	-	-	-	-	-	-
<i>A. peterseni</i>	+	-	-	-	-	-	-
<i>A. thailandicum</i>	-	-	-	-	+	-	-
<i>A. hirsutum</i>	-	-	-	-	+	-	-
<i>A. liguriae</i>	-	-	-	-	-	+	-
<i>A. magnum</i>	-	-	-	-	-	+	-
<i>Microasteropteron parvum</i>	-	-	-	-	+	-	-
<i>M. youngi</i>	-	-	+	-	-	-	-
<i>M. bacescui</i>	+	-	-	-	-	-	-
<i>Asteropteron fuscum</i>	-	-	-	+	-	-	-

lected in Hawaii is 1 of the 2 species comprising this genus. The second species, *Microasteropteron parvum*, has been collected near Thailand.

Faunal Resemblance

Members of the Cyclasteropinae and Asteropteroinae are mainly shelf species, primarily members of the benthos, and are without pelagic larval stages. Because of this they are unlikely to

migrate across extensive areas of deep water such as the oceans. Also, members of the subfamilies seem restricted to tropical and temperate waters so that they are unlikely to migrate across shallow polar seas. Thus, considerable endemism could be predicted within these taxa, and the known distribution supports such a prediction; e.g., with 1 exception, members of the same species are not present on continents separated by deep water.

Members of both subfamilies appear absent

from the tip of South America, so it seems likely that migration between the western Atlantic and eastern Pacific ceased when the Isthmus of Panama was uplifted in the early Pliocene, about 2.5–4 million years ago (Berggren and Hollister, 1974:132), unless species have moved through the Panama Canal. The minimum salinity at which species in these taxa have been collected is 20 parts per thousand (Indian River, Florida) (Kornicker, 1977: table 2), but generally they are collected in waters of normal marine salinity. Thus, it seems unlikely that members of either subfamily would survive passage through the canal. If any member were to survive passage through the canal, it would more likely belong to the Cyclasteropinae rather than the Asteropterioninae, because members of the former have occasionally been collected in plankton, whereas the Asteropterioninae have been collected only on the bottom.

Five genera with representatives in both the western Atlantic and eastern Pacific are present in waters in the vicinity of the Americas (Table 5). One genus (*Asteropella*), with 10 species in addition to 2 left in open category, is endemic to

TABLE 5.—Taxa collected in the vicinity of North, Central, and South America

Species	Western Atlantic	Eastern Pacific
<i>Amboleberis americana</i>	+	+
<i>Leuroleberis sharpei</i>	-	+
<i>L. orbicularis</i>	-	+
<i>L. poulsoni</i>	+	-
<i>Asteropterygion oculitristis</i>	+	+
<i>Asteropella kaufmani</i>	-	+
<i>A. slatteryi</i>	-	+
<i>A. trithrix</i>	-	+
<i>A. scammonensis</i>	-	+
<i>A. rotundicostata</i>	-	+
<i>A. agassizii</i>	+	-
<i>A. monambon</i>	+	-
<i>A. punctata</i>	+	-
<i>A. macclauglinae</i>	+	-
<i>A. mortenseni</i>	+	-
<i>Asteropella</i> species A	+	-
<i>Asteropella</i> species 1	+	-
<i>Actinoseta chelisparsa</i>	+	-
<i>A. jonesi</i>	+	-
<i>A. hummelincki</i>	+	+?

American waters. Although some species in the western Atlantic are quite distinct from those of the eastern Pacific, others are not, and additional study is required to assess the closeness of the relationship: *Amboleberis americana* is present in both oceans, but populations in each ocean may have small differences that I consider intraspecific; *Asteropterygion oculitristis* is also present in both oceans, but the Pacific population needs further study when more material is available; *Actinoseta hummelincki* is an Atlantic species possibly also in the Pacific, but the Pacific populations require further study when more material is available; *Leuroleberis orbicularis*, a species collected only in the Pacific, and *L. poulsoni*, a species collected only in the Atlantic, could be conspecific, but additional study is required, especially of *L. orbicularis*; *Asteropella agassizii*, collected only in the Atlantic, and *A. rotundicostata*, collected only in the Pacific, could be conspecific, but additional study is required, especially of the latter species.

At the generic level the Simpson Index of faunal resemblance

$$\left(\frac{\text{No. of taxa common to both faunas} \times 100}{\text{No. of taxa in smaller fauna}} \right)$$

is 100 when comparing the eastern Pacific and western Atlantic (Table 6). At the specific level the Simpson Index is 20–30 using the identifications used herein, and 50 if *Leuroleberis orbicularis* should prove conspecific with *L. poulsoni*, and *Asteropella rotundicostata* with *A. agassizii*, and if *Actinoseta hummelincki* is unquestionably present in both oceans.

None of the species in the vicinity of the Americas are found elsewhere. The eastern Atlantic and Mediterranean Sea together have 4 genera of which only 1 (*Asteropterygion*) also lives in American waters (Simpson Index, 25). *Cycloleberis lobiancoi*, the only species in the 2 families under study reported from the Mediterranean, appears to be endemic to that sea, but it is very closely related to several species of the genus collected along the coast of west Africa, and could be conspecific with them. The monotypic genera *Omegasterope* and *Pteromeniscus* have been collected only off west Africa (Mauritania).

TABLE 6.—Simpson indices of genera and species between geographic regions

Geographic Areas	Eastern Atlantic plus Mediterranean	Western Atlantic	Eastern Pacific	Western Indian Ocean	Central Pacific	Eastern Indian and Western Pacific Oceans and adjacent seas	Australia	New Zealand
	<i>Genera</i>							
Eastern Atlantic plus Mediterranean	●	25	25	50	0	25	33	0
Western Atlantic	0	●	100	60	0	40	66	100
Eastern Pacific	0	20-30	●	60	0	40	66	100
Western Indian Ocean	33	0	0	●	0	60	66	0
Central Pacific	0	0	0	0	●	100	0	0
Eastern Indian and Western Pacific oceans and adjacent seas	0	0	0	10	0	●	66	0
Australia	0	0	0	0	0	50	●	100
New Zealand	0	0	0	0	0	0	0	●
<i>Species</i>								

The western Indian Ocean supports 6 genera in the taxa under study, 3 of these are also found in American water (Simpson Index, 60), and 2 in the combined eastern Atlantic and Mediterranean (Simpson Index, 50). At the species level the faunal resemblance between the western Indian Ocean and the combined eastern Atlantic and Mediterranean is about 33. Madagascar contains the monotypic genus *Alphaleberis*.

The eastern and north central Indian Ocean and the western Pacific Ocean including adjacent seas in the vicinity of Japan and Indonesia, but excluding Australia and New Zealand, support 5 genera of which 2 are present also in American waters (Simpson Index, 40), 3 are present also in the western Indian Ocean (Simpson Index, 60), and 1 is present also in the eastern Atlantic (Simpson Index, 25). The genus *Cyclasterope* appears restricted to the eastern Indian Ocean and the seas in the vicinity of Indonesia and Australia. The monotypic genus *Asteropteron* has been collected only in the vicinity of Japan.

Only 1 species in the taxa under study has been reported from New Zealand; it is an endemic species in a genus (*Leuroleberis*) that also lives in

the vicinity of Australia and the Americas (Simpson Index at generic level, 100 for both areas).

Five species in 4 genera have been reported from Australia; 4 of the species are endemic, the other has been reported also from Japan (Simpson Index at species level, 50). At the generic level Simpson Indices for Australia and other regions are as follows: New Zealand, 100; eastern Indian Ocean plus the western Pacific Ocean including adjacent seas in the vicinity of Japan and Indonesia, about 66; eastern Atlantic, about 33; American waters, about 66; western Indian Ocean, about 66.

The central Pacific is represented by 1 endemic species living in Hawaii. The genus to which the species belongs, *Microasteropteron*, has been reported elsewhere only from Bab el Mandeb and Thailand (Simpson Index, 100).

Relationship between Eye Development and Water Depth

All members of the subfamily *Cyclasteropinae* have large, pigmented, lateral eyes with 24-80

TABLE 7.—Water depth, carapace length of adults, number of eggs per clutch, and development of lateral eyes of species of the subfamilies Cyclasteropinae and Asteropteroinae. (w.d. = well developed; n.d. = no data; “?” after length = specimen may not be adult)

Species	Depth range (m)	Carapace length (mm)		Number of eggs per clutch	Size of lateral eyes/number of ommatidia*	
		female	male		female	male
Cyclasteropinae						
<i>Cyclasterope fascigera</i>	surface to 50	5.6–6.0	5.5–6.0	n.d.	w.d.	w.d.
<i>C. hilgendorffi</i>	14–291	6.25	5.4	n.d.	n.d.	w.d.
<i>C. hendersoni</i>	7.3–9.1	7	n.d.	n.d.	w.d./~68	n.d.
<i>C. bisetosa</i>	<50	5.8	n.d.	n.d.	w.d.	n.d.
<i>C. arthuri</i>	110–128	8	n.d.	n.d.	w.d.	w.d.
<i>Cycloleberis lobiancoi</i>	10–30	4.29–4.3	n.d.	n.d.	w.d./~70	n.d.
<i>C. squamiger</i>	10–53 (1100?), surface	3.21–4.32	3.60–4.55	22, 26, 28, 38	w.d./~65	w.d./~74
<i>C. galathea</i>	0–38	4.3–4.7	4.8	11	w.d./~60	w.d./60
<i>C. christiei</i>	inter-tidal–24	4.8–5.0	5.3–5.5	n.d.	w.d./~70	w.d./~67
<i>Leuroleberis sharpei</i>	2–146.3	4.9–6.2	4.0–6.4	57	similar to ♂	w.d./>50
<i>L. orbicularis</i>	12	2.7 [jv?]	n.d.	n.d.	w.d.	n.d.
<i>L. zealandica</i>	1–91	n.d.	7.1	n.d.	w.d./>50	w.d./~80
<i>L. poulsenii</i>	10–22	5.2–5.3	n.d.	n.d.	w.d.	n.d.
<i>L. mackenziei</i>	12–50	5.1?	4.8–5.4	n.d.	w.d./~70	w.d./similar to ♀
<i>Amboleberis americana</i>	inter-tidal–53.5	2.99–3.20	3.49	37	w.d./~50	w.d./similar to ♀
<i>A. antyx</i>	21–29	n.d.	2.00	n.d.	w.d.	w.d./33
<i>Tetraleberis brevis</i>	21.9–38	3.25–3.56?	n.d.	n.d.	w.d./~40	n.d.
<i>T. similis</i>	14.6	5	n.d.	n.d.	n.d.	n.d.
<i>T. maddocksaе</i>	12–18.5	3.5	n.d.	n.d.	w.d./24	n.d.
<i>T. tanzania</i>	7–12	3.2?	3.8	n.d.	w.d./~46	w.d./~46
<i>Alphaleberis alphathrix</i>	infra-littoral–12	3.7	3.4–3.9	32	w.d./45	w.d./58
Asteropteroinae						
<i>Actinoseta chelisparsa</i>	subtidal–34	2.29–2.30	1.71–1.73	11	w.d./16	w.d./17
<i>A. hummelincki</i>	inter-tidal–6	2.35–2.42	1.63–1.64	n.d.	w.d./~15	w.d./~12
<i>A. jonesi</i>	1.5	1.97–2.21	n.d.	13, 15, 17, 18, 18	w.d./~9	n.d.
<i>A. nodosa</i>	1/3–1 m	n.d.	n.d.	n.d.	w.d.	n.d.
<i>Asteropella mortenseni</i>	25–40	1.6–1.66	1.14	n.d.	none	none
<i>A. monambon</i>	1–24	1.62–1.86	1.18–1.27	7	minute/0	same as ♀
<i>A. punctata</i>	6–30	1.5–1.53	n.d.	n.d.	minute/12	n.d.
<i>A. scammonensis</i>	up to 21	1.45?	n.d.	n.d.	minute/4	n.d.
<i>A. agassizii</i>	<1	1.93–2	1.5	2, 5	small/5	small
<i>A. rotundicostata</i>	12	1.88?	n.d.	n.d.	n.d.	n.d.

TABLE 7.—continued

Species	Depth range (m)	Carapace length (mm)		Number of eggs per clutch	Size of lateral eyes/number of ommatidia*	
		female	male		female	male
<i>A. slatteryi</i>	14.5–37.0	1.85–1.97	1.34	11, 11, 12, 12	small/4	similar to ♀
<i>A. maclaughlinae</i>	1–15	1.59–1.72	n.d.	n.d.	small/5–6?	n.d.
<i>A. trithrix</i>	6–38	1.57–1.79	1.19	14, 17	small/4	similar to ♀
<i>A. kaufmani</i>	inter-tidal–1.2	1.29–1.40	0.96	1, 3, 5?	small/3 to 4	similar to ♀
<i>Asteropella</i> species A	45–57	1.78?	n.d.	n.d.	n.d.	n.d.
<i>Asteropella</i> species 1	15	n.d.	n.d.	n.d.	n.d.	n.d.
<i>Asteropteron fuscum</i>	18.3	2.50–2.7	2.2	n.d.	none	n.d.
<i>Asteropterygion thomassini</i>	reef flat–60	3.00–4.03	2.25–2.43	19, 19, 21	similar to ♂	w.d./16
<i>A. thailandicum</i>	10–30	n.d.	n.d.	n.d.	n.d.	none observed
<i>A. setiferum</i>	10–80; 1100?	1.72–2.70	n.d.	5, 11, 12, 12, 13	w.d./~14	n.d.
<i>A. aff. setiferum</i>	1	n.d.	n.d.	n.d.	n.d.	n.d.
<i>A. hulingsi</i>	44	3.04–3.17?	n.d.	n.d.	w.d./10	n.d.
<i>A. nodulosum</i>	20	n.d.	3.4	n.d.	w.d./~25	n.d.
<i>A. oculitristis</i>	inter-tidal–15	2.70–3.03	1.84–1.85	1, 25	w.d./14	w.d./14
<i>A. hirsutum</i>	30	n.d.	3.7 (A–1♂)	n.d.	n.d.	w.d./~50 (A–1♂)
<i>A. skogsbergi</i>	shallow–40	3.4	n.d.	n.d.	w.d./~25	w.d.
<i>A. magnum</i>	65.8–100	3.6–4.0	3.4	n.d.	none	none
<i>A. liguriae</i>	4	2.3?	n.d.	n.d.	n.d.	n.d.
<i>A. dayi</i>	inter-tidal–7	3.40–3.56	n.d.	19	w.d./~15	n.d.
<i>A. romei</i>	0.5–6	3.17–3.35	2.68	24, 26	w.d./~17	w.d./~24
<i>A. peterseni</i>	0.5–6	2.69–2.76	n.d.	10, 20	w.d./~17	n.d.
<i>Omegasterope upsilon</i>	35–82	1.74	n.d.	9	small/4	n.d.
<i>Pteromeniscus intesi</i>	270–699	n.d.	2.28–2.47	n.d.	absent	absent
<i>Microasteropteron parvum</i>	9–18	0.63–0.71	n.d.	4	not observed	n.d.
<i>M. youngi</i>	<1	0.73	n.d.	n.d.	small/0	n.d.
<i>M. bacescui</i>	25	0.80–0.84	n.d.	4	small/3	n.d.

* When known.

large bifid ommatidia. The eyes of the male are similar in size or larger than those of the female, and generally have about the same number of ommatidia (because of the black pigment, it is often difficult to count the number of ommatidia with accuracy) (Table 7). Species in the subfamily are generally found in waters shallower than 100 m, but *Cyclasterope hilgendorfi* has been reported

from as deep as 291 m (Müller, 1906:36) (Table 7; Figure 2).

In the subfamily Asteropteroninae, the lateral eyes vary considerably and are never as large, or as well developed, as those of the Cyclasteropinae. All members of the genus *Actinosea* have well developed lateral eyes with ommatidia of a similar type to those of the Cyclasteropinae, but the

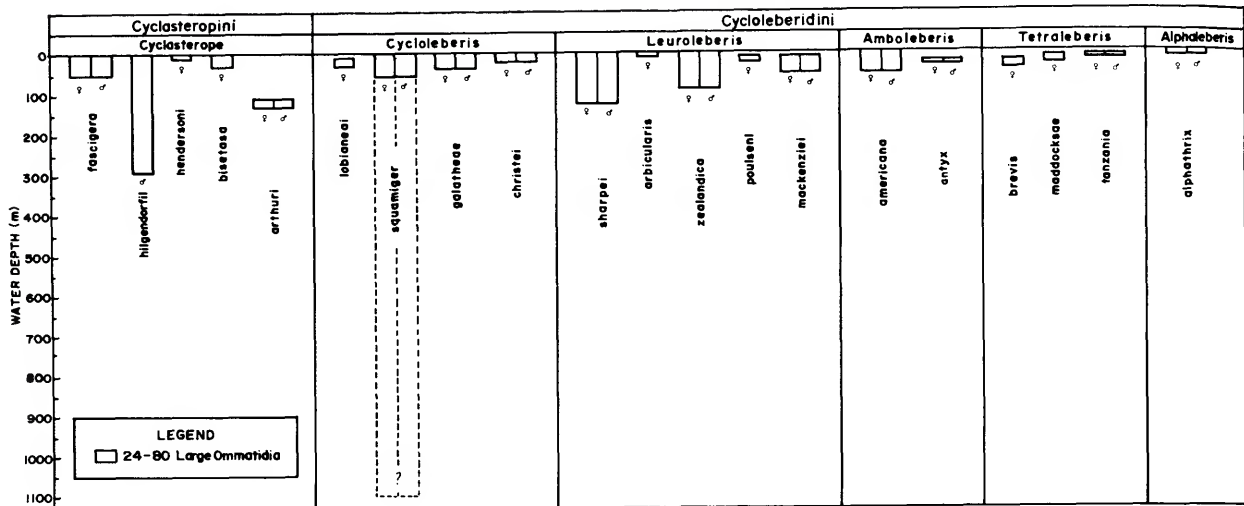


FIGURE 2.—Relationship between water depth and development of lateral eyes in species of Cyclasteropinae (data from Table 7).

eyes are smaller and have fewer ommatidia (9–17). Eyes of males and females are about the same size and have about the same number of ommatidia. *Actinoseta* has not been collected below 34 m (Table 7; Figure 3).

Members of the genus *Asteropella* have minute lateral eyes or are without eyes. The eyes, when present, are minute, usually with light brown pigment, and 4–6 minute cells that may be vestigial ommatidia. About 12 of these cells were observed in *A. punctata*, a species that Poulsen (1965:237) reported to be without eyes. The eyes on those species having them are difficult to observe. The small size of the eyes and the poorly developed ommatidia suggest that they may be vestigial organs of little use to the animal. The eyes of the males and females appear to be similar. *Asteropella* is generally found shallower than 40 m (Figure 3), and has not been reported deeper than 57 m (Table 7).

The monotypic genus *Asteropteron* (*A. fuscum*) has been collected only at 18.3 m; the female is without eyes (Table 7, Figure 3); Müller (1890) reported absence of eyes in a collection of *A. fuscum* that included juvenile males. The monotypic genus *Pteromeniscus* (*P. intesi*) has been collected at depths of 270–699 m, and is without

eyes in both the male and female (Table 7, Figure 4). The monotypic genus *Omegasterope* (*O. upsilon*) has been collected at depths of 35–82 m; the male is unknown but the female has minute lateral eyes, each with 4 minute ommatidia (Table 7, Figure 4).

The lateral eyes of members of the genus *Asteropterygion* are quite variable; some species are without eyes (*A. magnum*, *A. thailandicum*), whereas others have well developed eyes with as many as 50 ommatidia (*A. hirsutum*), but most species have between 10 and 25 ommatidia (Table 7, Figure 4). In general, the eyes of males and females are similar both in size and in having the same number of ommatidia. Members of *Asteropterygion* have been collected at intertidal depths down to 100 m.

Kornicker (1975a:48) observed that all members of the Cylindroleberididae are blind below depths of 1212 m. No members of Cyclasteropinae or Asteropteroninae have been reported below that depth. *Pteromeniscus intesi* collected only at slope depths is blind, and blindness in that species may be attributed to the depth at which it lives. Other species in the subfamilies are shelf species, and the absence of lateral eyes in some of them is probably not related to the depth at

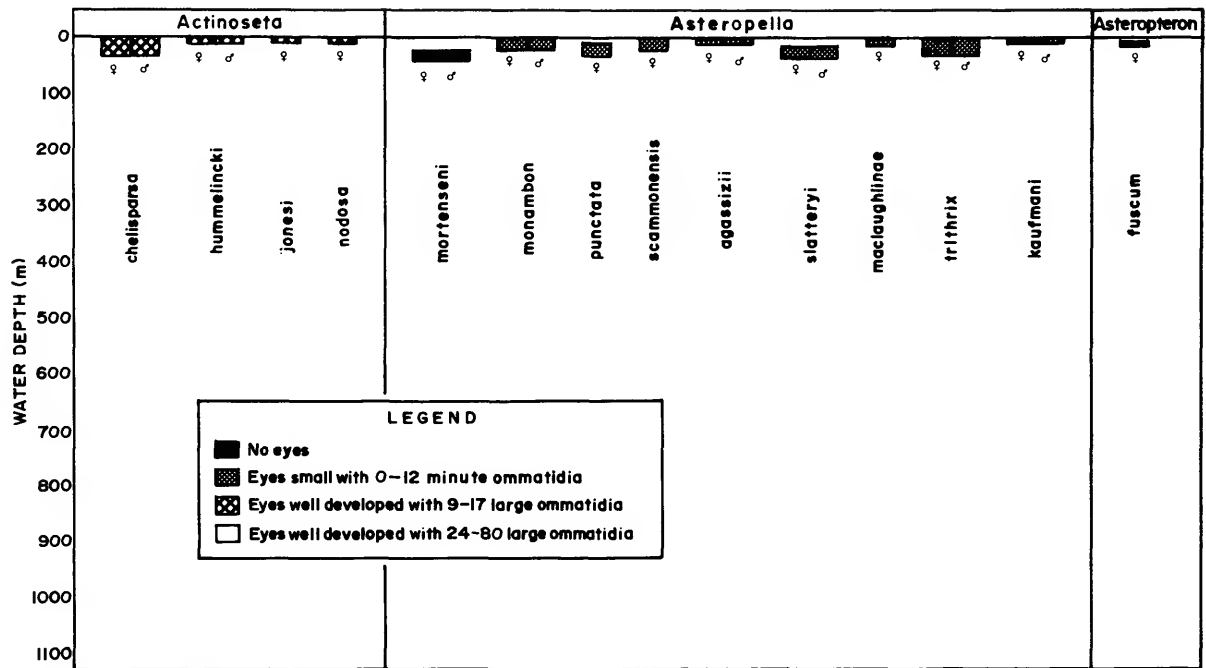


FIGURE 3.—Relationship between water depth and development of lateral eyes in species of Asteropterinae (*Actinoseta*, *Asteropella*, *Asteropteron*) (data from Table 7).

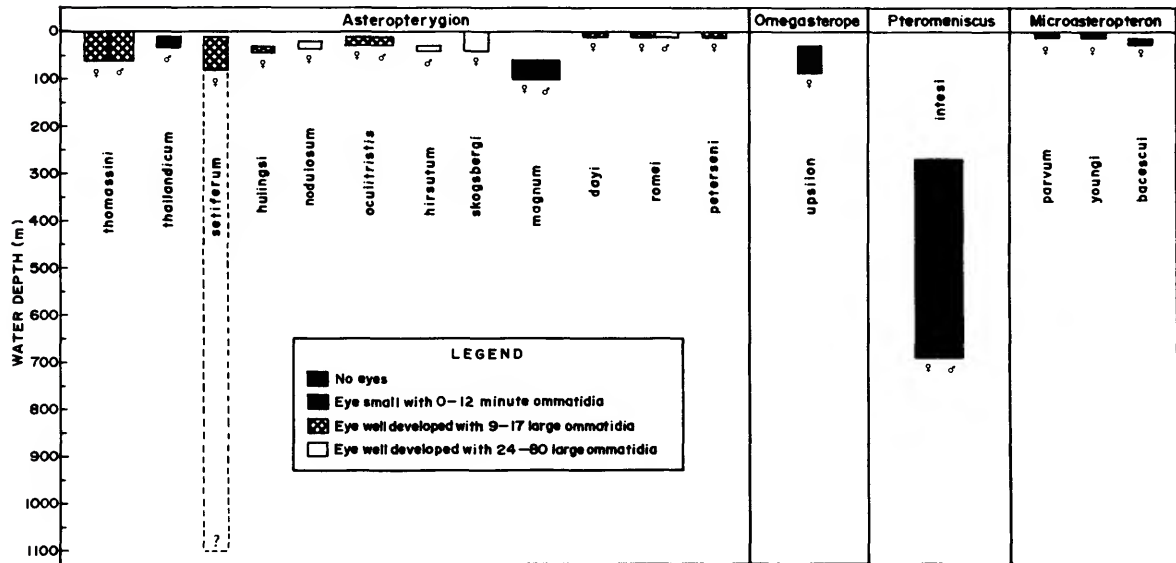


FIGURE 4.—Relationship between water depth and development of lateral eyes in species of Asteropterinae (*Asteropterygion*, *Omegasterope*, *Pteromeniscus*, *Microasteropteron*) (data from Table 7).

which they are presently living. Poulsen (1965: 471) observed that in a general way the number of ommatidia in lateral eyes decreases with size of the individual; for example, lateral eyes of *Microasteropteron* have fewer ommatidia than lateral eyes of *Cyclasterope*, but there are many exceptions.

Vertical Distribution

Prior to a discussion of the vertical distribution of the Cyclasteropinae and Asteropteroninae it is necessary to discuss a sample from station X044 from off Mauritania in which Kornicker and Caraion (1974:5) reported an adult female of *Cycloleberis squamiger* and 2 juveniles of *Asteropteron setiferum*. The sample was collected in a Menzies trawl at a depth of 1100 m, a depth much deeper than members of either genus had previously been reported.

The species did not appear in other samples collected in the vicinity of station X044. Although it is possible that an isolated population may live at station X044, I am inclined to ignore the record until additional collections show that members of the genera are found at those depths. Although I am unable to provide a reason for ignoring the locality, such as mislabeling, or contamination of equipment, I believe that the depth is too anomalous not to question it. In the following discussion I have ignored the record, and have questioned it in Figures 2 and 4.

With the single exception of *Pteromeniscus intensi*, a bathyal, upper slope species (270–699 m), members of the subfamilies Cyclasteropinae and Asteropteroninae are restricted to the continental shelf (0–200 m), and live mostly in the upper 100 m (Figures 2–4).

Sexual Dimorphism

ADULT SEXUAL DIMORPHISM.—Morphological differences between males and females may be divided into primary and secondary types. Primary sexual dimorphism refers to morphological differences in structures directly concerned with reproduction, such as in genitalia and internal

accessories. Secondary sexual dimorphism refers to other morphological differences. The reasons for some secondary sexual differences are not clear.

Primary Sexual Dimorphism: The copulatory organ of the male Cypridinacea consists of a short, conical penis between 2 elongate lobed organs. The elongate organs differ considerably among the genera and families of Cypridinacea, and in some, appear to have a clasp function. Whether or not the elongate organs assist in placement of the spermatophore or sperm on the female is not known. The female genitalia consists of a minute oval genital aperture, often with an oval attached ?spermatophore, on each side of the body. Both the female and male genitalia are located immediately anterior to the base of the furca. The discussion of the reproductive system of the genus *Spinacopia* (Sarsiellidae) by Kornicker (1969a:5) probably applies to other Cypridinacea. For SEM photographs of genitalia of male and female Cypridinidae see Kornicker (1975a, figs. 80, 126; 1976a, fig. 17), and Kornicker, et al. (1976, figs. 12–14).

Secondary Sexual Dimorphism: It is possible, or probable, that if looked at in sufficient detail differences could be detected between the shell and all limbs of the adult male and female. The following discussion concerns only “major” differences. Morphological differences attributed to secondary sexual dimorphism may be divided into those associated with differences in feeding habit of the adult male and female, and those associated with the different sex roles of the adult male and female. The latter may be divided into differences directly related to the act of copulation, and those related to precopulation and postcopulation activities. Some sexual dimorphism cannot be attributed with certainty to either differences in feeding or to the different sex roles.

Secondary sexual dimorphism associated with differences in feeding seems to be exhibited mainly by the mandible, maxilla, and 5th limbs. These limbs are less well developed (in all or part) in adult males than in adult females of the Phylomedidae, Rutidermatidae, and Sarsiellidae;

adult males apparently do not eat, or eat in a different manner than do the adult females. The mandible, maxilla, and 5th limb are similar in adult males and females of the Cypridinidae and Cylindroleberididae, in which both sexes apparently feed in a similar manner.

Secondary sexual dimorphism directly related to the act of copulation occurs mainly on the 1st and 2nd antenna. In most of the Cypridinidae, the b- and c-bristles of the 1st antenna of the adult male bear discs that may act as suckers to hold the female during copulation (Skogsberg 1920:195). It is possible, however, that these are actually sensory organs used in detecting the presence of a female prior to copulation. The endopodite of the 2nd antenna is a clasping organ in all Philomedidae, Rutidermatidae, and Cylindroleberididae, and in some Cypridinidae and Sarsiellidae. The dorsal margin of the comb of the 5th limb of adult male Cyclasteropinae has a process (hook-shaped in some species) that possibly might have a holding function during copulation.

Secondary sexual dimorphism resulting from differences in the sex role prior to copulation occur mainly in the 1st and 2nd antenna, lateral eye, and the carapace. Differences may be divided into those related to motility, restricted to the carapace and 2nd antenna, and to those having a sensory function, restricted to the 1st antenna and lateral eye. Adult males of the Sarsiellidae, Rutidermatidae, Philomedidae, and some Cylindroleberididae (Cylindroleberidinae, Cyclasteropinae) have more elongate and more streamlined carapaces than those of adult females, suggesting that the male carapaces are better adapted for rapid swimming. The muscular protopodite of the 2nd antenna is larger in the adult male than in the adult female of some groups, apparently to enable the adult male to swim more rapidly. The exopodites of adult males of some groups are also better equipped for swimming than are adult females (see Kornicker, 1975a:74 for discussion). Adult males of Philomedidae, Rutidermatidae, Sarsiellidae, and some members of the Cylindroleberididae (most Cylindroleberidinae and Asteropteroninae, all Cyclasteropinae) have a sensory

bristle on the 5th joint of the 1st antenna with abundant long filaments not present on that bristle of the adult female. Extremely long c- and f-bristles with numerous short filaments on the adult males of some members of the Philomedidae, all members of the Rutidermatidae, and on some members of the Cylindroleberididae (most Cylindroleberidinae and Cyclasteropinae), probably have a sensory function in seeking the female. The lateral eyes of the adult male are larger and may have more ommatidia in some species of all families of Cypridinacea (Kornicker, 1975a:42).

Secondary sexual dimorphism resulting from differences in the sex role after copulation occurs mainly on the 7th limb and carapace. The posterodorsal part of the carapace (where eggs are held) is often wider in the adult female of some groups. This is especially so in the Sarsiellidae where the posterodorsal part of the carapace of adult female is often bulbous, and is less apparent in carapaces of other families. The 7th limb of the adult male of many members of the Sarsiellidae and in at least 1 member of the Philomedidae is either missing or poorly developed compared to that of the adult female. Although the function of the 7th limb is unknown, it may be related to egg moving or cleaning.

Secondary sexual dimorphism not attributable to either copulation, precopulation or postcopulation activities, involves the carapace, the caudal furca, and also small differences in other appendages that will not be discussed further here. Adult males are often smaller than the adult females of the same species. The reason for this may be related to conservation of energy in the process of forming the adult male, or in the ability of a smaller male to survive longer without feeding, and not to carapace function. The caudal furcae of a few species of Cypridinidae and Sarsiellidae have different numbers of claws united with the lamella in the male and female. (For appendage differences relating to burrowing activities of the female see discussion in Müller, 1893:357-360.)

The parts generally affected by sexual dimorphism in families of Cypridinacea are summarized in Table 8. For additional discussion of

TABLE 8.—Parts generally affected by major sexual dimorphism in adults of families of Cypridinacea

Family	Carapace	1st antenna	2nd antenna	Man-dible	Max-illa	5th limb	6th limb	7th limb	Furca
Cypridinidae	rare	yes	rare	no	no	no	no	no	rare
Philomedidae	yes	yes	yes	yes	yes	yes	no	rare	no
Sarsiellidae	yes	yes	usually	yes	yes	yes	no	usually	rare
Rutidermatidae	yes	yes	yes	yes	yes	yes	no	no	no
Cylindroleberididae	usually	usually	yes	no	no	rare	no	no	no

sexual dimorphism among families of Cypridinacea see Poulsen (1965:481–483).

JUVENILE SEXUAL DIMORPHISM.—The sex of myodocopid ostracodes is fixed from birth; dimorphism related to both primary and secondary sexual causes occurs in juveniles. The relationship between adult and juvenile sexual dimorphism may be generalized as follows: 1, Sexual dimorphisms that do not occur in the adults do not occur in juveniles; 2, Sexual dimorphisms that occur in the adults may or may not occur in juveniles.

Primary Sexual Dimorphism: Genitalia are usually not apparent on the male prior to the A-1 or A-2 instars, and on the female prior to the A-1 instar, and are not always apparent in that instar. The A-1 female may have small eggs in the ovaries.

Secondary Sexual Dimorphism: Juveniles of both sexes have the same feeding habits and, therefore, do not have that type of dimorphism. Although juveniles do not have sex roles, dimorphism in the juveniles reflect dimorphisms attributable to sex role in the adult; therefore, for comparative purposes, the subheadings below refer to the adult function.

Secondary Sexual Dimorphism Related to Copulation: Differences between male and female 1st antennae are minor or absent. If the endopodite of the 2nd antenna of the adult male is formed as a clasping organ, sexual dimorphism of the endopodite is present in juveniles of that species, but may not be apparent in instars I to III.

Secondary Sexual Dimorphism Attributable to Differences in the Sex Role Prior to Copulation: Motility: Differences in the 2nd antenna and carapace are not apparent (the carapace of juve-

nile males may differ slightly in shape from those of females, but major differences that occur between adult male and female carapace of some taxa are not evident). Sensory function: Dimorphism of the 1st antenna is relatively minor, being restricted to small differences in the sensory bristle of the 5th joint, or in the number of short filaments in some of the bristles of the 7th and 8th joints on the A-1 instar, and then only in some species. When sexual dimorphism of the lateral eyes occurs in adults, a similar dimorphism exists in juveniles (whether the dimorphism is evident in very early instars requires documentation).

Secondary Sexual Dimorphism Resulting from Differences in the Sex Role after Copulation: A broadening of the posterodorsal part of the carapace in the area in which eggs are held is not apparent in the juvenile female, although small differences may be detectible in the shape of juvenile males and females. Species having major differences in the 7th limbs of the adult males and females also have major differences in this limb in juvenile males and females. This difference, however, will not be apparent in instar I, in which the 7th limb is absent or minute in both sexes, and may not always be apparent in instars II and III, in which the 7th limbs may be without bristles in both sexes.

Secondary Sexual Dimorphism Not Attributable to Either Copulation, Precopulation or Postcopulation Activities: When the carapace of the adult male and female differ in size, this difference is reflected in the relative sizes of juvenile males and females. The difference, however, is less in juveniles than in adults, and may not be apparent in instars I and II, and possibly

III. The decrease in size difference between adults and juveniles is due to the growth factor between the A-1 male and adult male being less than the growth factor between the A-1 female and adult female. Whether differences in the caudal furca of adults of some species are also present in juveniles of those species needs documentation.

Recognition of Sexual Dimorphism in Juveniles: Determination of sex of early instars (Instars I and II) is difficult and may not be possible unless lateral eyes are better developed in the male. For example, in some Philomedidae the lateral eye is well developed in the male and absent in the female, however, whether it is possible to identify the sexes of instars I and II on the basis of lateral eyes needs documentation. In many Sarsiellidae and in at least 1 species of Philomedidae, the 7th limb is less developed on the male. For these species, the relative development of the 7th limb may be used to identify the sex of later instars (instars III+). The endopodite of the 2nd antenna forms a clasping organ in adult males of Philomedidae, Rutidermatidae, Cylindroleberididae, and in many Sarsiellidae and Cypridinidae. The clasping type male endopodite develops gradually from instar to instar and is generally recognizable in later instars (instars III+), but not always in instar III. In those species of the Sarsiellidae not having males with a clasping type endopodite, differences in number and distribution of bristles in the male and female endopodite may be sufficient to make it possible to identify the sex of later instars.

For a discussion of sexual dimorphism in juveniles (precocious sexual dimorphism) in fossil and Recent Ostracoda see Whatley and Stephens (1977:69-91).

Dimorphism between Adult and Juvenile

Changes that take place during the growth of Cypridinacea have been discussed herein in the section on ontogenetic development. Many changes that occur during ontogeny are gradual (for example, an increase in the number of bristles on an appendage, or an increase in the complexity of a limb), but some changes that occur when the

A-1 instar molts to become an adult are sudden not predictable from examination of instars. It is with the latter type of dimorphism that the present discussion is concerned.

FEMALES.—Dimorphism between the A-1 instar and adult female occurs mainly in the carapace and 2nd antenna.

Carapace: This is more apparent in members of the Sarsiellidae than in other families of Cypridinacea. In the Sarsiellidae, the posterodorsal part of the carapace of the adult female of many species is broader than that part of the carapace of A-1 females. Also, on some species of Sarsiellidae, the caudal process, which is at the poster-ventral corner of the carapace in juveniles, moves to a more ventral position on adults. A broadening of the posterodorsal part of the carapace in the adult female is generally less apparent, but not uncommon, in other families of the Cypridinacea.

Second Antenna: In the Rutidermatidae and most Philomedidae, natatory hairs are present on many bristles of the exopodite of the 2nd antenna, but absent on the bristles of juveniles (for discussion see Kornicker, 1975a:74).

MALES.—Dimorphism between the A-1 instar and adult male occurs mainly in the carapace, the 1st and 2nd antenna, the mandible, maxilla, and 5th limb.

Carapace: In the Philomedidae, Sarsiellidae, Rutidermatidae, and Cylindroleberididae, the carapace of the A-1 male resembles more closely that of the adult female than that of the adult male. In adult males of many species of Philomedidae and Rutidermatidae, the rostrum is broader and the incisur forms a wider angle than on the A-1 male; the carapace may also be more elongate and have more subdued ornamentation. In the Sarsiellidae, most species have no rostrum on the A-1 male and a well-defined rostrum on the adult male. In the Cyclasteropinae and Cylindroleberidinae, the carapace of the adult male is more elongate than that of the A-1 male, has bristles forming a vertical row near the posterior end, and may have an incisur with a wider angle.

First Antenna: The adult male of the Cypridinidae bears suctorial or sensory discs on the b- and

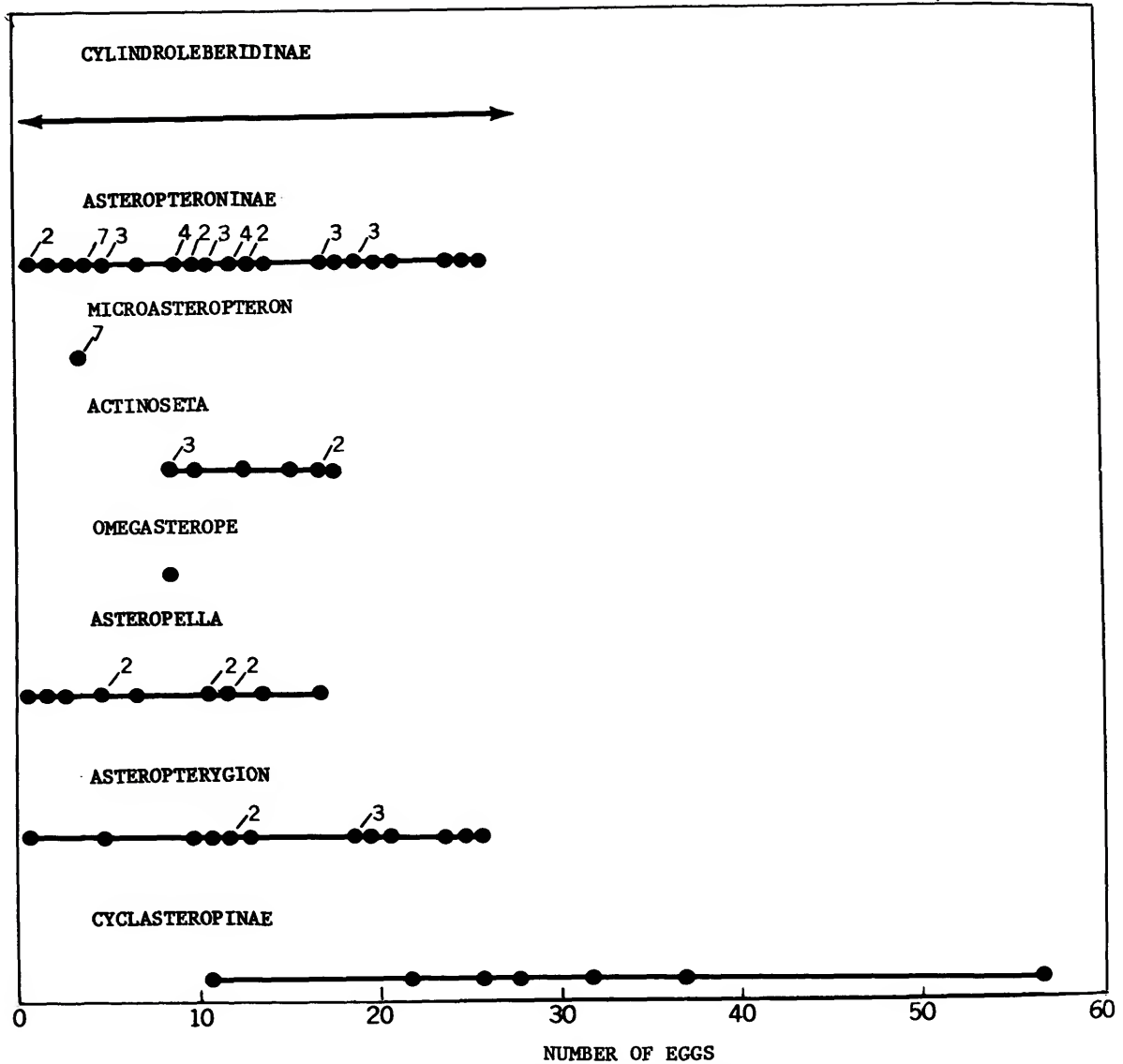


FIGURE 5.—Comparison of the number of eggs per clutch in the subfamilies *Cylindroleberidinae*, *Cyclasteropinae*, and *Asteropteroninae* and in some genera of *Asteropteroninae*.

c-bristles not present on the A-1 male. Most adult males of other families have well developed sensory bristles on the 5th limb that are poorly developed or absent on A-1 males (see discussion in "Sexual Dimorphism"). Extremely long c- and f-bristles on some adult males (see discussion in "Sexual Dimorphism") are not present on A-1 males.

Second Antenna: In the *Rutidermatidae* and most *Philomedidae*, natatory hairs are present on many bristles of the exopodite of the 2nd antenna, but absent on the bristles of juveniles (for discussion see Kornicker, 1975a:74). On most species of *Cyclasteropinae*, spines present on exopodial bristles of the A-1 male are absent on the exopodial bristles of the adult male.

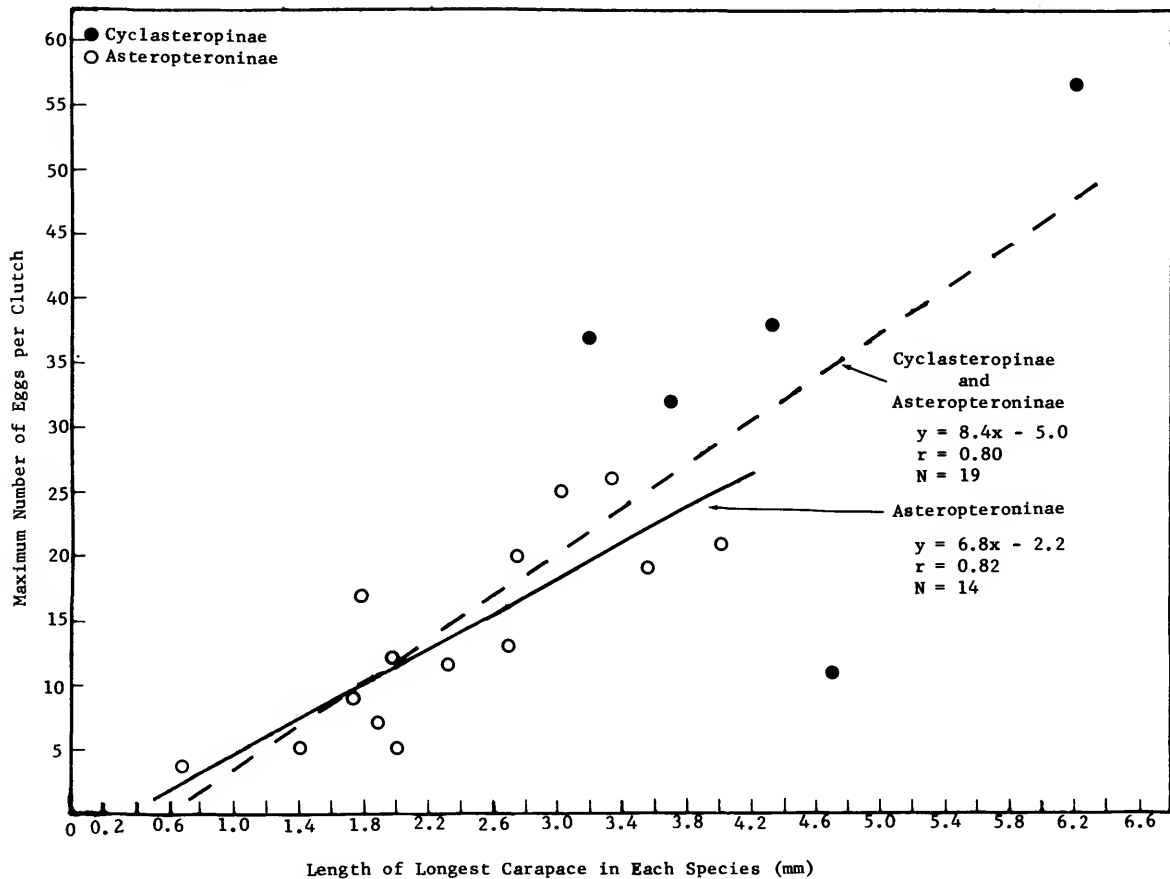


FIGURE 6.—Comparison of relation between the maximum number of eggs per clutch and the maximum length of carapace in the subfamilies Cyclasteropinae and Asteropteroinae (data from Table 7).

Mandible, Maxilla, 5th Limb: These limbs on the A-1 males of members of the Philomedidae, Ruditomatidae, and Sarsiellidae, resemble those of the adult female. On the adult male of those families the limbs, or parts of them, are reduced, reflecting the change in eating habits of the adult male. In the Cyclasteropinae, the dorsal margin of the comb of the 5th limb bears a process not present on the A-1 male.

Reproduction

Females of the Cylindroleberididae carry eggs inside the posterior end of the carapace—in an area that has been called both brood chamber

and marsupium. When the eggs reach the first instar stage of development they leave the carapace (Müller, 1893:366). All the eggs in the marsupium of an individual are generally similar in size indicating that the eggs are deposited within the shell at about the same time, and as a result, all of the first instar stages leave the shell at about the same time, although when an abnormally low number of eggs or larvae are encountered in a specimen, it could be the result of the initial or last phase being interrupted when the specimen was captured.

The numbers of eggs within the carapace were counted only for those adult females whose bodies were removed for study, a total of about 35

TABLE 9.—Morphology of the 6th and 7th limbs of Instars I–IV (n.d. = no data)

Growth stage	<i>Amboleberis americana</i>	<i>Leuroleberis sharpei</i>	<i>Cycloleberis christiei</i>	<i>Tetraleberis tanzania</i>	<i>Tetraleberis</i> species 1	<i>Asteropella monambon</i>	<i>Asteropella maclaughlinae</i>
Instar I							
6th limb	no bristles	no bristles	no bristles	n.d.	no bristles	no bristles	n.d.
7th limb	absent	absent	absent	n.d.	absent	absent	n.d.
Instar II							
6th limb	2 anterior bristles	many bristles	1 anterior bristle	2 anterior bristles	n.d.	1 anterior bristle	1 anterior bristle
7th limb	minute or absent	minute, bare	absent	minute, bare	n.d.	minute, bare	minute, bare
Instar III							
6th limb	many bristles	many bristles	many bristles	n.d.	n.d.	many bristles	n.d.
7th limb	elongate, bare	elongate, bare	elongate, bare	n.d.	n.d.	elongate, bare	n.d.
Instar IV							
6th limb	many bristles	many bristles	many bristles	n.d.	n.d.	n.d.	many bristles
7th limb	many bristles	many bristles	many bristles	n.d.	n.d.	n.d.	many bristles

^a Data from Poulsen (1965: Table 22).

^b Data from Kornicker and Caraion (1974: 63, 64).

^c Data from Poulsen (1965: 376).

specimens. Although the data are few, they suggest that, in general, members of the Cyclasteropinae produce more eggs per clutch than do members of the Asteropteroinae (Figure 5). Also, within the Asteropteroinae, members of *Asteropterygion* may produce more eggs per clutch than do members of *Asteropella* (Figure 5).

Kornicker (1975a:49, figs. 25–28) presented data indicating that clutch size in myodocopid ostracodes is, in part, a function of carapace size. This relationship is also present in the combined Cyclasteropinae and Asteropteroinae, taxa that were not analyzed by Kornicker (1975a) because of insufficient data. The correlation coefficient is significant at the 0.001 level (Figure 6).

For comparative purposes the relationship of carapace size and clutch size was calculated for the Cyclindroleberidinae ($y = 4.3x + 3.2$, $r = 0.56$, $N = 49$) using data in Kornicker (1975a, 1976a) and Kornicker and Caraion (1974). The relationship between carapace and clutch size for the Cyclindroleberidinae is fairly similar to that for the Asteropteroinae.

The relationship between carapace size and clutch size was calculated for the Cyclindroleberididae by combining the data for the 3 subfamilies ($y = 7.0x + 1.7$, $r = 0.76$, $N = 68$). The relationship for the Cyclindroleberididae is similar to that of the families Cypridinidae and Philomedidae (for equations of the relationship of carapace and clutch sizes of the latter 2 families see Kornicker, 1975a:figs. 25, 26). Thus, with the exceptions of the Sarsiellidae and Rutidermatidae, clutch size increases with carapace size.

Ontogenetic Development

Poulsen (1965:472) summarized the ontogenetic development of the following species of Cyclindroleberididae: *Asteropteron magnum*, *Cyclasterope fascigera*, *Asteropteron thailandicum*, *Asteropella mortenseni*, *Cycloleberis americana*, and *Parasterope muelleri*. He concluded from his study that the Cyclindroleberididae have 5 juvenile growth stages. The development of 4 species were studied herein: *Amboleberis americana* (= *Cycloleberis ameri-*

<i>Asteropella mortenseni</i> ^a	<i>Pteromeniscus intesi</i> ^b	<i>Asteropteron Thailandicum</i> ^a	<i>Parasterope muelleri</i> ^c
n.d.	no anterior bristles	n.d.	no bristles
n.d.	absent	n.d.	absent
not developed	n.d.	anterior with bristles	n.d.
not developed	n.d.	minute, bare	n.d.
many bristles	n.d.	many bristles	n.d.
8 bristles	n.d.	elongate, bare	n.d.
n.d.	n.d.	many bristles	n.d.
n.d.	n.d.	elongate, bare	n.d.

cana), *Cycolleberis christiei*, *Leuroleberis sharpei*, and *Asteropella monambon*. It is tentatively concluded that these species have 6 juvenile growth stages, but the data on *Asteropella monambon* is insufficient to exclude the possibility that that species has only 5 juvenile stages. In neither the present study nor in Poulsen's are the specimens in sufficient numbers to reach definitive conclusions concerning the number of growth stages, but the number of stages appears to be either 5 or 6. It is not unlikely that the number of stages varies at the species level.

Kornicker (1969a:3) presented a "Key to Early Myodocopid Instars" that identified the first 3 instars (Instars I-III). That key was based on 5 species in the family Cypridinidae, 1 in the family Philomedidae, and 3 in the family Sarsiellidae. In the key, the 1st instar is identified by having a 6th limb without bristles and in not having a 7th limb. Hiruta (1977:55) observed a minute budlike 7th limb on instar I of his new species, *Sarsiella japonica*, showing that some species do not fit the key so far as the absence of a 7th limb on instar

I. The 7 species of *Cylindroleberididae* on which data are available have 1st instars that fit the key (Table 9). The key also fits the observations of Müller (1893:379) on the genus *Cylindroleberis*. According to Poulsen (1965:232) the 6th and 7th limbs of the 2nd instar (1st instar unknown) of *Asteropella mortenseni* are not developed; although the meaning of "not developed" is not clear to me, it seems likely that *A. mortenseni* does not fit the key (assuming Poulsen is correct in his interpretation of the stage of development of the instar on hand). In the key to early instars of *Cylindroleberididae* presented herein, the 1st instar is identified by the absence of anterior bristles on the trunk of the 6th limb. On some of the 6th limbs of the 1st instars the posterior tip of the skirt bears an incomplete bristle, one that is poorly defined and appears to be a narrow extension of the tip of the skirt.

In the "Key to Early Myodocopid Instars" in Kornicker (1969a:3), the 2nd instar (instar II) is identified by having a 6th limb with 1 bristle (anteroventral). The 2nd instar of 5 species was studied herein: 3 have 1 anterior bristle on the trunk; 2 have 2 anterior bristles on the trunk, and 1 has many anterior bristles on the trunk and also many bristles on the ventral margin of the skirt. Poulsen (1965:232) reported the 6th limb of instar II of *Asteropella mortenseni* to be undeveloped, and the 6th limb of *Asteropteron thailandicum* (Poulsen, 1965:200; table 22) to have anterior bristles. Clearly, the number of bristles on the 6th limb on 2nd instars are variable at the species level, but in general, the limb seldom has more than 1 or 2 anterior bristles on the trunk. The 7th limb of Instar II in the *cylindroleberids* is minute and bare, or absent (Table 9).

In the "Key to Early Myodocopid Instars" (Kornicker, 1969a:3), instar III is identified by having a 7th limb without bristles. In the 4 3rd instars studied herein the 7th limb is without bristles (Table 9). The 7th limb of instar III of *Asteropteron thailandicum* is also without bristles (Poulsen, 1965:200). An exception is the 7th limb of instar III of *Asteropella mortenseni*, which bears 8 bristles (Poulsen, 1965:232). Poulsen (1965: table 22) also reported that the 3rd instars of *Asteropteron*

skogsbergi, *Cyclasterope fascigera*, and *Cycloleberis bradyi* have 7th limbs with numerous bristles. Earlier instars are unknown for the 3 species. In view of the morphology of the early instars of the species described herein I am inclined to interpret the 3rd instars of Poulsen's 3 species to be 4th instars, and have based the key to the early instars of the Cylindroleberididae presented herein on that interpretation. The 6th limbs of 3rd instars of all the cylindroleberids studied are similar to the 6th limbs of species within other myodocopid families in having many ventral bristles (also many anterior bristles except for the Cylindroleberidinae, which have usually only 1 or 2 anterior bristles on later instars as well as on adults).

In the "Key to Early Myodocopid Instars" (Kornicker, 1969a:3), instars IV to the adult are identified by having a 7th limb with bristles. The 4 species studied herein have bristles on the 7th limbs of the 4th instars (Table 9). An exception appears to be the 4th instar of *Astropteron thailandicum*, which is without bristles (Poulsen, 1965: table 22).

In general, although many exceptions are evident, it would appear that the early development of the 6th and 7th limbs are fairly similar for all families of the Cypridinacea.

All members of the Cylindroleberididae have 7 or 8 pairs of gill-like structures along the posterodorsal part of the body. The structures are already well developed in the 1st instar—the instar on which the 7th limb is generally absent.

Thus, it is unlikely that the structures are remnants of epipodial appendages of limbs that may have once been present on ancestors in a position posterior to the 7th limb. Because the epipodial appendage of the 5th limb is well developed, the gill-like structures, if they are remnants of the epipodial appendages of limbs, would have to be remnants of limbs placed between the 5th and 7th limbs. I concur with Skogsberg (1920:59) that the gill-like structures are probably folds unrelated to lost limbs. I do not believe that the structures on the Cylindroleberididae are homologous with the transverse folds on some members of the Cypridinidae (*Paradoloria dorsoserrata* (Müller, 1908) and *Vargula hilgendorffii* (Müller, 1890)) which are not paired. Possibly, the gill-like structures of the Cylindroleberididae developed as a consequence of members of the family being filter-feeders.

While the present paper was in press, Hiruta (1979) published a paper giving the larval development of *Astropteron fuscum* which he interpreted as having only 4 larval stages (1979:23). He also expressed the opinion that *A. thailandicum* also has a total of 4 larval stages. The characters of the 6th and 7th limbs of the 1st 4 stages of *A. fuscum* (Table 9, herein) conform with the general key to early instars of Cylindroleberididae given here. I have found it expedient not to attempt revision of the present paper at this late date by further analysis of the Hiruta paper.

Generalized Key to Early Instars of Cylindroleberididae

(For known exceptions see underlined characters in Table 8)

1. 6th limb without anterior bristles on trunk Instar I
 6th limb with anterior bristles on trunk 2
2. 7th limb usually minute, but may be absent; 6th limb usually with only 1
 or 2 anterior bristles on trunk and no ventral bristles on skirt . Instar II
 7th limb elongate, with or without bristles; 6th limb with many anterior*
 and ventral bristles on skirt 3
3. 7th limb bare Instar III
 7th limb with bristles Instar IV—Adult

* The Cyclasteropinae and Astropteroninae have many anterior bristles, but the Cylindroleberidinae generally have only 2 anterior bristles on later instars as well as on adults.

Parasites and Attached Organisms

Copepods, isopods, and nematodes have been previously reported as parasites within the carapace of several species of *Cylindroleberidinae* (Table 10). The present paper reports for the first time copepod and isopod parasites on species of *Asteropteroninae*, and isopod parasites on a species of *Cyclasteropinae* (Table 10). The copepods and isopods were each found in only 1 specimen of 3 different species, suggesting that parasitism is rare in the subfamilies *Cyclasteropinae* and *Asteropteroninae*. In addition to species listed in Table 10, a parasitic copepod was present within the carapace of an undescribed species of *Asteropterygion* collected at Bab el Mandeb.

Stalked cuplike organisms (Protista) are fairly common along the anterior and posterior margins of members of the *Cyclasteropinae* (Plates 17b, 19b, 21b, 43c), and are also present on some specimens of *Asteropteroninae* (Plate 145a-c, e, f).

Diatoms were observed on the carapaces of a few species of *Asteropteroninae*, usually within fossae (Plates 59j, 150c, 151a).

Antiquity of the *Cylindroleberididae*

Until recently the *Cylindroleberididae* were considered to be restricted to the Holocene

(Sylvester-Bradley, 1961:Q402). Dzik (1978) described from the Upper Jurassic of the Volga River region (USSR) a specimen with some appendages preserved that he identified as *Cycloleberis* species. Because of the similarity of the fossilized appendages with those of living specimens of the genus, Dzik (1978:398) concluded that "the derivation of the *Cylindroleberididae* [Cylindroleberididae] from the *Cypridinidae* happened well before the Upper Jurassic." I concur with Dzik, and think it quite possible that the Paleozoic *Eocypridina aciculata* (Scott and Summerson, 1943) (sensu Sohn, 1977:132) is a member of the subfamily *Cyclasteropinae* in the *Cylindroleberididae*, not in the *Cypridinidae* to which it was referred by Bless (1973:250) and Sohn (1977:132). The reasons for this are discussed below.

Central Adductor Muscle Attachment Scars: Bless (1973:250) believed the muscle scars of *E. aciculata* from the Hance Formation of Kentucky resemble those of *Vargula* Skogsberg, 1920 (see Sylvester-Bradley, 1961: fig. 321:7d, for muscle scars of *Vargula*), in having additional scars in a poster-ventral and posterodorsal position relative to the main adductor muscle scars. In the present study of living *Cyclasteropinae* adductor muscle attachments were routinely drawn as seen through a valve, but these were often obscure in varying

TABLE 10.—Species of *Cylindroleberididae* parasitized by Copepoda, Isopoda, and Nematoda

Species	Copepoda	Isopoda	Nematoda
<i>Cyclasteropinae</i>			
<i>Leuroleberis mackenziei</i> , new species	-	+	-
<i>Asteropteroninae</i>			
<i>Asteropella kaufmani</i> , new species	+	-	-
<i>Pteromeniscus intesi</i> , new species	-	+	-
<i>Cylindroleberidinae</i>			
<i>Parasterope pollex</i> Kornicker, 1967	+	-	-
<i>P. beta</i> Kornicker, 1976a	+	-	-
<i>Parasterope</i> species indet. Kornicker, 1975a	+	-	-
<i>Cylindroleberis kliei</i> Kornicker, 1976a	+	-	-
<i>Skogsbergiella scotti</i> Kornicker, 1975a	+	-	-
<i>S. macrothrix</i> Kornicker, 1975a	+	-	-
<i>Skogsbergiella</i> species indet. Kornicker, 1975a	+	-	-
<i>Homasterope micra</i> Kornicker, 1975a	+	-	-
<i>Synasterope duplex</i> Kornicker, 1975a	-	+	+
<i>S. dimorpha?</i> (Hartmann, 1965)	+	-	-
<i>Archasterope</i> species indet. Kornicker, 1975a	-	-	+

degrees, and the illustrations presented herein should be considered approximations. On some specimens, for example *Leuroleberis sharpei*, new species (Figure 28c), scars were observed that could be considered to be in posteroventral and posterodorsal positions. In my opinion the main cluster of central adductor muscle attachment scars of *E. aciculata* (see Bless, 1973, text-fig. 1), resembles much more closely those of members of the subfamily Cyclasteropininae than other myodocopid taxa.

Carapace Shape: Bless (1973:250) considered the outline of *E. aciculata* to be evidence that the species should be referred to the Cypridinidae. Sohn (1977:125) pointed out that the lateral outline of valves of *E. aciculata* from the Hance Formation is affected by the orientation of the valves in the rock. In any case, the outlines of specimens of *E. aciculata* do not exclude the possibility of their being members of the Cyclasteropininae rather than the Cypridinidae.

Structure of the Incisur Area: Many valves of *E. aciculata* illustrated by Sohn (1977, fig. 2), also some not illustrated (see below), have a curved ridge or groove that extends backward from the posterior end of the ventral edge of the rostrum, then curves ventrally, and then anteriorly to intersect the anterior edge of the valve below the incisur. Although a similar ridge is present on a few members of Recent genera of Cypridinidae, it is always present on members of the Cyclasteropininae, as may be seen from micrographs presented herein (ridge not always visible in lateral view).

Size of Specimens: Specimens of *E. aciculata* not

uncommonly reach a length of 7 mm (Bless, 1973, table 1). Although a few Recent Cypridinidae reach lengths of 7 mm or longer, most Recent cypridinids have lengths on the order of 2 or 3 mm. On the other hand, many members of the Cyclasteropininae reach lengths of 4–7 mm. Unfortunately, not much weight should be given to carapace size because it is not a conservative character.

In conclusion, I see no characters in the shell morphology of *E. aciculata* that make it possible to exclude the taxon from the Cylindroleberididae. The shell pores of members of the Cyclasteropininae differ from those of members of the Cypridinidae in having concentric peripheral ridges, whereas the pores of the Cypridinidae are without concentric ridges, but instead have a single node-like process on the pore edge. The anterodorsal edge of valves of the Cyclasteropininae often have a row of minute teeth not present on members of the Cypridinidae. Unfortunately, because of poor shell preservation of known specimens of *E. aciculata*, detailed knowledge of structures such as marginal teeth or pores is not a likely prospect. Through the courtesy of I. G. Sohn, I examined for pores and marginal teeth many additional specimens of *E. aciculata* from the Hayne Formation of Kentucky, but was not successful in finding any. I did find, however, that a curved ridge was behind the incisur on all specimens on which the incisur was preserved, thus showing that the specimens illustrated by Sohn (1977, fig. 2) are representative.

Members of the Cyclasteropininae live mainly on the continental shelf, generally in water shallower

TABLE 11.—Equivalent major groupings within the family Cylindroleberididae recognized by T. Skogsberg, E. M. Poulsen, G. Hartmann and H. S. Puri, and herein (Poulsen, Hartmann and Puri, and I recognize more genera than listed by Skogsberg)

<i>Poulsen (1965)</i>	<i>Herein</i>	<i>Skogsberg (1920)</i>	<i>Hartmann and Puri (1974)</i>
Subfamily Asteropininae	Subfamily Cylindroleberidinae	Genus <i>Asterope</i>	Subfamily Cylindroleberidinae
Subfamily Cyclasteropininae	Subfamily Cyclasteropininae	Genus <i>Cyclasterope</i>	
		Genus <i>Cycloleberis</i>	Subfamily Cycloleberidinae
	Subfamily Asteropteroininae	Genus <i>Asteropteron</i>	

than 100 m (Table 7); *E. aciculata* probably also lived in shallow water (Sohn, 1977, pers. comm.). All known living Cypridinidae are either scavengers, carnivores, or detritus feeders, whereas, all known Cyindroleberididae are filter feeders (Kornicker, 1975a:38). Thus, if *E. aciculata* should prove to be a member of the Cyindroleberididae, it is likely to have been a filter feeder, and would indicate that this feeding type was represented among myodocopids in the Paleozoic.

In his description of the Jurassic specimen of *Cycolleberis* species having parts of some appendages fossilized, Dzik illustrated (1978, fig. 3), but did not mention, 7 lines forming concentric arcs in the vicinity of the base of the 7th limb. These may represent the proximal lower edges of gill-like structures common to members of the Cyindroleberididae (for comparison with a living form see Kornicker, 1975b, fig. 2). If so, it indicates that the gill-like structures are an ancient development.

Phylogeny and Classification of Suprageneric Categories of Cyindroleberididae

Skogsberg (1920:440-443) recognized 4 genera in the family Asteropidae (= Cyindroleberididae) (Table 11). Poulsen (1965:167) and Hartmann and Puri (1974:13) (also see Hartmann, 1975:677) subdivided the family into two subfamilies, but they did not include the same genera in the subfamilies (Table 11). In an attempt to resolve the differences in the above two classifications, I decided to investigate the phylogeny (cladistics) of the family using the principles proposed by Hennig (1966) in which the derived (apomorphic) rather than primitive (plesiomorphic) character states are considered important for grouping taxa.

In making a Hennigian analysis it is necessary to determine which condition of a character is plesiomorphic and which is apomorphic (directionality); which of many possible reconstructed phylogenies is more likely to approximate the actual phylogeny; and to what degree the derived phylogeny should be used to form the basis of a classification (Kornicker, 1978:5). (This method

was used for reconstructing a phylogeny of superfamilial and higher categories of Ostracoda by Kornicker and Sohn (1976), for the subfamilies of the Philomedidae by (Kornicker (1978), and for the subfamilies of the Sarsiellidae by Kornicker and Cohen (1978).)

Based on the consideration of the 10 characters listed in Table 12, characters selected because their directionality could be estimated with some confidence, a phylogeny was reconstructed and the family Cyindroleberididae was subdivided into 3 subfamilies (Figure 7). The classification used herein is summarized below.

The classification of the Cyindroleberididae derived herein differs at the subfamily level from that of Poulsen (1965) and of Hartmann and Puri (1974) in recognizing the Asteropteroninae, new subfamily. According to the reconstructed phy-

TABLE 12.—Plesiomorphic and apomorphic character states in the Cyindroleberidinae, Cyclasteropinae, and Asteropteroninae

Character state	Plesiomorphic	Apomorphic
1. Deep incisur in carapace	present	absent
2. Ridges and processes on carapace	absent	present
3. Carapace of adult male with hairs forming vertical row near posterior	absent	present
4. Length of 2nd exopodial joint of 2nd antenna of adult male	short	very long
5. c- and f-bristles of 1st antenna of adult male	short	very long
6. Some pores on carapace with peripheral concentric rings	absent	present
7. Dorsal margin of comb of 5th limb of adult male with 1 or 2 processes	absent	present
8. Carapace surface with fossae	absent	present
9. Number of bristles on 2nd endopodial joint of maxilla	4-6	1-2
10. Posterior list of infold with tubular pores at base of broad flat bristles	absent	present

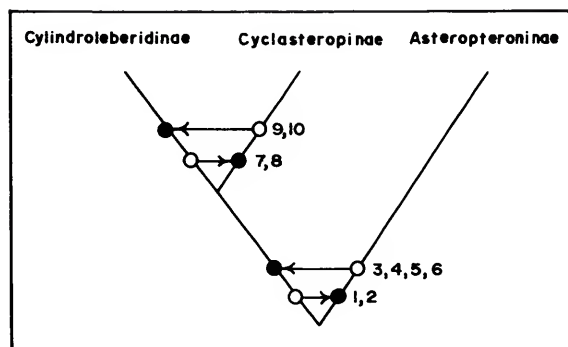


FIGURE 7.—Phylogeny of the family Cyndroleberididae (open circle = plesiomorphic (ancestral) character states; solid circle = apomorphic (derived) character states; numbers = numbered morphological characters referred to in Table 12).

logeny (Figure 7), Asteropteroinae is the sister group of all other members of the family.

Summary of Classification

Family CYLINDROLEBERIDIDAE Müller, 1906

CYLINDROLEBERIDINAE Müller, 1906. (Genera: *Cylindroleberis* Brady, 1868; *Dolasterope* Poulsen, 1965; *Brunniella* Poulsen, 1965; *Heptonema* Poulsen, 1965; *Archasterope* Poulsen, 1965; *Diasterope* Poulsen, 1965; *Parasterope* Poulsen, 1965; *Synasterope* Poulsen, 1965; *Polyleberis* Kornicker, 1974; *Prionotoleberis* Kornicker, 1974; *Empoulsenia* Kornicker, 1975a; *Skogsbergiella* Kornicker, 1975a; *Bathyleberis* Kornicker, 1975a; *Homasterope* Kornicker, 1975a).

CYCLASTEROPINAE Poulsen, 1965

Tribe CYCLASTEROPINI Poulsen, 1965. (Genus: *Cyclasterope* Brady, 1897).

Tribe CYCLOLEBERIDINI Hartmann, 1974. (Genera: *Cycloleberis* Skogsberg, 1920; *Leuroleberis*, new genus; *Alphaleberis*, new genus).

Tribe TETRALEBERIDINI, new tribe. (Genera: *Tetraleberis*, new genus; *Amboleberis*, new genus).

ASTEROPTERONINAE, new subfamily. (Genera: *Asteropteron* Skogsberg, 1920; *Actinoseta* Kornicker, 1958; *Microasteropteron* Poulsen, 1965; *Astropella*, Poulsen, 1965; *Asteropterygion*, new genus; *Omegasterope*, new genus; *Pteromeniscus*, new genus).

Comparative Morphology of the Cypridinacea

In the following discussion of morphology of the carapace and appendages of families in the

Cypridinacea Baird, 1850a, emphasis is on the subfamilies Cyclasteropinae and Asteropteroinae in the family Cyndroleberididae, the subfamilies that form the basis of this study. A key to families is presented in Kornicker (1975a: 83).

CARAPACE.—The carapace of members of the Cyndroleberidinae and Cyclasteropinae are basically similar, all having a fairly deep incisur, and not having lateral ribs, ridges, or processes. In both subfamilies the rostrum overhangs the lower edge of the incisur laterally. Carapaces of members of the Asteropteroinae differ in not having a deep incisur, and in having a more ornate carapace. In a general way, the carapaces of members of the Cyndroleberidinae and Cyclasteropinae resemble those of members of the Cypridinidae and Philomedidae, whereas carapaces of members of the Asteropteroinae more closely resemble those of members of the Sarsiellidae and Rutidermatidae. At least some members of the Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae have backward projecting caudal processes; these are not known in members of the Cyndroleberididae.

APPENDAGES.—*First Antenna*: The sensory bristle of the 5th joint of both the adult male and adult female of most members of the Cypridinidae are more-or-less similar. In the Philomedidae, Rutidermatidae, and Sarsiellidae, the sensory bristle of the adult male bears many more filaments than on the sensory bristle of the adult female. In the Cyndroleberididae, adult males of all members of the Cyclasteropinae have sensory bristles with more filaments than on the adult female. With the exception of the genus *Homasterope*, this also holds for members of the Cyndroleberidinae. Among genera of Asteropteroinae, *Asteropteron* and *Pteromeniscus* have more filaments on the sensory bristles of adult males than on females. With the exception of *Asteropterygion oculitristis*, this relationship also holds for species of *Asteropterygion*. The sensory bristle on adult males of species of *Astropella* have more filaments than on the sensory bristle of adult females, but the number of filaments is quite variable. The sensory

bristle of the adult male and female of species of *Actinoseta* are similar. The adult male is unknown for *Microasteropteron* and *Omegasterope*.

The sensory bristle of the 5th joint of females in the families Sarsiellidae and Rutidermatidae are either bare or have a few small filaments. In the Philomedidae, the sensory bristle of the female generally bears several short proximal and terminal filaments. In the Cypridinidae, the sensory bristle generally bears several short and several long filaments. The sensory bristle of the female differs considerably within the Cylindroleberididae. With the exception of *Dolasterope*, which bears numerous short and long filaments on the sensory bristle (Figure 8c), species of the Cylindroleberidinae have no or 1 short proximal filament and 6 to 8 long terminal filaments (Figure 8t–bb). The sensory bristle of female Cyclasteropinae have 2 to 9 short proximal filaments and 6 to about 15 long terminal filaments (Figure 8a–r). The sensory bristle of females of the Asteropteroninae vary considerably. The sensory bristle of *Microasteropteron* is without filaments (Figure 9n). The sensory bristle of species of *Asteropella* has 0–2 minute proximal filaments, and 2 distal branches, each with a bifurcate tip (Figure 9u–cc). The sensory bristle of *Actinoseta* is similar to that of *Asteropella* except for having 2–5 short proximal filaments, and in having longer branches forming the bifurcate tip (Figure 9o–r). The sensory bristle of *Asteropteron* bears only short filaments (Figure 9m). The sensory bristle of *Pteromeniscus* bears 2 minute proximal filaments, 2 distal marginal filaments, and a stem with a bifurcate tip (Figure 9t). The sensory bristle of *Omegasterope* is somewhat similar to that of *Pteromeniscus* but has only 1 minute proximal filament, and the 2nd of the distal marginal filaments is longer on *Omegasterope* than it is on *Pteromeniscus* (Figure 9s). The sensory bristle of *Asteropterygion* bears 1–11 short proximal filaments and 4–6 long distal filaments (Figure 9a–l).

The a-bristle of the 7th joint of the 1st antenna of the Cypridinacea has been discussed by Poulsen (1965:451, 452). The a-bristles in the families Cypridinidae, Philomedidae, Sarsiellidae, and

Rutidermatidae are ringed bristles. Within the Cylindroleberididae, members of the Cylindroleberidinae have short clawlike a-bristles (Figure 10l–p); members of the Cyclasteropinae (Figure 10j), with the exception of the monotypic genus *Alphaleberis* (*A. alphathrix*) (Figure 10k), have clawlike a-bristles; members of the Asteropteroninae have both bristlelike and clawlike a-bristles (Figure 10a–i). Species of *Asteropella*, *Actinoseta*, and some species of *Asteropterygion* (the *A. thomassini* Group) have short clawlike a-bristles (Figure 10a–c,f). The monotypic genus *Pteromeniscus* (*P. intesi*) and some species of *Asteropterygion* (the *A. dayi* Group) have an a-bristle that is clawlike proximally, bristle-like distally, and tapers to a pointed tip (Figure 10d,g). The a-bristle of *Microasteropteron* is bristlelike (Figure 10h). The a-bristle of the monotypic genera *Omegasterope* (*O. upsilon*) and *Asteropteron* (*A. fuscum*) is long, slender, claw-like (Figure 10e,i).

The b-bristle of the 7th joint is missing on a few taxa of the Philomedidae and Sarsiellidae, but is present on all members of other families of the Cypridinacea.

Sensory or suctorial discs are present on the b- and c-bristles of the 1st antenna of adult males of members of the Cypridinidae. Discs are absent on these bristles of adult males of other families of the Cypridinacea.

The c- and f-bristles are very long on the 1st antenna of adult males of some members of the Philomedidae, on all members of the Rutidermatidae, but not on members of the Sarsiellidae. Within the Cylindroleberididae, the c- and f-bristles of the adult male are very long in most Cylindroleberidinae and Cyclasteropinae (except for *Amboleberis antyx*), but not in the Asteropteroninae. On the 1st antenna of adult males of the Cypridinidae, some species have very long c- and f-bristles, some have very long f- and g-bristles, and on some species none of these bristles are extra long.

The c-, f-, and g-bristles, or only the f- and g-bristles, are clawlike on some members of the Sarsiellidae, but not on other families of the Cypridinacea.

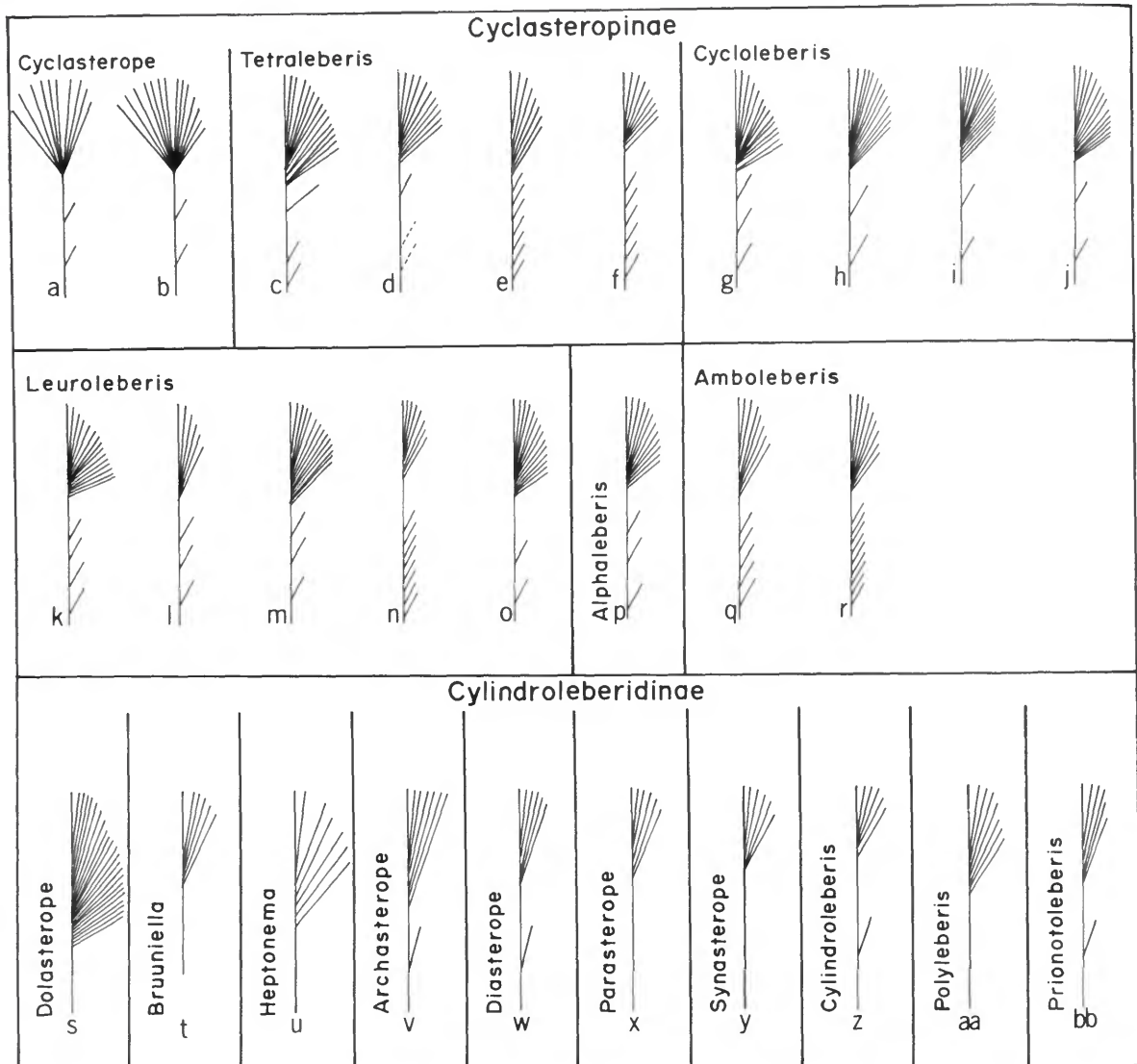


FIGURE 8.—Comparisons of sensory bristle of the 5th joint of the 1st antennae of females (adults unless noted otherwise) of species of Cyclasteropinae and Cylindroleberidinae, dorsal margin of bristle to right (filaments arranged diagrammatically): a, *Cyclasterope fascigera* Brady; b, *C. bisetosa* Poulsen; c, *Tetraleberis brevis* (Müller) (adult or A-1 instar); d, *T. similis* (Brady); e, *T. maddocksae*, new species; f, *T. tanzania*, new species (adult or A-1 instar); g, *Cycloleberis galathea* Poulsen; h, *C. christiei* Kornicker and Maddocks; i, *C. lobiancoi* (Müller); j, *C. squamiger* (Scott); k, *Leuroleberis zealandica* (Baird, 1850b) (A-1? instar); l, *L. orbicularis* (Brady) (early instar); m, *L. poulseni* (Moguilevsky and Ramírez); n, *L. sharpei*, new species; o, *L. mackenziei*, new species (adult or A-1 instar); p, *Alphaleberis alphathrix*, new species; q, *Amboleberis antyx*, new species (juvenile); r, *A. americana* (Müller); s, *Dolasterope johanseni* Poulsen (juvenile); t, *Brunniella breviata* Poulsen; u, *Heptonema serrata* Poulsen; v, *Archasterope dentata* Poulsen; w, *Diasterope pilosa* Poulsen; x, *Parasterope obesa* Poulsen; y, *Synasterope bassana* Poulsen; z, *Cylindroleberis thailandica* (Poulsen); aa, *Polyleberis mackenziei* Kornicker; bb, *Prionotoleberis pax* Kornicker and Carraon.

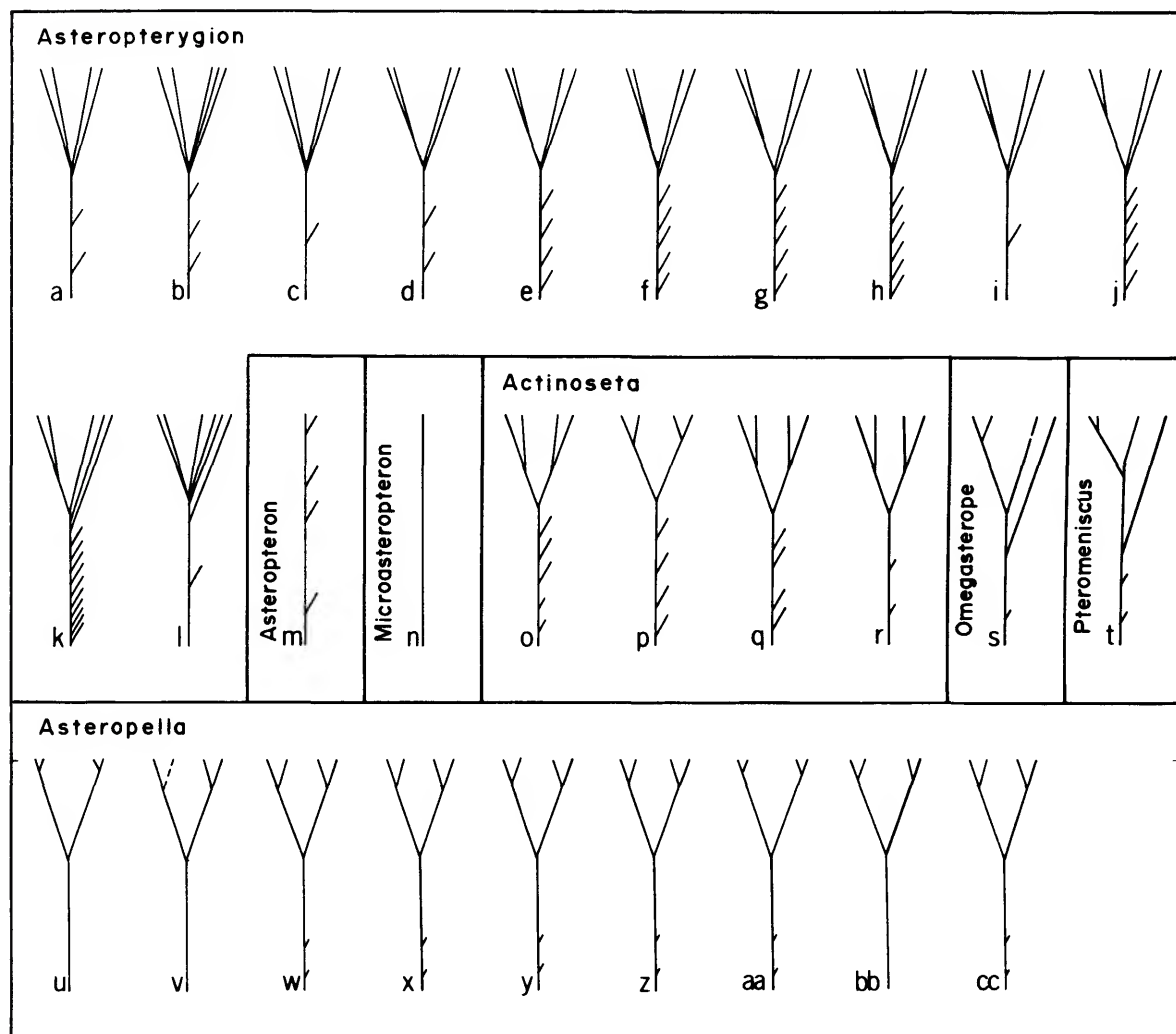


FIGURE 9.—Comparisons of sensory bristles of 5th joint of 1st antennae of species of Asteropteroninae (adult females unless noted otherwise), dorsal margin of bristle to right (filaments arranged diagrammatically): a, *Asteropterygion magnum* (Poulsen); b, *A. skogsbergi* (Poulsen); c, *A. spinosum* (Poulsen); d, *A. setiferum* (Kornicker and Caraión); e, *A. hulingsi* (Kornicker); f, *A. romei*, new species; g, *A. thomassini*, new species; h, *A. oculitristis* (Darby); i, *A. dayi*, new species; j, *A. peterseni*, new species; k, *A. hirsutum* (Poulsen) (juvenile male); l, *A. thailandicum* (Poulsen) (juvenile male); m, *Asteropteron fuscum* (Müller); n, *Microasteropteron parvum* Poulsen, (*M. youngi* Kornicker same); o, *Actinoseta chelisparsa* Kornicker; p, *A. jonesi*, new species; q, *A. hummelincki*, new species; r, *A. nodosa*, new species (juvenile female); s, *Omegasterope upsilon* (Kornicker and Caraión); t, *Pteromeniscus intesi*, new species (juvenile female); u, *Asteropella mortenseni* Poulsen; v, *A. scammonensis* McKenzie (juvenile female); w, *A. kaufmani*, new species; x, *A. punctata* Poulsen; y, *A. macLaughlinae*, new species; z, *A. slatteryi*, new species; aa, *A. monambon* (Kornicker); bb, *A. agassizii* (Müller); cc, *A. tritrix*, new species.

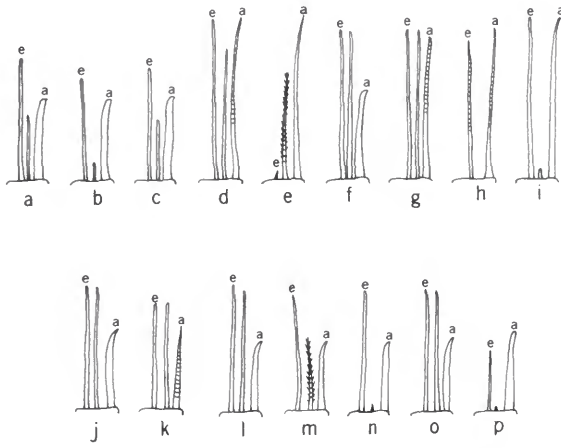


FIGURE 10.—Comparisons of a-bristles of 7th joint and d- and e-bristles of 8th joint of 1st antennae of cylindroleberids, upper edge of limb to right (sketches); a, *Asteropella mortenseni* Poulsen, 1965, fig. 76e; b, *A. punctata* Poulsen, 1965, fig. 80e; c, *Actinoseta hummelincki*, new species; d, *Pteromeniscus intesi*, new species (male); e, *Omegasterope epsilon* (Kornicker and Caraion); f, *Asteropterygion skogsbergi* (Poulsen, 1965, fig. 71b); g, *A. hirsutum* (Poulsen, 1965, fig. 61b); h, *Microasteropteron youngi* Kornicker, 1976b, fig. 19e; i, *Asteropteron fuscum* (Müller); j, *Leuroleberis zealandica* (Baird, 1850a) (Poulsen, 1965, fig. 83c); k, *Alphaleberis alphathrix*, new species; l, *Skogsbergiella plocus* Kornicker (1975a, fig. 299f); m, *Bathyleberis monothrix* Kornicker, 1975a, fig. 336d; n, *Parasterope pseudoquadrata* (Hartmann, 1965) (Kornicker, 1975a, fig. 260d); o, *Dolasterope johanseni* Poulsen, 1965, fig. 105c; p, *Brunniella breviata* Poulsen, 1965: fig. 108f.

The d- and e-bristles of the 8th joint of the 1st antenna of members of the Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae are sensory bristles generally differing from other bristles in being more transparent, being without marginal filaments, having more closely spaced rings distally, and having parallel sides. They are well developed in those families and are equal or subequal in length. The d- and e-bristles vary considerably among the members of the Cylindroleberidinae. In the Cylindroleberidinae, the e-bristle is well developed in all members, but the d-bristle is missing or represented by a minute spine on some taxa (Figure 10n,p), is represented by a tapering bristle (spinous on some species) on the genus *Bathyleberis* Kornicker, 1975a, (Figure 10m), and is well developed on the remaining

taxa (Figure 10l,o). In the Cyclasteropinae, the d- and e-bristles are well developed and about equal in length (Figure 10j,k). Among members of the Asteropteroninae, the d- and e-bristles vary considerably: in *Microasteropteron* the d-bristle is absent, and the e-bristle is tapered and bristle-like (Figure 10h); in *Omegasterope* the d-bristle is well developed, spinous, and bristle-like, whereas the e-bristle is minute (Figure 10e); in *Asteropteron* the d-bristle is minute and the e-bristle is well developed (Figure 10i); in *Actinoseta* and *Asteropella* the e-bristle is well developed and the d-bristle when present is smaller (often minute) than the e-bristle (Figure 10a-c); in *Pteromeniscus* and *Asteropterygion* both the d- and e-bristles are well developed (Figure 10d,f,g).

Second Antenna: Although not studied herein, the outline of the protopodite of the 2nd antenna varies considerably among taxa of the Cylindroleberididae (Figure 11). The protopodite of the adult male is larger than that of the adult female (Poulsen, 1965:480). A distal bristle is present on the protopodite of all members of the Cypridinidae, and is absent on all members of the Philomedidae, Sarsiellidae, and Rutidermatidae. In the Cylindroleberididae, a distal bristle is present on all members of the Cyclasteropinae and Asteropteroninae, except on the monotypic genus *Omegasterope*, and on most members of the Cylindroleberidinae (exceptions are *Brunniella breviata* and most species of *Cylindroleberis*).

In the Cypridinacea the endopodite of the adult female is described as having 1 to 3 joints, never more. In some species of Cyclasteropinae, however, the 1st joint actually consists of a proximal and distal part; such endopodites could be interpreted as having 4 joints. The sutures dividing joints on the endopodite of the female cylindroleberid are often indistinct or lacking, making it difficult to interpret the number of joints present.

In the Cylindroleberididae, differences among genera occur in the female endopodite in its relative size compared to that of the exopodite and protopodite (Figure 11), in number of joints and their relative lengths, and in the distribution of hairs and bristles (Figure 12). The female

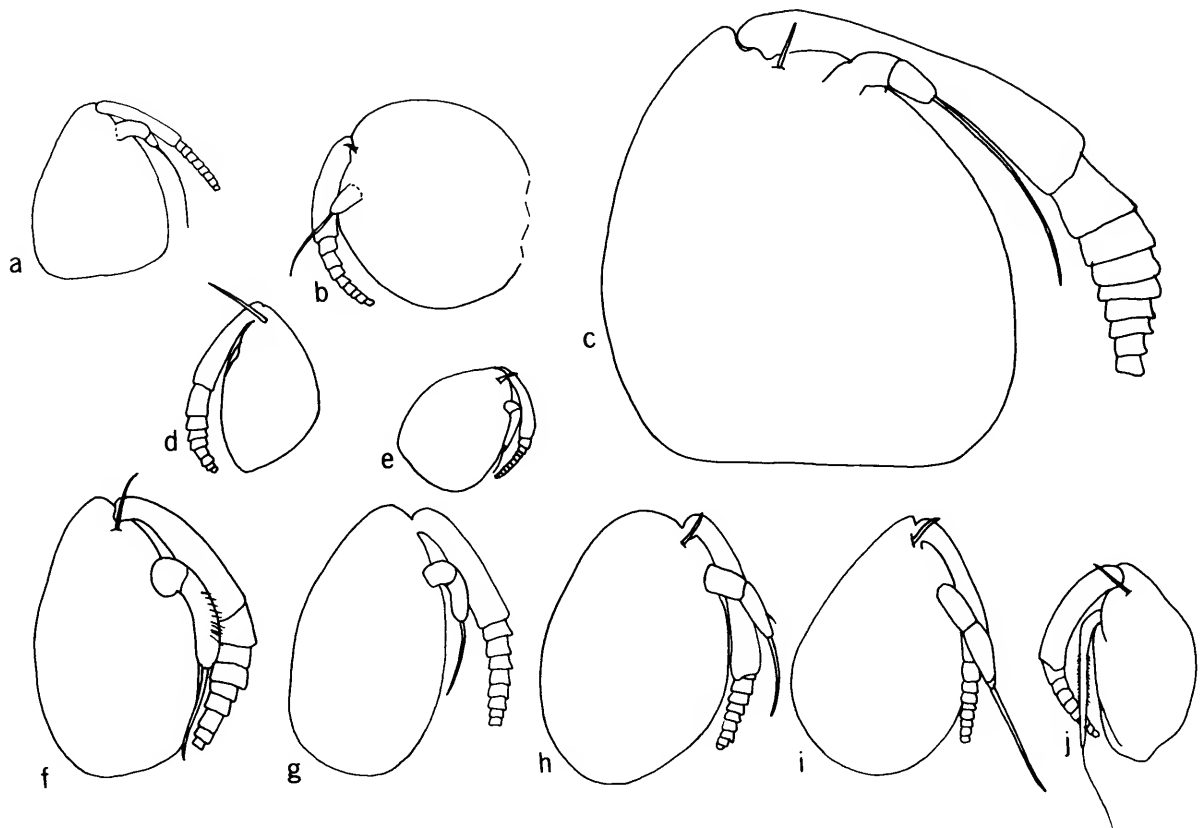


FIGURE 11.—Comparisons of 2nd antennae of female cylindroleberids showing relative lengths of endopodites and exopodites (sketches), medial views, exopodial bristles and most short endopodial bristles omitted: *a*, *Brunniella breviata* Poulsen, 1965, fig. 107e; *b*, *Parasterope beta* Kornicker, 1976a, fig. 6d; *c*, *Tetraleberis maddocksae*, new species (juvenile female); *d*, *Microasteropteron youngi* Kornicker, 1976b, fig. 19g; *e*, *Actinoseta chelisparsa* Kornicker; *f*, *Pteromeniscus intesi*, new species (instar III); *g*, *Omegasterope upsilon* (Kornicker and Caraion); *h*, *Asteropteron fuscum* (Müller); *i*, *Asteropterygion magnum* (Poulsen, 1965, fig. 57f); *j*, *Asteropella mortenseni* Poulsen, 1965, fig. 76f.

endopodite of species of *Microasteropteron* is unusual in consisting of only 1 joint, and in not having a long terminal bristle (Figure 12g). The endopodite of *Actinoseta* is unusual in having a 2nd joint with many (3–10) bristles (Figure 12c). The female endopodite of most species of *Asteropella* is hirsute (Figure 12a), as is the endopodite of the monotypic *Pteromeniscus* (*P. intesi*) (Figure 12d). The female endopodite of *Asteropella* is interpreted herein as having small 1st and 2nd joints, and a long hirsute 3rd joint. Another interpretation could be that it has a short 1st joint,

a long hirsute 2nd joint, and a small 3rd joint not separated from the 2nd joint by a suture. The latter interpretation might better fit the basic pattern of endopodites of most cylindroleberids that have a 2nd joint longer than the 3rd.

In the Cylindroleberididae, Rutidermatidae, Philomedidae, most members of the Sarsiellidae, and some members of the Cypridinidae, the endopodite of the adult male is 3-jointed, with the 3rd joint reflexed on the 2nd; the endopodite is probably used as a clasper during copulation. In most members of the Cypridinidae and in some

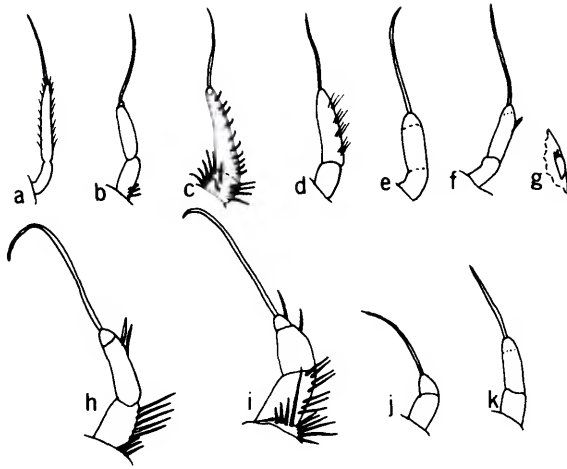


FIGURE 12.—Comparisons of right endopodites of 2nd antennae of female cylindroleberids (sketches), medial views: *a*, *Asteropella mortenseni* Poulsen, 1965, fig. 76f; *b*, *Asteropterygion magnum* (Poulsen, 1965, fig. 57f); *c*, *Actinoseta chelispara* Kornicker; *d*, *Pteromeniscus intesi*, new species (instar III); *e*, *Omegasterope upsilon* (Kornicker and Caraion); *f*, *Asteropteron fuscum* (Müller); *g*, *Microasteropteron parvum* Poulsen, 1965, fig. 74f; *h*, *Cycloleberis squamiger* (Scott) (see Kornicker, 1975b), fig. 5d; *i*, *Cyclasterope bisetosa* Poulsen, 1965, fig. 102c; *j*, *Bruniella breviata* Poulsen, 1965, fig. 107e; *k*, *Parasterope pollex* Kornicker (in Bowman and Kornicker, 1967, fig. 4k).

members of the Sarsiellidae, the endopodite of the adult male does not serve as a clasper, and is not greatly dissimilar from that of the female. The endopodite of the adult male, when developed as a clasper, is usually much larger than that of the adult female.

Basically, the clasping type endopodite of the adult male is fairly similar in all families of the Cypridinacea. In the Cylindroleberididae, differences occur among the genera in the relative size of the joints, in the presence or absence of hairs and bristles, and in the shape and armature of the 3rd joint (Figure 13). In some taxa the 2nd joint is grooved to receive the 3rd joint when it closes on the 2nd. The 3rd joint of members of *Asteropella* is unusual in being very short (Figure 13a). The adult male is unknown for *Microasteropteron* and *Omegasterope*.

In adult males of the Cyclasteropinae and Cylindroleberidinae, the 2nd exopodial joint compared to the 3rd joint is relatively long. The long

2nd joint is not present in adult males of Asteropteroninae, nor in adult males of members of the families Cypridinidae, Rutidermatidae, Sarsiellidae, and Philomedidae. Most members of the Philomedidae have a relatively long 3rd joint on the exopodite of the adult male.

Mandible: The way in which the mandible is used by members of the Cylindroleberididae in feeding was discussed by Cannon (1933:743, 750, 753). The coxale endite (scythe-shaped process), which projects into the esophagus, is unlike the coxale endite in other families of Cypridinacea (see Poulsen, 1965:452, for comparison and discussion). The coxale endites of members of the Cypridinidae and Cylindroleberididae have little or no sexual dimorphism, whereas, in other families, the endite of the adult male is much smaller than those of adult females.

The basale of the mandible of members of the Cylindroleberididae differs from those of other families of Cypridinacea in having a well-developed endite bearing triaenid bristles. Triaenid bristles may also be present on the ventral margin

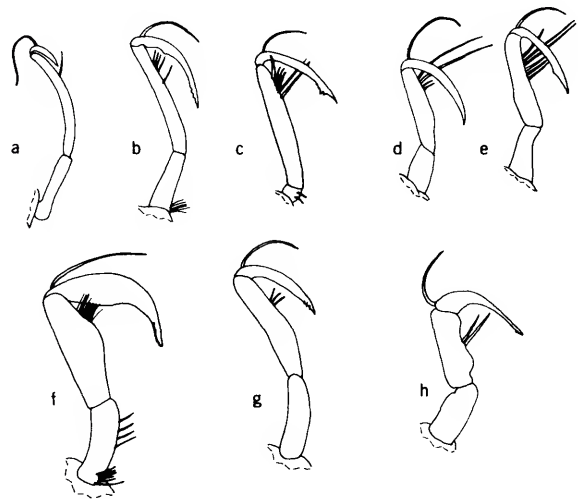


FIGURE 13.—Comparisons of endopodites of 2nd antennae of adult male (sketches): *a*, *Asteropella mortenseni* Poulsen, 1965, fig. 78c; *b*, *Asteropterygion nodulosum* (Poulsen, 1965, fig. 67f); *c*, *Actinoseta hummelincki*, new species; *d*, *Pteromeniscus intesi*, new species; *e*, *Asteropteron fuscum* (Müller); *f*, *Leuroleberis sharpei*, new species; *g*, *Parasterope pollex* Kornicker (in Bowman and Kornicker, 1967, fig. 6k); *h*, *Diasterope bisetosa* Poulsen, 1965, fig. 118c.

of the basale of Cyndroleberididae, and on a few species are more weakly developed on the male than on the female (for discussion of triaenid bristles see Poulsen, 1965:454, 455). *Bruniella breviata* Poulson, 1965, is an exception in that the mandible is without triaenid bristles. The mandible of *B. breviata* also differs from that of other members of the Cyndroleberidinae in having the 2nd and 3rd endopodial joints fused, and in several other characters.

The endopodites of the mandible have considerable sexual dimorphism in the families Sarsiellidae and Rutidermatidae, but little, if any, in the Cypridinidae, Philomedidae, and Cyndroleberididae. The exopodites of the mandible, which have little sexual dimorphism in the Cypridinidae, Philomedidae, and Cyndroleberididae, have considerable dimorphism in the Rutidermatidae. In the Sarsiellidae the exopodite is either missing on both sexes, present in reduced form in both sexes, or absent on the female and present in reduced form on the adult male.

Reduction of the coxale endites of the adult male members of the Philomedidae, Sarsiellidae, and Rutidermatidae, suggests that males do not eat, or at least do not eat in the same manner as adult females and juveniles of both sexes. The endopodite of the mandible of female and juvenile members of the carnivorous Rutidermatidae are developed as pincers, which are used in grabbing prey. These pincers are not present on the mandible of adult males. In the carnivorous Sarsiellidae, the 3 endopodial joints of the adult female and juveniles of both sexes each bears 1 or more claws probably used in feeding. The claws on the 1st and 2nd joints are replaced by bristles on adult males of some genera.

Maxilla: The main function of the maxilla in the Cypridinacea appears to be feeding. In the Sarsiellidae, Rutidermatidae, and Philomedidae, the maxillae of the adult male are reduced and modified, suggesting that adult males do not eat, or at least that they eat differently than do the adult female and juveniles (both sexes). In the Cyndroleberididae and Cypridinidae, maxillae of adult males are not reduced, suggesting that the feeding habit of the adult male is not different

than that of the adult female or juveniles of both sexes. The use of the maxilla was studied by Cannon (1933:746).

The maxilla of the Cyndroleberididae differs considerably in morphology from that of the other families of the Cypridinacea. Homologies between the families have been discussed by Skogsberg (1920:33, 36, 431) and Poulsen (1965:455). The baleen-comb attached to a list along the lateral side of the basale and coxale of the Cyndroleberididae is not found in other families of the Cypridinacea. The epipodial appendage is much larger and is shaped differently on the maxilla of the Cyndroleberididae than on the maxillae of other families of the Cypridinacea.

An exopodite is present on the maxillae of the Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae. In the Cyndroleberididae, an exopodite is present in reduced form on the maxilla of the Cyclasteropinae, and is absent on the maxilla of the Cyndroleberidinae. In the Asteropteronae the exopodite is variable. The exopodite is either absent, or consists of 1 or 2 bristles, or a small lobe with up to 3 bristles.

The end joint of the endopodite of the maxilla of members of the Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae bears many normal bristles and clawlike bristles, some pectinate. Members of the Cyndroleberididae have on the end joint of the maxilla relatively few bristles, of which none are clawlike or pectinate, although some have marginal spines. Except for the monotypic genus *Dolasterope* (*D. johanseni* Poulsen, 1965) and the species *Parasterope jenseni* Poulsen, 1965, which bear 2 bristles on the end joint of the endopodite of the maxilla, all members of the Cyndroleberidinae have only 1 bristle on the end joint. The maxilla of members of the Cyclasteropinae have 5 or 6 bristles on the end joint of the endopodite. The number of bristles on the end joint for genera of the Asteropteronae is *Asteropterona* 5, *Asteropella* 3-4, *Asteroptygion* 5-7, *Microasteropona* 3-4, *Pteromeniscus* 3, *Omegasterope* 4, *Actinoseta* 5-6.

Fifth Limb: The 5th limb in the Cypridinacea is used in feeding. In the Sarsiellidae, Rutidermatidae, and Philomedidae, the 5th limbs of the

adult male are reduced and modified suggesting that adult males do not eat, or at least that they eat differently than do adult females and juveniles of both sexes. In the Cypridinidae and Cyndroleberididae, 5th limbs of adult males are not reduced, suggesting that the feeding habit of the adult male is not different than that of the adult female or juveniles of both sexes. The use of the 5th limb by cyndroleberids was studied by Cannon (1933).

The 5th limbs of the Cyndroleberididae differ considerably from those of members of other families. Homologization of the components of the 5th limbs of families of the Cypridinacea has been discussed by Skogsberg (1920:38-42) and Poulsen (1965:456, 457). I have followed Poulsen (1965:457) herein in using the terminology of Skogsberg in descriptions of this limb.

Except for *Amboleberis antyx*, the combs of the 5th limbs of adult males of members of the Cyclasteropinae have dorsal margins with 1 or 2 processes, which on some species are strongly sclerotized. The structures on the dorsal margin have been found useful in identifying species. Their function is unknown, but possibly they are used as claspers during copulation. The shape of the distal end of the comb of the 5th limbs of adult males of some species of the Cyclasteropinae also differs from that of the female. Sexual dimorphism is slight or absent in members of the Asteropteroinae and Cyndroleberidinae.

The combs of the 5th limbs of members of the Cyndroleberidinae have bare dorsal margins (Poulsen, 1965, table 17, indicates that *Dolasterope johanseni* Poulsen, 1965, and *Archasterope dentata* Poulsen, 1965, have hairs along the dorsal margin, but described them as being bare on pages 322 and 344, respectively), and 1 very long and several short exopodial bristles.

The combs of the 5th limbs of members of the Cyclasteropinae have dorsal margins with several short bristles, and most species also have dorsal hairs. Members of the Cyclasteropini of which the 5th limb is known, and also the Cycloleberidini, have 2 long and several short exopodial bristles. The 2 long bristles are adjacent to each other, and the anterior of them is much stouter.

The stout bristle is probably homologous with the single long exopodial bristle of the 5th limb of members of the Cyndroleberidinae.

The dorsal margins of the comb of the 5th limbs of all members of the Asteropteroinae have hairs, some also have a few small bristles. Species of *Actinoseta* and most species of *Asteroptygion* have combs with only 1 long and stout exopodial bristle in addition to several short ones, but a few species have in addition, a long slender bristle just proximal to the stout bristle. The comb of the 5th limb of the monotypic genus *Asteropterion* (*A. fuscum*) bears a long stout exopodial bristle as well as a long slender bristle (proximal and ventral to the stout bristle) and several shorter bristles. The 2 known species of *Microasteroptygion* have a single long spinous bristle and only 1 short bristle. Species of *Asteropella*, *Omegassterope*, and *Pteromeniscus* differ from other genera of the Asteropteroinae in having a long, slender, spinous, exopodial bristle close to the proximal end of the comb in addition to a stout, spinous, distal bristle and several shorter bristles.

Sixth Limb: The 6th limb of the Cyndroleberididae differs from that of other families of Cypridinacea in shape and absence of well-developed endites, and also in having fewer internal muscles. A lateral longitudinal ridge is present near the ventral margin of the skirt. The use of this limb in feeding was described by Cannon (1933:746).

With the exception of species of *Bruuniella*, 6th limbs of species of the Cyndroleberidinae have straight or convex posterior margins, broadly rounded posteroventral corners, and 1-3 anterior bristles on the trunk (Figure 14*i,k,l*). The posterior margin of the 6th limb of *Bruuniella* is concave, the posteroventral corner is narrowly rounded, and the anterior margin of the trunk is without bristles (Figure 14*j*). The posterior margin of the trunk of 6th limbs of members of the Cyndroleberidinae are without epipodial bristles, and, except for a few species, the ventral margin of the skirt bears many bristles. The trunk and skirt of 6th limbs of the Cyndroleberidinae are not well delimited along the posterior margin.

The 6th limbs of members of the Cyclastero-

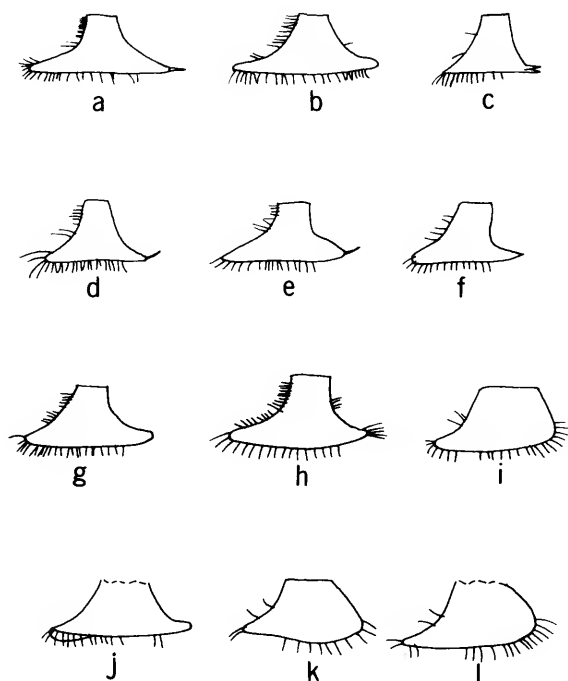


FIGURE 14.—Comparisons of cylindroleberid 6th limbs (sketches), anterior to left, bristles generalized, hairs not shown: a, *Asteropella mortenseni* Poulsen, 1965, fig. 77b; b, *Asteropterygion magnum* (Poulsen, 1965, fig. 59g); c, *Microasteropteron parvum* Poulsen, 1965, fig. 74k; d, *Omegasterope upsilon* (Kornicker and Caraion, 1974, fig. 33o); e, *Pteromeniscus intesi*, new species; f, *Actinoseta hummelincki*, new species; g, *Asteropteron fuscum* (Müller); h, *Cycloleberis galathea* Poulsen, 1965, fig. 88c; i, *Dolasterope johanseni* Poulsen, 1965, fig. 106c; j, *Bruuniella breviata* Poulsen, 1965, fig. 108b; k, *Heptonema serrata* Poulsen, 1965, fig. 110b; l, *Parasterope skogsbergi* Poulsen, 1965, fig. 125e.

pinæ have a narrow trunk clearly separated along both the anterior and posterior margins from a broad skirt. The anterior margin of the trunk bears numerous bristles; the posterior margin bears several epipodial bristles near the distal end. The skirt bears numerous anterior and ventral bristles as well as several hirsute bristles on the narrow posterior tip (Figure 14h).

The 6th limbs of members of the Asteropteroinae resemble those of the Cyclasteropinæ in having a concave posterior margin and a skirt with a narrow projecting posterior tip. The 6th limbs of the monotypic genus *Asteropteron* (*A.*

fuscum) have a trunk with numerous anterior bristles and no epipodial bristles, and a skirt with numerous ventral bristles, but no bristles on the posterior tip (Figure 14g). Some species of *Asteropterygion* have 6th limbs that differ from those of *Asteropteron fuscum* in having 0–4 epipodial bristles on the skirt (Figure 14b) and 1–5 bristles on the posterior tip of the skirt. The 6th limbs of species of *Actinoseta* are in general, similar to those of *Asteropteron fuscum* (Figure 14f). The 6th limbs of some species of *Asteropella* and of the monotypic genera *Omegasterope* and *Pteromeniscus* differ from those of *Asteropteron fuscum* in having a bristle on the posterior tip of the skirt (Figure 14a,d,e). The 6th limbs of members of the genus *Microasteropteron* differ from those of other genera of the Asteropteroinae in having an almost straight posterior margin, and only 2 bristles on the anterior margin of the trunk; the posterior tip of the skirt bears 2 bristles (Figure 14c). In having only 2 bristles on the anterior margin of the trunk, species of *Microasteropteron* resemble some species of Cyclindroleberidinae.

Seventh Limb: The function of the 7th limb is unknown (see discussion in Skogsberg, 1920:88, 89). The 7th limb is poorly developed in males of most species of the Sarsiellidae, and is absent in the male *Harbansus paucichelatus* (Kornicker, 1958), suggesting that the limb may be concerned with brood care by the adult female. The pore through which eggs are extruded is located on each side of the body anterior to the base of the furcal lamellae. Extruded eggs are then held inside the posterior end of the carapace in back of, and also above, the posterior end of the body. Thus, the eggs have to move, or be moved, from the pore from which they are extruded to the posterior end of the carapace, passing the posterior part of the body in doing so. Perhaps the 7th limb assists in moving the extruded eggs from the pore to their final position.

The tips of the 7th limbs in the Cyclindroleberididae mostly consist of single or double opposing combs, each with about the same number of spinous and alate teeth, but some genera of the Asteropteroinae are not distinctly divided into 2 combs. In other families the tip of the 7th limb

is quite variable: the Cypridinidae generally with a single comb opposite either a few teeth or a complex process, but a few species with opposing combs; the Philomedidae with a single comb opposite 1 or more pegs; the Sarsiellidae generally with opposing combs, each with relatively few teeth; the Rutidermatidae with either opposing combs, or with a single comb opposite 1 or more pegs. The comb teeth often have a minute pore at the tip (see Kornicker, 1975a, fig. 47e,f; 1975b, fig. 8; Kornicker, et al., 1976, fig. 17d).

The 7th limbs of *Cylindroleberidinae* generally have few marginal bristles and a tip with a V-shaped indentation with spinous teeth forming a comb along each arm of the V (Figure 15j-l). Although not studied in detail on many species, the comb teeth vary in length, but otherwise seem similar, having marginal spines and a bifurcate tip (the inner branch of the tip is blunt and probably bears a pore) (see Poulsen, 1965, fig. 106d,d'; Kornicker, 1975a, fig. 328b,c).

The 7th limbs of the *Cyclasteropinae* have abundant marginal bristles. The tips of the 7th limbs of the *Cyclasteropini* differ from those of the *Cycloleberidini* and *Tetraleberidini* in having

4 rather than 2 combs (Figure 15h,i). The tip of the limb of the *Cyclasteropinae* has a V-shaped indentation as in the *Cylindroleberidinae*. The comb teeth may be divided into several types based on the kinds of marginal spines (see Kornicker, 1975b, fig. 8).

The 7th limbs of the *Asteropteroninae* vary considerably in the number of marginal bristles and in the morphology of the tips. The tips of the 7th limbs of species of *Asteropteron*, *Actinoseta*, and *Asteropterygion* resemble those of the *Cycloleberidini* and *Tetraleberidini*, but have fewer comb teeth (Figure 15a,d,e). The tips of the 7th limbs of species *Microasteropteron* differ from those of *Asteropteron fuscum* in having in the middle of each comb a few large rounded teeth (Figure 15b); these are not found on the 7th limbs of other *Cypridinacea*. The tips of the 7th limbs of species of *Asteropella*, *Pteromeniscus*, and *Omegasterope* do not have a V-shaped indentation; also, the teeth are not clearly differentiated into paired combs, and they are similar to each other (Figure 15c,f,g).

Furca: All known *Cypridinacea* have strong furcal claws. The function of the furca appears unrelated to feeding because strong claws are

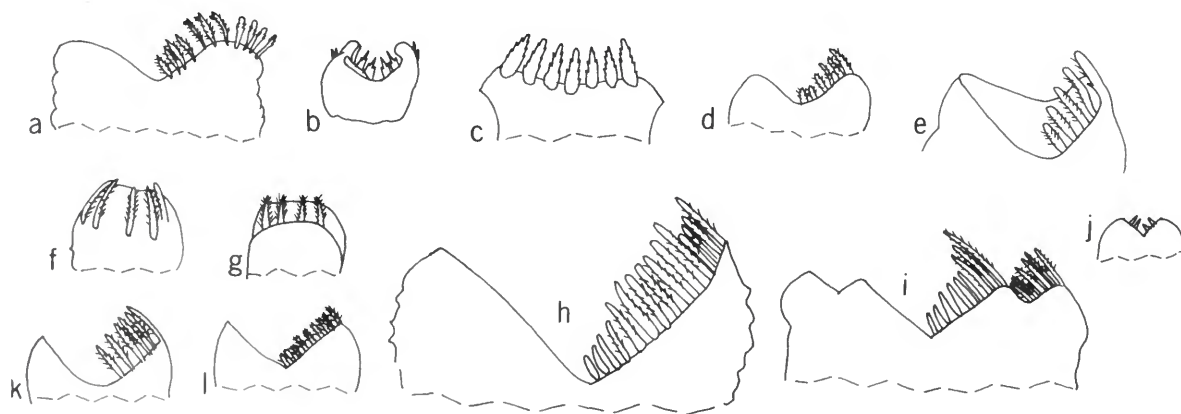


FIGURE 15.—Comparisons of terminal combs of cylindroleberid 7th limbs (sketches), only half of combs shown in a,d,e,h,i,k,l: a, *Asteropterygion magnum* (Poulsen, 1965, fig. 58j); b, *Microasteropteron parvum* Poulsen, 1965, fig. 741; c, *Asteropella mortenseni* Poulsen, 1965, fig. 77c; d, *Asteropteron fuscum* (Müller); e, *Actinoseta hummelincki*, new species; f, *Pteromeniscus intesi*, new species; g, *Omegasterope upsilon* (Kornicker and Caraion, 1974, fig. 33p); h, *Leuroleberis zealandica* (Baird, 1850b) (Poulsen, 1965, fig. 92c); i, *Cyclasterope fascigera* Brady (Poulsen, 1965, fig. 98d); j, *Brunniella brevata* Poulsen, 1965, fig. 108c; k, *Heptonema serrata* Poulsen, 1965, fig. 110c; l, *Dolasterope johanseni* Poulsen, 1965, fig. 106d.

present on different feeding types (filter feeders, carnivores, and detritus feeders; also see Cannon: 1931:438; 1933:743; 1940:193). The furca of the Myodocopa differs from that of the Podocopa in being posterior rather than ventral to the anus (see Kornicker, 1975a:81–82). Strong claws are present on burrowing taxa (e.g. *Cylindroleberidinae*) as well as on planktonic taxa (e.g. halocyprids). It seems likely, however, the strong claws would be useful in burrowing (Müller, 1893:358). Other uses might be defense, cleaning debris from inside the carapace, and crawling. In view of the anterior position of the anus relative to the furca in the Myodocopa, the furca might be used to remove egested material from the immediate vicinity of the carapace. In all Ostracoda the furca may be withdrawn completely inside of the carapace and the valves closed.

Although the number of claws on each lamella of the furca of an individual specimen may vary slightly in the Cypridinacea, dimorphism between the lamellae is not pronounced. Morphological differences between furcae of different taxa are shape of the lamellae, number of claws, shape of claws, presence or absence of a suture at the base of some claws, relative length and width of claws, distribution of teeth or spines on claws; presence or absence of bristles following or between claws; distribution of spines along bristles; position of bristles relative to ventral margin of lamellae; and the presence or absence of a pedestal at base of some claws. In some species of the Cypridinidae (in genus *Cypridina*) major differences occur between the adult male and adult female furca. In other families differences are absent or minor; e.g. small differences in the number, size, or shape of claws and bristles.

In the Cypridinidae some species have 1 to 3 claws without a suture between the claw and the lamella, and in the species of Sarsiellidae the first claw is always, and other claws are sometimes without a basal suture. In the *Cylindroleberidinae*, *Rutidermatidae*, and *Philomedidae* all claws are separated from the lamella by a suture. All families have some species with the furca having markedly weaker claws between stronger claws; the latter are often termed main claws and the

former secondary claws. In the *Cylindroleberididae* the furca of some taxa have secondary claws that are bristlelike; these are termed either bristlelike claws, or bristles. Also, on the furca of some *Cylindroleberididae* are bristles that can hardly be called claws; these are also termed bristles.

With the exception of the monotypic genus *Dolasterope*, each lamella of the furca of members of the *Cylindroleberidinae* have 7–10 claws decreasing in length and width posteriorly (Figure 16l,m). The posterior 1–3 of these are weaker than the others and are termed secondary claws; some are bristlelike, and some are annulated bristles. On some species, such as *Bruuniella breviata* Poulsen, 1965, the proximal bristle (bristles in other species) is placed laterally on the lamella a short distance from the ventral margin of the lamella (Figure 16l). The furca of *Dolasterope johanseni* Poulsen, 1965 differs from other members of the *Cylindroleberidinae* in having more triangular-shaped lamellae, and 4 long bristles between main claws 2–6 of each lamella (Figure 16k).

The furca of members of the genus *Cyclasterope* in the tribe *Cyclasteropini* of the *Cyclasteropinae* have bristles between main claws as in *Dolasterope johanseni*, but the number of bristles differ, and the 2nd and 3rd claws on the lamellae of species of *Cyclasterope* have short pedestallike bases (Figure 16h).

Species in the tribes *Cycloleberidini* and *Tetraleberidini* of the *Cyclasteropinae* differ from the *Cyclasteropini* and *Cylindroleberidinae* in having fewer main claws: 3 for the *Cycloleberidini*, (Figure 16j), 4 for the *Tetraleberidini* (Figure 16i). The main claws are followed by 5 or more bristles placed laterally on the lamella. A short bristle is present between the 3rd and 4th claws of the *Tetraleberidini*.

Genera in the subfamily *Asteropterioninae* have various kinds of furcae, but no species has bristles placed between main claws. In the monotypic genus *Asteropterion*, *A. fuscum* has on each lamella 3 main claws followed by 5 or 6 secondary claws (Figure 16g). Except for *Asteropterygion hirsutum*, species of *Asteropterygion* have on each lamella 3 main claws followed by as many as 10 secondary claws, some bristlelike (Figure 16b). Each lamella

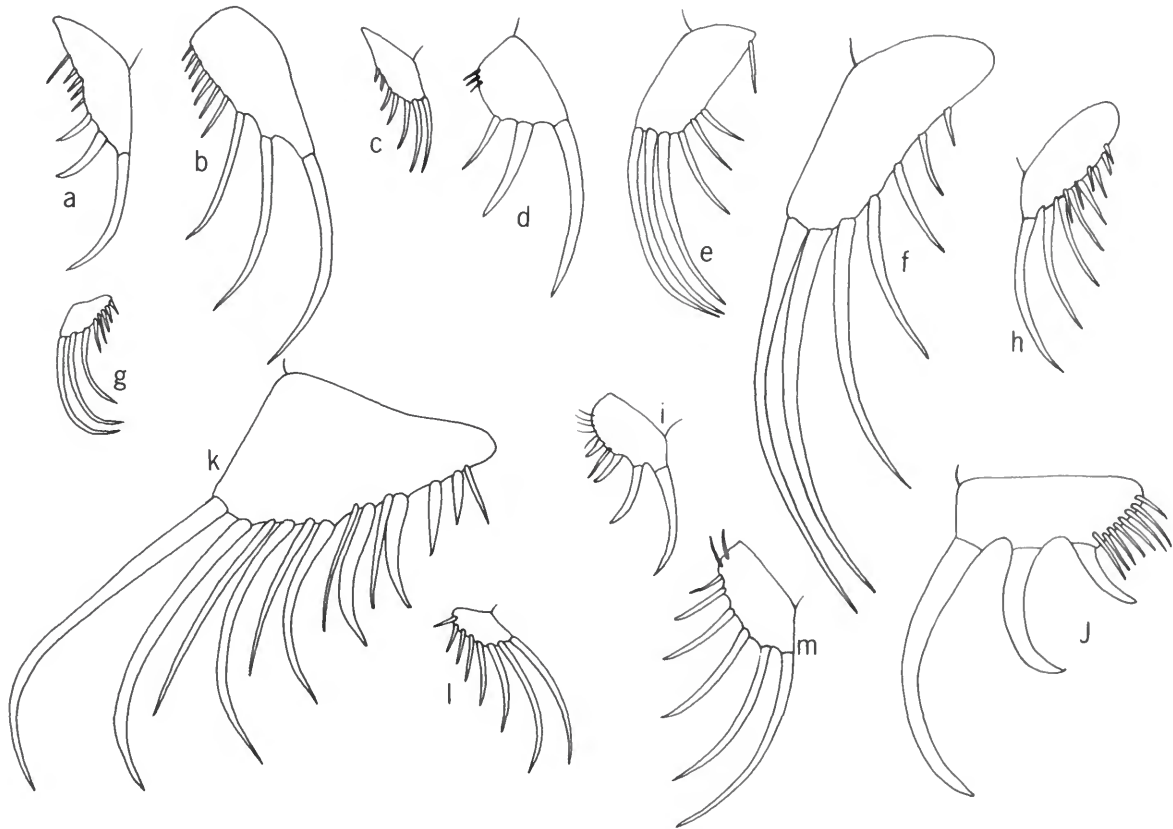


FIGURE 16.—Comparisons of cylindroleberid furcal lamellae: *a*, *Asteropella mortenseni* Poulsen, 1965, fig. 77g; *b*, *Asteropterygion magnum* (Poulsen, 1965, fig. 59a); *c*, *Microasteropteron youngi* Kornicker, 1976b, fig. 19n; *d*, *Actinoseta chelisparsa* Kornicker, 1958, fig. 70a; *e*, *Omegasterope upsilon* (Kornicker and Caraion, 1974, fig. 33q); *f*, *Pteromeniscus intesi*, new species; *g*, *Asteropteron fuscum* (Müller); *h*, *Cyclasterope bisetosa* Poulsen, 1965, fig. 104f; *i*, *Tetraleberis brevis* (Müller) (Poulsen, 1965, fig. 84f); *j*, *Lewoleberis zealandica* (Baird, 1850b) (Poulsen, 1965, fig. 92d); *k*, *Dolasterope johanseni* Poulsen, 1965, fig. 106e; *l*, *Brunniella breviata* Poulsen, 1965, fig. 108d; *m*, *Diasterope bisetosa* Poulsen, 1965, fig. 118h.

of *A. hirsutum* has as many as 5 main claws in addition to 4 or 5 secondary claws. Members of *Asteropella* have 3 main claws followed by 3 or 4 bristlelike secondary claws, and in addition, 1 long, laterally placed bristle with its base separated by a wide space from the posterior secondary claw (Figure 16a). Species of *Actinoseta* have 3 main claws followed by a wide space and then 1 to 3 short, laterally placed bristles (Figure 16d). In the monotypic genus *Pteromeniscus*, each lamella of *P. intesi* bears 7 main claws, of which the anterior 2 claws are similar in length and have

bases close together; the remaining claws decrease in length posteriorly along the lamella (Figure 16f). In the monotypic genus *Omegasterope*, each lamella of *O. upsilon* has 3 long, closely spaced claws followed by 3 shorter claws, a wide space, and then a laterally placed bristle (Figure 16e). Species of *Microasteropteron* have 7 main claws on each lamella, of which the anterior 3 long claws are separated by a fairly wide space from the shorter posterior claws (Figure 16c).

Rod-shaped Organ: The rod-shaped organ is short in all species of the Cypridinidae. In the Philo-

medidae, the organ is long on most species and short or absent in a few species. The organ is long on all members of the Sarsiellidae, Rutidermatidae, and Cylindroleberididae.

Upper Lip: Members of the Cypridinidae and Philomedidae have glands that lead to slitlike openings on the upper lip. Members of the Sarsiellidae and Rutidermatidae are without glands (lips are hirsute, a few species also with hairlike spines). Some, possibly all, members of the Cylindroleberididae have glands less well developed than those of the Cypridinidae. The glands lead to hollow spines with open tips on the anterior margins of the upper lips. The spines may be large or minute, and appear to be absent on some

specimens. Because the upper lips of the Cylindroleberididae are hirsute, it is now always possible to determine whether or not some of the hairs are actually slender spines. Slender anterior spines may also be present on the saddle between the 2 lobes of the upper lips of the Cylindroleberididae.

In the Cylindroleberidinae, most members bear minute anterior spines on each lobe of the upper lip (Figure 17*j-l*); the monotypic genus *Dolasterope* (*D. johanseni*) bears a fairly large anterior spine (Figure 17*i*). Upper lips of members of the Cyclasteropinae are without spines (Figure 17*g,h*), have minute spines (Figure 43*i*) or hairlike spines (Figure 45*i*). Among the Asteropteroinae, mem-

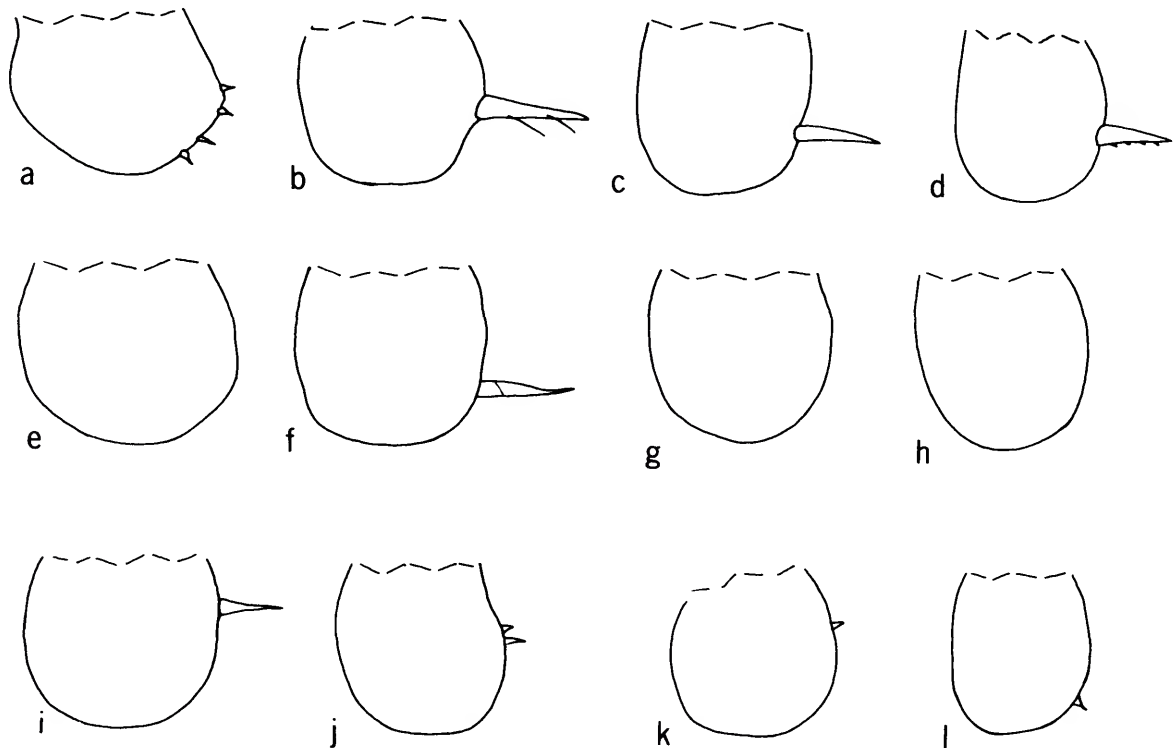


FIGURE 17.—Comparisons of right lobe of cylindroleberid upper lips (sketches), anterior to right, hairs not shown: a, *Asteropterygion magnum* (Poulsen, 1965, fig. 59b); b, *Asteropella kaufmani*, new species; c, *Omegasterope epsilon* (Kornicker and Caraion, 1974, fig. 34a); d, *Pteromeniscus intesi*, new species; e, *Actinoseta chelisparsa* Kornicker; f, *Microasteropteron youngi* Kornicker, 1976b, fig. 19p); g, *Cyclasterope fascigera* Brady; h, *Leuroleberis zealandica* (Baird, 1850b) (Poulsen, 1965, fig. 94f); i, *Dolasterope johanseni* Poulsen, 1965, fig. 106f; j, *Diasterope bisetosa* Poulsen, 1965, fig. 118i; k, *Parasterope muelleri* (Skogsberg) (Poulsen, 1965, fig. 122j); l, *P. longungues* Poulsen, 1965, fig. 127f.

bers of the genus *Actinoseta* either have small spines or are without spines (Figure 17e); members of *Asteropterygion* have small spines (Figure 17a), or are without spines; members of *Asteropella* (except *A. monambon*), *Omegasterope*, and *Pteromeniscus* have a single large spine on each lobe (Figure 17b-d), and the monotypic genus *Asteropteron* bears small spines on the lip. *Microasteropteron youngi* bears a long anterior spine on each lobe of the upper lip (Figure 17f), whereas, according to Poulsen (1965:222) a spine is absent on the lobes of *M. parvum*. The lips of *Cyclasterope hendersoni* and their operation are described by Cannon (1933:743, 750).

Lower Lip: The lower lips of the Cyndroleberididae differ from those on members of other families of the Cypridinacea in having a hirsute, thin, ovoid flap projecting outward at each side of the mouth. The paragnaths (term used by Cannon: 1933:743) are called lateral flaps herein.

Posterior of Body: Kornicker and Caraion (1977:5) described a small process with 3 spines on the posterior of the body of juvenile specimens they identified as ?*Paradoloria* species indeterminate. Except for that species, processes are unknown on members of the Cypridinidae. Processes are also absent on members of the Philomedidae, Sarsiellidae, and Rutidermatidae. On the other hand, they are fairly common on members of the Cyndroleberididae, generally as a fingerlike or thumblike process with spines and hairs at the tip. The process is absent on most members of the Cyndroleberidinae, but is well developed on some species. The process is poorly developed in members of the Cyclasteropinae. A fingerlike process is well developed in all members of the Asteropteroninae.

Gills: The posterior of the body of members of the Cyndroleberididae with the exception of *Bruuniella* bear gill-like structures on each side of the body. These are longer and wider in some groups than in others. They have not been studied in detail but their distal ends differ somewhat among the several groups. For example, a small process is present on the lower edge of the distal end of *Asteropella monambon*. Gill-like structures

have not been observed on members of the Philomedidae, Sarsiellidae, and Rutidermatidae. A few species of the Cypridinidae have rudimentary folds or serrations on the posterodorsal part of the body, but the relationship of these to the gills of the Cyndroleberididae is unknown (see Skogsberg, 1920:59). The fine structure of the gills on members of the Cyndroleberididae resemble the lamellae of the gills in other closely related crustacean groups (Skogsberg, 1920:432).

CYLINDROLEBERIDIDAE Müller, 1906

The family Cyndroleberididae has been subdivided herein into 3 subfamilies: Cyndroleberidinae Müller, 1906; Cyclasteropinae Poulsen, 1965; and Asteropteroninae, new subfamily.

DISTRIBUTION.—Worldwide, but Cyclasteropinae and Asteropteroninae more restricted than the Cyndroleberidinae. Depth range of members of the Asteropteroninae (except for *Pteromeniscus intesi*, which is found at bathyal depths) and Cyclasteropinae generally restricted to shelf depths of less than 150 m; the Cyndroleberidinae with depth range of intertidal to 4500 m.

DIAGNOSIS.—Carapace shape and ornamentation extremely variable; carapaces of Cyndroleberidinae and Cyclasteropinae generally appearing smooth, whereas those of Asteropteroninae generally with ribs and processes; incisur slitlike in Cyndroleberidinae and Cyclasteropinae, and forming a right or acute angle in Asteropteroninae; carapace of adult male of Cyndroleberidinae and Cyclasteropinae with hairs forming vertical row near posterior end, and more elongate than that of adult female.

First Antenna: Suture separating 3rd and 4th joints forming distinct angle; however, suture on some species not well defined; sensory bristle of adult male generally with many more long filaments than on sensory bristle of adult female; c- and f-bristles of most adult male Cyndroleberidinae and Cyclasteropinae very long and with many short filaments; a-bristle clawlike on all Cyndroleberidinae, most Cyclasteropinae, and

some Asteropteroinae; d- and e-bristles well developed on Cyclasteropinae, but variable in other subfamilies.

Second Antenna: 2nd exopodial joint of adult male Cyclasteropinae and Cylindroleberidinae relatively long compared to 3rd joint; endopodite of females generally 3-jointed but with joints often fused (except *Microasteropteron*, which is 1-jointed); endopodite of adult male 3-jointed with 3rd joint reflexed on 2nd.

Mandible: Coxale endite scythelike, consisting of dorsal and ventral branches; basale endite well developed and with many bristles, some of triaenid type; exopodite present on all members, but small on some members of the Cylindroleberidinae.

Maxilla: Differs from that of members of other families in having comb of lateral bristles along both ventral margin of basale and joints proximal to basale, and in having long, triangular, epipodial appendage dorsal to basale; small exopodite present on Cyclasteropinae and few Asteropteroinae, absent on Cylindroleberidinae and most Asteropteroinae. Unlike other families, end joint of endopodite with 1-7 bristles, no clawlike bristles; maxilla of adult males similar to those of adult females, unlike these appendages in the Philomedidae, Sarsiellidae, and Rutidermatidae, which are sexually dimorphic.

Fifth Limb: Differs from those of other families in having an anterior comb with many short bristles forming rows along the ventral margin. Dorsal margin of comb of adult male Cyclasteropinae usually bears processes not present on female; little sexual dimorphism in other subfamilies.

Sixth Limb: Differs from those of other families in having less well-defined endites, and in having hatchet shape when viewed laterally. A lateral longitudinal ridge present near ventral margin of skirt.

Seventh Limb: Terminus consisting of teeth forming opposing combs, single combs in all genera except *Cyclasterope*, which has double combs; teeth not distinctly separated into combs in some genera of Asteropteroinae.

Furca: All claws separated from lamella by suture.

Rod-shaped Organ: Elongate, generally broadening in middle part, and with 1 or 2 sutures.

Upper Lip: Consisting of a pair of hirsute lobes with saddle between them; anterior margin of each lobe with or without 1 or more small spines, or with 1 long stout spine; anterior margin of saddle of some species with small spines; small glands present in lip (Skogsberg, 1920:171) but not easily visible.

Lower Lip: Unlike other families, lower lip of Cylindroleberididae has a thin, hirsute, ovoid flap (paragnath) projecting laterally on each side of mouth.

Posterior of Body: Fingerlike posterior process present on Asteropteroinae and few Cylindroleberidinae; much smaller process present on some Cyclasteropinae.

Gills: Generally well-developed gills along posterodorsal part of body; these not present on other families (except for a few species of Cypridinidae, which have smaller structures possibly not related to gills).

SEXUAL DIMORPHISM.—Carapaces of adult males of Cyclasteropinae about same length as those of adult females, but not as high (Table 13). Carapaces of adult male Asteropteroinae generally shorter than those of adult females, but height as percent of length about same for both sexes (Table 13). Carapaces of adult male Cylindroleberidinae and Cyclasteropinae with vertical row of hairs near posterior end; these not present on adult male Asteropteroinae. Carapaces of adult males of some species of Cyclasteropinae with indentation in dorsal margin near posterior end, at dorsal end of vertical row of hairs.

First Antenna: Sensory bristles of adult male Cyclasteropinae with abundant, long, thin filaments. In Asteropteroinae, sensory bristle with many, long, thin filaments on adult males of monotypic genera *Asteropteron* and *Pteromeniscus*, and also, except for *Asteropterygion oculitristis*, on adult male *Asteropterygion*. Sensory bristle of adult male *Asteropella* with long filaments, but these may be few (10) or abundant (Table 13). Adult

TABLE 13.—Comparison of carapace dimensions and morphology of the 1st and 2nd antennae of adult males and females of the Cyclasteropinae and Asteropteroinae (n.d. = no data; ? = specimen may not be an adult; + present, - absent)

Species	Carapace length (mm)		Carapace height as percent of length		Exopodite of 2nd antenna				Number of bristles on 9th joint		Abundant filaments on sensory bristle (no. of long filaments)	
	female	male	female	male	Spines on bristles		Basal spines on joints		female	male		
					female	male	female	male				female
Cyclasteropinae												
<i>Cyclasterope fascigera</i> ^a	5.6-6.0	5.5-6.0	73-77	55-61	+	-	+	+	+	5	5	+
<i>C. higendoffii</i>	6.25	5.4	78 ^b	61 ^c	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	+
<i>Cycloleberis squamiger</i> ^d	3.21-4.32	3.60-4.55	78-85	67-73	+	-	+	+	+	5	5	+
<i>C. galathea</i>	4.3-4.7	4.8	81-88	71	+	-	+	+	+	5	5	+
<i>C. christiei</i> ^e	4.8-5.0	5.3-5.5	78-81	69-72	+	+	+	+	+	5	5	+
<i>Leuroleberis sharpei</i>	4.9-6.2	4.0-6.4	81-87	67-73	+	-	+	+	+	5	5	+
<i>L. mackenziei</i>	5.1 ^f	4.8-5.4	82	61-69	+	-	+	+	+	5	n.d.	+
<i>Amboleberis americana</i>	2.99-3.20	3.49	75-83	65	+	-	+	+	+	5	5	+
<i>Tetraleberis tanzania</i>	3.2 ^g	3.8	88	66	+	-	+	+	+	5	5	+
<i>Alphaleberis alphathrix</i>	3.7	3.4-3.9	78	69-74	+	-	+	+	+	5	5	+
Asteropteroinae												
<i>Actinosteta chelisparsa</i>	2.29-2.30	1.71-1.73	76-78	73-76	+	+	-	-	-	3	3	-
<i>A. hummelincki</i>	2.35-2.42	1.63-1.64	72-79	75-79	+	+	-	-	-	3	3	-
<i>Asterophella mortenseni</i> ^h	1.60 ⁱ -1.66 ^j	1.14	74 ^k	69	+	(few)	-	-	-	2	3	+(17)
<i>A. monambon</i>	1.62-1.86	1.18-1.27	70-73	69-74	+	+	-	-	-	2	2	+(27)
<i>A. agassizii</i>	1.93-2.00	1.5 ^b	75	n.d.	+	n.d.	-	-	-	n.d.	2	n.d.
<i>A. slatteryi</i>	1.85-1.97	1.34	71-75	68	+	+	-	-	-	3	2	+(10)
<i>A. irithrix</i>	1.57-1.79	1.19	70-75	74	+	+	-	-	-	3	2	+(14)
<i>A. kaiyuanii</i>	1.29-1.40	0.96	71-72	74	+	+	-	-	-	3	2	+(16)
<i>Asteropleron fuscum</i>	2.50-2.7	2.2 ^l	73-74	n.d.	-	n.d.	-	-	n.d.	3	n.d.	+
<i>Asteropterygion thomassini</i>	3.00-4.03	2.25-2.43	72-77	72-75	+	+(few)	-	-	-	5	5	+
<i>A. oculitristis</i>	2.70-3.03	1.84-1.85	72-74	64-71	+	+(few)	-	-	-	4	4	-
<i>A. magnum</i> ^m	3.6-4.0	3.4	78	71	+	(few)	-	-	-	5	5	+
<i>A. ronei</i>	3.17-3.35	2.68	76	72	+	+(few)	-	-	-	5-6	5	+

^a Data from Poulsen (1965). ^b Data from Müller (1890). ^c Data from Müller (1906, pl. 5: fig. 1). ^d Data from Kornicker (1975). ^e Data from Kornicker and Maddocks (1977). ^f Data from Kajiyama (1912). ^g Small.

male unknown for *Microasteropteron* and *Omegasterope*. The c- and f-bristles of adult male Cyclasteropinae extremely long and with many short filaments.

Second Antenna: Protopodite of adult male larger than that of adult female (Poulsen, 1965:480). Second exopodial joint much longer than 3rd joint on adult male Cyclasteropinae, but not on adult female. Exopodial bristles of adult female Cyclasteropinae with spines as well as natatory hairs; spines generally missing or very sparse on bristles of adult males (Table 13). Exopodial joints of adult male Cyclasteropinae with long hairs in distal dorsal corner; these lacking in adult female (Table 13).

Fifth Limb: Dorsal margin of comb of adult male Cyclasteropinae with 1 or 2 processes; these absent on female; adult males of some species with comb and processes appearing sclerotized.

Lateral Eyes: Eyes of the male similar in size or slightly larger than those of female (Table 7). Eyes discussed in more detail in "Relationship between Eye Development and Water Depth."

For additional discussion of sexual dimorphism see Poulsen (1965:478-483).

MICROSTRUCTURES OF THE CARAPACE.—The scanning electron microscope was used to observe structures on the carapace not clearly visible with the light microscope. The microstructures give additional morphological information useful in the classification of ostracodes. The micrographs of complete valves are presented mainly for orienting micrographs of structures; the valves often become distorted during the freeze-dry operation; therefore accompanying drawings of the carapace are more reliable representations.

Ultrastructure: Harding (1965, figure 7) illustrated a section through the shell of *Cyclasterope hendersoni* showing a thin, outer sclerotized layer and a thick, laminated, inner layer. Herein, the thin outer layer of the shell is considered to be epicuticle and the laminated inner layer endocuticle (see Kornicker, 1969b). The outer part of the endocuticle of myodocopids should probably be termed exocuticle (see Bate and East, 1972, 1975, and also Kornicker, et al., 1976:13, figure 2d), but because the boundary between exocuticle

and endocuticle is either absent or indistinct in the few known cylindroleberids, the term endocuticle is used herein to encompass both layers.

Epicuticle: The epicuticle of arthropods consists of several layers having a complex chemical composition (Neville, 1975:9). According to Richards (1951:168) the crustacean epicuticle consists of 2 layers composed of proteins, lipids, and polyphenols. Bate and East (1972:189) believed that the presence of an epicuticle on calcified and uncalcified Recent podocopids, and the absence of an epicuticle on fossil ostracodes suggest that this layer is not calcified in ostracodes.

Kornicker (1975b, fig. 18b-f) illustrated a section of the shell of *Asteropterygion setiferum* showing that it has a laminated endocuticle, and that tubelike processes ornamenting fossae do not penetrate the endocuticle (Kornicker, 1975b:27). This suggests that the surface ornamentation of species of *Asteropterygion* should be considered epicuticle. The vesicular surface of the monotypic genus *Asteropteron* (*A. fuscum*) resembles that of some species of *Asteropterygion* and is probably epicuticle.

In the present study, a right valve of *Leuroleberis sharpei* was boiled in dilute KOH and then compared with the untreated left valve (Plates 17, 18). The KOH treatment removed not only surface bristles, but also surface reticulations and rims around pores. The removal of these features indicates that they were not calcified, and suggests that the features should be considered epicuticle.

When specimens of Cyclasteropinae are freeze-dried there is a tendency for a thin outer layer to peel off (Plates 17a, 42a, b, 47a-c, 48f, also, Kornicker, 1974: fig. 24a-c). The thin outer layer was not removed on the valve boiled in dilute KOH (Plate 18a,b,f). I interpret this layer to be equivalent to the amber outer layer shown in the cross section of *Cyclasterope hendersoni* illustrated by Harding (1965: fig. 7); the layer probably should be considered epicuticle.

The oval discs on the surface of carapaces of species of *Actinoseta* are apparently discrete plates forming a layer only weakly adhering to the shell beneath them (Plates 52, 53a-c, 55, 56a,b,d,f,l,

59*a-i*, 62*a-c*, 63*b*, 66, 67*c,d*, 68*a,c*, 71*c*, 72). Oval marks on the underlying layer indicate the former locality of discs (Plates 56*d,f*, 68*c,f*). Discs along the margin of the valve of *Actinoseta chelisparva* (Plate 56*c*) and also those forming nodes on *Actinoseta nodosa* seem to be fused to the underlying layer (Plates 71*b*, 72*d*). The non-fused discs should probably be considered epicuticle. A layer containing small shallow fossae found only on well preserved specimens also is probably epicuticle; these fossae are smaller than the deeper and less abundant fossae that occur in the endocuticle (Figure 59*f*). The reticulate structures and, possibly, also the papillate structures on the carapace of *Actinoseta jonesi* are probably epicuticle (Plates 62*d,e*, 63*c,d*).

The ornate surface layer between ridges on species of *Asteropella* is connected to the underlying layer by struts (Plates 78*b*, 81*a*, 82*a,b,d*, 83*e*, 89*d*, 90*d*, 91*a,b*, 94*b*, 101*c,e*, 102*d*, 105*b*). The outer layer is probably epicuticle. The epicuticle appears basically to be modified reticulations (e.g. compare Plates 91*a*, 94*a*, and 95*d*). The various ridges on the carapace of species of *Asteropella* also appear to be epicuticle.

Ridges on the carapace of the monotypic genus *Pteromeniscus* (*P. intesi*) are similar to those on species of *Asteropella*, and are considered herein to be epicuticle (Plate 176*c-e*). When attempting to clean a valve of *Omegasterope epsilon* using the sonic vibrator, the upper part of the U-shaped central ridge broke off. The smooth surface on the shell layer, which was beneath the portion of ridge that broke off, is without openings, showing that the ridge is merely an outer shell layer, and probably epicuticle.

Endocuticle: The endocuticle of *Cyclasterope hendersoni* and *Asteropterygion setiferum* is laminated (Harding, 1965, fig. 7; Kornicker, 1975*b*, fig. 18*b-f*). Although no sections through the carapace were studied herein, it seems likely that other members of the Cyndroleberidinae also have laminated endocuticle. Oval calcareous nodules form in the outer layer of the endocuticle of members of the Cyclasteropinae just below the layer that tends to peel (Plates 34*a,b*, 35*a*, 47*a-c*,

48*f*). The method of formation of the nodules has been described by Sohn and Kornicker (1969). Anastomosing nodules also occur in the Cyclasteropinae (Plate 18*a,f*). Nodules also form in the Cyndroleberidinae (Sohn and Kornicker, 1969: 106), and in the *Asteropterygion* (Plate 113*a*; also see Kornicker, 1975*b*; fig. 23). The upper surface of the endocuticle, where the outer thin layer of epicuticle has peeled on members of the Cyclasteropinae, appears fibrous (Plates 17*l*, 51*b*). A similar fibrous surface was observed beneath the outer layer of *Actinoseta chelisparva*, but in that instance a layer of endocuticle in addition to the epicuticle may be missing (Plate 55*b,e*).

Major fossae in the carapace of members of *Actinoseta* occur in the endocuticle (Plates 56*b,d,f*, 57*b,c*, 59*b,f,i*, 67*d*, 68*c*). On some specimens of *Actinoseta*, the fossae are shallow (Plate 63*c*).

The ornamentation formed by epicuticle on species of *Asteropella* contains abundant minute fossae not always clearly discernible with the optical microscope. Fossae usually visible in valves of *Asteropella* when using transmitted light occur in the endocuticle; these are not always visible in SEM micrographs because they are hidden by a layer of epicuticle. On some micrographs, fossae of the endocuticle are partly visible beneath the epicuticle (Plates 81*b*, 90*d*).

Attached Margin: The attached margin of the carapace is that part connected dorsally by a ligament (Kornicker, 1969*b*:110). The attached margin generally contains the hingement, and terminates anteriorly in the anterior juncture and posteriorly in the posterior juncture (see Kornicker, 1969*b*, fig. 1*a*). Also included in this discussion is dentition of some Cyclasteropinae located on the free margin anterior to the anterior juncture. The morphology of the attached margin (including hingement) of the various subfamilies of the Cyclasteropinae seems fairly uniform. Among the genera of the Asteropteroninae, only the hingement of *Asteropterygion* and *Actinoseta* were studied in detail, and these differ considerably in morphology.

In the Cyclasteropinae denticulations along or near the edges of the valves have been described

or illustrated for *Cyclasterope fascigera* (Skogsberg, 1920:542, 543; fig. 2), *Cycloleberis lobiancoi* (Kornicker, 1974:53, fig. 23c), *Cycloleberis galathea* (Kornicker, 1975b, fig. 11a, b) and *Cycloleberis squamiger* (Kornicker, 1975b, fig. 11c-h). Dentition along the dorsal margin of the right valve of *Leuroleberis sharpei* is shown in Plate 20. Dentition on all the species on which it has been described is located anterior to the anterior juncture (see Plate 20a). Similar dentition may be present on other species within the Cyclasteropinae but it is often difficult to see and is omitted from descriptions. On SEM micrographs the teeth may be hidden by the lamellar prolongation of the selvage. The only valve on which they were clearly visible in the present study is one boiled in dilute KOH, which removed the lamellar prolongation (Plate 20). The posterior hinge element in the Cyclasteropinae needs further study; a small tooth and socket may be present at the dorsal end of the posterior list, but they were not clearly visible on the SEM micrographs made during the present study. A socket is indicated in the illustration of a left valve of *Cyclasterope fascigera* by Poulsen (1965, fig. 95d).

In members of *Actinoseta* the left valve broadly overlaps the right along the middle of the dorsal margin (compare left valve shown in Plate 63a, with right valve in Plate 66b, also see Plate 60b). Each valve bears along the dorsal margin teeth and sockets that intermesh with teeth and sockets of the opposite valve (Plates 53e,f, 57d-f,i, 58a-c, 59h, 60a-h, 63a,b,e,f, 64a,f, 66b, 67a,b, 69a,c,d, 73a,b,e,f). The teeth and sockets on the right valve are formed of about 8 overlapping layers, each with a terminal fringe of hairs (Plates 57d-f, 58a,b, 60a-e, 67b, 69c,d). The teeth and sockets of the left valve are not distinctly layered (Plates 53e-g, 63f, 64a, 73b,e,f), but may have hairs (Plate 64a,f). The teeth and sockets of each valve are outside the ligament.

The lamellar prolongation of the selvage of the right valve, which is broad and fringed along the anterior margin, terminates at the anterior juncture. (The terminal end of the lamellar prolongation of the right valve is visible at the upper

right of Plate 60b.) The lamellar prolongation of the right valve is located between the valve edge and the anterior edge of the row of teeth and sockets (Plate 60b). Although not clearly visible on illustrations, the lamellar prolongation along the posterior valve margin apparently terminates near the posterior juncture, because it is not evident in the area immediately anterior to the posterior juncture (Plates 58a-c, 67a,b, 69c). On the left valve, the fringed lamellar prolongation of the selvage along the anterior margin continues along the dorsal margin to a point just past the middle of the dorsal margin and appears to be outside the teeth and sockets (Plate 63e,f; also see remnant of left valve on Plate 60a-c,f). The lamellar prolongation along the posterior margin of the left valve appears to terminate just anterior to the posterior end of the row of teeth and sockets, and to be outside the teeth and sockets (plate 63f).

In members of *Astropterygion* the left valve overlaps the right along the middle of the dorsal margin (Plates 134c, 146a). The hinge structures of *A. oculitristis* were studied in detail (Plates 124-132); other species of the genus are probably similar. The left valve has a posterior tooth and linear medial bar that fit into a posterior socket and shallow, linear, medial groove of the right valve (Plate 124). The hinge elements lie outside of the ligament. The anterior juncture is located just anterior to point of maximum valve height (Plates 124, 131a). The posterior juncture of the left valve is located just ventral to the posterior tooth (Plates 124a, 125a, 126). The posterior juncture of the right valve is located just ventral to the posterior socket (Plates 124b, 127, 128a, 129, 130). At the junctures the vestment fused to the inner margin of the infold along the free margin joins the ligament along the attached margin (see Kornicker, 1969b). On the illustrated left and right valves both the ligament and vestment were torn apart when the valves were separated. In the inverted V shown in Plate 130a, the right leg of the V is the torn vestment, whereas, the left leg of the V is the torn ligament. The apex of the V is the posterior juncture of the right valve. The

space between the legs of the V represents haemocoel. The posterior juncture, ligament, and torn vestment of the right valve are also shown on Plates 127, 128a, 129, 130b,c. The posterior juncture, ligament, and torn vestment of the left valve are shown in Plates 125a, 126a. In section the ligament appears fibrous and laminated (Plate 132a). The surface of the medial groove of the right valves bears minute structures and pores (Plates 131b, 132b).

On the right valve, the lamellar prolongation of the selvage that is present along the posterior edge of the valve continues along the ventral margin of the posterior socket of the hinge, and then terminates in the vicinity of the posterior juncture (Plates 127-130). On the left valve, the lamellar prolongation of the selvage along the posterior edge of the valve continues along the ventral margin of the posterior tooth and medial bar (Plates 125, 126). The lamellar prolongation of the left valve is very wide in the hingement area and bears a long fringe; the prolongation covers both the tooth and bar (Plates 125c,d, 126b). It apparently is sandwiched between the hingements of both valves when the valves are joined. Hairs form rows perpendicular to the edge of the lamellar prolongation on the posterior tooth of the left valve (Plate 126b,c). These appear to be part of the lamellar prolongation.

Pores: Pores in the carapace of myodocopid ostracodes are not unlike those in podocopid ostracodes (see Sandberg and Plusquellec, 1969; Puri and Dickau, 1969; Omatsola, 1970; Sylvester-Bradley and Benson, 1971). In the present paper I have used the terminology "open pore" for those pores having a deep annular depression, usually without visible bottom, around a bristle, and also for pores without bristles. The term "closed pore" is used for bristle pores without a deep annular depression around the bristle emerging from it.

All known members of the Cyclasteropini and Cycloleberidini have shallow fossae, each containing a closed bristle-pore (Table 14; Plates 1c, 2a,f,j, 3a, 8b,c, 12e, 24e). A closed bristle-pore within a fossa is rare on the carapace of *Amboleberis americana* (Plate 46b,c), which is in the tribe Te-

traleberidini, and absent on members of the Cyndroleberidinae and Asteropteroinae.

Closed bristle-pores not in fossae are rare in the Cyclasteropinae, being observed only on the adult male *Leuroleberis sharpei*, near the vertical row of posterior bristles (Plate 14e), and on *Amboleberis antyx* (Plates 50b, 51a). This type pore is more abundant on members of the Asteropteroinae, especially species in the genus *Asteroptyrgion* (Table 14; Plates 56j, 57a,g, 63b, 64e, 76e, 79b, 87d, 106d, 117b,c,e, 122a, 139f, 140g, 152b, 164e). This type bristle is also rare on carapaces of Cyndroleberidinae, being observed only on *Cyndroleberis bacescui* Kornicker and Caraion, 1974 (see Kornicker and Caraion, 1974, fig. 15e).

Open pores with bristles in the Cyndroleberididae are of 4 types: (1) with concentric rims (raised rings) around the pore; (2) with a single rim (raised ring) within a stellate pattern; (3) with a single rim without a stellate pattern around it; and (4) without a rim. Type 1 is present on all known Cyndroleberidinae, Cyclasteropini (only *Cyclasterope fascigera* known), Tetraleberidini, and also on 3 species of *Leuroleberis*, which is in the tribe Cycloleberidini (Table 14; Plates 2b-d, 12f, 16d,e, 17i, 29c,d, 35d,e, 38b,d,f, 41d-f, 43a, 48b,c, 50d,e). Type 2 is present on all known species of *Cycloleberis* and *Alphaleberis* (monotypic genus), and also on 1 species of *Leuroleberis* (Table 14; Plates 7e,f, 8a, 22a-d, 25a-d). The type 1 and type 2 pores do not occur on the same species. Type 3 is absent in the Cyclasteroptero-pini (only *Cyclasterope fascigera* examined), rare in the Cycloleberidini and Cyndroleberidinae, and common in the Tetraleberidini and Asteropteroinae (Table 14; Plates 25e, 29f, 35b,c, 41h, 48a). Type 4 is not always clearly separable from Type 3; it is present on *Cyclasterope fascigera*, common on the Tetraleberidini, absent on the Cyndroleberidinae, and is either rare or absent on other groups (Table 14; Plates 29e, 38c, 43b, 47e,f, 53c,d).

Pores without bristles may be divided into individual pores (with or without single rims) sparsely distributed over the carapace surface, and resembling the type 3 or 4 bristle pore, and pores occurring in groups that resemble the sieve

pores of some podocopids. Individual pores are present on all known members of the Cyclasteroleberididae, are common on the Cyclasteropinae, but are absent on the Asteropteroinae (Table 14; Plates 2*k*, 3*b-d*, 8*e,f*, 15*d*, 16*f*, 22*e*, 25*f*, 29*b*, 35*f*, 38*d,e*, 41*f*, 46*f*, 47*f*, 48*d*, 50*f*). Sievelike pores are present only on members of *Asteropterion* and *Asteropterygion* (for example, Plates 111*b*, 150*f*, 161*b*), but it is uncertain whether these are pores or are merely superficial ornamentation over fossae.

A brief survey of pores on the carapaces of members of the Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae indicates that both the open and closed type pores are present, but the closed type appears to be dominant. The open bristle pore with concentric rims is well developed only in the Cyclasteroleberididae. An open bristle pore with a large node within a single peripheral rim appears to be restricted to members of the Cypridinidae (Table 15). A bristle pore without a rim is absent on known Cypridinidae, but common on other families (Table 15). Pores without bristles are generally absent from members of the Sarsiellidae, Rutidermatidae, and some genera of the Philomedidae, but are common on some members of the Cypridinidae and Philomedidae (Table 15).

Bristles: The term bristles in this study has been used to designate setae and hairs on the outer surface of the carapace as well as on the infold and appendages. Bristles on the outer surface of the carapace may be designated according to their location as being either marginal bristles or lateral bristles.

Marginal Bristles. In the Cyclasteropinae, bristles emerging from open pores form a row along the anterior, posterior, and ventral edges of each valve adjacent to the lamellar prolongation of the selvage. In *Cyclasterope fascigera* the bristles along the ventral margin of the valve are flat with papillate edges (Plates 1*d,l*, 4*k,l*). Along the anterior margin ventral to the incisur of *Cycloleberis galathea*, similar bristles have a peculiar striated band between the bristles and what appears to be the calcified edge of the valve that bears a scalloped rim (Plates 6*e,f*, 7*b,c*). A row of very slender bristles is present between the striated row

and scalloped rim (Plate 6*e,f*). Bristles along the ventral margin of *Leuroleberis sharpei* have similar bristles separated by a narrow lip from a smooth rim along the valve edge (Plate 14*f*). Marginal bristles along both the anterior margin of the rostrum and the posterior margin of the valve of *L. sharpei* are set back from the valve edge onto the inner side of the valve (Plates 17*k*, 19*f*). Bristles along the anterior margin of the rostrum of *Alphaleberis alphathrix* emerge from pores located slightly back from the valve edge and on outer side of the valve (Plate 24*c*); longer bristles emerging from pores set back from the edge and on both the inner and outer sides of the valve are present on the anterior margin of the valve ventral to the incisur (Plate 24*d*). Long bristles are inset slightly on the inside surface of the anterior margin of the rostrum of *Tetraleberis brevis* (Plate 29*a*). In the same location on *Tetraleberis maddocksae*, the bases of the bristles are separated by a narrow band from a smooth rim bordering the valve edge (Plate 34*d*). A molting specimen of *T. maddocksae* shows that the marginal bristles are already well developed prior to the new valve escaping from within the old valve; the bristles on the emerging valve appear to be bent backwards (Plate 36*c-e*). Marginal bristles along the anterior margin of the rostrum of *Tetraleberis tanzania* are set slightly back from the valve edge and on the inner side of the valve (Plate 37*f*). The bristles along the anteroventral margin of this species are very abundant (Plate 39*c*). The marginal bristles along the anterior margin below the incisur of *Amboleberis antyx* are set slightly back from the edge and on the inner side of the valve (Plate 49*c*).

In the Asteropteroinae, bristles that form a row along the anterior margin of the rostrum of *Actinoseta jonesi* have papillate margins (Plate 64*e*). A 2nd row of bristles emerges from closed pores set back from the edge and on the outside of the valve on this species (Plate 64*b,d,e*), and also on *Actinoseta chelisparis* and *Actinoseta nodosa* (Plate 73*c*). These bristles appear rounded and seem to be without papillae (Plate 64*e*). The anterior margin of the rostrum of *Asteropella agassizii* bears 2 rows of round bristles just outside the valve

TABLE 14.—Distribution of pores in the carapaces of species of the Cylindroleberididae (all observations based on SEM micrographs with exception of *Leuroleberis poulsoni*, which is based on light microscope; plus sign = presence of character; minus sign = absence of character; n.d. = no data; R = ridge present anterior to fossa; ♂ = pore present in vertical row of bristles near posterior of male; 2p = 2 adjacent pores; ? = type doubtful because of intermediate nature of pore or lack of clarity of micrograph)

Species	Open pore with bristle						Closed pore with bristle			Individual pores without bristle		Source (SEM micrographs)
	Single rim		Single rim	Without rim	Within fossa		Within fossa	Not within fossa	Rimmed	Unrimmed		
	Concentric rims	Stellate pattern										
Cylindroleberididae												
Cyclasteropinae												
Cycloleberidini												
<i>Cycloleberis squamiger</i>	-	+	+	-	-	+R	-	-	+	-	-	Kornicker and Carraion, 1974; Kornicker, 1975b
<i>C. galathea</i>	-	+	-	-	-	+R	-	-	+	+	-	herein
<i>C. lobiancoi</i>	-	+	-	-	-	+R	-	-	+	-	-	Kornicker, 1974a
<i>C. christiei</i>	-	+	-	-	+ (♂)	+R	-	-	-	+	-	Kornicker and Maddocks, 1977
<i>Leuroleberis orbicularis</i>	+	-	+ (♂)	-	-	+R	-	-	+	-	-	herein
<i>L. sharpei</i>	+	-	-	-	-	+	-	+ (♂)	+	+	-	herein
<i>L. poulsoni</i>	n.d.	-	n.d.	n.d.	-	+R	n.d.	-	n.d.	n.d.	+	herein (optical microscope)
<i>L. mackenziei</i>	-	+	-	-	-	+R	-	-	-	-	+	herein
<i>L. zealandica</i>	+	-	-	-	-	+R	-	-	-	-	-	Kornicker, 1979
<i>Alphaleberis alphathrix</i>	-	+	+	-	-	+R	-	-	+	+	-	herein
Tetraleberidini												
<i>Tetraleberis brevis</i>	+	-	+	+	+?	-	-	-	+	-	-	herein
<i>T. maddocksae</i>	+	-	+	-	-	-	-	-	+	+	-	herein
<i>T. tanzania</i>	+	-	-	+	-	-	-	-	-	+	-	herein
<i>Tetraleberis</i> species 1	+	-	+	-	-	-	-	-	+	-	-	herein
<i>Ambaleberis antyx</i>	+	-	+	+	+	-	-	+	+	+	-	herein
<i>A. americana</i>	+	-	+	+	+	rare	-	-	+	+	-	herein
Cyclasteropini												
<i>Cyclasterope fascigera</i>	+	-	-	+	+	+	-	-	+	+	-	herein
Asteropteroninae												
<i>Actinoseta chelisparsa</i>	-	-	+	+	+?	-	-	+	-	-	-	herein
<i>A. hummelincki</i>	-	-	+	+	-	-	-	-	-	-	-	herein
<i>A. jonesi</i>	-	-	+	+	-	-	-	+?	-	-	-	herein
<i>A. nodosa</i>	-	-	+	+	-	-	-	-	-	-	-	herein

TABLE 14.—continued

Species	Open pore with bristle				Closed pore with bristle		Individual pores without bristle		Source (SEM micrographs)
	Concentric rims	Single rim within stellate pattern			Within fossa	Not within fossa	Rimmed		
		Single rim	Without rim	Without rim			Rimmed	Unrimmed	
<i>Asteropella monambon</i>	-	+2p	-	-	-	+	-	-	herein
<i>A. agassizii</i>	-	+	-	-	-	+	-	-	herein
<i>A. punctata</i>	-	+	-	-	-	-	-	-	herein
<i>A. macLaughlinae</i>	-	+2p	-	-	-	-	-	-	herein
<i>A. trihrux</i>	-	+	-	-	-	-	-	-	herein
<i>A. slatteryi</i>	-	+2p	-	-	-	-	-	-	herein
<i>A. kaufmanni</i>	-	+	-	-	-	+	-	-	herein
<i>Asteropteron fuscum</i>	-	-	-	-	-	-	-	-	herein
<i>Asteropterygion setiferum</i>	-	+2p	-	-	-	+	-	-	herein
<i>A. hulingsi</i>	-	+	-	-	-	+	-	-	Kornicker, 1975a; herein
<i>A. oculitristis</i>	-	+	-	-	-	+	-	-	herein
<i>A. thomassini</i>	-	+2p	-	-	-	+	-	-	herein
<i>A. romei</i>	-	+?	-	-	-	+	-	-	herein
<i>A. magnum</i>	-	+	-	-	-	-	-	-	herein
<i>A. dayi</i>	-	-	-	-	-	+	-	-	herein
<i>A. peterseni</i>	-	+	-	-	-	-	-	-	herein
<i>Pteromiscus inlesi</i>	-	-	-	-	-	-	-	-	herein
<i>Omegasterope upsilon</i>	-	+2p	-	-	-	-	-	-	herein
<i>Microasteropteron youngi</i>	-	+2p	-	-	-	-	-	-	herein
<i>Cylindroleberidinae</i>	-	+	-	-	-	+	-	-	Kornicker, 1976
<i>Parasterope muelleri</i>	+	-	-	-	-	-	+	-	Kornicker and Caraion, 1974
<i>Synasterope cushmani</i>	+	+	-	-	-	-	+	-	Kornicker, 1974b
<i>S. bensoni</i>	+	+	-	-	-	-	+	-	Kornicker and Caraion, 1974
<i>Cylindroleberis bacescui</i>	+	+	-	-	-	+	+	-	Kornicker and Caraion, 1974
<i>Prionotoleberis pax</i>	+	-	-	-	-	-	+	-	Kornicker and Caraion, 1974
<i>P. gylon</i>	+	-	-	-	-	-	+	-	Kornicker, 1974a
<i>Polyleberis mackenziei</i>	+	-	-	-	-	-	+	-	Kornicker, 1974a; Kornicker and Caraion, 1974
<i>Diasterope grisea</i>	+	+(♂)	-	-	-	-	-	+	Kornicker, in press

TABLE 15.—Distribution of pores in the carapaces of species of Cypridinidae, Philomedidae, Sarsiellidae, and Rutidermatidae (all observations based on SEM micrographs; plus sign = presence of character; minus sign = absence of character; ? = doubtful assignment of type either because of intermediate nature of pore or lack of clarity of micrograph)

Species	Bristle pores			Individual pores without bristles		Source (SEM micrographs)
	Node within rim	Rim without node	Without rim	With rim	Without rim	
Cypridinidae						
Cypridininae						
<i>Paradoloria dorsoserrata</i>	+	-	-	-	+	Kornicker, 1976a
<i>Cypridinodes concentrica</i>	+	+	-	+	-	Kornicker, 1979
<i>Metavargula mazeri</i>	+	-	-	+	-	Kornicker, 1979
<i>Macrocypridina castanea</i>	-	-	-	+	-	Kornicker, Wirsing, McManus, 1976
<i>Rugosidoloria serrata</i>	+	+	-	-	-	Kornicker, 1975a
<i>Gigantocypris muelleri</i>	+*	-	-	-	-	Kornicker, Wirsing, McManus, 1976
Philomedidae						
Philomedinae						
<i>Philomedes bonneti</i>	-	+	+	-	-	Kornicker and Caraion, 1977
<i>P. tetradens</i>	-	-	+	-	-	Kornicker and Caraion, 1977
<i>P. assimilis</i>	-	-	+	-	-	Kornicker, 1975a
<i>P. charcoti</i>	-	-	+	-	-	Kornicker, 1975a
<i>P. eugeniae</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. orbicularis</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. rotunda</i>	-	+	-	-	-	Kornicker, 1975a
<i>P. heptathrix</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. tetrathrix</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. subantarctica</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. minys</i>	-	+	+	-	-	Kornicker, 1975a
<i>P. ramus</i>	-	-	+	-	-	Kornicker, 1975a
<i>P. lofthousae</i>	-	+	-	-	-	Kornicker, 1975a
<i>Euphilomedes asper</i>	-	-	+	-	-	Kornicker and Caraion, 1977
<i>E. sinister pentathrix</i>	-	-	+	-	-	Kornicker and Caraion, 1977
<i>Scleroconcha folinii</i>	-	+	-	+	-	Kornicker and Caraion, 1977
<i>S. arcuata</i>	-	+	-	+	-	Kornicker, 1975a
<i>S. flexilis</i>	-	+	-	+	-	Kornicker, 1975a
<i>S. gallardoi</i>	-	-	+	+	-	Kornicker, 1975a
<i>S. frons</i>	-	+	-	+	-	Kornicker, 1975a
<i>S. wolffi</i>	-	+	-	+	-	Kornicker, 1975a
<i>Anarthron reticulata</i>	-	+	-	-	-	Kornicker, 1975a
<i>A. chilensis</i>	-	+	+	-	-	Kornicker, 1975a
<i>A. pholion</i>	-	-	+	-	-	Kornicker, 1975a
<i>A. evexum</i>	-	-	+	-	-	Kornicker, 1975a
Pseudophilomedinae						
<i>Pseudophilomedes angulatus</i>	-	+	+?	+	-	Kornicker and Caraion, 1977
<i>P. thalassa</i>	-	-	+	-	-	Kornicker and Caraion, 1977
<i>P. tetrathrix</i>	-	-	+	+	+	Kornicker and Caraion, 1977
<i>Tetragonodon ctenorynchus</i>	-	-	+	+	-	Kornicker and Caraion, 1977
<i>Harbansus paucichelatus</i>	-	+	-	+	+	Kornicker, 1978
<i>H. bradmyersi</i>	-	+	-	-	-	Kornicker, 1978
<i>H. mayeri</i>	-	+	+	+	-	Kornicker, 1978
<i>H. dayi</i>	-	-	+	+	-	Kornicker, 1978
<i>H. bowenae</i>	-	-	+	+	-?	Kornicker, 1978
<i>H. barnardi</i>	-	+	-	-	+?	Kornicker, 1978

TABLE 15.—continued

Species	Bristle pores			Individual pores without bristles		Source (SEM micrographs)
	Node within rim	Rim without node	Without rim	With rim	Without rim	
<i>Hambansus</i> species A	-	+	-	+	-	Kornicker, 1978
<i>Hambansus</i> species B	-	+	-	+	-	Kornicker, 1978
Sarsiellidae						
<i>Sarsiella lunata</i>	-	-	+	-	-	Kornicker, 1975a
<i>S. janiceae</i>	-	-	+	-	-	Kornicker, 1976b
<i>S. capsula</i>	-	+	+	-	-?	Kornicker and Caraion, 1978
<i>S. neapolis</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>S. anommata</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>S. africana</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>S. ocula</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>S. gomoii</i>	-	+	+	-	-	Kornicker and Caraion, 1978
<i>S. rudescui</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>S. maurae</i>	-	+	+	-	-	Kornicker, 1977b
<i>Junctichela margalefi</i>	-	-	+	-	-	Kornicker and Caraion, 1978
<i>Spinacopia menziesi</i>	-	-	+	-	-	Kornicker, 1975a
<i>S. variabilis</i>	-	-	+	-	-	Kornicker, 1975a
<i>S. bisetula</i>	-	-	+	-	-	Kornicker, 1975a
<i>S. octo</i>	-	-	+	-	-	Kornicker, 1975a
<i>S. mastix</i>	-	-	+	-	-	Kornicker, 1975a
<i>Ancohenia hawaiiensis</i>	-	-	+	-	-	Kornicker, 1976b
<i>Cymbicopia hanseni</i>	-	-	+	-	-	Kornicker, 1975a
<i>C. hispida</i>	-	-	+	-	-	Kornicker, 1975a
<i>C. brevicosta</i>	-	-	+	-	-	Kornicker, 1975a
Rutidermatidae						
<i>Rutiderma gerdhartmanni</i>	-	-	+	-	-	Kornicker, 1975a
<i>R. ovata</i>	-	-	+	-	-	Kornicker, 1975a
<i>R. irrostratum</i>	-	+	-	+?	-	Kornicker and Caraion, 1978
<i>R. tridens</i>	-	+	-	-	-?	Kornicker and Caraion, 1978
<i>R. leloeffi</i>	-	-	+	-	-	Kornicker and Caraion, 1978

* Double rim.

edge (Plate 87e). The row closest to the valve edge appears to emerge from closed pores, whereas the other row emerges from open pores with a peripheral rim. The ventral margin of *Astropteron fuscum* bears long bristles emerging from indented pores forming a row along the valve edge adjacent to the lamellar prolongation of the selvage (Plate 112b). Similar bristles are present along the ventral margin of *Astropterygion hulingsi* (Plate 117e). On this species long slender bristles emerge from closed pores forming a row just lateral to the bristles along the valve edge (Plate 117e). Similar bristles are present along the margins of valves of *Astropterygion oculitristis* (Plates 122j, 135d).

Members of the *Cylindroleberidinae* are without bristles along the valve edges, or have just a few bristles near the edges.

Lateral Bristles. In the *Cyclasteropinae*, lateral bristles are fairly abundant and consist of several types that emerge from 6 different kinds of pores, not all kinds of pores are on the same species (see Table 14 for pores present on various species). Known members of the *Cyclasteropini* and *Cycoleberidini* have abundant oval shallow fossae containing a short bristle emerging from a closed pore. These bristles are broad at the base and then become slender and whiplike distally, and do not have a basal pore in them (Plates 2f, 8b-d, 12d,e, 15d,e, 16b,c, 21e, 24e). Known members of

the Cyclasteropini (only carapace of *Cyclasterope fascigera* known in detail) and Tetraleberidini, and some of the Cycloleberidini have a long bristle with a pore in it near the base emerging from an open pore with several concentric rims (Plates 2b-d, 12f, 16d,e, 17e,h,i, 29c,d, 35d,e, 38a,b,d,f, 41d-f, 42f, 43a, 48b,c, 50d,e). The pore in the bristle is not visible in all the illustrations, and it could be absent from some of the bristles. The members of the Cycloleberidini without bristles emerging from pores with concentric rims have in its place a similar bristle emerging from an open pore with a single rim in the middle of a stellate pattern of ridges (Plates 7d-f, 8a, 22a-d, 25a-d). The pore with the concentric rims and the pore with the peripheral stellate pattern do not appear on the carapace of the same species, and bristles emerging from them are much more sparsely distributed than the bristles in fossae. Some of the bristles emerging from pores with concentric rims have poorly developed ridges at their bases proximal to the pore in the bristle (Plates 16d, 38b,d,f).

Adult males of the Cyclasteropinae have bristles emerging from open pores (with or without a single rim) forming a vertical row near the posterior end of each valve (Plates 14e, 45e; also see Kornicker and Caraion, 1974, fig. 24g, and Kornicker and Maddocks, 1977, fig. 4d). Not previously reported, and unknown on other species in the subfamily, the female of *Cyclasterope fascigera* bears a small cluster of bristles near the ventral margin in the posterior end of the valves (Plate 1e,f). These bristles, which emerge from open pores without rims, are either single or bifurcate, have short marginal papillae, and some have long papillae near the base (Plate 1g-j).

Both sexes of many species of Cyclasteropinae have bristles emerging from sparsely distributed open pores with or without a single rim (Plates 2e, 25e, 29e,f, 35b,c, 41h, 43b, 47e,f, 48a, 50f). These bristles appear to be more common on members of the tribe Tetraleberidini than on other tribes of the Cyclasteropinae. Bristles emerging from closed pores not located in fossae are rare in the Cyclasteropinae, being observed only on *Amboleberis antyx* (Plate 51a) and *Leuroleberis sharpei* (Plate 14e).

Removal of bristles from a valve of *Leuroleberis sharpei* by boiling it in KOH (which also removed both the outer layer of the shell bearing reticulations, and rims around pores) revealed that bristles emerging from closed pores penetrate the shell and are not merely surface spines. The small abundant pores in the treated valve shown in Plate 18c indicate the former location of closed pores within fossae; whereas the larger pore in the upper right of Plate 18c indicates the location of an open pore that formerly had several concentric rims.

The carapaces of members of the Asteropteroinae do not have bristles emerging from pores with either concentric rims or single rims with stellate peripheral patterns as on the carapaces of members of the Cyclasteropinae. They do, however, have sparsely distributed bristles emerging from open pores with and without rims; the bristles have a hole near their base, and thus are probably equivalent functionally to the bristles emerging from the pores with concentric rims or the stellate pattern on the Cyclasteropinae. In the genus *Actinoseta*, the bristles, some with short marginal papillae, emerge from pores without rims or with poorly defined rims. Only a few bristles are close to each other (Plates 53c,d, 56e,i, 59j-l, 62d, 68b, 71c,d). Bristles emerging from closed pores are very sparse on carapaces of *Actinoseta*; both single and bifurcate bristles occur, some have a pore in the bristle near its base (Plates 56j,k, 57a,g, 63b).

Bristles emerging from open-rimmed pores on the carapace of species of *Asteropella* are similar to those on the carapaces of species of *Actinoseta*, except pairs of bristles emerging from closely spaced rimmed pores may be more common on *Asteropella* (Plates 75b,e, 77c,d, 78c-e, 81d,e, 83a-d, 87b, 89d, 91d, 94b,c, 95f, 100f, 101a,b, 102e,f,j, 106b,c). The bristles often are placed at the middle of a group of fossae (Plates 75b, 77c,d, 78c,d, 81d,e, 94b, 100e, 101a). On *Asteropella*, lateral bristles emerging from closed pores are extremely sparse and were observed on only 3 species (Plate 76d, 79b, 87d, 106d,f).

Lateral bristles were not observed on the single valve examined of the monotypic genus *Asterop-*

teron. On *Asteropterygion*, bristles emerging from open pores are similar to those of *Actinoseta* and *Asteropella* (Plates 117a-d, 121j,k, 136d,e, 139e,f, 140a-f, 152b, 161d,e). On *Asteropterygion hulingsi* some of the bristles emerge from pores much larger than the bristles (Plate 117a), and some emerge from pores almost the same diameter as the bristles (Plate 117b-d); the bristles have marginal papillae, but only the former type appears to have a pore in it (Plate 117a). *Asteropterygion thomassini* has 4 types of bristles emerging from open pores: 1, long bristles emerging from a pore with a high rim (Plate 139c,e); 2, paired long bristles emerging from low rimmed pores (Plates 139f, 140a-c); 3, a short bristle emerging from a pore with a high rim (Plates 139f, 140e,f); and 4, a short bristle with open end emerging from a pore having papillae around the edge (Plates 139f, 140a,d). Types 1 and 2 have a small pore in the bristle near its base; in addition, type 2 has a tube emerging from the pore in one of the bristles (Plate 140b). The pore from which a bristle on *Asteropterygion romei* emerges appears intermediate between the open and closed type (Plate 152b). Bristles emerging from closed pores are sparse on species on *Asteropterygion* (Plates 122a, 140g, 164e).

The monotypic genera, *Pteromeniscus* and *Ome-gasterope*, have bristles emerging from open pores with a rim similar to those of *Asteropella* (Plates 177a,b, 180g-j). *Microasteropteron youngi* has bristles emerging from an open-lipped pore similar to those of *Asteropella* and *Asteropterygion* (see Kornicker 1976b, fig. 16a).

The carapace of members of the *Cylindroleberidinae* bears bristles emerging from open pores with several concentric rims (see Kornicker and Caraion, 1974, figs. 4b, 11c, 15f, 19b, 21b,c, 23a,b), as well as a few bristles emerging from open pores without rims or with only a single rim (see Kornicker and Caraion, 1974, figs. 11d,e, 15e). The pores with concentric rims appear only in members of the *Cyclasteropinae* and *Cylindroleberidinae*, not in the *Asteropteroninae*.

Anteroventral and Ventral Infold: The presence of a wide lamellar prolongation on the anteroventral and ventral list (ridge on infold) of the adult male and female of *Cycloleberis squamiger* was reported

by Kornicker and Caraion (1974:51, figs. 25f, 27e-k) and Kornicker (1975b:7, fig. 4g,h). Kornicker (1975b:7) suggested that the channel formed between the list and selvage may be used to circulate water into or out of the carapace when the valves are closed, possibly during feeding. In the present study a wide lamellar prolongation was observed on micrographs of the following species: *Cycloleberis galathea* (Plate 9c,e), *Leuroleberis sharpei* (Plate 19b), *Alphaleberis alphathrix* (Plate 26c), *Tetraleberis brevis* (Plate 30d), *T. madocksae* (Plate 36c,d), *T. tanzania* (Plate 39c), *Amboleberis americana* (Plate 43c,e), *A. antyx* (Plate 51e), *Actinoseta hummelincki* (Plate 60i-l), *A. jonesi* (Plate 64c), *Asteropella monambon* (Plate 84c), *Asteropterygion hulingsi* (Plates 115d-f, 118a,b), *A. oculitristis* (Plate 133a,b), *A. thomassini* (Plate 141a,b, 147a), *A. romei* (Plate 157b), *A. dayi* (Plate 165b). A lamellar prolongation of the list was not visible on all specimens of *Cyclasteropinae* and *Asteropteroninae* examined, but this could be because of the poor condition of the specimens. It seems likely that a wide lamellar prolongation of the list is characteristic of members of both subfamilies. The anteroventral and ventral list on species of the *Cylindroleberidinae* is generally narrow, but a fairly wide lamellar prolongation may be present on *Skogsbergiella macrothrix* (see Kornicker, 1975a, fig. 295d). A lamellar prolongation has not been reported on the anteroventral or ventral lists of other families of *Cypridinacea*.

Posterior Infold: The posterior list of members of the *Cylindroleberididae* bears diverse bristles, many tubular with terminal openings. With the exception of *Microasteropteron*, genera of the *Cylindroleberididae* bear many more bristles on the posterior infold than are present on members of other families of *Cypridinacea*. Setose bristles on some genera of the *Asteropteroninae* resemble those on the posterodorsal infold of members of the *Sarsiellidae*. Stout tubular bristles on the posterior list of species of *Asteropterygion* resemble only slightly tubular processes on the posterior list of species of *Cypridinodes* in family *Cypridinidae* (Kornicker, 1979, pl. 10).

Stout Bristles Emerging from Closed Pore on List: These bristles are equivalent to the flaplike

bristles with basal tube-pores described for many species of the *Cylindroleberidinae* (e.g. see Kornicker, 1975a, fig. 251d-f). In the *Cyclasteropinae* the stout bristles differ from those of the *Cylindroleberidinae* in completely enclosing pores that are equivalent to the tube-pores of the *Cylindroleberidinae*. Basal pores become visible when the bristle is broken off (Plate 23f); a broken bristle surrounding and hiding pores similar to those shown in Plate 23f is visible in Plate 23e. The stout bristles are tubular and have terminal openings (Plates 5e,f, 9f, 10a, 19d,e, 23a-c,e,f, 26d, 27a-c, 31a-c, 39d-f, 40e,f, 40e,f, 44a,c-f). Some of the stout bristles have an anterior opening near the base (Plates 5e,f, 27c, 39e, 40a,b,e,f); whereas other generally shorter bristles do not have an opening near the base (upper bristle in Plate 40c); the former type is more abundant than the other and seems closer in morphology to the flaplike bristle of the *Cylindroleberidinae*. The stout bristle on the list of species of *Actinoseta* has branching tips and completely encloses a quadrate pore (Plate 58d-g, 61b,c,f, 65c, 69e). Stout bristles similar to those of *Actinoseta* are present on the posterior list of *Asteropella* but they are not clear on SEM micrographs (Plates 84e, 88d-f, 96d-f, 103i-l, 107c,d,f, 109c,f). A few stout bristles are present on the list of the *Asteropteron fuscum* (Plate 112c-e). An empty pore near the stout bristles of this species probably once contained bifurcate bristles (Plate 112d,e). Members of the genus *Asteropterygion* bear many stout bristles on the list (Plates 118b-d, 119d-f, 123a-c,f,g, 133c,d, 137d-f, 141e, 142a,c,d, 145d, 147b,c, 148d,e, 157c,d, 173a). Only a few stout bristles are present on the lists of *Pteromeniscus intesi* (Plate 178b-e), *Omegasterope epsilon* (Plate 181c,d,f), and *Microasteropteron youngi* (see Kornicker, 1976b, fig. 17b,d-f). A small anterior flap is present at the base of bristles on *Tetraleberis tanzania* (Plate 40a,b).

Setose Bristles (setal tassels of Sylvester-Bradley and Benson, 1971) Emerging from Open Pores: Each bristle of this type is generally associated with a stout tubular bristle emerging from a closed pore on the list. The setose bristles are generally distal to the list. They have previously

been reported on species of *Microasteropteron* (Poulsen, 1965:219, fig. 74c; Kornicker, 1976b:16, figs. 17b,c,e, 18a, 19b,c). Similar bristles are present on members of *Actinoseta* (Plates 53j,k, 61a,b, 65c,e, 69e). Bristles on species of *Asteropterygion* are considered setose herein, but branches are not apparent on all micrographs cited below. The bristles are close to the list on *Asteropterygion hulingsi* (Plates 118c-f, 119a,b), and farther from the list on *A. oculitristis* (Plates 133c,d, 137c,d), *A. thomassini* (Plate 142c,e, 145d, 147d,e, branching is seen best on Plate 142e), *A. romei* (Plates 157c,f), *A. dayi* (Plate 165c), and *A. peterseni* (Plates 172f, 173c,d). The setose type bristle has not been observed with certainty on other members of the *Asteropteroninae*, and appears to be absent from members of the *Cyclasteropinae* and *Cylindroleberidinae*. The bristles resemble those on the posterior infold of members of the *Sarsiellidae*, as previously mentioned for those of *Microasteropteron parvum* by Poulsen (1965:219).

Indistinctly Bifurcate Bristle with Branches Fused Except near Tip Emerging from Open Pore on List and Associated with Stout Bristle: The branches of this type bristle are less numerous and more fleshy than those of the setose bristle. Each bristle of this type is generally associated with a stout bristle on the list and is just distal to it. Bifurcate bristles are present on members of *Asteropella* (Plates 84e, 88d-f, 96d-f, 107d,f). This type bristle (bifurcate only at tip) is also present on *Pteromeniscus intesi* (Plate 178b-e). The location of this type bristle and its emergence from an open pore suggests that it is equivalent to the previously described setose bristle present on genera of *Asteropteroninae* not having the bifurcate bristle.

Bristles Emerging from Open Pores Forming Row near Posterior Edge of Valve: On members of *Actinoseta* these bristles are single and may have an open end (Plates 53j, 61a,g,h, 65b,d). Longer bristles form a row on members of *Asteropterygion* (Plates 118b-d, 119c, 137c, 141e, 142a, 147c,f, 148a-c, 152c,d, 172e,f, 173b). On *A. thomassini* some of the bristles have a digitate tip (Plate 142b) and others have marginal spines (Plate 148a-c). Bristles near the posterior edge of the

valve are sparse on species of *Asteropella* and appear bifurcate (Plates 84e,f, 107c). Posterior bristles are sparse on *Pteromeniscus* and *Omegasterope* and absent on *Microasteropteron*. Bristles of this type are abundant on some species of the Cyclasteropinae (Plates 23a, 27a,d, 30f, 31a, 39d,f, 49d; also see Kornicker and Caraion, 1974, figs. 26a, 27d). Some of these have digitate tips (Plate 27d). Posterior bristles are also present in varying numbers on members of the Cyndroleberidinae (e.g. Kornicker, 1975a, fig. 295d).

Bristles Emerging from Open Pores Forming Row Anterior to Stout Bristles of List: Bristles in this locality are abundant in the Cyndroleberidinae; they vary in length, and many have open and bifurcate tips (e.g. Kornicker, 1975a, figs. 251e,f, 269e,f, 287e, 304f,g, 310b, 317e). Bristles of this type are also present among the Cyclasteropinae (Plates 9f, 10a, 23c, 31a,d, 39e, 40a,c,d, 49e,f, 51f; also see Kornicker and Caraion, 1974, fig. 26d-j). These bristles are also present on some members of the *Asteropterygion* (Plates 118c,d, 120e,f, 123f). Bristles of this type appear to be absent on *Asteropella*, *Microasteropteron*, *Pteromeniscus*, *Omegasterope*, and *Actinoseta*.

Bristles Emerging from Open Pores Forming Row Posterior to Stout Bristles of List (excluded from these bristles are setose bristles and bifurcate bristles discussed separately and which appear associated on a one-on-one basis with stout bristles on the list): Short bifurcate bristles of this type are present on *Actinoseta jonesi* (Plate 65c);

they appear to be posteriorly displaced bristles of the type forming a row anterior to the stout bristles on some members of *Asteropterygion*.

Cylindrical Tube-Pores Emerging from Closed Pores on the List: On the Cyndroleberidinae cylindrical tube-pores are present just proximal to the bases of the flaplike bristles (e.g. see Kornicker, 1975a, fig. 251d-f). Pores in this location appear to be completely enclosed within the stout bristles on the Cyclasteropinae and *Asteropteroninae*, but additional cylindrical tube-pores are present on the list of members of the *Asteropteroninae*: *Actinoseta* (Plates 53l, 61b,e), *Asteropella* (Plates 84e, 88d-i, 103h-k), *Asteropterygion* (Plates 120d, 142f,g, 165d-f, 173a), *Pteromeniscus* (Plate 178c-f), *Omegasterope* (Plate 181c,e), *Microasteropteron* (see Kornicker, 1976b, fig. 17e). On the Cyclasteropinae, tubelike bristles are present that may be equivalent to the tube pores, but they appear to have stouter walls and some have digitate tips and are complex (Plates 27b, 40c).

Structures between the List and Valve Margin: Some species of the Cyndroleberidinae have hollow scooplike processes (e.g. Kornicker, 1975a, figs. 305a,b, 317b). These were not observed on members of the Cyclasteropinae or *Asteropteroninae*. Pustules present between the list and valve edge along the anteroventral and ventral margins of *Leuroleberis sharpei* also are present near the posterior valve edge (Plate 19d). Elongate digitations occur along the posterior valve edge of *Actinoseta jonesi* (Plate 65d).

Key to Subfamilies in the Family Cyndroleberididae

1. Surface of carapace smooth without ornamentation; 1st antenna with 1 dorsal bristle on 2nd joint; end joint of maxilla with 1 (rarely 2) bristles **CYLINDROLEBERIDINAE**
Surface of carapace either smooth or ornamented; 1st antenna with 2 or more dorsal bristles on 2nd joint; end joint of maxilla with 3-7 bristles 2
2. Carapace with slitlike incisure; surface smooth except for minute fossae; central adductor muscle attachments characteristically with many elongate scars **CYCLASTEROPINAE**
Carapace with small incisur forming right or acute angle; surface smooth (*Actinoseta chelisparsa*, *A. jonesi*) or with ridges or nodes (remaining species); central adductor muscle attachments consisting of ovoid scars **ASTEROPTERONINAE**

CYLINDROLEBERIDINAE Müller, 1906

REMARKS.—For diagnosis and genera of this subfamily see Paulson, 1965, and Kornicker 1975a.

CYCLASTEROPINAE Poulsen, 1965

The Cyclasteropinae as revised herein includes 3 tribes: Cycloleberidini Hartmann, 1974, Cyclasteropini Poulsen, 1965, and Tetraleberidini, new tribe.

DISTRIBUTION.—From about 46°S in the vicinity of New Zealand to about 42°N in the Mediterranean, but with 1 questionable locality in the vicinity of Alaska (Figure 1). Except for 1 sample at 1100 m off Mauritania, members of the subfamily have not been collected deeper than about 290 m, and usually have been collected at shallower depths.

DIAGNOSIS.—Carapace of adults generally between 3 to 6 mm long, usually oval in adult females and juveniles, elongate in adult males, but members of Cyclasteropini often with angular posterior; fairly deep incisure present below rostrum; surface often with shallow fossae and scattered bristles; bristle pores with concentric rims on some short linear ridges present on some species generally more prominent in anteroventral part of valve; minute teeth along dorsal margin anterior to anterior juncture present on many species; carapace of adult males usually about same size as adult females, and with vertical row of hairs near posterior end; central adductor muscle attachments consisting of elongate and oval scars often appearing as spiral.

First Antenna: Dorsal margin of 5th joint with or without teeth or nodes; sensory bristle of 5th joint of adult female with 2–9 short proximal filaments and 6–15 long terminal filaments (see Figure 8 for examples); sensory bristle of adult male with abundant long filaments; a-bristle of 7th joint clawlike except in *Alphaleberis* (Cycloleberidini); c- and f-bristles of adult male very long (except for *Amboleberis antyx*); d- and e-bristles of 8th joint well developed.

Second Antenna: Exopodial joints with basal

spines; 9th joint generally with 5 bristles; exopodial bristles generally with spines as well as hairs on female and juvenile but with only hairs on adult male; long hairs present on exopodial joints of adult male, but absent on adult female and juvenile; 2nd exopodial joint of adult male very long. Endopodite of adult female 3-jointed, with proximal joint of some species divided into proximal and distal parts, each with short bristles; 2nd joint without bristles or with 1 or 2 bristles; 3rd joint with long terminal bristle.

Maxilla: Reduced exopodite present. End joint of endopodite with 5 or 6 bristles.

Fifth Limb: Dorsal margin of comb of adult male with 1 or 2 processes, which on some species is strongly sclerotized; dorsal margin of combs of females and males generally hirsute and with several minute bristles; lateral sides of combs with 2 long bristles with adjacent bases (anterior of these stouter than other), and several short bristles.

Sixth Limb: Limb with narrow trunk distinctly separated from wide skirt by angle in anterior and posterior margins; anterior margin of trunk with numerous bristles; posterior margin of trunk with ventral bristles as well as several hirsute bristles on the narrow posterior tip.

Seventh Limb: Limb with abundant marginal bristles. Terminus of Cyclasteropini with double opposing combs, other tribes with single opposing combs. Tip of limb with V-shaped indentation between opposing combs. Comb teeth divided into several types based on kinds of marginal spines.

Furca: Number and distribution of claws variable within family: Cyclasteropini with about 10 claws on each lamella in addition to 3 or 4 short bristles (1 bristle at anterior corners of bases of claws 4 to 6 or 7); Cycloleberidini with 3 stout main claws on each lamella followed by 8–10 slender bristlelike secondary claws; Tetraleberidini with 4 stout main claws followed by bristlelike secondary claws, and with 1 short bristle between main claws 3 and 4.

Lips: Each lobe of upper lip hirsute, usually without spines; saddle usually without spines.

Lower lip with hirsute lateral flap on each side of mouth.

Posterior Process of Body: Processes not well developed.

Gills: 7-10 well-developed, broad gills on each side of posterodorsal part of body.

COMPARISONS.—The subfamily Cyclasteropinae differs from the Cylindroleberidinae in many ways; for example, carapace generally but not always larger; surface with fossae; dorsal margin of valves often with minute dentition anterior to anterior juncture; central adductor muscles consisting of elongate as well as ovoid scars often appearing as spiral. The 1st antenna of the Cy-

clasteropinae differs from that of the Cylindroleberidinae in having many more bristles on the 2nd and 3rd joints, and in having more short and long filaments on the sensory bristle of the female 5th joint. The mandible of the Cyclasteropinae differs from that of the Cylindroleberidinae in having many more bristles, especially on the dorsal margin and medial surface of the 2nd endopodial joint. The maxilla of the Cyclasteropinae differs from that of the Cylindroleberidinae in having an exopodite, and in having 5 or 6 rather than 1 or 2 bristles on the end joint of the endopodite. Other differences are noted in the discussion of Cypridinacea.

Key to Tribes in the Subfamily Cyclasteropinae

- Furca with 3 main claws, no bristles between clawsCYCLOLEBERIDINI
- Furca with 4 main claws, usually with 1 bristle between claws 3 and 4TETRALEBERIDINI, new tribe
- Furca with more than 4 main claws and total of 3 or 4 bristles between four or five of the clawsCYCLASTEROPINI

CYCLASTEROPINI Poulsen, 1965, new status

COMPOSITION AND DISTRIBUTION.—The Cyclasteropini contains only 1 genus, *Cyclasterope* Brady, 1897; with members living mainly in the Indo-Pacific region (Figure 18).

DIAGNOSIS.—Carapace of some species with distinct angle near middle of posterior margin.

First Antenna: Fifth joint: dorsal margin without teeth or nodes; sensory bristle with 2 short marginal filaments and 10-14 long terminal filaments. Seventh joint: a-bristle clawlike, bare or pectinate dorsally.

Fifth Limb: Dorsal margin of comb of female strongly convex, of male with single hooklike process.

Seventh Limb: Terminus with inner and outer sets of opposing combs.

Furca: Each lamella with about 8 to 10 claws in addition to 3 to 5 short bristles (1 each at anterior corners of bases of claws 4 to 6 or 8); no distinct separation of claws into primary and secondary types, but posterior 3 or 4 claws straighter and somewhat more bristle-like than claws 1 to 6 or 7.

Posterior of Body: Small dorsal process projecting posteriorly and ventrally.

Cyclasterope Brady, 1897

TYPE-SPECIES.—*Cyclasterope hendersoni* Brady, 1897, by subsequent designation (Skogsberg, 1920:441, 542).

DISTRIBUTION.—Members of this genus have been reported mainly from the Indo-Pacific region: from as far west as India, as far east as Japan, and as far south as Indonesia, but 1 species is questionably reported from Australia (Figure 18). Specimens have been collected at the surface in night plankton tows and on the bottom to depths of 291 m.

COMPOSITION.—This genus contains 6 species: *Cyclasterope hendersoni* Brady, 1897, *C. hilgendorffii* (Müller, 1890), *C. arthuri* (Stebbing, 1900), *C. fascigera* Brady, 1902, *C. bisetosa* Poulsen, 1965, and ?*C. albomaculata* (Baird, 1860a).

REMARKS.—Having no new material belonging to *Cyclasterope*, I found it expedient not to attempt

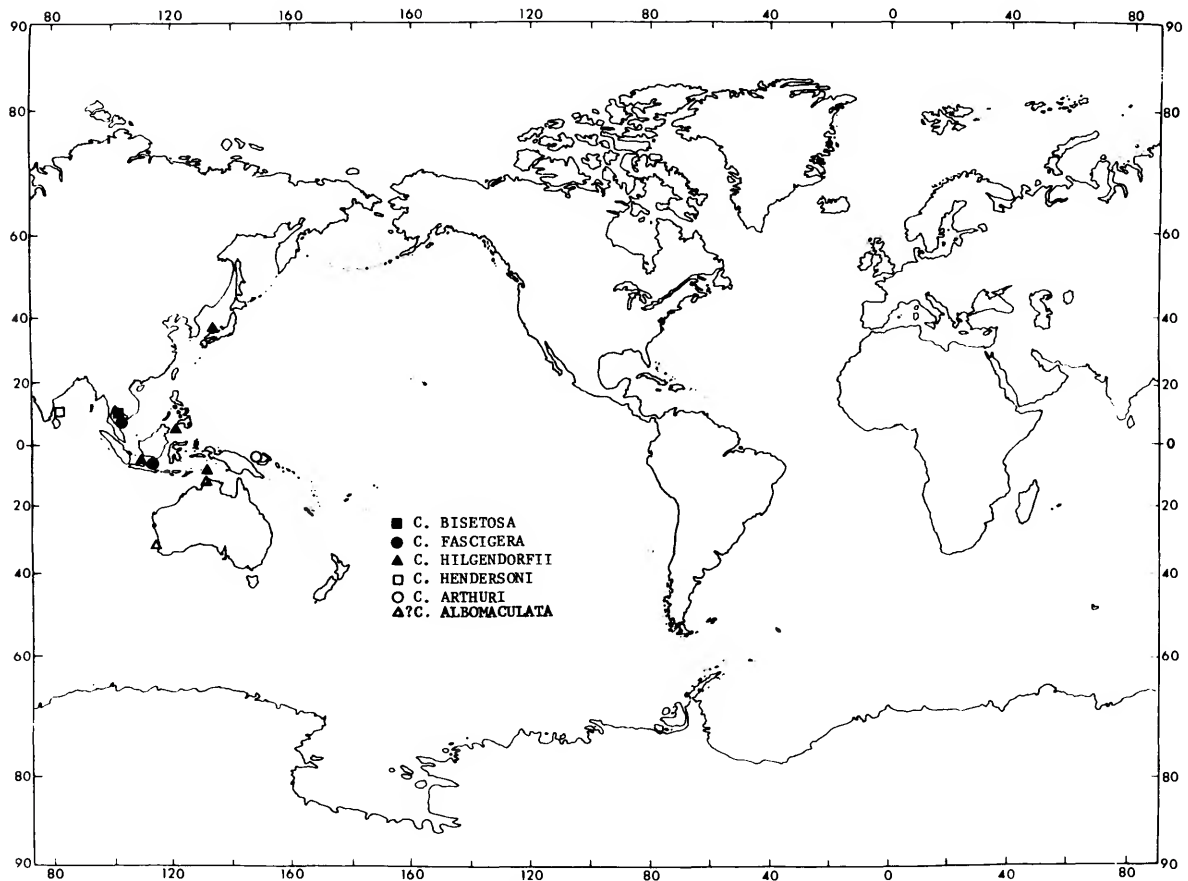


FIGURE 18.—Distribution map of species of *Cyclasterope*.

a restudy of existing specimens at other museums, except for the carapace of *C. fascigera*, which I examined using the scanning electron microscope.

Until more is known about some of the species in this genus, a key to the species is of limited use. A key has been presented by Poulsen (1965:285). That key does not include *C. arthuri*, which I have recognized herein because of its large size, or ?*C. albomaculata*. The shape of the posterior margin used by Poulsen in his couplet 1, may be of limited use in separating species, because the specimens of *C. fascigera* that I had the opportunity to examine have considerable intraspecific variability in the angularity of the posterior margin, and Stebbing (1900:660) reported only the left valve of *C. arthuri* to be angular.

1. *Cyclasterope fascigera* Brady, 1902

FIGURES 8a, 15i, 17g; PLATES 1-5

- Cyclasterope fascigera* Brady, 1902:181, pl. 21: figs. 20-31.—
Skogsberg, 1920:169, 439, 441, 542-554, figs. 106-110.—
Poulsen, 1965:169, 241-243, 283-306, 308, 396, 444, 455,
456, 472, 474, 477-479, 481, figs. 81, 82, 95-101, 152A'.
Cylindroleberis fascigera.—Müller, 1906:33.
Asterope fascigera.—Müller, 1912:43, 44.
Cycloleberis fascigera.—Poulsen, 1965:476 [obvious lapsus].

HOLOTYPE.—None selected. According to Skogsberg (1920:554) an adult male syntype is in the collection of the Copenhagen Zoological Museum.

TYPE-LOCALITY.—Java.

MATERIAL.—Through the courtesy of Dr. Torben Wolff, I received for study from the Zoolog-

ical Museum, Copenhagen, a vial of specimens from Ourust, Java Sea, identified as *Cyclasterope fascigera* and reported on by Poulsen (1965:285). The vial contained many whole specimens and a few separated valves. I selected for study with the SEM a left valve, which from its size, I believe to be from an adult female. All specimens were returned to Copenhagen, including valve examined with the SEM, except a right valve and an adult male and female, which were put into the collections of the NMNH (USNM 157761) (in alcohol).

DISTRIBUTION.—Ourust, Java Sea, juveniles, adult and ovigerous females, adult males collected at surface with night light; Koh Lan, Thailand, 50 m, mud; Java, near Sourabaya, and Chiribon at 8.23 m.

REMARKS.—In the synonymy of this species, Poulsen (1965:285) questioned whether his specimens are conspecific with those described by Brady, but did not question that they are conspecific with the specimen described by Skogsberg (1920). Because Skogsberg's specimen is part of the type-series of Brady, and because Skogsberg specifically stated (1920:554) that the specimen he described and the specimen dissected and described by Brady belong to the same species, I have not questioned the conspecificity of Poulsen's specimens in my synonymy.

DIAGNOSIS OF ADULT FEMALE.—Carapace leathery, amber colored; surface with abundant shallow fossae; posterior margin with well-developed angle, especially on left valve that extends past right. Length 5.8–6.0 mm (Poulsen, 1965:295).

First Antenna: 2nd joint with 10 dorsal and 3 lateral bristles. 3rd joint with single ventral bristle about same length as ventral margin of 4th joint. 5th joint: sensory bristle with 2 short proximal and 12 long terminal filaments (only 11 terminal filaments shown in illustration of Poulsen, 1965, fig. 97b). 7th joint: a-bristle clawlike, not pectinate.

Second Antenna: Endopodite: 1st joint with 11 bristles; 2nd joint with 1 or 2 short bristles; 3rd joint with 1 long terminal bristle.

Mandible: Basale: dorsal margin with total of 12

bristles. Endopodite: 1st joint about same length as 2nd.

Fifth Limb: Dorsal margin of comb with 12 short bristles.

Sixth Limb: With 12 epipodial bristles.

Seventh Limb: With about 165 marginal bristles.

Furca: Each lamella with total of 15 claws and bristles; claws 4–8 with lateral bristle near anterior corner of bases.

DESCRIPTION OF LEFT VALVE STUDIED WITH SEM (Probably Adult Female) (Plates 1–5).—Posterior margin acuminate (Plate 1a); incisur with rounded inner margin present just ventral to valve middle (Plate 1a,b).

Ornamentation: Surface with abundant shallow fossae bearing small bristle emerging from closed pore (Plates 1b,c,e,k, 2a,f, 3a); surface of fossae, and also between fossae, spongelike and with minute papillae (Plates 2b–i,k,l, 3b–f); groups of papillae somewhat longer than rest scattered over valve surface (Plate 3a,e,f); a group of bristles emerging from open pores present along posteroventral margin (Plate 1e–j); some of these bristles with minute marginal papillae (Plate 1g,i), and some with flagellae near base (Plate 1g,h,j); bristles emerging from open pores sparsely distributed over valve surface (Plate 2b–e) and along margin of incisur (Plates 1b, 2e); bristles emerging from open pores with concentric rims present between fossae (Plate 2b–d); these bristles have pore near base (Plate 2b,c); minute pores, some on raised pustules, scattered over valve surface (Plates 2k,l, 3b–d) (pore in Plate 2l stopped up); ventral margin with row of flat bristles with marginal spines (Plate 1d,l); similar bristles present along anterodorsal margin of valve (Plate 4b,j); bristles also present along anteroventral margin (Plate 4d,k); vertical ridge present extending from ventral margin to point just posterior and ventral to incisur (Plate 1a). Concretions abundant.

Infold: Infold posterior to rostrum with numerous bristles (Plate 4a,b); a few bristles present near inner end of incisur (Plate 4b,g); narrow list bearing bristles present starting from point just ventral to incisur and ending near middle of posterior margin (Plates 4a–d,f,l; 5a,b); postero-

ventral list with tubular bristles (Plate 5*b,f*) and bristles with pore at base (Plate 5*b,e*); ventral infold with striae proximal to list (Plate 4*c,e,l*), and both minute processes and widely separated bristles distal to list (Plate 4*l*); anteroventral infold with numerous bristles between list and valve edge (Plate 4*d*); posterior infold with both tubular bristles (Plate 5*b,d*) and small processes distal to list (Plate 5*b,c*).

Selvage: Lamellar prolongation along both inner margin of incisur and anterior margin of rostrum with long fringe (Plate 4*b,g,j*); outer edge of lamellar prolongation along anteroventral, and posteroventral margins of valve with minute papillae giving serrate appearance (Plates 1*d*, 4*h,i,k*).

Size: Length 5.9 mm.

2. *Cyclasterope bisetosa* Poulsen, 1965

FIGURES 8*b*, 12*i*, 16*h*

Cyclasterope bisetosa Poulsen, 1965:301, figs. 102, 103, 104.

HOLOTYPE.—Ovigerous female in Copenhagen Museum.

TYPE-LOCALITY.—*Dana* station 3839, Padang Harbor, west coast of Sumatra. Shallow water less than 50 m depth (Poulsen, 1965:306).

MATERIAL.—None examined.

DISTRIBUTION.—West coast of Sumatra, south-east coast of Thailand (50 m).

DIAGNOSIS OF ADULT FEMALE.—Carapace with short hairs longer and more abundant than on *Cyclasterope fascigera*. Posterior of carapace with angle near middle. Surface appearing white, porcelainous. Length of adult female 5.8 mm (only 1 mature female known).

First Antenna: 2nd joint with 7 or 8 dorsal bristles and 1 lateral bristle. 3rd joint with single ventral bristle two-thirds the length of ventral margin of 4th joint. 5th joint: sensory bristle with 2 short proximal and 14 long terminal filaments. 7th joint: a-bristle clawlike, not pectinate.

Second Antenna: Endopodite: 1st joint with 18 bristles (some proximal bristles quite long); 2nd joint with 1 short bristle; 3rd joint with 1 short and 1 very long bristle.

Mandible: Basale: dorsal margin with total of 26 bristles. Endopodite: 1st joint longer than 2nd.

Fifth Limb: Dorsal margin of comb with 15 or 16 bristles.

Sixth Limb: With 5 epipodial bristles.

Seventh Limb: With 200 marginal bristles.

Furca: Each lamella with total of 14 claws and bristles; claws 4–7 with lateral bristle near anterior corner of bases (Poulsen, 1965:305, stated that the furca has lateral bristles off claws 5–7, but on p. 308 stated that the bristles are off claws 4–7). Poulsen (1965:305) stated that the furca of *C. bisetosa* is similar to that of *C. fascigera*, but the furca of the female of the latter species bears lateral bristles adjacent to claws 4–8 (Poulsen, 1965:294).

3. *Cyclasterope hilgendorffii* (Müller, 1890)

Asterope hilgendorffii Müller, 1890:221, 239, 241, 250–252, pl. 25: fig. 15; pl. 26: figs. 8, 20; pl. 27: figs. 4–6, 17.—1912: 43, 44, 47.—Skogsberg, 1920:40.

Cylindroleberis hilgendorffii.—Müller, 1894:63; 1906:33, 34, 36, pl. 5; figs. 1–5.

Cylindroleberis Hilgendorffii.—Müller, 1894:217, 218.

Asterope Hilgendorffii.—Skogsberg, 1920:40, 438, 439, 441, 443. [Skogsberg (1920:441) stated that the species should probably be included in *Cyclasterope*.]

Cyclasterope hilgendorffii.—Hanai, 1959:425.—Hanai, et al, 1977:80.

Asterope hilgendorffii.—Poulsen, 1965:251.

Cyclasterope hilgendorffii.—Poulsen, 1965:243, 284, 285, 301, 309.

HOLOTYPE.—Female, unique specimen.

TYPE-LOCALITY.—Coast of Japan near Enosima (Shonan), 21.9 m.

MATERIAL.—None examined.

DISTRIBUTION.—Coast of Japan (Müller, 1890). Indonesia (Müller, 1906): 7°44'S, 114°29'E, Java Sea, 291 m, trawl; Bay of Madura, Java, 69–91 m, dredge and trawl; 5°36'S, 132°55'E, Banda Sea, 90 m, Blake dredge. Sulu Archipelago, Philippines, 14 m, dredge and tow (Müller, 1906).

REMARKS.—I think it likely that the specimens collected in Indonesia by the *Siboga* Expedition and reported on by Müller (1906), who referred them to *Cylindroleberis hilgendorffii* (see above synonymy), are conspecific with *Cyclasterope fascigera*

Brady, which were collected in the same general area, especially the 2 specimens from the Bay of Madura, one of Brady's localities.

Müller (1912:44) referred *Cyclasterope hendersoni* and *Asterope arthuri* (= *Cyclasterope arthuri*) to *Asterope hilgendorffii* (= *Cyclasterope hilgendorffii*) and listed Ceylon as a collecting locality. I have been unable to find any other reference in the literature to the species having been collected from Ceylon, and therefore, have not included that locality in the distribution of the species given above.

DIAGNOSIS OF FEMALE (possibly adult).—Carapace porcelaneous, with minute surface fossae and angular posterior margin. Length 6.25 mm.

First antenna: a-bristle of 7th joint clawlike, pectinate.

Second antenna: Endopodite: 1st joint with about 12 bristles.

Furca: Lamella with total of 12 claws and bristles; lateral bristles at anterior corner of claws 4–7.

4. *Cyclasterope hendersoni* Brady, 1897

Cyclasterope hendersoni Brady, 1897:86, pl. 15: figs. 1–12.—Cannon, 1933:740, figs. 5–7.—Poulsen, 1965:243, 282, 284, 285, 301, 309.

Cylindroleberis hilgendorffii.—Müller, 1906:33 [part].

Asterope hilgendorffii.—Müller, 1912:44 [part].

Cyclasterope Hendersoni.—Skogsberg, 1920:438, 439, 441, 542.

HOLOTYPE.—None selected. The Brady Collection at the Hancock Museum, Newcastle-on-Tyne contains a dry specimen, and some specimens are listed in their card file as being in the spirit collection (personal observation, 1967).

TYPE-LOCALITY.—Madras Harbor, India, 7.3–9.1 m.

MATERIAL.—None examined.

DISTRIBUTION.—Collected only at the type-locality.

DIAGNOSIS OF FEMALE (probably adult).—Posterior of carapace fairly evenly rounded; surface with minute fossae. Length 7 mm.

Second Antenna: Endopodite: 1st joint with about 12 bristles; 2nd joint without bristles; 3rd joint with 1 long terminal bristle (from Brady, 1897, pl. 15: fig. 4).

Mandible: Basale: dorsal margin with 14 bristles (from Brady, 1897: pl. 15: fig. 5). Endopodite: 1st joint longer than 2nd.

Seventh Limb: Each limb with about 250 marginal bristles.

Furca: Each lamella with total of 11 claws and bristles; lateral bristles at anterior corner of bases of claws 4–6.

5. *Cyclasterope arthuri* (Stebbing, 1900), new combination

Asterope species.—Stebbing, 1899:31, 3 figs. [see Stebbing, 1901:100].

Asterope arthuri Stebbing, 1900:607, 660–662, 686, pl. 72A; 1901:100.

Cylindroleberis hilgendorffii.—Müller, 1906:33 [part].

Asterope hilgendorffii.—Müller, 1912:44 [part].

HOLOTYPE.—None selected.

TYPE-LOCALITY.—Blanche Bay, New Britain, Bismarck Archipelago, 110–128 m.

MATERIAL.—None examined.

DISTRIBUTION.—Known only from type-locality.

REMARKS.—Because 2 of the 3 species reported by Stebbings (1900:660) have lengths of 8.0 mm and 7.5 mm, respectively (p. 662), which are greater than lengths reported for other species of the genus, I have recognized this species; however, additional information concerning the species is needed to be certain that it is valid.

DIAGNOSIS OF FEMALE (probably adult).—Carapace length 8 mm. Stebbing, 1900, pl. 72A, illustrated the outline of the carapaces of 2 specimens at natural size, and the appendages of a juvenile male; presumably the appendages came from the smaller of the 2 illustrated carapaces; the appendages described by Stebbing, 1900:661, are those of the juvenile male; I have assumed that the larger of the 2 illustrated carapaces is that of an adult female.

First Antenna: a-bristle of 7th joint pectinate?

6. ?*Cyclasterope albomaculata* (Baird, 1860)

Cypridina albo-maculata Baird, 1860a:201, pl. 71: figs. 1, 1a-d; 1860b:140.—Miers, 1884:321.—Müller, 1912:50 [re-

ferred species to "Cypridinarum genera dubia et species dubiae"].

Cypridina(?) *albo-maculata*.—Brady, 1880:153 [listed].

Cypridina albomaculata.—Brady, 1897:87.—Skogsberg, 1920: 444 [suggested a close relationship to genus *Cyclasterope*].

?*Cyclasterope albomaculata*.—Kornicker, 1975a:30.

HOLOTYPE.—British Museum (Natural History) dry collection, 61.69.

TYPE-LOCALITY.—Swan River, Western Australia, near Perth.

MATERIAL.—None examined.

DISTRIBUTION.—Western and Northwestern Australia (22–31 m depth at latter locality, Miers, 1884:321).

REMARKS.—The species is referred questionably to the genus *Cyclasterope* because of the acuminate posterior indicated by the illustration of Baird (1860a, fig. 1). The generic placement needs verification by examination of the appendages of the holotype, or by study of specimens collected in the vicinity of the type-locality. The acuminate posterior margin distinguishes it from *Leuroleberis mackenziei*, new species, described herein, collected from the eastern coast of Australia, but only additional studies of western Australian specimens will eliminate the possibility that the 2 species are synonyms.

CYCLOLEBERIDINI Hartmann, 1974, new status

COMPOSITION.—The Cycloleberidini contains 3 genera: *Cycloleberis* Skogsberg, 1920, *Leuroleberis*, new genus, and *Alphaleberis*, new genus.

DISTRIBUTION.—Mediterranean Sea: Gulf of Naples and Bay of Marseille. Eastern Atlantic Ocean: off West Africa: Spanish Sahara, Mauritania, São Thomé Island, Ivory Coast, South

Africa in False Bay, Saldanha Bay, Langebaan Lagoon, and Lambert's Bay. Western Atlantic Ocean: Argentina. Western Indian Ocean: Madagascar, Mozambique?, Bab el Mandeb. Western Pacific Ocean (southern part): Australia, New Zealand. Eastern Pacific Ocean: ?Alaska, California, Baja California, Chile. Depth range intertidal to 96 m, also collected in surface tow. A record of 1100 m off Mauritania is considered atypical or questionable.

DIAGNOSIS.—Carapace of females and juveniles evenly rounded. Anterior margin of rostrum and anteroventral margin with inner edge of peripheral rim either scalloped (*Cycloleberis*) or smooth (*Leuroleberis*, *Alphaleberis*).

First Antenna: Fifth joint: dorsal margin of 1st joint without teeth or nodes; sensory bristle of adult female with 2–8 marginal filaments and 7 to 15 long terminal filaments. Seventh joint: a-bristle straight bristlelike (*Alphaleberis*) or curved clawlike (*Leuroleberis*, *Cycloleberis*).

Fifth Limb: Dorsal margin of comb of female weakly convex, of male with 1 or 2 processes.

Seventh Limb: Terminus with single set of opposing combs.

Furca: Each lamella with 3 stout main claws followed by 8–10 slender bristlelike secondary claws. No bristles present between main claws.

Posterior of Body: Dorsal process either absent or represented by small posteriorly pointing bulge.

COMPARISONS.—The tribe Cycloleberidini differs from the tribes Cyclasteropini and Tetraleberidini in not having bristles between the main claws of the furca. The terminus of the 7th limb of the Cycloleberidini bears single opposing combs, not double as do members of the Cyclasteropini.

Key to Genera in the Tribe Cycloleberidini

1. Rim along anterior margin of rostrum and anteroventral margin of valve scalloped along inner margin ***Cycloleberis***
Rim along anterior margin of rostrum and anteroventral margin of valve with smooth inner margin 2
2. a-bristle of 7th joint of 1st antenna curved clawlike
..... ***Leuroleberis*, new genus**
a-bristle of 7th joint of 1st antenna straight, bristle-like
..... ***Alphaleberis*, new genus**

Cycloleberis Skogsberg, 1920

TYPE-SPECIES.—*Cylindroleberis lobianci* Müller, 1894.

DISTRIBUTION.—*C. lobianci*: Gulf of Naples, Italy; Gulf of Marseille, France. *C. squamiger*: off São Thomé Island, off Spanish Sahara, Mauritania, and the Ivory Coast. *C. christei* ?Biera, Mozambique; Langebaan Lagoon and Saldanha Bay, South Africa (Figure 19). *C. galathea*: in False Bay and Lambert's Bay, South Africa, and Madagascar. Depth range intertidal to 96 m. Indeterminate species collected at Bab el Mandeb.

COMPOSITION.—This genus contains the following species: *Cycloleberis lobianci* (Müller, 1894), *C. squamiger* (Scott, 1894), *C. galathea* Poulsen, 1965, and *C. christei* Kornicker and Maddocks, 1977.

DIAGNOSIS.—Anterior margin of rostrum with bordering rim having scalloped inner edge; rim

continuing along upper edge of incisur, then curving and continuing along anterior margin of valve just ventral to incisur; inner margin of rim being without scallops in vicinity of inner end of incisur but with scallops along anteroventral margin of valve.

Ornamentation: Surface with shallow fossae bearing short bristle emerging from closed pore; bottom of fossae with reticulate structure; short straight-to-curved ridges often present anterior to fossae.

First Antenna: 5th joint: dorsal margin without teeth or nodes; sensory bristle with 2 or 3 short marginal filaments and up to 14 long terminal filaments. 7th joint: a-bristle clawlike, bare.

Fifth Limb: Dorsal margin of comb of adult male with 1 or 2 processes.

Furca: Each lamella with 3 stout main claws followed by 8–10 secondary bristle-like claws.

Key to Species of *Cycloleberis*

ADULT FEMALE

- 1. 1st endopodial joint of 2nd antenna with 9–3 proximal bristles 8. *C. christiei*
- 1st endopodial joint of 2nd antenna with fewer than 6 proximal bristles 2
- 2. Sensory bristle of 1st antenna with 3 short marginal filaments, dorsal margin of basale of maxilla with 4 or 5 distal bristles .. 7. *C. galathea*
- Sensory bristle of 1st antenna with 2 short marginal filaments, dorsal margin of basale of maxilla usually with 8 or more distal bristles, rarely with fewer distal bristles 3
- 3. Sixth limb with 4 or 5 epipodial bristles 10. *C. lobianci*
- Sixth limb with 2 or 3 epipodial bristles 9. *C. squamiger*

ADULT MALE

(adult male of *C. lobianci* unknown)

- 1. Dorsal margin of comb of 5th limb without rounded protuberance anterior to middle process 8. *C. christiei*
- Dorsal margin of comb of 5th limb with rounded protuberance anterior to middle process 2
- 2. 2nd joint of 1st antenna with 9 lateral bristles, 2nd endopodial joint of 2nd antenna with 11 bristles 7. *C. galathea*
- 2nd joint of 1st antenna with 5–7 lateral bristles, 2nd endopodial joint of 2nd antenna with 5–8 bristles 9. *C. squamiger*

7. *Cycloleberis galathea* Poulsen, 1965

FIGURES 8g, 14h, 20, 21; PLATES 6–10

Cycloleberis galathea Poulsen, 1965 [part]:260, figs. 87, 88 [A-1 female holotype only, not juvenile male on p. 260, 267, fig. 89. That specimen questionably referred to *Cycloleberis christiei* Kornicker and Maddocks by Kornicker and Maddocks (1977)].—Kornicker, 1975b:14, figs. 11a,b, 12.

HOLOTYPE.—A-1 female in collection of the Zoological Museum of the University of Copenhagen, Denmark.

TYPE-LOCALITY.—False Bay, South Africa, *Galathea* station 169, 20 m.

MATERIAL.—From Lambert's Bay, South Africa: USNM 150298, 1 adult male, sta LBT-10B; USNM 157629, 1 A-3 male, sta LBT-8J; USNM 157631, 2 juveniles, sta LBT-8J; USNM 157632, 1 juvenile, sta LBT-82H; USNM 157633, 2 juveniles, sta LBT-100F. From Madagascar: USNM 157409, 1 ovigerous female, sta BT-213; USNM 157630, 1 adult female, sta BT-213; USNM 157634, 1 adult female, sta BT-227; USNM 157735, 157739, 2 juveniles, sta BT-222; USNM 157732, 2 juveniles, sta BT-224; USNM 157742, 157733, 157720, 6 juveniles, sta BT-230; USNM 157734, 1 juvenile, sta BT-231; USNM 157727, 1 juvenile, sta BT-236; USNM 157725, 157731, 157745, 157749, 4 juveniles, sta BT-259; USNM 157737, 2 specimens, sta BT-261; USNM 157757, 1 specimen, sta BT-356.

DISTRIBUTION.—South Africa: False Bay, Lambert's Bay; Madagascar. Depth range 0–38 m (Figure 19).

REMARKS.—Poulsen (1965:260) described *Cycloleberis galathea* from an A-1 female (holotype) from False Bay, South Africa, and an A-1 or A-2 male from Beira, Mozambique. Kornicker and Maddocks (1977) referred the juvenile male questionably to their new species, *Cycloleberis christiei*, leaving only the holotype (A-1 female) in *C. galathea*. I believe that *C. galathea* may be conspecific with *Cycloleberis squamiger* (Scott), whose known range is Spanish Sahara to the Ivory Coast, but think it advisable to retain both names until more specimens from False Bay are available for study.

In the present collection from Lambert's Bay,

South Africa, are an adult male, an A-3 male, and 6 earlier instars. These specimens are referred herein to *C. galathea* because the 2nd joint of the 1st antenna of the adult male has 9 lateral bristles, and the 2nd joint of the endopodite of the 2nd antenna has 11 ventral bristles. The 3 adult males of *C. squamiger* studied by Kornicker (1975b, table 1) have 5–7 and 5–8 bristles, respectively, in those locations. Because of the proximity of Lambert's Bay and False Bay, I consider it not unlikely that the specimens in the two localities represent, more-or-less, the same population. More specimens from each place must be studied to test this hypothesis.

Three females in the collections from Madagascar are referred herein to *C. galathea*. One of them is an ovigerous female, and the remaining 2 are also probably adults, although their not having eggs makes it difficult to be certain that they are not A-1 instars. Differences in the number of proximal bristles on the dorsal margin of the basale of the maxilla, in the number of bristles on the endites of the maxilla, in the absence of hairs between teeth on main claws of the furcal lamellae and the number of comb teeth on the 7th limb suggest that the specimens from Madagascar are not conspecific with the holotype of *C. galathea* from False Bay, Africa. The presence of 3 proximal filaments on the sensory bristle of the 5th joint of the 1st antenna weighed heavily in my decision to refer the specimens from Madagascar to *C. galathea*. Study of adult males of the species from Madagascar is needed to help resolve the problem. Many additional specimens from Madagascar studied in less detail than the above 3 females were also referred to *C. galathea*.

DESCRIPTION OF ADULT FEMALE (Figure 20a–e, Plates 6–10).—Carapace oval in lateral view with deep incisur at middle of anterior margin (Figure 20a,b, Plate 6a).

Ornamentation: Anterior and anteroventral margins with scalloped border (Plates 6, 7a); entire surface of each valve with short vertical ridges tending to be linear on anterior part of valve and undulate on posterior part (Plates 6a–d, 7d,e); shallow fossae, with short bristle emerging from closed pore, posterior to middle part of each

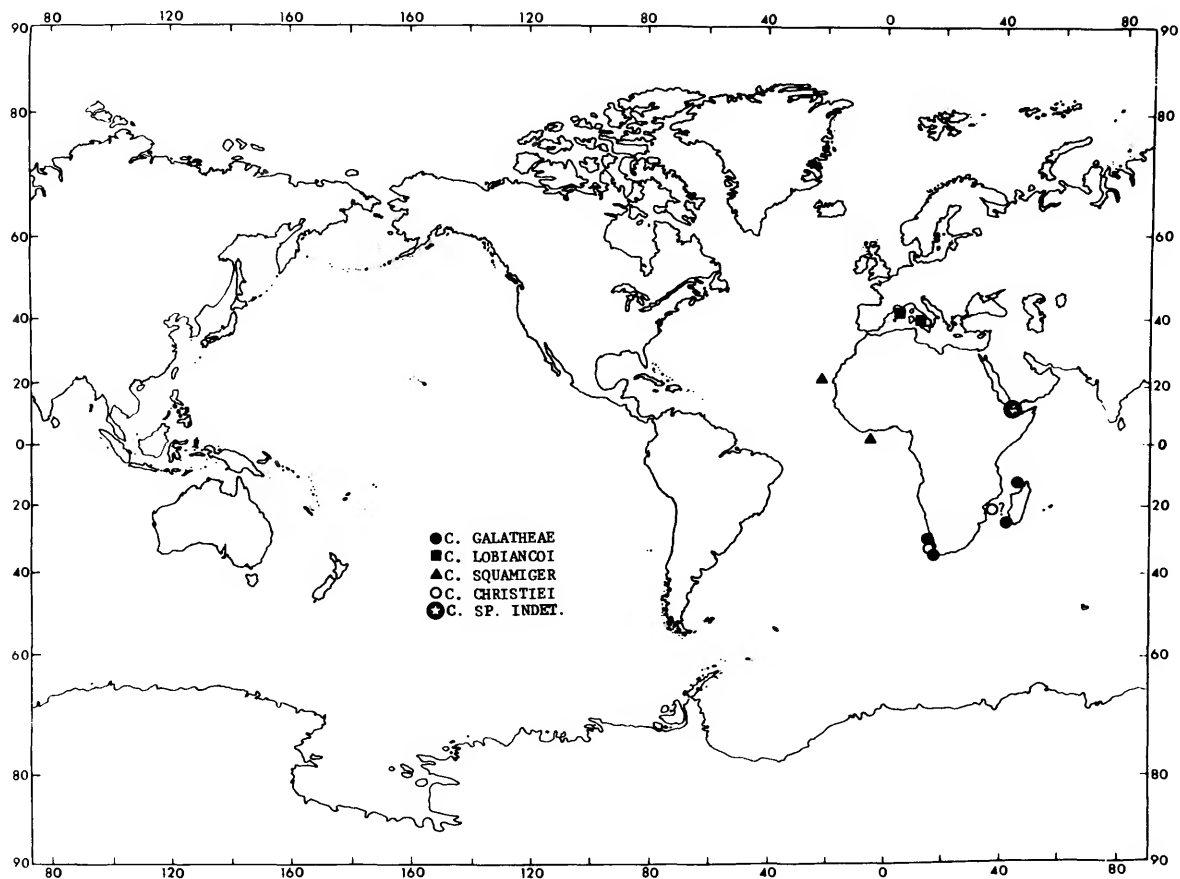


FIGURE 19.—Distribution map of species of *Cycloleberis*.

vertical ridge (Plates 7*d*, 8*b-d*); longer bristles emerging from open-rimmed pores sparsely distributed over valve surface (Plates 7*d-f*, 8*a*); many of the rimmed pores with radiating structure around rim (Plates 7*d-f*, 8*a*); minute pores sparsely distributed on valve surface (Plate 8*e, f*).

Infold: Normal for genus (Plates 9–10*a*).

Selvae: Lamellar prolongation present along ventral anterior and anterodorsal margin (Plate 9*b-e*), with long fringe along anterior part of dorsal margin (Plate 10*c*).

Central Adductor Muscle Attachments: Normal for genus. In transmitted light, with valve viewed from outer side, each elongate muscle attachment appearing as numerous small oval scars.

Dorsal Muscles: Muscles attached to dorsal margin of valves (Plate 10*d-f*).

Size: USNM 157409, length 4.7 mm, height 3.8 mm; USNM 157630, length 4.5 mm, height 3.7 mm; USNM 157634, length 4.3 mm, height 3.8 mm.

First Antenna: 1st joint with long hairs along ventral margin both short and long hairs on medial side near ventral margin. 2nd joint: dorsal margin with 6 bristles; lateral side with 9–12 distal bristles; medial and lateral sides with long hairs near ventral margin; medial side with stiff hairs forming rows near distal margin. 3rd joint: length of dorsal margin of 3rd joint about 60 percent that of 2nd joint; short ventral margin with short midbristle; long dorsal margin with about 17 bristles. 4th joint: ventral margin with 5 terminal bristles; dorsal margin with 1 very long terminal bristle. Sensory bristle of 5th joint

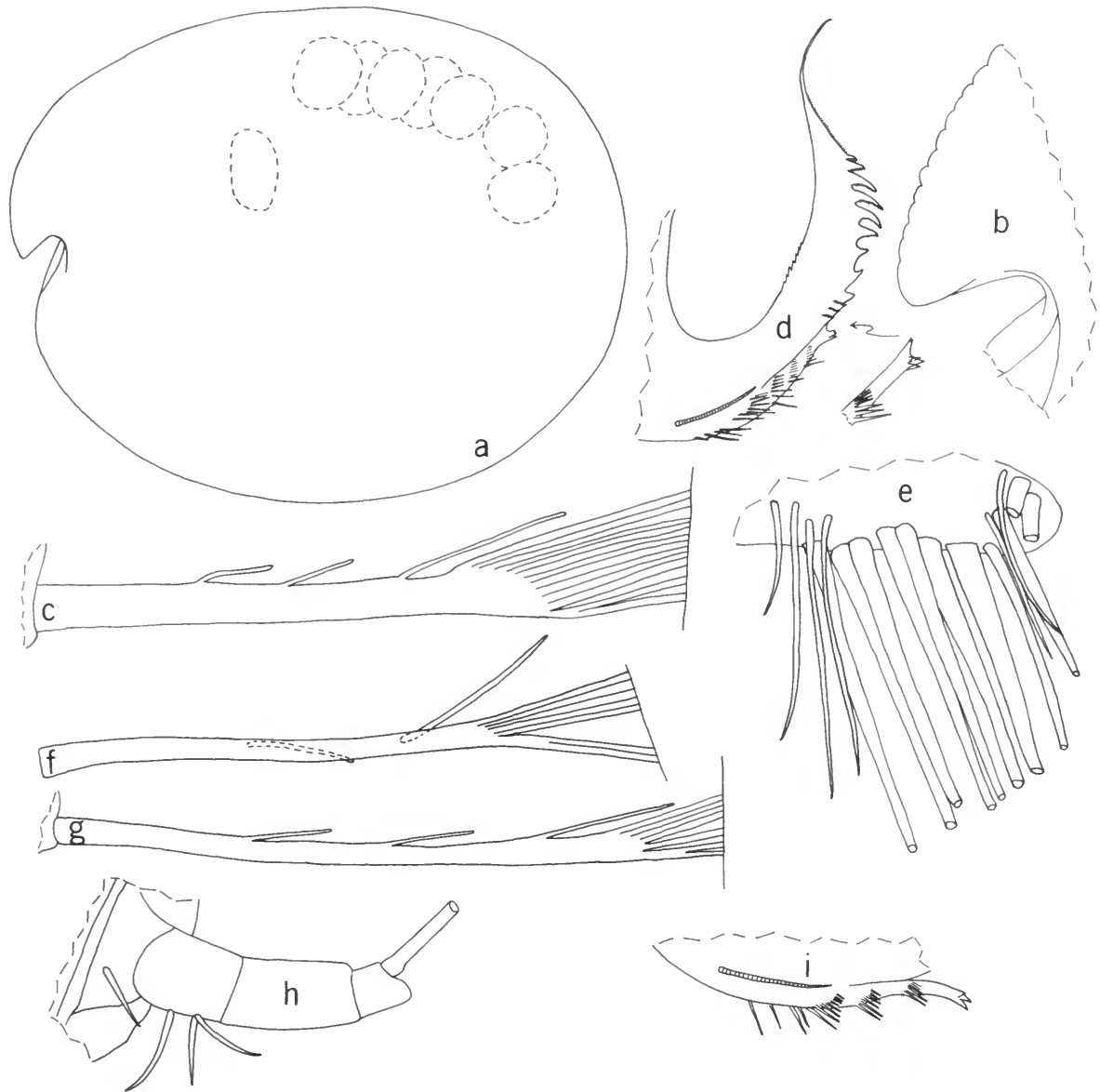


FIGURE 20.—*Cycloleberis galatheae* Poulsen, ovigerous female, USNM 157409: *a*, complete specimen showing position of lateral eye and eggs, length 4.7 mm; *b*, rostrum and incisor of left valve showing scalloped anterior margin of rostrum, lateral view; *c*, sensory bristle of 5th joint of left 1st antenna, medial view; *d*, coxale endite of right mandible, medial view; *e*, endite bristles of left maxilla, medial view. Male (A-3 instar), USNM 157629: *f*, *g*, sensory bristle of 5th joints of right and left 1st antennae; *h*, endopodite of right 2nd antenna, medial view; *i*, ventral branch of coxale endite of right mandible, medial view.

with 3 short proximal filaments and 13 long terminal filaments (the distal short filament longer than other 2 and with base fairly close to proximal terminal filament) (Figure 20c). 6th joint with 1 long medial bristle near middle of distal margin. 7th joint: a-bristle clawlike, bare; b-bristle about same length as sensory bristle, with about 11 filaments; c-bristle reaching past sensory bristle, with 14 filaments including tip. 8th joint: d- and e-bristles bare, about same length as sensory bristle, with blunt tips; f-bristle bending slightly dorsally, about same length as b-bristle, with about 11 filaments; g-bristle same length as c-bristle, with about 16 filaments.

Second Antenna: Protopodite with long hairs on medial side near ventral and dorsal margins and along ventral margin, and 1 short, distal, medial bristle. Endopodite: 1st joint with 3–5 short bristles on proximal part and 5 or 6 short bristles on distal part; 2nd joint with 1 short bristle; 3rd joint with 1 long terminal bristle. Exopodite: 1st joint with minute spines forming rows on medial surface and small, medial, terminal spine (teeth not observed along ventral margin); bristles of joints 2–8 with proximal ventral spines and natatory hairs; 9th joint with 5 bristles, all with natatory hairs, 2 or 3 also with ventral spines; joints 2–8 with small basal spines; basal spine of 8th joint about one-half length of 9th joint; lateral spine of 9th joint about same length as spine of 8th joint; joints 3–8 with minute spines forming row along distal margin.

Mandible: Coxale endite (Figure 20d): ventral branch with spines forming about 6 oblique rows, and tip with 3–5 minute teeth; slender bristle present near base of ventral branch; ventral margin of dorsal branch with spines forming 3 rows followed by 3 short, forward pointing processes, 1 fairly straight process and 5 recurved slender processes; tip of branch forming slender point near base of long bristle; dorsal margin of branch with serrations. Basale endite: tip with 1 long and about 3 short end-type bristles; ventral margin with about 16 triaenid bristles forming row (paired teeth of triaenid bristles small); 7 or 8 dwarf bristles present forming row near dorsal margin (distal of these longer than others). Ba-

sale: ventral margin with about 15 triaenid bristles followed by 2 longer spinous bristles; medial surface with 2 or 3 short slender distal bristles near ventral margin, and long hairs near middle; dorsal margin with 7 short bristles and 2 very long terminal bristles. Exopodite with hirsute tip reaching past distal edge of 1st endopodial joint, with 2 ventral bristles (distal of these about one-half length of other). Endopodite: 1st joint with 8 bristles (1 of these minute); ventral margin of 2nd joint with bristles forming 2 distal groups (3 bristles in proximal group, 2 in other); dorsal margin and medial side near dorsal margin with numerous bristles (about 5 of the cleaning bristles with stout marginal spines); end joint with 3 long stout claws, 2 ventral bristles, and 1 very long lateral bristle.

Maxilla: Endites not well defined (Figure 20e): endite I with 3 stout and 2 slender bristles; combined endites II and III with total of 9 stout bristles; 4 long slender bristles present near endite III. Basale: ventral margin with 21 short bristles followed by 2 long bristles and 1 long, spinous, terminal bristle; dorsal margin spinous, with 4–5 proximal bristles with bases on medial side and 1 long and 4 short distal bristles; medial side spinous, with 5 distal bristles (4 short and 1 long, the latter close to ventral margin). Exopodite with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with 1 anterior bristle distal to middle, and 1 long beta-bristle; end joint with 6 bristles.

Fifth Limb: Dorsal margin of comb slightly convex, hirsute, with 5 small proximal bristles; lateral side with stout, hirsute, exopodial bristle just reaching end of comb, 1 long, slender, spinous bristle proximal to base of stout exopodial bristle, 4 minute bristles just distal to base of the long slender bristle, 7 short bristles near margin ventral to the long slender bristle, and 2 short bristles near anteroventral corner.

Sixth Limb: Left limb with 3 small epipodial bristles and 6 hirsute bristles on posterior end of skirt. Right limb with 4 small epipodial bristles, posterior end of skirt fragmented. Limbs otherwise similar to those of adult male.

Seventh Limb (1 examined): Limb with about

100 bristles, each with up to 9 bells; proximal joints with not more than 2 bristles (1 on each side); distal joints with 3 to 5 bristles (1 to 3 on each side). Terminus consisting of opposing combs, each with about 25 teeth of various types.

Furca: Each lamella with 3 main claws followed by 8 secondary bristlelike claws; main claws with medial and lateral row of large teeth along concave margin; 1 minute tooth present between each pair of large teeth (no hairs present between teeth); hairs present along convex margin of main claws, medial at base of main claws, and on joined lamellae between and following secondary claws.

Rod-shaped Organ: Similar to that of adult male.

Eyes: Medial eye similar to that of adult male but with brown pigment in preserved specimen. Lateral eye well developed, about same length as medial eye, with about 60 ommatidia (Figure 20a).

Upper Lip, Posterior of Body: Similar to those of adult male.

Eggs: USNM 157409 with 11 eggs in marsupium (eggs have black eye spots) (Figure 20a).

DESCRIPTION OF ADULT MALE (Figure 21).—Carapace similar in shape to adult male of *Cycloleberis squamiger* illustrated by Kornicker and Caraión (1974, fig. 28a); ventral margin of separated right valve of *C. galathea*e illustrated herein (Figure 21a) may be artificially distended, making specimen erroneously appear tumid.

Ornamentation: Similar to carapace of adult male of *C. squamiger* illustrated by Kornicker and Caraión (1974, figs. 24, 25a–e); anterior, anterodorsal, and anteroventral margins with scalloped border.

Infold: Bristles not counted but, in general, distribution appearing similar to those of adult male of *C. squamiger* illustrated by Kornicker and Caraión (1974, figs. 25f, h–l, 26, 27a–i).

Selvage: Lamellar prolongation along anterior part of dorsal margin with marginal fringe; prolongation not clearly observed elsewhere.

Dentition of Valves: Minute teeth present anterior to anterior juncture on dorsal margin of each valve.

Size: USNM 150298, length 4.8 mm, height 3.4 mm.

First Antenna (right limb; left missing from specimen): 1st and 2nd joints hirsute; 2nd joint with 5 dorsal and 9 lateral bristles. 3rd joint: short ventral margin with few spines and 1 short bristle; long dorsal margin with 18 bristles. 4th joint with 1 dorsal and 5 ventral bristles. Sensory bristle of 5th joint broken off limb. Bristle of 6th joint with base near dorsal margin (bristle about one and one-half times length of a-bristle of 7th joint). 7th joint: a-bristle bare, clawlike, fairly straight, longer than combined lengths of joints 6–8; b-bristle about 3 times length of a-bristle, with about 14 marginal filaments (extreme tip of bristle broken off); c-bristle very long, distal part broken off, with 36 marginal filaments on remaining part, some of these slightly wider in proximal part. 8th joint: d- and e-bristles bare, shorter than b-bristle, with blunt tips; f-bristle similar to c-bristle; g-bristle with tip missing, but remaining part much longer than b-bristle, with 18 marginal filaments.

Second Antenna: Protopodite bare except for 1 short, distal medial bristle. Endopodite: 1st joint elongate with 1 small proximal bristle and 3 short distal bristles (some distal bristles could be missing); 2nd joint about twice length of 1st joint, with 11 short distal bristles on ventral margin; 3rd joint recurved, reflexed on 2nd joint, with 1 long proximal bristle and pointed tip with marginal ridges. Exopodite: 1st joint with very faint teeth along ventral margin, usual terminal medial spine not observed; 2nd joint about twice length of 3rd joint; bristles of joints 2–9 with natatory hairs, no spines; 9th joint with 5 bristles; joints 2–8 with basal spines increasing in length on distal joints; basal spine of 8th joint about two-thirds length of 9th joint; lateral spine of 9th joint slightly smaller than spine of 8th joint; joints 2–8 with minute spines along distal margin and long hairs at distal dorsal corner.

Mandible: Coxale endite similar to that of A-1 female illustrated by Poulsen (1965, fig. 87g) except spines of ventral branch pointed, without encrustations, and ventral margin of dorsal

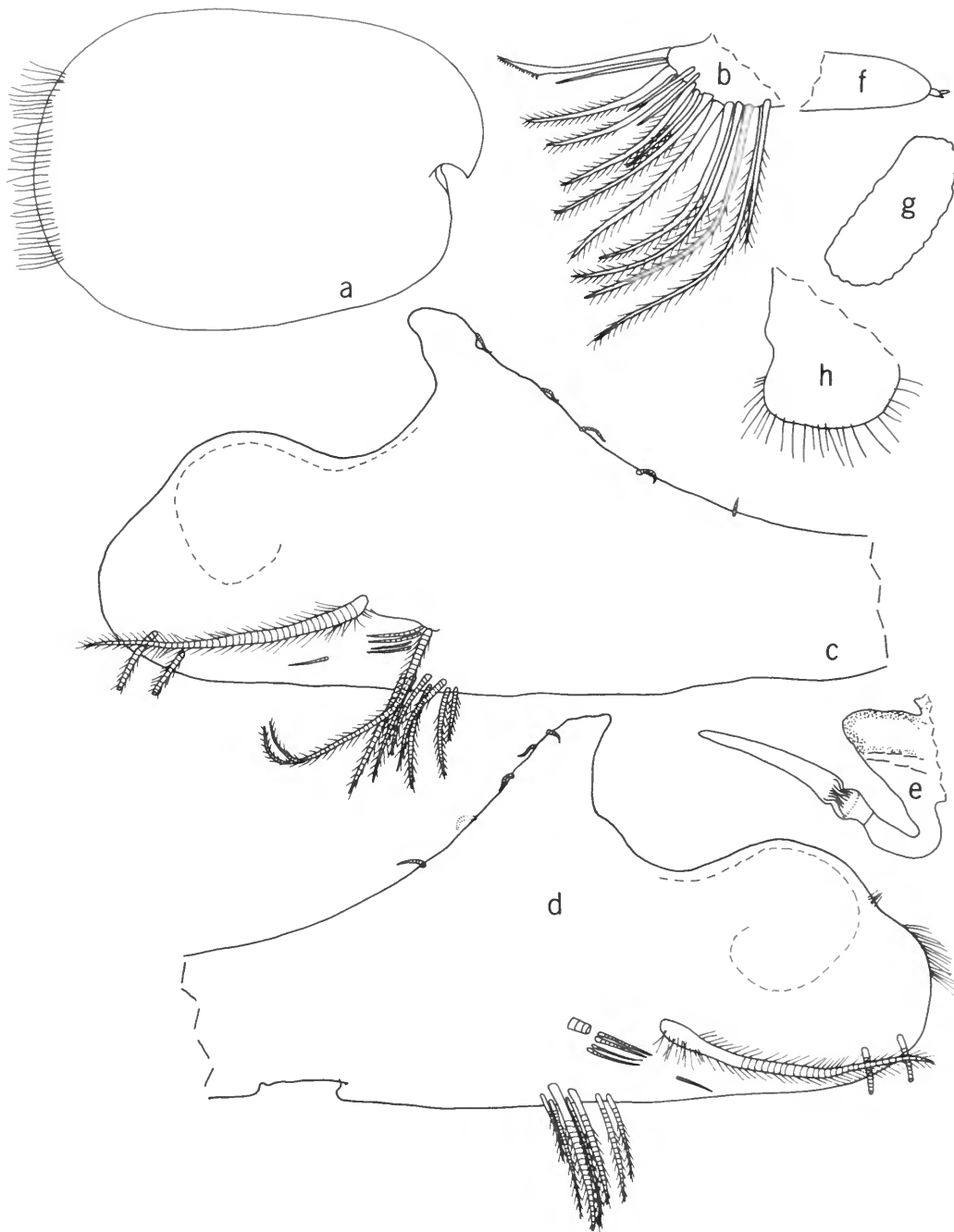


FIGURE 21.—*Cycloleberis galatheae* Poulsen, adult male, USNM 150298: *a*, complete specimen, length 4.8 mm; *b*, endite bristles of left maxilla, medial view; *c*, *d*, combs of left and right maxillae, lateral views; *e*, medial eye and rod-shaped organ; *f*, tip of epipodite of left maxilla, medial view; *g*, outline of lateral eye; *h*, upper lip (lateral flap not shown), anterior to left.

branch with 6 proximal processes followed by 4 longer recurved processes. Basale endite similar to that illustrated by Poulsen (1965, fig. 87f). Basale: ventral margin with 10 triaenid bristles followed by 1 longer spinous bristle and 1 very short bare bristle (triaenid bristles similar to that illustrated by Poulsen (1965, fig. 87f'')); dorsal margin with 5–6 distal bristles (3–4 short, slender; 2 long, stout, spinous); medial surface with long proximal hairs near dorsal margin (no bristles observed). Exopodite hirsute, tip reaching past distal end of 1st endopodial joint, with 2 ventral bristles (distal of these shorter than other). Endopodite: 1st joint with 8 ventral bristles (1 of these very small); ventral margin of 2nd joint with bristles forming 2 distal groups (3 bristles in proximal group, 2 in other); dorsal margin and medial surface near dorsal margin with abundant bristles (none of the cleaning bristles with stout marginal spines); end joint with 3 stout claws, 1 long lateral bristle, and 2 shorter ventral bristles.

Maxilla: Epipodite reaching past middle of dorsal margin of basale, with minute process at tip of left limb (probably aberrant) (Figure 21f). Endite I with 3 long stout bristles and 2 short slender bristles; endite II with 2 long stout bristles and 1 short slender bristle; endite III with 4 long stout bristles and 1 shorter slender bristle (Figure 21b). Basale: dorsal margin hirsute, with 4 short proximal bristles (with bases on medial side), and 1 long and 2 short distal bristles (limbs fragmented in vicinity of distal bristles—an additional short bristle might have been present originally); ventral margin with 12 short bristles followed by 2 longer distal bristles and 1 very long terminal bristle; medial side hirsute proximally, with 5 distal bristles (longer of these near ventral margin); lateral side with 1 short proximal bristle. Endopodite: 1st joint spinous, with 1 short bristle on anterior margin near middle, and 1 long spinous beta-bristle; end joint with 6 bristles. Exopodite minute with 1 long and 2 short bristles.

Fifth Limb (Figure 21c,d): Dorsal margin of comb with 2 sclerotized processes (a curved process near middle, and a rounded process distal to middle); 5 minute bristles present on dorsal mar-

gin proximal to tip of curved process. Lateral surface with 1 stout, spinous, exopodial bristle reaching just past tip of comb, 1 long, slender, spinous bristle with bifurcate tip (base proximal to stout exopodial bristle, and about two-thirds its length), 4 minute bristles forming row distal to base of long slender bristle, 1 minute bristle ventral to base of stout exopodial bristle, 2 short, slender bristles in distal ventral corner, and 7 short bristles near middle of ventral margin.

Sixth Limb: Similar to adult male limb of *Cycloleberis squamiger* illustrated by Kornicker and Caraion (1974, fig. 30c), except one limb with 5 and other with 6 bristles on posterior tip of skirt. Epipodial bristles consisting of 3 minute bristles.

Seventh Limb: Each limb with 100–101 bristles, 45–56 on each side on 1 limb, 50 on each side on other limb, each bristle with up to 7 bells; most joints with 2 bristles, 1 on each side, but distal joints with 3 or 4 bristles (1 or 2 on each side). Terminus consisting of opposing combs, each with 20–24 teeth of various types.

Furca: Each lamella with 3 main claws followed by 9 bristlelike secondary claws; concavity between claws 1 and 2 with greatest depth about 40 percent of greatest width; concavity between claws 2 and 3 with greatest depth about 70 percent of greatest width; teeth on claws similar to those on adult male of *Cycloleberis squamiger* in illustration by Kornicker and Caraion (1974, fig. 30d–f); teeth without hairs between them; main claws with hairs along convex margins and medial at bases; hairs present on junction of lamellae between secondary claws and following secondary claws.

Rod-shaped Organ (Figure 21e): Elongate with broad base, suture proximal to short broad part near middle; distal part tapering to rounded tip.

Eyes: Medial eye bare, pigmented black in preserved specimen (Figure 21e). Lateral eye well developed, pigmented black, with about 60 ommatidia, and about one-third times longer than medial eye (Figure 21g).

Upper Lip: Each lobe hirsute, without anterior spines (Figure 21h).

Posterior of Body: Hirsute without dorsal process.

DESCRIPTION OF A-3 MALE (Figure 20*f-i*).—Carapace similar in shape to that of adult female, with similar ornamentation and dentition.

Size: USNM 157629, length 2.5 mm, height 2.1 mm.

First Antenna: 1st joint with long hairs. 2nd joint: dorsal margin with 3 bristles and long proximal hairs; lateral side with 4 bristles and long hairs. 3rd joint: short ventral margin with 1 small bristle; dorsal margin with 6 bristles. 4th joint: dorsal margin with 1 long bristle; ventral margin with 2 long bristles. 5th joint: sensory bristle of left limb with 3 short proximal filaments and 7 long terminal filaments (Figure 20*g*); sensory bristle of right limb with 2 short proximal filaments and 7 long terminal filaments (Figure 20*f*). 6th joint with long medial bristle near middle. 7th joint: a-bristle clawlike, bare, about same length as combined lengths of joints 5–8; b-bristle slightly shorter than sensory bristle of 5th joint, with 3 short proximal filaments and 3 longer terminal filaments including stem; c-bristle about same length as sensory bristle, with 9 filaments including stem. 8th joint: d- and e-bristles bare, about same length as sensory bristle, with blunt tips; f-bristle bent slightly dorsally, with 6 filaments including stem; g-bristle about same length as c-bristle, with 9 filaments including stem.

Second Antenna: Endopodite (Figure 20*h*): 1st joint distinctly divided into proximal part with 1 small bristle and distal part with 3 small bristles; 2nd joint elongate, bare; 3rd joint short with 1 long bristle at inner corner (not terminal as on female). Exopodite: 1st joint with spines forming medial rows, faint teeth along ventral margin, and small, medial, terminal spine; bristles of joints 2–8 with proximal ventral spines and natatory hairs; 9th joint with small lateral spine and 4 bristles (2 ventral of these with proximal ventral spines and natatory hairs, others with only natatory hairs); joints 3–8 with small basal spines; joints 2–8 with spines forming row along distal margin.

Mandible: Coxale endite similar to that of adult female (Figure 20*i*). Endopodite: ventral margin of 1st joint with 6 bristles (1 of these minute);

ventral margin of 2nd joint with bristles forming 2 groups, 2 bristles in each group; dorsal margin and medial surface with numerous bristles, but less than on adult male (3 of the cleaning bristles with broad marginal spines); end joint similar to that of adult male.

Maxilla: Endite I with 3 stout bristles and 1 short slender bristle; endites II and III with total of 5 long stout bristles and 2 shorter slender bristles. Basale: dorsal margin hirsute, with 5 bristles (2 proximal with bases on medial surface, and 2 short and 1 long distal); ventral margin with 6 small bristles followed by 2 longer distal bristles and 1 very long, spinous, terminal bristle; medial side with long proximal hairs, spines near ventral margin, and 2 distal bristles, the longer of these with base near ventral margin; dorsal margin and proximal medial surface hirsute; lateral side with short proximal bristle. Endopodite: 1st joint spinous, with 1 short bristle near middle of anterior margin, and 1 long spinous beta-bristle; end joint with 6 bristles with marginal spines.

Fifth Limb: Dorsal margin of comb convex, hirsute, with 2 small proximal bristles, but without processes; lateral side with exopodial bristles similar to those of adult male; bristles along ventral and anteroventral margins similar to those of adult male.

Sixth Limb: Not examined in detail but with numerous bristles.

Seventh Limb (1 examined): Limb with 38 strongly tapering bristles, 18 on 1 side, 20 on other; each bristle with up to 4 bells; each joint generally with 1 or 2 bristles, rarely with more than 1 on each side. Terminus with opposing combs, each with about 20 teeth of various types.

Furca: Each lamella with 3 main claws followed by 5 bristlelike claws; teeth along main claws consisting of long teeth separated by several smaller teeth (smaller teeth fairly long, not minute).

Rod-shaped Organ: Similar to that of adult male.

Eyes: Medial eye similar to that of adult male but with brown pigment. Lateral eye about same size as medial eye, pigmented black, with about 36 ommatidia.

Upper Lip and Posterior of Body: Similar to those of adult male.

8. *Cycloleberis christiei* Kornicker and Maddocks, 1977

FIGURES 8*h*, 22

Cycloleberis galatheae Poulsen, 1965 [part; juvenile male only]: 260, fig. 89. [Referral questionable.]

Cycloleberis christiei Kornicker and Maddocks, 1977:894, figs. 1-7.

HOLOTYPE.—USNM 157334, ovigerous female on slides and in alcohol.

TYPE-LOCALITY.—Langebaan Lagoon, South Africa, station LB 601M, 33°07'S, 18°01'12"E.

MATERIAL.—Specimens studied by Kornicker and Maddocks (1977).

DISTRIBUTION.—Langebaan Lagoon and Saldanha Bay, South Africa; ?Beira, Mozambique (Figure 19). Depth range intertidal to 24 m.

DIAGNOSIS.—First antenna: 2nd joint of adult male with 8 lateral bristles; sensory bristle of adult female with 2 short proximal filaments.

Second Antenna: 1st endopodial joint of adult female with 9-13 proximal bristles; 2nd endopodial joint of adult male with 8 or 9 bristles.

Maxilla: Dorsal margin of basale of adult female with 11 or 12 distal bristles.

Fifth Limb: Dorsal margin of adult male with single sclerotized process near middle.

Sixth Limb: Adult female with 1-3 epipodial bristles.

DESCRIPTION OF A-4 INSTAR (Instar III) (Figure 22*c*).—Carapace similar in shape to that of adult female.

Size: USNM 157393G, length 2.34 mm, height 2.09 mm; USNM 157393C, length 2.42 mm, height 2.01 mm.

Sixth Limb: Well developed with many anterior and ventral bristles.

*Seventh Limb (Figure 22*c*):* Elongate, bare.

Sex: Indeterminate.

DESCRIPTION OF A-5 INSTAR (instar II) (Figure 22*b*).—Carapace similar in shape to that of adult female.

Size: USNM 157381C, length 1.84 mm, height 1.43 mm; USNM 157393D, length 1.90 mm,

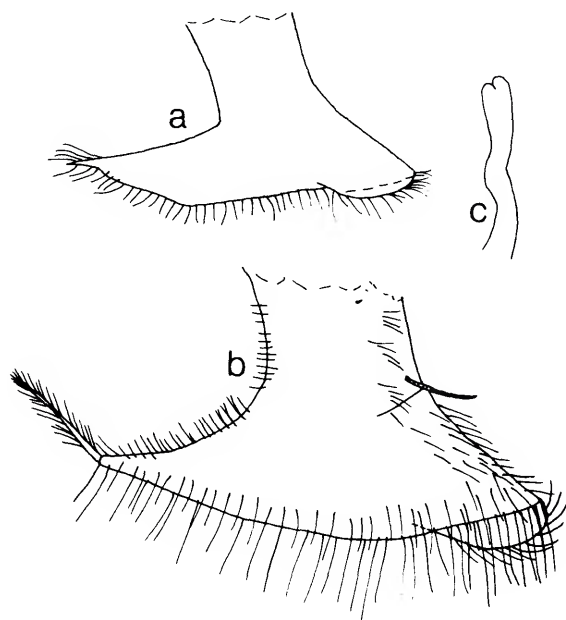


FIGURE 22.—*Cycloleberis christiei* Kornicker and Maddocks, juveniles: *a*, right 6th limb of instar I, lateral view, USNM 157393A; *b*, left 6th limb of instar II, medial view, USNM 157393B; *c*, 7th limb of instar III, USNM 157393C.

height 1.53 mm; USNM 157393B, length 1.84 mm, height 1.47 mm; USNM 157393E, length 2.00 mm, height 1.62 mm.

*Sixth Limb (Figure 22*b*):* Anterior of trunk with 1 bristle; medial side of trunk with minute proximal spine near anterior margin; posterior end of trunk with 1 spinous bristle.

Seventh Limb: Absent.

Furca: Each lamella with 3 strong claws separated from lamella by suture followed by 2 or 3 bristles.

Sex: Indeterminate.

DESCRIPTION OF A-6 INSTAR (Instar I) (Figure 22*a*).—Carapace similar in shape to that of adult female.

Size: USNM 157393A, length 1.59 mm, height 1.19 mm; USNM 157393F, length 1.55 mm, height 1.30 mm; USNM 157396H, length 1.52 mm, height 1.23 mm; USNM 157381A, length 1.49 mm, height 1.22 mm; USNM 157381B, carapace crushed, measurements approximate, length 1.45 mm, height 1.21 mm.

TABLE 16.—Morphological development of *Cycloleberis christiei* Kornicker and Maddocks

Instar	USNM	Sex	Length (mm)	Furcal claw (X) bristle (x) ^a							Bristles of 6th limb		7th limb
				1	2	3	4	5	6	7	anterior	ventral	
I	157393A	?	1.59	X	X	X ^b					0	0	absent
I	157393F	?	1.55	X	X	X ^b					0	0	absent
I	157396H	?	1.52	X	X	X ^b					0	0	absent
I	157381A	?	1.49	X	X	X ^b					0	0	absent
I	157381B	?	~1.45	X	X	X ^b					0	0	absent
II	157381C	?	1.84	X	X	X	x	x			1	0	absent
II	157393D	?	1.90	X	X	X	x	x			1	0	absent
II	157393B	?	1.84	X	X	X	x	x	x ^c		1	0	absent
II	157393E	?	2.00	X	X	X	x	x			1	0	absent
III	157393G	?	2.34	X	X	X	x	x	x	x	many	many	elongate, bare
III	157393C	?	2.42	X	X	X	x	x	x	x	many	many	elongate, bare
IV	(7 specimens) ^d	♂	2.86 ^g				no data			many	many	many bristles	
V	(4 specimens) ^e	♂	3.53 ^g				no data			many	many	many bristles	
VI	(5 specimens) ^f	♂	4.46 ^g				no data			many	many	many bristles	

^a Each number represents the position of a claw or bristle counting from the distal end of lamella.

^b Claw 3 not separated from lamella by suture.

^c Third bristle present only on right lamella.

^d USNM 157326-157332.

^e USNM 157295, 157297, 157299, 157333.

^f USNM 157293, 157294, 157296, 157298, 157323.

^g Average length of specimens.

Sixth Limb (Figure 22a): Hirsute without anterior or ventral bristles; posterior of skirt with partly developed bristle; lateral flap present; hairs on medial side, lateral side bare.

Seventh Limb: Absent.

Furca: Each lamella with 3 claws; claws 1 and 2 separated from lamella by suture, claw 3 not separated from lamella by suture.

Gills: 7 on each side, well developed.

Sex: Indeterminate.

ONTOGENETIC DEVELOPMENT (Table 16).—The 6th limb of the 1st instar (instar I) is hirsute and is without bristles on the anterior margin of the trunk and the ventral margin of the skirt. The posterior tip of the skirt bears a partly developed bristle. On instar II the 6th limb bears 1 bristle on the anterior margin of the trunk, and the bristle on the posterior tip of the skirt is well developed. On later instars numerous bristles are on both the anterior margin of the trunk and the ventral margin of the skirt.

The 7th limb is absent on both instars I and II, is elongate but without bristles on instar III, and

bears numerous bristles and terminal combs on later instars. The 3rd claw of each lamella of the furca of instar I is not separated from the lamella by a suture as it is on later instars. Bristles are absent on the furca of instar I, and only 2 or 3

TABLE 17.—Average carapace lengths (in mm) and calculated growth factors for specimens of *Cycloleberis christiei* Kornicker and Maddocks

Growth stage	Sex	Number of specimens	Average length	Growth factor
Instar I	?	4	1.54	1.23
Instar II	?	4	1.90	1.25
Instar III	?	2	2.38	1.20
Instar IV	♂	9	2.86	1.23
Instar V	♂	4	3.53	1.26
Instar VI	♂	5	4.46	1.23
Adult*	♂	2	5.50	

* Data from Kornicker and Maddocks (1977).

are present on each lamella of the furca of instar II; later instars bear many bristles on the furca. The average growth factor for the length of the male carapace is about 1.23 (Table 17).

As shown in the key to early instars of *C. christiei*, presented herein, the 3rd instar is without bristles on the 7th limb; whereas the A-3 male

has bristles on the 7th limb (Kornicker and Maddocks, 1977:909). Kornicker and Maddocks (1977:909) concluded that they were dealing with an A-3 instar on the basis of the development of the endopodite of the 2nd antenna. Thus, it may be concluded that *C. christiei* has a total of 6 juvenile stages (Table 16).

Key to Early Instars of *Cycloleberis christiei*

1. 6th limb without anterior bristles on trunk; 3rd claw of furca not separated from lamella by suture Instar I
- 6th limb with 1 or more anterior bristles on trunk; 3rd claw of furca separated from lamella by suture 2
2. 6th limb with 1 bristle on anterior of trunk and no bristles along ventral margin of skirt; 7th limb absent Instar II
- 6th limb with many bristles along both anterior margin of trunk and ventral margin of skirt; 7th limb present 3
3. 7th limb elongate, bare Instar III
- 7th limb with numerous bristles Instar IV to adult

9. *Cycloleberis squamiger* (Scott, 1894)

FIGURES 8j, 12h

Asterope squamiger Scott, 1894:140, pl. 14: figs. 56, 57; pl. 15: figs. 14, 22, 23, 26.—Müller, 1912:52 [referred species to "Cypridinidarum genera dubia et species dubiae"].

Cyclasterope lobiancoi.—Klie, 1943:50, figs. 1-4.

Cycloleberis squamiger.—Kornicker and Caraion, 1974:47, figs. 24-31.—Kornicker, 1975b:3, figs. 2-10, 11c-h.

LECTOTYPE.—A juvenile instar in the British Museum (Natural History) (registration number 1893.4.22.1) by subsequent designation (Kornicker and Caraion, 1974:47).

TYPE-LOCALITY.—São Tomé Island, Gulf of Guinea.

MATERIAL.—No new material.

DISTRIBUTION.—Gulf of Guinea, Spanish Sahara, Mauritania, Ivory Coast (Figure 19). Collected on bottom at depths of 10-96 m, questionably at 1100 m, also in surface tow.

DIAGNOSIS.—*First Antenna:* 2nd joint of adult male with 5-7 lateral bristles; sensory bristle of adult female with 2 short proximal filaments.

Second Antenna: 1st endopodial joint of adult female with 2-4 (rarely 1) proximal bristles; 2nd endopodial joint of adult male with 5-8 bristles.

Maxilla: Dorsal margin of basale of adult female with 10-15 (rarely 5) distal bristles.

Fifth Limb: Dorsal margin of comb of adult male with 2 sclerotized processes (a curved process near middle and a rounded process distal to middle).

Sixth Limb: Adult female with 2 or 3 (rarely 4) epipodial bristles.

NOTE.—I take this opportunity to correct an error in a previous paper (Kornicker, 1975b). In that paper an A-1 male (USNM 143978) of *Cycloleberis squamiger* (Scott, 1894) from the west coast of Africa was inadvertently listed as an A-1 female in Table 1 (page 15) and in the caption of Figure 6: k-m (page 10), but was correctly identified in the text in the 2nd paragraph on page 13, but without USNM number, and also in Kornicker and Caraion (1974:47).

10. *Cycloleberis lobiancoi* (Müller, 1893)

FIGURE 8i

Cylindroleberis Lobianci Müller, 1893:359; 1894:23, 37, 45 (fig. 3), 47, 72, 159, 218, 220, 221, pl. 4: figs. 40, 42; pl. 5: figs. 2, 3, 26, 32, 34, 40; pl. 37: figs. 31, 32, 43; pl. 40: figs. 36, 42, 44.—Brady and Norman, 1896:623.—Not Sharpe, 1908:401, 424, 425, pl. 63, pl. 65: figs. 3-7.

Cyclasterope lobianci.—Müller, 1906:33.

Cyclasterope lobiancoi.—Müller, 1912:48, 49 [part].—Müller, 1927:406, 412, 431, figs. 352, 353, 362.—Puri, 1963:2.—

Reys, 1965:256, 258.—Not Barney, 1921:179, fig. 2.—Not Klie, 1943:50, figs. 1–4.

Cycloleberis lobiancoi.—Skogsberg, 1920:437, 438, 442. [Skogsberg said that this species probably belongs in *Cycloleberis*.]

Cycloleberis lobiancoi.—Poulsen, 1965:238, 243–245, 276.—Hartmann, 1966:129, fig. 106c; 1967:342, 389, figs. 206, 248.—Kornicker, 1974:52, figs. 23–26; 1975b:13.

Cycloleberis lobiancoi.—Hanai, 1959:425.

Cyclasterope (Cycloleberis) lobiancoi.—Sylvester-Bradley, 1961: Q402.

HOLOTYPE.—None selected.

TYPE-LOCALITY.—Gulf of Naples.

MATERIAL.—No new material.

DISTRIBUTION.—Mediterranean: Gulf of Naples, Gulf of Marseille (Figure 19). Depth range 10–30 m.

DIAGNOSIS.—*First antenna*: sensory bristle of adult female with 2 short proximal filaments.

Second Antenna: 1st endopodial joint of adult female with 3 short proximal filaments.

Maxilla: Dorsal margin of basale of adult female with 8 distal bristles.

Sixth Limb: Adult female with 4 or 5 epipodial bristles.

COMMENT ON SPECIFIC NAME.—I have followed common usage in using *C. lobiancoi*; however, according to the present rules of nomenclature, the original spelling in which the final “o” is omitted should be retained.

Cycloleberis species indeterminate

MATERIAL.—11 juveniles from station 103, Bab el Mandeb, USNM 157800.

Leuroleberis, new genus

ETYMOLOGY.—The generic name from the Greek *leuros* (smooth) plus *leberis* (sloughed skin)

in reference to the smooth rim around the anterior margin of the rostrum of the genus. Gender feminine.

TYPE-SPECIES.—*Leuroleberis sharpei*, new species.

DISTRIBUTION.—*L. sharpei*: off west coast of California and Baja California, and off Alaska (?). *L. orbicularis*: off coast of Chile. *L. zealandica*: New Zealand. *L. poulseni*: off Atlantic coast of Argentina. *L. mackenziei*: Australia (Figure 23). Depth range intertidal to 146.3 m.

COMPOSITION.—This genus contains the following species: *Leuroleberis zealandica* (Baird, 1850b), *L. orbicularis* (Brady, 1897), *L. poulseni* (Moguil-evsky and Ramirez, 1970), *L. mackenziei*, new species, *L. sharpei*, new species.

DIAGNOSIS.—Anterior margin of rostrum with bordering rim with smooth inner edge.

Ornamentation: Surface with shallow fossae bearing short bristle emerging from closed pore; bottom of fossae with reticulate structure; ridges anterior to fossae extending well past end of fossae on all species except *L. sharpei*.

First Antenna: 5th joint: dorsal margin without teeth or nodes; sensory bristle with 2–4 short proximal filaments and 12–15 long terminal filaments (*L. sharpei* differs in having 6–8 short proximal and 7–8 long terminal filaments). 7th joint: a-bristle clawlike, bare.

Fifth Limb: Dorsal margin of comb of adult male with only 1 process (adult males known only for *L. sharpei*, *L. zealandica*, and *L. mackenziei*).

Furca: Each lamella with 3 stout claws followed by 8–10 secondary bristlelike claws.

COMPARISONS.—This genus differs from *Cycloleberis* in not having a scalloped rim bordering the anterior margin of the rostrum, and from *Alpha-leberis* in having a clawlike a-bristle on the 1st antenna.

Key to Species of *Leuroleberis**

- | | |
|---|--|
| 1. Carapace without short ridges on anterior surface | 14. <i>L. sharpei</i> , new species |
| Carapace with short ridges on anterior surface | 2 |
| 2. 1st joint of endopodite of female 2nd antenna with some proximal bristles longer than distal bristles | 15. <i>L. mackenziei</i> , new species |
| 1st joint of endopodite of female 2nd antenna with all proximal bristles about same size as distal bristles | 3 |

3. Furca with 3 main claws followed by 9 or 10 secondary claws 12. *L. zealandica*
 Furca with 3 main claws followed by 8 secondary claws 13. *L. poulseni*

* *Leuroleberis orbicularis* (Brady) is omitted from key because it is known only from juveniles. It is close to *L. poulseni* and might be conspecific with it.

**11. *Leuroleberis orbicularis* (Brady, 1897),
 new combination**

FIGURES 8l, 24; PLATES 11, 12

Cyclasterope orbicularis Brady, 1897:87, pl. 15: figs. 13-19; 1898:433.—Müller, 1906:33; 1912:48, 49.

Cycloleberis orbicularis.—Skogsberg, 1920:442.—Poulsen, 1965: 238, 243-245, 276, 282.

Cycloleberis cf. *orbicularis*.—Hartmann, 1965:326.

Cycloleberis species Indeterminate.—Kornicker, 1975a:570.

HOLOTYPE.—Female [juvenile ?], carapace length 2.7 mm, unique specimen. Present location of specimen, if extant, unknown.

TYPE-LOCALITY.—Valparaiso, ?Chile.

MATERIAL.—I received from Dr. G. Hartmann, University of Hamburg, Zoological Institute and Zoological Museum, a vial containing 3 labels ("27285," "*Cycloleberis orbicularis* 27285," "*Cyclasterope* cf. *orbicularis*, Mar Chile I, Chiloe") [73°53'W, 41°48'S, 12 m, mud with sand and stone] and 4 specimens, all juveniles. The juveniles consisted of 2 undissected specimens (length 1.70 mm, height 1.48 mm; length 2.12 mm, height 1.76 mm) and 2 dissected specimens with separated valves (Left valves: length 2.17 mm, height 1.77 mm; length 2.17 mm, height 1.79 mm. Right valves: length 2.13 mm, height 1.71 mm; length 2.16 mm, height unknown). The appendages and valves of the 2 dissected specimens occur together in the vial.

DISTRIBUTION.—Chile, 12 m (Figure 23).

DISCUSSION.—Brady (1897:87) described a new species, *Cyclasterope orbicularis*, based on a single specimen. Brady (1897:87) was not sure of the source of the specimen but stated, "It bears the inscription 'Valparaiso,' without any further particulars." Poulsen (1965:244), Hartmann (1965:326), and Kornicker (1975a:570) assumed that

the specimen was from the coast of Chile in the vicinity of Valparaiso (ca. 33°S, 71°40'W), and the same assumption is made here. I have written to numerous museums seeking the holotype but have been unable to locate it. The description of the species by Brady is incomplete, but the endopodite of the 2nd antenna differs from other species in the genus in having about 26 hairs on the 1st joint. The other species have no hairs but usually have a few bristles.

Hartmann (1965:326) identified juvenile specimens from Puerto Ingles, off Chiloé (41°48'S, 73°53'W), Chile as *Cycloleberis* cf. *orbicularis* (Brady, 1897). Through the courtesy of Dr. Hartmann I was able to study his specimens. The endopodite of the 2nd antenna of 1 of the specimens has a dense foreign growth of filaments of an unknown protistan (Figure 24l). I think it probable that the so-called hairs on the endopodite illustrated by Brady (1897, pl. 15: fig. 16) actually were a foreign filamentous growth. Because the specimens of both Hartmann and Brady were collected off the coast of Chile, it is possible that they belong to the same species. I have found it expedient to assume that they are conspecific. Some of the appendages of Hartmann's specimens are illustrated and briefly described herein (Figure 24g-t). The carapace of the specimens are distinctive in having fairly large linear ridges on the anterior part of the shell. Ridges of this type are absent on *Amboleberis americana* and are much smaller or absent on *Leuroleberis sharpei*, new species, the 2 other species from the east Pacific.

DESCRIPTION OF JUVENILE FEMALE (Figure 24, Plates 11, 12).—Carapace oval in lateral view (Figure 24a, Plate 11a); anterior surface of each valve with linear ridges (Figure 24c, Plate 11b,f); inner edge of rim along anterodorsal edge of valve

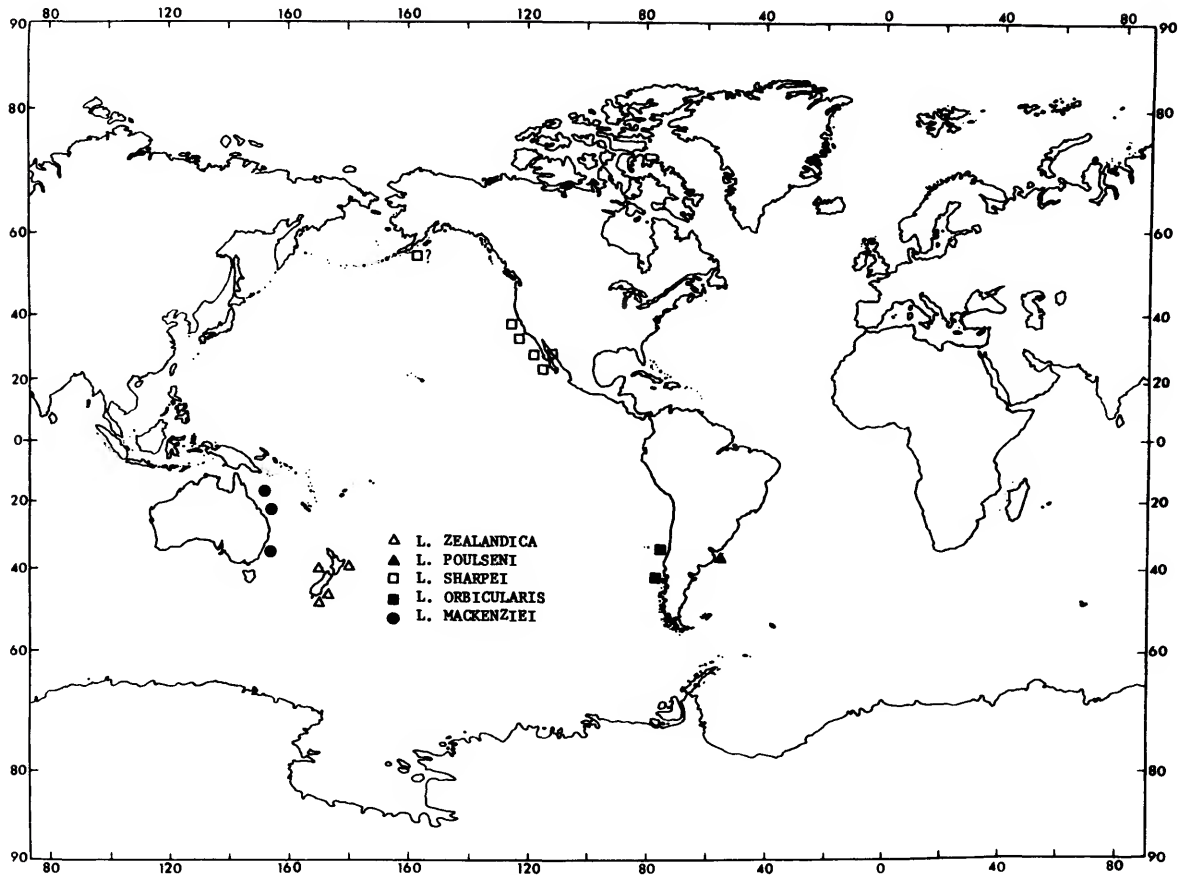


FIGURE 23.—Distribution map of species of *Leuroleberis*.

(Plates 11, 12a,b) without scallops like those on *Cycloleberis squamiger* (Scott, 1894) or *C. lobiancoi* (Müller, 1893), but rim itself appearing uneven (Figure 24f, Plate 11d,f); surface with bristles emerging from open pores bordered by more-or-less concentric rims (Plate 12f), and bristles emerging from closed, slightly depressed pores (Plate 12d,e); surface with abundant pits visible at high magnification ($\times 10,000$) (Plate 12f); pits larger in shallow fossae that often contain a single bristle (Plate 12d,e); lumen of scanned left valve visible as depression in anterior of valve just below incisur (Figure 24b,d, Plate 11a,b,d); anterior edge of dorsal margin of right valve with minute dentition (Figure 24e).

First Antenna (Figure 24g,h): 1st and 2nd joints

spinous; 2nd joint with 2 dorsal and 2 lateral bristles; 3rd joint triangular with 2 dorsal bristles and 1 small ventral bristle; 4th joint with 2 bristles (1 ventral, 1 dorsal); sensory bristle of 5th joint with 3 short marginal filaments and 5 or 6 long terminal filaments including stem; the distal, short, marginal filament longer than proximal 2 and close to base of longer terminal filaments; bristles of joints 6–8 of usual type but not examined in detail.

Second Antenna (Figure 24i,l): Protopodite with hairs along ventral margin and small, distal, medial bristle. Endopodite 3-jointed: 1st joint with 4–6 bristles; 2nd joint bare; 3rd joint with long terminal bristle. Exopodite: 1st joint with minute medial bristle on terminal margin; joints 3–8 with

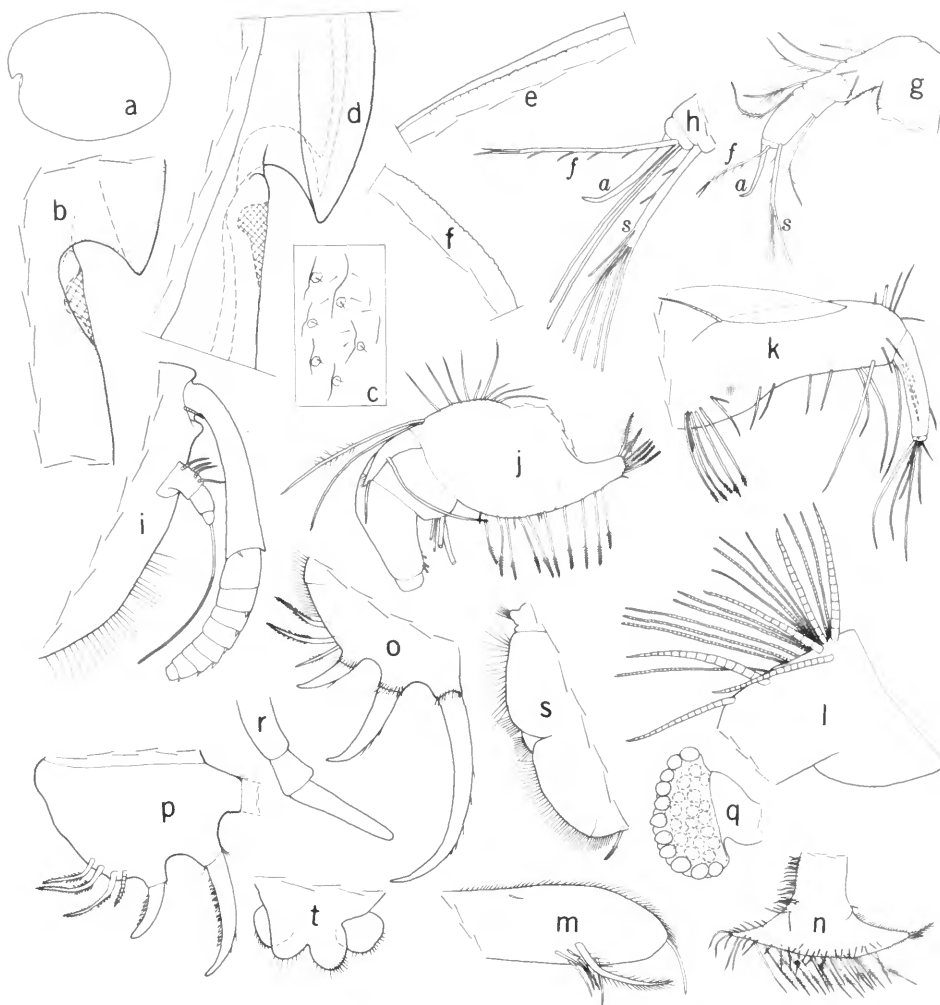


FIGURE 24.—*Leuroleberis orbicularis* (Brady), juvenile female, Zoological Institute Hamburg 27285: *a*, left valve, lateral view, length 2.17 mm, height 1.79 mm; *b*, rostrum and incisur of right valve, lateral view; *c*, anteroventral surface of left valve, lateral view; *d*, inside view of anterior of left valve (bristles not shown); *e*, inside view of anterodorsal edge of right valve showing dentition; *f*, outside view of anterodorsal edge of left valve showing uneven edge; *g*, left 1st antenna (only a- and f-bristles of 7th and 8th joints shown), lateral view; *h*, distal end of left 1st antenna showing sensory bristle of 5th joint, a-bristle of 7th joint, and d-, e-, and f-bristles of 8th joint, lateral view; *i*, left 2nd antenna, medial view; *j*, part of left mandible, lateral view; *k*, left maxilla, medial view; *l*, 1st joint of endopodite of right 2nd antenna showing 6 bristles and many filamentous protistans; *m*, comb of right 5th limb, lateral view; *n*, right 6th limb, medial view; *o*, left lamella of furca medial view; *p*, right lamella of furca, lateral view; *q*, lateral eye; *r*, rod-shaped organ; *s*, posterior of body showing posterior hairs and posterior bristle of furca; *t*, anterior view of upper lip.

basal spines; bristles of joints 2–8 with ventral spines and natatory hairs. 9th joint with 3 bristles: 2 long with ventral spines and natatory hairs, 1 shorter, dorsal, with natatory hairs. Abundant foreign filaments of unknown protistan present on 1st joint of endopodite of I of the 2nd antennae observed (see 12 narrow filaments on Figure 24l).

Mandible (Figure 24j), *Maxilla* (Figure 24k), *Fifth Limb* (Figure 24m) and *Sixth Limb* (Figure 24n): Of usual type for genus.

Seventh Limb: None found (suggests that specimens are not older than the 2nd or 3rd instar).

Furca: Right lamella with 3 main claws followed by 4 bristles; anterior bristle shorter than following bristle and separated from posterior claw by distance greater than width of 3rd claw (Figure 24p); left lamella of same specimen with 3 main claws followed by 3 bristles; anterior bristle shorter than following bristle but closer to 3rd claw than same bristle of right lamella (Figure 24o).

Lateral Eye (Figure 24q): Well developed with numerous ommatidia.

Rod-shaped Organ (Figure 24r): 3-jointed with rounded tip.

Upper Lip (Figure 24t): Consisting of 2 hirsute lobes without spines and lateral hirsute flaps.

Posterior of Body (Figure 24s): Hirsute, with small, hirsute, posterodorsal protuberance.

12. *Leuroleberis zealandica* (Baird, 1850), new combination

FIGURES 8k, 10j, 16j, 17h

Cypridina zealandica Baird, 1850b:102, pl. 17: figs. 11–13; 1851:430, 431; 1860a:199.—Brady, 1880:152.

Cypridina zealanica Baird, 1850c:257, pl. 17: figs. 11–13; 1852:58.—Thomson, 1879:256.

Cypridina zelandica.—Grube, 1859:322; 1861:93.

Cyclasterope zealandica.—Brady, 1898:433, pl. 43: figs. 15–23.—Müller, 1912:48, 49.

Cyclasterope tenera Brady, 1898:433, pl. 44: figs. 27–29.—Müller, 1912:52.

Cyclasterope ovulum Brady, 1898:432, pl. 43: figs. 24–30.—Müller, 1912:48, 49.

Cycloleberis zealandica.—Skogsberg, 1920:442.—Poulsen, 1965:281.—Kornicker, 1975a:569, fig. 351.—Kornicker, 1979:23, figs. 10–12, pls. 14–21.

Cycloleberis tenera.—Skogsberg, 1920:442.—Poulsen, 1965:281.

Cycloleberis ovulum.—Skogsberg, 1920:442.—Poulsen, 1965:245, 282.—Kornicker, 1975a:569, 570.

Cyclasterope lobiancoi.—Barney, 1921:179, fig. 2.

Cycloleberis bradyi Poulsen [part], 1965:268, figs. 90–92 [includes only holotype].—Kornicker, 1975a:568.

Azygocypridina zealanica [part].—Eagar, 1971:60 [only Eagar's *Cypridina zealanica* included here].

Cycloleberis ovulum.—Eagar, 1971:61 [genus misspelled].

Cycloleberis tenera.—Eagar, 1971:61 [genus misspelled].

Cycloleberis lobiancoi.—Eagar, 1971:61 [genus misspelled].

HOLOTYPE.—Not designated. Two syntypes are in the British Museum (Natural History, no. 1966.616.6 (one with valves intact, other with valves disarticulated).

SYNTYPE-LOCALITY.—New Zealand (more specific locality unknown, see Kornicker, 1975a:569).

MATERIAL.—Through the courtesy of Dr. Torben Wolff I received from the Zoological Museum of the University of Copenhagen, Denmark, the adult male described as *Cycloleberis bradyi* by Poulsen (1965:268), from Colville Channel, New Zealand.

DISTRIBUTION.—New Zealand at depths of intertidal to 91 m (Figure 23).

REMARKS.—In describing the endopodite of the 2nd antenna of the adult male of *Cycloleberis bradyi* (= *L. zealandica*), Poulsen (1965:271) stated that the 2nd joint bears 20 bristles; however, the illustration of the endopodite (1965, fig. 90d) has only 10 bristles. I examined the right 2nd antenna of the specimen and found it to have about 20 bristles. The anterior margin of the carapace is without a scalloped border; however, the anteroventral edge of the valve bears minute scallops, but these are visible only when the valve is viewed from the inside.

13. *Leuroleberis poulseni* (Moguilevsky and Ramírez, 1970), new combination

FIGURES 8m, 25

Cycloleberis poulseni Moguilevsky and Ramírez, 1970:461–471, figs. 1–3.—Kornicker, 1975a:568.

HOLOTYPE.—Not designated.

TYPE-LOCALITY.—Mar del Plata, Argentina.

MATERIAL.—Dr. Mognilevsky kindly sent 3 complete specimens on loan. I dissected the largest of these, an adult female without eggs. Because Dr. Mognilevsky indicated that she planned additional study of the species I have restricted my comments and illustrations to a minimum. Although I do not know the precise collecting locality, I presume it to be at or near the type-locality.

DISTRIBUTION.—In vicinity of Mar del Plata, Argentina, at depths of 10–22 m (Figure 23).

DESCRIPTION OF FEMALE.—Surface microstructures of carapace similar to those of *L. orbicularis* (see Plates 11, 12); anterior one-fourth of edge of

dorsal margin of right valve with about 80 minute teeth forming row; inner edge of rim along anterodorsal edge of each valve without scallops like those on *C. squamiger* (Scott, 1894) or *C. lobiancoi* (Müller, 1893); small lumen present beneath surface at edge of each valve below incisur.

Size: Dissected specimen, length 5.2 mm, height 4.5 mm.

First Antenna (Figure 25a): Ventral margin of 4th joint with 6 bristles, 2 long, 2 medium, 2 short. Sensory bristle of 5th joint with 3 short proximal filaments and 13 or 14 long terminal filaments.

Second Antenna (Figure 25b): Endopodite: 1st

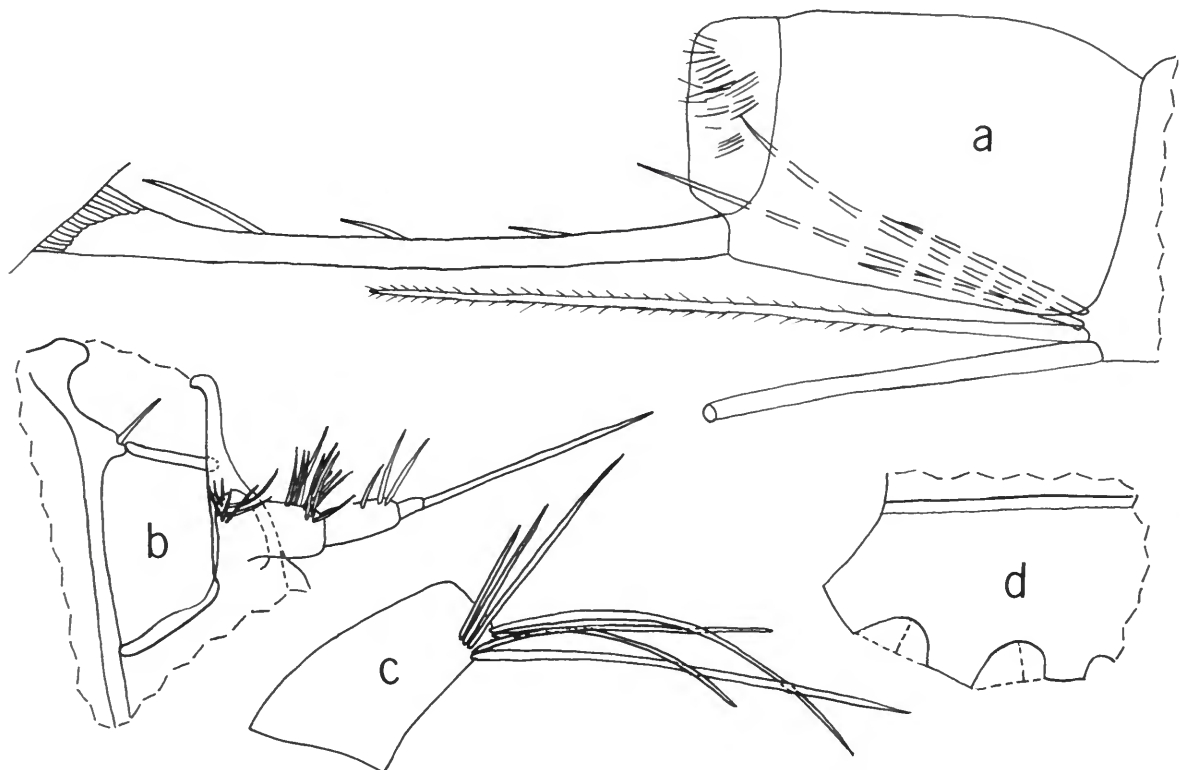


FIGURE 25.—*Leuroleberis poulsoni* (Mognilevsky and Ramírez), adult female: a, distal end of right 1st antenna showing ventral bristles of 4th joint and sensory bristle of 5th joint; b, endopodite and distal part of protopodite of right 2nd antenna; c, ventral bristles on 2nd endopodial joint of left mandible, medial view; d, distal part of left lamella of furca showing concavities between main claws (dashed lines within concavities indicate lines along which depth and width were measured).

joint with 18 short bristles, 7 proximal, 11 distal; 2nd joint with 3 short bristles; 3rd joint with 1 long terminal bristle.

Mandible: 2nd endopodial joint (Figure 25c): ventral margin with bristles forming 2 groups: proximal group with 5 bristles having bases on medial side of joint; terminal group with 2 bristles.

Furca (Figure 25d) Left lamella: depth of concavity between main claws 1 and 2, 56 percent of width; depth of concavity between main claws 2 and 3, 61 percent of depth.

Lateral Eyes: Well developed.

REMARKS.—The 1st antenna on the specimen I examined differed from that described by Moguilevsky and Ramírez (1970) in having 6 bristles instead of 4 on the ventral margin on the 4th joint, and in having 3 instead of 4 short proximal bristles on the sensory bristle of the 5th joint. The distribution of bristles on the endopodite of the 2nd antenna of the specimen I examined is more-or-less similar to that described by Moguilevsky and Ramírez (1970:467), but differs from that given in the diagnosis of Kornicker (1975a:568), which he based on the endopodite illustrated by Moguilevsky and Ramírez (1970, fig. 3:5).

The carapace of *L. poulsenii* resembles that of *L. orbicularis* (Brady), which is known only from juveniles collected off Chile. It is possible that the species are conspecific, but it will be necessary to study adults of *L. orbicularis* before the true relationship of the 2 species can be ascertained.

14. *Leuroleberis sharpei*, new species

FIGURES 8n, 13f, 26–33; PLATE 13–20

Cylindroleberis lobianci.—Sharpe, 1908:424, pl. 63: figs. 1–5, pl. 65: figs. 3–7.

Cycloleberis lobiancoi.—Hobson and Chess, 1976:574, 584, 588, fig. 5I.

ETYMOLOGY.—The species is named for Richard W. Sharpe.

HOLOTYPE.—USNM 141552, adult female, length 6.0 mm, on slides and in alcohol.

TYPE-LOCALITY.—Monterey Bay, California,

Moss Landing Marine Laboratory, off South Jetty, station KR 3–2, 36.6 m, sand bottom, 11 December 1971.

ALLOTYPE.—USNM 143780, adult male, length 6.4 mm, on slides and in alcohol, from breakwater at Monterey Bay, station B-1, depth 2 m, Smith-McIntyre grab sampler, sand or muddy sand bottom.

PARATYPES.—Monterey Bay, California: USNM 156928, 1 specimen; USNM 156927, 1 specimen; USNM 156936, 1 juvenile; USNM 156937, 2 specimens; USNM 139286, 1 A-1 female; USNM 156929, 1 specimen; USNM 156924, 2 juveniles; USNM 156925, 1 juvenile; USNM 156926, 1 adult female and 11 juveniles; USNM 156922, 1 juvenile; USNM 156923, 1 adult female and 1 juvenile; USNM 156921, 3 juveniles; 4 juveniles from PG and E station 2, sample B-2, returned to Mr. Slattery; USNM 156935, 1 adult female; 1 ovigerous female returned to K. M. Mawn. Huntington Beach, California: USNM 156774, 1 ovigerous female. San Diego Bay, California: USNM 156916, 1 specimen; USNM 156919, 1 juvenile; USNM 156920, 3 juveniles. Continental shelf, California: 23 specimens returned to Brad Myers. Santa Catalina Island, California: USNM 156917, 156918, 2 adult males. California (exact locality unknown): USNM 156938, 3 specimens. Alaska?: USNM 156775, 1 adult male. Mexico: USNM 156930, 1 adult male; USNM 156931, 5 adult males; USNM 156932, 1 adult male; 2 specimens including 1 adult male in collection of Alan Hancock Foundation.

ADDITIONAL MATERIAL [specimens identified as *Cylindroleberis lobianci* Müller by Sharpe (1908:424)].—USNM 43780, appendages of 1 female on slide, from Ballenas Bay, Baja California; USNM 44316, dry left valve from near Ensenada, Baja California; USNM 44317, dry left valve from off Santa Catalina Island, California; USNM 44318, dry left valve from off Abreojos Point, Baja California. Other specimens listed by Sharpe (1908:425) could not be located.

DISTRIBUTION (Figure 23).—California: Continental shelf, Monterey Bay, San Diego Bay,



FIGURE 26.—*Leuroleberis sharpei*, new species, adult female, holotype, USNM 141552: *a*, complete specimen showing position of central adductor muscle attachments (dashed oval) and lateral eye, length 6.0 mm; *b*, left 1st antenna, lateral view; *c*, exopodite of 2nd antenna (most bristles not shown), lateral view; *d*, coxale endite of left mandible, medial view; *e*, outline of right lateral eye; *f*, medial eye and rod-shaped organ; *g*, upper lip, anterior to right.

Santa Catalina Island. Mexico: Gulf of California and on shelf off Baja California. Possibly off Alaska. Depth range 2–146.3 m.

DESCRIPTION OF ADULT FEMALE (Figures 26, 27).—Carapace more rounded in lateral view than that of adult male and without indentation in posterodorsal corner (Figures 26a, 27d); carapace similar to that of the A-1 female described herein; anterior part of dorsal margin of right valve with minute dentition (Figure 27e).

Ornamentation: Similar to that of the A-1 female described herein.

Infold: Not examined in detail, but in general similar to that of adult male.

Size: USNM 141552, length 6.0 mm, height 5.0 mm; ovigerous female returned to K. M. Mawn, length 5.6 mm, height 4.8 mm; USNM 156774, ovigerous female, length 5.2 mm, height 4.2 mm; specimens from Alan Hancock collection, station 1240–41, length 6.2 mm, height 5.1 mm; ovigerous female from Alan Hancock collection station 7534, length 6.0 mm, height 4.9 mm; specimen from Alan Hancock collection station 1205–40, length 6.0 mm, height 5.2 mm; USNM 156926D, ovigerous female, length 5.9 mm, height 5.0 mm.

First Antenna (Figure 26b): 1st joint with long hairs on medial surface and shorter spines on lateral surface; 2nd joint with 7–9 short lateral bristles, 5 or 6 short or medium length dorsal bristles, and hairs on medial surface and along ventral margin; 3rd joint with 14 short or medium length bristles along dorsal margin, and 1 short ventral midbristle; 4th joint with 1 long dorsal bristle, and 5 ventral bristles (1 long, 4 shorter); right limbs of USNM 141552 and 156774 with 1 short medial bristle near base of dorsal bristle; sensory bristle of 5th joint with 6–8 short marginal filaments and 7 or 8 longer terminal filaments including stem (the distal, short, marginal filament is very close to the proximal, long, terminal filament); 6th joint with medial and lateral hairs, and medial bristle about same length as joints 4–8 (measured along ventral margin). Seventh joint: a-claw bare; stout b-bristle reaching tip of sensory bristle of 5th joint, with 7 short marginal filaments and 3 short terminal filaments; c-bristle longer than sensory bristle, with

15 short filaments including stem. Eighth joint: d- and e-bristles bare, with blunt tips reaching just past terminal end of sensory bristle, slightly shorter than c-bristle; f-bristle bent dorsally, about same length as b-bristle, with 13 filaments including stem; g-bristle about same length as c-bristle, with 14 filaments including stem.

Second Antenna (Figure 26c): Protopodite with small medial bristle, and long hairs on medial surface near ventral margin and along ventral margin. Endopodite 3-jointed: 1st joint divided into short proximal part with 10 short bristles and longer distal part with 7 short bristles on USNM 141552, and 7–8 proximal and 4–5 distal on 156774; 2nd joint shorter than 1st joint, with 1 short distal bristle; end joint very short, with long terminal bristle. Exopodite: 1st joint with hairs along dorsal margin and short mediobasal bristle; 2nd joint about twice length of 3rd joint; bristles of joints 2–8 with natatory hairs and ventral spines; 9th joint with 5 bristles with natatory hairs (3 ventral with ventral spines, 1 medium length without ventral spines, 1 dorsal and short, also without ventral spines); joints 2–8 with basal spines increasing in length on distal joints; basal spine of 8th joint not reaching distal end of 9th joint; lateral spine of 9th joint about same size as that of 8th joint; joints 2–8 with short spines forming row along distal margin.

Mandible: Coxale endite (Figure 26d): ventral branch with long proximal spines and stouter distal spines forming about 6 oblique rows; tip of branch with 2 ventral teeth and 1 dorsal tooth with digitate end; slender bristle present near proximal end of branch; ventral margin of dorsal branch with 4–5 triangular processes with dentate posterior margins and 5 crescentic processes proximal to main spine; crescentic processes with teeth along anterior margins; main spine short with slender spines along anterior margin; a minute crescentic process present just distal to base of main spine; terminal bristle broken off specimen examined but base of bristle at tip of branch; narrow dorsal ridge extending posteriorly from base of bristle to point opposite main spine; dorsal margin near middle with minute serrations. Basale: tip of endite with 1 long stout bristle with

marginal spines along whole margin and triaenid tip, and 2 slightly shorter and more slender bristles with similar spines; ventral margin of endite with about 18 shorter bristles with about 7 pairs of spines near triaenid tip; about 11 dwarf bristles forming row near dorsal margin of endite; ventral margin of basale with about 20 triaenid bristles with about 17 pairs of spines near small triaenid tip (spines decrease in size distally), and 5 terminal bristles (3 long, 1 medium, 1 short); medial surface near ventral margin with 5 small bristles; medial surface of basale with long hairs; dorsal margin with long hairs proximally, 13 short bristles distally, and 2 long terminal bristles. Exopodite reaching just past distal end of 1st endopodite joint, with 2 bare, ventral, subterminal bristles (last of these longer than other); tip with hairs and minute recurved process. Endopodite: ventral margin of 1st joint with 9 ventral bristles; dorsal margin and medial surface of 2nd joint with numerous bristles; ventral margin of 2nd joint with 5 spinous distal bristles forming 2 groups, 3 in subterminal group, 2 in terminal group; end joint with 3 long subequal claws (dorsal claw shorter than others), 1 long, spinous, lateral bristle about same length as dorsal claw, and 2 short ventral bristles.

Maxilla (Figure 27a): Epipodite with pointed tip almost reaching distal bristles on dorsal margin of basale; surface with minute hairs forming short rows distally near ventral margin. Proximal scythe-shaped bristle of baleen comb with 1 slender bristle just distal to its base and proximal to endite bristles. Endites consisting of 3 long stout bristles and 2 short bristles followed by 8 long stout bristles (not all bristles shown in Figure 27a); 8 to 11 short bristles present just distal to the 8 long bristles, and slightly dorsal to them. Basale: dorsal margin hirsute, with 7–12 short proximal bristles and 3–7 distal bristles, 1 long, 2–6 short; medial surface with 20–28 minute bristles forming row near ventral margin, 2 long distal bristles with bases on or near ventral margin, 1 long and 8–10 short distal bristles forming row parallel to distal margin; ventral margin with long terminal bristle reaching past end joint of endopodite. Exopodite with at least 2 small bris-

gles. Endopodite: 1st joint with 1 short dorsal bristle, abundant dorsal and medial spines forming rows, and stout spinous beta-bristles; end joint with 6 spinous bristles.

Fifth Limb (Figure 27b): Dorsal margin of comb hirsute with 13–23 minute bristles along proximal half; Exopodial bristles consisting of 2 long bristles with 3 or 4 minute bristles at their bases and 7 short bristles ventral to these near ventral margin.

Sixth Limb: 5 short bristles in place of epipodial appendage; posterior tip of skirt with 7 or 8 short hirsute bristles; remaining part of limb not examined in detail but similar to that of adult male.

Seventh Limb: Limb with 174–210 bristles, about same number on each side; each joint with 2, 4, or 6 bristles; each bristle with up to 9 bells; terminus consisting of opposing combs, each with about 28 spinous teeth; the 7 teeth in middle of comb shorter than teeth on either side.

Furca (Figure 27c): Each lamella with 3 primary claws followed by 8 short bristles; distal bristle shorter than following bristle, but latter bristle not clawlike as on *C. americana*; right lamella with bristles separated from claw 3 by space; left lamella with bristles close to claw 3; hairs and teeth on claws and bristles similar to those on furca of adult male; hairs on lamella following claw 3 and at bases of main claws.

Rod-shaped Organ and Medial Eye (Figure 26f), *Lateral Eye* (Figure 26e), *Upper Lip* (Figure 26g), and *Posterior of Body*: Similar to those of adult male.

Eggs: USNM 156774 with 57 eggs.

Epizoa: Valves with numerous stalked protistans, especially around edges (Figure 27f,g).

DESCRIPTION OF ADULT MALE (Figures 28–32, Plates 13–16).—Carapace oval in lateral view with deep incisur and small indentation in posterodorsal corner (Figures 28a, 32h, Plates, 13, 14a,c,d); small lumen just ventral to incisur (Figure 28d).

Ornamentation: Numerous bristles forming row along edge of anterior, ventral, and posterior margins (Plates 13, 14a,b,c,f); surface with abundant oval fossae with short bristle in each and reticulate surface (Figure 28b, Plates 15, 16a–c); area between fossae with scattered minute pores

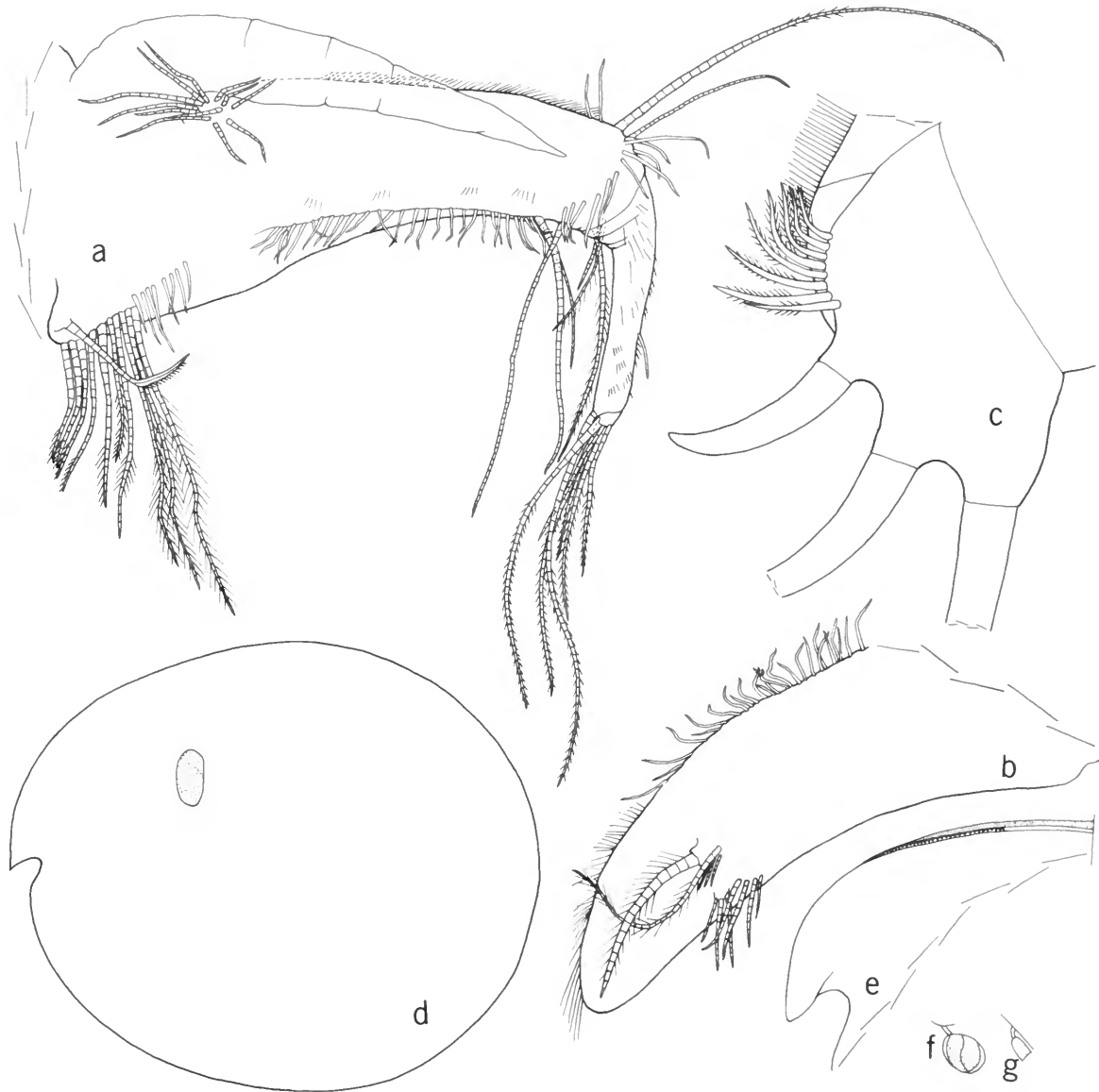


FIGURE 27.—*Leuroleberis sharpei*, new species, adult female, holotype, USNM 141552: *a*, left maxilla, medial view; *b*, comb of left 5th limb, lateral view; *c*, ovigerous female, USNM 156774, right lamella of furca (marginal teeth not shown). Adult female, USNM 139286: *d*, complete specimen showing position of lateral eye; *e*, inside view of anterodorsal part of right valve showing denticulations along edge; *f*, *g*, protostans? along valve margins.

(Plate 16*f*); anterodorsal margin smooth, without scalloping (Plates 13*c-e*, 14*a-c*); vertical row of dense bristles near posterior margin (Plates 13*a*, 14*d,e*); scattered bristles emerging from pores with concentric rims (Plate 16*d,e*).

Infold: Anterodorsal infold between list and outer edge of valve with about 200 bristles; infold between list and incisur with about 25 bristles; anteroventral infold with about 9 short bristles and about 35 minute bristles on outer part, and

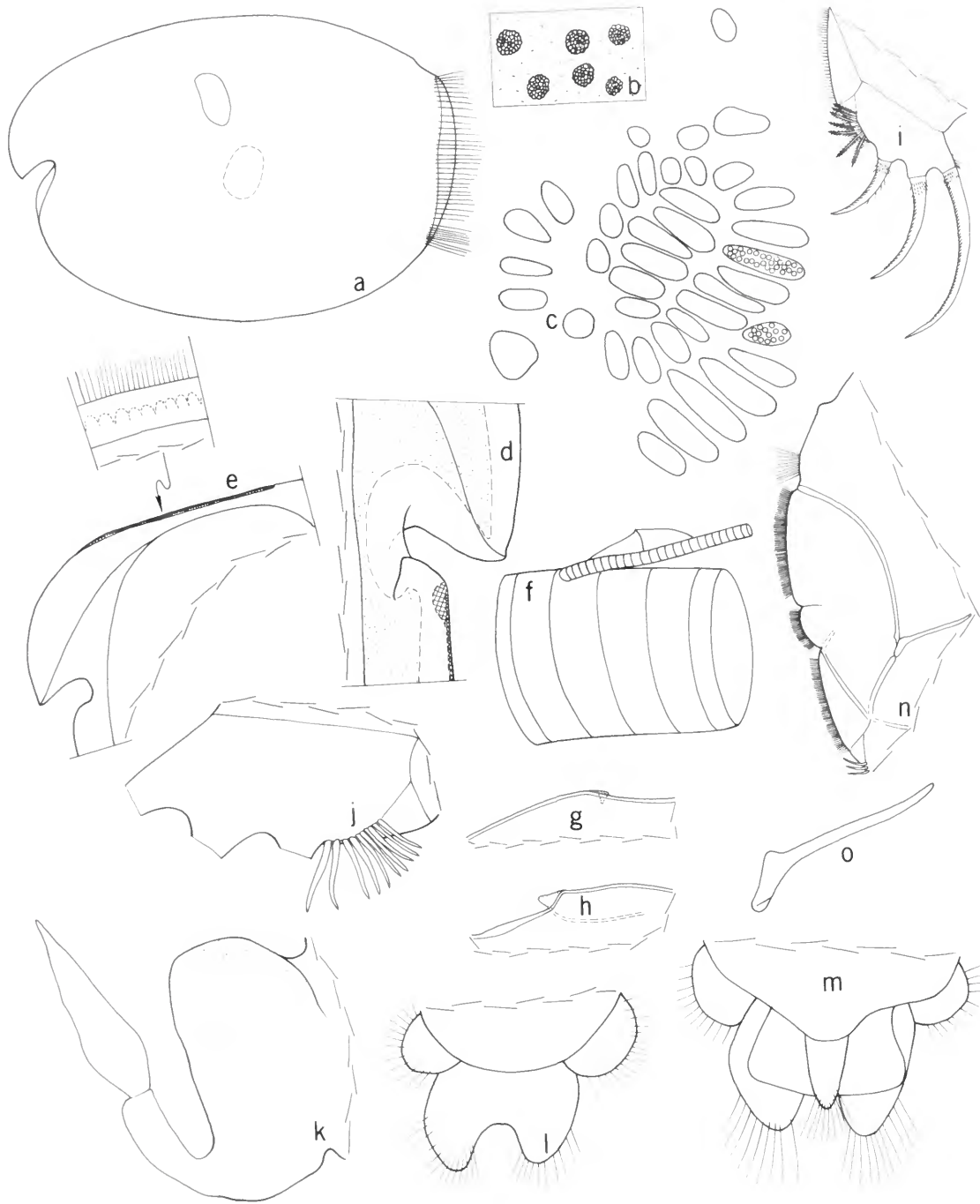


FIGURE 28.—*Lewoleberis sharpei*, new species, adult male, allotype, USNM 143780: *a*, complete specimen showing position of central adductor muscle attachments (lower dashed circle) and lateral eye (upper circle), length 6.4 mm; *b*, detail of fossae on posterior part of left valve as seen with transmitted light; *c*, central adductor muscle attachments as seen through left valve, anterior to left; *d*, inside view of incisur of left valve; *e*, anterior of right valve showing minute teeth along dorsal margin; *f*, proximal filament on segment

of c-bristle of right 1st antenna, lateral view; *g*, *h*, toothlike process on middle of dorsal margin of combs of right and left 5th limbs, lateral views; *i*, right lamella of furca, lateral view; *j*, left lamella of furca (claws 1-3 not shown), lateral view; *k*, medial eye and rod-shaped organ; *l*, ventral view of upper lip; *m*, dorsal view of upper lip; *n*, posterior of body showing internal sclerites and posterior 3 bristles of furca; *o*, right Y-sclerite, anterior to right.

single row of about 10 short bristles on inner part (pores dense along row of bristles); ventral infold with about 100 spinous bristles, mostly along list; broad posterodorsal list with about 175 bristles of various lengths; infold between posterodorsal list and valve edge with about 50 bristles forming row, most bristles in ventral half.

Selvae: Lamellar prolongation present, fringed along anteroventral margin, possibly elsewhere.

Central Adductor Muscle Attachments (Figure 28c): Consisting of 39 oval and elongate areas, each containing numerous individual oval scars.

Dentition: Right valve with row of minute teeth anterior to anterior juncture (Figure 28e); teeth lateral to lamellar prolongation of selvae; left valve with only a few indistinct teeth.

Size: USNM 143780, length 6.4 mm, height 4.5 mm; USNM 156917, length 4.7 mm, height 3.4 mm; USNM 156918, length 5.0 mm, height 3.4 mm; specimen from Alan Hancock collection station 1236-41, length 6.0 mm, height 4.2 mm; USNM 156930, length 4.0 mm, height 2.9 mm; USNM 156931A, length 4.5 mm, height 3.0 mm; USNM 156775, length 4.5 mm, height 3.1 mm.

First Antenna (Figures 28f, 29a): 1st joint with hairs on lateral surface; 2nd joint with 7 short, spinous, lateral bristles, 4 short dorsal bristles (with long spines near middle and short spines distally), and spines on medial surface and along ventral margin; 3rd joint with 13 bristles (with long spines near middle and short distal spines) along dorsal margin, and 1 short ventral midbristle; 4th joint short, with 1 long, stout, dorsal bristle with long proximal and short distal spines, and 4 ventral bristles (3 long, 1 short); sensory bristle of 5th limb stout with abundant filaments, about 10 filaments at tip stouter than others; medial bristle of 6th joint slender, about same length as joints 5-8. Seventh joint: a-claw shorter than bristle of 6th joint; b-bristle about twice length of a-claw, with 6 long proximal filaments, 7 shorter filaments along middle part, and 3 long terminal filaments including stem; c-bristle very long, tip missing, remaining part with 46 short dorsal filaments, proximal 35 filaments with small triangular process on dorsal margin near base, tip

of filaments with minute spine. Eighth joint: d- and e-bristles bare with blunt tip, slightly shorter than b-bristle; f-bristle very long, tip missing, 36 short ventral filaments on remaining part, proximal 25 of these with small triangular process on ventral margin near base; g-bristle about two and one-half times length of b-bristle, with about 18 marginal filaments, about 7 of these clustered proximally on bristle.

Second Antenna (Figure 29b,c): Protopodite bare except for small medial bristle. Endopodite 3-jointed: 1st joint elongate with 7 to 9 short proximal bristles and also with 3 or 4 short ventral bristles near middle; 2nd joint elongate with about 15 short, distal, ventral bristles; 3rd joint reflexed, with 1 proximal ventral bristle and ridges at tip. Exopodite: presence or absence of medial spine on distal margin of 1st joint could not be ascertained on specimen examined; 1st joint with few hairs dorsally near distal end; long, terminal, dorsal hairs on joints 2-8; joint 2 with minute basal spine; joints 3-8 with long basal spines; 9th joint with lateral spine shorter than basal spine of 8th joint and located on ventral corner of joint; bristles of joints 2-8 with natatory hairs, no spines; 9th joint with 5 bristles, all with natatory hairs, dorsal bristle short, projecting dorsally.

Mandible (Figures 30, 32a,c,d): Coxale endite similar to that of female (Figure 32a,c,d). Basale: tip of elongate endite with 2 long bristles and 5 bristles about three-fourths length of longer bristles, all with marginal spines; medial surface of endite with 13 bristles (oriented ventrally) with short distal spines and minute triaenid tip, and about 12 dwarf bristles near dorsal margin (not all shown in Figure 30); ventral margin of basale with 16 triaenid bristles with about 23 pairs of spines excluding terminal pair (spines decrease in length distally along bristle), and 4 subterminal bristles; medial surface near ventral margin with 5 minute bristles; medial surface near middle with long hairs forming rows; lateral surface near ventral margin with 3 minute bristles; dorsal margin with long hairs proximally and 9 short and 2 long bristles distally. Exopodite: reaching



FIGURE 29.—*Leurolaberis sharpei*, new species, adult male, allotype, USNM 143780: *a*, right 1st antenna, lateral view; *b*, distal bristle of protopodite and endopodite of left 2nd antenna, medial view; *c*, exopodite of right 2nd antenna, (most bristles not shown), lateral view; *d*, right maxilla (epipodial appendage and endites not shown), medial view; *e*, proximal part of left maxilla showing endite bristles, medial view; *f*, comb of left 5th limb, lateral view.

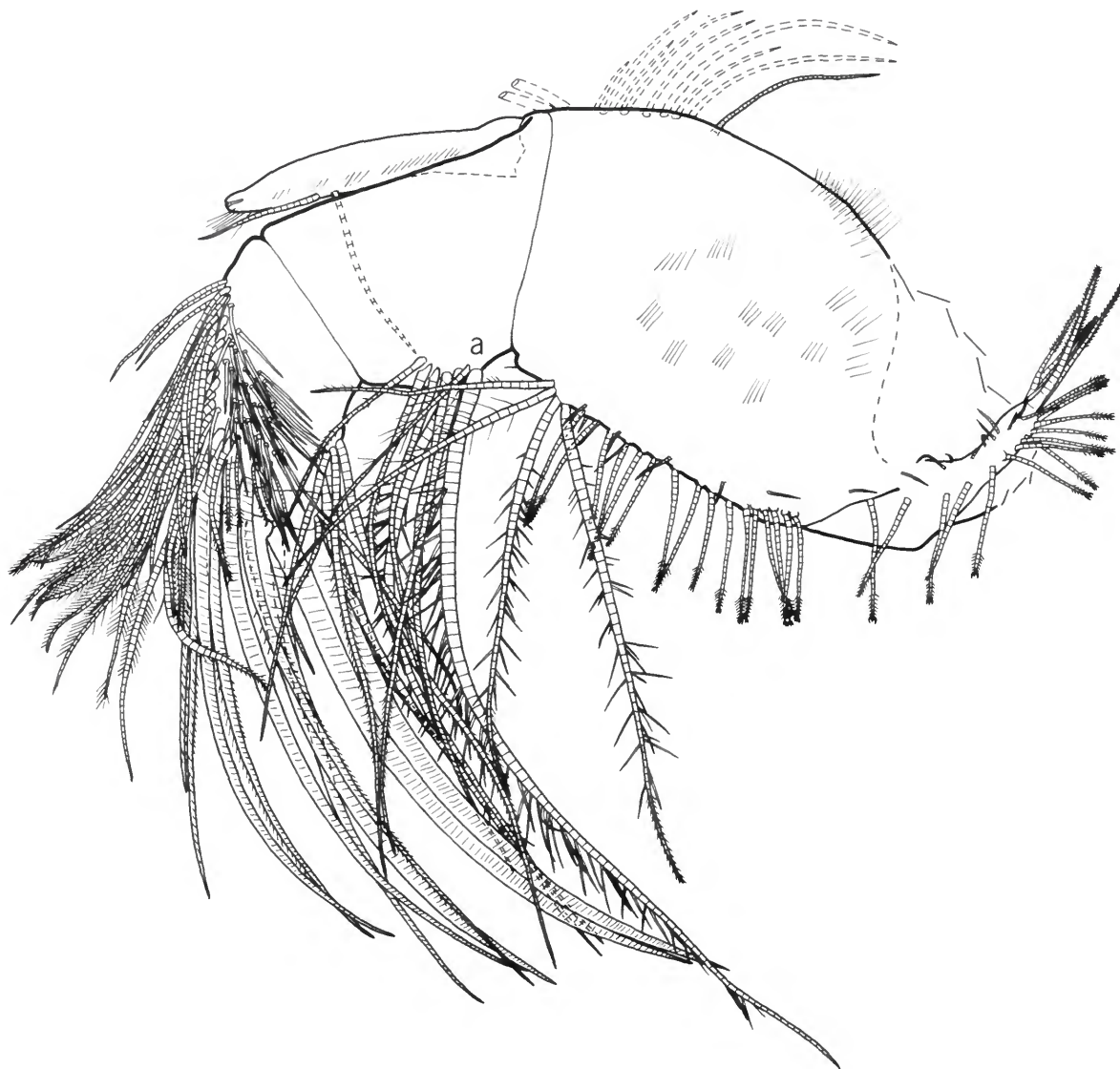


FIGURE 30.—*Leuroleberis sharpei*, new species, adult male, allotype, USNM 143780, right mandible (coxale endite not shown), medial view.

past distal end of 1st endopodite joint, with 2 bare, ventral bristles (proximal of these longer than other), long hairs, and small recurved process at tip. Endopodite: 1st joint with 8 ventral bristles, 4 with short marginal spines, 4 with long proximal and short distal spines; dorsal margin and medial surface of 2nd joint with abundant bristles; ventral margin with 5 spinous distal bris-

gles forming 2 groups, 3 in subterminal group, 2 in terminal group; end joint with 3 long subequal claws (ventral claw with few, minute, ventral teeth proximally; dorsal claw shorter than others), 1 long, spinous, lateral bristle slightly shorter than dorsal claw, and 2 short ventral bristles with short marginal spines.

Maxilla (Figure 29d,e): Proximal ventral margin

of baleen comb with scythe-shaped bristle followed closely by slender bristle. Endites with 3 long and 2 short bristles followed closely by 8 long bristles; 8 small bristles present just distal to the 8 long bristles, and slightly dorsal to them. Basale: dorsal margin hirsute, with 5 short proximal bristles and 6 distal bristles (5 short, 1 very long); medial surface with 24 minute bristles forming row near ventral margin, 2 long distal bristles near ventral margin, 1 long and 3 short bristles near distal end (with bases some distance from ventral margin), and in ventral half of joint few long hairs forming proximal rows and short spines forming distal rows; ventral margin with 1 long, spinous, terminal bristle reaching just past end of endopodite; lateral surface with long hairs near dorsal margin and short proximal bristle. Exopodite: Without lobe, consisting of 2 short bristles, or 2 short and 1 longer bristle. Endopodite: 1st joint with 1 short dorsal bristle, dorsal hairs, and long spinous beta-bristle; end joint with 6 spinous bristles.

Fifth Limb (Figures 28g,h, 29f, 32b,e-g,i): Dorsal margin with about 11 minute bristles proximal to low rise terminating in small anteriorly oriented tooth just distal to middle of margin on some specimens, and without tooth on others; exopodial bristles consisting of 2 long and 4 minute bristles on low process, and ventral to these 8 bristles on low ridge (4 of these could be considered to be in the row of bristles along ventral edge of comb); anterodorsal edge of comb with numerous hairs; 7 bristles along anterior edge of comb form single row; bristles along ventral edge of comb form 2 rows, 1 with bases on medial side, other with bases on lateral side; anterior 2 bristles of lateral row with bases slightly inward from valve edge; these are near anterior edge of comb just ventral to the single row of 7 anterior bristles.

Sixth Limb (Figure 31a): Anterior margin with 2 sutures; bristles along anterior margin dorsal to upper suture forming 3 rows with 22 bristles in medial row, 19 bristles in middle row, and about 30 bristles in lateral row; bristles in lateral row more slender and slightly shorter than bristles in other rows; section between upper and lower sutures bears 4 bristles forming medial row, 3

bristles forming middle row, and 8 bristles forming lateral row; only lateral row continues below lower suture, with 11 short and 3 longer bristles between suture and anterior tip of limb; anteroventral tip of limb with about 12 bristles; lateral sole very narrow, hirsute, sole bristles not observed; ventral margin with about 85 bristles; about 16 minute bristles present on posterior half of medial surface near ventral margin; posterior tip of limb with 6 short hirsute bristles; medial and lateral surfaces and especially posterior margin hirsute; 3-5 short bristles in place of epipodial appendage.

Seventh Limb (Figure 31b): Limb with 139 bristles (66 on one side, 73 on other); each bristle with up to 7 bells; proximal joints having 2 bristles, 1 on each side; some of the more distal joints with 3 bristles, 1 on one side, 2 on other; some still more distal joints with 4 to 6 bristles, 2 or 3 bristles on each side of same joint. Terminus consisting of opposing combs, each with 28 spinous recurved teeth.

Furca (Figure 28i,j): Each lamella with 3 primary claws followed by 7-10 short bristles (right lamella of USNM 143780 with 7 bristles, left with 10); right lamella with bristles separated from claw 3 by space, whereas left lamella with bristles close to claw 3; primary claws with teeth of uniform size forming medial and lateral rows along posterior margin; claw 3 with few hairs along anterior margin; posterior bristles with short spines along both margins; 1st bristle slightly more slender than 2nd bristle (not shown in Figure 28j); anterior of lamella with few faint spines; long hairs present on main claws near base and along ventral margin of each lamella.

Rod-shaped Organ and Eyes: Elongate with suture near middle (Figure 28k); part of organ distal to suture broad proximally and tapering to point distally. Lateral eyes well developed (Figures 28a, 32h), pigmented, slightly smaller than medial eye (eye fragmented before ommatidia were counted, but with more than 50 ommatidia).

Upper Lip (Figure 28l,m): Consisting of 2 hirsute lobes without spines; a hirsute lateral flap posterior to each lobe.

Posterior of Body (Figure 28n): Hirsute, without

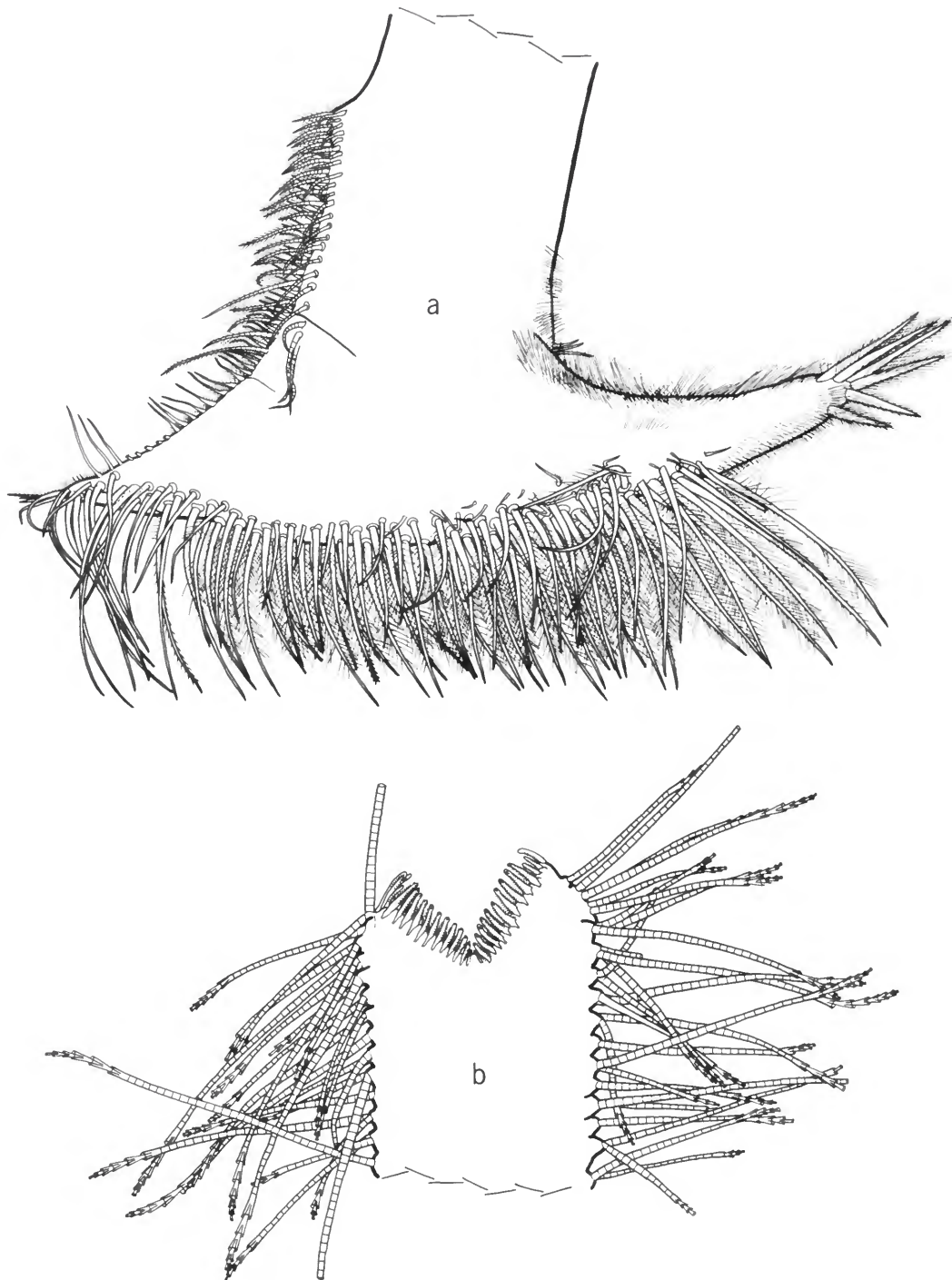


FIGURE 31.—*Leuroleberis sharpei*, new species, adult male, allotype, USNM 143780: *a*, right 6th limb, medial view; *b*, tip of 7th limb.

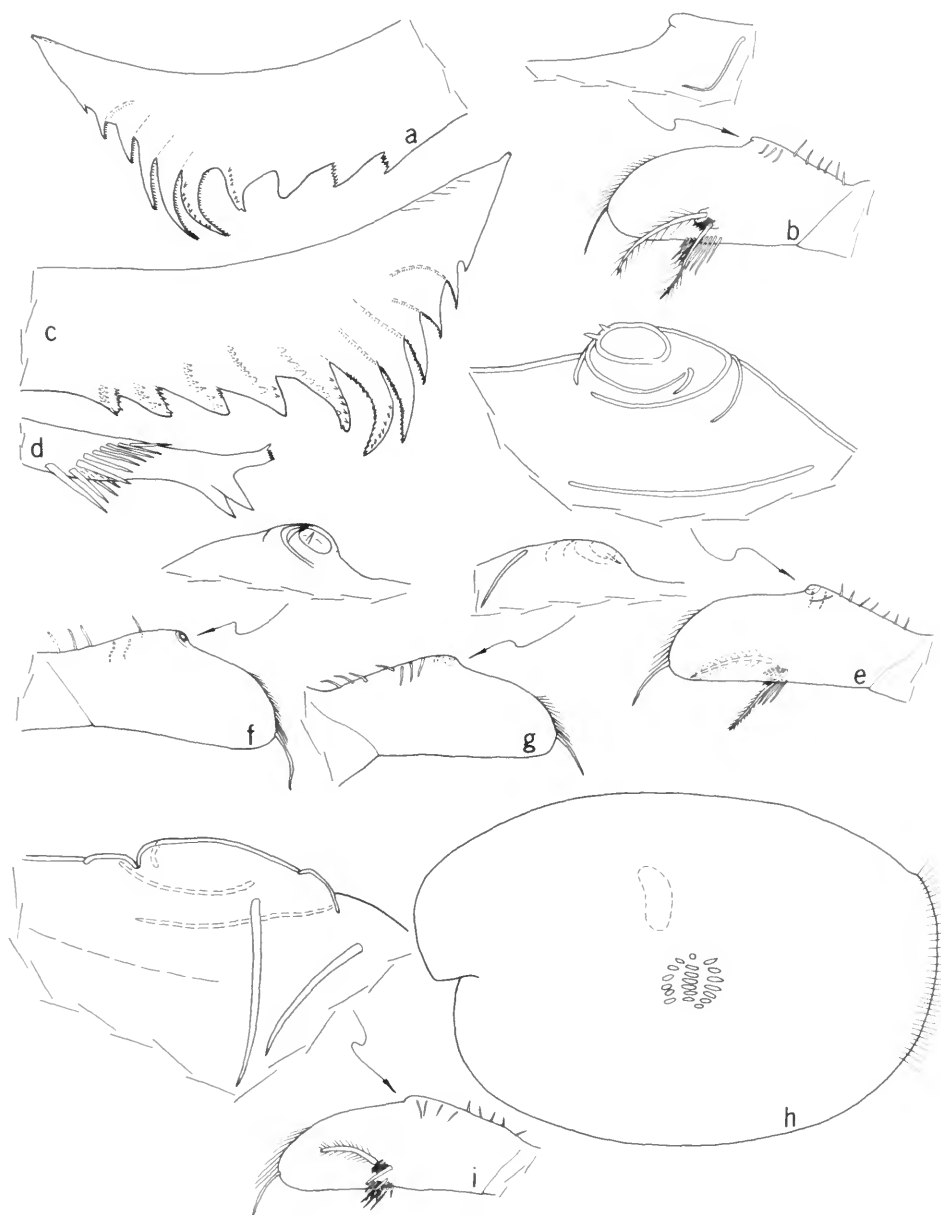


FIGURE 32.—*Leuroleberis sharpei*, new species, adult males, paratypes: USNM 156930: *a*, tip of dorsal branch of coxale endite of mandible (terminal bristle broken off); *b*, comb of left 5th limb, lateral view. USNM 156917: *c*, tip of dorsal branch of coxale endite of mandible (terminal bristle broken off); *d*, tip of ventral branch of coxale endite of mandible; *e*, comb of right 5th limb, medial view. USNM 156932: *f*, *g*, lateral view of comb of right 5th limb, and medial view of comb of left 5th limb (illustration shows only terminal comb bristle; exopodial bristles not shown). USNM 156775: *h*, complete specimen showing position of some central adductor muscle attachments and lateral eye (dashed), length 4.5 mm; *i*, comb of 5th limb, lateral view.

lobate dorsal process, but dorsum represented by clusters of long hairs.

Y-Sclerite (Figure 28*o*): Proximal end down-curved, stout; ventral branch absent.

DESCRIPTION OF A-1 FEMALE (Instar VI) (Plates 17–20).—Carapace oval in lateral view with small incisor near middle of anterior margin (Plate 17*a,b*).

Ornamentation (Plate 17): Surface with abundant shallow fossae, each with small bristle emerging from closed pore (Plate 17*c,d,f*); surface between fossae with minute open pores, some with a small bristle (Plate 17*d,e*); a few long bristles distributed over valve surface emerging from ringed pores (Plate 17*h,i*); surface of valve at high magnification with vesicular structure, especially within fossae (Plate 17*e-g*); anterior edge of rostrum with narrow smooth ridge paralleling edge of valve (Plate 17*j*); bristles present along edge of rostrum between smooth ridge and lamellar prolongation of selvage (Plate 17*j,k*); surface of valve with outer layer removed appearing amorphous (Plate 17*l*).

The right valve of USNM 139286 was boiled for 15 minutes in dilute potassium hydroxide (Plates 18, 20). The treatment resulted in the removal of all bristles and also the vesicular structure between and within surface fossae (compare Plate 17*e-g* with Plate 18*c-e*). This suggests that the outer vesicular layer is highly organic. The shell beneath the outer layer that tends to curl during the freeze-drying process appears similar in the treated and untreated valves (compare Plate 17*l* with Plate 18*f*). The inside of the valve treated with potassium hydroxide is shown in Plate 20.

Infold (Plate 19): Not examined in detail but, in general, similar to that of adult male.

Dentition: Anterodorsal edge of right valve anterior to anterior juncture with minute teeth forming row (Plate 20*a,c-f*).

Size: USNM 156926C, length 4.8 mm, height 4.0 mm; USNM 139286, length 4.9 mm, height 4.0 mm.

Endopodite of 2nd Antenna: Proximal part of 1st joint with 6 short bristles, distal part with 5 short bristles; 2nd joint shorter than 1st and with 1

short distal bristle; end joint short with long terminal bristle.

Furca: Each lamella with 3 primary claws followed by 7 short bristles.

Remaining Appendages: Not examined in detail but well developed.

DESCRIPTION OF A-1 MALE (Instar VI) (Figure 33*k*).—Carapace similar to that of A-1 female.

Size: USNM 156923A, length 5.0 mm, height 4.0 mm; USNM 156938B, length 4.9 mm, height 4.2 mm.

Endopodite of 2nd Antenna (Figure 33*k*): Proximal part of 1st joint with 3–5 short bristles, distal part with 3 short bristles; elongate 2nd joint with 1 short distal bristle; elongate 3rd joint with 1 long proximal bristle and 1 short terminal spine.

Furca: Each lamella with 3 primary claws followed by 7 short bristles.

Remaining Appendages: Not examined in detail but well developed.

DESCRIPTION OF A-2 FEMALE (Instar V).—Carapace similar in shape to that of adult female.

Size: USNM 156936, length 3.8 mm, height 3.2 mm; USNM 156927, length 3.9 mm, height 3.2 mm; USNM 156937, length 3.9 mm, height 3.4 mm; USNM 156938A, length 4.2 mm, height 3.5 mm.

Endopodite of 2nd Antenna: Proximal part of 1st joint with 3–5 short bristles, distal part with 4 short bristles; 2nd joint either bare or with 1 short bristle; 3rd joint small with 1 long terminal bristle.

Furca: Each lamella with 3 primary claws followed by 6 short bristles.

Remaining Limbs: Not examined in detail but in general well developed.

DESCRIPTION OF A-3 FEMALE (Instar IV).—Carapace similar in shape to that of A-2 female.

Size: USNM 156938C, length 3.0 mm, height 2.4 mm.

Endopodite of 2nd Antenna: Proximal part of 1st joint with 3 short bristles, distal part with 4 short bristles; 2nd joint bare, 3rd joint with long terminal bristle.

Sixth Limb: Anterior and ventral margins with numerous bristles.

Seventh Limb: Each limb well developed with

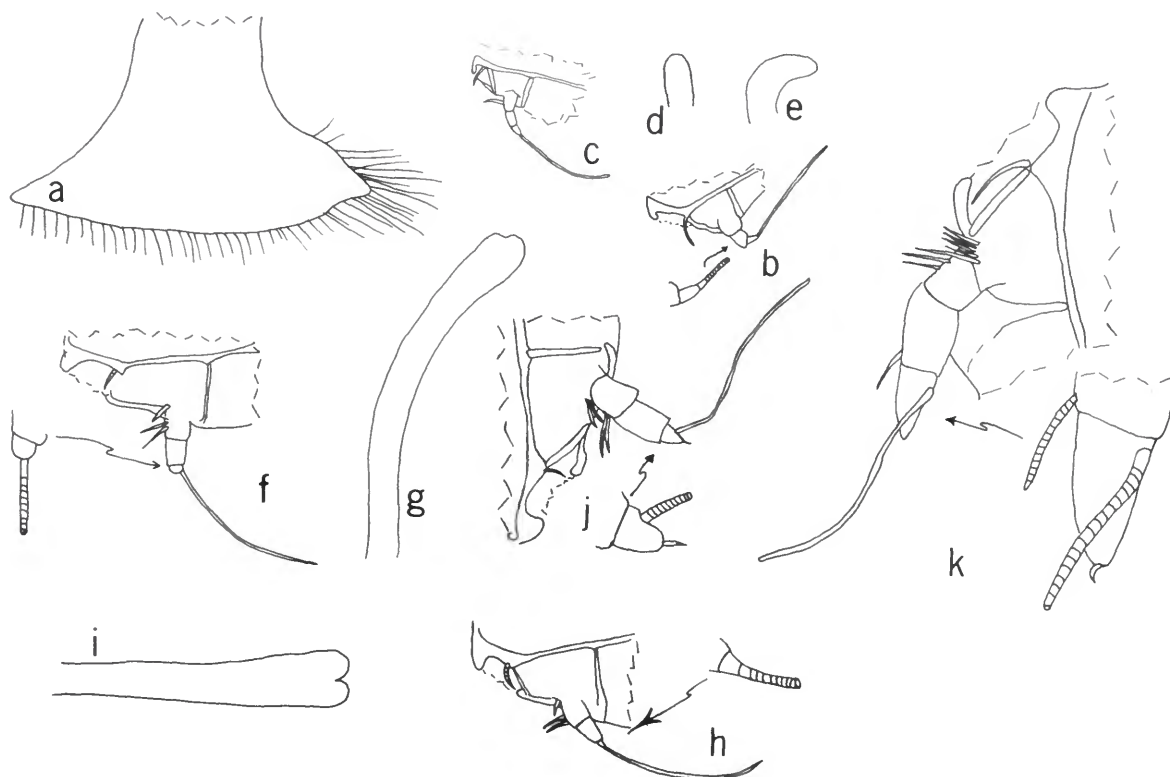


FIGURE 33.—*Leuroleberis sharpei*, new species, juveniles: *a*, left 6th limb of instar I, lateral view, USNM 156921A; *b*, endopodite and distal part of protopodite of right 2nd antenna of instar I, medial view, USNM 156721B; *c*, *d*, endopodite and proximal part of protopodite of right 2nd antenna (medial view) and 7th limb of instar II, USNM 156920A; *e*, 7th limb of instar II, USNM 156926A; *f*, *g*, endopodite and proximal part of protopodite of right 2nd antenna (medial view) and 7th limb of instar III (male?), USNM 156926J; *h*, *i*, endopodite and distal part of protopodite of right 2nd antenna (medial view) and 7th limb of instar III (female?), USNM 156926B; *j*, endopodite and distal part of protopodite of right 2nd antenna of male instar IV, medial view, USNM 156926E; *k*, endopodite and distal part of protopodite of right 2nd antenna of male instar VI, medial view, USNM 156923A.

numerous bristles.

Furca: Each lamella with 3 primary claws followed by 6 short bristles.

Remaining Limbs: Not examined in detail but in general well developed.

DESCRIPTION OF A-3 MALE (Instar IV) (Figure 33j).—Carapace similar in shape to that of adult female.

Size: USNM 156926E, length 3.2 mm, height 2.7 mm; USNM 156921, length 3.3 mm, height 2.8 mm.

Endopodite of 2nd Antenna (Figure 33j): Proximal part of 1st joint with 2 short bristles, distal part with 2 short bristles; elongate 2nd joint bare; short 3rd joint with 1 long proximal bristle and 1 short terminal spine.

Furca: Each lamella with 3 primary claws and 6 short bristles.

Seventh Limb: Each limb with numerous lateral bristles and terminus with opposing comb teeth.

Remaining Limbs: Not examined in detail but well developed.

DESCRIPTION OF A-4 ?FEMALE (Instar III) (Figure 33*h,i*).—Carapace similar in shape to that of adult female.

Size: USNM 156926G, length 2.23 mm, height 2.05 mm; USNM 156926H, length 2.4 mm, height 2.0 mm; USNM 156926B, length 2.44 mm, height 2.07 mm; USNM 156926F, length 2.45 mm, height 2.05 mm.

Endopodite of 2nd Antenna (Figure 33*h*): Proximal part of 1st joint with 1 or no short bristle, distal part with 2 short bristles; short 2nd joint bare; small 3rd joint with long terminal bristle.

Seventh Limb (Figure 33*i*): Elongate, bare, without bristles or terminal teeth.

Furca: Each lamella with 3 primary claws followed by 4 or 5 short bristles.

Remaining Limbs: Not examined in detail but well developed.

DESCRIPTION OF A-4 ?MALE (Instar III) (Figure 33*f,g*).—Carapace similar in shape to that of A-4 female.

Size: USNM 156926J, length 2.6 mm, height 2.0 mm; USNM 156926I, length 2.5 mm, height 2.0 mm.

Endopodite of 2nd Antenna (Figure 33*f*): Proximal part of 1st joint with 1 short bristle, distal part with 2 short bristles; 2nd joint bare; 3rd joint short, broader than 3rd joint of A-3 female, with 1 long bristle almost terminal.

Seventh Limb (Figure 33*g*): Elongate bare without bristles or terminal teeth.

Furca: Each lamella with 3 primary claws followed by 4 short bristles.

Remaining Appendages: Not examined in detail but well developed.

DESCRIPTION OF A-5 INSTAR (Instar II) (Figure 33*c-e*).—Carapace similar in shape to that of A-4 female.

Size: USNM 156926A, length 1.92 mm, height 1.61 mm; USNM 156920A, length 1.68 mm, height 1.35 mm.

Endopodite of 2nd Antenna (Figure 33*c*): 1st joint with 1 short distal bristle; 2nd joint bare; 3rd joint with long terminal bristle.

Sixth Limb: With numerous bristles along anterior and ventral margins.

Seventh Limb (Figure 33*d,e*): Short bare.

Furca: Each lamella with 3 stout claws followed by 2 bristles.

Remaining Appendages: Not examined in detail but well developed.

Sex: Indeterminate.

DESCRIPTION OF A-6 INSTAR (Instar I) (Figure 33*a,b*).—Carapace similar in shape to that of A-4 female.

Size: USNM 156921B, length 1.57 mm, height 1.27 mm; USNM 156921A, length 1.61 mm, height 1.30 mm.

First Antenna: Sensory bristle of 5th joint without filaments.

Endopodite of 2nd Antenna (Figure 33*b*): 1st and 2nd joints bare; 3rd joint with long terminal bristle.

Sixth Limb (Figure 33*a*): Hirsute but without bristles.

Seventh Limb: Absent.

Furca: Each lamella of USNM 156921B with 3 stout claws and several stout spines following claw 3 (claw 3 not separated from lamella by suture). Left lamella of USNM 156921A with 4 stout claws (claws 3 and 4 not separated from lamella by suture); right lamella similar but without 4th claw.

Gill-like Structures: 7 well-developed structures present.

Remaining Appendages: Not examined in detail but all present and fairly well developed.

Sex: Indeterminate.

DESCRIPTION OF LARVAE REMOVED FROM MARSUPIUM OF OVIGEROUS FEMALE.—Carapace soft; misshapen but clearly divided into 2 valves and with slitlike incisur.

Size: Two larvae from USNM 156926D (length 5.9 mm, height 5.0 mm): Length 1.03 mm, height 0.81 mm; length 0.97 mm, height 0.85 mm.

Second Antenna: Exopodial bristles visible within but not yet extruded. Endopodite 3-jointed with long terminal bristle.

First Antenna: Many bristles unextruded; sensory bristle of 5th limb without filaments and partly extruded.

Mandible, Maxilla, 5th Limb: Present and with extruded bristles.

Sixth and 7th Limbs: Absent.

Furca: Each lamella with 2 long, stout, brown claws (claw folded back forming right angle near middle).

Gill-like Structures: Well developed, exact number not clearly discernable, but appear similar in relative size and number to those of instar I.

Gut: Yellow opaque substance fills gut.

REMARKS.—The collections from Santa Catalina Island, Scammon Lagoon, and Alaska contained only males. Therefore, the identifications of the specimens as *L. sharpei* must be considered tentative until females from those places are studied.

VARIABILITY.—The variability in size of the carapaces of specimens referred to this species is considerable, especially in adult males. The smallest specimen with a length of 4.0 mm was from Scammon Lagoon and the largest with a length of 6.4 mm was from Monterey Bay. Seven adult males from Scammon Lagoon varied in length from 4.0 mm to 4.5 mm. The large difference in size of the Scammon Lagoon and Monterey Bay specimens could be the result of 3 causes: 1, intraspecific variability; 2, postadult molting; or 3, my inclusion of more than 1 taxon in the species. I have tentatively concluded that the variability is due to the first cause listed—intraspecific variability—because no evidence of molting was observed in the few specimens examined in detail, and differences in appendage and shell morphology of the specimens examined were not sufficiently great, in my opinion, to refer the specimens to more than 1 taxon. Further study, however, may permit division of the species. For example, the process on the dorsal margin of the comb of the 5th limb on an adult male from Santa Catalina Island (Figure 32e) had 2 small spines not present on specimens from Monterey Bay or Scammon Lagoon, which had either no spines or only 1 spine (Figures 29f, 32b,f,g). Further study of this character may be rewarding but was not attempted here. Another noted difference that may indicate the presence of more than 1 taxa in the collection is that the dorsal margin of the coxale endite of the mandible of the adult male (USNM 156930) from Scammon

Lagoon (Figure 32a) has a total of 10 protuberances compared to 11 on the adult male (USNM 156917) from Santa Catalina Island (Figure 32c). As noted above under “Remarks” no females were collected in Scammon Lagoon or from Alaska or Santa Catalina Island and therefore, the identification of the males from those places as *L. sharpei* must be considered tentative.

ONTOGENETIC DEVELOPMENT (Table 18).—Larvae (length 0.97–1.03 mm) within the carapace of a female (USNM 156926D), have fairly well-developed maxillae, mandibles, 5th limbs, and 1st and 2nd antennae. Many of the bristles in the larvae examined were not completely extruded, but are visible inside the appendages. The 6th and 7th limbs could not be seen and are assumed absent. Each furcal lamella has 2 brown claws that are folded back near the middle of each claw; a 3rd claw is not present. The lateral eyes, medial eye and rod-shaped organ, and gill-structures are well developed. I have interpreted the larvae to be partly developed 1st instars.

The smallest free-living specimens in the collection, interpreted here to be examples of the fully developed instar I, have lengths of 1.57–1.61 mm, sixth limbs that are fairly large, hirsute, and without bristles, no 7th limbs, and furcas with 3 claws on each lamella (the 3rd claw is not separated from the lamella by a suture). The lengths of the carapace of the first free-living instars and the larvae within the marsupium necessitate a growth factor of about 1.59 after the larva leaves the carapace of its mother. This is within the growth factor range of 1.57–1.63 obtained by Elofson (1941:367; see Kornicker, 1969a:3) between the egg length and that of the 1st free living instar of *Philomedes globosus*, to support the interpretation that the smallest specimens of *L. sharpei* in the collection are first instars. On the other hand, the absence of a 3rd furcal claw on the partly developed larva inside the shell of the female suggests that the smallest free-living specimens in the collection, which have 3 furcal claws, are the 2nd instar, not the 1st as interpreted herein.

On the 2nd instar the 6th limb bears many

TABLE 18.—Morphological development of instars of *Leuroleberis sharpei*, new species

Instar	USNM	Sex	Length (mm)	Furcal claw (X)/bristle (x) ¹										Number of bristles on endopodial joints of 2nd antenna								
														1st joint		3rd joint						
				1	2	3	4	5	6	7	8	9	10	Proximal/	Distal	Proximal bristle	Terminal bristle	Terminal spine	6th limb	7th limb		
Larva ²	156926D	?	0.97	X	X											0/0	0	0	1	0	absent	absent
Larva ²	156926D	?	1.03	X	X											0/0	0	0	1	0	absent	absent
I	156921B	?	1.57	X	X	X ³										0/0	0	0	1	0	no bristles	absent
I	156921A	?	1.61	X	X	X ³										0/0	0	0	1	0	no bristles	absent
II	156920A	?	1.68	X	X	X	x									0/1	0	0	1	0	many bristles	small, bare
II	156926A	?	1.92	X	X	X	x	x								0/1	0	0	1	0	many bristles	small, bare
III	156926G	??	2.23	X	X	X	x	x	x							0/2	0	0	1	0	many bristles	elongate, bare
III	156926H	??	2.4	X	X	X	x	x	x	x						1/2	0	0	1	0	many bristles	elongate, bare
III	156926B	??	2.44	X	X	X	x	x	x	x						1/2	0	0	1	0	many bristles	elongate, bare
III	156926F	??	2.45	X	X	X	x	x	x	x						1/2	0	0	1	0	many bristles	elongate, bare
III	156926I	??	2.5	X	X	X	x	x	x	x						1/2	0	0	1	0	many bristles	elongate, bare
III	156926J	??	2.6	X	X	X	x	x	x	x						1/2	0	0	1	0	many bristles	elongate, bare
IV	156938C	♀	3.0	X	X	X	x	x	x	x	x					3/4	0	0	1	0	many bristles	many bristles
IV	156926E	♂	3.2	X	X	X	x	x	x	x	x					2/2	0	0	1	0	many bristles	many bristles
IV	156921	♂	3.3	X	X	X	x	x	x	x	x					2/3	0	1	0	1	many bristles	many bristles
V	156936	♀	3.8	X	X	X	x	x	x	x	x					4/4	0	0	1	0	many bristles	many bristles
V	157927	♀	3.9	X	X	X	x	x	x	x	x					3/4	1	0	1	0	many bristles	many bristles
V	156937	♀	3.9	X	X	X	x	x	x	x	x					5/4	0	0	1	0	many bristles	many bristles
V	156938A	♀	4.2	X	X	X	x	x	x	x	x					3/4	1	0	1	0	many bristles	many bristles
VI	156926C	♀	4.8	X	X	X	x	x	x	x	x	x				6/5	1	0	1	0	many bristles	many bristles
VI	156938B	♂	4.9	X	X	X	x	x	x	x	x	x	x			3/3	1	1	0	1	many bristles	many bristles
VI	156923A	♂	5.0	X	X	X	x	x	x	x	x	x	x			5/3	1	1	0	1	many bristles	many bristles

¹ Each number represents the position of a claw or bristle counting from distal end of lamella.

² Partly developed instar I from inside shell of female USNM 156926D.

³ Claw 3 not separated from lamella by suture.

bristles on the anterior and ventral margins, and the 7th limb is small and bare. In addition to the terminal bristle of the 3rd joint, the endopodite of the 2nd antenna bears a small distal bristle on the 1st joint. The number of bristles on the 1st joint generally increases in later instars (Table 18). Each lamella of the furca of the 2nd instar bears 3 claws (all separated from the lamella by a suture) followed by 2 short bristles. The number of bristles generally increases in later instars (Table 18).

On the 3rd instar the 7th limb is elongate (much longer than the 7th limb of the 2nd instar) and is bare. On the 4th and later instars the 7th limb bears many bristles and has terminal combs.

The morphology of the endopodite of the 2nd antenna may be used to distinguish the male from the female in the 4th and later instars because the 3rd joint of the male endopodite bears a long proximal bristle absent on the female, and the female bears a long terminal bristle absent on the male. The 3rd joint of the endopodite of the 2nd antenna of the male instar III may be larger than that of the female, and thus be useful in identifying the sexes at this stage, but it is difficult to be certain that the size difference is not the result of intraspecific variability rather than sex; for this reason sex is questioned for instar III in Table 18 and in the text.

An insufficient number of specimens were collected to arrive at accurate growth factors that varied from 1.13 to 1.36, and average 1.25 (Table

TABLE 19.—Average shell dimensions (in mm) and calculated growth factors for *Leuroleberis sharpei* (adults include only females; juveniles include both males and females)

Growth stage	Number of specimens	Average length	Growth factor
Larva*	2	1.00	
INSTAR I	2	1.59	1.59
INSTAR II	2	1.80	1.13
INSTAR III	6	2.44	1.36
INSTAR IV	3	3.17	1.30
INSTAR V	4	3.95	1.25
INSTAR VI	3	4.90	1.24
Adult	7	5.84	1.19
Average growth factor excluding larval stage			1.25

* Partly developed instar I from inside shell of female

19). Because of the high variability in the size of adult males, only adult females were used to arrive at the final growth factor in Table 19. Because differences in the size of juvenile males and females at the same stage of development are probably small, male and female juveniles were lumped together in the calculations for Table 19. With the exception of 4 specimens (USNM 156920A from the vicinity of San Diego, and USNM 156938A–C, whose exact locality along the California coast is unknown) all specimens listed in Table 19 are from Monterey Bay, California. Inclusion of specimens from more than one area may contribute to inaccuracies in growth factor calculations.

Key to Early Instars of *Leuroleberis sharpei*

1. 6th limb present but without bristles; 7th limb absent Instar I
- 6th limb with anterior and ventral bristles; 7th limb present 2
2. 7th limb small, bare Instar II
- 7th limb elongate with or without bristles 3
3. 7th limb bare Instar III
- 7th limb with numerous bristles Instar IV–Adult

COMPARISONS.—Two species have previously been reported from the eastern Pacific, *Leuroleberis orbicularis* (Brady, 1897) and *Ambroleberis americana* (Müller, 1890). The new species, *L. sharpei*, differs from *A. americana* in not having a vertical ridge

posterior to the incisur of the carapace, in not having a 4th main claw, and in not having processes on the ventral margin of the 5th joint of the 1st antenna. The differences between *L. sharpei* and *L. orbicularis* (as redefined herein) are

based on the comparison of the two species. *L. sharpei* does not have the distinct ridges on the anterior part of the carapace that are present on *L. orbicularis*, and has 6–8 short proximal filaments on the sensory bristle of the 1st antenna of the adult female, compared to only 4 on the sensory bristle of *L. orbicularis*. The last 2 criteria also distinguish *L. sharpei* from *L. poulsenii* Mognilevsky and Ramírez, 1970, described from specimens collected off the coast of Argentina. Also, the 2nd endopodial joint of the mandible of *L. poulsenii* bears 5 subterminal medial bristles near the ventral margin compared to only 3 on *L. sharpei*.

15. *Leuroleberis mackenziei*, new species

FIGURES 80, 34–38; PLATES 21–23

Cycloleberis bradyi Poulsen [part], 1965:268, figs. 93, 94 [juvenile females only, not adult male holotype; that specimen referred to *Leuroleberis zealandica* (Baird) herein].

ETYMOLOGY.—The species is named for Dr. K. G. McKenzie who supplied some of the specimens.

HOLOTYPE.—Juvenile female, 4.8 mm, described by Poulsen (1965:277, fig. 93). Specimen in the Zoological Museum of Copenhagen.

TYPE-LOCALITY.—*Galathea* station 541, Moreton Bay, Brisbane, E-Australia, 22 m, 5 November 1951.

PARATYPES.—USNM 156967, 1 adult or A-1 female, New South Wales; USNM 157127, 1 adult male, New South Wales. From Belmont and Burwood beaches (near Newcastle), New South Wales: USNM 157622, 1 adult male, station 2.06.02.02.04; USNM 157623, 1 juvenile female, length 3.2 mm, station 2.06.03.02.02; USNM 157624, 1 juvenile, length 3.1 mm, station 2.09.01.02.01.

DISTRIBUTION.—Australia at depths of 12–50 m (Figure 23).

DESCRIPTION OF FEMALE WITH SMALL UNEXTRUDED EGGS (Adult or A-1 Instar) (Figures 34, 35a–j, Plates 21–23).—Carapace oval in lateral view, with deep incisur (Figure 34a, Plate 21a,b).

Ornamentation: Surface with abundant shallow fossae, each with small bristle emerging from closed pore (Plate 21c,e); minute linear ridges,

slightly concave in middle part, present anterior to fossae on anterior and ventral parts of valves (Plate 21c); a few long bristles with pore near base distributed over valve surface and emerging from open pore with single rim (Plates 21f, 22a–d); latter pores often surrounded with nodes sometimes forming roughly stellate pattern (Plate 22a–d); minute open pores without bristles very sparsely distributed on valve surface (Plate 22e); surface of valve with pebbly texture when viewed at very high magnification ($\times 20,000$) (Plate 22f); scalloped border absent along anteroventral and anterodorsal valve margins (Plate 21b,d).

Infold: Anterodorsal, anteroventral, and ventral infolds with abundant bristles; widened posteroventral infold with stout tubular bristles and processes (Plate 23); some of the stout tubular bristles broken near base revealing reticulate base (Plate 23c,f); Short bristles posterior to posteroventral list with digitate tips (Plate 23d).

Dentition: Right valve with minute teeth forming row along dorsal margin anterior to anterior juncture of ligament.

Size: USNM 156967, length 5.1 mm, height 4.2 mm.

First Antenna (Figure 34b): 1st joint: ventral margin with long hairs; lateral side with short spines forming row in distal dorsal corner. 2nd joint: dorsal margin with 6 spinous bristles; lateral side with 10 distal bristles; ventral and dorsal margins and medial and lateral surfaces hirsute (relatively few hairs along dorsal margin). 3rd joint: short ventral margin with small proximal bristle; longer dorsal margin with 15 spinous bristles. 4th joint: short dorsal margin with 1 terminal bristle; longer ventral margin with 4 terminal bristles. 5th joint: sensory bristle with 2 short proximal filaments and 12 or 13 long terminal filaments (proximal of terminal filaments may be much shorter than others). 6th joint short, with 1 long medial bristle. 7th joint: a-claw about same length as combined lengths of joints 5–8, tip rounded; b-bristle reaching past tip of sensory bristle of 5th joint, with about 15 marginal filaments; c-bristle same length as b-bristle, with about 13 marginal filaments. 8th joint: bare d- and e-bristles about same length as sensory bristle,



FIGURE 34.—*Levoleberis mackenziei*, new species, female (adult or A-1 instar), paratype, USNM 156967: *a*, outline of specimen, length 5.1 mm; *b*, left 1st antenna, lateral view, and left lateral eye (folded back); *c*, endopodite of left 2nd antenna, medial view; *d*, left mandible, medial view; *e*, tip of dorsal branch of coxale endite of mandible shown in *d*; *f*, tip of ventral branch of coxale endite of mandible shown in *d*.

d-bristle slightly shorter than *e*-bristle; *f*-bristle recurved dorsally, about one and one-half times length of *a*-claw, with about 11 short marginal filaments; *g*-bristle stouter than *f*-bristle but only slightly longer, with about 11 marginal filaments.

Second Antenna (Figure 34*c*): Protopodite with

short medial bristle; hairs along ventral and dorsal margins and on medial and lateral surfaces. Endopodite: proximal part of 1st joint with about 17 bristles; distal margin of 1st joint with about 8 bristles (these bristles shorter than many bristles on proximal part of joint); 2nd joint with 3 short

bristles; small end joint with 1 long terminal bristle. Exopodite: long 1st joint with minute teeth along dorsal margin and small, medial, terminal bristle; bristles of joints 2–8 with fairly stout ventral spines and natatory hairs; 9th joint with 5 bristles (3 long with ventral spines and natatory hairs, 1 medium, and 1 short with only natatory hairs); joints 3–8 with small basal spines increasing in length on distal joints; spine of 8th joint about one-half length of 9th joint; lateral spine of 9th joint about same length as spine of 8th joint; joints 2–8 with short spines along distal margin.

Mandible (Figure 34d–f): Coxale endite: small slender bristle present near base of ventral branch; ventral branch with about 8 oblique rows of spines (spines of proximal rows not as stout as spines of distal rows); tip of ventral branch with 3 teeth, dorsal of these blunt (Figure 34f); ventral margin of dorsal branch with 3 forward-pointing processes followed by 1 upright process and then 5 recurved processes; dorsal branch terminating with long bristle; dorsal margin of dorsal branch with about 9 backward-pointing spines near base of terminal bristle. Basale endite: 1 long and 1 medium length bristle at distal end, each with spines along the distal two-thirds; about 19 medium-length bristles on distal end and along ventral margin (marginal spines occupying distal one-fourth); 11 shorter bristles along dorsal margin of endite (last of these longer than others). Basale: ventral margin with 16 triaenid bristles with about 21 pairs of marginal spines (spines decreasing in length distally, terminal pair stouter but not longer than penultimate pair and not very different from medium length bristles of endite), and 2 long subterminal bristles with long marginal spines; medial surface with 8 small bristles near proximal ventral margin and long hairs (hairs abundant on dorsal half of joint but a few on ventral half); dorsal margin with abundant proximal hairs, about 18 short bristles, and 2 long, stout, subterminal bristles. Exopodite hirsute distally with tip reaching just past dorsal margin of 1st endopodial joint, with 2 ventral midbristles (proximal of these longer than other).

Endopodite 1st joint with 8 ventral bristles (1 missing on illustrated limb). Endopodite 2nd joint: dorsal margin and medial surface near dorsal margin with abundant bristles; ventral margin with bristles forming 2 distal groups (proximal of the groups with 4 bristles forming row, other group with 2 bristles). End joint with 3 stout clawlike bristles, 1 long lateral bristle, and 2 short, medial, ventral bristles.

Maxilla (Figure 35a): Epipodite broken off both limbs of specimen studied. Endite I with 3 stout and 3 small bristles; endite II with 1 slender and 2 stout bristles; endite III with 5 stout bristles of varying length proximal to 8 or 9 small bristles. Basale: medial side near ventral margin with 28 small bristles proximal to 2 long bristles; medial side near distal margin with 1 long and 12 short bristles; hirsute dorsal margin with 17 proximal bristles and 1 long and 11 short distal bristles; ventral margin with 1 long, spinous, terminal bristle; lateral surface with 1 proximal bristle. Exopodite consisting of minute lobe with 1 long and 2 short bristles. Endopodite: dorsal margin of 1st joint spinous, with 1 short midbristle; ventral margin of 1st joint with long spinous beta-bristle; end joint aberrant on both limbs of specimen examined, with weak stumps of 4 bristles.

Fifth Limb (Figure 35b): Dorsal margin of comb hirsute, with 12 small proximal bristles; lateral side with stout, hirsute, epipodial bristle not reaching past tip of comb, 1 slender, long, hirsute bristle with base just proximal to base of stout epipodial bristle, 4 minute bristles between bases of the 2 hirsute bristles, and 7 short bristles near ventral margin; lateral side also with 2 distal bristles near ventral margin (not shown in illustrated comb); ventral margin of comb with bristles forming 2 rows except for distal 15 bristles that form single row; hairs along dorsal margin of comb slightly longer than hairs at distal end.

Sixth Limb (Figure 35c): Anterior margin with 1 suture at intersection of skirt and trunk, and 1 small suture on upper margin of skirt; anterior margin of trunk above upper suture with bristles forming 3 rows (medial row with about 22 bristles); lateral row with about 33 slender bristles;

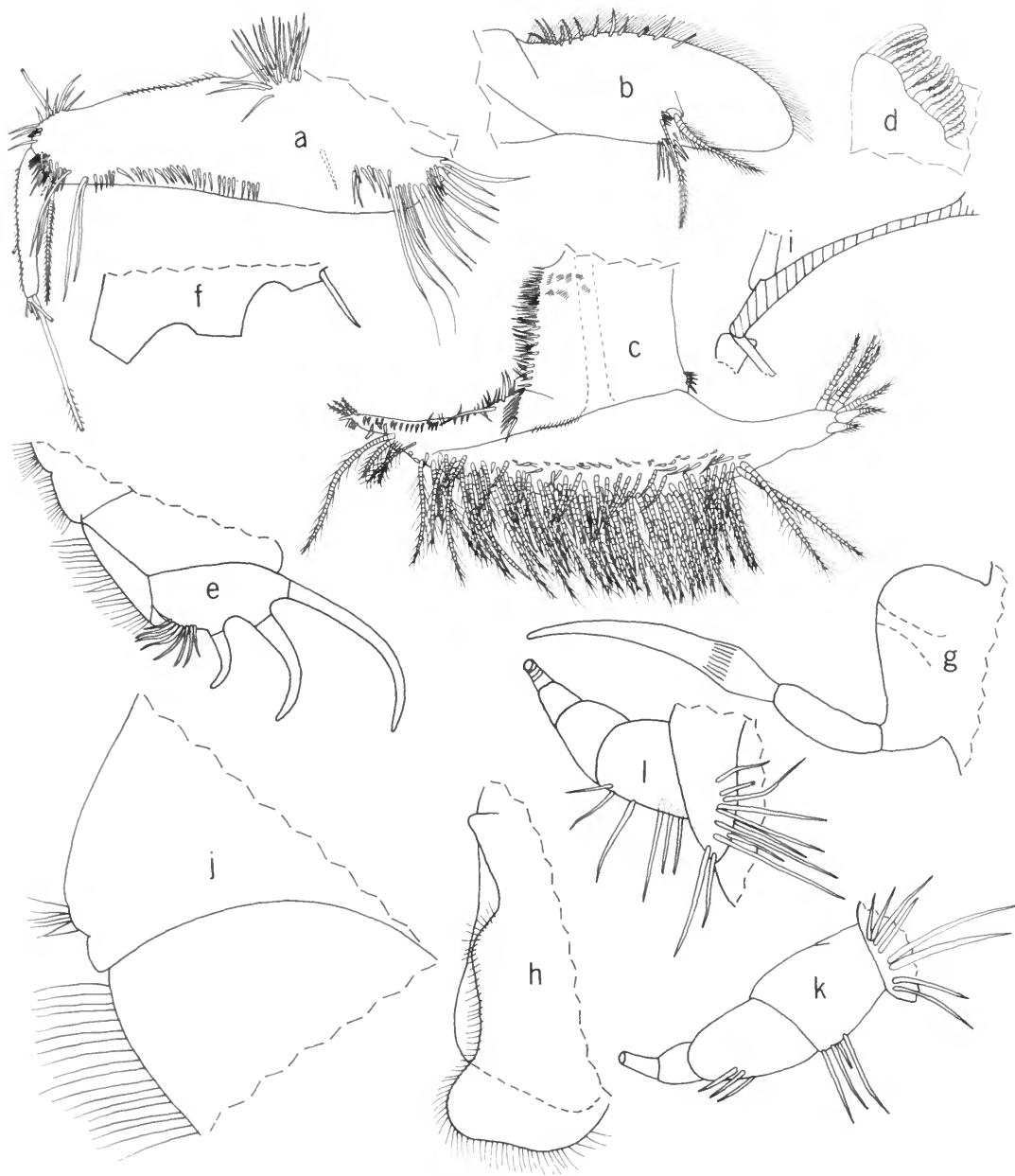


FIGURE 35.—*Leucoleberis mackenziei*, new species, female (adult or A-1 instar), paratype, USNM 156967: *a*, right maxilla (epipodial appendage not shown), medial view; *b*, comb of right 5th limb, lateral view; *c*, right 6th limb, medial view; *d*, comb of 7th limb (opposing similar comb not shown); *e*, right lamella of furca; *f*, distal part of left lamella of furca (claws not shown), lateral view; *g*, medial eye and rod-shaped organ; *h*, anterior of body showing anterior process and upper lip; *i*, right Y-sclerite, anterior to right; *j*, posterior of body. Female (early instar), USNM 157623: *k*, endopodite of right 2nd antenna, lateral view; *l*, endopodite of left 2nd antenna, medial view.

middle row with about 27 slightly longer bristles; anterior margin between upper and lower sutures with 7 bristles in medial row, about 12 bristles in lateral row, and 4 bristles in middle row (distal of these longer than others); anterior margin of skirt below lower suture with about 22 bristles forming single row; ventral margin of skirt and medial side near ventral margin with abundant bristles; posterior end of skirt with 6 bristles; 5 bristles in place of epipodial appendage; limb hirsute.

Seventh Limb: Each limb with about 168 bristles, 80–86 on each side; each segment commonly with 4 bristles, 2 on each side, rarely with 5 bristles, many with 1 to 3 bristles; each bristle with 3 to 8 bells. Terminus with opposing combs, each with about 34 spinous teeth (Figure 35d).

Furca (Figure 35e,f): Each claw with 3 strong claws followed by 8 bristles; anterior bristle of right lamella separated by space from 3rd claw; anterior bristle of left lamella immediately adjacent to 3rd claw; each claw with medial and lateral row of teeth of equal length along convex margins; bristles with paired weak and strong spines along each margin; concavity between claws 1 and 2 with maximum depth 25–28 percent of maximum width; concavity between claws 2 and 3 with maximum depth 33–35 percent of maximum width.

Rod-shaped Organ (Figure 35g): Elongate with suture proximal to middle, widening after suture and then tapering to rounded tip.

Eyes: Medial eye bare (Figure 35g). Lateral eye larger than medial eye, with ommatidia forming 5 rows, each with about 14 ommatidia.

Upper Lip (Figure 35h): Hirsute.

Posterior of Body: Thumblike dorsal process absent, but low mound in its place bearing few hairs shorter than hairs on posterior of body closer to furca (Figure 35j).

Y-Sclerite (Figure 35i): Slightly arcuate without branching.

Parasites: USNM 156967 with 1 cyproniscid isopod in marsupium.

Epizoa: USNM 156967 with vaselike stemmed protistan attached to tip of rostrum (Plate 21b).

DESCRIPTION OF ADULT MALE (Figures 36–38).—Carapace differing from that of female in

being more elongate and in having hairs forming a vertical row near posterior margin (Figures 36a, 38a).

Ornamentation (Figure 36b), *Infold*, *Dentition*, *Central Adductor Muscle Attachments* (Figure 38b): Similar to those of female.

Size: USNM 157127, length 5.4 mm, height 3.3 mm; USNM 157622, length 4.8 mm, height 3.3 mm.

First Antenna (Figure 36c): 1st joint with long hairs on medial and lateral surfaces near ventral margin. 2nd joint: dorsal margin with 4 or 5 bristles; lateral side with 5–9 distal bristles; medial side with abundant long hairs, some also along ventral margin. 3rd joint: long dorsal margin with 10–13 bristles; shorter ventral margin with 1 short bristle; medial side with few short spines forming rows. 4th joint: dorsal margin with 1 terminal bristle, ventral margin with 5 terminal bristles. 5th joint: sensory bristle long, stout, with abundant marginal filaments of which terminal filaments stouter than others (filaments longer than shown in illustrated limb). 6th joint: medial bristle longer than a-claw of 7th joint and with base near dorsal margin. 7th joint: a-claw about equal in length to combined joints 6–8 measured along ventral margin of limb; b-bristle about 3 times length of a-claw, with about 17 marginal filaments; c-bristle extremely long, with 45 filaments. 8th joint: d- and e-bristles broken on both limbs, longest stumps twice length of a-claw; f-bristle extremely long, about same length as c-bristle, with about 37 marginal filaments; g-bristle slightly longer than b-bristle, with 22 marginal filaments (not all shown in illustrated limb); proximal filaments of f- and c-bristles with narrow ringed central part and transparent marginal part, but margins not forming flare as in bristle illustrated by Poulsen (1965, fig. 90c) of *Cycloleberis bradyi* Poulsen, 1965.

Second Antenna (Figure 36d): Protopodite with short, medial, distal bristle, otherwise bare. Endopodite: elongate 1st joint with about 12–15 short proximal filaments and 5 or 6 short distal filaments; 2nd joint elongate with about 13 bristles, most longer than those of 1st joint; 3rd joint reflexed on 2nd, with 1 long proximal filament



FIGURE 36.—*Leuroleberis mackenziei*, new species, adult male, paratype, USNM 157127: *a*, complete specimen showing positions of lateral eye and central adductor muscle attachments (dashed), length 5.4 mm; *b*, surface structures (bristles and ridges) in anteroventral part of left valve as seen with $\times 10$ objective; *c*, right 1st antenna, lateral view; *d*, endopodite of right 2nd antenna, medial view; *e*, left mandible, medial view; *f*, tip of 7th limb; *g*, *h*, distal parts of left and right lamellae of the furca showing positions of 1st bristle relative to base of 3rd claw (claws not shown), lateral views.

and pointed tip with marginal ridges. Exopodite: joints 3–8 with basal spines one-half to two-thirds length of following joint, some spines with 2 prongs; lateral spine of 9th joint about same length as basal spine of 8th joint; bristles of joints 2–8 and bristles of 9th joint with natatory hairs but no spines; joints 2–8 with long hairs on distal dorsal corner. (The presence or absence of medial bristles on 1st joint and the number of bristles on the 9th joint were obscured on both limbs examined.)

Mandible (Figure 36e): Coxale endite similar to that of female. Basale endite with 1 long and 1 medium length end bristles, about 17 shorter bristles of triaenid type but with minute, terminal, paired spines, and about 8–11 bare bristles (last of these much longer than others). Basale: ventral margin with 11 or 12 triaenid type bristles (terminal paired spines minute) and 2 distal spinous bristles; medial surface near ventral margin with 3–7 small proximal bristles; dorsal half of medial side with long hairs; dorsal margin with about 17–19 short distal bristles (not all shown on illustrated limb) and 2 long subterminal bristles. Exopodite similar to that of female. Endopodite 1st joint with 8 ventral bristles. Endopodite 2nd joint: dorsal margin and medial surface near dorsal margin with abundant bristles (not all shown on illustrated limb); ventral margin with bristles forming 2 groups (proximal of the groups with 5 or 6 bristles forming row, other group with 2 bristles, neither group shown in illustrated limb). End joint similar to that of female.

Maxilla (Figure 37a): Epipodite pointed, reaching to about middle of dorsal margin of basale. Endite I with 3 stout and 2 small bristles; endite II with 1 slender and 2 stout bristles, all long; endite III with 4 stout bristles proximal to 8 or 9 small bristles. Basale: medial side near ventral margin with 24–31 small bristles proximal to 2 long bristles; medial side near distal margin with 1 long bristle and about 8–17 small bristles; ventral margin with 1 long terminal bristle; lateral surface with 1 short proximal bristle; hirsute dorsal margin with 11 or 12 proximal bristles, 1 very long, spinous, distal bristle, and 7 or 8 short, bare,

distal bristles; most bristles of basale bearing minute terminal spine. Exopodite consisting of minute lobe with 1 long and 2 short bristles (only 1 of the short bristles shown in illustrated limb). Endopodite: 1st joint spinous, with 1 short anterior bristle distal to middle, and long spinous beta-bristle; end joint with 6 spinous bristles.

Fifth Limb (Figures 37b, 38c,d): Dorsal margin of comb with curved process with pointed tip and 10–12 small bristles on, or proximal to, process; anterodorsal distal margin hirsute and curved, not square as in comb of *Cycloleberis bradyi* illustrated by Poulsen (1965, fig. 92a); lateral side of comb with 2 long spinous bristles and about 12 short bristles ventral to base of long bristles, and 2 short bristles near distal ventral corner; ventral margin of comb with bristles forming 2 rows except for distal 14 or 15 bristles that form single row (last 2 of these shown in Figure 37b).

Sixth Limb (Figure 37c): Bristles not counted, but limb similar to that of female except with only 5 bristles on posterior end of skirt.

Seventh Limb: Each limb with 86–117 bristles (41–60 on each side), each bristle with up to 9 bells; most segments with only 2 or 3 bristles; terminus consisting of opposing combs, each with about 20 spinous teeth.

Furca (Figure 36g,h): Each lamella with 3 strong claws followed by 8 short bristles; anterior bristle of right lamella separated by space from 3rd claw; anterior bristle of left lamella immediately adjacent to 3rd claw; concavity between claws 1 and 2 with maximum depth 23 percent of maximum width; concavity between claws 2 and 3 with maximum depth 28–30 percent of maximum width; teeth of main claws and spines of bristles similar to those of female.

Rod-shaped Organ, Eyes, Upper Lip, Posterior of Body, Y-Sclerite: Similar to those of female.

DESCRIPTION OF EARLY INSTAR (Figure 35k,l).—Carapace oval in lateral view.

Size: USNM 157623, length 3.2 mm, height 2.5 mm.

Second Antenna: Endopodite (Figure 35k,l): 1st joint divided by suture into proximal and distal parts; proximal part with 8–11 bristles of which



FIGURE 37.—*Leuroleberis mackenziei*, new species, adult male, paratype, USNM 157127: *a*, left maxilla, medial view; *b*, comb of left 5th limb, lateral view; *c*, right 6th limb, medial view.

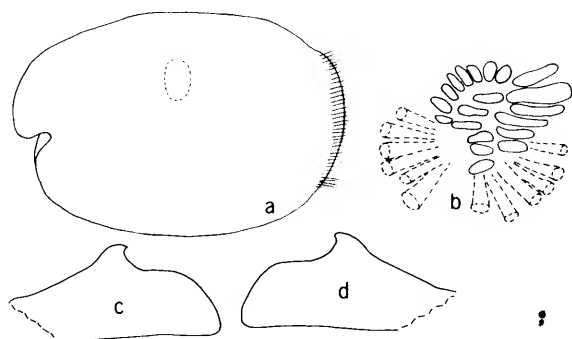


FIGURE 38.—*Leuroleberis mackenziei*, new species, adult male, paratype, USNM 157622: *a*, complete specimen showing position of lateral eye (dashed oval), length 4.8 mm; *b*, left ends of central adductor muscle attachments as seen with left valve removed, anterior to left; *c*, *d*, outlines of combs of right and left 5th limbs, lateral views.

some are fairly long; distal part with 4–6 bristles; 2nd joint with no or 3 bristles; short 3rd joint with long terminal bristle.

Sixth and Seventh Limbs: Well developed.

Furca: Each lamella with 3 stout claws followed by 6 bristles.

COMPARISONS.—Male: The distal end of the comb of the 5th limb of *Leuroleberis zealandica* is square, not rounded as on *L. mackenziei*; the only adult male known of *L. zealandica* is 7.1 mm long compared to a length of 4.8–5.4 mm for the 2 known adult males of *L. mackenziei*. Female: Some of the proximal bristles on the 1st joint of the endopodite of the 2nd antenna are longer than the distal bristles of the 1st joint, and are about twice the length of the bristles on the 2nd joint on *L. mackenziei*, whereas these bristles are about the same size on *L. zealandica*. The open bristle-pores on the outside of the valves of *L. zealandica* have several concentric rims, whereas the pores on *L. mackenziei* have only a single rim, but this difference is visible only at high magnifications.

Alphaleberis, new genus

ETYMOLOGY.—The name is derived from the Greek *alpha* (first letter of the Greek alphabet) plus *leberis* (“sloughed skin”) in reference to the unusual a-bristle of the 1st antenna on the type-species. Gender feminine.

TYPE-SPECIES.—*Alphaleberis alphathrix*, new species. Monotypic genus.

DISTRIBUTION.—Madagascar at depths of 6–18 m (Figure 39).

DIAGNOSIS.—Carapace oval in lateral view, with evenly rounded posterior, and anterior with deep incisur.

Ornamentation: Surface of valves with discontinuous ridges anterior to shallow porous fossae; each fossa with short bristle emerging from closed pore; additional bristle emerging from open pores with single rim sparsely distributed over valve surface. No vertical ridge present posterior to incisur. Anterior margin without scalloped rim.

First Antenna: a-bristle straight, ringed except in proximal part, pointed, bristlelike, not forming claw.

Fifth Limb: Dorsal margin of comb of female broadly convex, of male with curved process near middle and rounded process distal to middle.

Furca: Each lamella with 3 strong main claws followed by 8 secondary bristlelike claws.

COMPARISONS.—The new genus *Alphaleberis* differs from other genera in the tribe in having an a-bristle on the 1st antenna that is not clawlike.

16. *Alphaleberis alphathrix*, new species

FIGURES 8*p*, 10*k*, 40–43; PLATES 24–27

ETYMOLOGY.—The specific name from a combination of the Greek *alpha* (the letter a) plus *thrix* (“hair”) in reference to the bristle-like structure of the a-bristle of the 1st antenna.

HOLOTYPE.—USNM 157410, ovigerous female, on slides and in alcohol.

TYPE-LOCALITY.—Station BT-852, Madagascar.

ALLOTYPE.—USNM 150297, adult male, BT-622, Madagascar.

PARATYPES.—Madagascar: USNM 157411, 1 adult male, sta BT-602; 1 adult male, sta BT-730 deposited in Paris Museum; USNM 150297, 1 adult male, sta BT-622; USNM 157744, 1 juvenile, sta BT-620; USNM 157729, 2 specimens, sta BT-730; USNM 157746, 1 juvenile, sta BT 777; USNM 157743, 1 juvenile, sta BT-836;

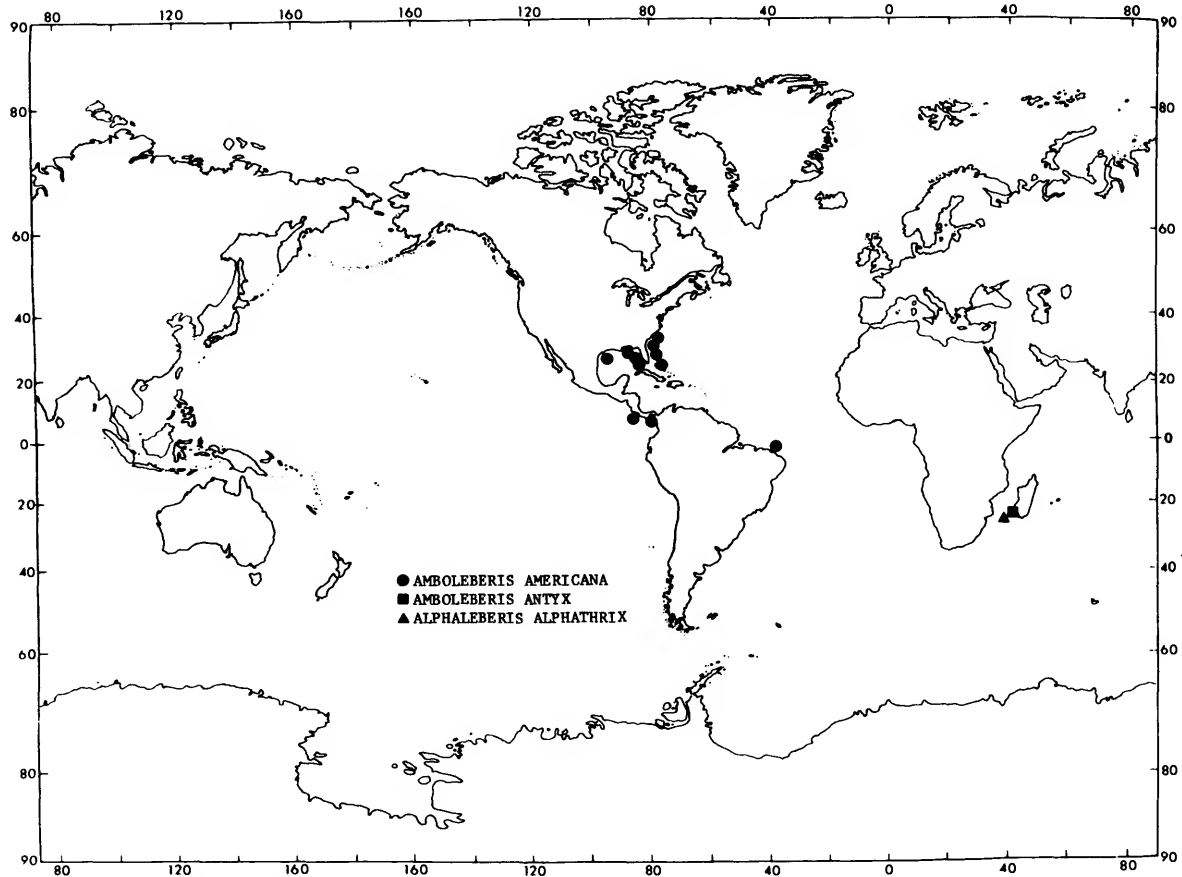


FIGURE 39.—Distribution map of species of *Amboleberis* and *Alphaleberis*.

USNM 157724, 1 female, sta BT-135; USNM 157751, 1 juvenile, sta BT-197; USNM 157741, 1 juvenile, sta BT-734; USNM 157410, 1 ovigerous female, sta BT-852; USNM 157265, 1 adult male, sta BT-227; 1 specimen deposited in Paris Museum, sta BT-227.

DISTRIBUTION.—Madagascar at depths of 6–27 m (Figure 39).

DESCRIPTION OF ADULT FEMALE (Figures 40–42, Plates 24–27).—Carapace oval in lateral view but dorsal margin fairly straight (Figure 40a); deep incisur at middle of anterior margin (Figure 40b, Plate 24a,b).

Ornamentation: Surface of valve with discontinuous ridges tending to be linear in anterior half of valve and with convex parts in posterior half

of valve (Plate 24a–d); small shallow fossae with short bristle present posterior to central part of each ridge (Plate 24e); additional bristles emerging from open-rimmed pores sparsely distributed over valve surface (Plate 25a–e); minute pores without bristles present (Plate 25a,e,f); anterior margin of valves dorsal and ventral to incisur without scalloped border (Plate 24a–d).

Infold: Rostral infold with about 110 long bristles and many minute bristles in addition to about 7 long bristles along distal part of list (Plate 26a,b); about 11 bristles between rostral list and upper edge of incisur; list starting below incisur, where it is close to inner margin of infold, then continuing along ventral margin, where it is close to valve edge, and then continuing along poste-

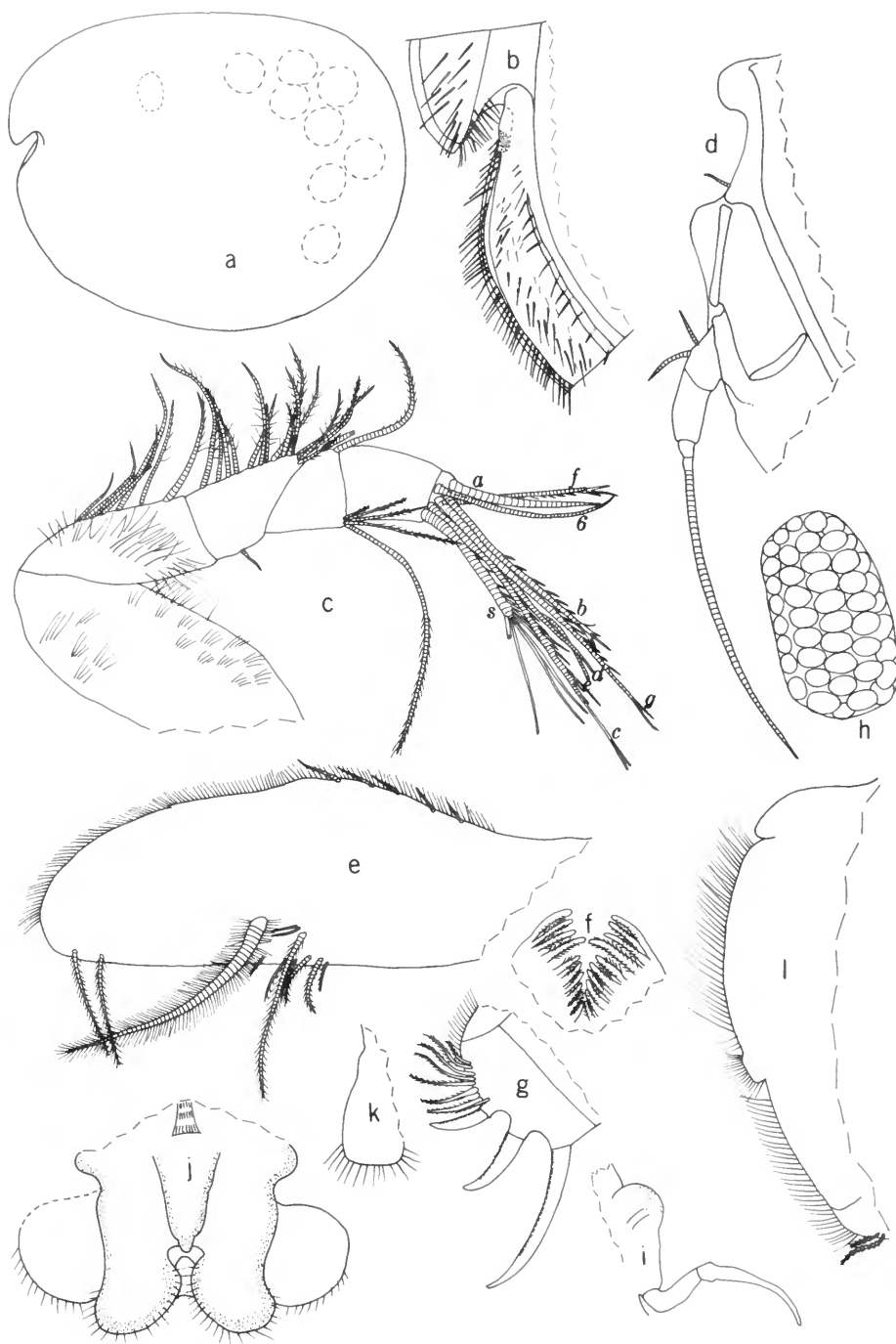


FIGURE 40.—*Alphaloberis alphathrix*, new species, ovigerous female, holotype, USNM 157410: *a*, complete specimen showing position of lateral eye (dashed oval to upper left) and eggs (dashed ovals to right), length 3.7 mm; *b*, inside view of anterior of right valve; *c*, left 1st antenna, medial view; *d*, distal part of protopodite, and endopodite of right 2nd antenna, medial view; *e*, comb of left 5th limb, lateral view; *f*, combs on 7th limb; *g*, right lamella of furca, lateral view; *h*, right lateral eye; *i*, medial eye and rod-shaped organ; *j*, upper lip, anterior view; *k*, upper lip, lateral view, anterior to left (lateral flap not shown); *l*, posterior of body showing posterior hairs and 2 posterior bristles of furca.

rior margin, where it is again close to inner margin of infold (Plate 26a); anterior half of list with wide lamellar prolongation; anteroventral list with about 13 long, slender, spinous bristles (Figure 40b, Plate 26a-c); about 30 long, slender, bare bristles and about 15 minute bristles between anteroventral list and edge of valve (Plate 26c); ventral list with about 40 short spinous bristles; about 25 bristles between ventral list and edge of valve; broad posteroventral and posterior list with about 40 long, stout, tubular bristles and many smaller bristles (Plates 26d-f, 27a-d); about 43 bristles forming row near posteroventral and posterior valve edge.

Selvage: Wide lamellar prolongation with minute spines along edge present along anterior margin of rostrum (Plates 24c, 27f); a similar selvage, although possibly narrower, continues along anteroventral, ventral, and posterior valve edge; selvage with long fringe present along dorsal margin anterior to anterior juncture (Plate 27e).

Central Adductor Muscle Attachment Scars: Typical for genus.

Size: USNM 157410, length 3.7 mm, height 2.9 mm.

First Antenna (Figure 40c): 1st joint with long hairs on medial and lateral surfaces. 2nd joint: medial surface with long proximal hairs; lateral surface with long hairs near ventral margin and 7-9 distal bristles; dorsal margin with 7 bristles and few long hairs. 3rd joint: long dorsal margin with 16 bristles; short ventral margin with 1 short bristle and few spines. 4th joint: dorsal margin with 1 long terminal bristle; ventral margin with 5 terminal bristles. Sensory bristle of long 5th joint with 3 short filaments followed by 12 long terminal filaments (the distal of the short filaments close to the proximal long terminal filament). 6th joint minute, with 1 bare medial bristle reaching past tip of a-bristle of 7th joint. 7th joint: a-bristle straight, tapering to a point, bare, annulate except near base, about equal in length to combined dorsal margins of joints 4-8, not clawlike; b-bristle not quite reaching tip of sensory bristle of 5th joint, with 9 dorsal filaments and 3 terminal filaments, all short; c-bristle reaching slightly past tip of sensory bristle, with 13

dorsal filaments and 2 terminal filaments, all short. 8th joint: d- and e-bristles bare with blunt tips not quite reaching tip of sensory bristle; g-bristle about same length as c-bristle, with 15 dorsal filaments and 2 terminal filaments, all short; f-bristle bent slightly dorsally, broken on both limbs of specimen examined, with 10 short ventral filaments on remaining part.

Second Antenna (Figure 40d): Protopodite: long hairs numerous on medial surface and along ventral and dorsal margins; distal medial bristle very small. Endopodite 3-jointed: 1st joint without proximal bristles and with 3 or 4 short distal bristles (not all shown in Figure 40d); well-defined 2nd joint bare; 3rd joint small, with long terminal bristle with blunt tip. Exopodite: 1st joint with minute teeth along inner margin, short faint spines forming rows on lateral and medial surfaces, and small, straight, terminal, medial spine; bristle of 2nd joint very long, about 3 times length of combined exopodial joints 2-9, with natatory hairs and proximal ventral spines; bristles of joints 3-8 with natatory hairs and proximal ventral spines; 9th joint with 5 bristles (3 long with natatory hairs and proximal ventral spines, 2 short with only natatory hairs); joints 3-8 with very small basal spines (spine on joint 8 about one-half length of 9th joint); lateral spine of 9th joint about same length as spine of 8th joint; spines forming row along terminal ends of joints 2-8 (mainly on lateral side).

Mandible (Figure 41): Coxale endite: small bristle present near base of ventral branch; ventral branch with proximal hairs on ventral margin and spines forming 5 or 6 oblique rows; tip of ventral branch with 5 minute teeth, dorsal of these with oblique tip; dorsal branch of endite broken off both limbs of specimen examined. Basale endite: tip of endite with about 4 end-type bristles with spines along most of margin; side of endite with about 12 triaenid bristles with 9-15 pairs of marginal teeth excluding terminal pair (teeth decreasing in length distally, and terminal pair only slightly larger than penultimate pair), and 3 dwarf bristles (proximal of these longer than others). Basale: ventral margin with 8-11 triaenid bristles (paired teeth slightly larger than



FIGURE 41.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410, left mandible (dorsal branch of coxale endite not shown), medial view.

those on triaenid bristles of basale endite) and distally, 1 minute, and 2 long spinous bristles; dorsal margin with spines and 6 or 7 bristles (4 or 5 short, 2 long); medial surface with abundant long hairs; lateral surface with long hairs near dorsal margin. Exopodite: hirsute distally; tip with minute peg and reaching past distal end of dorsal margin of 1st endopodial joint; ventral margin with 2 bare bristles (proximal of these longer than other). Endopodite: ventral margin of 1st joint with 8 bristles (7 of these forming row extending onto medial surface); ventral margin of 2nd joint with distal bristles forming 2 groups (3 bristles in proximal group, 2 in other); dorsal margin of 2nd joint with numerous bristles; medial surface of 2nd joint with abundant cleaning bristles, the larger 5 or 6 of these with stout marginal spines; end joint with 3 long bare claws, 1 long lateral bristle with ventral spines (this bristle is almost clawlike), and 2 spinous ventral bristles (1 of these short, the other about one-half the length of ventral claw).

Maxilla (Figure 42a): Epipodite with tapered tip almost reaching distal bristles on dorsal margin of basale. Endite I with 3 long stout bristles and 2 short slender bristles; endite II with 2 long stout bristles, endite III with 5 long stout bristles (proximal of these shorter than others); 5 slender bristles present just dorsal to bases of bristles of endite III. Basale: dorsal margin hirsute, with 3 short proximal bristles (these have bases on medial side) and 3 distal bristles (1 of these longer than others); medial side with proximal hairs, spines near ventral margin, and 4 distal bristles (3 short, 1 long, the latter near ventral margin); ventral margin with 12 short bristles, 2 long distal bristles, and 1 very long terminal bristle; lateral side with 1 short proximal bristle. Exopodite consisting of small lobe with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with 1 short bristle proximal to middle of anterior margin, and 1 long spinous beta-bristle; end joint with 6 terminal bristles.

Fifth Limb (Figure 40e): Dorsal margin of comb convex, hirsute (proximal dorsal hairs about same length as hairs on anterior end of comb), with 5 short bristles proximal to middle; medial side

with stout, spinous, exopodial bristle reaching tip of comb, a slender spinous bristle proximal to, and almost as long as, stout bristle, 4 minute bristles between the 2 long bristles, 5 short slender bristles near ventral margin proximal to the long slender bristle, and 2 short bristles near ventral margin in vicinity of distal end of comb.

Sixth Limb (Figure 42b): Medial side of antero-dorsal corner of limb with about 10 stout spines and additional slender spines forming rows; anterior edge of limb with 2 sutures (not visible in Figure 42b), upper of these more prominent; anterior edge dorsal to upper suture with bristles forming 2 rows (inner row with about 16 short, stout, spinous bristles, and outer row with about 29 longer and more slender spinous bristles; area between sutures with 7 slender spinous bristles along anterior edge (a continuation of outer row of bristles dorsal to upper suture) and 6 medial bristles (some of these fairly long); about 24 slender spinous bristles along anterior margin of skirt between lower suture and tip of skirt; about 40 long and short spinous bristles along ventral margin of skirt (bases of bristles on medial side of skirt); posterior tip of skirt with 4 or 5 fairly long spinous bristles; skirt hirsute; 2 short bristles present in place of epipodial appendage.

Seventh Limb: Each limb with 85–92 bristles; each bristle with up to 9 bells; each joint with 2 bristles, 1 on each side, but some joints with as many as 4 bristles, 2 on each side. Terminus with opposing combs, each with about 20 teeth of various types (Figure 40f).

Furca (Figure 40g): Each lamella with 3 main claws followed by 8 secondary bristle-like claws; anterior, small, secondary claw close to posterior main claw on right lamella and some distance from it on left lamella; teeth on main claws consisting of large teeth with none or 1 or 2 minute teeth between them; depth of concavity between main claws 1 and 2 about 55 percent of its width; depth of concavity between main claws 2 and 3 about 78 percent of its width; secondary claws with spines or teeth along anterior and posterior margins; ventral margin of lamella between and following secondary claws hirsute.

Rod-shaped Organ (Figure 40i): Elongate with 1



FIGURE 42.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410: *a*, left maxilla (epipodial appendage not shown), medial view; *b*, right 6th limb, medial view.

suture proximal to widened middle part, then tapering to rounded tip.

Eyes: Medial eye bare, pigmented (Figure 40i). Lateral eye larger than medial eye, pigmented black, with 45 ommatidia (Figure 40h).

Upper Lip (Figure 40j,k): Lobes hirsute without spines, saddle without spines; a hirsute lateral flap on each side of mouth.

Posterior of Body (Figure 40l): Hirsute but without dorsal process.

Eggs: USNM 157410 with 32 eggs in marsupium (some eggs shown in Figure 40a).

DESCRIPTION OF ADULT MALE (Figure 43).—Carapace slightly more elongate than that of adult female and with hairs forming vertical row near posterior end (Figure 43a).

Ornamentation: Similar to that of adult female.

Infold: Not examined in detail but, in general, similar to that of adult female.

Central Adductor Muscle Attachments (Figure 43b): Typical for subfamily.

Size: USNM 150297, length 3.74 mm, height 2.59 mm; USNM 157411, length 3.4 mm, height 2.5 mm; USNM 157625, length 3.9 mm, height 2.9 mm.

First Antenna (Figure 43c): 1st joint with medial hairs near ventral margin. 2nd joint with hairs on medial and lateral surfaces and proximally on dorsal margin; dorsal margin with 5 or 6 bristles; lateral surface with 5 distal bristles. 3rd joint with 11 or 12 bristles on long dorsal margin, 1 small bristle on short ventral margin, and few proximal hairs on medial side. 4th joint with 6 terminal bristles (1 dorsal, 5 ventral). Sensory bristle of 5th joint with abundant filaments, those at terminal end slightly thicker than others. Medial bristle of 6th joint bare, with base near dorsal margin, about same length as combined joints 5–8. 7th joint: a-bristle tapering to point, bristlelike, annulated except proximally, with base on short pedestal; b-bristle about twice length of a-bristle, with 15 marginal filaments; c-bristle very long, with about 45 marginal filaments (filaments annulate proximally and with very narrow flare proximally). 8th joint: d- and e-bristles bare, shorter than b-bristle; f-bristle similar to c-bristle;

g-bristle longer than b-bristle, with about 18 marginal filaments.

Second Antenna (Figure 43d): Protopodite bare except for small distal medial bristle. Endopodite 3-jointed: 1st joint with 4–7 short bristles near middle and no proximal bristles; 2nd joint with 6–9 short distal bristles; 3rd joint reflexed on 2nd, with 1 long proximal bristle and tip with minute ridges. Exopodite: joints 2–8 with tufts of long hairs terminally on inner margin; all bristles with natatory hairs but without spines; 2nd joint somewhat longer than that of female, limb otherwise similar to that of adult female.

Mandible: Coxale endite (Figure 43e): Small bristle present near base of ventral branch; ventral branch with few proximal hairs on ventral margin, spines forming 5 or 6 oblique rows, and tip with 4 minute teeth (1 of these about one-half length of others) ventral margin of dorsal branch with 2 rows with few lateral spines proximal to 3 nodes, followed by 5 backward-pointing processes; tip of dorsal branch with terminal bristle with only few hairs; dorsal margin of branch with few serrations distal to middle. Basale endite: tip with about 3 end-type bristles (1 of these much longer than others); tip and ventral margin with about 13 triaenid bristles; medial side with 4 dwarf bristles forming widely spaced row (proximal bristle longer than others). Basale: ventral margin with 7 or 8 triaenid bristles proximal to 2 longer spinous bristles; dorsal margin with 5 distal bristles (3 short, bare, 2 long, spinous); medial surface with long medial hairs on proximal dorsal part of joint. Exopodite: spinous tip just reaching, or extending past, distal edge of 1st endopodite joint, with 2 ventral bristles (proximal of these slightly longer than other). Endopodite: 1st joint with 8 ventral bristles; ventral margin of 2nd joint with bristles forming 2 distal groups (3 or 4 bristles in proximal group, 2 in other); dorsal margin and medial side of 2nd joint with abundant bristles (cleaning bristles with stout marginal spines present on adult female not observed on adult male); end joint similar to that of adult female.

Maxilla: Epipodite with tapered tip reaching



FIGURE 43.—*Alphaleberis alphathrix*, new species, adult male, allotype, USNM 150297: *a*, complete specimen showing positions of lateral eye and central adductor muscle attachments, length 3.74 mm; *b*, left ends of central adductor muscles as seen through left shell, anterior to left; *c*, right 1st antenna, lateral view; *d*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *e*, coxale endite of right mandible, medial view; *f*, comb of left 5th limb, lateral view; *g*, *h*, distal parts of left and right lamellae of furca showing position of 1st bristle relative to 3rd claw (claws not shown), lateral views; *i*, anterior of body showing medial eye, rod-shaped organ, and upper lip; *j*, right Y-sclerite, anterior to right.

well past middle of dorsal margin of basale. Endite I with 3 long stout bristles distal to 2 slender bristles about one-half length of stout bristles; endite II with 2 stout bristles and 1 slender bristle about one-half length of the 2 stout bristles (slender bristle between bristles on endites I and II and could be considered to be on endite I); endite III with 4 stout bristles; 2-4 slender bristles present just dorsal to bases of bristles of endite III. Basale: dorsal margin hirsute, with 4 fairly short proximal bristles (these have bases on medial side of basale) and 1 long and 2-4 short distal bristles; medial side with proximal hairs, faint spines forming distal rows, and 3-4 distal bristles (2-3 short, 1 long, the latter near ventral margin); ventral margin with 7-11 short bristles, 2 long distal bristles, and 1 very long terminal bristle; lateral side with 1 short proximal bristle. Exopodite consisting of small lobe with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with 1 short bristle proximal to middle of anterior margin, and 1 long beta-bristle; end joint with 5 bristles.

Fifth Limb (Figure 43f): Dorsal margin of comb with curved process near middle and rounded process distal to middle; sclerotized internal structure similar to that of *Cycloleberis squamiger* (Scott, 1894) (see Kornicker and Caraion, 1974, figs. 30a, 31h); 4 or 5 minute bristles present on dorsal margin posterior to tip of curved process; anterior margin of comb hirsute; ventral and anteroventral margins with abundant bristles. Lateral surface: stout, spinous, epipodial bristle near middle with tip reaching just past anterior end of comb; 1 long, slender, spinous bristle just proximal to base of stout epipodial bristle; area between the 2 long bristles with 5 minute bristles; 5 or 6 small bristles present near ventral margin of comb ventral to base of the long, slender, spinous bristle; 2 short spinous bristles near ventral margin at anteroventral corner of comb.

Sixth Limb: Medial side of anterodorsal corner of limb with about 11 stout spines and additional slender spines forming rows; medial row along anterior margin of trunk dorsal to upper suture with 14 short, stout, spinous bristles; 26 longer

and more slender spinous bristles along anterior edge of trunk dorsal to upper suture; area between upper and lower anterior sutures with 3 spinous medial bristles and 5 slender, spinous, marginal bristles; anterior margin of skirt between lower suture and anterior tip of skirt with about 18 short, slender, spinous bristles; lateral flap with 6 short, slender, hirsute bristles; anterior edge of skirt, just within marginal row of short slender bristles, with 4 long stout bristles having slender marginal spines; ventral margin of comb with about 60 bristles of varying lengths, all with spines (the longer of these bristles along edge of margin and with stout marginal spines; shorter bristles forming rows dorsal to longer bristles and with more slender marginal spines); marginal bristles separated by space from posterior end of skirt; 5 or 6 fairly long hirsute bristles present on posterior tip of skirt; limb hirsute; 2 or 3 short bare bristles present in place of epipodial appendage.

Seventh Limb: Each limb with 59-61 bristles, 28-31 on each side, each bristle with up to 8 bells; each joint generally with 2 bristles, 1 on each side, many bristles very short with only 1 or 2 bells. Terminus with opposing combs, each with about 20 teeth of various types.

Furca (Figure 43g,h): Similar to that of adult female except anterior secondary claw close to posterior main claw on left lamella and some distance from it on right lamella (the reverse of the relative position of the claws on the adult female); depth of concavity between main claws 1 and 2 39-44 percent of maximum width; depth of concavity between main claws 2 and 3 56-74 percent of maximum width.

Rod-shaped Organ (Figure 43i): Similar to that of adult female.

Eyes: Medial eye similar to that of adult female (Figure 43i). Lateral eye darkly pigmented, about 1.5 times longer than that of adult female, with about 58 ommatidia forming 5 rows, each with 10-13 ommatidia (outline shown in Figure 43a).

Upper Lip: Differs from that of female in having several minute spines on anterior of lobes and saddle (Figure 43i).

Posterior of Body: Similar to that of adult female.

Y-Sclerite (Figure 43j): Posterior end forming sharp angle in vicinity of dorsal socket; anterior part unbranched, concave ventrally.

TETRALEBERIDINI, new tribe

COMPOSITION.—The Tetraleberidini contains 2 genera: *Tetraleberis*, new genus, and *Amboleberis*, new genus.

DISTRIBUTION.—Japan, Taiwan Bank, East China Sea, Australia, Malaysia, Madagascar, Somalia, Zanzibar, Tanzania, Bab el Mandeb, in Pacific Ocean off Panama and Costa Rica, in Gulf of Mexico off Florida and Texas, in west Atlantic Ocean off Georgia, Florida, Bahamas,

Dry Tortugas, Brazil, Belize (Figures 39, 44). Depth: range surface to about 65 m.

REMARKS.—Tseng (1978:232) proposed a new species, *Cycloleberis poani*, for a single specimen collected from Taiwan Bank. Although he considered it to be a female, the illustrated endopodite of the 2nd antenna shows it to be a juvenile male (probably an A-1 instar). This species differs from other members of the *Tetraleberidini* in not having a bristle between the 3rd and 4th claws of the furca. I believe that the study of additional specimens is needed to better define this species, which, except for the furca, closely resembles *Tetraleberis brevis*. Tseng's publication was received by me too late for inclusion of the species in maps and tables and elsewhere herein. I tentatively

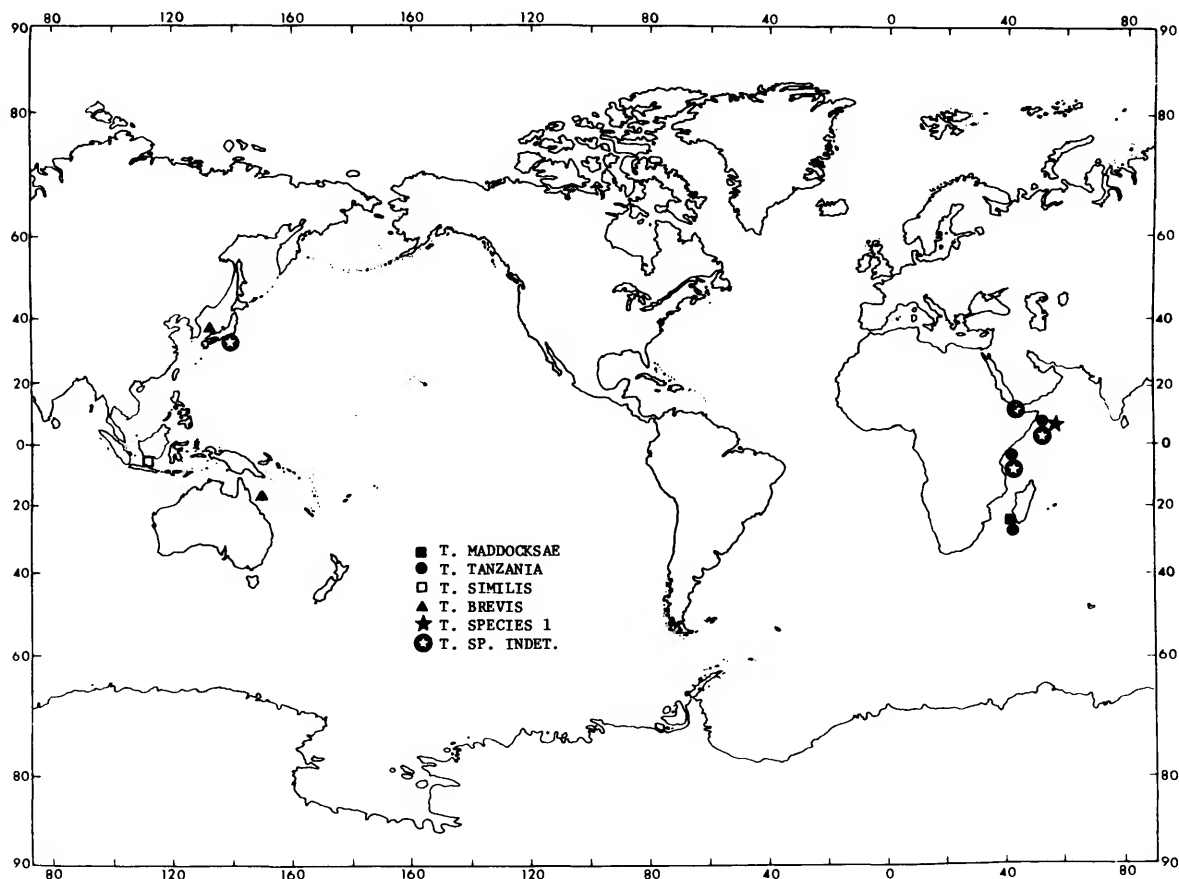


FIGURE 44.—Distribution map of species of *Tetraleberis*.

refer this species to *Tetraleberis poani* (Tseng). In the legend to figure 77, Tseng (1978:237) named the species *Cycleberis greashien*, evidently a lapsus; herein put in the synonymy of *Tetraleberis poani*.

DIAGNOSIS.—Carapace of females and juveniles with evenly rounded posterior. Vertical ridge posterior to incisur present (*Amboleberis*) or absent (*Tetraleberis*).

First Antenna: Fifth joint: dorsal margin with single node (*Tetraleberis*), without nodes or with 3–6 nodes (*Amboleberis*). Seventh joint: a-bristle clawlike, generally bare, rarely pectinate (*Tetraleberis* species 1, *Amboleberis antyx*).

Fifth Limb: Dorsal margin of comb of female

weakly convex, of male with single process (except for male of *Amboleberis antyx*, which is without dorsal process).

Seventh Limb: Terminus with single set of opposing combs.

Furca: Each lamella with 3 stout main claws usually followed by 1 short bristle, a 4th main claw, and then bristle-like secondary claws.

COMPARISONS.—The new tribe differs from Cycloleberidini in having only 1 bristle between claws of the furca, and in having the terminus of the 7th limb with only a single set of opposing combs. It differs from the tribe Cycloleberidini in having a bristle between main claws 3 and 4 of the furca.

Key to Genera in the Tribe Tetraleberidini

- Carapace with vertical ridge posterior to incisur and intersecting ventral margin of valve *Amboleberis*, new genus
Carapace without vertical ridge posterior to incisur . *Tetraleberis*, new genus

Tetraleberis, new genus

ETYMOLOGY.—The name is derived from the Greek *tetra* (“four”) plus *leberis* (“sloughed skin”) in reference to the 4 main claws on species of this genus. Gender Feminine.

TYPE-SPECIES.—*Asterope brevis* Müller, 1890.

COMPOSITION AND DISTRIBUTION.—*T. brevis*: off Japan, and in Coral Sea. *T. similis*: Java Sea. *T. tanzania*: off Tanzania, Somalia, and Madagascar, Indian Ocean. *T. species 1*: off Somalia, Indian Ocean. *T. maddocksae*: Madagascar. *T. species indeterminate*: Japan, Somalia, Zanzibar Island, Bab el Mandeb (Figure 44). Depth 3–65 m.

DIAGNOSIS.—Carapace without vertical rib pos-

terior to incisur.

First Antenna: 5th joint: dorsal margin with teeth forming row (*T. species 1*) or with single prominent node (remaining species). 7th joint: a-bristle clawlike, pectinate along dorsal margin (*T. species 1*) or bare (remaining species).

Second Antenna: Bristles of exopodial joints 3–8 without spines along ventral margin (*T. similis*) or with spines (remaining species).

Furca: Each lamella with 3 main claws usually followed by 1 short bristle, 1 short main claw, and then bristlelike secondary claws.

COMPARISONS.—The new genus *Tetraleberis* differs from *Amboleberis* in not having a vertical ridge posterior to the inner end of the incisur.

Key to Species of *Tetraleberis*

1. Dorsal margin of 5th joint of 1st antenna with numerous minute teeth forming row 21. *T. species 1*
Dorsal margin of 5th joint of 1st antenna with single node 2
2. Bristles on joints 3–8 of exopodite of 2nd antenna without ventral spines 18. *T. similis*
Bristles on joints 3–8 of exopodite of 2nd antenna with ventral spines* . 3
3. Sensory bristle of 5th joint of female 1st antenna with 2–4 short marginal filaments 17. *T. brevis*

- Sensory bristle of 5th female 1st antenna with 6–7 short marginal filaments 4
4. Bristles on joints 3–8 of exopodite of 2nd antenna with slender ventral spines, some epipodial bristles of 6th limb of female very long 19. *T. maddocksaе*, new species
- Bristles on joints 3–8 of exopodite of 2nd antenna with stout ventral spines, epipodial bristles of 6th limb of female of normal length 20. *T. tanzania*, new species

* Adult males may not have spines.

17. *Tetraleberis brevis* (Müller, 1890), new combination

FIGURES 8c, 16i, 45–48; PLATES 28–33

Asterope brevis Müller, 1890:239, pls. 25: figs. 10, 14; 26: fig. 7; 27: figs. 7–10, 12, 15, 16.

Cyclasterope brevis.—Müller, 1906:33, 35; 1912:48, 49.—Hanai, 1959:425.

Cylindroleberis brevis.—Kajiyama, 1912b:617, figs. 32, 33.

Cycloleberis brevis.—Skogsberg, 1920:442.—Poulsen, 1965:245, figs. 83, 84.—Hanai, et al, 1977:81.—Not Brady, 1902:183, pl. 24: figs. 16–22 [= *Amboleberis americana* (Müller, 1890)].

HOLOTYPE.—None selected (16 syntypes).

TYPE-LOCALITY.—Coast of Japan near Enoshima at a depth of 21.9 m.

MATERIAL.—Through the courtesy of Dr. H. E. Gruner, I received from the Zoological Museum, Berlin, a vial labeled “Types, Kat. Nr. 6909, Species *Cyclasterope brevis* (G. W. Müller, 1890), Fundort Japan, Enosima, gesammelt von Hilgendorf, determiniert von G. W. Müller”. The vial contained a 2nd vial with 13 whole specimens, mostly juveniles, 1 incomplete specimen that had been removed from the shell, 1 empty carapace, 1 left 2nd antenna, and 1 right maxilla. The largest whole specimen, an adult or A-1 female with small unextruded eggs, is described herein; it has been designated specimen 1 on the slides and vial returned to Berlin.

Through the courtesy of Dr. Torben Wolff, I received from the Zoological Museum of the University of Copenhagen, a specimen identified as *Cycloleberis brevis* by Poulsen (1965:245). The specimen was netted at *Dana* station 3668, 21°03'30"S, 149°45'E, Coral Sea, at 38 m water depth. The vial I received contained a right valve,

a left 1st antenna, a left 2nd antenna, a right mandible and the proximal part of a left mandible, a right 5th limb, the upper lip and furca, all of *C. brevis*. The vial also contained the valves of a halocyprid. A supplementary description of the specimen of *C. brevis* based on the available appendages is presented herein. I think it possible that this specimen represents a new species, but additional material is necessary to document this.

DISTRIBUTION.—Japan and Coral Sea. Depth 21.9–38 m (Figure 44).

DESCRIPTION OF FEMALE SYNTYPE, SPECIMEN 1 (Adult or A-1 instar) (Figures 45–47, Plates 28–33).—Carapace oval in lateral view with small incisur near middle of anterior margin (Figure 45a, Plate 28a,c–f); valve widest posterior to middle (Plate 28b), and more-or-less evenly rounded in anterior view (Plate 28c).

Ornamentation: Anterior margin without scalloped peripheral ridge (Plates 28c, 29a); surface without fossae or ridges; punctae visible at high magnification (Plate 29b–f); bristles emerging from open pores with rim consisting of concentric rings (Plate 29c,d), and from open pores with low pustulose rim (Plate 29e,f); minute open pores without bristles, but with low narrow rim, sparsely distributed on valve surface (Plate 29b); minute open pores also observed on some rims consisting of concentric rings (Plate 29d).

Infold: Typical for genus (Plates 30–31).

Central Adductor Muscle Attachments: Typical for subfamily (Figure 45b, Plates 32–33).

Size: Length and height of specimen 1: 3.56 mm, 3.00 mm. Range for 3 syntypes (see Table 20): length 3.25–3.56 mm, height 2.68–3.00 mm.

First Antenna (Figures 45c, 46a): 1st joint with

long lateral and medial hairs near ventral margin, and minute spines forming medial row near distal margin. 2nd joint: long medial and lateral hairs near ventral margin; dorsal margin with long proximal hairs and 5 bristles; lateral side with 5 or 6 bristles. 3rd joint: short ventral side with small bristle; long dorsal margin with 13 spinous bristles. 4th joint: short dorsal margin with 1 long spinous bristle; long ventral margin with 5 terminal bristles (1 long, 4 short). 5th joint: dorsal margin with stout sclerotized node proximal to middle; medial side with few long hairs distal to node; sensory bristle of 5th joint with 2 or 3 short proximal filaments and 14 or 15 long terminal filaments. 6th joint with spinous medial bristle extending past tip of a-bristle of 7th joint. 7th joint: a-bristle clawlike, bare, slightly longer than dorsal margin of 5th joint; b-bristle stout, about one and one-half times longer than a-bristle, with about 13 filaments including tip; c-bristle longer than sensory bristle of 5th joint, with tip broken but 13 filaments on remaining part. 8th joint: d- and e-bristles bare, with blunt tips reaching tip of sensory bristle; f-bristle about two-thirds length of c-bristle, with 12 ventral filaments; g-bristle about same length as c-bristle, with about 17 marginal filaments, excluding tip.

Second Antenna (Figure 45*d,e*): Protopodite with long hairs along ventral margin and on medial surface near ventral margin, and 1 short, bare, distal, medial bristle. Endopodite: 1st joint divided into proximal part with 3 small bristles, and distal part with 6 short bristles; 2nd joint bare, with well-defined sutures separating it from 1st and 3rd joints; 3rd joint with long terminal bristle. Exopodite: 1st joint with spines along dorsal margin, and 1 minute, straight, terminal, medial spine; bristle of 2nd joint about same length as 1st joint, with abundant short hairs along both margins; bristles of joints 3–8 with natatory hairs and stout proximal ventral spines; 9th joint with 5 bristles (3 long, with proximal ventral spines and natatory hairs, 2 short, with only natatory hairs); joints 2–8 with large basal spines; 9th joint with lateral spine about two-thirds length of joint; joints 2–8 with spines forming row along distal margin.

Mandible (Figure 46*b*): Coxale endite remained in mouth of specimen examined (Figure 46*e*); medial bristle near base of ventral branch fairly long. Basale endite: tip of endite with 6 end-type bristles with several sets of marginal spines, and 2 intermediate bristles with about 30 minute paired spines along distal part; ventral margin of endite with 10 triaenid bristles with 11–14 paired terminal teeth decreasing in length distally; medial side of endite with 6 dwarf bristles (distal of these longer than others). Basale: ventral margin with 9 or 10 triaenid bristles similar to those of endite followed by 2 or 3 longer spinous bristles; dorsal margin with 9 short bristles and 2 long, spinous, terminal bristles; medial side hirsute, with 3 or 4 minute bristles near ventral margin. Exopodite hirsute, reaching distal end of 1st endopodite joint, with 2 ventral bristles (distal of these short). Endopodite: 1st joint with 8 ventral bristles (1 of these very small); ventral margin of 2nd joint with bristles forming 2 distal groups (3 bristles in proximal group, 2 in other); dorsal margin of 2nd joint and medial surface near dorsal margin with numerous bristles (3 of the cleaning bristles with broad marginal spines); medial surface of 2nd joint with few short distal spines forming row; end joint with 3 long claws, 1 long lateral mid-bristle, and 1 long and 1 short ventral bristle.

Maxilla (Figure 47*a*): Epipodite with faint hairs, and tip reaching distal bristles on dorsal margin of basale. Endite I with 4 stout bristles; endite II with 1 small bristle and 2 long stout bristles; endite III with 1 long stout bristle and 3 long, fairly slender bristles; 8 or 9 short slender

FIGURE 45.—*Tetraleberis brevis* (Müller), female (adult or A-1 instar), syntype, Zoological Museum Berlin 6909 (specimen 1): *a*, complete specimen showing location of central adductor muscle attachments (lower dashed circle) and lateral eye (upper dashed circle); *b*, central adductor muscle attachments as seen through right valve, anterior to right; *c*, left 1st antenna, medial view; *d*, endopodite of left 2nd antenna, medial view; *e*, exopodite of right 2nd antenna (bristles left off), lateral view; *f*, right lamella of furca, lateral view; *g*, *h*, left and right lateral eyes; *i*, anterior of body showing medial eye, proximal part of rod-shaped organ, and upper lip; *j*, posterior of body showing posterior hairs and 2 posterior bristles of right lamella of furca; *k*, right Y-sclerite, anterior to right.

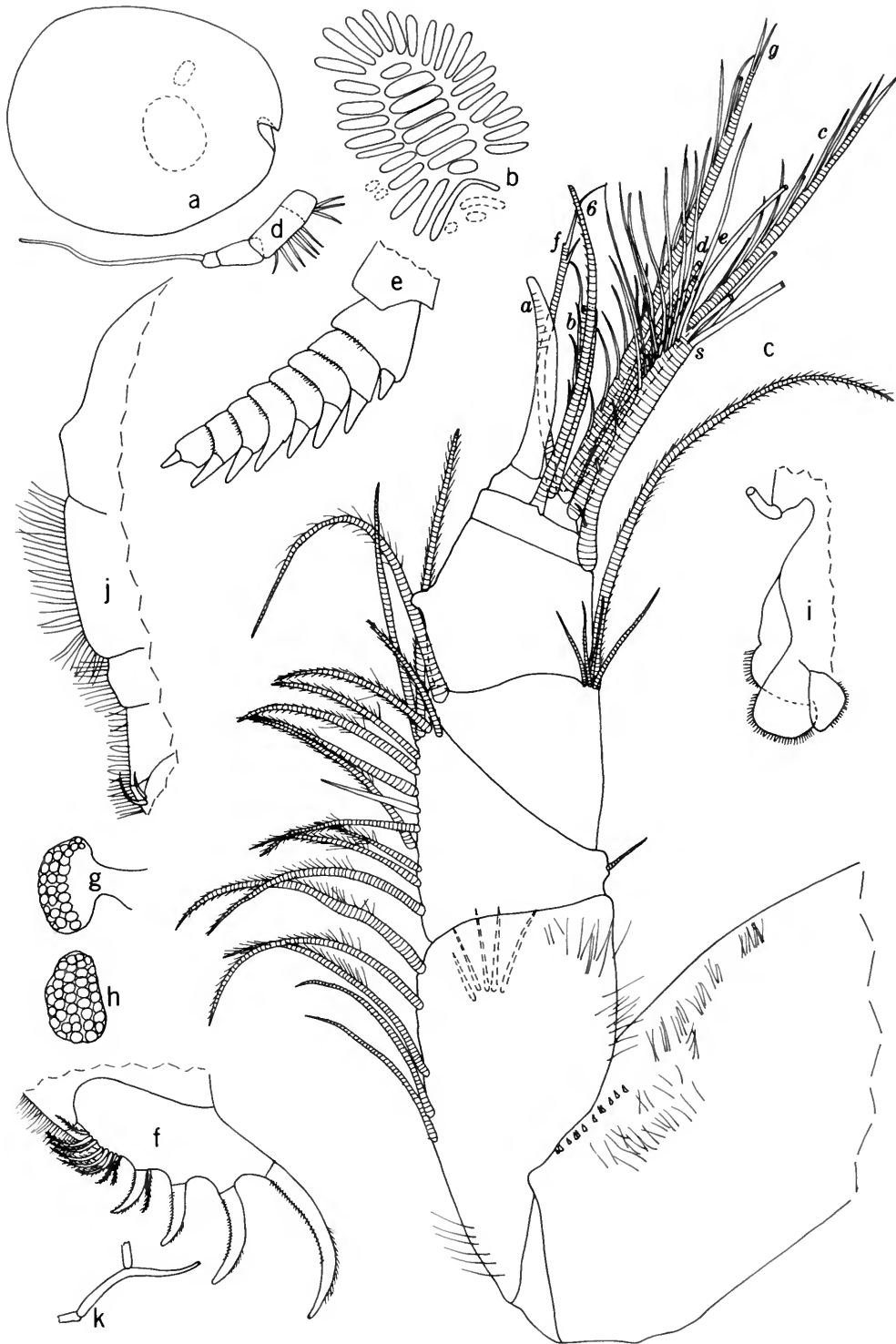




FIGURE 40.—*Tetraleberis brevis* (Müller), female (adult or A-1 instar), syntype, Zoological Museum Berlin 6909 (specimen 1): *a*, distal end of right 1st antenna, lateral view; *b*, left mandible (coxale endite not shown), medial view; *c*, terminus of 7th limb; *d*, medial eye and rod-shaped organ; *e*, posterior view of upper lip showing position inside the esophagus of ventral branch of coxale endite of both mandibles.



FIGURE 47.—*Tetraleberis brevis* (Müller), female (adult or A-1 instar), syntype. Zoological Museum Berlin 6909 (specimen 1): *a*, left maxilla, medial view; *b*, comb of right 5th limb, lateral view; *c*, left 6th limb, medial view.

bristles present mostly anterior to bases of bristles of endite III. Basale: dorsal margin hirsute, with 10–13 proximal bristles with bases on medial side, and 6 or 7 distal bristles; ventral margin with 12 or 13 short bristles, 2 long distal bristles, and 1 long, spinous, terminal bristle; medial surface with 5 distal bristles (longest of these near ventral margin); lateral side with 1 short proximal bristle. Exopodite: short lobe with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with 2 short, proximal, anterior bristles and 1 long spinous beta-bristle; end joint with 6 spinous bristles.

Fifth limb (Figure 47*b*): Dorsal margin of comb slightly convex, with abundant short hairs that continue along anterior margin, and 4 or 5 small proximal bristles; lateral side with stout, spinous, exopodial bristle almost reaching distal end of comb, 3 minute bristles just posterior to base of stout exopodial bristle, 8 small bristles near ventral margin just posterior to base of stout exopodial bristle, and 2 proximal and 2 distal bristles with bases almost on ventral margin; ventral margin with spinous bristles forming 2 rows (lateral row longer than medial row) except anteriorly where 6 bristles form single row (bristles in medial row with long flaring hairs near tip).

Sixth Limb (Figure 47*c*): Anterior margin with well-defined upper and lower sutures. Anterior margin dorsal to upper suture with bristles forming 3 rows: inner medial row with 18 short, stout, spinous bristles; middle row with 20 slender spinous bristles (distal of these longer than others); outer row with about 23 short, very slender, spinous bristles. Anterior margin between upper and lower sutures with 4 spinous bristles in inner row, 3 or 4 spinous bristles in middle row (the distal of these very long), and 8 short, slender, spinous bristles in outer row. A single row of about 24 slender bristles present near anterior margin of skirt between lower suture and point near ventral margin of skirt. Lateral flap with 5 or 6 slender hirsute bristles. Ventral margin of skirt with numerous bristles continuing almost to posterior tip of skirt. Posterior tip with 4 or 5 short, stout, hirsute bristles. Numerous small bristles present on medial surface near ventral margin

of skirt. Five small bare bristles in place of epipodial appendage. Limb hirsute. No medial spines present in anterodorsal corner of trunk.

Seventh Limb: Each limb with 96–102 bristles, 48–52 on each side, each bristles with up to 7 bells; most bristle-bearing joints with 2 bristles, 1 on each side, but many distal joints with 3 or 4 bristles, 1 or 2 on each side. Terminus with opposing combs, each with about 24 teeth of various types.

Furca (Figure 45*f*): Each lamella with 4 stout main claws, 1 slender, spinous bristle between claws 3 and 4 (closer to claw 4), and 9 additional slender bristles following claw 4, main claws with teeth of equal length forming medial and lateral row along concave margin; some adjacent teeth with minute tooth between them; main claws with hairs along convex margin; bristle between claws 3 and 4 shorter than claw 4; bristles with stout and slender spines along margins; anterior margin of each lamellae with few hairs; long hairs along edge of joined lamellae posterior to bristles; space between claw 4 and following bristle wider on right lamella than on left.

Rod-shaped Organ (Figure 46*d*): Elongate with suture proximal to widened middle part, tapering to rounded tip (proximal part shown in Figure 45*i*).

Eyes: Medial eye without dark pigment, bare (Figures 45*i*, 46*d*). Lateral eye about same size as medial eye, pigmented light amber on preserved specimen, with about 40 ommatidia (Figure 45*g,h*).

Upper Lip (Figures 45*i*, 46*e*): Each lobe with few slender, hairlike, anterior spines, and long hairs along ventral and posterior surfaces; anterior of saddle also with few short hairlike spines; hirsute lateral flap present on each side of mouth.

Posterior of Body (Figure 45*j*): Hirsute.

Y-Sclerite (Figure 45*k*): Convex, dorsal socket near middle;

SUPPLEMENTARY DESCRIPTION OF FEMALE (A-1 instar?) DESCRIBED BY POULSEN (1965:245) (Figure 48).—Right valve without teeth visible along anterior part of dorsal margin (left valve not available for study); surface without scalloped

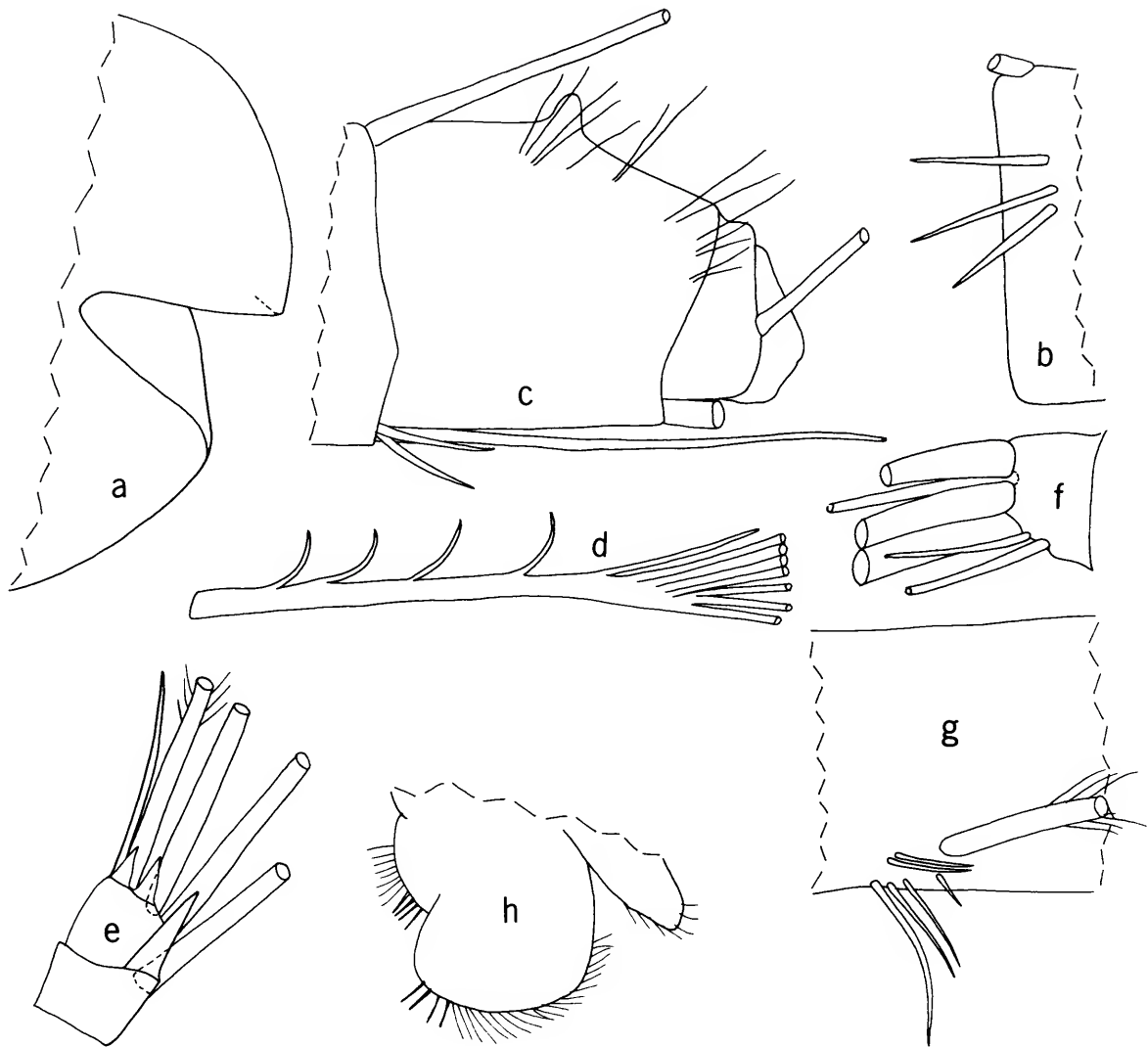


FIGURE 48.—*Tetraleberis brevis* (Müller), female (A-1 instar?), specimen from Dana sta 3668: *a*, anterior of right valve, lateral view; *b*, distal end of 2nd joint of left 1st antenna, lateral view; *c*, distal end of left 1st antenna (not all bristles shown), medial view; *d*, sensory bristle of 5th joint of left 1st antenna (only proximal part of terminal bristles shown), medial view; *e*, 8th and 9th joints of exopodite of left 2nd antenna, lateral view; *f*, end joint of endopodite of right mandible, medial view; *g*, segment of comb of right 5th limb showing exopodial bristles, lateral view; *h*, upper lip, anterior to left.

ridge along anterior margin; surface appearing smooth, without fossae or ridges (Figure 48*a*).

Size: Length 2.2 mm (from Poulsen, 1965:245) (flattened right valve available to me about same length).

Left 1st Antenna (Figure 48*b-d*): 1st joint hirsute, with 1 minute distal medial spine. 2nd joint: hirsute with 4 dorsal bristles; lateral side with 3 distal bristles. 3rd joint: short ventral side with small bristle; long dorsal margin with 7 spinous

bristles. 4th joint: short dorsal margin with 1 long spinous bristle; long ventral margin with 3 terminal bristles (1 long, 2 short). 5th joint: dorsal margin with stout sclerotized node near middle; medial side with long hairs near and also distal to node; sensory bristle of 5th joint with 4 short proximal filaments and 8 longer terminal filaments (proximal of the terminal filaments shorter than others and separated from them by small space). Bristles on joints 6–8 not examined in detail, but similar to those on right antenna illustrated by Poulsen (1965, fig. 83c).

Left 2nd Antenna (Figure 48e): Exopodite differs from illustration of Poulsen (1965, fig. 83e) in having 4 bristles (3 long, 1 short) on the 9th exopodial joint. Also, although the 1st endopodial joint bears 2 proximal and 4 distal bristles as illustrated by Poulsen (1965, fig. 83d), an additional proximal and distal bristle may have been present but subsequently broke off.

Right Mandible: Similar to left mandible illustrated by Poulsen (1965, fig. 83f–j) except for bristles and claws on end joint being normal for genus (3 claws, 1 long lateral bristle, 2 ventral bristles) (Figure 48f).

Maxilla: Not available for study.

Right 5th Limb: Differs from left limb illustrated by Poulsen (1965, fig. 84b) in having comb with 6 short lateral bristles near base of stout exopodial bristle (Figure 48g).

Sixth and 7th Limbs: Not available for study.

Furca: Similar to illustrations of Poulsen (1965, fig. 84f–f’).

Rod-shaped Organ and Eyes: Not available for study.

Upper Lip (Figure 48h): Each lobe with few slender, hairlike, anterior spines, and long hairs along ventral and posterior surfaces; anterior of saddle with few hairlike spines in addition to long hairs; hirsute lateral flap present on each side of mouth.

REMARKS.—The single specimen described by Poulsen (1965:245) is listed as a female with embryos (p. 250); however, Poulsen (1965:260) states that the specimen is most probably a juvenile. I did not see embryos in the posterior of the

body available in the present study, but it is possible that they had once been there. The low number of bristles on the dorsal margin of the 3rd joint of the 1st antenna, terminally on the sensory bristle of the 1st antenna, and on the 9th exopodial joint of the 2nd antenna support the conclusion by Poulsen that the specimen is a juvenile, although it is also possible that the sparsity of bristles are specific characters indicating that the specimen should not be referred to *T. brevis*. The syntypes of *T. brevis* studied herein have 6th limbs without a bare space along the ventral margin, unlike the 6th limb of the specimen illustrated by Poulsen (1965, fig. 84c). Unfortunately, the 6th limbs were not present in the vial containing the specimen I studied, but if a space should prove to be characteristic of the Coral Sea population, I believe proposing the population as a new species would be warranted.

DISCUSSION OF DESCRIPTION BY MÜLLER (1890: 239, pls. 25:10, 14; 26:7; 27:7–10, 12 15, 16).—The carapace illustrated by Müller (pl. 25:10) bears radiating “veins.” These are not visible from the outside on the preserved specimens, but are visible from the inside of the specimen I dissected and are formed by absence of protoplasm on the side of the vestment facing the shell. The area between the “veins” bears protoplasm. The 5th limb of the specimen I examined bears many more lateral bristles near the ventral margin of the comb than on the illustration of Müller (pl. 26:7). I believe that the difference is the result of lack of observation by Müller, rather than intraspecific variability. The caudal furca illustrated by Müller (pl. 27:10) does not have a bristle between the 3rd and 4th main claws. I examined 2 of the larger specimens and 1 of the smaller specimens in the type-series with the body removed from the shell; all have a bristle between main claws 3 and 4. In addition, I examined the remaining specimens without removing the shell. On some of these, appendages were visible through the shell, and on some the appendages were protruding from the shell. A bristle was present between the 3rd and 4th claws of all specimens on which the furca was sufficiently

visible to determine whether a bristle was present or absent (Table 20). Therefore, I believe that the absence of the bristle on the furcae illustrated by Müller was due to lack of observation. All the specimens in the type-series on which the 1st antennae were visible contain a sclerotized node on the dorsal margin of the 5th joint (Table 20). The maxillae on the specimen I dissected contained more bristles on the basale than on that illustrated by Müller (pl. 27:12). This could be the result of intraspecific variability, but because of Müller's failure to observe the bristle between the 3rd and 4th furcal claws on the furca, I think that the presence of only 4 proximal bristles on the dorsal margin of the basale illustrated by Müller may be the result of poor observation. Only 1 of the smaller specimens in the type-series was removed from the shell. This specimen had a 7th limb with many bristles indicating that it was no younger than a stage IV instar, according to the key to early myodocopid instars worked out by Kornicker (1969a:3); however, when that key was made, no information was available on cylindroleberids. The new key (page 38) supports the earlier key.

18. *Tetraleberis similis* (Brady, 1902), new combination

FIGURES 8d, 49

Cyclasterope similis Brady, 1902:183, plate 23: figs. 25–29.—Müller, 1912:52 [referred species to "Cypridinidarum genera dubia et species dubiae"].—Skogsberg, 1920:443.

Cycloleberis similis.—Poulsen, 1965:243–245, 251, 282.—Chen, 1978:43, fig. 6. [Because the only specimen in his collection is very young instar 0.94 mm in length, I believe additional collections are necessary to verify the presence of this species in the East China Sea; therefore, this locality has been left off species distribution map and tables.]

HOLOTYPE.—Female, length 5 mm (Brady, 1902 measurement). The Hancock Museum, Newcastle-on-Tyne has 1 slide with appendages in Brady Collection (drawer 6 in large cabinet); the Copenhagen Zoological Museum has 1 valve (Skogsberg, 1920:2).

TYPE-LOCALITY.—Java Sound, depth 14.6 m.

MATERIAL (Holotype).—Through the courtesy of Dr. A. G. Long, Deputy Curator, I received from the Hancock Museum a glass slide labeled in ink, "*Cyclasterope similis* n. sp. ♀, type, Lat. 3°25'S, Long. 106°50'E., Java Sound, 8 fathoms," and in pencil the initials "G. S. B." The append-

TABLE 20.—Morphology of *Tetraleberis brevis* syntypes (n.d. = no data; ? = exact number uncertain)

Stage	Shell length (mm)	Shell height (mm)	Sex	1st antenna, 5th joint with node	Furca		
					Main claws	Bristles between claws 3 and 4	Bristles following claw 4
Adult or A-1 instar	3.56	3.00	♀	+	4	1	9
	3.27	2.68	♀ ^a	+	4	1	8
	3.25	2.88	n.d.	n.d.	4	n.d.	n.d.
A-1 or A-2 instar	2.46	2.00	n.d.	n.d.	4	1	5–6
	2.45	1.98	n.d.	+	4	1	4–5
	2.33	1.91	n.d.	n.d.	4	1	5?
	2.13	1.70	n.d.	n.d.	4	n.d.	n.d.
	2.14	1.74	n.d.	+	4	1	4?
	2.30 ^b	1.90 ^b	n.d.	+	4	1	n.d.
A-2 or A-3 instar ^c	1.88	1.55	n.d.	+	4	1	4
	1.82	1.49	n.d.	+	4	n.d.	n.d.
	1.86	1.50	n.d.	+	4	n.d.	n.d.
	1.60 ^b	1.20 ^b	n.d.	+	4	n.d.	n.d.
	1.77	1.43	♀	+	4	1	4

^a Shell and appendages were found separated in vial and may not belong to each other.

^b Shell distorted; measurements approximate.

^c Presence of bristles on 7th limb indicates that this stage is not younger than a stage IV instar.

ages on the slide are in poor condition because of cracks in the mounting medium. The appendages present are two 1st antennae, two 2nd antennae, one mandible in 2 parts, one mandible with proximal part lacking, one maxilla, one 5th limb, two 6th limbs, and both lamellae of furca along with posterior of animal.

DISTRIBUTION.—Java Sound, depth 14.6 m (Figure 44). Scott (1905:367) reported the species from Sri Lanka, but this needs verification.

DISCUSSION.—Müller (1912:52) referred *Cyclasterope similis* (= *Cycloleberis similis*) to the category "Cypridinidarum genera dubia et species dubiae." Skogsberg (1920:443) referred *Cyclasterope similis* to his family Asteropidae but stated that because of Brady's incomplete description of the species its generic position is unknown. Poulsen (1965:244) referred the species to the genus *Cycloleberis* [Poulsen states on page 244 that the species was referred to *Cycloleberis* by Skogsberg, but I find no statement to that end in Skogsberg, 1920], but could not with certainty separate it from *Cycloleberis brevis* (Müller, 1890), stating (p. 251), "Whether or not this species [*C. similis*] is identical with *C. brevis* (G. W. Müller) can hardly be decided on the basis of the somewhat insufficient description by Brady." In an attempt to resolve the above uncertainties, I obtained a slide containing the appendages and have redescribed and illustrated some of them herein. I concur with Poulsen's conclusion (1965:251) that *C. similis* is not conspecific with *C. brevis*.

SUPPLEMENTARY DESCRIPTION OF FEMALE APPENDAGES (Figure 49).—*First Antenna* (Figure 49a, b): 1st joint with medial row of dense hairs near ventral margin and more distally 11 to 14 tooth-like spines; medial surface with additional long hairs near ventral margin and near middle, and shorter hairs near dorsal margin; lateral surface also with hairs; 2nd joint with 5 or 6 spinous dorsal bristles, 6 spinous, distal, lateral bristles, and long medial hairs near ventral margin; 3rd joint triangular, with very short ventral bristle about equal in length to length of ventral margin of joint, 14 long, spinous, dorsal bristles, and lateral hairs near dorsal margin; combined 4th

and 5th joints form rectangle; 4th joint shorter than 3rd joint, with 1 long, stout, dorsal bristle, and several short, terminal, ventral bristles; 5th joint with stout node on dorsal margin just proximal to middle, fine medial hairs near dorsal margin, and stouter lateral hairs distally near dorsal margin; sensory bristle of 5th joint with 10 long, terminal filaments and 1 short filament just proximal to base of terminal filaments (additional proximal filaments probably present but are obscure on specimen); medial bristle of 6th joint broken, but remaining part almost reaching tip of a-claw of 7th joint. Seventh joint: a-claw about length of 5th joint; b-bristle stout, about a third longer than a-claw, with about 10 filaments including stem; c-bristle longer than both b-bristle and sensory bristle of 5th joint, with about 14 filaments including stem. Eighth joint: d- and e-bristles well developed, bare, slightly shorter than b-bristle, reaching distal end of sensory bristle of 5th joint; f-bristle bent dorsally, broken on specimen, with 5 short marginal filaments on stump; g-bristle almost as long as c-bristle, with about 16 filaments including stem. (Condition of limb did not permit certain determination as to whether hairs were on lateral or medial surfaces; this also applies to teethlike spines on 1st joint.)

Second Antenna (Figure 49c, d): Protopodite with small medial bristle and long medial hairs along ventral margin. Endopodite 3-jointed; 1st joint elongate with about 8 short bristles; 2nd joint elongate, bare; 3rd joint short with long terminal bristle. Exopodite: 1st joint with small medial spine on terminal margin; joints 2–8 with large basal spines about twice length of following joint, and short spines along distal margins; 9th joint with 2 lateral spines, ventral of these about half length of 9th joint, other slightly longer than joint; bristle of 2nd joint reaching just past 9th joint, with natatory hairs, no spines; joints 3–8 with long bristles with natatory hairs, spines not observed; 9th joint with 2 long bristles and 1 short dorsal bristle, all with natatory hairs, no spines.

Mandible: Coxale endite not observed. Basale: with total of 20 medium and long bristles, most

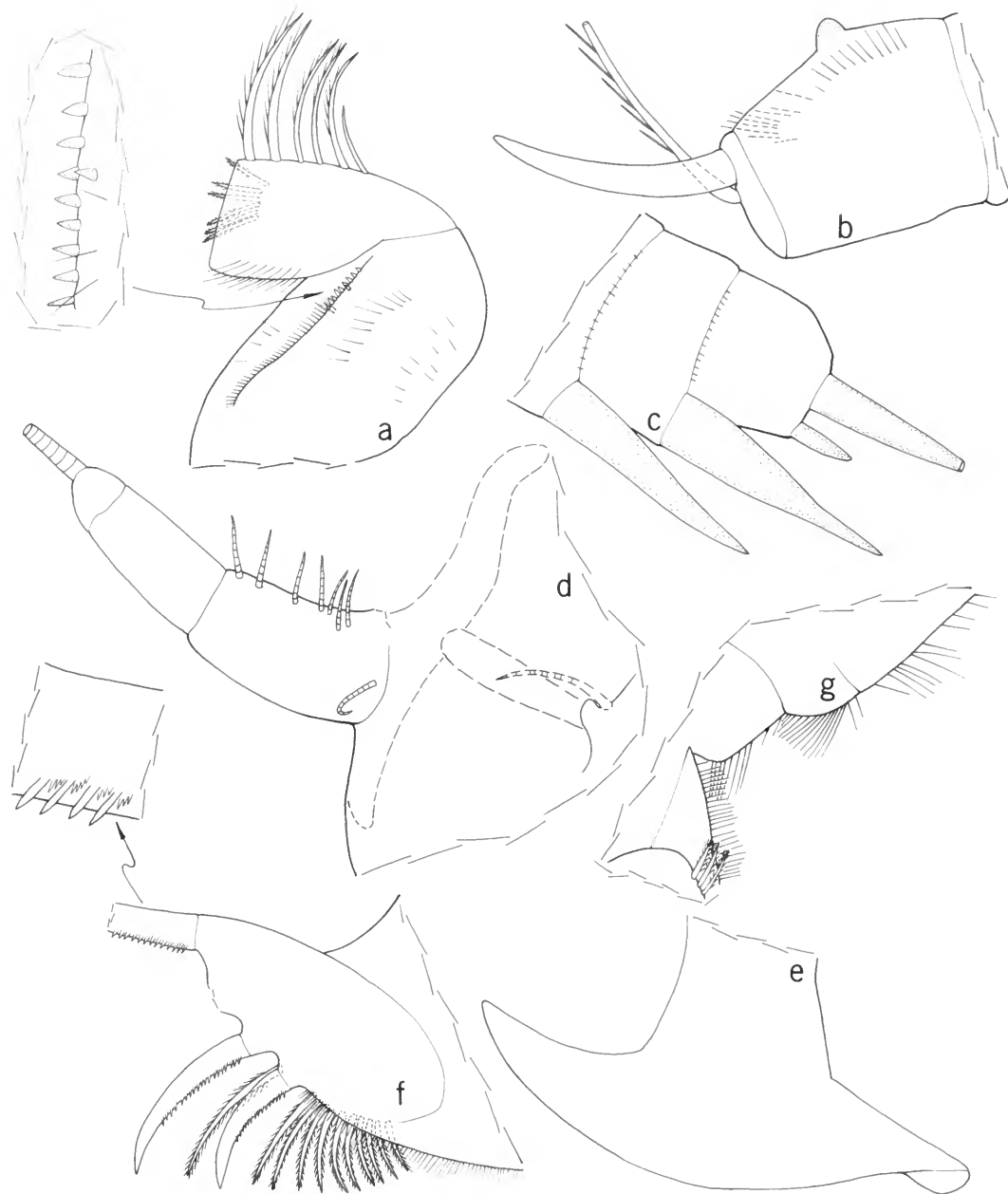


FIGURE 49.—*Tetraleberis similis* (Brady), female, holotype: *a*, 1st and 2nd joints of right 1st antenna, medial view; *b*, distal end of right 1st antenna showing node on dorsal margin of 5th joint, a-claw of 7th joint, and proximal part of f-bristle of 8th joint; *c*, 8th and 9th joints and distal part of 7th joint of exopodite of left 2nd antenna showing basal and lateral spines, lateral view; *d*, endopodite and distal part of protopodite of left 2nd antenna, lateral view; *e*, outline of left 6th limb (bristles not shown), medial view; *f*, right lamella of furca, medial view; *g*, posterior of body showing 3 posterior bristles of furca.

of these with 11–13 pairs of spines near tip; the spines decrease in length distally on bristles which have minute triaenid tips; endite also with 3 dwarf bristles near distal end; ventral margin of basale with 12 triaenid bristles with about 11 pairs of spines in distal part including triaenid tip (these bristles similar to many of those on endite), and 2 long, stout, terminal bristles with long marginal spines; dorsal margin of basale with about 15 faint bristles and 2 long, stout, terminal bristles with short marginal spines; medial (could be lateral) surface of basale spinous, with 4 minute bristles near ventral margin. Exopodite with spinous tip reaching distal end of 1st endopodite joint; stump of 1 bristle observed on exopodite, other bristle usually found on exopodite probably broken off but indication of its past presence not discernible. Endopodite: 1st joint with 7 or 8 bristles near ventral margin (2 long stout, 4 or 5 medium length, 1 minute); 2nd joint with abundant bristles on or near dorsal margin, and 7 distal bristles on ventral margin; end joint with 2 long stout claws and 1 small bristle (3rd claw and additional bristles probably broken off limb examined).

Maxilla: Endites not distinctly separated, consisting of 3 proximal long bristles, then 1 short bristle followed by 2 long bristles. Basale: proximal medial side with 24 bristles near dorsal margin projecting dorsally and 4 bristles in distal ventral corner; dorsal margin of basale hirsute, with 8 distal bristles; ventral margin with long terminal bristle. Exopodite consisting of 3 faint bristles without lobe. Endopodite: dorsal (anterior) margin of 1st joint with about 5 short bristles (4 proximal, 1 distal); ventral margin with stout terminal bristle (represented by stump on limb examined); end joint with 6 bristles. Epipodial appendage long, pointed, reaching to about middle of basale.

Fifth Limb: Epipodial appendage with about 100 bristles; comb with short hairs along dorsal margin becoming longer near tip of comb; 3 short bristles present proximally on dorsal margin of comb; stout spinous exopodial bristle reaching end of comb; 1 minute bristle present just distal to base of main exopodial bristle, other minute

bristles, if present, obscure on limb examined; 2 bristles at distal ventral corner of comb with bases set slightly proximal to bristles along ventral margin.

Sixth Limb (Figure 49e): Both limbs obscure on slide; lateral flap well developed, with at least 5 bristles but possibly many more; anterior margin of stem with many short bristles; ventral margin of skirt posterior to lateral flap with at least 50 spinous bristles; posterior end of skirt obscure; epipodial bristles difficult to discern but at least 1 and possibly 4 present.

Seventh Limb, Rod-shaped Organ, Eyes: Not present on slide.

Furca (Figure 49f): Furca with 4 stout primary claws and 11 spinous bristles; 1 spinous bristle between claws 3 and 4, but closer to claw 4, 10 spinous bristles following claw 4 with bases slightly proximal to edge of lamella; edge of lamella between and following bristles hirsute; claw 1 with teeth forming lateral and medial row, 3 or 4 minute teeth between each adjacent pair of large teeth (Figure 49f); remaining claws also with teeth forming lateral and medial row but with fewer minute teeth between pairs of adjacent teeth; first bristle following claws separated by small space from claw 4 on right lamella, space on left lamella about half width that of right lamella.

Posterior of Body (Figure 49g): Hirsute without dorsal lobe.

19. *Tetraleberis maddocksae*, new species

FIGURES 8e, 11c, 50–52; PLATES 34–36

ETYMOLOGY.—The species is named for Dr. Rosalie Maddocks who has contributed to the knowledge of podocopid Ostracoda of Madagascar.

HOLOTYPE.—USNM 157626, 1 juvenile female in process of molting, on slides and in alcohol.

TYPE-LOCALITY.—Station BT-770, Madagascar.

PARATYPES.—Madagascar: USNM 157747, 1 juvenile male, sta BT-212; USNM 157750, 1 specimen, sta BT-771; USNM 157723, sta BT-813, 1 ovigerous female.

DISTRIBUTION.—Madagascar at depths of 12–18.5 m (Figure 44).

DESCRIPTION OF JUVENILE FEMALE (Figures 50–52a–d, Plates 34–36).—Carapace oval in lateral view with deep incisur (Figure 50a, Plate 34a, c).

Ornamentation: Peripheral ridge bordering anterior edge of valve without scallops (Plate 43c,d); valve surface without fossae or linear ridges; sparsely distributed bristles emerging from open pores with and without concentric rims (Plates 34e, f, 35b–e); surface of valve with many minute nodes with central pore (these resemble those bearing bristles and may have contained bristles at one time) (Plates 34e, f, 35f); simple unrimmed pores also present; bristles especially abundant along free margins and on anteroventral part of valve (Plates 34c,d, 36a,b); calcareous concretions in form of discs under outer layer of valve surface (Plates 34a,b, 35a).

Infold: Infold with numerous bristles, typical for genus (Plate 36a,b).

Central Adductor Muscle Attachments: Typical for genus.

Size: USNM 157626, length 2.8 mm, height 2.0 mm (molting specimen).

REMARKS.—USNM 157626 is in process of molting; the anteroventral margin of the new valve is visible within the old valve in Plate 36c–f.

First Antenna (Figure 50b,c): 1st joint: lateral side with groups of slender spines forming rows near dorsal margin; medial side with 6 stout spines forming row near distal margin and long hairs near ventral margin; ventral margin with long hairs. 2nd joint: lateral side with 4 distal bristles and short and long hairs on ventral half; ventral margin with long hairs; dorsal margin with long hairs and 5 spinous bristles. 3rd joint: lateral side with long hairs near dorsal margin; short ventral margin with 1 short bristle; long dorsal margin with 11 spinous bristles and long hairs. 4th joint: ventral margin with 4 terminal bristles (1 long, spinous, 3 short, bare); short dorsal margin with 1 long spinous bristle; lateral side with long hairs near dorsal margin. 5th joint: lateral and medial sides with long hairs near dorsal margin; dorsal margin with stout toothlike

process near middle; sensory bristle with 6 short, proximal, marginal filaments and 8 long terminal filaments (proximal of these about one-half length of longest filament). 6th joint with 1 long, spinous, medial bristle. 7th joint: a-bristle claw-like, bare; b-bristle about twice length of a-bristle, with about 9 filaments including stem; c-bristle reaching past tip of sensory bristle of 5th joint, with about 13 filaments including stem. 8th joint: d- and e-bristles bare, with blunt tips reaching past end of b-bristle; f-bristle bent dorsally, with 12 short dorsal filaments including stem; g-bristle about same length as c-bristle, with about 11 filaments including stem.

Second Antenna (Figure 50d–g): Protopodite with short distal medial bristle, and long hairs along ventral margin and on medial and lateral sides near ventral margin. Endopodite: 3-jointed: 1st joint with 1 short bristle on proximal part and 5 short bristles on distal part; 2nd joint bare; 3rd joint with long terminal bristle with blunt tip (base of bristle on left limb of USNM 157626 slightly off center, right limb at center). Exopodite: 1st joint with minute spines along dorsal margin and distally on lateral surface; minute straight terminal spine present on medial side; bristle of 2nd joint reaching just past 9th joint, with numerous slender hairlike spines on both margins; bristles of joints 3–8 long, with slender, proximal, ventral spines and long natatory hairs (where both spines and natatory hairs occur together, spines are medial to hairs); 9th joint with 4 bristles (2 long with natatory hairs and proximal, slender, ventral spines, 1 medium and 1 short, both with only natatory hairs); joints 2–8 with stout basal spines; 9th joint with either 2 teeth or 1 stout bifurcate tooth (each branch of tooth of left limb of USNM 157626 with minute terminal teeth; tooth of right limb much longer than that on left and without terminal teeth); joints 2–8 with minute spines forming terminal row; 8 minute medial teeth forming row near base of bristle of joint 2 (Figure 50g).

Mandible (Figure 51a): Coxale endite: 1 slender bristle present near base of ventral branch; ventral branch with slender spines forming 6 oblique rows; tip of ventral branch with 2 minute ventral



FIGURE 50.—*Tetraleberis maddocksae*, new species, juvenile female in process of molting, holotype, USNM 157626: *a*, outline of right valve, length 2.8 mm; *b*, left 1st antenna, lateral view; *c*, distal part of 1st joint and proximal part of 2nd joint of right 1st antenna (note spines on 1st joint), medial view; *d*, endopodite and distal bristle of protopodite of left 2nd antenna, lateral view; *e*, exopodite of left 2nd antenna (hairs and spines left off most bristles), lateral view; *f*, segment of bristle of 4th joint of exopodite of left 2nd antenna showing slender spines along ventral margin, lateral view; *g*, distal part of 2nd joint of exopodite of right 2nd antenna showing spines forming row at base of bristle, medial view; *h*, right lamella of furca, lateral view; *i*, tips of claw 1 of both left and right lamellae of new furca as seen through claws of molting specimen.



FIGURE 51.—*Tetraleberis maddockae*, new species, juvenile female in process of molting, holotype, USNM 157626: *a*, right mandible, medial view; *b*, right maxilla, medial view; *c*, terminus of 7th limb; *d*, outline of left lateral eye; *e*, medial eye and proximal part of rod-shaped organ.

teeth and blunt dorsal corner bearing minute spines; ventral margin of dorsal branch with 4 distally pointing processes followed by 1 straight process and 2 recurved pointed processes; tip of dorsal branch ending in long bristle; dorsal margin of branch with few serrations. Basale endite: tip with 1 long end-type bristle and 6 shorter bristles (some or all of end-type); ventral margin with 10 or 11 triaenid bristles with 9–11 pairs of teeth including terminal pair (teeth decrease in size distally along bristle; no spines or teeth proximal to distal paired teeth), and 4 or 5 dwarf bristles (distal of these longer than others). Basale: ventral margin with 9 triaenid bristles (most similar to those on endite) and 2 long, spinous, terminal bristles; dorsal margin with 9 short bristles, 1 longer distal bristle, and 2 very long, spinous, terminal bristles; medial surface with long hairs, and 1 minute bristle near ventral margin. Exopodite hirsute reaching just past distal end of 1st endopodial joint, with 2 ventral bristles (distal of these shorter of two). Endopodite: ventral margin of 1st joint with about 7 bristles (1 of these minute); ventral margin of 2nd joint with 5 long spinous bristles (3 subterminal, 2 terminal); dorsal margin and medial side near dorsal margin with numerous bristles; end joint with 3 long clawlike bristles, 2 ventral bristles (1 of these short), and 1 long, lateral, spinous mid-bristle.

Maxilla (Figure 51*b*): Endites not well defined: endite I with 3 bristles, endite II with 2 bristles, endite III with 4 bristles; 4 or 5 short bristles present distal to bases of bristles of endite III. Basale: ventral margin with 11 short bristles, 2 long, spinous, distal bristles, and 1 long, spinous, terminal bristle; medial surface with 5 distal bristles (4 short and 1 long, the latter with base almost on ventral margin); dorsal margin spinous, with 8 proximal bristles with bases on medial side, and 5 short distal bristles; lateral side may have 1 short proximal bristle. Exopodite: small lobe with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with 1 short bristle near middle of anterior margin and 1 long spinous beta-bristle; end joint with 6 bristles. Epipodite long,

pointed, with tip reaching distal dorsal bristles of basale; minute spines present near ventral margin.

Fifth Limb: Dorsal margin of comb with about 4 minute proximal bristles and distal hairs (bristles absent on illustrated limb, Figure 52*b*); lateral side with long, spinous, exopodial bristle almost reaching tip of comb; 3 small bristles present proximal to base of exopodial bristle; 3 minute bristles present ventral to exopodial bristle; about 7 bristles near ventral margin of comb proximal and ventral to base of exopodial bristle.

Sixth Limb (Figure 52*a*): Anterior margin with 2 well-defined sutures; bristles dorsal to upper suture forming 3 rows with about 13 short spinous bristles in medial row, about 19 longer spinous bristles in middle row, and about 18 short, very slender bristles in lateral row; margin between sutures with 4 spinous bristles in medial row, 4 in middle row (the distal of these very long), and 5 bristles in lateral row; anterior margin of skirt ventral to lower suture with about 16 bristles forming single row (continuation of bristles of lateral row); ventral margin of skirt and medial side near ventral margin with numerous bristles not interrupted by space without bristles; posterior end of skirt with 1 or 2 stout hirsute bristles. Epipodial bristles consisting of 4 bare bristles, the distal of these very long.

Seventh Limb (Figure 51*c*): Each limb with 78–81 bristles, 38–42 on each side; each bristle with up to 6 bells; most joints with not more than 2 bristles, 1 on each side, but few with 3 (2 on 1 side, 1 on other). Terminus with opposing combs, each with 17–19 teeth of various types.

Furca (Figure 50*h,i*): Each lamella with 4 main claws, 1 bristle between claws 3 and 4, but closer to claw 4, and 7 bristles following claw 4; main claws with teeth forming medial and lateral row along posterior margin (1 or 2 minute teeth between adjacent large teeth); anterior edge of main claws with slender spines; bristles with abundant, long, slender spines along anterior margin and shorter similar spines along posterior margin, but without teeth or stout spines; lamella near proximal posterior corner of main claws with few

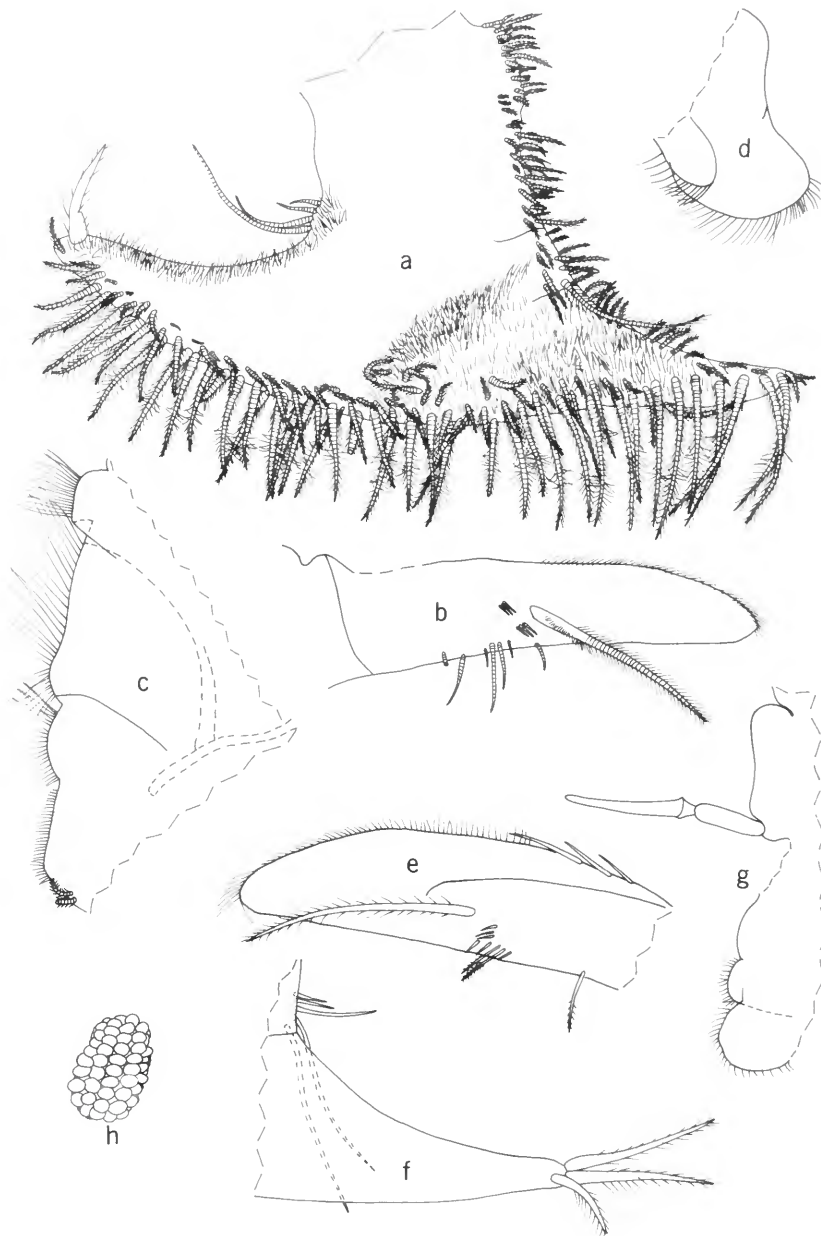


FIGURE 52.—*Tetraleberis maddocksaе*, new species, juvenile female in process of molting, holotype, USNM 157626: *a*, left 6th limb, medial view; *b*, comb of right 5th limb, lateral view; *c*, posterior of body showing posterior hairs, right Y-sclerite, and 2 posterior bristles of right lamella of furca; *d*, upper lip, anterior to right. Ovigerous female, USNM 157723: *e*, comb of left 5th limb, lateral view; *f*, posterior part of left 6th limb showing epipodial bristles and posterior bristles of skirt, medial view; *g*, anterior of body showing medial eye, rod-shaped organ, and upper lip; *h*, left lateral eye.

slender spines; slender, spinelike, medial hairs present on lamella near bases of main claws; hairs also present following main claws. Tips of main claws visible inside main claws of USNM 157626 (molting specimen) drawn to fine point (tips of main claws have been worn off on claws 1 and 2, but not 3 and 4 of USNM 157626).

Rod-shaped Organ: Elongate, but distal part broken off USNM 157626 (Figure 51e).

Eyes: Medial eye lightly pigmented, bare (Figure 51e); lateral eye about same size as medial eye, with black pigment and about 24 ommatidia (Figure 51d).

Upper Lip (Figure 52d): Each lobe evenly rounded, hirsute, with a few hairs along anteroventral margin forming weak spines; hirsute lateral flap present on each side of mouth.

Posterior of Body (Figure 52c): Hirsute but without dorsal process.

Y-Sclerite (Figure 52c): Unbranched, forming small arc, dorsal socket near middle.

DESCRIPTION OF ADULT FEMALE (Figure 52e-h).—Carapace similar to that of described juvenile.

Size: USNM 157723, length 3.5 mm, height 2.8 mm.

First Antenna: Limb similar to that of described juvenile except for following: 1st joint with 14 stout medial spines forming row. 2nd joint with 6 lateral and 6 dorsal bristles. 3rd joint with 14 dorsal bristles. 4th joint with 5 ventral bristles (1 long, spinous, 4 short, bare). 5th joint: sensory bristle with 7 short proximal filaments in addition to 8 long terminal filaments. 7th joint: b-bristle with 14 filaments including tip and c-bristle with 14 filaments including stem. 8th joint: f- and g-bristles each with 14 filaments including tip.

Second Antenna: Limb similar to that of described juvenile with following exceptions: distal part of 1st endopodial joint with 6 bristles; 9th exopodial joint with 5 bristles (3 long, 1 medium, 1 short) and single lateral spine.

Mandible: Coxale endite and endopodite similar to those of described juvenile. Basale endite with 1 long and 6 short end-type bristles, 14 triaenid bristles along ventral margin, and 6 or 7 dwarf

bristles (distal of these longer than others). Basale: ventral margin with 12 or 13 triaenid bristles and 2 long, spinous, terminal bristles; dorsal margin with 8 or 9 short bristles and 2 long terminal bristles; medial surface with long hairs and 2–4 minute bristles near ventral margin. Exopodite similar to that of described juvenile but tip just reaching distal margin of 1st endopodial joint.

Maxilla: Endites not well defined: endite I with 3 long marginal bristles and 1 minute proximal bristle, endite II with 1 short and 2 long marginal bristles, endite III with 5 long marginal bristles; 8 short bristles present just distal to bases of bristles of endite III. Basale: ventral margin with 14 short bristles, 2 long, bare, distal bristles, and 1 long, spinous, terminal bristle; medial surface with 6 distal bristles (5 short and 1 long, the latter with base almost on ventral margin); dorsal margin spinous, with 13 proximal bristles with bases on medial side, and 6 short distal bristles (1 of these about 3 times length of others); lateral side with short proximal bristle. Exopodite, endopodite, and epipodite similar to those of described juvenile.

Fifth Limb (Figure 52e): Dorsal margin of comb with 3–5 small proximal bristles and distal hairs; lateral side with long, stout, spinous, exopodial bristle reaching tip of comb; 3 small bristles present proximal and ventral to base of stout exopodal bristle; 6 bristles near ventral margin of comb and ventral and proximal to base of stout exopodial bristle.

Sixth Limb (Figure 52f): Anterior margin with 2 sutures (upper suture with better definition than lower suture); bristles dorsal to upper suture forming 3 rows with about 21 short spinous bristles in medial row, about 27 longer, but more slender, spinous bristles in middle row, and about 29 shorter, very slender, spinous bristles in lateral row; margin between sutures with 4 spinous bristles in medial row, 6 in middle row (the distal of these very long), and 7 bristles in lateral row; anterior margin of skirt ventral to lower suture with about 19 bristles forming single row (continuation of bristles of lateral row); ventral margin of skirt and medial side near ventral margin with

numerous bristles not interrupted by space without bristles; posterior end of skirt with 3 stout hirsute bristles. Epipodial bristles consisting of 5 bare bristles, the 2 distal of these very long.

Seventh Limb: Each limb with about 110 bristles, 53–58 on each side, and terminus with opposing combs, each with about 22 teeth. Limb otherwise similar to that of described juvenile.

Furca: Each lamella with 9 bristles following claw 4, otherwise similar to that of described juvenile. Also, tip of claw 1 narrowly rounded, whereas tips of claws 2–4 drawn out to fine point.

Rod-shaped Organ (Figure 52g): Elongate, widening near middle, then tapering to rounded tip.

Eyes: Medial eye bare, with narrow band of brown pigment (Figure 52g); lateral eye slightly larger than medial eye, with black pigment and about 24 ommatidia (Figure 52h).

Upper Lip (Figure 52g), *Posterior of Body*, *Y-Sclerite:* Similar to those of described juvenile.

COMPARISONS.—This species differs from previously described species in the genus in that the spines on the natatory bristles of the exopodite of the 2nd antenna are very slender, and in having 1 or 2 very long epipodial bristles on the 6th limb.

20. *Tetraleberis tanzania*, new species

FIGURES 8f, 53–57; PLATES 37–40

ETYMOLOGY.—Specific name from the locality of the holotype.

HOLOTYPE.—USNM 157414, 1 female (adult or A-1 instar), on slides and in alcohol.

TYPE-LOCALITY.—Station 80, off Tanzania.

ALLOTYPE.—USNM 157415, 1 adult male from off Tanzania, station not designated, off East Kunduchi.

NON-TYPES.—USNM 157627, 157628, 2 juvenile females (probably instar II) from off Somalia, Indian Ocean, sta 9-446. Madagascar: USNM 157740, 1 juvenile, sta BT-622; USNM 157721, 1 adult male, sta BT-623; USNM 157748, 2 juveniles, BT-740; USNM 157730, 1 late juvenile, BT-822D.

DISTRIBUTION (Figure 44).—Somalia, Indian Ocean, at depth of about 65 m; Madagascar at

depths of 7–12 m; Tanzania at unknown depth but not deeper than 25 m.

DESCRIPTION OF FEMALE (Probably Adult or A-1 Instar) (Figures 53–55a; Plates 37–40).—Carapace oval in lateral view with deep incisur at middle of anterior margin (Figure 53a; Plate 37a,c,d).

Ornamentation: Fossae and ridges absent. Anterodorsal and anteroventral margin with unscaloped ridge (Plate 37d–f). Bristles with pore near base emerging from open pores without rims (Plate 38c) and open pores with 6–8 more-or-less concentric rims (Plate 38a,b,d,f); bristles from rimmed pores longer than those from unrimmed pores; minute simple pores sparsely distributed on valve surface (Plate 38a,d,e); abundant minute punctae on valve's surface visible only at very high magnification (Plate 38e); minute papillae observed in some areas (not illustrated); anterior, ventral, and posterior margins with long bristles forming row just lateral to selvage (Plate 37).

Infold: Anterodorsal, anteroventral, and ventral infolds with numerous bristles (Plate 39a–c); posterodorsal list with long and short tubular bristles (Plates 39d–f, 40); tubular bristles with small proximal flap with digitate distal edge (Plate 40a,b), and with digitate open tips (Plate 40c,e,f); short bristles, with fingerlike tips, forming row just proximal to tubular bristles (Plate 40c,d); a few minute tubular bristles present distal to the row of long and short tubular bristles (Plate 39e,f); bristles of various lengths forming row between posterior list and valve edge (Plate 39d–f). Anteroventral list with lamellar prolongation (Plate 39c).

Selvage: Lamellar prolongation of selvage along anterodorsal margin with marginal fringe (Plate 37f).

Central Adductor Muscle Attachments: Normal for genus.

Size: USNM 157414, length 3.2 mm, height 2.8 mm.

First Antenna (Figure 53b,c): 1st joint with long lateral and medial hairs near ventral margin, and minute spines forming medial row near distal margin. 2nd joint: long medial and lateral hairs



FIGURE 53.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414: *a*, complete specimen (dotted oval represents position of lateral eye), length 3.2 mm; *b*, right 1st antenna, lateral view; *c*, 1st and 2nd joints of left 2nd antenna showing hairs and spines (bristles omitted), medial view; *d*, exopodite of left 2nd antenna, lateral view; *e*, detail of *d*; *f*, segment of bristle of 3rd joint of exopodite of right 2nd antenna, medial view; *g*, distal part of propodite, endopodite, and proximal part of 1st exopodial joint of right 2nd antenna, medial view; *h*, right mandible (coxale endite not shown), medial view; *i*, epipodite and proximal part of basale of right maxilla, medial view; *j*, medial eye and rod-shaped organ; *k*, upper lip, anterior to left.

near ventral margin; dorsal margin with 5 bristles; lateral side with 5 or 6 distal bristles. 3rd joint: short ventral margin with small bristle; long dorsal margin with 14 spinous bristles; lateral side with hairs near dorsal margin. 4th joint: short dorsal margin with 1 long spinous bristle; long ventral margin with 5 terminal bristles (1 long, 4 short). 5th joint: dorsal margin with stout sclerotized tooth proximal to middle; lateral and medial sides with long hairs near dorsal margin distal to protuberance; sensory bristle of 5th joint with 7 short marginal filaments and 9 longer terminal filaments (the proximal terminal filament much shorter than others). 6th joint with spinous medial bristle extending past tip of a-bristle of 7th joint. 7th joint: a-bristle clawlike, bare, equal in length to combined lengths of joints 5–8; b-bristle stout, about one and one-half times longer than a-claw, with about 10 filaments including 4 at tip; c-bristle longer than sensory bristle of 5th joint, with 13 marginal filaments (excluding tip). 8th joint: d- and e-bristles bare, with blunt tips reaching tip of sensory bristle; f-bristle bent dorsally, with 11 ventral marginal filaments; g-bristle about same length as c-bristle, with 13 marginal filaments (excluding tip).

Second Antenna (Figure 53d–g): Protopodite with long hairs along ventral margin and on medial surface near ventral margin, and 1 short, bare, distal, medial bristle. Endopodite: 1st joint divided into proximal part with 3 small bristles, and distal part with 6 short bristles; 2nd joint bare, with well-defined sutures separating it from 1st and 3rd joints; 3rd joint with long terminal bristle with blunt tip. Exopodite: 1st joint with spines along dorsal margin and on medial and lateral surfaces near dorsal margin, and minute, straight, terminal, medial spine; bristle of 2nd joint about five-sixth length of dorsal margin of 1st joint, with abundant short hairs (these could be called slender spines but are not similar to stout spines on bristles of other exopodial joints); bristles of joints 3–8 with natatory hairs and stout proximal ventral spines; 9th joint with 5 bristles (3 with proximal ventral spines and natatory hairs, 2 with only natatory hairs); joints 2–8 with

large basal spines; 9th joint with lateral spine equal to length of joint; joints 2–8 with minute spines forming row along distal margin.

Mandible (Figure 53h): Coxale endite broken off both limbs of specimen examined; small bristle present near base of ventral branch. Basale endite: tip of endite with 4 or 5 end-type bristles; margin with about 14 triaenid bristles with small paired teeth (teeth not shown in Figure 53h); inner margin with 6 dwarf bristles (distal of these longer than others). Basale: ventral margin with 12 triaenid bristles (with 8–10 pairs of distal teeth excluding terminal pair) and 2 longer, spinous, distal bristles; dorsal margin with proximal hairs followed by 9 short or medium bristles and 2 long bristles; medial side with 5 short bristles near ventral margin, and long hairs on dorsal half of joint. Exopodite hirsute, tip not quite reaching distal end of 1st endopodial joint, with 2 ventral bristles (distal of these quite short). Endopodite: ventral margin of 1st joint with 8 bristles (7 of these forming row extending onto medial surface); ventral margin of 2nd joint with bristles forming 2 distal groups (3 bristles in proximal group, 2 in other); dorsal margin and medial surface near dorsal margin with about 35 bristles (about 3 of the larger cleaning bristles with stout marginal spines); end joint with 3 long bare claws, 1 long, spinous, lateral bristle (spines not shown in figure 53h), and 2 ventral bristles (1 long, 1 short).

Maxilla (Figures 53i, 54a): Epipodial appendage long, slender, tapering to slender point, with minute spines near ventral margin. Endite I with 3 stout bristles; endite II with 1 small bristle and 2 stout bristles; endite III with 3 or 4 fairly stout bristles; 9 short bristles present anterior to bases of bristles of endite III. Basale: dorsal margin hirsute, with 6 proximal bristles (with bases on medial side) and about 7 distal bristles; ventral margin with 15 short bristles, 2 long distal bristles and 1 long, spinous, terminal bristle; medial surface with 6 distal bristles (longest of these near ventral margin); lateral side with 1 short proximal bristle. Exopodite: small lobe with 1 long and 2 short bristles. Endopodite: 1st joint spinous, with



FIGURE 54.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414: *a*, left maxilla, medial view; *b*, comb of right 5th limb (ventral bristles not shown), lateral view; *c*, types of bristles along ventral margin of comb shown in *b*; *d*, terminus of 7th limb; *e*, left lamella of furca, lateral view; *f*, 4th tooth and adjacent bristles on right lamella of furca, lateral view; *g*, segment near middle of claw 1 of right lamella of furca showing small teeth at base of larger teeth; *h*, posterior of body (last bristle of furca is at bottom of illustration).

1 short anterior bristle proximal to middle and 1 long spinous beta-bristle; end joint with 5 spinous bristles.

Fifth Limb (Figure 54*b,c*): Dorsal margin of comb slightly convex, with abundant short hairs that continue along anterior margin, and 5 small proximal bristles; lateral side with stout, spinous, exopodial bristle just reaching distal end of comb, 3 minute bristles just posterior to base of stout exopodial bristle, and 5 small bristles near ventral margin posterior to base of stout exopodial bristle; ventral margin with long bristles with short marginal spines and shorter bristles with long flaring hairs near tip (Figure 54*c*).

Sixth Limb (Figure 55*a*): Anterior margin with a well-defined upper suture ventral to trunk middle and a poorly defined lower suture near juncture of trunk and skirt. Anterior margin dorsal to upper suture with bristles forming 3 rows: 18 short, stout, spinous bristles in inner row, about 20 slender spinous bristles in middle row (distal of these longer than others), and about 23 short, very slender, spinous bristles in outer row. Anterior margin between upper and lower sutures with 5 spinous bristles in inner row, 5 spinous bristles in middle row (the distal of these very long), and 6 spinous bristles in outer row. A single row of about 15 short, slender, spinous bristles present near anterior margin of skirt between lower suture and ventral margin of skirt. Lateral flap with 5 slender hirsute bristles (flap of illustrated limb not in its usual lateral position). Ventral margin of skirt with numerous bristles continuing almost to posterior tip of skirt. Posterior tip of skirt with 3 short, stout, hirsute bristles. Five small bristles in place of epipodial appendage. No medial spines present in anterodorsal corner of trunk. Limb hirsute.

Seventh Limb: Each limb with about 90 bristles, 45 on each side; each bristle with up to 8 bells; most bristle-bearing joints with 2 bristles, 1 on each side, but distal joints with 3 or 4 bristles, 1 or 2 on each side. Terminus with opposing combs, each with about 20 teeth of various types (Figure 54*d*).

Furca (Figure 54*e-g*): Each lamella with 4 stout main claws, 1 slender spinous bristle between

claws 3 and 4 (closer to claw 4), and 7 additional slender bristles following claw 4; main claws with teeth of equal length forming medial and lateral row along concave margin; each pair of teeth with minute tooth between them (Figure 54*g*); bristle between claws 3 and 4 shorter than claw 4; bristles following claw 4 with stout and slender spines along anterior and posterior margins; main claws with hairs along convex margin; right lamella with hairs along anterior margin; hairs present on medial side of main claws near base and between and following bristles posterior to main claws; space between claw 4 and following bristle slightly wider on right lamella than on left lamella.

Rod-shaped Organ (Figure 53*j*): Elongate with suture proximal to widened middle part, tapering to rounded tip.

Eyes: Medial eye without dark pigment, bare (Figure 53*j*). Lateral eye about same size as medial eye, pigmented black, with about 46 ommatidia (outline of eye shown in Figure 53*a*).

Upper Lip (Figure 53*k*): Each lobe with a few minute slender anterior spines, and long hairs along ventral and posterior surfaces; a lateral hirsute flap present on each side of mouth.

Posterior of Body (Figure 54*h*): Hirsute; dorsal process represented by small bulge with long hairs.

DESCRIPTION OF ADULT MALE (Figure 56, 57).—Carapace more elongate than that of female, and with hairs forming vertical row near posterior (Figure 56*a*).

Ornamentation: Similar to that of female.

Infold: Not examined.

Size: USNM 157415, length 3.8 mm, height 2.5 mm; USNM 157721, length 3.6 mm, height 2.6 mm.

First Antenna (Figure 56*b*): 1st joint with medial hairs near ventral margin. 2nd joint: dorsal margin with 4 bristles; medial side spinous; lateral side with 4 distal bristles and long hairs in distal ventral corner. 3rd joint: short ventral margin with 1 short bristle; long dorsal margin with 11 bristles. 4th joint: ventral margin with 5 terminal bristles (1 of these very small); dorsal margin with 1 long spinous bristle. 5th joint: dorsal margin

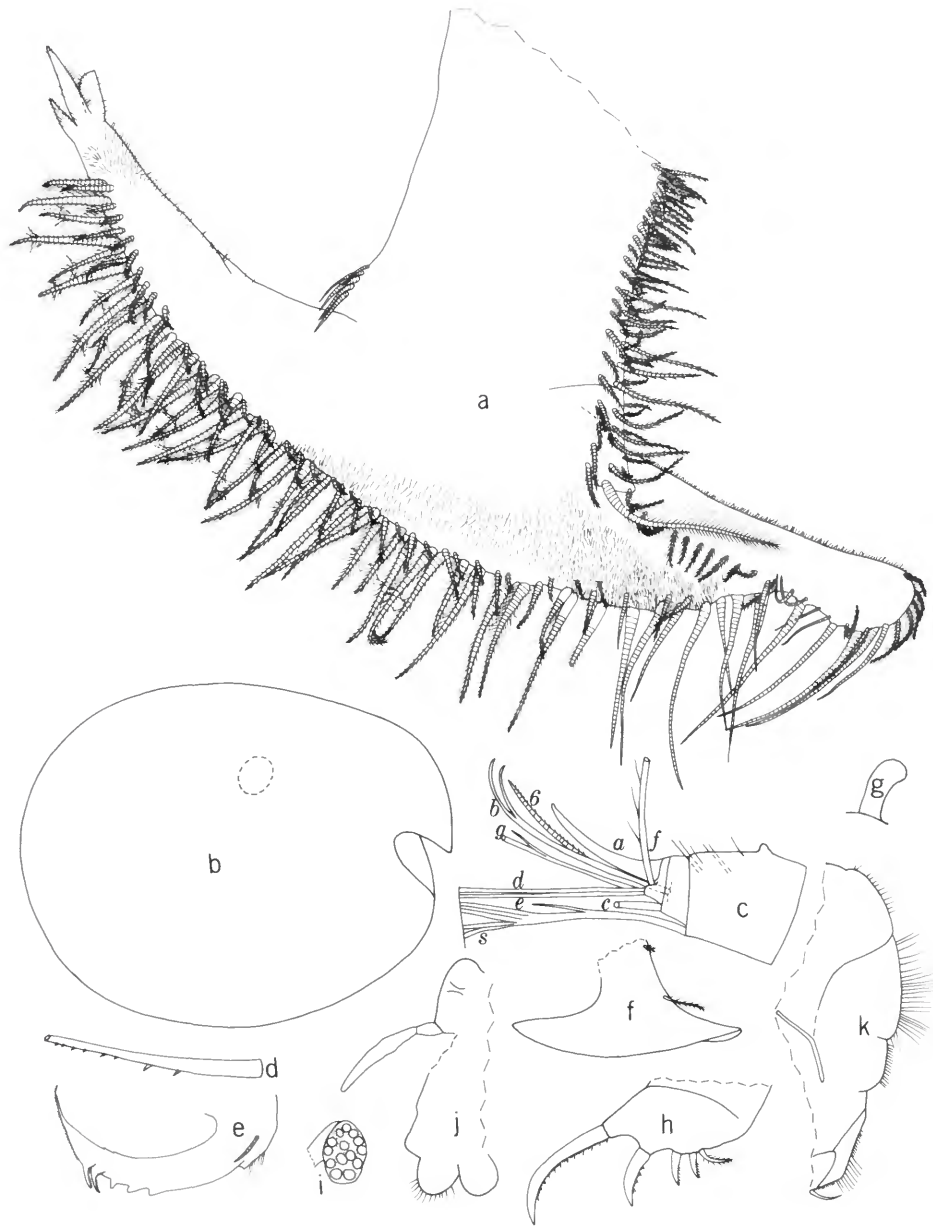


FIGURE 55.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414: *a*, left 6th limb, medial view. Juvenile female (probably instar II), USNM 157627: *b*, complete specimen showing position of lateral eye, length 1.18 mm; *c*, distal end of right 1st antenna, lateral view; *d*, part of exopodial bristle of 3rd joint of left 2nd antenna showing ventral spines, medial view; *e*, coxale endite of right mandible, medial view; *f*, left 6th limb (hairs not shown), medial view; *g*, 7th limb; *h*, left lamella of furca, lateral view; *i*, lateral eye; *j*, anterior of body showing medial eye and rod-shaped organ, upper lip, and lateral flap of lip; *k*, posterior of body showing Y-sclerite and posterior bristle of furca, anterior to left.

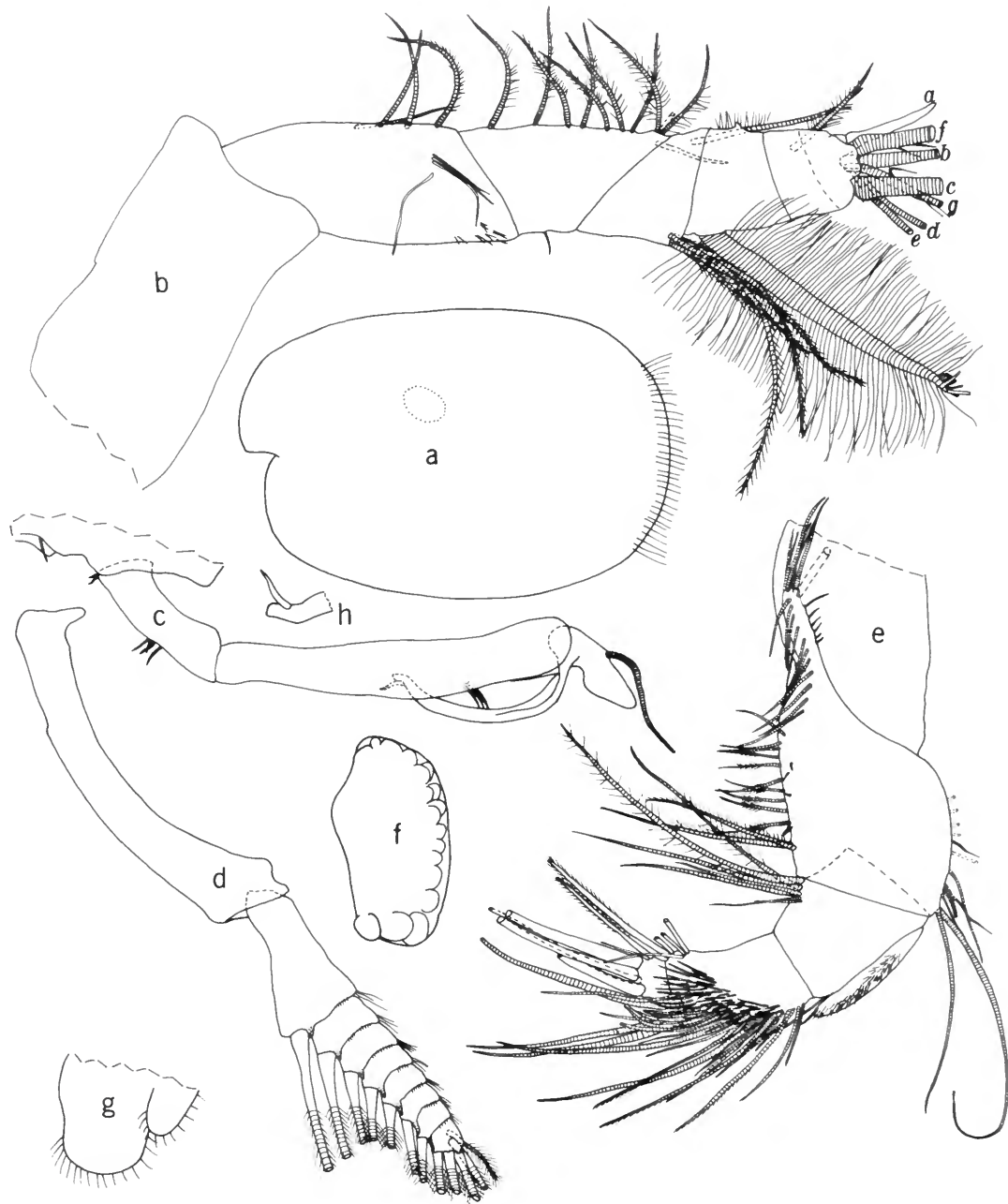


FIGURE 56.—*Tetraleberis tanzania*, new species, adult male, allotype, USNM 157415: *a*, complete specimen showing position of lateral eye, length 3.8 mm; *b*, right 1st antenna, lateral view; *c*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *d*, exopodite of left 2nd antenna, lateral view; *e*, left mandible (coxale endite not shown), medial view; *f*, left lateral eye (not all ommatidia shown); *g*, upper lip, anterior to left; *h*, tip of 3rd endopodial joint of left 2nd antenna, medial view.

with single protuberance distal to middle; ventral margin slightly undulate; sensory bristle with abundant filaments of which 8 at tip thicker than others. 6th joint with fairly short medial bristle near dorsal margin. 7th joint: a-bristle claw-like, bare, about equal in length to combined lengths of joints 6–8, base of bristle on short pedestal; b-bristle about 4 times length of a-bristle, with about 13 marginal filaments; c-bristle very long, tip broken off, with 60 filaments on remaining part (filaments with narrow flare near base). 8th joint: d- and e-bristles bare, broken off on both limbs of specimen examined, but remaining part more than twice length of a-bristle; f-bristle very long, tip broken off, with 60 filaments on remaining part (filaments with narrow flare near base); g-bristle same length as f-bristle, with about 21 marginal filaments.

Second Antenna: Protopodite bare except for minute distal medial bristle (Figure 56c). Endopodite (Figure 56c,h): 1st joint with 2 minute proximal bristles and 4 small bristles near middle; 2nd joint very long, with 4 small distal bristles; 3rd joint reflexed on 2nd, with proximal triangular process bearing long bristle; tip of 3rd joint rounded, weakly ridged, and with subterminal, weakly ringed bristle. Exopodite (Figure 56d): 1st joint with minute spines along concave margin and small, straight, medial, terminal spine; bristle of 2nd joint as long as bristles of joints 3–8, with natatory hairs, no spines; bristles of joints 2–8 with natatory hairs, no spines; 9th joint with 3 long, 1 medium, and 1 short bristle, all with natatory hairs, no spines; joints 2–8 with slender basal spines; basal spine of joint 8 about equal in length to length of dorsal margin of 9th joint; lateral spine of 9th joint small with rounded tip; joints 2–8 with short spines on lateral terminal margin, and long hairs along distal dorsal edge.

Mandible (Figure 56e): Coxale endite broken off on both limbs of specimen examined; small bristle present near base of ventral branch. Basale endite: tip with 1 very long and 5 or 6 shorter endite bristles; ventral margin of endite with 14 triaenid bristles with minute, paired teeth near tip (some of these bristles could be on ventral

margin of basale); inner margin of endite with 6 dwarf bristles forming row (distal of these longer than others). Basale: ventral margin with 9 short spinous bristles and 2 long, spinous, distal bristles (the short bristles have distal teeth so minute that they do not appear to be of triaenid type); dorsal margin with 10 short bristles and 2 long distal bristles; medial side with 3 minute bristles near ventral margin; lateral side with 2 minute bristles near ventral margin. Exopodite hirsute, with tip reaching just past distal edge of 1st endopodial joint, with 2 bristles on ventral margin (distal of these short). Endopodite: 1st joint with 8 bristles on ventral margin (7 of these form row extending onto medial side); ventral margin of 2nd endopodial joint with bristles forming 2 groups (3 bristles in proximal group, 2 in other); dorsal margin and medial side of 2nd joint with abundant bristles (none of the cleaning bristles with stout marginal spines as on female); end joint with 3 stout claws, 1 long, stout, lateral bristle, and 2 ventral bristles.

Maxilla (Figure 57a): Epipodite with slender pointed tip reaching past middle of dorsal margin of basale, with minute spines near ventral margin. Endite I with 1 minute bristle and 3 long stout bristles; endite II with 1 minute bristle and 2 long stout bristles; endite III with 3 long bristles; 7 short slender bristles present distal to bases of bristles of endite III. Basale: dorsal margin spinous, with 5 proximal bristles (bases on medial side) and 5 or 6 distal bristles; medial side with 5 distal bristles (longer of these near ventral margin), and with proximal spines near ventral margin; lateral side with 1 short proximal bristle; ventral margin with 12 or 13 short bristles, 2 long distal bristles, and 1 very long, spinous, terminal bristle. Exopodite consisting of lobe with 3 short bristles. Endopodite: 1st joint spinous, with 1 small bristle proximal to middle of anterior margin, and long beta-bristle; end joint with 6 terminal bristles.

Fifth Limb (Figure 57b): Dorsal margin of comb with 4 minute bristles proximal to low process; anterodorsal margin hirsute and sloping gradually to base of 1st anteroventral bristle; exopodial



FIGURE 57.—*Tetraleberis tanzania*, new species, adult male, allotype, USNM 157415: *a*, left maxilla, medial view; *b*, comb of left 5th limb, medial view; *c*, medial eye and rod-shaped organ; *d*, right Y-sclerite, anterior to right. USNM 157721: *e*, left 6th limb, lateral view; *f*, medial eye and rod-shaped organ; *g*, part of upper lip, anterior to right.

and ventral bristles similar to those of adult female.

Sixth Limb (Figure 57e): 4 small bristles in place of epipodial appendage; 1 limb with 2 bristles at posterior tip of skirt, other with 3 (possibly 4); limb otherwise similar to that of adult female, but remaining bristles not counted.

Seventh Limb: Single limb examined with 77 bristles, 38 or 39 on each side; each bristle with up to 6 bells. Terminus similar to that of adult female.

Furca and Rod-shaped Organ (Figure 57c,f): Similar to those of adult female.

Eyes: Medial eye similar to that of adult female (Figure 57c,f). Lateral eye slightly larger than medial eye, about 15 percent longer than that of adult female, pigmented black; ommatidia not counted but appearing to have number similar to that of female (Figure 56f).

Upper Lip (Figures 56g, 57g): Similar to that of adult female, but anterior spines appear to be short hairs rather than spines.

Posterior of Body: Similar to that of adult female.

Y-Sclerite (Figure 57d): Arcuate.

DESCRIPTION OF JUVENILE FEMALE (probably instar II) (Figure 55b-k).—Carapace shape and ornamentation similar to that of previously described female (Figure 55b).

Infold: Not examined.

Size: USNM 157627, length 1.18 mm, height 0.94 mm; USNM 157628, length 1.19 mm, height 0.92 mm.

First Antenna (Figure 55c): 1st joint with long lateral and medial hairs near ventral margin, and minute spines forming medial row near distal margin. 2nd joint: long medial and lateral hairs near ventral margin; dorsal margin with few long hairs and 1 distal spinous bristle; lateral side with 1 distal bristle. 3rd joint: short ventral margin with 1 short bristle; long dorsal margin with 1 spinous bristle proximal to middle; lateral side with long hairs near dorsal margin. 4th joint: short dorsal margin with 1 long, spinous, terminal bristle; long ventral margin with few long hairs but no bristles. 5th joint: dorsal margin with stout tooth proximal to middle; lateral and medial

sides with few long hairs near dorsal margin; sensory bristle of 5th joint with 1 fairly long filament just distal to middle, and 5 long terminal filaments. 6th joint with spinous medial bristle reaching past tip of a-bristle of 7th joint. 7th joint: a-bristle clawlike, bare, about same length as dorsal margin of 5th joint; b-bristle stout, about one and one-half times length of a-bristle, with bifurcate tip, no proximal filaments; c-bristle longer than sensory bristle, with 5 marginal filaments. 8th joint: d- and e-bristles bare, with blunt tips just reaching past tip of sensory bristle of 5th joint; f-bristle bent dorsally, with 3 or 4 short proximal filaments on ventral margin; g-bristle reaching past tip of sensory bristle but shorter than c-bristle, with 5 marginal filaments.

Second Antenna: Protopodite similar to previously described female. Endopodite: 1st joint with 1 short distal bristle; 2nd joint bare, with well-defined sutures separating it from 1st and 3rd joints; 3rd joint with long terminal filament with blunt tip. Exopodite (Figure 55d): similar to that of previously described female except with only 3 bristles on 9th joint (1 long bristle with few small, proximal, ventral spines, and natatory hairs; 1 short bristle with short, closely spaced, marginal spines along both margins; and 1 very short bare bristle).

Mandible: Coxale endite (Figure 55e): ventral branch broken off; small bristle present near base of ventral branch; ventral margin of dorsal branch with 3 nodes followed by 2 backward-pointing, curved processes with spines along concave margins; spines present along margin between processes and tip of branch; tip of dorsal branch with long bristle; dorsal margin of dorsal branch with few serrations. Basale endite: tip with 3 end-type bristles; ventral margin with 2 triaenid bristles, each with 4 pairs of widely spaced proximal spines and about 12 pairs of distal marginal teeth decreasing in length distally along bristle; also present, 1 dwarf bristle with length about one-half that of triaenid bristles. Basale: ventral margin with 1 triaenid bristle with 7 pairs of slender, widely spaced, proximal spines and 8 pairs of distal teeth excluding ter-

minal pair (similar to those on basale endite); dorsal margin with 2 short bristles near middle, and 2 long distal bristles; medial side with spines and hairs. Exopodite reaching past distal dorsal margin of 1st endopodial joint, with 2 ventral bristles (distal of these short). Endopodite: ventral margin with 3 long spinous bristles; ventral margin of 2nd joint with distal bristles forming 2 groups (1 bristle in proximal group and 2 in other); dorsal margin with 3 long stout bristles; medial side with 1 long spinous bristle near distal dorsal corner and 4 cleaning bristles (largest of these with stout marginal spines); end joint with 3 long stout claws, 1 long lateral bristle, and 2 ventral bristles (1 long, 1 short).

Maxilla: Epipodial appendage long, slender, tapering to slender tip. Endite I with 1 small bristle and 1 long stout bristle; endites II and III combined with 1 short bristle and 3 long stout bristles. Basale: dorsal margin spinous, with 1 short, spinous, proximal bristle (actually on medial side) and 1 long distal bristle; ventral margin with 2 short spinous bristles, 2 long, spinous, distal bristles, and 1 very long, spinous, terminal bristle; medial side with 1 long distal bristle near ventral margin, and spines proximally, distally, and along ventral margin. Endopodite: 1st joint spinous, with 1 short bristle proximal to middle of anterior margin, and 1 long beta-bristle; end joint with 5 bristles. Exopodite consisting of small lobe with 3 bristles (1 long, 2 short).

Fifth Limb: Short hairs of comb along both distal half of dorsal margin and anterodorsal corner becoming slightly longer on anterior margin; lateral side with stout, spinous, epipodial bristle just reaching past end of comb, 3 minute bristles just posterior to base of stout epipodial bristle, and 5 small bristles near ventral margin in vicinity of base of stout epipodial bristle (2 bristles just posterior, and 3 just anterior to base of stout epipodial bristle); bristles along ventral margin similar to those on comb of previously described female.

Sixth Limb (Figure 55f): Limb hirsute; anterior margin with 1 distinct suture; margin dorsal to suture with 1 short, spinous, medial bristle in

dorsal corner, and 1 long spinous bristle immediately above suture.

Seventh Limb (Figure 55g): Small, bare.

Furca (Figure 55h): Each limb with 4 stout claws followed by 1 short, stout, spinous bristle; teeth along posterior margin of main claws consisting of long teeth separated by 3 or 4 smaller teeth (distribution of teeth differs from that of previously described female); hairs present on lamella following claws; all claws distinctly separated from lamella by suture.

Rod-shaped Organ (Figure 55j): Similar to that of previously described female.

Eyes: Medial eye similar to that of previously described female (Figure 55j). Lateral eye about same size as medial eye, pigmented black, with about 15 ommatidia (Figure 55i).

Upper Lip (Figure 55j): Similar to that of previously described female but no anterior spines observed.

Posterior of Body (Figure 55k): Similar to that of previously described female.

Y-Sclerite (Figure 55k): Dorsal socket near middle; parts anterior and posterior to socket forming distinct angle.

Gill-like Structures: 7 well-developed structures on each side of posterior of body.

COMPARISONS.—The new species, *T. tanzania*, differs from *T. brevis* (Müller, 1890) in the morphology of the sensory bristle on the 5th joint of the 1st antenna of the female. The sensory bristle of *T. tanzania* bears 7 short marginal filaments, whereas this bristle on *T. brevis* bears 2–4 short marginal filaments. Of course, the variability of this character on both species is not known, but in other species in the subfamily, the number of short filaments is fairly constant, although occasionally a rare specimen has been observed to vary from the norm (e.g., in *Leuroleberis zealandica* (Baird, 1850) (see Kornicker, 1979).

The distal epipodial bristles on the 6th limb of specimens of *T. tanzania* collected off Madagascar appear to be longer than those bristles on specimens collected off Tanzania. In that respect the Madagascar specimens are similar to *Tetraleberis maddocksae*. The latter species has very slender



FIGURE 58.—*Tetraleberis* species 1, juvenile (instar I), USNM 157416: *a*, complete specimen showing outline of lateral eye, length 1.33 mm; *b*, right 1st antenna, lateral view; *c*, teeth along dorsal edge of 5th joint of right 1st antenna, lateral view; *d*, teeth along dorsal edge of 5th joint of left 1st antenna, lateral view; *e*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *f*, exopodite of right 2nd antenna (hairs not shown on all bristles), medial view; *g*, left mandible (coxale endite not shown), medial view; *h*, left maxilla (endites not shown), lateral view; *i*, right lamella of furca, lateral view.

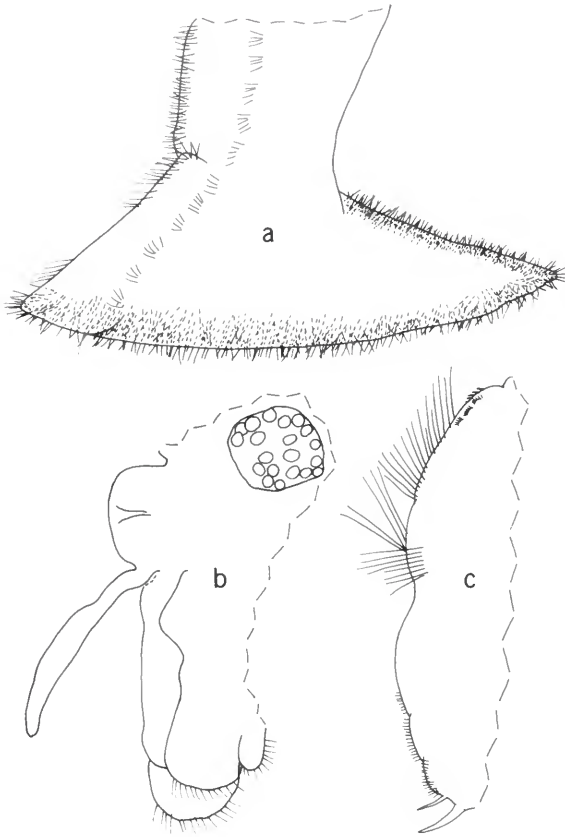


FIGURE 59.—*Tetraleberis* species 1, juvenile (instar I), USNM 157416: *a*, 6th limb; *b*, anterior of body showing left lateral eye, medial eye and rod-shaped organ, and both left and right lobes of upper lip; *c*, posterior of body showing posterior hairs and 2 posterior claws of right lamella of furca.

spines on the bristles of the exopodite of the 2nd antenna, whereas the spines are stout on *T. tanzania*. Adult males of the 2 species will be difficult to separate, because spines are not present on the exopodial bristles of adult males of *T. tanzania*, and also may not be present on adult males of *T. maddockiae*, which is unknown.

21. *Tetraleberis* species 1

FIGURES 58, 59; Plate 4

MATERIAL.—USNM 157416, 1 juvenile (instar I) from station 9-446, Indian Ocean

DISTRIBUTION.—Off Somalia at depth of about 65 m (Figure 44). Because of having only 1 early juvenile of this species in the collection it has been left in open nomenclature.

DESCRIPTION OF JUVENILE, INSTAR I (Figures 58, 59, Plate 41).—Carapace oval in lateral view with fairly deep incisur and pointed rostrum (Figure 58*a*, Plate 41*a,b*).

Ornamentation: Anterior margin without scalloped ridge; no vertical ridge present posterior to incisur; surface with minute reticulations (Plate 41*c-f,h*); bristles emerging from open pores both with single rim (Plate 41*h*) and concentric rims (Plate 41*c-f*); minute pores without bristles also present (Plate 41*f*).

Infold: Typical for genus.

Selvage: Selvage along anterior margin of rostrum with marginal fringe (Plate 41*g*).

Size: USNM 157416, length 1.33 mm, height 1.10 mm.

First Antenna (Figure 58*b-d*): Joints 1-6 hirsute. 3rd joint with 1 long dorsal and 1 short ventral bristle. 5th joint with teeth forming row along dorsal margin; sensory bristle without filaments. 6th joint with long, spinous, medial bristle. 7th joint: a-bristle clawlike, pectinate along dorsal margin; b-bristle about same length as a-bristle, bare; c-bristle reaching past sensory bristle of 5th joint, bare. 8th joint: d- and e-bristles about same length as sensory bristle, bare with blunt tips; f-bristle bent dorsally, bare; g-bristle about same length as c-bristle, bare.

Second Antenna (Figure 58*e,f*): Protopodite with short, medial, distal bristle. Endopodite 3-jointed: 1st and 2nd joints bare; 3rd joint with long terminal bristle. Exopodite with 9 joints: 1st joint with medial spine on distal margin; bristle of 2nd joint reaching 9th joint, with numerous slender marginal spines; bristles of joints 3 and 4 with slender ventral spines and natatory hairs; bristles of joints 5-8 with natatory hairs, no spines; 9th joint with 2 bristles (dorsal of these with short hairs, other with long natatory hairs, no spines); joints 3-8 with stout basal spines; 9th joint with stout lateral spine; joints 2-8 with minute spines forming row along distal margin.

Mandible (Figure 58g): Coxale endite broken off both limbs of USNM 157416, but slender bristle present near base of ventral branch (not shown on illustrated limb). Basale endite: tip with 2 end-type bristles; ventral margin with 1 fairly long dwarf bristle and 1 long bristle with marginal hairs. Basale: ventral margin with 1 triaenid bristle near endite (paired teeth of triaenid bristle decreasing in size distally along bristle); dorsal margin with 1 bristle near middle and 2 terminally. Exopodite hirsute, reaching past distal end of 1st endopodial joint, with 2 ventral bristles (distal of these short). Endopodite: 1st joint with 2 long ventral bristles (left limb only of USNM 157416 also with 1 dorsal bristle); ventral margin of 2nd joint with 1 long, spinous, terminal bristle; dorsal margin and medial surface of 2nd joint near dorsal margin with total of 6 bristles; medial side of 2nd joint with long spines forming rows; end joint with 3 long, spinous, clawlike bristles and 1 long, spinous, ventral bristle.

Maxilla (Figure 58h): Epipodial appendage about two-thirds length of dorsal margin of basale. Endites with total of 4 long bristles. Basale: dorsal margin with 1 proximal bristle with base on medial side; ventral margin with 3 long distal bristles and 1 very long terminal bristle. Exopodite consisting of small lobe with 1 long and 2 short bristles. Endopodite: 1st joint with 1 short anterior bristle and 1 long beta-bristle; end joint with 4 or 5 bristles.

Fifth Limb: Present but not examined in detail.

Sixth Limb (Figure 59a): Hirsute, but without bristles.

Seventh Limb: Absent.

Furca (Figure 58i): Each lamella with 4 claws, but no bristles; all claws with teeth along posterior margins; claws 1 and 2 with teeth near middle longer than others, especially on claw 2; sutures at bases of claws 3 and 4, if present, not well developed.

Rod-shaped Organ (Figure 59b): Elongate with unevenly rounded tip.

Eyes: Medial eye bare, without pigment (Figure 59b). Lateral eye about same size as medial eye, with amber pigment and about 20 ommatidia (Figure 59b).

Upper Lip (Figure 59b): Consisting of 2 hirsute lobes, middle saddle, and hirsute lateral flaps, 1 on each side of mouth.

Posterior (Figure 59c): Spinous but without dorsal process.

COMPARISONS.—No other species in the genus has a row of minute teeth along the dorsal margin of the 5th joint of the 1st antenna.

Tetraleberis species indeterminate

FIGURES 60, 61

MATERIAL.—USNM 157698, 1 juvenile (instar I), sta LK-35, Indian Ocean (Figure 60a); this specimen is without teeth or processes on dorsal margin of the 5th joint of the 1st antenna, has a bare clawlike a-bristle on the 1st antenna, bears 4 claws on each lamella of the furca, and does not have a vertical ridge posterior to the incisur on the carapace; length 1.07 mm, height 0.86 mm. USNM 157699, 2 juveniles (instar I), sta 9-446 (Figure 60b,c), Indian Ocean; both specimens similar to previous specimen (USNM 157698), except a-bristle of 1st antenna pectinate along dorsal margin; length 0.91 mm, height 0.79 mm; length 0.92 mm, height 0.77 mm. USNM 134476, 1 juvenile (instar I), length 0.87 mm, height 0.70 mm, from Kagami-ga-ura Bay, Tateyama, Japan (Figure 61); the 1st antenna is without a node on the dorsal margin and the bristles of the 7th and 8th joints are without filaments; no bristles are on the 6th limb, and the 7th limb is absent; each furcal lamella has 4 main claws but no bristle between claws 3 and 4, and spines are present in place of bristles following claw 4. USNM 157801, 4 juveniles, from Bab el Mandeb; may be *T. tanzania*, but insufficiently developed to be certain.

DISTRIBUTION.—Off Somalia at about 65 m; off Zanzibar Island at 20 m; Bab el Mandeb at 24 m; in plankton (0–1 m below surface) off Tateyama, Japan, bottom depth 3–6 m. (Figure 44).

Amboleberis, new genus

ETYMOLOGY.—The generic name derived from the Greek *ambon* (ridge) plus *leberis* (sloughed skin)

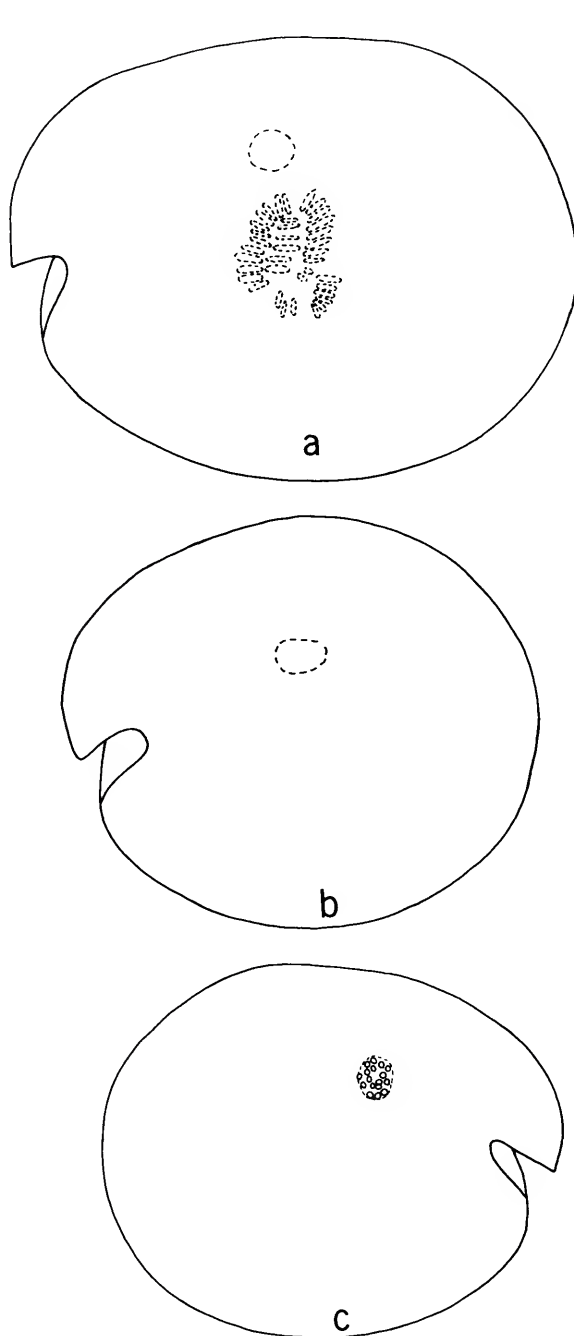


FIGURE 60.—*Tetraleberis* species indeterminate, lateral views of carapace: *a*, juvenile (instar I), USNM 157698, length 1.07 mm; *b*, *c*, 2 juveniles (instar I), USNM 157699, lengths 0.91 mm and 0.92 mm.

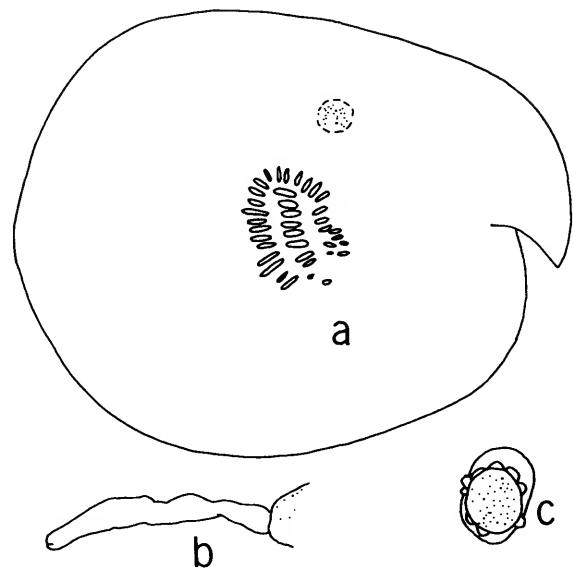


FIGURE 61.—*Tetraleberis* species indeterminate, juvenile (instar I), USNM 134476: *a*, complete specimen, length 0.87 mm; *b*, rod-shaped organ and part of medial eye; *c*, right lateral eye.

in reference to the vertical ridge posterior to the incisur of species in this genus. Gender feminine.

TYPE-SPECIES.—*Asterope americana* Müller, 1890.

COMPOSITION AND DISTRIBUTION (Figure 39).—*Amboleberis antyx*: Madagascar. *Amboleberis americana*: Pacific Ocean: Panama, Costa Rica. Atlantic Ocean: South Carolina, Georgia and Florida Shelf, Dry Tortugas, Brazil, Bahamas, Florida keys. Gulf of Mexico: Florida, Texas. Caribbean Sea: Belize. Depth range surface to 53.5 m.

Two species are referred to this genus: *Amboleberis americana* (Müller, 1890) and *Amboleberis antyx*, new species.

DIAGNOSIS OF FEMALE.—Carapace with vertical ridge with dorsal end just posterior to inner end of incisur and ventral end curving posteriorly to intercept ventral margin of valve (also on carapace of adult male); valves oval in lateral view with deep anterior incisur;

Ornamentation: Surface without abundant shallow fossae; bristles scattered over valve surface emerging both from open pores without rims and open pores with concentric rims; pores without

bristles also present; abundant pits visible on surface when viewed at very high magnification ($\times 10,000$); anteroventral and anterodorsal borders without scalloped edge.

First Antenna: Sensory bristle of adult female of *A. americana* with 7 short proximal and 8 or 9 long terminal filaments; sensory bristle of juvenile female (instar IV?) of *A. antyx* with 5 short proximal and 7 long terminal filaments. Clawlike a-bristle of *A. americana* bare, that of *A. antyx* with teeth proximally along dorsal margin.

Second Antenna: Most exopodial bristles with stout ventral spines; exopodial joints 2-8 with stout basal spines.

Maxilla: Exopodite with 3 bristles present.

Fifth Limb: Dorsal and ventral margin of comb

subparallel.

Seventh Limb: Terminus consisting of opposing combs, 1 on each side. Adult female of *A. americana* with 64 bristles; juvenile female (instar IV?) *A. antyx* with 39 or 40 bristles.

Furca: Each lamella with 4 stout claws, 1 short bristle between claws 3 and 4, but closer to claw 4, and several bristles following 4th claw (6 bristles on adult *A. americana*, 4 on instar IV? *A. antyx*).

COMPARISONS.—The vertical ridge posterior to the incisur and intersecting the ventral margin of each valve distinguishes *Amboleberis* from *Tetraleberis* the only other genus in the tribe. A similar ridge is present on the carapace of *Cyclasterope fascigera* (see Plate 1a).

Key to Species of *Amboleberis*

- Dorsal margin of 5th joint of 1st antenna with nodes 22. **A. americana**
 Dorsal margin of 5th joint of 1st antenna without nodes
 23. **A. antyx**, new species

22. *Amboleberis americana* (Müller, 1890), new combination

FIGURES 62-66; PLATES 42-46

Asterope americana Müller, 1890:240, pl. 25: fig. 16; pl. 26: fig. 9; pl. 27: fig. 11.

Asterope dentata Müller, 1890:240 [lapsus].

Cylindroleberis americana.—Müller, 1894:218, 220 [inferred].

Cyclasterope brevis.—Brady, 1902:183, pl. 24: figs. 16-22 [see Poulsen, 1965:250].

Cyclasterope amerikana.—Müller, 1906:33.

Cyclasterope americana.—Müller, 1912:48.

Cyclasterope dentata.—Müller, 1912:48 [misspelling of *C. dentata* in synonymy].

Cycloleberis americana.—Skogsberg, 1920:442 [Skogsberg stated that the species probably should be placed in *Cycloleberis*].—Poulsen, 1965:169, 250, 252, figs. 85, 86.—Kornicker, 1975a:69, 78; 1977a:792, 795.

Cyclasterope priacanthus Tressler, 1949:338, figs. 1-3.

Cyclasterope tripla Tressler, 1949:340, figs. 10, 11.

Cyclasterope sphaerica Tressler, 1949:336, 337, 340, figs. 13, 14.

Cycloberis biminiensis Kornicker, 1958:232, 243, figs. 67A-D, 68A-F, 85A-E.

Cyclasterope biminiensis.—Darby, 1965:30, pl. 17: figs. 1-8; pl. 18: figs. 1-7; pl. 19: figs. 1-4.

Cycloleberis biminiensis.—Poulsen, 1965:245 [key].

Cycloleberis priacanthus.—Poulsen, 1965:245 [key].

Cycloleberis tripla.—Poulsen, 1965:245 [key].

Cycloleberis sphaerica.—Poulsen, 1965:245 [key].

HOLOTYPE.—Unique specimen, present locality of specimen, if extant, unknown.

TYPE-LOCALITY.—Coast of South America (Pernambuco), pelagic.

MATERIAL.—USNM 88842, holotype of *Cyclasterope tripla*, juvenile male, seaweed on rocks on east side of Loggerhead Key, Tortugas, Florida; USNM 88844, holotype of *Cyclasterope sphaerica*, juvenile male, 18-20 m, east side of White Shoal, Tortugas, Florida; USNM 88848, holotype of *Cyclasterope priacanthus*, adult male, off Loggerhead Key, near marker 754, Tortugas, Florida (from fish stomach); USNM 88857, paratype of *Cyclasterope tripla*, 1 juvenile male, 16-18 m in southwest channel north of Red Buoy No. 2, Tortugas, Florida; USNM 88851, paratype of *Cyclasterope sphaerica*, 1 juvenile female, debris of cracked rock from west side of Loggerhead Key, Tortugas,

Florida; USNM 150290A, 1 ovigerous female, Tampa Bay, Florida; USNM 150290B, 1 juvenile female, Tampa Bay; USNM 81645, 3 specimens (2 without all appendages), northeast of Lake Worth, Palm Beach County, Florida; USNM 150296, 1 adult male, continental shelf off Georgia; USNM 156913, 1 specimen, Gosnold cruise 222, sta 268B on Atlantic shelf off Florida; USNM 156989, 3 specimens, Carrie Bow Cay, Belize, sta 56; USNM 156800, 156801, 2 specimens, Costa Rica, sta 1567 and 1566, respectively; USNM 157587, 1 juvenile, sta 14, replicate 4, Anclote Anchorage, Florida. USNM 157763, 1 specimen, sta 16(2), off Galveston, Texas. Specimens returned to M. Bowen, Virginia Institute of Marine Science: 2 specimens, sta 1D off South Carolina, 2 specimens, sta 6B off Jacksonville, Florida.

Panama specimens, Pacific side: USNM 157138-140, 3 juveniles, sta 182-1; USNM 156933, 157141, 4 juveniles, sta 182-3; USNM 157142-145, 1 adult male, 10 juveniles sta 183-1; USNM 157146-149, 2 ovigerous females, 9 juveniles, sta 183-2; USNM 157168, 1 ovigerous female, sta 83; 1 juvenile male, sta 75 (retained by H. W. Kaufman); USNM 157198, 1 juvenile, sta 5; USNM 157199, 1 juvenile, sta 6; USNM 157200, 1 ovigerous female, sta 76.

DISTRIBUTION (Figure 39).—Atlantic Ocean: South Carolina, Georgia, Florida, Dry Tortugas, Bahamas, Belize, Brazil. Gulf of Mexico: Florida, Texas. Pacific Ocean: Costa Rica, Gulf of Panama. Collected in surface plankton and on the bottom at intertidal depths and as deep as 53.5 m.

REMARKS.—Müller (1890:240) described the furca of this species as having 3 stout claws, and in 1912 (page 48) stated that the furca is similar to that of *Cycloleberis lobiancoi* (3 stout claws). On the furca of the specimens studied herein, the 3rd stout claw is followed by a slender bristle and then a 4th claw. The 4th claw varies in width from about one-quarter to one-half the width of the 3rd claw. I consider this a main claw. It is not obvious from Müller's original illustration of the furca (1890, pl. 27: fig. 11) that more than 3 claws

are present; however, the 2nd bristle after the 3rd claw is straighter than the following bristles and could very well be a weak claw. I have written to many European museums looking for the holotype of the species but have been unable to locate it and suspect that it has been lost.

DIAGNOSIS.—Each valve with vertical ridge having upper end just posterior to incisur and lower end reaching ventral margin of valve; carapace of adult female about 3 mm, of adult male about 3.5 mm; ventral margin of 5th joint of 1st antenna of female with 4-6 processes, of male with 3 or 4; furca with 3 stout claws followed by a short slender bristle close to a 4th claw; width of the 4th claw one-fourth to one-half width of 3rd claw.

SUPPLEMENTARY DESCRIPTION OF HOLOTYPE (USNM 88848) OF *Cyclasterope priacanthus* TRESSLER, 1949 (= adult ♂ of *Amboleberis americana*) (Figure 62k,l).—Flattened left valve under cover slip with length 2.73 mm.

First Antenna (Figure 62k): 5th joint: dorsal margin with 3 nodes; sensory bristle with abundant long thin filaments.

Furca (Figure 62l): Each lamella with 3 stout main claws followed by 1 short bristle, 1 short main claw, and then 5 bristles.

SUPPLEMENTARY DESCRIPTION OF HOLOTYPE (USNM 88842) OF *Cyclasterope tripla* TRESSLER, 1949 (= A-2 ♂ of *Amboleberis americana*) (Figure 62a-c).—Carapace length 1.87 mm.

First Antenna (Figure 62a): 5th joint: dorsal margin with 4 nodes.

Second Antenna (Figure 62b): Endopodite 3-jointed: 1st joint with 4 bristles; 2nd joint elongate bare; 3rd joint with 1 very long proximal bristle and 1 short terminal spine.

Furca (Figure 62c): Each lamella with 3 stout main claws followed by 1 short bristle, 1 short main claw, and 4 bristles.

SUPPLEMENTARY DESCRIPTION OF HOLOTYPE (USNM 88844) OF *Cyclasterope sphaerica* TRESSLER, 1949 (= A-1 or A-2 ♂ of *Amboleberis americana*) (Figure 62d-j).—Left valve under cover slip with length 2.26 mm.

First Antenna (Figure 62d,e): Dorsal margin of

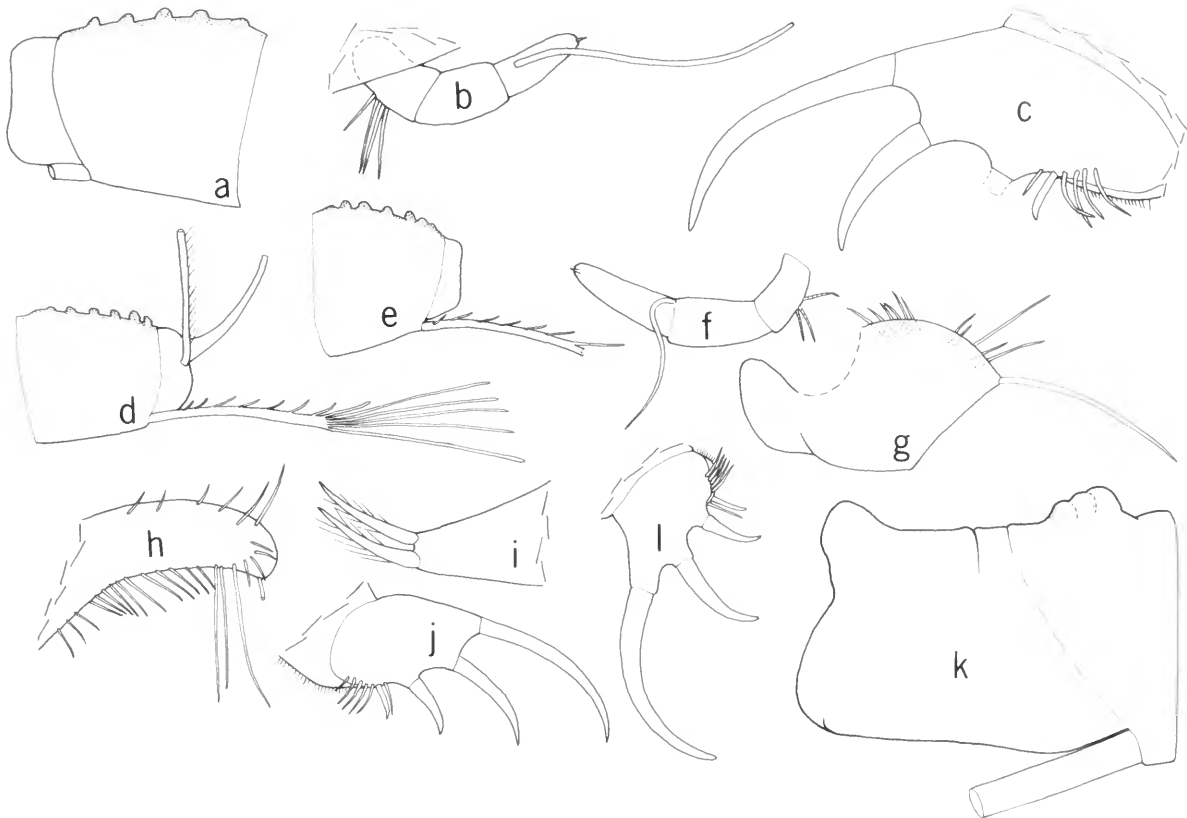


FIGURE 62.—*Amboleberis americana* (Müller), holotypes of species referred to *A. americana* herein: *Cyclasterope tripla* Tressler, A-2 male, USNM 88842: *a*, processes along dorsal margin of 5th joint of right 1st antenna, medial view; *b*, endopodite of left 2nd antenna, lateral view; *c*, right lamella of furca, medial view. *Cyclasterope sphaerica* Tressler, A-1 or A-2 male, USNM 88844: *d*, sensory bristle and dorsal nodes of 5th joint, lateral view; *e*, proximal part of sensory bristle and dorsal nodes of 5th joint of left 1st antenna, medial view; *f*, endopodite of left 2nd antenna, medial view; *g*, bristles on dorsal margin of basale of left mandible, medial view; *h*, basale of left maxilla, medial view; *i*, posterior bristles on skirt of right 6th limb, lateral view; *j*, right lamella of furca, lateral view. *Cyclasterope priacanthus* Tressler, adult male, USNM 88848: *k*, dorsal nodes and proximal part of sensory bristle of right 5th joint and joints 6-8 of 1st antenna, medial view; *l*, left lamella of furca, lateral view.

5th joint with 6 nodes; sensory bristle with 7 or 8 short proximal and 5 long terminal filaments.

Second Antenna (Figure 62*f*): Endopodite 3-jointed: 1st joint with 3 short bristles; 2nd joint elongate, bare; 3rd joint elongate, with 1 long proximal bristle and spine near tip.

Mandible (Figure 62*g*): Dorsal margin of basale with about 12 bristles.

Maxilla (Figure 62*h*): Basale with numerous bristles.

Sixth Limb (Figure 62*i*): Posterior tip of skirt with 2 short hirsute bristles.

Furca (Figure 62*j*): Each lamella with 3 stout main claws followed by 1 short bristle, 1 short main claw, and 5 bristles.

DESCRIPTION OF ADULT FEMALE (Figures 63, 64,

Plates 42–44).—Carapace oval in lateral view with slitlike incisur (Figure 63a, Plate 42a); some specimens flattened dorsally.

Ornamentation: Bristles emerging from simple open pores scattered over valve surface (Plate 43b); longer less abundant bristles emerging from more-or-less concentrically rimmed pores (Plates 42f, 43a); anterodorsal margin of valves without scallops (Plate 42c); surface between pores pitted (Plate 43a,b); long bristles present along anterodorsal, anteroventral, and ventral margins (Plate 42c,d); a vertical ridge present posterior to incisur and extending to ventral margin (Plate 42a,d).

Infold (Plates 43c,e,f, 44): Anterodorsal infold above incisur with about 60 bristles; outer part of infold below incisur with about 20 short bristles forming row parallel to valve margin; additional bristles present along anteroventral and ventral list (Plate 42e); small band with pebbly surface present along outer edge of infold just proximal to lamellar prolongation of selvage (Plates 43f, 44b); posterior infold with stout bristles along list, and additional bristles between list and posterior shell margin; stout bristles of posterior list with numerous pores at base (Plate 44a,c–f); smaller tubelike bristles present between stout bristles (Plate 44a,c); a small bristle emerging from open pore present near base of some stout bristles (Plate 44d); minute processes also present on posterior list (Plate 44c).

Central Adductor Muscle Attachments: Typical for genus (some of the muscles shown in Plate 43c,d; outline shown in Figure 63a).

Selvage: Lamellar prolongation with serrated edge present along anterior and ventral margins (Plate 43e,f); prolongation with fringed edge along inner margin of incisur (Plate 42d).

List: Anteroventral list with broad lamellar prolongation (Plate 43c,e).

Size: USNM 150290A, length 2.99 mm, height 2.33 mm; USNM 157168, length 3.2 mm, height 2.4 mm; USNM 156800, length 3.20 mm, height 2.65 mm.

First Antenna (Figure 63b): 1st joint with long hairs on medial surface near ventral margin; 2nd joint with long hairs on medial and lateral sur-

faces near ventral margin, 5 or 6 distal lateral bristles, and 3 dorsal bristles; 3rd joint triangular, with small bristle on short ventral margin and 11 or 12 dorsal bristles; 4th joint triangular, with 1 terminal bristle on short dorsal margin and 3 terminal bristles (1 long, 2 short) and few spines on ventral margin; sensory bristle of 5th joint with 7 proximal filaments and 8 or 9 longer terminal filaments; dorsal margin of 5th joint with 4–6 nodes; medial bristle of 6th joint about twice length of 5th joint. Seventh joint: a-claw bare, about same length as 5th joint; b-bristle, including filaments, about twice length of a-claw, with 6 short proximal filaments and 6 longer terminal filaments including stem; c-bristle longer than sensory bristle of 5th joint, with about 14 filaments. Eighth joint: d- and e-bristles bare with blunt tips, about two-thirds length of c-bristle; f-bristle bent dorsally, with more than 10 filaments; g-bristle about same length as c-bristle, with about 12 filaments.

Second Antenna (Figure 63c): Protopodite with short medial bristle and long hairs proximally along ventral margin and on lateral surface. Endopodite 3-jointed: 1st joint with 5 ventral bristles; 2nd joint shorter than 1st, bare; 3rd joint short, separated from 2nd joint by suture, with long terminal bristle. Exopodite: 1st joint with minute, distal, medial spine; 2nd joint about twice length of 3rd joint, with stout basal spine about one-half length of 3rd joint; joints 3–8 also with basal spines, spine of 8th joint reaching past distal end of 9th joint; 9th joint with 1 or 2 lateral spines about three-fourths length of joint, and 5 bristles (dorsal bristle very short); bristle of 2nd joint reaching past 9th joint, with abundant, closely spaced, short, slender, ventral and dorsal spines but no natatory hairs; bristles of joints 3–8 and 3 longest bristles of 9th joint with stout ventral spines proximally and natatory hairs; remaining 3 bristles of 9th joint with natatory hairs; joints 2–8 with short spines forming row along distal margin.

Mandible (Figure 63d–f): Coxale endite: ventral margin of dorsal branch with 3 nodes followed by 2 recurved processes and shorter main spine;



FIGURE 63.—*Amboleberis americana* (Müller), ovigerous female, USNM 150290A: *a*, complete carapace showing position of central adductor muscle attachments (larger of the 2 anterior dashed ovals), position of lateral eye (upper of 2 anterior dashed ovals), and position of eggs, length 2.99 mm; *b*, right 1st antenna, lateral view; *c*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *d*, left mandible, lateral view; *e*, ventral branch of coxale endite of right mandible, lateral view; *f*, dorsal branch of coxale endite of right mandible, lateral view. *g*, terminus of 7th limb; *h*, upper lip, anterior to right; *i*, right lamella of furca, lateral view.

tip of branch appearing to join long, posterior, hirsute bristle; dorsal margin with serrations near middle and short hairs distally; ventral branch with spines forming 4 rows and terminus with 2 ventral teeth, 1 small dorsal tooth, and several small spines between ventral teeth and dorsal tooth; slender bristle present on endite near base of ventral branch. Basale: endite with 8 spinous end bristles, 7 triaenid bristles (with about 14 pairs of spines that decrease in size distally), and 1 dwarf bristle; ventral margin of basale with 6 triaenid bristles similar to those on endite (terminal pair of spines smaller than proximal spines), and 2 longer, spinous, subterminal bristles; lateral side of basale with 5 minute bristles in distal ventral corner, and with long hairs; dorsal margin with 6 or 7 bristles forming row near middle and 2 long, spinous, terminal bristles; medial side with long hairs. Exopodite reaching just past distal end of 1st endopodite joint, with hirsute tip and 2 subterminal bristles on inner edge, proximal of these about three times length of other. Endopodite: ventral margin of 1st joint with 7 bristles; ventral margin of 2nd joint with 2 or 3 subterminal bristles and 2 terminal bristles; dorsal margin and medial surface with numerous bristles; end joint with 3 stout, bare claws and 3 bristles, longest of these with short spines.

Maxilla (Figure 64a): Epipodite fragmented on USNM 150290A. Endites with total of 10 bristles; 3 short bristles present on medial surface just distal to endites. Basale: 1 short proximal bristle present on lateral surface; medial surface with 1 short proximal bristle near dorsal margin and 1 long and 5 short distal bristles near terminal margin; dorsal margin hirsute, with 2 short distal bristles; ventral margin with 9 or 10 short spinous bristles, 2 long, spinous, distal bristles, and 1 long, spinous, terminal bristle. Exopodite consisting of 3 minute bristles without distinct lobe, 1 of the bristles about twice length of others. Endopodite: 1st joint with 1 short bristle on anterior margin and a long spinous beta-bristle; end joint with 5 bristles (1 long with spines, 2 short and 2 medium with faint spines, or bare).

Fifth Limb (Figure 64b): Dorsal margin of comb

with 5 short proximal bristles and short hairs distally, hairs longer along terminal end; lateral side with long, stout, spinous, exopodial bristle extending past end of comb, 5 minute bristles just proximal to base of stout bristle, 5 short bristles near middle of ventral margin, and 1 short bristle near ventral margin proximal to other bristles; 2 bristles near tip with bases on lateral surface near edge.

Sixth Limb (Figure 64c): 1 bristle present in place of epipodial appendage; anterior margin with 2 distinct sutures; margin proximal to upper suture with bristles forming 3 rows: anterior row with bases on edge of limb, with about 20 short bristles; middle row with bases on medial surface, with about 10 bristles longer than bristles in anterior row; inner row with bases on medial surface with about 10 bristles shorter than bristles in middle row. All bristles between upper and lower sutures with bases on medial surface: 12 short bristles in outer row, 1 bristle in middle row, and 5 bristles in inner row (bristle of inner row closest to lower suture much longer than others). Single row of 26 short bristles present between lower suture and point near anterior tip of skirt (2 of the bristles in row near tip longer than others); anterior tip of skirt with 7 additional, mostly longer, bristles; ventral margin of skirt with abundant bristles; posterior tip of skirt with 4 or 5 short hirsute bristles; medial side of limb hirsute distally near posterior margin.

Seventh Limb: Each limb with about 64 bristles, about same number on each side; many rings with 2 bristles, 1 on each side; each bristle with up to 7 bells; terminus with opposing combs, each with about 20 teeth (Figure 63g).

Furca (Figure 63i): Each lamella with 3 stout claws followed by 1 slender bristle, a 4th stout claw, and 6 slender bristles; a few small spines along anterior margin of lamella; long hairs present on ventral margin of fused lamellae between and following the 6 posterior slender bristles; teeth present along posterior margins of stout claws and stout spines present along anterior and posterior margins of slender bristles.

Rod-shaped Organ (Figure 64d): Elongate, 2-



FIGURE 64.—*Amboleberis americana* (Müller), ovigerous female, USNM 150290A: *a*, right maxilla (epipodial appendage not shown), medial view; *b*, comb of right 5th limb, lateral view; *c*, right 6th limb, medial view; *d*, left lateral eye, medial eye, and rod-shaped organ; *e*, posterior of body showing posterior hairs and also posterior bristles on right lamella of furca; *f*, right Y-sclerite, anterior to right.

jointed, broad near middle, tapering to pointed tip.

Eyes (Figure 64d): Medial eye lightly pigmented, bare; lateral eye about same size as medial eye, with black pigment and about 50 ommatidia (outline shown in Figure 63a).

Posterior of Body (Figure 64e): Hirsute but without dorsal process.

Upper Lip (Figure 63h): Evenly rounded, hirsute, without anterior spines.

Y-Sclerite (Figure 64f): Ventral branch absent, dorsal socket near middle; sclerite forming angle convex upward.

Eggs: USNM 150290A with 37 eggs in marsupium. (Outlines of 9 eggs shown in Figure 63a).

Epizoa: Posterior edge of valve with numerous stemmed protozoans (Plate 43c).

DESCRIPTION OF ADULT MALE (Figure 65, Plates 45, 46).—Carapace elongate with notch in posterodorsal corner (Figure 65a, Plate 45a,d), and shorter rostrum than on female (Plate 42a,d).

Ornamentation: Surface similar to that of female in having abundant minute pores visible in transmitted light and bristles along anterior, anteroventral, and ventral margins; long hairs numerous near anteroventral margin below incisor and on posterior end of valves (Plate 45a–d); a distinct vertical ridge present posterior to incisor and extending to ventral margin (Figure 65b, Plate 45a,b); anterior edge of rostrum without scallops but minute nodes present along anterodorsal corner; vertical ridge with hairs near posterior end of valve appearing nodose (Plate 45d); bristles emerging from closed pore in slightly depressed reticulate areas sparsely distributed over valve surface (Plate 46a–c); surface of valve with peculiar minute branching structures (Plate 46a,d,e), oval depressions (Plates 45f, 46a), and pores with rims (Plate 46f).

Infold: Not studied in detail but in general similar to that of female.

Central Adductor Muscle Attachments (Figure 65a,c): Normal for subfamily.

Size: USNM 150296, length 3.49 mm, height 2.25 mm.

First Antenna (Figure 65f,g): 1st joint with long

lateral hairs forming row near ventral margin; medial side of 2nd joint with spines and hairs forming rows; lateral side with long hairs near middle of ventral margin and 4 distal bristles; dorsal margin with 2 spinous bristles; 3rd joint triangular, with 1 minute bristle on short ventral margin and 10 bristles on dorsal margin; 4th joint short, with 4 terminal bristles on ventral margin (medial of these minute), and 1 long terminal bristle on dorsal margin; 5th joint short, with stout, ventral, filamentous sensory bristle, terminal filaments slightly stouter than others, and 3 or 4 processes on or near dorsal margin; medial bristle on dorsal margin; 5th joint short, with stout, ventral, filamentous sensory bristle (terminal filaments slightly stouter than others) and 3 or 4 processes on or near dorsal margin; medial about 9 short marginal filaments; c-bristle extremely long, with 60 short filaments, filaments more widely spaced distally; except for distal filaments; filaments on c- and f-bristles with broadened segment proximally with ridged outer margin. Eighth joint: d- and e-bristles bare with blunt tips, slightly shorter than b-bristle; f-bristle similar to c-bristle; g-bristle about same length as b-bristle, with 10 short filaments.

Second Antenna (Figure 65d,e): Protopodite with short medial bristle. Endopodite 3-jointed: 1st joint with 3 short bristles; 2nd joint elongate, with 9 short distal bristles; 3rd joint reflexed on 2nd, with 1 long proximal and 1 short distal bristle; distal end of 3rd joint with ridges. Exopodite: 1st joint elongate, with faint spines along inner (dorsal) margin, and a small tooth near distal outer corner; 2nd joint expanding distally, with basal spine, and long hairs on distal dorsal corner; joints 3–8 short with basal spines, and long hairs on distal dorsal corner; basal spines increase in length distally, spine on 8th joint reaching just past distal end of 9th joint; bristles of joints 2–8 with natatory hairs but no spines; 9th joint with 5 bristles with natatory hairs (dorsal of these very short), and 1 short blunt (possibly broken) lateral spine.

Mandible: Coxale endite broken off USNM 150296. Basale: endite with 7 or 8 end bristles, 3



dwarf bristles, and 6 longer bristles with faint distal spines (not triaenid type); ventral margin of basale with 5 slender bare bristles and 2 long, spinous, subterminal bristles; dorsal margin of basale with 5 bristles near middle and 2 long terminal bristles; lateral side with 4 or 5 minute bristles in vicinity of distal ventral corner; medial surface with few short spines forming rows. Exopodite reaching just past distal margin of 1st endopodite joint, hirsute, with 2 subterminal bristles, proximal of these about twice length of other. Endopodite: 1st joint with 7 ventral bristles (1 of these minute); ventral margin of 2nd joint with 2 subterminal and 2 terminal bristles; dorsal margin and medial surface with abundant bristles; end joint with 3 long, stout, bare claws and 3 bristles.

Maxilla (Figure 65h): Epipodite reaching to about middle of dorsal margin of basale, with rounded tip bearing few hairs. Endites consisting of 6 long bristles, 2 medium bristles, and 1 short bristle; 3 short bristles present just distal to endite bristles. Basale: dorsal margin with proximal hairs and 2 short distal bristles; medial surface with 1 short proximal bristle and 3 short and 1 long distal bristle; lateral surface with 1 short proximal bristle; ventral margin with 7 short proximal bristles, 2 long distal bristles, and 1 very long terminal bristle. Exopodite consisting of short lobe with 3 bristles, 1 of these about twice length of others. Endopodite: 1st joint with 1 short anterior bristle and 1 long spinous beta-bristle; 2nd joint with 5 spinous bristles (1 long,

2 medium, 2 short).

Fifth Limb (Figure 65i-k): Dorsal margin of comb with 4 short bristles proximal to dorsal arch near middle of margin; anterior edge of arch smoothly rounded on left limb and slightly undulate on right limb, and with few hairs; dorsal margin distal to arch bare except near end, which bears short and then longer hairs; exopodial bristles consisting of long, stout, spinous bristle, 5 minute bristles just proximal to base of stout bristle, 5 small bristles near ventral margin proximal to stout bristle; 2 bristles with bases on lateral surface present near ventral margin close to proximal and distal ends of comb; a minute bristle present on lateral side of proximal ventral corner of comb.

Sixth Limb: Each limb with 1 epipodial bristle; left limb with 4 hirsute bristles on posterior end of skirt, right limb with only 2; remaining bristles not counted but, in general, similar to those of adult female.

Seventh Limb: Each limb with about 58 bristles, about same number on each side; many rings with 2 bristles, 1 on each side; each bristle with up to 6 bells; terminus with opposing combs, each with about 16-18 teeth (Figure 65l).

Furca (Figure 65m): Similar to that of adult female except claws 1-3 longer and more strongly curved (possibly claws of female worn down).

Rod-shaped Organ and Medial Eye (Figure 65o), *Lateral Eye* (Figure 65n), *Upper Lip* (Figure 65o), *Posterior of Body, Y-Sclerite*: Similar to that of female, but lateral eye slightly larger (outline of lateral eye shown in Figure 65a).

DESCRIPTION OF A-1 FEMALE (Instar VI).—Carapace similar in shape to that of adult female.

Size: USNM 157149E, length 2.45 mm, height 1.86 mm.

First Antenna: Dorsal margin of 5th joint with 4 prominent processes.

Second Antenna: Endopodite 3-jointed: 1st joint with 5 anterior bristles; 2nd joint short bare; 3rd joint minute with 1 long terminal bristle.

Furca: Each lamella with 3 strong claws followed by 1 bristle, then 1 strong claw and 7 bristles.

DESCRIPTION OF A-1 MALE (Instar VI) (Figure

FIGURE 65.—*Amboleberis americana* (Müller), adult male, USNM 150296: a, complete specimen showing position of central adductor muscle attachments and left lateral eye (dashed), length 3.49 mm; b, anteroventral corner of left valve, lateral view; c, central adductor muscle attachments as seen through left valve viewed laterally, anterior to left; d, endopodite of left 2nd antenna, medial view; e, joints 2 and 3 and distal part of joint 1 of exopodite of left 2nd antenna, medial view; f, right 1st antenna, lateral view; g, proximal part of proximal filament attached to segment of c-bristle of 7th joint of right 1st antenna; h, right maxilla medial view; i, comb of left 5th limb, lateral view; j, k, detail of processes near middle of dorsal margin of combs of right and left 5th limbs, lateral view; l, terminus of 7th limb; m, right lamella of furca, lateral view; n, left lateral eye; o, anterior of body showing medial eye, rod-shaped organ, and upper lip.

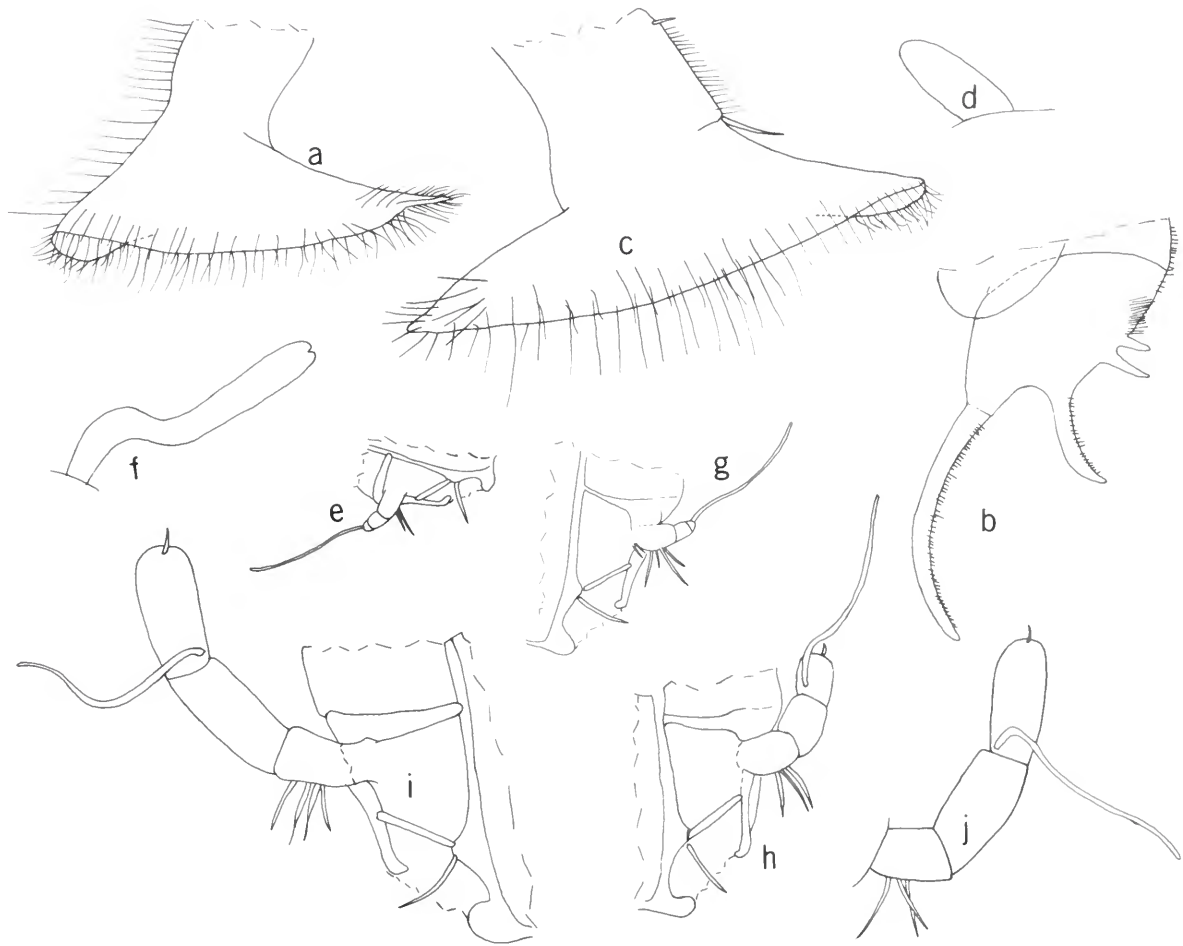


FIGURE 66.—*Amboleberis americana* (Müller), juveniles: *a, b*, right 6th limb (medial view) and left lamella of furca of instar I, USNM 157142A; *c, d*, left 6th limb (medial view) and 7th limb of instar II, USNM 157149C; *e*, endopodite and distal part of protopodite of left 2nd antenna of instar III, medial view, USNM 157149D; *f*, 7th limb of instar III, USNM 157149A; *g*, endopodite and distal part of protopodite of right 2nd antenna of female instar V, medial view, USNM 157144; *h*, endopodite and distal part of protopodite of right 2nd antenna of male instar V, medial view, USNM 157142C; *i, j*, endopodites of left and right 2nd antennae of male instar VI, medial views, USNM 157142D.

66*i, j*).—Carapace similar in shape to that of adult female.

Size: USNM 157142D, length 2.53 mm, height 2.11 mm.

First Antenna: Dorsal margin of 5th joint with 4 prominent protuberances.

Second Antenna (Figure 66*i, j*): Endopodite 3-jointed: 1st joint with 3 or 4 distal bristles; elongate 2nd joint bare; 3rd joint with 1 long proximal bristle and 1 short terminal spine.

Sixth and 7th Limbs: Well developed with numerous bristles.

Furca: Each lamella with 3 strong claws fol-

lowed by 1 bristle, then a 4th strong claw and 6 bristles.

DESCRIPTION OF A-2 FEMALE (Instar V) (Figure 66*g*).—Carapace similar in shape to that of adult female.

Size: USNM 157144, length 1.83 mm, height 1.43 mm; USNM 156933A, length 1.89 mm, height 1.47 mm; USNM 157146A, length 1.78 mm, height 1.44 mm; USNM 157147, length 1.96 mm, height 1.52 mm.

First Antenna: Dorsal margin of 5th joint with 4 or 5 well-defined protuberances.

Second Antenna (Figure 66*g*): Endopodite 3-

jointed: 1st joint with about 6 bristles (2 proximal, 4 distal); 2nd joint short, bare; 3rd joint short with 1 long terminal bristle.

Sixth Limb: Well developed with numerous bristles.

Seventh Limb: Elongate with numerous marginal bristles and well-developed terminal combs.

Furca: Each lamella with 3 stout claws followed by 1 bristle, then 1 weak claw and 4 bristles.

DESCRIPTION OF A-2 MALE (Instar V) (Figure 66h).—Carapace similar in shape to that of adult female.

Size: USNM 157142C, length 2.15 mm, height 1.64 mm.

First Antenna: Dorsal margin of 5th joint with 5 or 6 protuberances.

Second Antenna (Figure 66h): Endopodite 3-jointed: 1st joint elongate with 3 bristles; 2nd joint elongate, bare; 3rd joint elongate with 1 long proximal bristle and 1 short terminal spine.

Sixth Limb: Well developed with numerous bristles.

Seventh Limb: Well developed with numerous bristles and well-developed terminal combs.

Furca: Each lamella with 3 strong claws followed by 1 bristle, then 1 weak claw and 4 bristles.

DESCRIPTION OF A-3 INSTAR (Instar IV).—Carapace similar in shape to that of adult female.

Size: USNM 157199, length 1.36 mm, height 1.11 mm.

First Antenna: Dorsal margin of 5th joint with 3 or 4 well-defined protuberances.

Sixth Limb: Well developed with numerous bristles.

Seventh Limb: Elongate with marginal bristles; terminal combs not well developed.

Furca: Each lamella with 3 claws followed by 1 weak claw and then 3 bristles.

Sex: Indeterminate.

DESCRIPTION OF A-4 INSTAR (Instar III) (Figure 66e,f).—Carapace similar in shape to that of adult female.

Size: USNM 157149D, length 1.29 mm, height 0.96 mm; USNM 157149A, length 1.25 mm, height 0.97 mm.

First Antenna: Dorsal margin of 5th joint with 4

or 5 well-defined protuberances; sensory bristle of 5th joint with filaments.

Second Antenna (Figure 66e): Endopodite 3-jointed: 1st joint with 2 anterior bristles; 2nd joint bare; 3rd joint short with 1 long terminal bristle.

Sixth Limb: Well developed with many bristles.

Seventh Limb (Figure 66f): Elongate, bare.

Furca: Each lamella with 3 stout claws followed by 1 slender claw and then 2 bristles; all claws separated from lamella by suture.

Sex: Indeterminate.

DESCRIPTION OF A-5 INSTAR (Instar II) (Figure 66c,d).—Carapace similar in shape to that of adult female.

Size: USNM 157149C, length 1.01 mm, height 0.76 mm.

First Antenna: Dorsal margin of 5th joint with 3 well-defined protuberances; sensory bristle of 5th joint with filaments.

Sixth Limb (Figure 66c): Anterior margin of trunk with 1 short upper bristle and 1 longer distal bristle.

Seventh Limb (Figure 66d): Either absent, or minute, bare. (Presence of minute limb could not be determined with certainty.)

Furca: Each lamella with 3 stout claws followed by 1 slender claw and 1 bristle; 3rd stout claw not separated from lamella by suture.

Sex: Indeterminate.

DESCRIPTION OF A-6 INSTAR (Instar I) (Figure 66a,b).—Carapace similar in shape to that of adult female.

Size: USNM 157142A, length 0.80 mm, height 0.64 mm; USNM 157142B, length 0.88 mm, height 0.71 mm; USNM 157149B, length 0.77 mm, height 0.61 mm.

First Antenna: Dorsal margin of 5th joint crenulate but without protuberances; sensory bristle of 5th joint without filaments.

Sixth Limb (Figure 66a): Hirsute medially, with lateral flap; posterior tip of skirt prolonged but bristle not developed.

Seventh Limb: Absent.

Furca (Figure 66b): Each lamella with 4 claws; only claw 1 or claws 1 and 2 separated from lamella by suture.

Sex: Indeterminate.

VARIABILITY.—The number of nodes on the dorsal margin of the 5th joint of the 1st antenna of late instars and adult females is generally 5, but may vary from 4 to 6. The 1st antennae of only 2 adult males were observed: USNM 88848 has a large proximal node followed by 2 small nodes on the dorsal margin of the 5th joint, whereas USNM 150296 has 4 nodes and the proximal node is not larger than the others, and the distal node is on the lateral side of the joint. The caudal lamellae of the furca of all the specimens of instar V to adult examined have a small slender bristle between the 3rd and 4th claws, but closer to the 4th claw; the 4th claw is definitely a claw, not a bristle, but varies in width at its base from one-quarter to one-half times the width of claw 3 at its base. The vertical ridge on the carapace that lies just posterior to the incisur and extends to the ventral margin is difficult to see on some specimens, especially on whole specimens when viewed in reflected light, but was discernible on all valves viewed with transmitted light.

ONTOGENETIC DEVELOPMENT (Tables 21, 22).—Poulsen (1965, table 22) reported on 3 juveniles that he referred to the first 3 instars. I concur with Poulsen in that designation and have included his data in Table 21. I have, however, changed his designation from female to sex indeterminate.

The protuberances on the dorsal margin of the 5th joint of the 1st antenna, which is characteristic of this species, is absent or very poorly defined on instar I, but is well developed in instar

II. The 6th limb is without bristles on instar I, has 2 bristles (an upper and lower bristle) on the anterior margin of the trunk on instar II, and has many bristles on both the anterior margin of the trunk and ventral margin of the skirt in later instars. The 7th limb is absent in instar I, is either absent or present as a minute bare process in instar II, is elongate and bare in instar III, and is well developed with many bristles in later instars. The furca is without bristles in instar I and has 1 or more bristles on each lamella in later instars.

Poulsen (1965:473) concluded that this species has 5 juvenile stages. He based the conclusion on the assumption that the specimen with a length of 2.3 mm described by Müller (1890:240) is an adult female. The present study indicates that adult females have a length of 2.99–3.20 mm. This suggests that Müller's specimen is a juvenile (probably A-1 female). Therefore, I have tentatively concluded that the species has 6 juvenile stages. I have tried in Table 21 to derive from the size of the carapace and morphology of the 6th and 7th limbs, and the furca, the growth stage of the specimens studied. Because of variability of the characters, I am uncertain that the specimens have always been assigned to the correct growth stage, but I believe the data suggest that the species has at least 6 juvenile stages. The high variability in the growth factors for females presented in Table 22 may reflect incorrect assignment of specimens to a growth stage, and also the few specimens in the sample.

Key to Early Instars of *Amboleberis americana*

1. 6th limb without anterior bristles on trunk Instar I
6th limb with 2 or more anterior bristles on trunk 2
2. 6th limb with 2 anterior bristles on trunk, and no ventral bristles on skirt;
7th limb absent or minute, bare Instar II
6th limb with more than 2 anterior bristles on trunk, and many ventral
bristles on skirt; 7th limb elongate, either bare or with bristles 3
3. 7th limb bare Instar III
7th limb with many bristles Instar IV–Adult

REMARKS CONCERNING SPECIMENS IDENTIFIED BY TRESSLER (1949) AND KORNICKER (1958).—

Tressler (1949:338) described the new species *Cyclasterope priacanthus* (USNM 88848) from a single

TABLE 21.—Morphological development of instars of *Amboleberis americana* (Müller)

Instar	USNM	Sex	Length (mm)	Furcal claw (X)/bristle (x) ^a												Bristles of 6th limb			
				1	2	3	4	5	6	7	8	9	10	11	12	anterior	ventral	7th limb	
I ^b	none	?	0.73	X	X	X ^{c2}	X ^{c2}										0	0	absent
I	157142A	?	0.80	X	X ^c	X ^c	X ^c										0	0	absent
I	157142B	?	0.88	X	X	X ^c	X ^c										0	0	absent
I	157149B	?	0.77	X	X	X ^c	X ^c										0	0	absent
II ^b	none	?	0.93	X	X	X ^c	X ^c	x									2	0	minute, bare
II	157149C	?	1.01	X	X	X ^c	X	x									2	0	minute or absent
III ^b	none	♀?	1.10	X	X	X	X	x	x								many	many	elongate, bare
III	157149D	?	1.29	X	X	X	X	x	x								many	many	elongate, bare
III	157149A	?	1.25	X	X	X	X	x	x								many	many	elongate, bare
IV	157199	?	1.36	X	X	X	X	x	x	x							many	many	many bristles
V	157146A	♀	1.78	X	X	X	x	X	x	x	x	x					many	many	many bristles
V	157144	♀	1.83	X	X	X	x	X	x	x	x	x					many	many	many bristles
V	156933A	♀	1.89	X	X	X	x	X	x	x	x	x					many	many	many bristles
V	157147	♀	1.96	X	X	X	x	X	x	x	x	x					many	many	many bristles
V	88842	♂	1.87	X	X	X	x	X	x	x	x	x					many	many	many bristles
V	157142C	♂	2.15	X	X	X	x	X	x	x	x	x					many	many	many bristles
V or VI	88844	♂	2.26	X	X	X	x	X	x	x	x	x	x				many	many	many bristles
VI	157149E	♀	2.45	X	X	X	x	X	x	x	x	x	x	x			many	many	many bristles
VI	157142D	♂	2.53	X	X	X	x	X	x	x	x	x	x				many	many	many bristles

^a Each number represents the position of a claw or bristle counting from the distal end of lamella.

^b Data from Poulsen (1965:252-260, Table 22).

^c Claw not separated from lamella by suture.

specimen he thought to be a female. It is actually an adult male and has some processes on the dorsal margin of the 5th joint of the 1st antenna and a furca similar to that of *A. americana*. Therefore, it has been referred to that species herein. I should point out that the processes on the dorsal margin of the 5th joint differ in outline from those on another adult male (USNM 150296) described herein from the shelf off Georgia. This could mean that more than 1 species is involved, but I have considered the difference to be the result of intraspecific variation. Tressler (1949:340) also described as new *Cyclasterope tripla* and *Cyclasterope sphaerica*. He stated that the holotypes (USNM 88842, 88844) are females, but actually they are juvenile males. Both species have processes on the dorsal margin of the 5th joint of the 1st antenna and a furca with 4 main claws on each lamella. I have referred both species to *A. americana*. Kornicker (1958:243) described as a new species *Cycloberis* [= *Cycloleberis*] *biminiensis*. That species is referred here to *Amboleberis americana*.

23. *Amboleberis antyx*, new species

FIGURES 8q, 67-70; PLATES 47-51

ENTYMOLOGY.—The specific name from the Greek *antyx* (rim, edge, frame) in reference to the vertical ridge posterior to the incisur on the valves of the species.

HOLOTYPE.—USNM 157625, juvenile female (instar IV?), on slides and in alcohol.

TYPE-LOCALITY.—Station BT-230, Madagascar.

PARATYPES.—Madagascar: USNM 157728, 1 adult male, sta BT-172; USNM 157736, 157738, 3 specimens, sta BT-222; USNM 157726, 1 juvenile male, sta BT-230.

DISTRIBUTION.—Madagascar at depths of 21-29 m (Figure 39).

DESCRIPTION OF JUVENILE FEMALE (Instar IV?) (Figures 67, 68, Plates 47-49).—Carapace oval in lateral view (Figure 67a, plate 47a), with deep incisur near middle of anterior margin (Plate 47a,b); valve widest just posterior to middle (Plate 47c).

TABLE 22.—Average shell dimensions (in mm) and calculated growth factors for females of *Amboleberis americana*

Growth stage	Number of Specimens	Average length	Growth factor
Instar I*	4	0.80	1.21
Instar II*	2	0.97	1.25
Instar III*	3	1.21	1.12
Instar IV*	1	1.36	1.37
Instar V	4	1.87	1.31
Instar VI	3	2.45	1.28
Adult	3	3.13	

* Because males and females could not be distinguished for these early stages, males are probably included in the average dimensions.

Ornamentation: Anterior margin without scalloped border; vertical ridge present posterior to incisur and intersecting ventral margin of valve (Plate 47a,b); surface of valve with abundant minute pits with low narrow rims (Plate 48d,e); bristles present emerging from open pores without rims (Plate 47d-f), with single narrow rim (Plate 48a), or concentric rims (Plate 48b,c); pores with single rim and without bristles also present (Plates 47f, 48d).

Infold: Ventral and posterior segments of infold broader than usual in members of genus, but with similar types of bristles (Plate 49).

Concretions: Abundant in each valve of holotype (Plate 47a-c); concretions not penetrating outer layer of shell (Plate 48f).

Size: USNM 157625, length 1.85 mm, height 1.63 mm.

First Antenna (Figure 67b): 1st joint with long hairs along ventral margin and on medial surface near ventral margin, and short, slender, lateral spines near distal dorsal margin. 2nd joint: hairs along ventral and dorsal margins and on medial and lateral surfaces; dorsal margin with 2 bristles; lateral surface with 1 distal bristle. 3rd joint: short ventral margin with 1 small bristle; long dorsal margin with 6 bristles; lateral surface with hairs

near dorsal margin. 4th joint: short dorsal margin with 1 long terminal bristle; long ventral margin with 3 terminal bristles (1 long, 2 short); medial side with long hairs near dorsal margin. 5th joint: medial side with long hairs near dorsal margin; sensory bristle with 5 short proximal filaments and 7 long terminal filaments. 6th joint: well-defined, with 1 long medial bristle. 7th joint: a-bristle clawlike, with about 16 stout teeth along proximal half of dorsal margin; b-bristle about one-third longer than a-bristle, with about 6 marginal filaments excluding tip; c-bristle reaching well past tip of sensory bristle of 5th joint, with about 9 marginal filaments excluding tip. 8th joint: d- and e-bristles bare with blunt tips reaching just past tip of sensory bristle; f-bristle bent dorsally, distal part broken off on specimen examined, but with 4 or 5 ventral filaments on remaining part; g-bristle broken off on specimen.

Second Antenna (Figure 67c-e): Protopodite with few hairs along ventral margin and short, distal, medial bristle. Endopodite: proximal and distal parts of 1st joint each with 4 or 5 short bristles; 2nd joint bare; 3rd joint with long terminal bristle. Exopodite: 1st joint with few slender spines along dorsal margin and minute, distal, medial spine; 2nd joint with spinous bristle just reaching 9th joint; minute teeth forming medial row at base of bristle of 2nd joint; bristles of joints 3-8 with stout ventral spines and natatory hairs; 9th joint with stout lateral spine and 4 bristles (2 long with ventral spines and natatory hairs, 2 short with only natatory hairs); joints 2-8 with stout basal spines and minute spines forming row along distal margin.

Mandible (Figure 68a): Coxale endite: slender bristle present at base of ventral branch; ventral branch with spines forming about 5 oblique rows; tip with 3 minute teeth (dorsal of these blunt); ventral margin of dorsal branch with 6 processes proximal to small main spine; tip terminating in long bristle; posterior margin of main spine and margin between main spine and tip of dorsal branch with minute spines. Basale endite: tip with about 5 end-type bristles; ventral margin of endite with about 8 triaenid bristles (paired teeth decreasing in length distally along bristle); 4

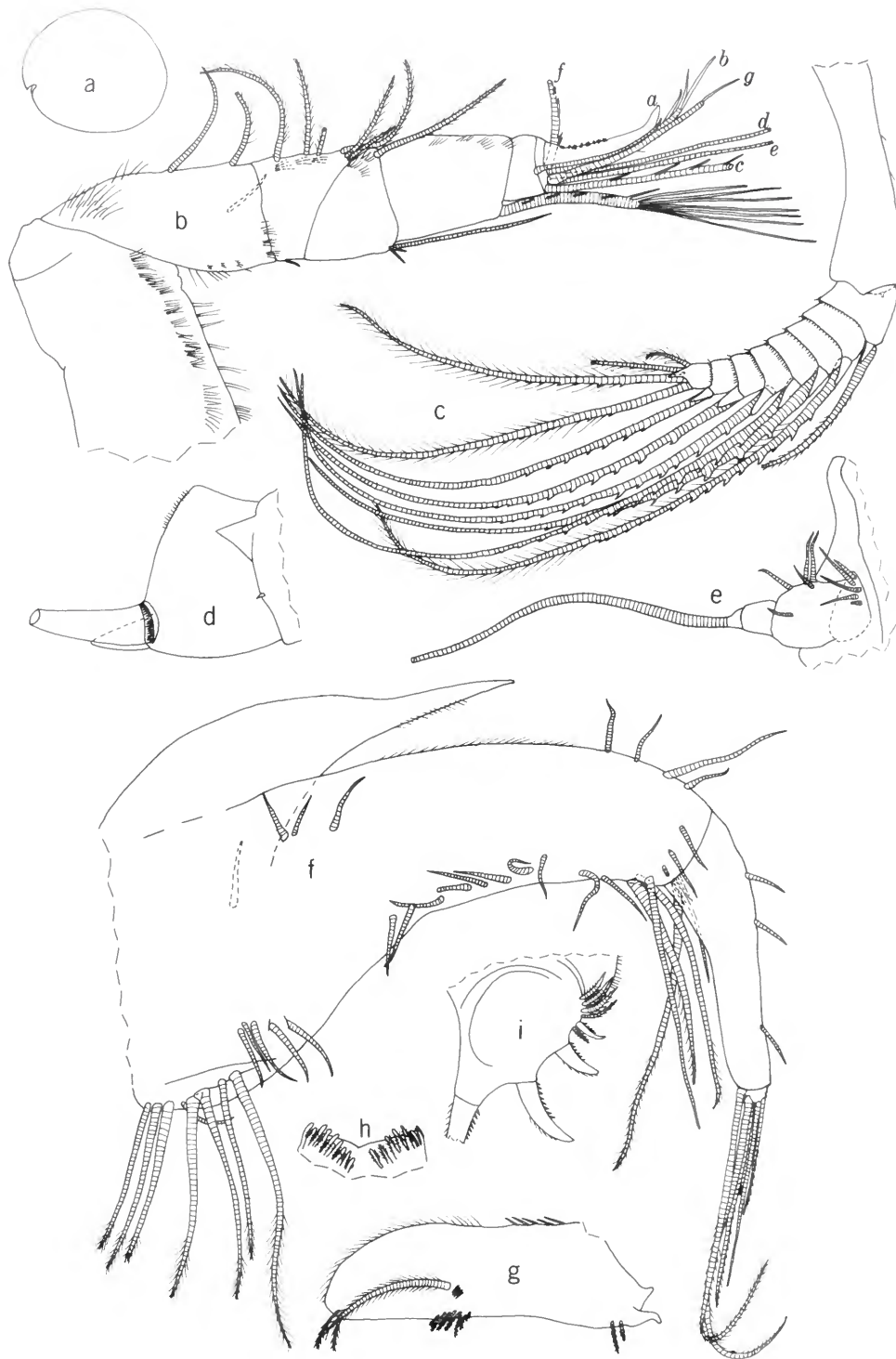


FIGURE 67.—*Amboleberis antyx*, new species, female (instar IV?), holotype, USNM 157625: *a*, complete carapace, length 1.85 mm; *b*, left 1st antenna, medial view; *c*, exopodite of right 2nd antenna, lateral view; *d*, 2nd joint and distal end of 1st joint of exopodite of left 2nd antenna, medial view; *e*, endopodite of right 2nd antenna, medial view; *f*, left maxilla, medial view; *g*, comb of left 5th limb, lateral view; *h*, terminus of 7th limb; *i*, left lamella of furca, lateral view.



FIGURE 68.—*Amboleberis antyx*, new species, female (instar IV?), holotype, USNM 157625: *a*, right mandible, medial view; *b*, right 6th limb, medial view; *c*, right lateral eye; *d*, anterior of body showing medial eye, rod-shaped organ, and upper lip; *e*, right lamella of furca and posterior of body.

dwarf bristles present (distal of these longer than others). Basale: ventral margin with 4 or 5 triaenid bristles of same type as on endite and 2 longer, distal, spinous bristles; medial side hirsute, with 1 minute proximal bristle near ventral margin; lateral side hirsute, with 3 distal bristles near

ventral margin; dorsal margin with 9–11 short and medium bristles and 2 longer, spinous, distal bristles. Exopodite: hirsute tip reaching just past distal end of 1st endopodial joint, with 2 spinous ventral bristles (distal of these shorter than other). Endopodite: 1st joint with 6 ventral bristles (1 of

these minute); ventral margin of 2nd joint with bristles forming 2 distal groups (proximal of these with 3 bristles, other with 2); dorsal margin and medial surface near dorsal margin with numerous bristles (about 3 of the cleaning bristles with stout marginal spines); medial surface with few spines forming distal rows; end joint with 3 claws, 1 long lateral bristle, and 2 ventral bristles.

Maxilla (Figure 67f): Epipodite with few faint spines and tip reaching about two-thirds length of dorsal margin of basale. Endite I with 3 or 4 long bristles; endite II with 1 short and 2 long bristles; endite III with 2 long bristles; 5 short bristles present just distal to bases of bristles of endite III. Basale: Dorsal margin with 3 short proximal bristles with bases on medial surface and 4 distal bristles; ventral margin with 10 short proximal bristles, 3 long distal bristles, and 1 long, spinous, terminal bristle; lateral surface with 1 short proximal bristle. Medial surface with 3 short distal bristles. Exopodite: minute lobe with 1 long and 2 short bristles. Endopodite: 1st joint with 3 short bristles on anterior margin and 1 long spinous beta-bristle; end joint with 5 or 6 bristles.

Fifth Limb (Figure 67g): Lateral surface of comb with stout spinous exopodial bristle reaching past end of comb, 4 minute bristles just proximal to base of stout bristle, 8 small bristles near margin ventral to base of stout bristle, and 2 short proximal and 2 short distal bristles near ventral margin.

Sixth Limb (Figure 68b): Anterior margin with 2 distinct sutures; margin dorsal to upper suture with bristles forming 3 rows containing 9 bristles in inner row, 8 bristles in middle row, and 12 shorter and more slender bristles in outer row; margin between sutures with 2 bristles in inner row, 2 in middle row (ventral of these quite long), and 3 bristles in outer row; margin ventral to lower suture with 5 short slender bristles forming single row (continuance of outer row present dorsal to suture); lateral flap with 2 slender spinous bristles; ventral margin of skirt with numerous bristles; posterior end of skirt with 4 hirsute bristles; 1 short hirsute bristle present in place of epipodial appendage.

Seventh Limb: Each limb with 39 or 40 bristles,

18 to 21 on each side; many joints with 2 bristles, 1 on each side; each bristle with up to 5 bells; many bristles strongly tapering distally (a juvenile character); terminus with opposing combs, each with about 19 spinous teeth of various types (Figure 67h).

Furca (Figures 67i, 68e): Each lamella with 4 stout claws, 1 short bristle between claws 3 and 4, but closer to claw 4, and 4 bristles following claw 4; space between claw 4 and following bristle wider on left lamella than on right lamella, main claws with stout teeth separated by smaller teeth, and with small teeth distally.

Rod-shaped Organ (Figure 68d): Elongate, broadening near middle, then tapering to rounded tip.

Eyes: Medial eye bare, without pigment (Figure 68d). Lateral eye about same size as medial eye, without pigment, with about 28 ommatidia (Figure 68c).

Upper Lip (Figure 68d): Consisting of 2 hirsute lobes with medial saddle bearing few anterior hairlike spines; hirsute lateral flap on each side of mouth.

Posterior (Figure 68e): Hirsute, but without dorsal process.

Y-Sclerite (Figure 68e): Normal for genus.

DESCRIPTION OF ADULT MALE (Figures 69, 70, Plates 50–51).—Carapace oval in lateral view (Figure 69a); hairs present near posterior end of each valve (Figure 69a, Plate 50a).

Ornamentation: Anterior margin without scalloped border (Plate 50c); vertical ridge present posterior to incisur and intersecting ventral margin of valve (Figure 69a, Plate 50a,b); surface of valve with abundant minute pores (Plate 50d); bristles present emerging from closed pores (Plate 50d, 51a), and from open pores without rims, with single rim, and with concentric rims (Plate 50d–f); pores without bristles also present (Plate 50d,f). Surface appearing matted where outer layer of shell missing (Plate 51b).

Infold (Plate 51c,e,f): Similar to that of female.

Central Adductor Muscle Attachments (Figure 69a, Plate 51d): Typical for genus.

Size: USNM 157728, length 2.00 mm, height 1.60 mm.

First Antenna (Figure 69b–d): 1st joint bare. 2nd joint: hairs along ventral margin, on medial side

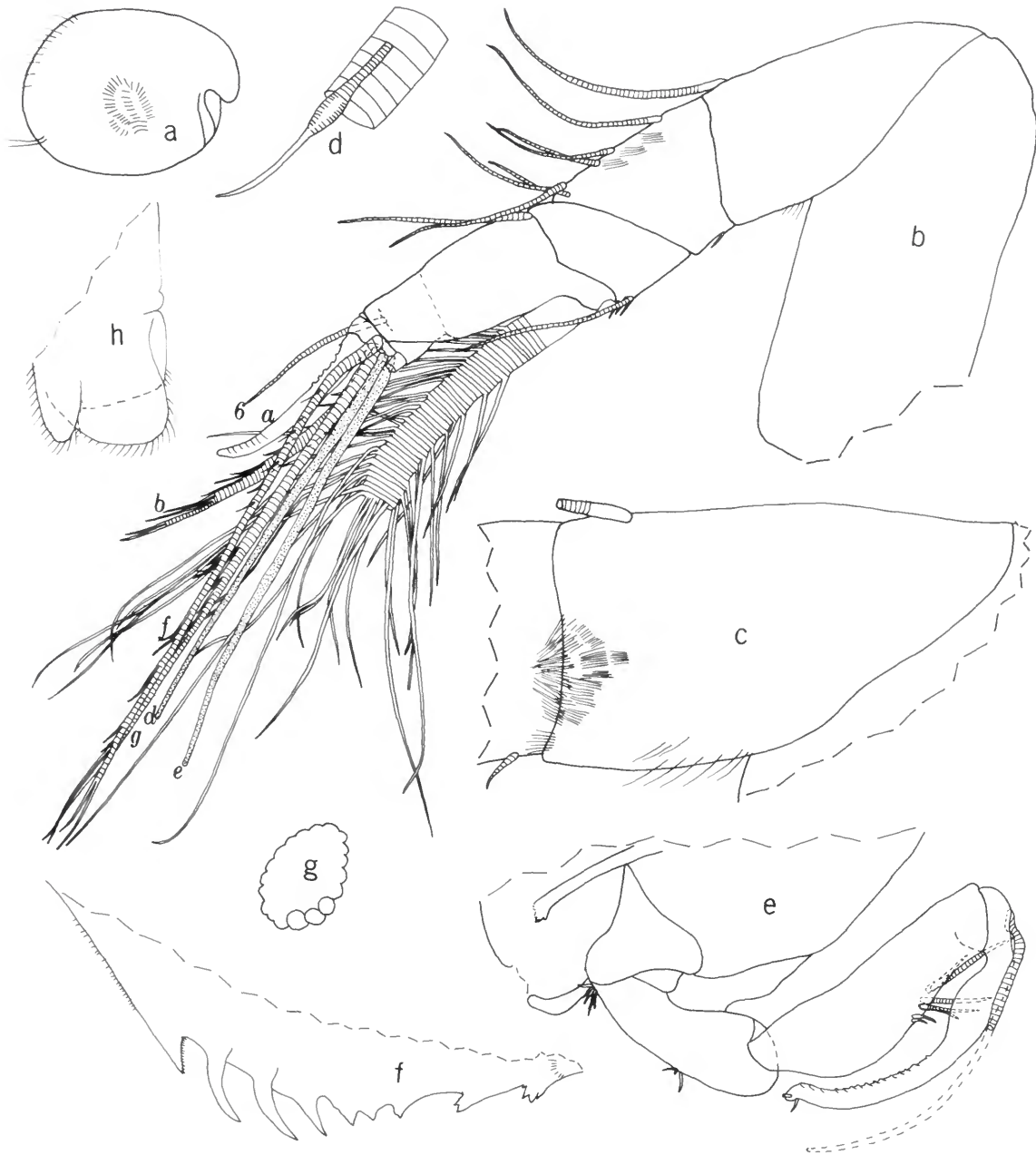


FIGURE 69.—*Amboleberis antyx*, new species, adult male, paratype, USNM 157728: *a*, complete specimen indicating position of central adductor muscle attachments, length 2.00 mm; *b*, left 1st antenna, lateral view; *c*, 2nd joint of right 1st antenna showing hairs, medial view; *d*, proximal filament on c-bristle of right 1st antenna, medial view; *e*, distal part of protopodite and endopodite of left 2nd antenna, lateral view; *f*, distal part of ventral margin of dorsal branch of coxale endite of left mandible, medial view; *g*, lateral eye (only 3 of the ommatidia shown); *h*, upper lip, anterior to left.

near ventral margin, and on medial side near middle of distal margin; dorsal margin with 1 bare distal bristle (an empty socket near middle of margin suggests that another bristle may have broken off); lateral side bare. 3rd joint: short ventral margin with 1 small bristle; long dorsal margin with 6 bare bristles; lateral side with hairs near dorsal margin. 4th joint: short dorsal margin with 1 long, bare, terminal bristle; long ventral margin with 4 bristles (1 long, 3 very short). 5th joint with stout filamentous sensory bristle (distal end broken off on both limbs of USNM 157778). 6th joint with long, bare, medial bristle on distal end near dorsal margin. 7th joint: a-bristle claw-like, with about 11 proximal teeth along dorsal margin (not all shown in Figure 69b); b-bristle about one and one-half times longer than a-bristle, with 8 marginal filaments including tip; c-bristle about 3 times length of b-bristle and almost 5 times length of a-bristle, with about 17 filaments including tip (proximal filaments with widened proximal section, Figure 69d). 8th joint: d- and e-bristles bare with blunt tips, more than twice length of a-bristle; f-bristle about 3-times length of a-bristle and almost twice length of b-bristle, with about 13 filaments including tip (proximal filaments with widened proximal section, similar to those of c-bristle, but bristle only about two-thirds length of c-bristle); g-bristle same length as f-bristle, with about 16 filaments.

Second Antenna: Protopodite with short, distal, medial bristle; no ventral hairs observed. Endopodite (Figure 69e): proximal part of elongate 1st joint with 4 minute bristles, distal part with 3 minute bristles; elongate 2nd joint with 7 or 8 short bristles; elongate 3rd joint reflexed on 2nd, with 1 long proximal bristle, 2 small terminal bristles, and ridges along inner margin. Exopodite: 1st joint with few slender spines along dorsal margin and minute, straight, distal, medial spine; bristle of 2nd joint more than twice length of combined length of joints 2–9, with ventral spines and natatory hairs; minute teeth forming medial row at base of bristle of 2nd joint; bristles of joints 3–8 with stout ventral spines and natatory hairs; 9th joint with stout lateral spine and 5 bristles (2

long with ventral spines and natatory hairs, 1 medium and 2 short with only natatory hairs); joints 2–8 with stout basal spines and minute spines forming row along distal margin.

Mandible: Coxale endite: ventral margin of dorsal branch with 8 processes proximal to short main spine (Figure 69f), otherwise similar to that of female. Basale endite similar to that of female. Basale: ventral margin with 5 triaenid bristles (bristles similar to those of female) and 3 longer, distal, spinous bristles; medial side without hairs, but with 2 minute bristles near ventral margin; lateral side with 3 small distal bristles near ventral margin; dorsal margin with 10 short proximal bristles and 2 long, spinous, distal bristles. Exopodite similar to that of female. Endopodite: 1st joint similar to that of female; ventral margin of 2nd joint with bristles forming 2 distal groups (proximal of these with 5 bristles, distal with 2); remaining part of 2nd joint as well as 3rd joint similar to those of female.

Maxilla (Figure 70a,b): Endites I and II each with 1 short and 3 long bristles; endite III with 3 long bristles; 5 medial bristles present just distal to endites. Basale: dorsal margin with 1 short bristle with base on medial surface and 3 distal bristles; ventral margin with 12 or 13 short proximal bristles, 2 long, spinous, distal bristles (proximal of these extremely stout) and 1 long, spinous, terminal bristle; medial surface with 4 distal bristles (ventral of these long, others short). Exopodite: minute lobe with 1 long and 2 short bristles. Endopodite: 1st joint with 3 short bristles on anterior margin and 1 long beta-bristle; end joint with 5 or 6 bristles.

Fifth Limb (Figure 70c): Lateral surface with stout, spinous, exopodial bristle and 3 minute bristles proximal to base of stout bristle; only 3 of the 12 small lateral bristles observed near ventral margin of comb of female also observed on male, but bristles possibly broken off on male; dorsal margin with 4 minute proximal bristles, and hairs along distal end; dorsal margin without processes.

Sixth Limb: Similar to that of female except 1 of the limbs without epipodial bristle, other with 1 bristle as on female.

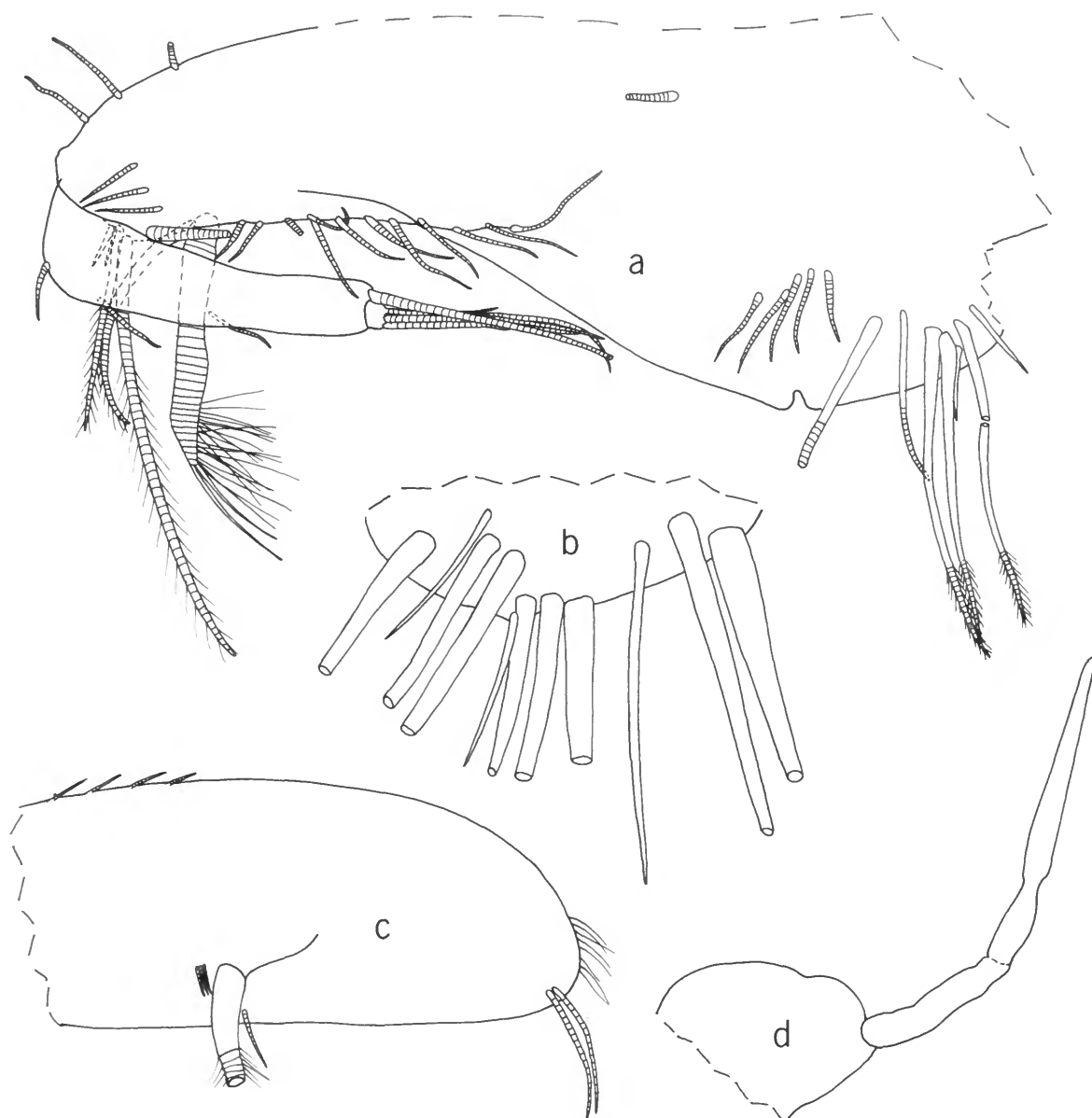


FIGURE 70.—*Amboleberis antyx*, new species, adult male, paratype, USNM 157728: *a*, right maxilla (epipodial appendage and part of endites missing), medial view; *b*, endite bristles of left maxilla, medial view; *c*, comb of right 5th limb, lateral view; *d*, medial eye and rod-shaped organ.

Seventh Limb: Similar to that of female, but bristles not counted.

Furca: Similar to that of female, except some of bristles following claw 4 broken off, probably about 6 originally present.

Rod-shaped Organ (Figure 70*d*): Similar to that of female.

Eyes: Medial eye similar to that of female except with brown pigment (Figure 70*d*). Lateral eye about same size as medial eye, with black

pigment and about 33 ommatidia forming 5 rows (Figure 69g).

Upper Lip (Figure 69h), *Posterior of Body*, *Y-Sclerite*: Similar to those of Female.

COMPARISONS.—The only other species of *Amboloberis* having a verticle rib posterior to the incisur is *A. americana*. That species differs from *A. antyx* in having nodes along the posterior margin of the 5th joint of the 1st antenna and in not having teeth on the a-bristle of the 1st antenna.

ASTEROPTERONINAE, new subfamily

COMPOSITION.—This new subfamily is comprised of 7 genera: *Asteropella* Poulsen, 1965; *Microasteropteron* Poulsen, 1965; *Asteropteron* Skogsberg, 1920; *Actinoseta* Kornicker, 1958; *Asteropterygion*, new genus; *Pteromeniscus*, new genus; *Ome-gasterope*, new genus.

DISTRIBUTION (Figure 1).—From about 42°S to about 42°N. *Pteromeniscus intesi*, new species, collected at 270–699 m appears to be a bathyal species; except for 1 sample containing *Asteropterygion setiferum* collected at 1100 m off Mauritania, remaining species of Asteropteroninae have not been collected below about 100 m.

DIAGNOSIS.—Carapaces generally oval in lateral view, but some with posterodorsal projections; incisur generally forming right angle between ventral margin of rostrum and anterior margin of valve below rostrum, not forming the deep incisur of the type present in the Cyndroleberidinae and Cyclasteropinae; with the exception of some species of *Actinoseta*, surface with ribs and large processes; surface details usually more complex than found in other subfamilies of the Cyndroleberididae; bristle pores with concentric rims present on many species of Cyndroleberidinae and Cyclasteropinae not present; dorsal margin of each valve of *Actinoseta* with groove and spur dentition; carapace of adult male generally smaller than that of adult female, but not more elongate, and without vertical row of hairs near posterior edge; central adductor muscle attachments generally consisting of many discrete, individual, ovoid scars forming cluster.

First Antenna: Dorsal margin of 5th joint without teeth or nodes; sensory bristle of 5th joint of female variable (see Figure 9 for examples), generally with fewer filaments than on either the sensory bristle of Cyndroleberidinae or Cyclasteropinae; a-bristle of 7th joint either bristle-like or clawlike; c- and f-bristles of adult male not extra long as on most species of Cyndroleberidinae and Cyclasteropinae; development of d- and e-bristles varies considerably among genera and species (see Figure 10 for examples).

Second Antenna: Second exopodial joint of adult male not extra long as in Cyndroleberidinae and Cyclasteropinae; exopodial joints without basal spines (except *Asteropterygion hirsutum*); 9th joint with 1–5 (rarely 6) bristles; exopodial bristles of both sexes generally with spines as well as hairs. Endopodite of female 1-jointed in *Microasteropteron*, 3-jointed in other genera but joints often fused; endopodial joints variable in relative lengths and armature of hairs and bristles among genera (see Figure 12 for examples). Endopodite of adult male 3-jointed; 3rd joint reflexed on 2nd and varying in length among different genera (see Figure 13 for examples).

Maxilla: Exopodite variable: absent, consisting of 1 or 2 bristles, or small lobe with up to 3 bristles. Endopodite with 3–7 bristles on end joint.

Fifth Limb: Comb of adult males without processes such as those on adult males of Cyclasteropinae; dorsal margins of combs generally hirsute, and with a few minute bristles on some species; lateral side of comb with 1–2 long bristles and several short bristles; position of the more slender of the 2 long bristles proximally located on some genera.

Sixth Limb: Limb of *Microasteropteron* resembling those of the Cyndroleberidinae; limbs of other taxa resembling more those of Cyclasteropinae; limbs either without, or with 1–4 epipodial bristles; anterior margin of trunk with numerous bristles (except *Microasteropteron*, which has 2–4 bristles on anterior margin of trunk); ventral margin of skirt with numerous bristles; posterior tip of skirt without bristles, or with 1–5 bristles (see Figure 14 for examples).

Seventh Limb: Terminus with opposing combs or

with teeth not distinctly separated into opposing combs; type of comb varies among genera (see Figure 15 for examples).

Furca: Distribution of main and secondary claws varies among genera, but no species with bristles or secondary claws between main claws (see Figure 16 for examples).

Upper Lip: Spineation of lobes varies: no spines, several small spines, 1 very long spine (see Figure 17 for examples).

Posterior of Body: Fingerlike dorsal process well developed on all members.

Gills: Gills generally well developed, but fairly small on some species.

COMPARISONS.—The new subfamily Asteropteroinae differs from the Cylindroleberidinae and Cyclasteropinae in many ways; for example, the carapace of most genera of Asteropteroinae have ribs, ridges, and processes absent on carapaces of other subfamilies. Some species of *Actinoseta*, which have fairly smooth carapaces, are exceptions; members of *Actinoseta* have spur and groove dentition along the dorsal margin not present on any members of other subfamilies. The incisurs

on carapaces of most Asteropteroinae differ from those in the other families in being formed by a right angle, or a fairly open acute angle, between the ventral margin of the rostrum and the anterior margin of the valve below the rostrum; on the carapaces of the other subfamilies, the incisur forms a slit extending into the anterior margin just below the rostrum. The central adductor muscle attachments of Asteropteroinae differ from those of the Cyclasteropinae in consisting of small ovoid scars without a spiral arrangement. The microstructures of the surface of members of the Asteropteroinae are extremely variable, and generally more complex than the other subfamilies, especially that of the Cylindroleberidinae. The sensory bristle on the 5th joint of the adult female of members of Asteropteroinae are variable (see Figure 9 for examples), but differ considerably from members of other subfamilies. The 2nd antennae of members of the Asteropteroinae differ from those of the Cyclasteropinae in not having basal spines on exopodial joints (except for *Asteropterygion hirsutum*). For other differences see discussion of Cypridinacea (p. 42).

Key to Genera of Asteropteroinae

1. Dorsal margin of each valve with continuous row of well-developed teeth **Actinoseta**
Dorsal margin of each valve without continuous row of well-developed teeth 2
2. Endopodite of female 2nd antenna hirsute 3
Endopodite of female 2nd antenna without hairs 4
3. Each valve with single crescentic lateral rib with middle of rib ventral to central adductor muscle attachments; d- and e-bristles of 8th joint of 1st antenna well developed **Pteromeniscus**, new genus
Each valve generally with single more-or-less linear lateral rib passing through, or just dorsal to, central adductor muscle attachments, but may have additional subdued lateral ribs, or a fingerprint pattern (an undescribed species); d-bristle of 8th joint of 1st antenna generally much smaller than e-bristle, but rarely both bristles well developed **Asteropella***
4. Endopodite of female 2nd antenna short, 1-jointed ... **Microasteropteron**
Endopodite of female 2nd antenna elongate, 3-jointed but 2nd and 3rd joints may be fused 5
5. 8th joint of 1st antenna with minute e-bristle and much longer well-developed d-bristle **Omegastrope**, new genus

- 8th joint of 1st antenna with well-developed d- and e-bristles *Asteropterygion*, new genus
- 8th joint of 1st antenna with absent or small d-bristle and much longer e-bristle 6
- 6. Carapace with single more-or-less linear rib passing through central adductor muscle scars *Asteropella trithrix*
- Carapace with 2 curved ribs, 1 above and 1 below central adductor muscle scars *Asteropteron*

* Does not include *Asteropella trithrix*, which is included in cuplet 6, or an undescribed species of *Asteropella* collected off the coast of Louisiana (2-3 m depth) by R. D. Kalke. It is to be described by him, and was received too late for inclusion in this paper. It does not have the lateral midridge present on other species of *Asteropella*, but instead bears subdued ridges on each valve forming a fingerprint-like pattern.

Actinoseta Kornicker, 1958

TYPE-SPECIES.—*Actinoseta chelisparsa* Kornicker, 1958.

DISTRIBUTION (Figure 71).—Bahama Islands; Florida; West Indies; Bonaire. Venezuela; Curaçao; Male Atoll, Maldives; Farquhar Group, Indian Ocean; Panama, Pacific Ocean. Depth intertidal to 34 m.

COMPOSITION.—This genus contains 4 species: *Actinoseta chelisparsa* Kornicker, 1958, *A. hummelincki*, new species, *A. jonesi*, new species, and *A. nodosa*, new species.

DIAGNOSIS OF FEMALE.—Carapace oval in lateral view with small rostrum; left valve overlapping right along posterior and dorsal margins; carapace smooth or with many or only 3 or 4 low nodes, or 3 prominent posterior ridges. Groove and spur dentition along dorsal margin of each valve where left valve overlaps right.

First Antenna: Sensory bristle of 5th joint generally with 3-6 short proximal filaments and forming 2 branches distally, each branch dividing into 2 long filaments. Eighth joint: d- and e-bristles well developed but fairly short, except for *A. jonesi*, on which d-bristle is only about one-

tenth length of e-bristle.

Second Antenna: Endopodite 3-jointed, without hairs: 1st joint short with 4-18 bristles (rarely fewer); 2nd joint elongate, tapered, with 3-10 short bristles (rarely fewer); 3rd joint short with long terminal bristle.

Mandible: Ventral margin of basale with 1 or 2 long spinous bristles in addition to triaenid bristles. Medial surface near dorsal margin of 2nd endopodial joint with 2 stout triaenid bristles.

Maxilla: End joint of endopodite with 5 or 6 bristles.

Fifth Limb: Lateral side of comb with 2 or 3 short lateral bristles proximally near dorsal margin and 1 long and several short bristles near ventral margin.

Sixth Limb: No epipodial bristles.

Seventh Limb: Terminus with opposing combs, each with teeth of varying types.

Furca: Each limb with 3 large claws separated by space from 1-3 small bristles with bases set back from edge of lamella.

Lateral Eye: Well developed with about 15 ommatidia on known species.

Posterior of Body: With elongate hirsute dorsal process.

Key to Species of Actinoseta

- 1. Carapace with numerous prominent nodes ... 27. *A. nodosa*, new species
- Carapace without numerous prominent nodes 2

- 2. Carapace with 2 posterodorsal ridges ... 25. *A. hummelincki*, new species
- Carapace without 2 posterodorsal ridges 3
- 3. d-bristle of 1st antenna at least one-half length of e-bristle 24. *A. chelisparsa*
- d-bristle about one-tenth length of e-bristle 26. *A. jonesi*, new species

24. *Actinoseta chelisparsa* Kornicker, 1958

FIGURES 9o, 11e, 12c, 16d, 17e, 72-77; PLATES 52-58

Actinoseta chelisparsa Kornicker, 1958:244, figs. 43A-L; 46: 10A,B; 69A-F; 70A-I; 89H,J,P,Q

HOLOTYPE.—Ovigerous female, length 2.42 mm, height 1.92 mm (lost).

PARATYPE.—USNM 122898, 1 juvenile female, length 1.65 mm, height 1.32 mm, sta 60-1 (Kornicker, 1958:244).

TYPE-LOCALITY.—Bimini, Bahamas.

MATERIAL.—Bahama Islands: USNM 122898, juvenile female, paratype from Bimini; USNM 150283, adult female, sta 57, Andros Island. Bonaire: USNM 150294, ovigerous female, and 1

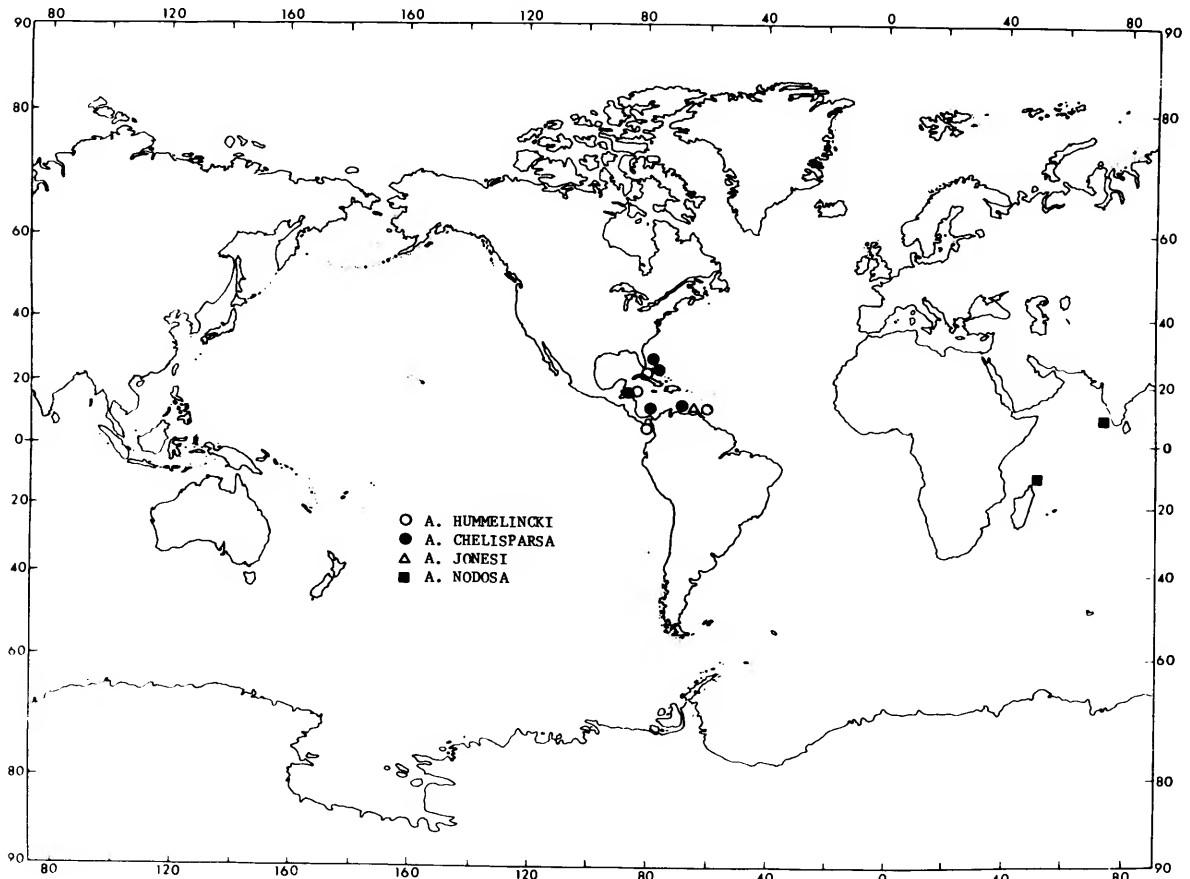


FIGURE 71.—Distribution map of species of *Actinoseta*.

specimen, USNM 157795, sta 1560; 1 ovigerous female and 1 juvenile, from sta 1567. Florida: USNM 152493, 1 adult female, off Fort Pierce, *Gosnold* Cruise 222, sta 0262b; USNM 156714, 1 juvenile female, Card Sound. Carrie Bow Cay, Belize: USNM 157177, adult male, sta AC-CBC-20; USNM 157175, 1 juvenile, sta AC-CBC-26; USNM 157185, juvenile male, sta AC-CBC-31; USNM 157176, juvenile male, sta AC-CBC-34; USNM 157181, juvenile, sta AC-CBC-43; USNM 157180, 3 juveniles, USNM 157184, juvenile male, sta AC-CBC-47; USNM 157179, juvenile, sta AC-CBC-56; USNM 157174, juvenile, USNM 157178, adult male, sta AC-CBC-58. Panama, Atlantic Ocean, sta 179, subsample B, 1 juvenile female, USNM 157764. Curaçao: 1 ovigerous female, sta 1457, USNM 157796; 1 ovigerous female, sta 1453a, USNM 157797; 1 specimen, sta 1460, USNM 157798; 1 specimen, sta 1460A, USNM 157799. Venezuela: USNM 157648, 1 adult female.

DISTRIBUTION (Figure 71).—Bimini, Andros Island, Bahamas; Carrie Bow Cay, Belize; Card Sound and off Fort Pierce, Florida; Bonaire; Curaçao; Venezuela; Canal Zone, Panama, Atlantic Ocean. Depth intertidal to 34 m.

DESCRIPTION OF ADULT FEMALE (Figures 72–75, Plates 52–55).—Carapace oval in lateral view with small rostrum (Figures 72, 73a, Plates 52a, 54a,b); left valve overlapping right along posterior and dorsal margins; 3 or 4 low nodes present in



FIGURE 72.—*Actinoseta chelisarsa* Kornicker, ovigerous female, USNM 150294, lateral view of complete specimen, length 2.29 mm.

posterodorsal part of valve (Plate 52a,b); posterior margin forming angle at midpoint.

Ornamentation: Small fossae with minute processes forming inner ring near edge and spines at bottom abundant over valve surface (Plates 52a–e, 54c, 55a,d); some fossae filled with debris and *Drewite* (aragonite needles) (Plate 52g,k); surface of valve with pavement of discs with various diameters (Plates 52a–c,e–j, 53b,c, 54); pavement on some specimens covers fossae (Plate 54d,f); edges of discs appearing broken on some discs and complete on others (Plates 52i, 53c); bristles emerging from both open and closed pores scattered over valve surface and along anterior, ventral, and posterior margins (Plates 52g, 53c,d); some bristles with pore near base (note aragonite needles on valve surface) (Plate 53c,d). USNM 150294 brown, USNM 150283 white; (On a broken edge of USNM 150294 the brown layer is seen to be beneath 2 shell layers). A reticulate pore (Plate 55b,c) and fibrous structure observed where outer layer of shell missing (Plate 55b,e).

Hinge Teeth: Intermeshing wedge-shaped teeth along dorsal and posterodorsal margins and external to ligament present on each valve (Plate 53e–g).

Infold: Broad along anterior, ventral, and posterior margins; anterodorsal infold with 50 short and 19 long bristles forming row parallel to valve margin; about 7 minute bristles present between row of long and short bristles and anteroventral valve margin; anteroventral infold with 6 short and several minute bristles; ventral infold with about 25 short bristles near inner margin of infold; posterior infold near inner margin with about 14 stout tubular bristles composed of 3 or 4 tubes (Plate 53j); 1 slender bristle terminating in 3 branches present posterior to each stout tubular bristle (Plate 53j,k); about 50 short tubes present between the stout tubular bristles, up to 6 tubes between each bristle (Plate 53j,l); about 59 short bristles forming row on posterior infold just within edge of valve (Plate 53j); list with lamellar prolongation present near middle of ventral infold.

Central Adductor Muscle Attachment Scars: Consisting of bundles of individual muscles (Plate 53h,i);

about 30 minute attachment areas forming cluster visible from outside of valve (Figure 73e).

Size: USNM 150283, length 2.30 mm, height 1.80 mm; USNM 150294, length 2.29 mm, height 1.73 mm; USNM 157794, length 2.29 mm, height 1.72 mm; USNM 157796, length 2.05 mm, height 1.53 mm; USNM 157797, length 1.97 mm, height 1.46 mm; USNM 157648, length 1.97 mm, height 1.48 mm.

First Antenna (Figure 73b,d): 1st joint with spines and hairs on medial and lateral surfaces; 2nd joint with spines along ventral and dorsal margins and 4 dorsal bristles; 3rd joint with 1 terminal bristle on ventral margin and 1 midbristle and 2–3 terminal bristles on dorsal margin; 4th joint with 1 stout terminal bristle on dorsal margin and 2 short terminal bristles on ventral margin; sensory bristle of 5th joint with 5 short filaments and 4 long terminal filaments including stem; 6th joint minute with 1 short medial bristle. Seventh joint: a-bristle forming a stout claw; b-bristle longer than a-bristle, with 3 minute marginal filaments (only 2 visible in Figure 73b) and bifurcate tip; c-bristle slightly longer than sensory bristle of 5th joint, with about 6 short marginal filaments and bifurcate tip. Eighth joint: d-bristle slightly shorter than e-bristle, about same length as a-bristle, both bare; f-bristle bent dorsally, with 3 marginal filaments and bifurcate tip; g-bristle about same length as c-bristle, with 3 distal marginal filaments and bifurcate tip.

Second Antenna (Figure 73c): Protopodite with spinous medial bristle and hairs along ventral and dorsal margins and on medial surface. Endopodite 3-jointed: 1st joint short with 7–8 proximal and 8–10 distal bristles; 2nd joint elongate, tapered, with 10 short bristles along ventral margin; 3rd joint short with long terminal bristle. Exopodite: 1st joint with short, recurved, terminal spine on medial side; bristles of joints 2–8 with natatory hairs; bristles of joints 2–5 also with slender ventral spines; 9th joint with 3 bristles (2 long, 1 short) with natatory hairs; no basal spines present.

Mandible (Figure 74a): Coxale endite with long hairs on ventral margin proximal to ventral

branch; minute medial bristle near base of ventral branch; ventral branch with spines forming 8 oblique rows and tip with 2 minute ventral teeth and minute hairs dorsal to teeth on small projection; ventral margin of dorsal branch with 2 small pointed processes followed by 3 larger rounded processes; main spine short with slender spines forming row proximally near its base; margin between main spines and tip of branch serrate; hirsute dorsal bristle with base slightly proximal to tip of branch; dorsal margin of branch serrate. Basale: endite with 9 end bristles, 1 proximal triaenid bristle with 1 set of the paired teeth long, reaching tip of bristle, and 5 short bristles; middle of ventral margin of basale with 3 triaenid bristles and 1 longer bristle with long proximal and short distal spines; medial surface of basale with 1 minute bristle near middle of ventral margin and spines forming clusters on dorsal half; dorsal margin of basale with about 11 proximal bristles, some with bases on lateral side, 4 short subterminal bristles, and 2 long, stout, terminal bristles. Exopodite hirsute, reaching past distal end of 1st endopodite joint, with 2 ventral bristles (proximal of these reaching distal end of 2nd endopodite joint, with short marginal spines; other bristle shorter, bare). Endopodite: 1st joint with 5 spinous bristles forming ventral row with bases on medial surface; 2nd joint with numerous bristles on dorsal margin and on medial surface near dorsal margin, including 2 stout triaenid bristles; ventral margin with 3 long terminal bristles; medial surface with long hairs forming rows; end joint with 3 claws and 3 bristles.

Maxilla (Figure 74b,c): Epipodial appendage hirsute, reaching middle of dorsal margin of basale. Protopodite with 2 endites: proximal endite with 5 long bristles; distal endite with 4 long, 1 medium, and 2 short bristles. Basale: medial surface near dorsal margin with bristles forming 3 groups: proximal group with 7–9 bristles; middle group with 3–4 bristles, distal group with 5 bristles; small bump present at terminal end of dorsal margin; medial surface near ventral margin with 4–6 short proximal bristles, 2 slightly longer distal bristles, and 1 very long, spinous, terminal bristle;



FIGURE 73.—*Actinoseta chelisarsa* Kornicker, adult female, USNM 150283: *a*, outline of carapace, length 2.30 mm; *b*, left 1st antenna, medial view; *c*, left 2nd antenna, medial view; *d*, some bristles at end joints of right 1st antenna, lateral view; *e*, adult female, USNM 150294, central adductor muscle attachments as seen through right valve, anterior to right.



FIGURE 74.—*Actinoseta chelisparsa* Kornicker, adult female, USNM 150283: *a*, right mandible, medial view; *b*, right maxilla, medial view; *c*, right maxilla, exopodite, distal part of basale, proximal part of 1st endopodial joint, medial view; *d*, comb of left 5th limb, lateral view; *e*, right 6th limb, lateral view; *f*, anterior part of left 6th limb, lateral view; *g*, 7th limb.

medial surface spinous, with 10–11 additional short bristles scattered over surface. Exopodite minute (not forming lobe), with 2 short spinous bristles, the shorter bristle about half the length of longer proximal bristle. Endopodite: 1st joint spinous with 3 short anterior bristles and long spinous beta-bristle; end joint with 2 long and 4 shorter spinous bristles.

Fifth Limb (Figure 74d): Dorsal margin of comb with long hairs along anterior margin; lateral surface with long, spinous, exopodial bristle reaching just past end of comb, 6 short bristles near ventral margin proximal to base of long bristle, and 3 short bristles dorsal and proximal to base of long bristle.

Sixth Limb (Figure 74e,f): Medial surface of anterior margin of proximal anterior part of limb (trunk) with single row of 6 or 7 short bristles dorsal to 4 longer spinous bristles; 3 or 4 short bristles present inward from the long bristles; horizontal suture not reaching anterior end of limb present ventral to the long bristles; about 4 long medial bristles present between suture and broad distal part of limb (skirt); lateral flap of skirt with 3 slender hirsute bristles; anterior end of skirt medial to flap with about 11 bristles; ventral margin of limb posterior to flap with 6–8 long spinous bristles; medial surface of skirt with abundant minute bristles (not all shown on Figure 74e); posterior end of skirt overlapping ventral part, without bristle or with 1 spinous bristle on dorsal margin between posterior tip of skirt and trunk of limb; limb hirsute; no epipodial bristle.

Seventh Limb (Figure 74g): Each limb with 49–51 bristles, 24–26 bristles on each side; each segment with not more than 1 bristle on each side (except rarely; only 1 segment on specimen examined with 2 bristles on one side and 1 on the other); each bristle with up to 7 bells and without marginal spines; terminus consisting of opposing combs, each with about 15 teeth consisting of 5 alate middle teeth with 5 spinous teeth on each side.

Furca (Figure 75a,i): Each lamella with 3 stout claws followed by space and then 2 or 3 short spinous bristles without annulae; each claw with

lateral and medial row of teeth along concave margin; minute tooth present on lamellae near inner corner of base of claw 1; teeth grouped with each group consisting of stout tooth and 1–4 smaller teeth.

Eyes: Medial eye bare, pigmented (Figure 75b); lateral eye smaller than medial eye, pigmented, with about 16 ommatidia (possibly more) (Figure 75c,d).

Rod-shaped organ (Figure 75b): Elongate, broadening towards middle and then tapering to rounded tip, suture may be present near proximal end.

Upper Lip (Figure 75b,e): Consisting of left and right hirsute lobes without spines, each with lateral hirsute flap.

Posterior (Figure 75f,g): Elongate hirsute dorsum present; posterior margin between dorsum and furca hirsute. Gills well developed. The dorsum on USNM 150294, which is an ovigerous female, was ventral to the eggs, as if it were holding the eggs to keep them from falling out of the shell when the valves are spread.

Y-Sclerite (Figure 75h): Unbranched.

Eggs: USNM 150294 with 11 eggs in marsupium; USNM 157794, 157796, 157797, each with 8 eggs in marsupium; USNM 157648 with 17 eggs in marsupium.

DESCRIPTION OF ADULT MALE (Figures 76, 77).—Carapace similar to that of adult female but smaller (Figure 76).

Size: USNM 157178, length 1.73 mm, height 1.31 mm; USNM 157177, right valve, length 1.71 mm, height 1.25 mm.

First Antenna (Figure 77a,b): 1st joint with hairs and spines on medial and lateral surfaces. 2nd joint with spines on medial and lateral surfaces, ventral margin, and proximally on dorsal margin; also, with 4 or 5 dorsal bristles. 3rd joint: short ventral margin with 1 subterminal bristle; longer dorsal margin with 1 midbristle and 2 terminal bristles. 4th joint with 3 bristles (1 dorsal, 2 ventral (1 very small)). Sensory bristle of long 5th joint with 4 short proximal filaments and dividing distally into 2 branches, each with 2 long filaments. Medial bristle of short 6th joint small. 7th

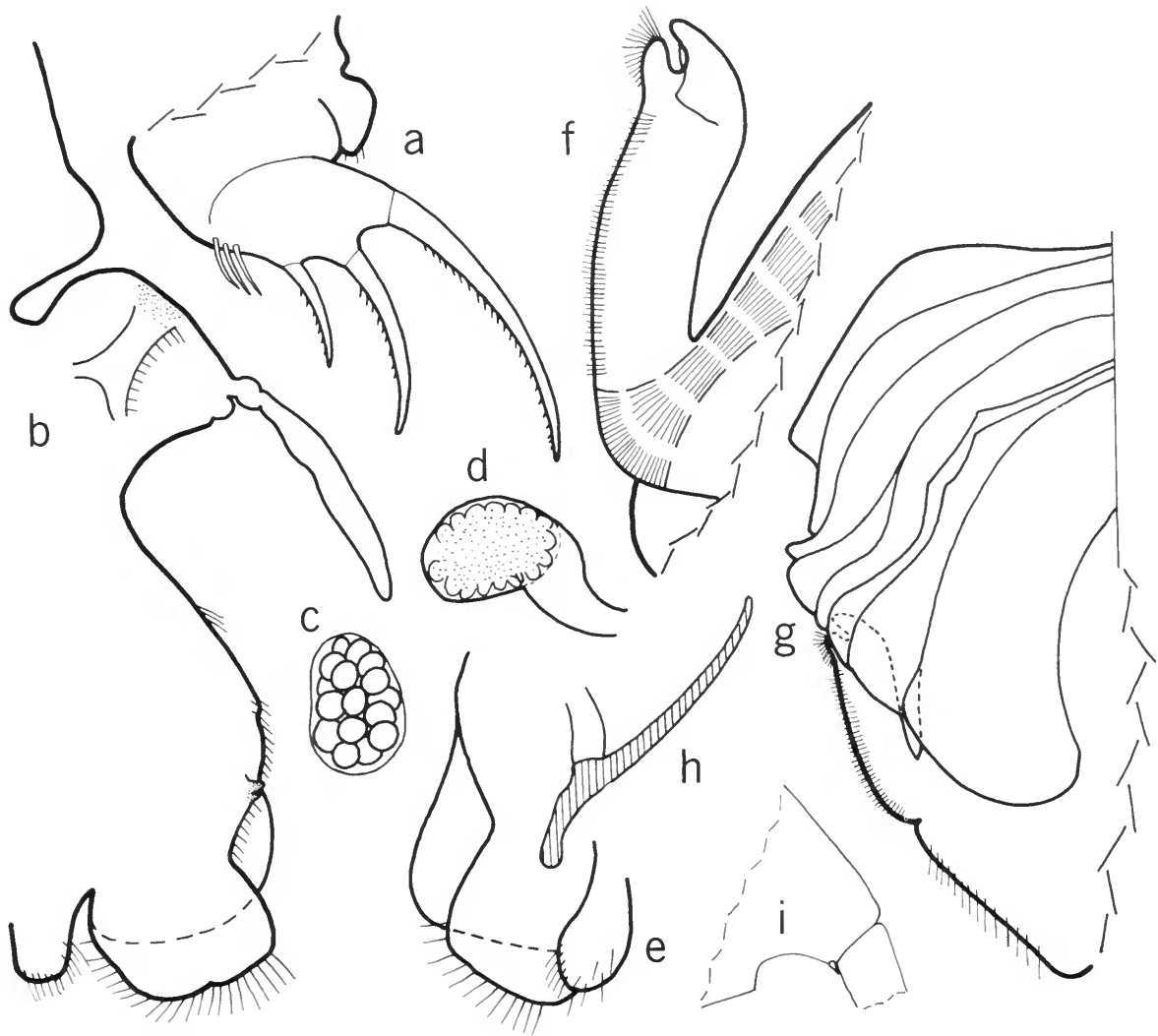


FIGURE 75.—*Actinoseta chelisparse* Kornicker, adult female, USNM 150283: *a*, right lamella of furca, lateral view; *b*, anterior of body showing medial eye, rod shaped organ, and upper lip; *c*, right lateral eye; *d*, right lateral eye showing stalk (ommatidia not shown), medial view; *e*, upper lip from left side, anterior to left; *f*, posterior process of body; *g*, posterior of body showing posterior process and gill-like structures; *h*, right Y-sclerite, anterior of animal to right; *i*, base of claw 1 of right lamella showing small adjacent tooth.

joint: a-claw about same length as combined joints 5–8, tip of claw rounded; b-bristle reaching past tip of a-claw, with 3 proximal filaments and bifurcate tip; c-bristle reaching just past tip of sensory bristle of 5th joint, with about 8 filaments including stem. 8th joint: d-bristle slender, not

quite reaching tip of a-claw; e-bristle stout, slightly longer than b-bristle; f-bristle bent dorsally, with 6 or 7 filaments including stem; g-bristle about same length as c-bristle, with 8 filaments including stem.

Second Antenna (Figure 77*c*): Protopodite with



FIGURE 76.—*Actinoseta chelisparsa* Kornicker, adult male, USNM 157177, inside view of left valve, length 1.71 mm.

distal medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint short, with 1 or 2 proximal and 1 distal bristles; 2nd joint long, with 5 or 6 distal, ventral bristles (2 or 3 annulate, 2 with few annulae distally, 1 without annulae); 3rd joint recurved, with 1 bristle proximally on dorsal margin, about 9 teeth along ventral margin, and long, terminal, pointed process with few spines at tip; teeth on knob-like process proximal to tip with minute spines along edge. Exopodite: 1st joint with small medial bristle on terminal margin; bristles of joints 2-8 with spines along part of ventral margin and with natatory hairs; 9th joint with 3 bristles, all with natatory hairs (long ventral bristle with ventral spines; dorsal bristle very short).

Mandible: Coxale endite: small bristle present near base of ventral branch; ventral branch with proximal hairs and spines forming 6 oblique rows, and tip with 3 minute teeth (dorsal of these with few spines); dorsal branch with 5 low teeth along ventral margin, short main spine, hirsute terminal bristle, and few serrations along dorsal margin. Basale endite and ventral margin of basale fragmented on specimen examined; dorsal margin of basale with 3 short proximal bristles and 1 short and 2 long terminal bristles; medial surface of basale with spines forming rows. Exopodite hirsute, tip reaching just past distal end of 1st en-

dopodial joint, with 2 distal bristles. Endopodite: 1st joint with 5 ventral bristles; ventral margin of 2nd joint with 3 long spinous bristles forming single group; dorsal margin and medial surface of 2nd joint with numerous bristles (2 of the cleaning bristles with broad marginal spines); medial surface of 2nd joint with spines forming rows; end joint with 3 long claws (all with ventral teeth), 2 short ventral bristles, and 1 long lateral bristle.

Maxilla: Endopodite: 1st joint with 1 short dorsal bristle and 1 long beta-bristle; end joint with 5 bristles.

Sixth Limb (Figure 77d): 1 short, annulate, medial bristle present in anterodorsal corner; anterior margin of trunk above single anterior suture with 8 bristles; anterior tip of skirt in vicinity of lateral flap with about 10 bristles; ventral margin of skirt posterior to lateral flap with 5 bristles; posterior end of skirt hirsute, with rounded tip without bristle; medial side of skirt with 5 minute bristles near ventral margin, 2 near middle of limb, and 1 just ventral to anterior suture separating trunk and skirt; no epipodial bristles present.

Seventh Limb: Single limb examined with 21 bristles, 9 on 1 side, 12 on other (some bristles could be missing); each segment with not more than 2 bristles, 1 on each side; each bristle with up to 5 bells; terminus consisting of opposing combs, each with 11 teeth consisting of 5 alate middle teeth and 3 spinous teeth on each side of middle teeth.

Furca (Figure 77e): Each lamella with 3 stout claws followed by space and then 1 or 2 short bristles without annulae; distribution of teeth along claws similar to those of adult female.

Eyes (Figure 77f): Medial eye bare, pigmented; lateral eye smaller than medial eye, pigmented, with about 17 ommatidia.

Rod-shaped Organ (Figure 77f): Elongate, broadening towards middle and then tapering to rounded tip; suture near middle.

Upper Lip (Figure 77f), Posterior of Body (Figure 77g), Y-Sclerite (Figure 77g): Similar to those of adult female.

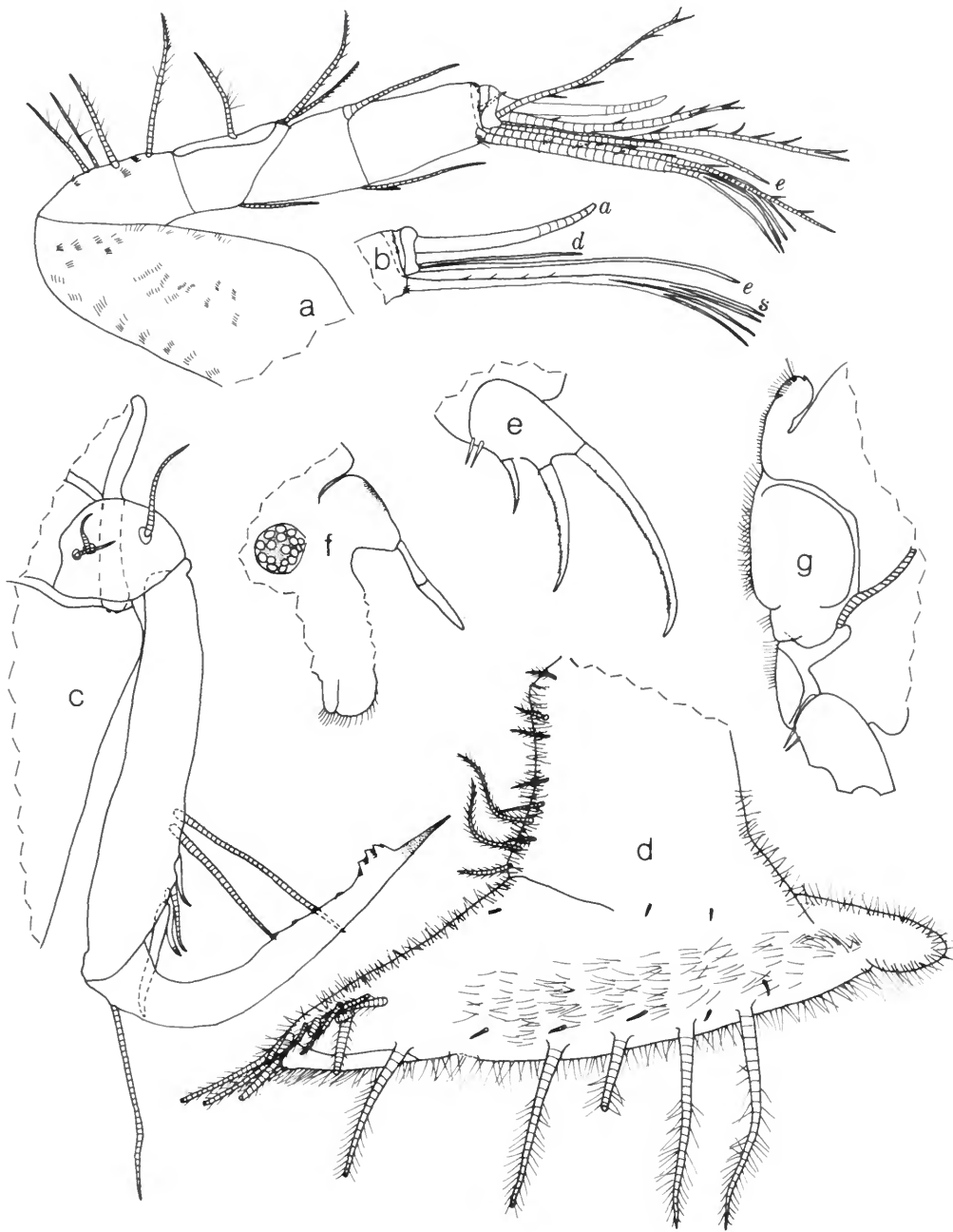


FIGURE 77.—*Actinoseta chelisarsa* Kornicker, adult male, USNM 157178: *a*, right 1st antenna, lateral view; *b*, detail from *a* showing some bristles of distal joints; *c*, endopodite of left 2nd antenna, medial view; *d*, right 6th limb, medial view; *e*, right lamella of furca, lateral view; *f*, anterior of body showing right lateral eye, medial eye, rod-shaped organ, and upper lip; *g*, posterior of body showing thumblike dorsum, Y-sclerite (lined pattern), and right lamella of furca (only 2 posterior bristles shown).

Copulatory Organ: Small.

DESCRIPTION OF JUVENILE FEMALE PARATYPE (Plates 56–58).—Carapace similar in shape to that of adult female and with 3 or 4 low nodes in posterodorsal part of valve (Plate 56a).

Ornamentation: Small fossae with minute processes forming inner ring near edge and spines at bottom abundant over valve surface (Plates 56a,b,d,f-h,l, 57a-d); surface of valve with pavement of discs with various diameters (Plate 56a-d,f,l); edges of discs appearing broken on some discs and complete on others (Plate 56c,l); small shallow fossae forming row along anterodorsal margin of valve near edge (Plate 57d,h); bristles emerging from both open and closed pores scattered over valve surface and along anterior, ventral, and posterior margins (Plates 56b,d-f,i-k, 57a,d,g,h); some bristles with pore near base (Plates 56e,i, 57g), and some bifurcate (Plate 56j).

Hinge Teeth: Intermeshing wedge-shaped teeth along dorsal and posterodorsal margins and external to ligament present on each valve (Plates 57d-f,i 58a-c).

Infold: Broad along anterior, ventral, and posterior margins (Plate 57i); anterodorsal infold with bristles forming row (Plate 57i-k); bristles also present along anteroventral margin (Plate 57l); list along posterior infold with stout tubular bristles composed of 3 or 4 tubes (Plate 58c-f); pore at base of tubular bristle with 4 compartments (observed where bristle partly broken off at base) (Plate 58f,g).

Size: USNM 122898, length 1.65 mm, height 1.32 mm.

REMARKS.—The 2 ovigerous females from Curaçao (USNM 157796, 157797) have carapaces smaller than the 3 measured females from the Bahamas and Bonaire. Of the Curaçao specimens, the endopodite of the 2nd antenna was examined only on USNM 157796. The endopodite of each limb bears only 1 bristle on the 1st joint and one on the 2nd, fewer bristles than generally found on the species. The Venezuelan specimen, USNM 157648, is also small. It has 7 bristles (5 proximal, 2 distal) on the 1st joint and 2 on the 2nd joint of the endopodite of the right

2nd endopodite; 9 bristles (5 proximal, 4 distal) on the 1st joint and 3 on the 2nd joint of the left endopodite.

25. *Actinoseta hummelincki*, new species

FIGURES 9q, 10c, 13c, 14f, 15e, 78–84; PLATES 59–61

HOLOTYPE.—USNM 150292, adult female, length 2.39 mm, complete specimen in alcohol.

TYPE-LOCALITY.—Station 1408A, Virginia Key, Florida (Hummelinck collection).

ETYMOLOGY.—The species is named for Dr. P. Wagenaar Hummelinck, who collected many of the specimens described herein.

PARATYPES.—2 adult females, USNM 150293, 150295, and 12 specimens, USNM 157793, from the same station as the holotype. USNM 156736, adult male, USNM 157186, juvenile, Virginia Key, collected by F. M. Bayer, 1976. Carrie Bow Cay, Belize: USNM 157192, juvenile, sta AC-CBC-23; USNM 157188, juvenile, sta AC-CBC-64; USNM 157182, adult male, USNM 157189, 157191, 2 juveniles, sta AC-CBC-30; USNM 157187, juvenile, USNM 157183, adult male, USNM 157197, 4 juveniles, sta CBC 23.4.74: USNM 157194, juvenile male, USNM 157196, 157190, 157195, 157193, 5 juveniles, sta AC-CBC-43. USNM 157808, 1 specimen, sta C-78-1-3, Venezuela.

NON-TYPES.—Panama, Pacific Ocean: USNM 157317, 1 juvenile, sta 23–2; USNM 157316, 1 juvenile, sta 161–2 (specific identification questionable).

DISTRIBUTION (Figure 71).—Virginia Key, Florida; Carrie Bow Cay, Belize; Venezuela; ?Panama, Pacific Ocean. Depth intertidal to 2 m.

REMARKS.—The 2 available specimens from Panama listed above as “Non-Types” are too young to identify at the specific level with certainty. They have been referred questionably to *A. hummelincki* because of having 2 posterior processes on each valve similar to those on valves of that species. The 2 specimens are the first of the genus *Actinoseta* to be reported from the Pacific.

DESCRIPTION OF ADULT FEMALE (Figures 78–80, Plates 59–61).—Carapace similar to that of *A. chelisparsa* except for having 3 prominent but short posterior ridges (Figure 78): 1 posterodorsal, 1 middorsal, and 1 posteroventral (Plates 59*a,h,i*, 60*a*); also, similar ridges present near anteroventral valve margin and along lower margin of rostrum (Plate 59*a,b*); the latter extends posteriorly a short distance.

Ornamentation: Fossae filled with debris and diatoms abundant over valve surface (Plate 59*a-f,h-j*); surface of valve with pavement of small discs and ellipsoids (Plate 59*a-c, e-i*); bristles emerging from both open and closed pores scattered over valve surface and along anterior, ventral, and dorsal margin (Plates 59*b,j-l*, 60*i-k*); some bristles with pore near base (Plate 59*k*).

Hinge Teeth: Right valve with wedged-shaped teeth consisting of overlapping plates with marginal spines present along dorsal and posterodorsal margins (Plate 60*a-e*); left valve with similar teeth except not consisting of overlapping plates; teeth on one valve fit into the sockets on the other (Plate 60*a,f-h*).

Infold: Broad along anterior, ventral, and posterior margins (Plate 60*i*); anterodorsal infold with about 12 long bristles and numerous shorter bristles (Plate 60*i,j*); anteroventral infold with about 6 bristles (Plate 60*j*); ventral infold with about 20 short bristles near inner margin (Plate



FIGURE 78.—*Actinoseta hummelincki*, new species, adult female, holotype, USNM 150292, lateral view of complete specimen, length 2.39 mm.

60*k,l*); posterior infold near inner margin with about 13 stout tubular bristles, each composed of several tubes (Plate 61*a-c,f*); 1 slender bristle terminating in about 4 branches present posterior to the stout tubular bristles (Plate 61*a,b*); many short tubular bristles present between the stout bristles; (Plate 61*b,d,e*); numerous short bristles forming row present on posterior infold just within valve edge (Plate 61*g,h*); list with lamellar prolongation along middle of ventral infold (Plate 60*i,k,l*).

Selvage: Broad lamellar prolongation present along anterior, ventral, dorsal, and posterior margins (Plate 60*a-c,i-l*).

Central Adductor Muscle Attachment Scars: Similar to those of *A. chelisparsa*.

Size: USNM 150295, length 2.35 mm, height 1.85 mm; USNM 150293, length 2.42 mm, height 1.73 mm; USNM 150292, length 2.39 mm, height 1.88 mm (valves not opened).

First Antenna (Figure 79*a*): Joints 1–3 similar to those of *A. chelisparsa*; 4th joint with 2 or 3 terminal bristles (1 ventral, 1 or 2 dorsal, each about same length as 5th joint); sensory bristle of 5th joint with 4 short proximal filaments and 4 long terminal filaments; 6th joint without medial bristle. Seventh joint: a-bristle forming stout claw; b-bristle stout reaching just past a-bristle, with 3 short marginal filaments and longer filament near tip reaching past rounded end of bristle; c-bristle slightly longer than sensory bristle of 5th joint, with about 6 marginal filaments excluding tip. Eighth joint: d-bristle shorter than a-bristle; e-bristle almost twice length of d-bristle; f-bristle bent dorsally, with 4 marginal filaments and bifurcate tip; g-bristle about same length as c-bristle, with 4 marginal filaments and bifurcate tip.

Second Antenna (Figure 79*b,c*): Protopodite with spinous medial bristle, a few long hairs along ventral margin, a few small spines along dorsal margin and on medial surface near dorsal margin, and numerous minute spines on dorsal half of medial surface. Endopodite 3-jointed: 1st joint with 2 proximal and 2 distal bristles; 2nd joint elongate, tapered, with 3 bristles along ventral

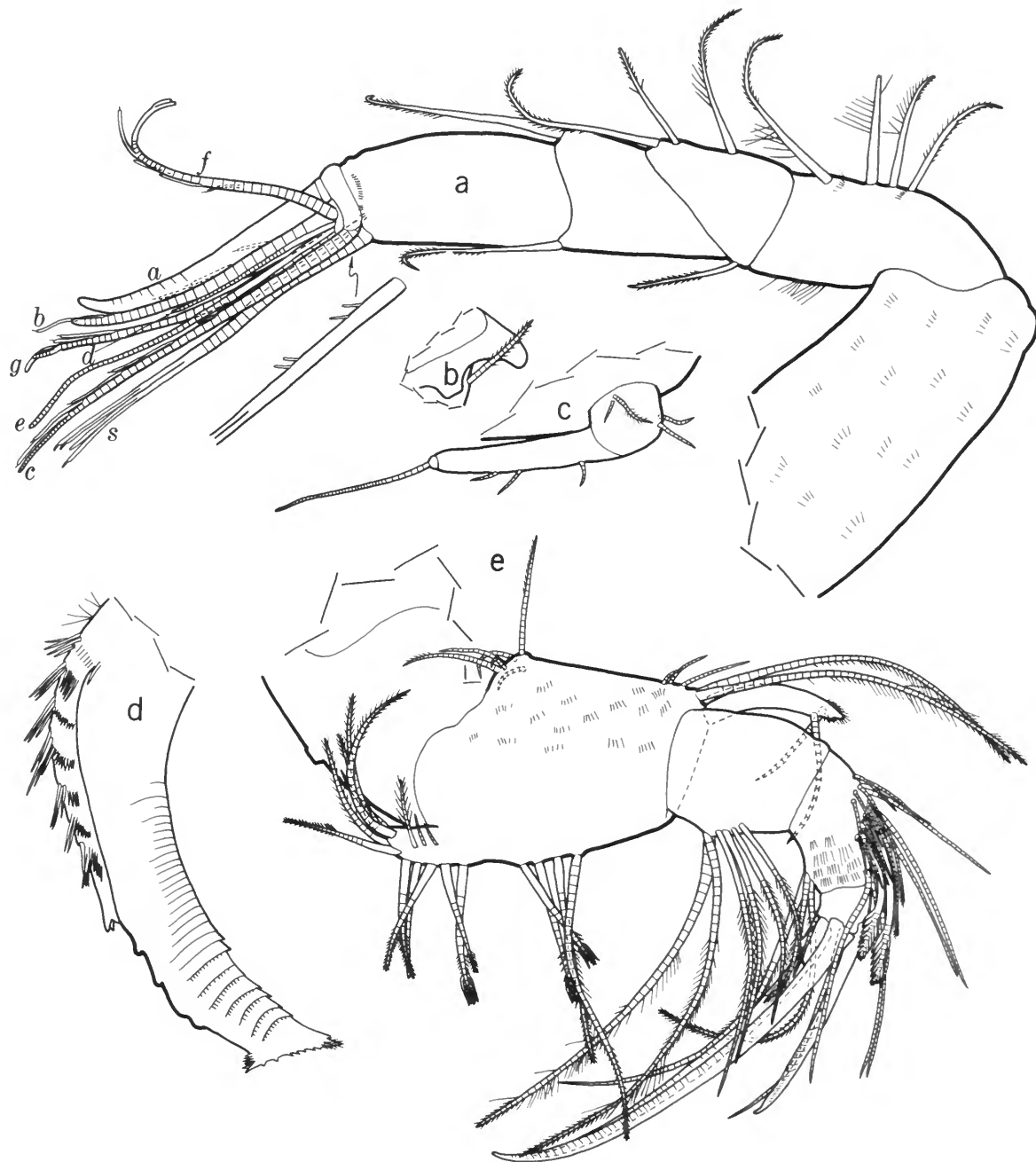


FIGURE 79.—*Actinoseta hummelincki* new species, adult female, paratype, USNM 150295: a, left 1st antenna, lateral view; b, distal bristle of protopodite of left 2nd antenna, medial view; c, endopodite of left 2nd antenna, medial view; d, coxale endite of right mandible, medial view (subterminal bristle broken off); e, left mandible (coxale endite not shown), medial view.

margin; 3rd joint with long terminal bristle. Exopodite similar to that of *A. chelisparsa*.

Mandible (Figure 79d,e): Coxale endite similar to that of *A. chelisparsa* (subterminal bristle broken off in Figure 79d). Basale: endite with 10 end-type bristles, 1 proximal triaenid bristle with 1 set of the paired teeth long, reaching end of bristle, and 3 short bristles; ventral margin of basale with 4–6 bristles (1 or 2 long spinous bristles, 2 triaenid bristles (each with 1 set of long teeth), and 1 or 2 triaenid bristles without set of long teeth; the latter bristles similar in appearance to end bristle of endite); medial surface of basale with spines forming rows on dorsal half; dorsal margin of basale with 6 short proximal bristles, 3 short subterminal bristles, and 2 long stout, terminal bristles. Exopodite hirsute, reaching distal margin of 1st endopodite joint, with 2 ventral bristles. Endopodite: ventral margin and medial surface near ventral margin of 1st joint with 6 bristles forming row; 2nd and 3rd joints similar to those of *A. chelisparsa*.

Maxilla (Figure 80a): Epipodial appendage hirsute, reaching just past middle of dorsal margin of basale. Protopodite with 2 endites separated by space: endite I with 6 long bristles (part of endite I missing on illustrated limb); distal endite with 1 long, 1 medium, and 2 short bristles. Basale: dorsal margin with proximal group of 6 bristles (bases on medial surface), 1 short bristle distal to middle, and 3 subterminal bristles; small bump present at terminal end of dorsal margin; medial surface near ventral margin with 1 proximal bristle (bristle not always present), 2 slightly longer distal bristles, and 1 short bristle near terminal end; ventral margin with long, spinous, terminal bristle; ventral surface spinous but without additional bristles other than those mentioned above. Exopodite consisting of small flap with 2 short spinous bristles (only longer of 2 bristles shown on illustrated limb). Endopodite: 1st joint spinous with 1 short anterior bristle and a long spinous beta-bristle; end joint with 6 bristles (3 long spinous, 2 medium spinous, 1 short).

Fifth Limb (Figure 80c): Dorsal margin of comb with long hairs along anterior margin; lateral

surface with long, spinous, exopodial bristle reaching just past end of comb, 5 or 6 short bristles near ventral margin proximal to base of comb, and 3 short proximal bristles near dorsal margin.

Sixth Limb (Figure 80b): 1 short bristle present on medial surface near dorsal edge of anterodorsal corner of limb; medial surface of anterior margin of trunk with single row of 4 short bristles dorsal to about 7 longer bristles and about 6 short bristles; bristles of lateral flap obscured on specimen examined; anterior end of skirt medial to flap with about 16 bristles; ventral margin of skirt posterior to flap with 8 or 9 spinous bristles; medial surface of skirt hirsute with about 13 short slender bristles, most near ventral margin; posterior tip hirsute, without bristles; no epipodial bristles.

Seventh Limb (Figure 80d): Each limb with 41–43 bristles, 20–22 bristles on each side; each segment with not more than 1 bristle on each side; each bristle with up to 7 bells and without marginal spines; terminus consisting of opposing combs, each with about 14 teeth consisting of 4 alate middle teeth with 5 spinous teeth on each side.

Furca (Figure 80g,h): Each lamella with 3 stout claws followed by space and then 1 or 2 short bristles (USNM 150295 and 150293 had one on left lamella and 2 on right); small tooth present on lamellae near inner base of claw 1; each claw with teeth along posterior margin.

Eyes: Medial eye similar to that of *A. chelisparsa* (Figure 80e); number of ommatidia in lateral eye difficult to determine because of dark pigment, about 9 ommatidia in central dark part and many more (about 15) around edge (Figure 80e,f).

Rod-shaped Organ (Figure 80e), **Posterior, Upper Lip** (Figure 80i), **Y-Sclerite**: Similar to those of *A. chelisparsa*.

DESCRIPTION OF ADULT MALE (Figures 81–84).—Carapace similar to that of adult female except for being smaller and in having a more truncate posterodorsal margin (Figures 81, 82a).

Size: USNM 156736, length 1.64 mm, height 1.23 mm; USNM 157182, length 1.64 mm, height



FIGURE 80.—*Actinoseta hummelincki*, new species, adult female, paratype, USNM 150295: *a*, right maxilla, medial view; *b*, right 6th limb, medial view; *c*, comb of right 5th limb, lateral view; *d*, 7th limb; *e*, outline of left lateral eye, medial eye, and rod-shaped organ; *f*, right lateral eye; *g*, right lamella of furca showing minute tooth at base of claw 1; *h*, right lamella of furca, lateral view; *i*, USNM 150293, upper lip, anterior to left.

1.29 mm; USNM 157183, length 1.63 mm, height 1.27 mm.

First Antenna (Figure 82*b*): 1st joint with spines forming rows on lateral surface. 2nd joint with lateral spines and 3 dorsal bristles. 3rd joint triangular: dorsal margin with few proximal spines, 1 midbristle and 2 subterminal bristles; short ventral margin with 1 bristle. 4th joint with 3 terminal bristles (1 dorsal, 2 ventral). 5th joint

about twice length of 4th joint; sensory bristle with 5 or 6 short, proximal, marginal filaments and with stem bifurcate distally, each segment with 2 long terminal filaments. 6th joint short with 1 short medial bristle. 7th joint: a-claw slightly longer than combined lengths of joints 5–8, tip rounded; b-bristle reaching just past tip of a-claw, with 3 marginal filaments and bifurcate tip; c-bristle same length as sensory bristle of 5th

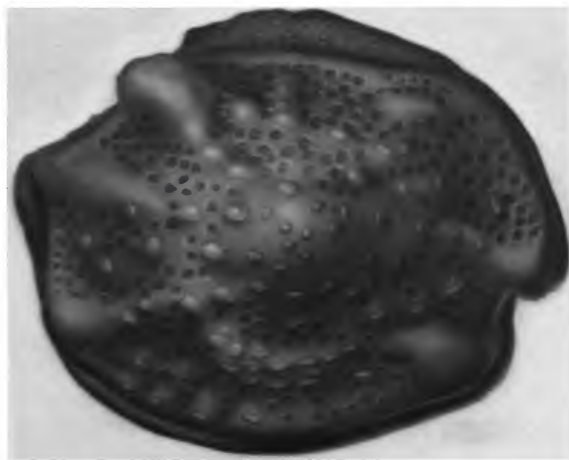


FIGURE 81.—*Actinoseta hummelincki*, new species, adult male, paratype. USNM 157182, lateral view of complete specimen, length 1.64 mm.

joint, with 5 marginal filaments, excluding stem. 8th joint: d-bristle bare, with blunt tip not reaching tip of a-claw; e-bristle bare, with blunt tip just reaching past tip of b-bristle; f-bristle bent dorsally, with 5 short marginal filaments and bifurcate tip; g-bristle about same length as c-bristle, with 7 or 8 marginal filaments excluding stem.

Second Antenna (Figure 82c–e): Protopodite bare except for short, distal, medial bristle. Endopodite 3-jointed: 1st joint short with 2 or 3 short bristles; 2nd joint elongate with 4–6 distal bristles (distal 2 of these not annulate); 3rd joint elongate, reflexed on 2nd joint, with 1 proximal bristle (about same length as longest bristle of 2nd joint), teeth present along ventral margin, and protracted tip with minute terminal teeth. Exopodite: 1st joint with minute, terminal, medial bristle; 2nd joint only slightly larger than 3rd joint; bristles of joints 2–6 with slender ventral spines along middle part and natatory hairs; bristles of joints 7 and 8 with natatory hairs; 9th joint with 3 bristles with natatory hairs; basal spines absent.

Mandible (Figure 83a): Coxale endite broken off both limbs of specimen examined. Basale: endite with 7 long end-type bristles, 2 small bristles (the longer of these with spines), and 1 triaenid bristle

with about 9 paired teeth proximal to 1 pair of very long teeth followed by about 11 paired teeth excluding terminal pair; ventral margin of basale with 1 proximal triaenid bristle (similar to that of endite), 1 end-type bristle, and 1 longer spinous bristle; dorsal margin of basale with 3 terminal bristles (1 of these very short) and 3 or 4 proximal bristles; medial surface of basale with spines forming rows. Exopodite hirsute, reaching just past distal margin of 1st endopodial joint, with 2 bristles of subequal length. Endopodite: ventral margin of 1st joint with 5 or 6 midbristles; ventral margin of 2nd joint with 3 terminal bristles; dorsal margin and medial surface near dorsal margin of 2nd joint with about 15 bristles (2 of the cleaning bristles of triaenid type and with very stout paired teeth; medial surface of 2nd joint with long distal spines forming rows; end joint with 3 stout claws (dorsal claw with ventral spines), 2 short ventral bristles, and 1 long lateral bristle.

Maxilla: Epipodial appendage hirsute, reaching past middle of dorsal margin of basale. Protopodite with 2 or 3 endites: endite I with 3 long bristles, endite II (could also be interpreted as part of endite I) with 2 long bristles, endite III with 1 long and 1 short bristle. Basale: dorsal margin with 2 proximal bristles, 1 short bristle distal to middle, and 1 subterminal bristle; small bump present at terminal end of dorsal margin; medial surface near ventral margin with short bristles just distal to middle, and 1 short bristle near terminal end; ventral margin with long, spinous, terminal bristle. Exopodite consisting of 2 short bristles without lobe. Endopodite: 1st joint spinous with 1 short anterior bristle and 1 long spinous beta-bristle; end joint with 5 or 6 bristles (3 long, 2 medium, 0 or 1 short).

Fifth Limb (Figure 83b): Dorsal margin of comb with long hairs along anterior margin; lateral surface with long, spinous, exopodial bristle reaching just past end of comb, 5 short bristles near ventral margin proximal to base of comb, and 2 short proximal bristles near dorsal margin; 1 or 2 longer bristles proximal to base of exopodial bristle and 1 distal bristle (all with bases on lateral

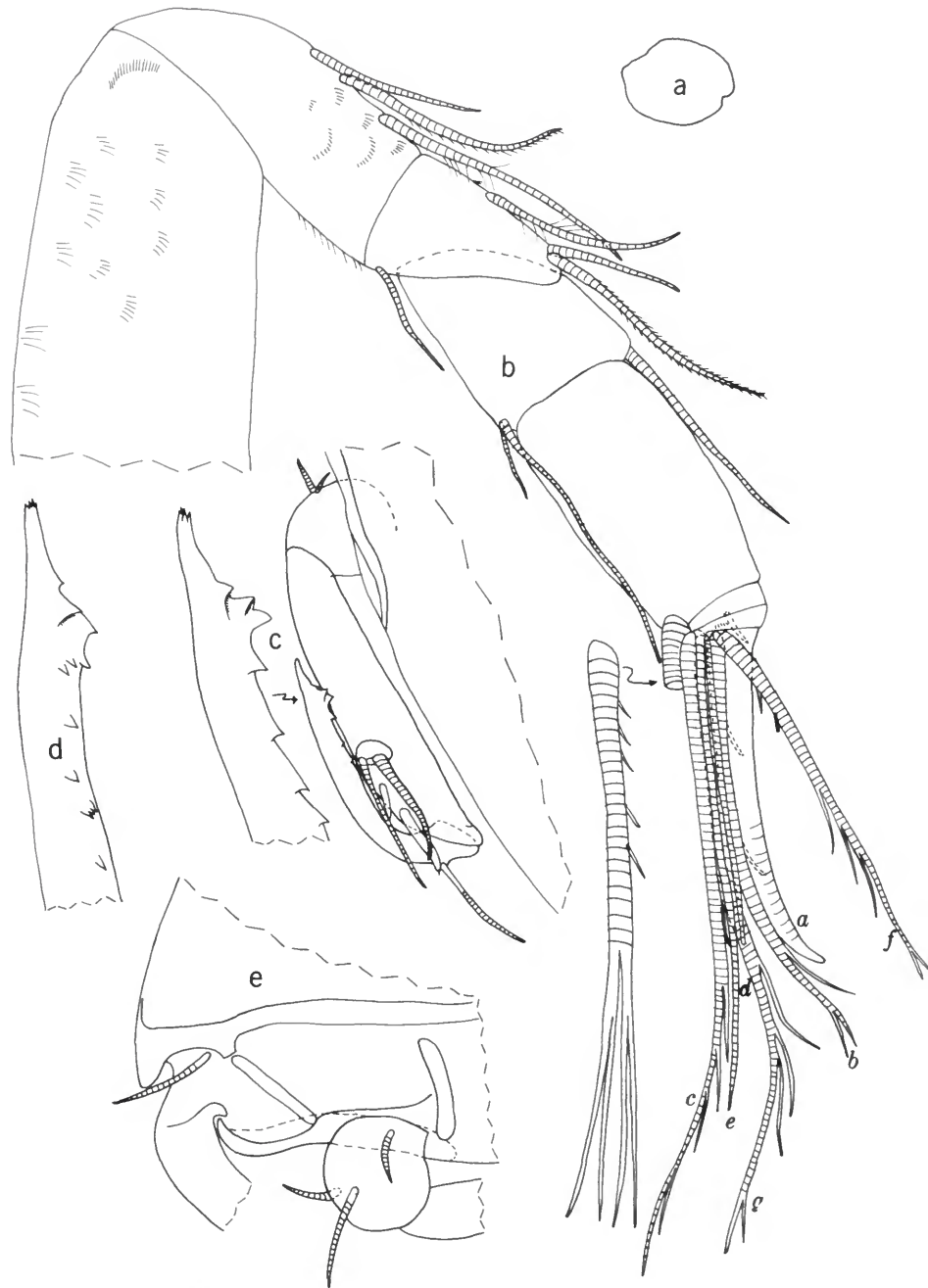


FIGURE 82.—*Actinoseta hummelincki*, new species, adult male, paratype, USNM 156736: *a*, outline of complete specimen, length 1.64 mm; *b*, right 1st antenna, lateral view; *c*, endopodite of left 2nd antenna, lateral view; *d*, tip of 3rd joint of endopodite of right 2nd antenna, medial view; *e*, distal part of protopodite and proximal part of endopodite of right 2nd antenna, medial view.



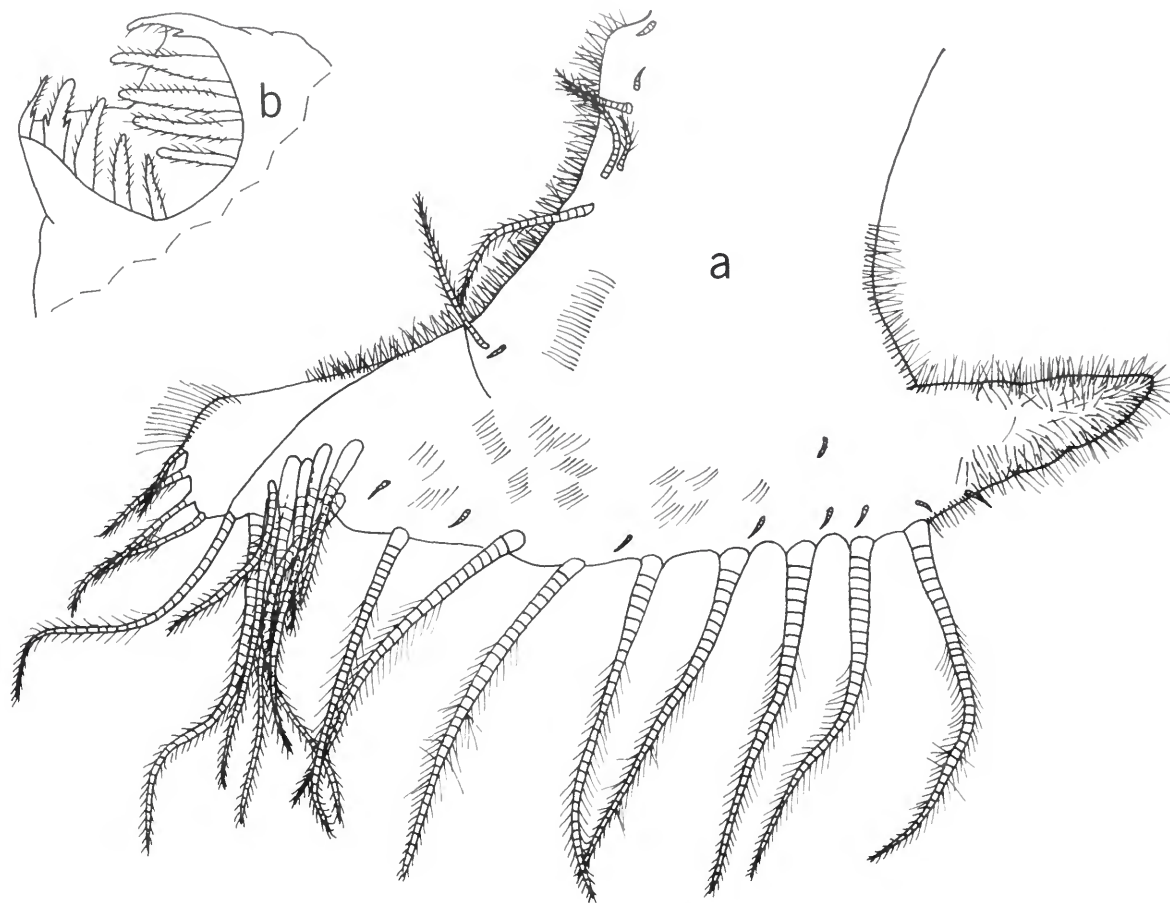


FIGURE 84.—*Actinoseta hummelincki*, new species, adult male, paratype, USNM 156736: *a*, right 6th limb, medial view; *b*, terminus of 7th limb.

side) set slightly back from ventral edge of comb.

Sixth Limb (Figure 84*a*): 1 short bristle present on medial surface near dorsal edge of anterodorsal corner of comb; a 2nd short bristle may be present just ventral to the bristle in anterodorsal corner; medial surface of anterior margin of trunk with row of 3 short and 2 long bristles, all dorsal to

suture separating trunk from skirt; lateral flap with 4 slender spinous bristles; anterior end of skirt medial to flap with 9 spinous bristles; ventral margin of skirt posterior to flap with 8 spinous bristles; medial surface of skirt with 9 minute bristles (1 near anterior suture, others near ventral margin); posterior tip of skirt hirsute, without bristles; no epipodial bristles present.

Seventh Limb: Each limb with 25 or 26 bristles, 11–14 bristles on each side; each segment with not more than 1 bristle on each side; each bristle with up to 5 bells, some bristles very short and with only 1 bell; terminus consisting of opposing

FIGURE 83.—*Actinoseta hummelincki*, new species, adult male, paratype, USNM 156736: *a*, right mandible (coxale endite not shown), medial view; *b*, comb of right 5th limb, lateral view; *c*, anterior of body showing lateral eye, medial eye, rod-shaped organ, and upper lip.

combs, each with about 10 teeth, all with spines, some also alate (Figure 84b).

Furca: Similar to that of adult female.

Eyes (Figure 83c): Medial eye bare, with dark pigment, and produced anteriorly; lateral eye smaller than medial eye, with dark pigment and about 12 ommatidia.

Rod-shaped Organ (Figure 83c): Elongate with suture proximal to broad middle part, tapering distally to rounded tip.

Upper Lip (Figure 83c): Consisting of 2 hirsute lobes and 2 hirsute lateral flaps; saddle between lobes with about 4 stiff, slender, hairlike spines.

Posterior: Similar to that of female.

Y-Sclerite: Similar to that of adult female.

COMPARISONS.—The carapace of the new species *A. hummelincki* differs from that of *A. chelisparsa* in having short ridges on the carapace. The new species also differs from *A. chelisparsa* in having fewer bristles on the endopodite of the 2nd antenna and on the medial surface of the basale of the maxilla.

26. *Actinoseta jonesi*, new species

FIGURES 9*p*, 85–87; PLATES 62–65

ETYMOLOGY.—The species is named for Dr. Meredith L. Jones, who collected the specimens from Venezuela.

HOLOTYPE.—USNM 157636, ovigerous female, on slides and in alcohol.

TYPE-LOCALITY.—Station M-9, Venezuela.

PARATYPES.—From same samples as holotype: adult females, USNM 157635, 157637, 157649, 157650.

NON-TYPES.—USNM 157700, 11 unopened specimens, 2 right valves and 1 left valve.

DISTRIBUTION (Figure 71).—Known only from type-locality. Depth intertidal to 1.5 m.

DESCRIPTION OF ADULT FEMALE (Figures 85–87, Plates 62–65).—Carapace oval in lateral view, with relatively small rostrum having lower edge forming right-angle (Figure 85*a,b*, Plate 62*a*); left valve larger than right; in dorsal view, anterior slightly more acuminate than posterior (Plate 63*a*).

Ornamentation: Surface of each valve with numerous round-to-irregular platelets (Plates 62*a–c*, 63*b*); surface between platelets with smooth areas, possibly representing places where platelets were once present (Plate 62*b–d*), oval crustose areas (Plate 62*b–e*), smaller reticulate structures (Plate 62*d,e*), and shallow fossae with about 5 minute papillate processes around the edge (Plates 62*b,c*, 63*c,d*); papillate bristles emerging from open pores with low narrow rim sparsely distributed over valve surface (Plate 62*c,d,f*); some bristles emerging from closed pores (Plate 63*b*).

Hingement: Teeth and sockets forming row along dorsal margin outside of ligament on each valve (Plates 63*a,b,e,f*, 64*a,f*); teeth and sockets of left valve bearing papillae (Plate 64*a,f*).

Infold: Normal for genus (Plates 63*e*, 64*b–d*, 65*b–e*).

Selvae: Narrow selvae along anterior margin of rostrum serrate (Plates 64*b,e*, 65*a*).

Size: USNM 157636, length 2.16 mm, height 1.65 mm; USNM 157635, length 2.05 mm, height 1.58 mm; USNM 157637, length 2.21 mm, height 1.37 mm; USNM 157649, length 2.13 mm, height 1.68 mm; USNM 157650, length 2.12 mm, height 1.61 mm.

First Antenna (Figures 85*c,d*): 1st joint: lateral side with long hairs near ventral margin and short spines forming rows on dorsal half; medial side with long hairs near ventral margin. 2nd joint: ventral margin with long hairs; dorsal margin with proximal and distal hairs, 3 proximal bristles, and 1 distal bristle. 3rd joint: short ventral margin with 1 bristle; long dorsal margin with 1 bristle near middle and 2 terminal. 4th joint: long ventral margin with 3 terminal bristles (2 long, 1 minute); short dorsal margin with 1 long terminal bristle. 5th joint: sensory bristle with 3 or 4 short marginal filaments and branching distally, with bifurcate tip on each branch. 6th joint with short medial bristle. 7th joint: a-bristle clawlike, smooth; b-bristle about one-third longer than a-bristle, with 4 marginal filaments and bifurcate tip; c-bristle reaching past tip of sensory bristle of 5th joint, with 5 marginal filaments and bifurcate tip. 8th joint: d-bristle about one-tenth length of e-bristle, with blunt tip; e-

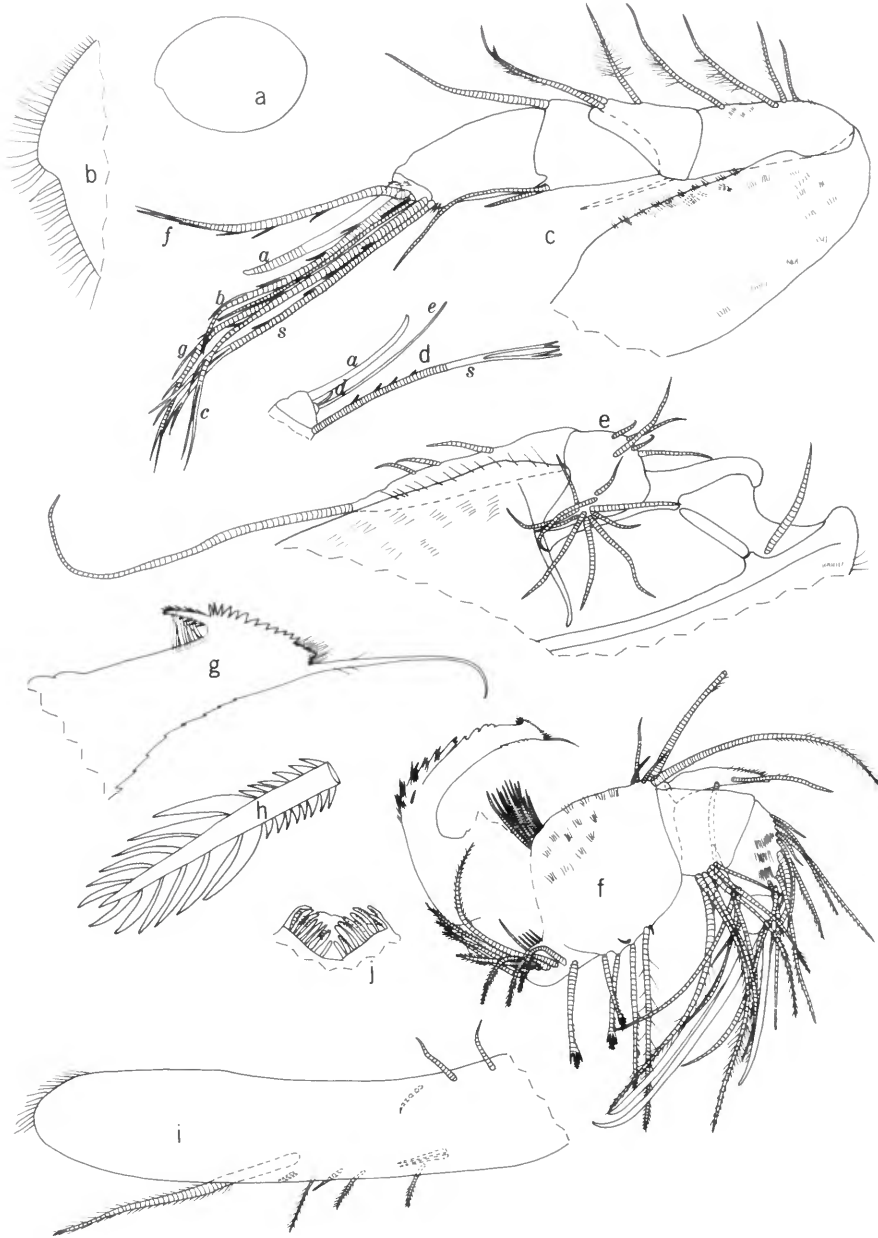


FIGURE 85.—*Actinoseta jonesi*, new species, adult female, paratype, USNM 157635: *a*, outline of complete specimen, length 2.05 mm; *b*, anterior end of carapace shown in *a*. Ovigerous female, USNM 157636: *c*, left 1st antenna, lateral view; *d*, sensory bristle of 5th joint, a claw of 7th joint, and d- and e-bristles of 8th joint of right 1st antenna, lateral view; *e*, endopodite and distal part of protopodite of right 2nd antenna, medial view; *f*, left mandible, medial view; *g*, detail of tip of dorsal branch of coxale endite of left mandible shown in *f*; *h*, tip of triaenid cleaning bristle on 2nd endopodial joint of left mandible, medial view; *i*, comb of right 5th limb, medial view; *j*, terminus of 7th limb.

bristle much stouter than d-bristle, slightly longer than a-bristle, bare with blunt tip; f-bristle bent dorsally in proximal section, about same length as b-bristle, with 4 or 5 ventral filaments and bifurcate tip; g-bristle about same length as c-bristle, with 6 marginal filaments and bifurcate tip.

Second Antenna (Figure 85e): Protopodite with spines along ventral and dorsal margins and on medial surface, and 1 distal medial bristle with terminal spine. Endopodite 3 jointed: 1st joint with 10–16 proximal and 4–7 distal bristles; 2nd and 3rd joints fused; 2nd joint elongate, with 3–6 short ventral bristles; 3rd joint short with long terminal bristle with blunt tip. Exopodite: 1st joint with minute spine on distal margin; bristle of 2nd joint very long, with natatory hairs and slender ventral spines; bristles of joints 3–8 with natatory hairs and slender ventral spines; 9th joint with 3 bristles (2 long with natatory hairs and ventral spines, 1 short, dorsal, with only natatory hairs); no basal spines or spines forming row along distal margins of joints 2–8. The distribution of bristles on the 1st and 2nd endopodial joints of 5 specimens is tabulated below.

USNM number	1st joint		2nd joint	
	Right (Proximal- distal)	Left (Proximal- distal)	Right	Left
	157637	14–5	15–6	3
157635	11–7	13–5	6	5
157649	15–4	13–5	3	3
157650	14–5	16–5	3	3
157636	10–5	10–5	3	n.d.

(n.d. = no data)

Mandible (Figure 85f–h): Coxale endite: minute bristle present near base of ventral branch; ventral branch with proximal hairs forming rows, spines forming 5 oblique rows, and tip with 3 minute teeth; ventral margin of dorsal branch with 3 nodes proximal to main spine; 6 stout spines present near base of main spine; main spine with slender teeth along both margins; margin distal to main spine with small teeth followed by hairs and then long bristle; dorsal

margin of dorsal branch serrate. Basale endite: tip with 4 end-type bristles; ventral margin with 5 triaenid bristles (proximal of these with single pair of very long teeth between rows of smaller teeth); dorsal margin with 5 dwarf bristles (distal of these much longer than others). Basale: ventral margin with 2 triaenid bristles with 1 pair of very long teeth, 1 longer triaenid bristle with 1 pair of teeth only slightly longer than others, and 1 long, distal, spinous bristle; medial surface spinous, with 2 minute bristles near ventral margin; dorsal margin with clump of about 15 proximal bristles and 5 or 6 distal bristles (3 or 4 short and 2 very long). Exopodite spinous, reaching past distal end of 1st endopodial joint, with 2 ventral bristles. Endopodite: 1st joint with 6 ventral bristles; ventral margin of 2nd joint with 3 distal bristles; dorsal margin and medial side near dorsal margin of 2nd joint with numerous bristles (2 of the cleaning bristles with broad distal spines, Figure 85h); medial surface with long slender spines forming rows; end joint with 3 long claws (dorsal of these shorter than others and with ventral spines), 1 long lateral bristle, and 1 short ventral bristle.

Maxilla (Figure 86a): Epipodial appendage with pointed hirsute tip reaching past middle of dorsal margin of basale. Endite I with 3 long bristles; endite II with 2 long bristles; endite III with 3 stout bristles of unequal length; 5 small bristles present near bases of stout bristles of endite III. Basale: dorsal margin with 14 or 15 proximal bristles with bases on medial side, 3 bristles distal to middle, and 5 distal bristles; medial side with 2 or 3 proximal and 2 distal bristles; ventral margin with 7 short bristles, 1 longer, spinous, distal bristle, and 1 very long terminal bristle. Exopodite represented by 1 short bristle. Endopodite: 1st joint spinous, with 2 proximal anterior bristles and 1 long spinous beta-bristle; end joint with 5 or 6 bristles.

Fifth Limb (Figure 85i): Lateral side of comb with 3 small proximal bristles near dorsal margin, 1 long, stout, spinous, exopodial bristle, 2 minute bristles just ventral to base of stout bristle, and 6 small bristles proximal and ventral to base of stout bristle; tip of comb with long hairs; ventral



FIGURE 86.—*Actinoseta jonesi*, new species, ovigerous female, paratype, USNM 157636: *a*, right maxilla, medial view; *b*, anterior of body showing lateral eye (stippled disc; ommatidia not shown), medial eye (part stippled), rod-shaped organ, and upper lip (lateral flap not shown); *c*, posterior process of body.



FIGURE 87.—*Actinoseta jonesi*, new species, ovigerous female, paratype USNM 157636: *a*, left 6th limb, medial view; *b*, right lamella of furca, lateral view.

margin with spinous bristles forming 2 rows.

Sixth Limb (Figure 87a): Anterior margin with short suture separating trunk and skirt; anterior margin of trunk with about 15 bristles, all with bases on medial side; lateral flap with 4 spinous bristles; ventral margin of skirt with about 11 bristles at anterior end and 7 long bristles along middle part; medial side of limb with abundant hairs and many minute bristles with slender spine at tip; posterior end of skirt hirsute, rounded, without bristles; no epipodial bristles.

Seventh Limb: Each limb with about 47 bristles, 23 or 24 on each side; each bristle with up to 6 bells; each joint generally with 2 bristles, 1 on each side; terminus with opposing combs, each with about 16 spinous teeth (Figure 85j).

Furca (Figure 87b): Each lamella with 3 main pectinate claws followed by 3 small bristles; a small tooth present on lamella near inner corner of base of claw 1; anterior bristle of left lamella slightly closer to claw 3 than anterior bristle of right lamella; a few short spines present along anterior edge of lamella; long medial hairs present on lamella near bases of claws 1 and 2.

Rod-shaped Organ (Figure 86b): Elongate, broadening near middle, with rounded tip; a suture may be present proximal to middle.

Eyes (Figure 86b): Medial eye bare with dark brown pigment; lateral eye smaller than medial eye, pigmented dark brown making ommatidia difficult to count, possibly about 9.

Upper Lip (Figure 86b): Each lobe with anterior spine and many hairs; hirsute lateral flap present on each side of mouth.

Posterior (Figure 86c): Posterior of body hirsute; dorsum fingerlike, with tip consisting of posterior spinous lobe and bare anterior process.

Eggs: USNM 157636 with all 18 well-developed eggs (bearing lateral eyes) in marsupium; USNM 157635—13 eggs; USNM 157637—18 eggs; USNM 157649—15 eggs.

COMPARISONS.—The new species, *Actinoseta jonesi*, differs from previously described species of the genus in that the d-bristle of the 1st antenna is only about one-tenth the length of the e-bristle. The carapace of *A. jonesi* does not have ridges that are present on the carapace of *A. hummelincki*,

and does not have the 3 minute processes in the posterodorsal part of the valve present on many specimens of *A. chelisparsa*. The rostral projection of *A. jonesi* is generally slightly less than that of *A. chelisparsa*. The fossae appear to be more abundant and deeper on valves of *A. chelisparsa* than on *A. jonesi*.

REMARKS.—With the exception of an ovigerous female (USNM 157648) with 17 eggs that was referred to *A. chelisparsa* because of having a long d-bristle on the 1st antenna and which was collected at the type-locality of *A. jonesi* in Venezuela, ovigerous females of *A. chelisparsa* appear to have fewer eggs, 8–11, (4 specimens) than do ovigerous females of *A. jonesi*, 13–18, (4 specimens).

27. *Actinoseta nodosa*, new species

Figures 9r, 88, 89; PLATES 66–73

HOLOTYPE.—USNM 157417, juvenile female, length 2.1 mm, in alcohol and on slides.

TYPE-LOCALITY.—Station LK 17, Male Atoll, Maldives, Indian ocean.

ETYMOLOGY.—The specific name from the Latin *nodosus* (full of knots) in reference to the many minute nodes on the carapace of this species.

NON-TYPES.—USNM 157418A–C, 3 empty valves (2 left, 1 right) from station LK 48, vicinity of North Island, Farquhar Group, Indian Ocean.

DISTRIBUTION (Figure 71).—Male Atoll and Farquhar Group, Indian Ocean. Depth 1/3–2 m.

DESCRIPTION OF FEMALE (A-1 or A-2 instar) (Figures 88, 89, Plates 66–69).—Carapace oval in lateral view with small rostrum (Figure 88a, Plate 66a); left valve overlapping right along posterior and dorsal margin (Figure 88a); carapace with numerous minute nodes (Plates 66b,d, 67a); right valve of holotype with 2 low posterodorsal ridges (Plates 66a,b,d, 67a).

Ornamentation: Small fossae with minute processes forming inner ring near edge, abundant over valve surface (Plates 67d, 68c–e); surface of valve with pavement of small punctate discs (Plates 66c,d, 67c,d, 68a,c); similar to those on

surface of carapace of *Actinoseta chelisparsa*; bristles with pore near base, and emerging from open pore, sparsely distributed on valve surface (Plate 68a,b).

Hinge Teeth: Wedge-shaped teeth consisting of overlapping plates with marginal spines (papillae?) present along dorsal and posterodorsal margins of right valve (Plates 66b, 67a,b, 69a,c,d).

Infold: Broad along anterior, ventral, and posteroventral margins; bristles forming row along anterodorsal infold (Plate 69a,b); posteroventral infold with stout tubular bristles consisting of several tubes (Plate 69e); 1 slender bristle terminating in 3 branches present posterior to each stout tubular bristle (Plate 69e); several short tubes present between the stout tubular bristles (Plate 69e).

Size: USNM 157417, complete specimen, length 2.1 mm, height 1.6 mm; right valve, length 1.94 mm, height 1.47 mm. USNM 157418A, left valve, length 1.91 mm, height 1.49 mm. (Juveniles: USNM 157418B, right valve, length 1.73 mm, height 1.36 mm; USNM 157418C, right valve, length 1.22 mm, height 0.94 mm.)

First Antenna (Figure 88b,c): 1st joint with hairs on medial surface near ventral margin. 2nd joint with hairs along ventral margin and 3 dorsal bristles. 3rd joint with 1 subterminal bristle on ventral margin, and 1 midbristle and 2 terminal bristles on dorsal margin. 4th joint with 1 terminal dorsal bristle and 2 small, terminal, ventral bristles. Sensory bristle of long 5th joint with 2 short proximal filaments and branching distally, each branch terminating in 2 long filaments. Medial bristle of minute 6th joint very small, with pointed tip. 7th joint: a-bristle forming stout bare claw with rounded tip; b-bristle reaching past tip of a-bristle, with 3 short marginal filaments and bifurcate tip; c-bristle slightly longer than sensory bristle of 5th joint, with 5 marginal filaments and bifurcate tip. 8th joint: d-bristle shorter than e-bristle, slightly shorter than a-bristle; e-bristle about same length as b-bristle both d- and e-bristles bare with blunt tips; f-bristle bent dorsally, with 5 marginal filaments and bifurcate tip; g-bristle about same length as c-

bristle, with 6 marginal filaments and bifurcate tip.

Second Antenna (Figure 88d): Protopodite with spinous medial bristle, few long hairs on medial surface near ventral margin, and few short hairs along dorsal margin. Endopodite 3-jointed but with sutures between joints not well defined; short 1st joint with 1 proximal bristle; elongate 2nd joint with 2 ventral bristles; short 3rd joint with 1 long terminal bristle reaching past 9th joint of exopodite. Exopodite: 1st joint with short terminal spine on medial side; bristles of joints 2-8 with natatory hairs; bristles of joints 2-5 also with slender ventral spines; 9th joint with 2 long bristles and 1 short bristle, all with natatory hairs; no basal spines present.

Mandible (Figure 88e-g): Coxale endite similar to that of *Actinoseta chelisparsa*. Basale endite with about 8 end bristles, 1 proximal triaenid bristle with paired marginal teeth decreasing gradually in length distally along bristle, and at least 1 dwarf bristle (part of basale endite and remaining part of basale fragmented). Ventral margin of basale with 2 or 3 triaenid bristles with 1 pair of the paired teeth very long, almost reaching tip of bristle, and 1 spinous bristle. Exopodite hirsute, reaching past distal end of 1st endopodite joint, with 2 ventral bristles (proximal of these reaching distal end of 2nd endopodite joint, with short marginal spines; other bristle shorter, with faint marginal spines). Endopodite: 1st joint with 5 ventral bristles; 2nd joint with numerous bristles on dorsal margin and on medial surface near dorsal margin, including 2 stout triaenid bristles with broad marginal teeth; ventral margin with 3 long terminal bristles; medial surface with long hairs forming rows; end joint with 3 claws and 3 bristles (1 lateral, 2 ventral).

Maxilla (Figure 89a): Epipodial appendage reaching middle of dorsal margin of basale, hairs not observed. Protopodite fragmented. Basale: dorsal margin hirsute, with 3 proximal and 3 distal bristles; minute bump present at terminal end of dorsal margin; medial surface near ventral margin obscure but with 6 short distal bristles with bases on medial side, and 1 long, spinous,

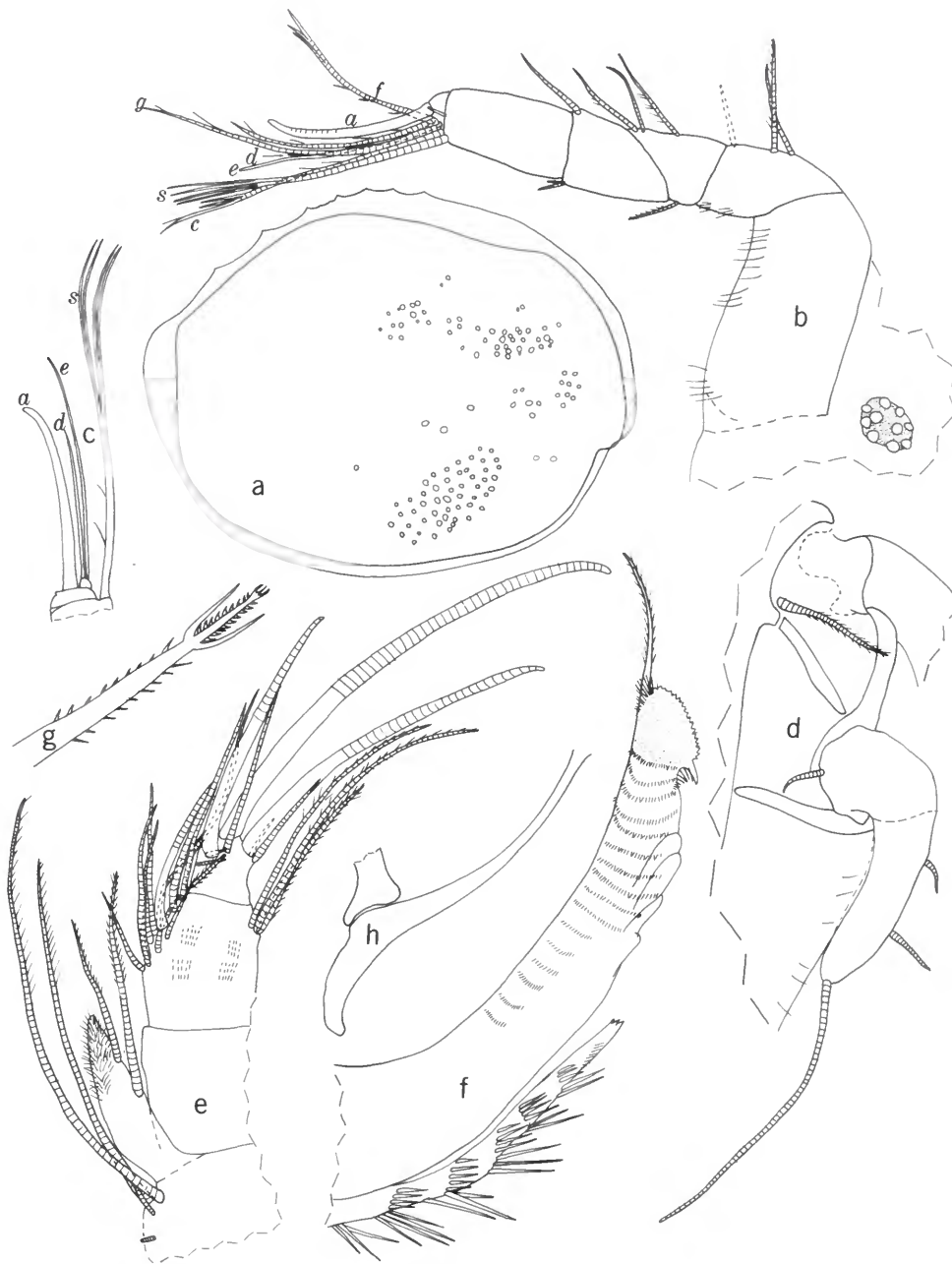


FIGURE 88.—*Actinoseta nodosa*, new species, female (A-1 or A-2 instar), holotype, USNM 157417: a, complete specimen, length 2.1 mm; b, lateral eye and right 1st antenna, medial view; c, sensory bristle of 5th joint and a-claw, d- and e-bristles of 7th and 8th joints of left 1st antenna, medial view; d, endopodite and distal part of protopodite of left 2nd antenna, medial view; e, distal part of right mandible, lateral view; f, coxale endite of right mandible, medial view; g, tip of triaenid bristle on ventral margin of basale of right mandible; h, right Y-sclerite, anterior to right.



FIGURE 89.—*Actinosea nodosa*, new species, female (A-1 or A-2 instar), holotype, USNM 157417: *a*, right maxilla (endite bristles not shown), lateral view; *b*, comb of left 5th limb, lateral view; *c*, left 6th limb, medial view; *d*, 7th limb; *e*, posterior of body showing posterior process and right lamella of furca, lateral view; *f*, detail of *e*, showing spine at base of claw 1.

terminal bristle. Exopodite consisting of 2 short spinous bristles. Endopodite: 1st joint spinous with 1 anterior midbristle and long spinous beta-bristle; end joint with 2 long and 4 shorter bristles, some with marginal spines.

Fifth Limb: Exopodial bristles obscure on limb studied (Figure 89*b*).

Sixth Limb (Figure 89*c*): Medial side of anterior margin of trunk with single row of 5 short bristles dorsal to 3 longer bristles; 2 short bristles present inward from the long bristles; suture present on anterior margin between trunk and skirt; 4 long, slender, medial bristles present on skirt between suture and stouter bristles near ventral margin; lateral flap of skirt with 3 slender hirsute bristles; anterior end of skirt medial to flap with about 8 bristles; ventral margin of skirt posterior to flap with 6 or 7 long, slender, spinous bristles; medial surface of skirt with about 5 minute bristles; 1 short, spinous, medial bristle present near base of anterior long bristle of ventral margin; posterior end of skirt hirsute but without bristles; limb hirsute, no epipodial bristles present.

Seventh Limb (Figure 89*d*): Each limb with about 40 bristles (some missing from illustrated limb); many bristles strongly tapering (juvenile character); bristles with up to 5 bells; terminus with opposing combs, each with about 9 spinous teeth.

Furca (Figure 89*e,f*): Each lamella with 3 stout claws followed by space and then 2 short spinous bristles without annulae; each claw with lateral and medial row of teeth along concave margin; teeth grouped with up to 3 small teeth between each pair of stout teeth; medial hairs present at base of stout claws.

Lateral Eye (Figure 88*b*): Lateral eye pigmented, with 10–12 ommatidia.

Medial Eye, Rod-shaped Organ, Upper Lip: Not examined.

Posterior of Body (Figure 89*e*): Elongate hirsute dorsum present, hairs longer at tip; posterior margin of body between dorsum and furca hirsute.

Y-Sclerite: Unbranched (Figure 88*h*).

DESCRIPTION OF VALVES FROM FARQUHAR

GROUP (Plates 70–73).—Carapace outline similar in lateral view to that of holotype; each valve with lateral ridge about midheight along posterior margin (Plate 70*a,b*).

Ornamentation: Similar to that of holotype (Plates 70, 72).

Hinge Teeth: Left valve of USNM 157418A similar to that of right valve of holotype but without layered structure (Plate 73*a,b,e,f*).

Size: USNM 157418A, left valve, length 1.91 mm, height 1.49 mm; USNM 157418B, left valve, length 1.73 mm, height 1.36 mm; USNM 157418C, right valve, length 1.22 mm, height 0.94 mm.

REMARKS.—The right valve of USNM 157418C differs from that of the holotype in not having a posterodorsal ridge above the middle of the posterior margin. The left valve of the holotype has been lost so that the number of posterodorsal ridges is unknown. Both left valves of the specimens from the Farquhar Group have only 1 ridge. Study of additional specimens from both Male Atoll and the Farquhar Group is necessary to be certain that the same species occurs at both places.

COMPARISONS.—The carapace of this species differs from the 3 previously described species *A. chelisparis*, *A. jonesi*, and *A. hummelincki* in having prominent nodes on the shell surface. The upper posterodorsal lateral ridge may be better developed in *A. hummelincki* than in *A. nodosa*.

Asteropella Poulsen, 1965

Type-SPECIES.—*Asteropella mortenseni* Poulsen, 1965, by subsequent designation, Kornicker, 1975a.

DISTRIBUTION (Figure 90).—Atlantic and Pacific Oceans in the vicinity of North and South America between the latitudes of about 37°30'N and 41°48'S. Members of the genus have been reported from intertidal depths to 57 m.

COMPOSITION.—This genus contains the following species: *Asteropella monambon* (Kornicker, 1958), *A. agassizii* (Fritz Müller, 1870), *A. punctata* Poulsen, 1965, *A. scammonensis* McKenzie, 1965, *A. rotundicostata* (Hartmann, 1975), *A. mortenseni*

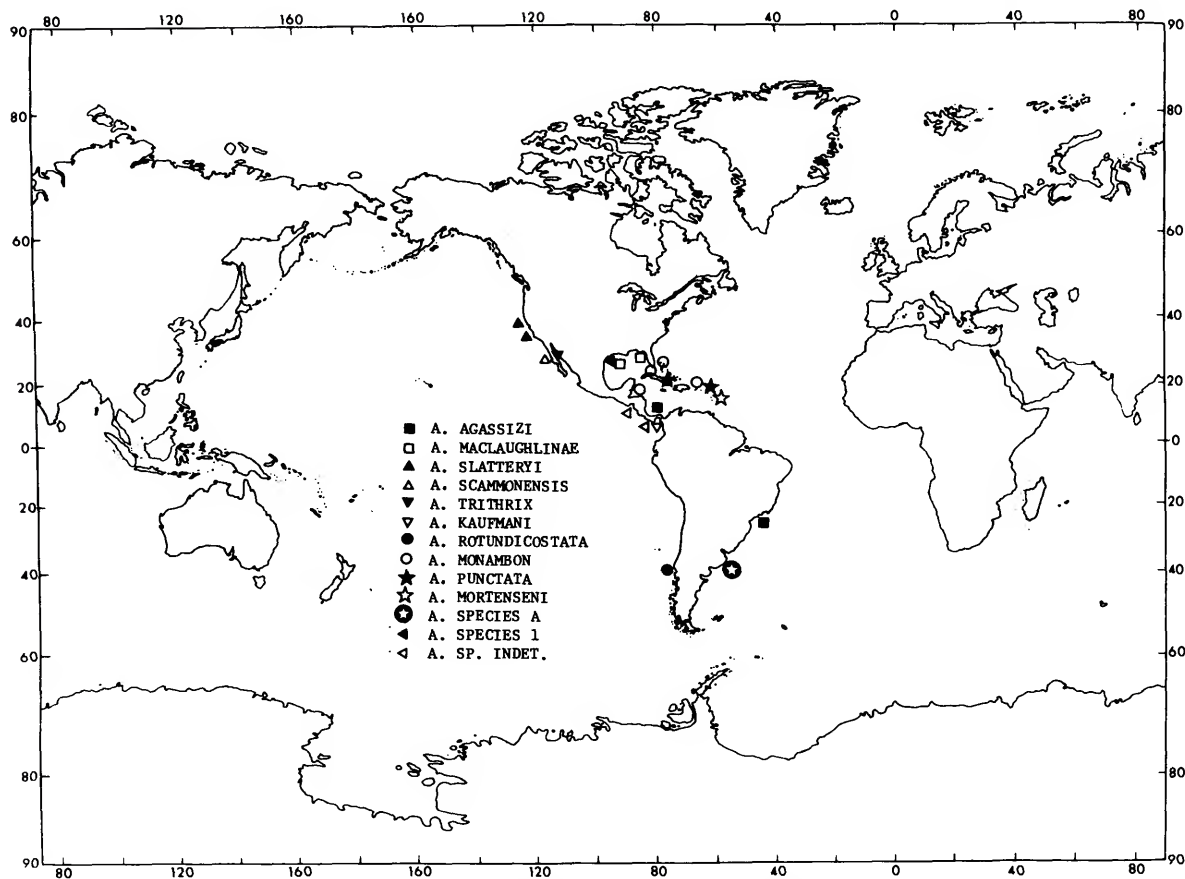


FIGURE 90.—Distribution map of species of *Asteropella*.

Poulsen, 1965, *A. maclaughlinae*, new species, *A. trithrix*, new species, *A. slatteryi*, new species, *A. kaufmani*, new species, *A. species A*, Kornicker, 1975, *A. species 1*, and *A. species indeterminate*.

DIAGNOSIS OF FEMALE.—Carapace oval in lateral view with shallow incisur; lateral surface with prominent ridge just within outer edge, ridge may be discontinuous in posterodorsal corner; horizontal ridge present crossing or just dorsal to central adductor muscle attachment area (an exception is an undescribed species that bears a fingerprint-like pattern on each valve; specimens of this species from off the coast of Louisiana were received from R. D. Kalke too late for inclusion in the present paper).

First Antenna: Sensory bristle of 5th joint generally forming 2 branches of varying length, each branch with bifurcate tip; proximal part of sensory bristle with few minute filaments or without filaments. Medial bristle of 6th joint long. Eighth joint: d-bristle minute or absent; e-bristle well developed but of varying length.

Second Antenna: Endopodite 3-jointed: 1st joint short bare; 2nd joint short, either bare or with hairs and up to 3 bristles; 3rd joint elongate, hirsute (except in *A. trithrix*, new species), and with terminal bristle.

Mandible: Only triaenid bristles present on ventral margin of basale.

Fifth Limb: Comb with 2 long and several short

lateral bristles; no short bristle on dorsal margin.

Sixth Limb: Epipodial bristles absent.

Seventh Limb: Terminus consisting of recurved, more-or-less uniform teeth.

Furca: Each lamella with 3 primary claws followed by 3–5 secondary claws, usually bristlelike;

posterior of the secondary claws often lateral, with base set back from edge of lamella and separated by space from adjacent claw.

Lateral Eyes: Small or absent.

Posterior of Body: With elongate dorsal process with hairs or spines at tip.

Key to Species of *Asteropella*

1. Inner concentric ridge forming concentric spiral 10
 Inner concentric ridge without concentric spiral 2
2. Inner concentric ridge with 2 posterodorsal processes 3
 Inner concentric ridge without 2 posterodorsal processes 6
3. Carapace with 3 narrow horizontal ridges in addition to midridge
 33. *A. mortenseni*
 Carapace with only midridge 4
4. Inner concentric ridge with several small posterior processes in addition
 to the 2 posterodorsal processes; d-bristle of 1st antenna one-fourth
 length of e-bristle 30. *A. punctata*
 Inner concentric ridge with only the 2 posterodorsal processes; d-bristle of
 1st antenna either absent or represented by minute spine 5
5. Anterior end of horizontal midridge intersecting concentric ridge
 28. *A. monambon*
 Anterior end of horizontal midridge not intersecting concentric ridge ...
 34. *A. maclaughlinae*, new species
6. Anterior end of horizontal ridge generally intersecting inner concentric
 ridge 7
 Anterior end of horizontal ridge generally not intersecting inner concentric
 ridge 8
7. 2nd endopodial joint of 2nd antenna of female usually with 3 bristles; 3rd
 endopodial joint without hairs 35. *A. trithrix*, new species
 2nd endopodial joint of 2nd antenna bare; 3rd endopodial joint
 hirsute 9
8. Fossae on carapace surface with stellate covering
 37. *A. kaufmani*, new species
 Fossae on carapace surface without stellate covering 11
9. Posterodorsal corner of concentric ridge flat or slightly concave; d-bristle
 of 1st antenna absent 36. *A. slatteryi*, new species
 Posterodorsal corner of concentric ridge evenly rounded; d-bristle of 1st
 antenna represented by minute spine 31. *A. scammonensis*
10. Furca with 5 bristle-like secondary claws 29. *A. agassizii*
 Furca with 4 claw-like secondary claws 32. *A. rotundicostata*
11. Midrib long 38. *A. species A*
 Midrib short 39. *A. species 1*

28. *Asteropella monambon* (Kornicker, 1958)

Figures 9aa, 91–96; PLATES 74–84

Asteropteron monambon Kornicker, 1958:246, figs. 46: 11; 71A–G; 72A–D; 86 D,H,K.

Asteropella monamba.—Poulsen, 1965:225 [key].

Asteropella monambon.—Kornicker, 1975a:561.

Holotype.—USNM 122899, adult male, unseparated valves, upper lip and furca in alcohol, remaining appendages on 2 slides.

TYPE-LOCALITY.—Bimini, Bahamas, station 113G.

The holotype of this species was a dry specimen. It was softened chemically and then dissected. The dissection revealed that the holotype is an adult male. The appendages of the adult male were previously unknown. Therefore, they are described herein.

MATERIAL.—USNM 150285, 1 ovigerous female, sta 1423B, Puerto Rico. From Carrie Bow Cay, Belize: USNM 157646, 1 adult female, sta AC-CBC-115A; USNM 157167, 1 instar II, sta AC-CBC-24; USNM 156995, 1 instar III, sta AC-CBC-8; USNM 157173, 1 instar I, sta AC-CBC-16. From Cuba: USNM 157366A, 157366B, 2 adult males from sta 8.

DISTRIBUTION (Figure 90).—Bahamas, Belize, Cuba, Puerto Rico. Depth 1–24 m.

SUPPLEMENTARY DESCRIPTION OF ADULT MALE (Figures 91–93, Plates 74–77).—Carapace oval in

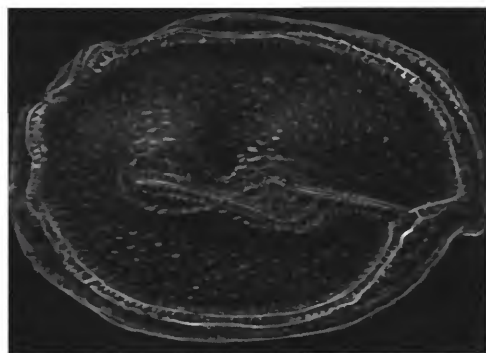


FIGURE 91.—*Asteropella monambon* (Kornicker), adult male, holotype, USNM 122899, lateral view of complete specimen, length 1.27 mm.

lateral view, highest in middle (Figure 91); carapace tapering anteriorly in dorsal view, widest posterior to middle (Plate 74b, and see Kornicker, 1958, fig. 11a); incisur small forming right angle.

Ornamentation: Peripheral ridge paralleling outer margin of each valve except in posterodorsal corner where shallow indentation in ridge forms obtuse angle (not deep right angle as on *Asteropella mortensi* Poulsen, 1965:226, fig. 76a) (Plates 74a, 76a). Horizontal midrib present extending from anterior part of peripheral ridge at indented portion of ridge near incisur to spot at distance equal to three-fourths length of valve measured from anterior margin (Plates 74a, 76a); rib broadens in vicinity of central adductor muscle scar attachment area (Plates 76a, 77a). Surface of peripheral ridge and medial rib more-or-less reticulate (Plate 76a,c); remaining valve surface with reticulations and round fossae (Plates 74–77); bristles emerging from open and closed pores present (Plates 75e, 76e, 77c,d); fossae beneath surface layer visible as dark spots (Plate 76b).

Infold: Not examined.

Size: Softened previously dry holotype, USNM 122899, length 1.27mm, height 0.88 mm, width 0.66 mm; USNM 157366A, length 1.25 mm, height 0.92 mm; USNM 157366B, length 1.18 mm, height 0.86 mm.

First Antenna (Figure 92a): First joint with few long hairs on lateral surface; 2nd joint with long hairs on ventral margin and proximally on dorsal margin, with 4 dorsal bristles, proximal of these with short marginal spines, others with long marginal hairs; 3rd joint short, triangular, with 5 bristles (1 ventral, 4 dorsal); 4th joint with few hairs along ventral margin and 2 bristles (1 ventral, 1 dorsal); sensory bristle of 5th joint with about 27 long filaments on basal part, main stem with 2 branches, each with bifurcate tip; 6th joint with bare medial bristle with hooklike tip. Seventh joint: a-claw smooth, reaching tip of bristle of 6th limb; b-bristle about one-third longer than a-claw, reaching tip of sensory bristle of 5th joint, with 3 filaments and bifurcate tip; c-bristle and 3 ringed proximal filaments and bifurcate tip. Eighth joint: d-bristle represented by minute peg;



FIGURE 92.—*Asteropella monambon* (Kornicker), adult male, holotype, USNM 122899: *a*, left 1st antenna, lateral view; *b*, left 2nd antenna, medial view; *c*, left mandible, lateral view; *d*, basale endite of right mandible, medial view; *e*, basale and endopodite of left maxilla, medial view; *f*, endite bristles and small proximal bristle of basale of left maxilla, lateral view.

e-bristle bare, about half length of *a*-claw; *f*- and *g*-bristles with 4 proximal filaments and bifurcate tip, slightly shorter than *c*-bristle.

Second Antenna (Figure 92*b*): Protopodite with fairly long medial bristle. Endopodite 3-jointed:

1st joint elongate, bare; 2nd joint elongate, with short ventral bristle distally; 3rd joint short, reflexed, with 1 proximal posterior bristle. Exopodite: 1st joint with minute, medial, terminal spine; bristles of joints 2–8 with natatory hairs, some

with ventral spines; 9th joint with 2 bristles: 1 long with natatory hairs, other short bare, or with short spines; some joints with faint spines along terminal margins but without basal spine.

Mandible (Figure 92*c,d*): Coxale endite: ventral branch with spines forming 4–6 oblique rows, tip with 3 minute teeth; slender medial bristle present near base of branch; ventral margin of dorsal branch with 4 low knobs between main spine and tip of ventral branch; long spines present on ventral margin proximal to main spine; margin between main spine and tip of dorsal branch with short spines; posterior bristle hirsute, with base proximal to tip of branch; dorsal margin of branch with 3 serrations distal to middle. Basale: endite with 4 end-bristles (2 of the end-bristles triaenid type, with 1 pair of spines slightly longer than others), 1 dwarf bristle, and 1 proximal triaenid bristle with 2–4 pairs of slender hairlike spines followed by 1 pair of long spines reaching halfway to tip of bristle and then 10 pairs of slender spines including terminal pair; a similar triaenid bristle present on medial side of basale near ventral margin; dorsal margin with 2 terminal bristles; right limb with few hairs near middle of lateral side. Exopodite hirsute with 2 terminal bristles, outer bristle slightly longer than inner bristle. Endopodite: 1st joint with 4–5 long ventral bristles; ventral margin of 2nd joint with 1 short terminal bristle; dorsal margin with about 8 slender bristles just proximal to middle of margin and 7 subterminal bristles, including 4 medial cleaning bristles; end joint with 3 claws and 2 bristles (outer short claw with few ventral spines).

Maxilla (Figure 92*e,f*): Endite I with 2 bristles, endite II with 3 bristles. Basale: lateral side with 1 proximal bristle near ventral margin; ventral margin with 1 minute distal bristle and long, stout, terminal bristle; medial side with 1 proximal bristle near middle and 1 distal bristle near dorsal margin; lateral side with 1 short proximal bristle. Endopodite: 1st joint with spinous beta-bristle; end joint with 4 bristles (one of these very short). Epipodite long pointed reaching distal bristle near dorsal margin of basale. Exopodite absent.

Fifth Limb (Figure 93*a*): Epipodial appendage

with 57 bristles; lateral side of comb with spinous exopodial bristle reaching end of comb, 4 proximal bristles near ventral edge (1 long spinous, 3 short slender; not all shown in illustration) and 2 short slender bristles just dorsal to proximal, long, spinous bristle; 2 of the hairs along anterior margin of comb very slightly stouter than others, but not almost bristlelike as on *Asteropella mortenseni* (Poulsen, 1965:229).

Sixth Limb (Figure 93*b*): Anterior margin of protopodite with 13–17 hirsute bristles, 2 distal of these longer than others; anterior and anterior part of ventral margin of skirt including lateral flap with 28–32 bristles; posterior pointed end of skirt with single hirsute bristle; limb hirsute.

Seventh Limb (Figure 93*c,d*): 12 to 15 bristles present, 5 to 8 on each side; each bristle with up to 5 bells; terminus with 5 or 6 spinous teeth.

Furca (Figure 93*e*): Each lamella with 3 stout main claws followed by 3 short secondary claws, a wide space, and then a bristle placed laterally on lamella; main claws equidistant from each other, with teeth forming row along lateral and medial posterior edges; secondary claws with closely spaced spines along anterior and posterior margins; some teeth in proximal half of lateral row on posterior edge of claw 1 longer than others; distal one-fourth or one-fifth of claws without teeth or spines.

Eyes, Rod-shaped Organ, Posterior of Body: Similar to those of adult female.

Upper Lip: Consisting of 2 hirsute lobes without anterior spines; spine on saddle between lobes; hirsute lateral flap present at each side of mouth.

Y-Sclerite (Figure 93*f*): Slightly arcuate.

Gills: Well developed, slender, about 7 on each side.

DESCRIPTION OF ADULT FEMALE (Figure 94, 95*a–e*, Plates 78–84).—Shape of carapace similar to that of adult male (Figure 95*a*, Plates 78*a*, 80*a*).

Ornamentation: Large fossae appearing as dark oval spots on carapace between fossae of surface layer (Figure 95*b*, Plate 80*a,c–f*), but visible at high magnification (Plate 81*b*); surface layer separated from underlayer by struts (Plates 81*a,b,d–f*, 82*a,b,d*, 83*e*); ridges with row of rectangular

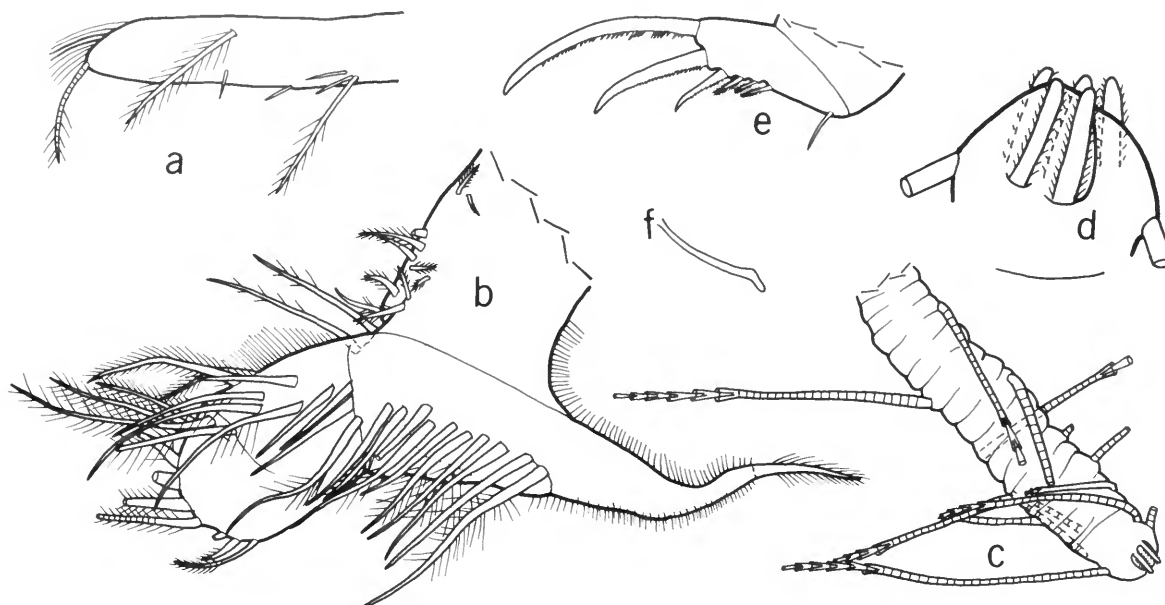


FIGURE 93.—*Asteropella monambon* (Kornicker), adult male, holotype, USNM 122899: *a*, comb of left 5th limb, lateral view; *b*, right 6th limb, medial view; *c*, 7th limb; *d*, tip of 7th limb; *e*, left lamella of furca, lateral view; *f*, left Y-sclerite of furca, anterior to left.

fossae (Plates 78*a,b*, 80*c*, 81*c*); area between ridges with oval fossae with narrow, low peripheral rim (Plates 78*a-d*; 79, 81*a,b,d-f*, 82*a,b,d-f*); 1 or 2 long bristles present where some fossae intersect (Plates 78*b-e*, 80*f*, 81*d,e*, 83*a,b*); these bristles emerge from open pores with raised rim and have marginal papillae (Plate 83*c,d*); some bristles have pore near base (Plates 78*e*, 83*a*); other bristles emerge from closed pores (Plate 79*b*); crinkled surface of carapace between fossae of USNM 150285 may be artifact of freeze-drying process used in preparing specimens for the SEM (Plates 78*f*, 79).

Size: USNM 150285, length 1.62 mm, height 1.18 mm; USNM 157646, separated left valve, length 1.86 mm, height 1.30 mm.

First Antenna (Figure 94*a,b*): Lateral and medial surfaces of 1st joint with long hairs; 2nd joint with long hairs on ventral margin and proximally on dorsal margin; dorsal margin of joint with 4 or 5 bristles, proximal of these with short spines, others also with long marginal hairs; 3rd joint short, triangular, with 5 or 6 bristles (1 ventral, 4

or 5 dorsal); combined 3rd plus 4th joints forming rectangle; 4th joint with 2 or 3 bristles (1 or 2 ventral, 1 or 2 dorsal); 5th joint longer than that of adult male, with sensory bristle with 2 minute proximal filaments (not shown in illustrated appendage) and forming 2 branches distally, each with bifurcate tip; 6th joint much shorter than that of adult male, with bare medial bristle with hooklike tip. Seventh joint: a-claw smooth; b-bristle almost reaching tip of sensory bristle of 5th joint, with 3 minute proximal filaments; c-bristle reaching slightly past tip of sensory bristle, with 1 minute proximal filament. Eighth joint: d-bristle represented by minute peg; e-bristle bare, about one-half length of a-claw; f-bristle bent backwards near base, shorter than sensory bristle, with 3 minute proximal filaments; g-bristle as long as sensory bristle, with 2 minute proximal filaments.

Second Antenna (Figure 94*c*): Protopodite and exopodite similar to that of adult male, except no spines observed along distal margins of exopodial joints. Endopodite 3-jointed: 1st joint short, bare;



FIGURE 94.—*Asteropella monambon* (Kornicker), ovigerous female, USNM 150285: *a*, right 1st antenna, lateral view; *b*, d-bristle and proximal part of e-bristle of 8th joint of left 1st antenna, lateral view; *c*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *d*, left mandible (coxale endite broken off), medial view; *e*, left maxilla, medial view; *f*, comb of left 5th limb, lateral view; *g*, left 6th limb, medial view; *h*, 7th limb; *i*, left lamella of furca, lateral view; *j*, anterior of animal showing medial eye; rod-shaped organ, anterior process, and upper lip; *k*, left lateral eye.

2nd joint short, hirsute; 3rd joint long, hirsute, and with long terminal bristle.

Mandible (Figure 94d): Coxale endite similar to that of adult male. Basale: endite with 2 bristles with short marginal spines (1 long, 1 short), 2 terminal triaenid bristles, 1 dwarf bristle, and 1 proximal triaenid bristle (triaenid bristles with 1 pair of very long spines); ventral margin of basale with 2 or 3 triaenid bristles similar to that proximal on basale endite; dorsal margin of basale with 2 subterminal bristles with short marginal spines; spines present on medial and lateral surfaces near dorsal margin, more on lateral side than on medial side (spines not present on USNM 157646). Endopodite: 1st joint with 6 ventral bristles; ventral margin of 2nd joint with 1 terminal bristle; dorsal margin of 2nd joint with 10 bristles (distal of these a pectinate claw); medial surface with 4 or 5 distal cleaning bristles near dorsal margin and long hairs forming rows; end joint with 3 claws and 2 bristles (dorsal claw about one-half length of other claws and with spines along inner concave margin). Exopodite hirsute with 2 bristles (outer bristle slightly longer than inner bristle).

Maxilla (Figure 94e): Endites I and II each with 3 bristles. Epipodite with hairs along ventral margin, pointed tip reaching bristle on dorsal margin of basale. Basale: medial and lateral surface each with 1 proximal bristle; dorsal margin with 1 distal bristle; ventral margin with 1 long terminal bristle with short marginal spines. Endopodite: 1st joint with 1 long beta-bristle with short marginal spines; end joint with 4 bristles (3 long with short marginal spines, 1 short and bare). Exopodite absent.

Fifth Limb (Figure 94f): Lateral side of comb with long, distal, spinous bristle near dorsal margin, long, proximal, spinous bristle near ventral margin, 3 short bare bristles with bases close to ventral margin, and 2 short, slender, bare bristles with bases just dorsal to long, spinous, proximal bristle.

Sixth Limb (Figure 94g): Bristles not counted but limb in general similar to that of adult male.

Seventh Limb (Figure 94h): Each limb examined with 26–28 bristles, 11 to 15 on each side; each

bristle with up to 5 bells; terminus with about 10 spinous teeth.

Furca (Figure 94i): Each lamella with 3 long, stout, primary claws followed by 3 or 4 shorter secondary claws, a space, and then a bristlelike claw set back from edge of lamella; all claws separated from lamella by suture; claws 1 and 2 with few hairs along convex margin; claws 1–6 with minute teeth along concave posterior margins; proximal teeth on claws 1 and 2 slightly longer and stouter than more distal teeth; anterior edge of lamellae with hairs.

Eyes: Lateral eye unpigmented, minute with 3–5 (possibly more) faint ommatidia or cells, but eye not always observed with certainty (Figures 94k, 95c). Medial eye bare, pigmented (Figures 94j, 95d).

Rod-shaped Organ (Figures 94j, 95d): Elongate, 3 jointed; 3rd joint broad proximally and tapering to broadly rounded tip.

Upper Lip (Figures 94j, 95d,e): Consisting of 2 hirsute lobes; 3 or 4 minute anterior spines on saddle between lobes; a hirsute lateral flap present on each side of mouth.

Posterior of Body (Figure 94l): Fingerlike dorsum with terminal hairs; hairs present along posterior margin between furca and base of dorsum.

Eggs: USNM 150285 with 7 eggs in marsupium and several much smaller, unextruded eggs.

DESCRIPTION OF INSTAR I (Figure 95f–i).—Carapace similar to that of adult female but with posterior more tumid (Figure 95f).

Ornamentation: Similar to that of adult female but fossae and reticulations relatively larger.

Size: USNM 157173, length 0.56 mm, height 0.40 mm.

First Antenna (Figure 95g): 2nd joint: Medial and lateral surfaces and dorsal margin with long spines forming rows; ventral margin with 1 long terminal bristle. 3rd joint: short ventral margin bare, long dorsal margin with 1 long proximal bristle. 4th joint: ventral margin bare; medial side with 11 stout spines forming row along distal edge near dorsal margin. 5th joint with long, distal, lateral hairs; sensory bristle long, unbranched, with pointed tip. 6th joint with medial bristle about half length of sensory bristle of 5th

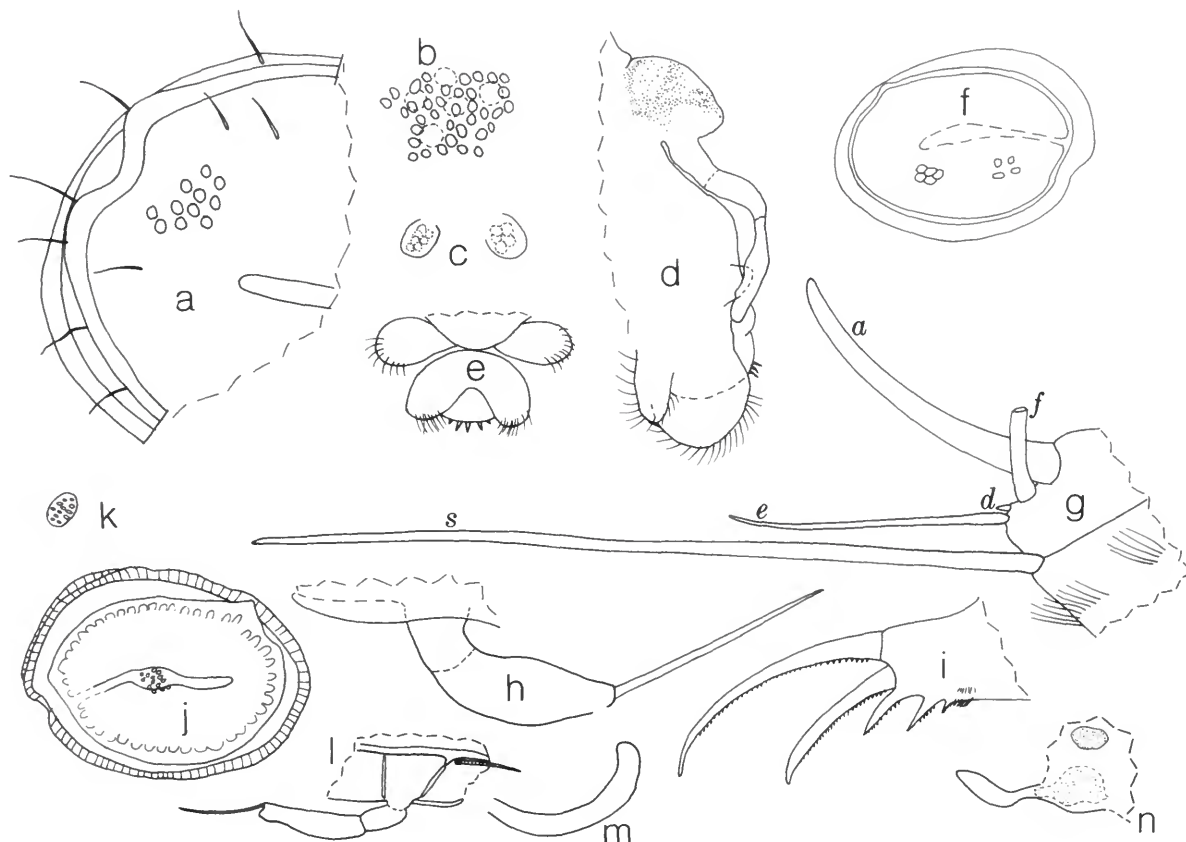


FIGURE 95.—*Asteropella monambon* (Kornicker), adult female, USNM 157646: *a*, posterior end of right valve, outside view; *b*, detail of surface between medial rib and peripheral ridge showing fossae over fewer large fossae; *c*, left and right lateral eyes; *d*, anterior of animal showing medial eye, rod-shaped organ, upper lip and lateral flap; *e*, ventral view of upper lip (lower lobes) and lateral flaps (2 upper lobes extending outwards on each side). Juvenile instar I, USNM 157173: *f*, camera lucida drawing of complete specimen, length 0.56 mm, anterior to right; *g*, distal end of left 1st antenna showing sensory bristle of 5th joint, a-bristle of 7th joint, d-, e-, and f-bristles of 8th joint, lateral view; *h*, endopodite of left 2nd antenna, lateral view; *i*, right lamella of furca, medial view. Juvenile instar II, USNM 157167: *j*, camera lucida drawing of specimen, length 0.69 mm, anterior to left; *k*, lateral eye. Juvenile instar III, USNM 156995: *l*, protopodite and endopodite of left 2nd antenna, medial view; *m*, 7th limb; *n*, left lateral eye (oval area in upper right), medial eye, and rod-shaped organ.

joint, with moderately hooked and pointed tip. 7th joint: a-bristle clawlike, bare, about same length as 5th joint; b-bristle bare, longer than a-bristle; c-bristle bare, slightly shorter than sensory bristle. 8th joint: d-bristle represented by minute peg; e-bristle bare, reaching past tip of a-bristle;

f-bristle bare, bent dorsally, g-bristle bare, about same length as sensory bristle.

Second Antenna: Protopodite bare except for fairly long, distal, medial bristle. Endopodite weakly 3-jointed (Figure 95*h*): 1st and 2nd joints short, bare; 3rd joint bare except for long terminal

bristle with pointed tip. Exopodite with 9 joints: 1st joint with minute medial spine on terminal margin; joints 2–8 with long bristles with natatory hairs, no spines; 9th joint with 1 long bristle with natatory hairs and 1 short bare bristle; joints 2–8 without basal or terminal spines.

Mandible: Coxale endite: ventral branch with spines forming 3 or 4 oblique rows; tip of branch with 2 small ventral teeth and 1 small dorsal tooth with few minute spines; small, slender, medial bristle present near base of ventral branch; ventral margin of dorsal branch with 3 low nodes followed by main spine; tip of branch ending in spine just ventral to short dorsal bristle; margin between main spine and tip of branch with spines forming row. Basale endite: tip with 1 spinous end-type bristle and 1 shorter bristle with marginal teeth; ventral margin with 1 distal dwarf bristle and 1 fairly long bristle with slender marginal spines (not triaenid type); 1 triaenid bristle present near proximal end of endite (proximal pair of teeth on bristle much stouter but only slightly longer than following teeth). Basale: ventral margin bare (the proximal triaenid bristle on the endite could be interpreted as being on ventral margin of basale); dorsal margin with 2 long terminal bristles. Exopodite spinous, about three-fourths length of dorsal margin of 1st endopodial joint, with 2 subequal terminal bristles. Endopodite: 1st joint with 2 long ventral bristles; ventral margin of 2nd joint with 1 stout, spinous, terminal bristle; dorsal margin with 4 distal bristles; end joint with 2 stout clawlike bristles, 1 medium-length lateral bristle near dorsal margin, and 1 short ventral bristle.

Maxilla: Epipodial appendage reaching middle of dorsal margin of basale, with pointed tip. Endites not well defined, with total of 3 stout bristles; long hairs present distal to bases of endite bristles. Basale: dorsal margin bare; ventral margin with 1 long terminal bristle; medial surface with 1 short proximal bristle near middle. Exopodite absent. Endopodite: 1st joint hirsute, with 1 long spinous beta-bristle; 2nd joint with 4 bristles.

Fifth Limb: Dorsal margin of comb bare; ventral

margin with 6 or 7 short spinous bristles; medial side with long hairs near ventral margin; lateral side with 2 short spinous bristles near middle of ventral margin; anterior end with long hairs. Epipodial appendage with about 47 hirsute bristles.

Sixth Limb: Hirsute but without bristles.

Seventh Limb: Absent.

Furca (Figure 95i): Each lamella with 2 long stout claws with sutures separating them from lamella, 3 small claws without basal sutures, and short slender spines following the claws; lateral side of lamella hirsute; minute teeth forming rows along posterior edge of claws (proximal teeth stouter than distal teeth).

Eyes: Lateral eyes small, with brown pigment and 3 ommatidia. Medial eye about twice diameter of lateral eye, with brown pigment.

Rod-shaped Organ: Obscure on specimen examined.

Posterior of Body: Fingerlike dorsal process with long hairs near tip. Gill-like structures long, slender.

DESCRIPTION OF JUVENILE, INSTAR II (Figure 95j,k).—Carapace more rounded in lateral view than that of adult (Figure 95j).

Ornamentation: In general, similar to that of adult but with larger fossae covering surface.

Size: USNM 157167, length 0.69 mm, height 0.50 mm.

First Antenna: Sensory bristle of 5th joint similar to that of adult female, but terminal branches shorter.

Sixth Limb: Anterior margin of trunk with 1 bristle; no bristles on skirt.

Seventh Limb: Small without bristles.

Furca: Each lamella with 3 main claws followed by 1 secondary claw; 3rd main claw about one-half length of 2nd claw; secondary claw smaller than 3rd main claw; all claws separated from lamella by suture.

Eyes: Lateral eye faint, unpigmented, but with several minute cells (ommatidia?) (Figure 95k). Medial eye bare, unpigmented.

Posterior of Body: Similar to that of adult.

DESCRIPTION OF JUVENILE, INSTAR III (Figures

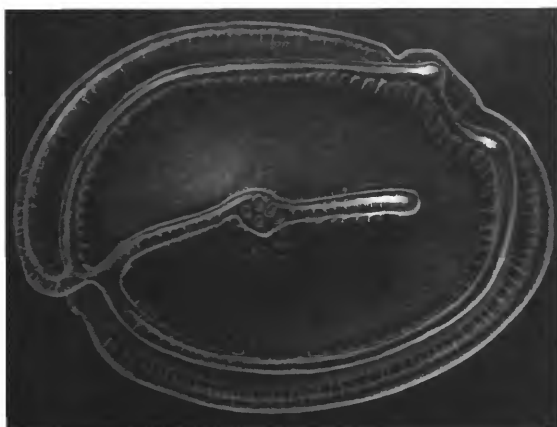


FIGURE 96.—*Asteropella monambon* (Kornicker), instar III, USNM 156995, lateral view of complete specimen, length 0.84 mm.

95l–n, 96).—Carapace similar to that of Instar II but deeper indentation in posterodorsal corner of concentric ridge (Figure 96).

Ornamentation: Similar to that of instar II.

Size: USNM 156995, length 0.84 mm, height 0.59 mm.

First Antenna: Sensory bristle of 5th joint similar to that of adult female but terminal branches quite short. 8th joint: d-bristle a minute peg; e-bristle about three-fourths length of a-claw of 7th joint, tapering to blunt tip.

Second Antenna: Protopodite and exopodite similar to that of adult female. Endopodite 3-jointed (Figure 95l): 1st and 2nd joints short, bare; 3rd joint elongate, with small peg and long bristle at tip.

Sixth Limb: Well developed with numerous bristles.

Seventh Limb (Figure 95m): Elongate, bare.

Furca: Each lamella with 3 main claws followed by 2 secondary claws; 3rd main claw about one-half length of 2nd claw.

Eyes (Figure 95n): Lateral eye, faint, unpigmented; ommatidia not observed. Medial eye bare, pigmented.

Rod-shaped Organ (Figure 95n): Elongate with rounded tip.

Posterior of Body: Similar to that of adult female.

ONTOGENETIC DEVELOPMENT (Table 23).—The 6th limb of instar I is well developed but has no bristles; on instar II the 6th limb bears 1 anterior bristle on the trunk, and on later instars the 6th limb bears many bristles. The 7th limb is absent on instar I, is minute and bare on instar II, is elongate and bare on instar III, and presumably bears many bristles on later instars.

The calculated growth factor between instars I and II is 1.23, and between instars II and III it is 1.22. If the average growth factor (1.225) is used to estimate the lengths of later instars, the following is the result:

Instar I:	0.56 mm (measured)
Instar II:	0.69 mm (measured)
Instar III:	0.84 mm (measured)
Instar IV:	1.03 mm (calculated)
Instar V:	1.26 mm (calculated)
Instar VI:	1.54 mm (calculated)
Adult ♀:	1.89 mm (calculated)

Two adult females of this species in the present collection have lengths of 1.62 and 1.86 mm. This suggests that the species has 6 juvenile stages, but does not rule out the possibility that there are only 5.

Key to Early Instars of *Asteropella monambon*

- 6th limb without anterior bristles on trunk; 7th limb absent Instar I
6th limb with 1 or more anterior bristles on trunk; 7th limb present . . . 2
- 6th limb with 1 anterior bristle on trunk; 7th limb minute Instar II
6th limb with more than 1 anterior bristle on trunk; 7th limb elongate..3
- 7th limb bare Instar III
7th limb with bristles Instar IV – adult

COMPARISONS.—The adult female and male of *A. monambon* differ from that of *A. mortenseni* Poul-

sen, 1965, in not having lateral ridges on the carapace between the horizontal midridge and

TABLE 23.—Morphological development of early instars of *Asteropella monambon* (Kornicker)

Instar	USNM	Sex	Length (mm)	Bristles of 6th limb		7th limb
				anterior	ventral	
I	157173	?	0.56	0	0	absent
II	157167	?	0.69	1	0	minute, bare
III	156995	?	0.84	many	many	elongate, bare

the inner concentric ridge, and in having a total of 7 claws instead of 8 on each lamella of the caudal furca. The carapace of *A. monambon* differs from that of *A. punctata* Poulsen, 1965, in having fewer posterodorsal and posterior protuberances on the inner concentric ridge; also, the single pair of long spines on the triaenid bristles on the ventral margin of the mandibular basale of *A. monambon* is much longer than the comparable pair on *A. punctata*. The e-bristle on the 8th joint of the 1st antenna of *A. monambon* may be shorter than that bristle on both *A. mortenseni* and *A. punctata*, but the intraspecific variability of this feature is not known. The d-bristle on the 8th joint of the 1st antenna of *A. punctata* differs from that bristle on both *A. monambon* and *A. mortenseni* in being relatively well developed.

29. *Asteropella agassizii* (Fritz Müller, 1870), new combination

FIGURES 96b, 97–99; PLATES 85–88

Cypridina Agassizii Fritz Müller, 1870:255, pl. 9.

Cylindroleberis Agassizii.—G.W. Müller, 1894:218 [combination inferred].

Cyclasterope agassizii.—G.W. Müller, 1912:48 [key], 50 [diagnosis].

Asteropteron Agassizi.—Skogsberg, 1920:88, 443, 444.

Cyclasterope agassizi.—Poulsen, 1965:225. [Poulsen states that the species should probably be referred to *Asteropella*.]

HOLOTYPE.—None selected.

SYNTYPE-LOCALITY.—Desterro [= Florianopolis], Santa Catarina Island, southern coast of Brazil.

MATERIAL.—USNM 150288A, 150288B, 2 ovigerous females, sta 179, Panama survey; USNM 157765, 1 juvenile (length 1.00 mm, height 0.71 mm), sta 174, Panama survey.

DISTRIBUTION (Figure 90).—Brazil, off Colon, Panama. Depth collected off Panama less than 1 m; depth off Brazil not known.

DESCRIPTION OF ADULT FEMALE (Figures 97–99, Plates 85–88).—Carapace oval in lateral view (Figure 97, Plate 85a); flangelike ridge present along anterodorsal edge of each valve extending from shallow incisur to just posterior to middle of dorsal margin on left valve (Plate 85) and to posterior juncture on right valve (Figure 97); similar ridge present along remaining part of valve edge starting from ventral end of incisur, continuing along ventral, posterior, and dorsal margin to end at inner end of incisur (Plate 85); on right valve this ridge is not present along the posterodorsal margin; the above ridge continues from the inner end of the incisur along the ventral and posterior margins inside the outer ridge and terminates dorsally inside the 2 outer ridges posterior to or near valve midlength (Figure 97, Plate 85); a lateral horizontal rib present just dorsal to muscle scars (Plate 85).

Ornamentation: Surface in vicinity of lateral mid-rib and peripheral ridges grill-like (Plates 85, 87c,e); edges of partitions forming reticulations spinous (Plate 86b–d); surface within peripheral ridges with distinct oval fossae in outer part (Plate 86a,b) and irregular openings towards center (Plate 87a); ribs and ridges with narrow cross-ridges perpendicular to shell surface (Plate 87c,e,f); numerous bristles along anterior and ventral margins (Plates 85, 87e); bristles sparsely distributed over valve surface, some with holes near base and emerging from open pores (Plates 85a, 86a, 87a,b,d).

Infold (Plate 88): Anterodorsal infold dorsal to incisur with 26 bristles (Figure 98a); anteroventral infold with small bristle near upper end of list

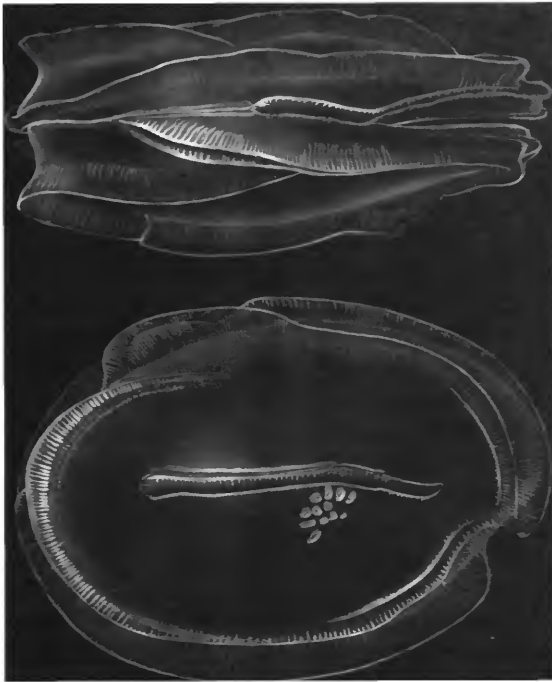


FIGURE 97.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150228A, dorsal and lateral view of complete specimen, length 1.93 mm.

(Figure 98a); ventral infold with about 6 short bristles; posteroventral infold with about 7 long, tapered, outer bristles forming row and inner row of about 16 long tubular bristles, usually paired, and about 23 short tubular bristles (Figure 98b, Plate 88c–g).

Size: USNM 150288A, length 1.93 mm, height 1.44 mm; 150288B, length 1.95 mm, height 1.47 mm.

First Antenna (Figure 98c): 1st and 2nd joints with spines along ventral margins; dorsal margin of 2nd joint with 6 spinous bristles; 3rd joint with 1 spinous ventral bristle and 5 dorsal bristles (1 proximal, 4 terminal); 4th joint with 3 bristles (2 ventral, 1 dorsal); 5th joint with spines, sensory bristle with 2 distal branches with bifurcate tips; 6th joint with long medial bristle. Seventh joint: a-bristle clawlike, about two-thirds length of sensory bristle of 5th joint, about same length as bristle of 6th joint; b-bristle longer than sensory bristle, with 4 short marginal filaments; c-bristle bare, slightly longer than b-bristle. Eighth joint:

d-bristle bare, minute; e-bristle bare with blunt tip, longer than a-bristle; f-bristle bent dorsally, about same length as c-bristle, with short marginal filaments; g-bristle about same length as c-bristle, with 3 or 4 minute filaments.

Second Antenna (Figure 98d): Protopodite with few long lateral hairs near ventral margin; medial bristle fairly long with short marginal spines. Endopodite 3-jointed: 1st joint short bare; 2nd joint short with long ventral hairs; 3rd joint elongate with long hairs and terminal bristle. Exopodite: 1st joint with short, recurved, terminal, medial spine; bristle of 2nd joint with spines along ventral margin and natatory hairs; bristles of joints 2–8 with natatory hairs; bristles of joint 3–5 with few ventral spines; 9th joint with 2 bristles (1 medium, 1 long) both with natatory hairs; no basal spines.

Mandible (Figure 99a): Coxale endite with minute bristle near base of ventral branch; ventral branch with spines forming about 5 oblique rows; tip with 3 minute teeth; ventral margin of dorsal branch with pointed tooth just distal to end of ventral branch followed by 3 more rounded teeth and then short backward-pointing tooth; main spine short with few marginal hairs or spines; terminal spine short with marginal hairs; edge of branch between main and terminal spine serrate; terminal bristle on dorsal margin of branch with marginal hairs and hairs near base. Basale: endite with 4 end bristles and 1 fairly long dwarf bristle; ventral margin of basale with 6 triaenid bristles (1 or 2 of these could be considered to have bases on proximal end of endite); triaenid bristles with 11–15 pairs of spines, proximal 2 or 3 pairs longer than others; margin of triaenid bristles proximal to spines with few short hairs; dorsal margin of basale with 2 long, slender, terminal bristles; medial surface with faint spines forming short rows in dorsal part. Exopodite hirsute, not quite reaching distal end of dorsal margin of 1st endopodite joint, with 2 distal bristles. Endopodite: 1st joint with 6 spinous ventral bristles: 2 stout with long proximal and short distal spines, 4 slender with short marginal spines; ventral margin of 2nd joint with bristles forming 2 groups with 1 bristle in proximal group and 2 in distal group; dorsal margin of 2nd joint with about 11

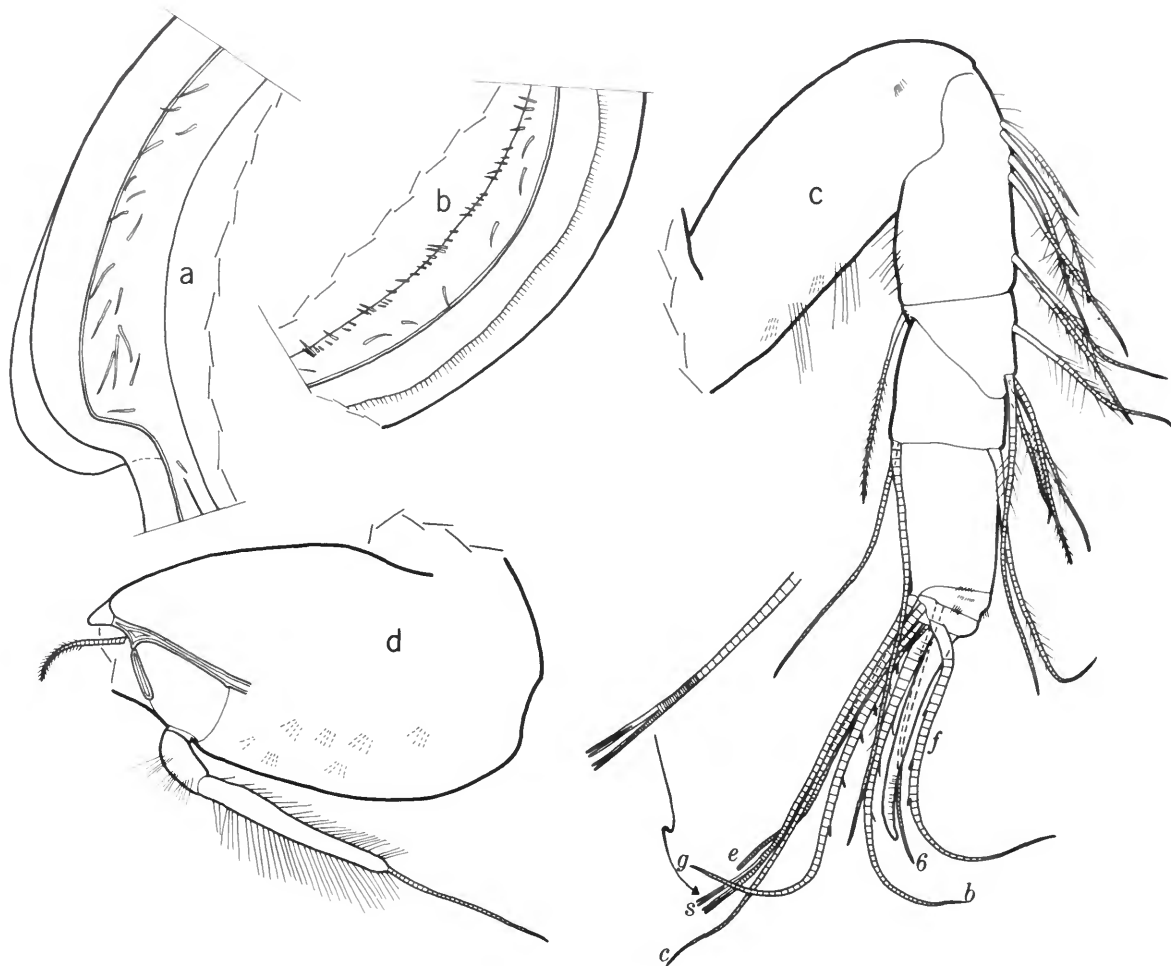


FIGURE 98.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B: *a*, inside view of rostrum and incisor of right valve; *b*, posteroventral margin of right valve; *c*, right 1st antenna and detail of tip of sensory bristle, lateral view; *d*, protodipite and endopodite of right 2nd antenna, medial view.

bristles proximal to middle and 2 subterminal; medial surface with spines forming rows and 5 distal cleaning bristles forming row; end joint with 3 clawlike bristles, 1 lateral and 1 ventral bristle.

Maxilla (Figure 99b): Endites I and II with total of about 6 bristles; epipodial appendage with short hairs and minute pointed process at tip; basale with 1 proximal lateral bristle, 1 short, proximal, medial bristle near dorsal margin, 1 medial bristle distal to middle of dorsal margin, 1 or no distal ventral bristle, and 1 short and 1 very long bristle terminally on ventral margin; medial surface of basale with spines forming short

rows in ventral half. Exopodite without lobe, consisting of 1 short bristle. Endopodite: 1st joint elongate with short spines and long spinous beta-bristle; 2nd joint with 4 spinous bristles.

Fifth Limb (Figure 99c): Dorsal margin of comb bare except for short hairs at distal end; lateral side with bristles forming proximal and distal groups (proximal group with 1 long and 4 short bristles; distal group with 1 long and 1 short bristle).

Sixth Limb (Figure 99d): 1 short bare bristle present on medial surface at proximal anterior corner of stem; anterior margin of stem with single row of 13 short hirsute bristles; medial



FIGURE 99.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B: *a*, left mandible and detail of tip of dorsal branch of coxale endite, medial view; *b*, left maxilla, medial view; *c*, comb of left 5th limb, medial view; *d*, left 6th limb, medial view; *e*, 7th limb; *f*, right lamella of furca, lateral view; *g*, right Y-sclerite, anterior to right; *h*, anterior of body showing left lateral eye, medial eye, rod-shaped organ, and upper lip; *i*, posterior process of body.

surface near anterior margin with 1 long spinous bristle just above suture separating stem and skirt, and 1 long and 2 short spinous bristles proximal to suture; lateral sole with 5 or 6 hirsute bristles; ventral margin of skirt including anterior tip with 26–28 spinous and hirsute bristles; hirsute posterior end of skirt with 1 spinous bristle; posterior margin of stem hirsute but without epipodial bristles.

Seventh Limb (Figure 99e): Each limb with 35–36 bristles, 17 on one side, 18–19 on other; each bristle with up to 8 bells; terminus with 6 spinous teeth.

Furca (Figure 99f): Each lamella with 3 strong claws followed by 5 slender bristles.

Eyes and Rod-shaped Organ (Figure 99h): Medial eye pigmented, bare; lateral eye pigmented, about half diameter of medial eye, with 5 ommatidia; rod-shaped organ elongate with long hairs on wide proximal part, crinkles in narrow middle part, and rounded tip.

Posterior (Figure 99i): With hirsute, elongate, dorsal process. Gill-like structures well developed.

Upper Lip (Figure 99h): Consisting of 2 hirsute lobes, each with 1 stout anterior spine; each side of mouth with hirsute lateral flap.

Y-Sclerite (Figure 99g): Unbranched.

Eggs: USNM 150288A with 5 and USNM 150288B with 2 eggs in marsupium.

30. *Asteropella punctata* Poulsen, 1965

FIGURES 9x, 10b, 100–102; PLATES 89–91

Asteropella punctata Poulsen, 1965:234, fig. 80.

Asteropella punctatum Poulsen, 1965:478 [spelling error].

HOLOTYPE.—Female, length 1.5 mm, unique specimen.

TYPE-LOCALITY.—East coast of Thatch Island, West Indies, 25–30 m.

MATERIAL.—USNM 157165, 1 A-1 female from Cuba, station 6; USNM 157365, 1 adult female from same station.

DISTRIBUTION.—Thatch Island, West Indies, and Cuba (Figure 90). Depth 6–30 m.

DISCUSSION.—Two specimens from station 6 off Cuba have been referred to *A. punctata* because

they have similar ridges on the carapace and also similar triaenid bristles on the mandible. However, Poulsen's description of his specimen suggests that it differs in many characters from the Cuban specimens described herein. For example, the surface of the Cuban specimens is distinctly reticulate, but this was not mentioned by Poulsen for his specimen. The posterodorsal list is without bristles on Poulsen's specimens, but has many bristles on the Cuban specimens. The b-, c-, f-, and g-bristles on the 1st antenna of Poulsen's specimens have long, distal, hairlike filaments not present on the Cuban specimens. The shape of the tip of the endopodite of the 2nd antenna of the adult female, but not the A-1 female, from Cuba differs from that of Poulsen's specimen. The comb of the 5th limb of the Cuban specimens bears many more lateral bristles than on the comb of Poulsen's specimen. The ventral bristles on the comb of the 5th limb on Poulsen's specimen are bare, whereas they are spinous on the Cuban specimens. The tip of the 7th limb of Poulsen's specimen bears 12 teeth compared to only 6 on the Cuban specimens. Poulsen's specimen is without lateral eyes, whereas the Cuban specimens have minute eyes. Also, the distribution of bristles on the endopodite of the maxilla differ. The following description is based on the Cuban specimens.

DESCRIPTION OF A-1 FEMALE (Figure 100, Plates 89–91).—Carapace oval in lateral view with minute incisur (Figure 100a, Plate 89a).

Ornamentation: Peripheral concentric ridge paralleling outer margin of each valve except along posterior margin where ridge forms several small processes (Figure 100a, Plate 89a,b). Medial horizontal rib broadening in area of central adductor muscle attachments but not intersecting concentric ridge (Plates 89a, 90a). Surface of valves with reticulations and shallow round fossae (Plates 89d, 90d, 91a,b); walls forming reticulations broad in vicinity of fossae, narrow elsewhere (Plates 89d, 90b–d, 91a,b); 3 or 4 reticulations intersecting in center of each fossa (Plates 89d, 90b–d, 91a,b), except those fossae in vicinity of adductor muscle attachments (Plate 91c). Bristles with pore near



base emerging from open pores scattered over valve surface (Plates 89d, 91d).

Central Adductor Muscle Attachments: Consisting of about 12 oval fossae (Plates 89a, 91c).

Size: USNM 157165, length 1.27 mm, height 0.84 mm.

First Antenna (Figure 100b,c): 1st joint with long hairs on medial and lateral surfaces. 2nd joint: ventral margin with long hairs forming rows extending onto medial surface; dorsal margin with 3 spinous bristles; lateral surface with short spines near ventral margin. 3rd joint: short ventral margin with long spinous bristle; dorsal margin with 1 spinous midbristle and 2 spinous terminal bristles. 4th joint with 3 terminal bristles (2 ventral, 1 dorsal). Sensory bristle of long 5th joint with 2 minute proximal filaments and tip with 4 short branches. Short 6th joint with fairly long medial bristle. 7th joint: a-claw bare, about equal in length to combined lengths of joints 5–8; b-bristle stout, longer than a-claw, with 1 or 2 minute proximal filaments and 1 near tip; c-bristle about same length as sensory bristle of 5th joint, with 1 minute filament near middle. 8th joint: d-bristle about one-fourth length of a-claw; e-bristle about same length as a-claw; both d- and e-bristles bare with pointed tips; f-bristle bent dorsally, longer than b-bristle, with 2 or 3 minute proximal filaments along inner edge; g-bristle same length as c-bristle, with 3 minute proximal filaments.

Second Antenna (Figure 100d): Protopodite with hairs along ventral margin and on medial surface near ventral margin; medial bristle spinous, fairly short. Endopodite 3-jointed: 1st and 2nd joints short, bare; 3rd joint long, hirsute, with long, pointed, terminal bristle. Exopodite: 1st joint

with minute, recurved, medial bristle; bristles of joints 2–8 with natatory hairs, some also with faint marginal spines; 9th joint with 1 long bristle with natatory hairs and 1 short bare bristle; basal spines absent.

Mandible (Figure 100e,f): Coxale endite: minute bristle present at base of ventral branch; ventral branch with spines forming 4 or 5 oblique rows and with tip with 3 minute teeth; ventral margin of dorsal branch with 2 pointed nodes followed by 2 low rounded nodes and short main spine; tip of dorsal branch ending in spine; spinous bristle present dorsal to base of branch tip; margin between main spine and tip of dorsal branch with short spines; dorsal margin of dorsal branch with few minute serrations. Basale endite: tip with 4 end bristles; ventral margin with 1 short and 1 longer triaenid bristle (triaenid bristles with few slender spines followed by paired teeth decreasing in length distally along bristle; terminal pair of teeth only slightly longer than penultimate teeth); 1 dwarf bristle present. Basale: ventral margin with 3 or 4 triaenid bristles similar to the longer triaenid bristle of the basale endite (no single pair of teeth more than slightly longer than any other pair, Figure 100f); dorsal margin with 2 long, spinous, terminal bristles; medial and lateral sides with spines forming rows. Exopodite: hirsute, about two-thirds length of dorsal margin of 1st endopodite joint, with 2 terminal bristles. Endopodite 1st joint: ventral margin with 4 spinous bristles. Endopodite 2nd joint: ventral margin with 2 terminal bristles (lateral of these short); dorsal margin with 4 bristles along proximal half and 3 terminal bristles; medial surface near distal dorsal corner with 4 pectinate bristles forming row; spines forming rows also present on medial surface. Endopodite 3rd joint with 3 claws and 2 bristles (1 lateral, 1 ventral).

Maxilla (Figure 100g,h): Epipodite reaching just past middle of dorsal margin of basale. Endites I and II each with 3 stout bristles. Basale: medial surface hirsute, with 1 short proximal bristle and 1 longer distal bristle, both near dorsal margin; ventral margin with 2 terminal bristles (1 short, medial, and 1 very long, lateral); dorsal margin with faint hairs. Endopodite: 1st joint

FIGURE 100.—*Asteropella punctata* Poulsen, female (A-1 instar), USNM 157165: a, complete specimen showing position of some central adductor muscle attachments (near center) and some reticulations and bristles, lateral view, length 1.27 mm; b, left 1st antenna and left lateral eye, lateral view; c, distal end of left 1st antenna, lateral view (from b); d, endopodite and distal part of protopodite of right 2nd antenna, medial view; e, right mandible, medial view; f, triaenid bristles on ventral margin of basale of mandible shown in e; g, left maxilla (not all endite bristles shown), medial view; h, endite of bristles of right maxilla, medial view; i, comb of left 5th limb, lateral view; j, part of left 6th limb, lateral view; k, 7th limb; l, posterior body showing left lamella of furca, posterior process, and left Y-sclerite; m, left lamella of furca, lateral view; n, medial eye and rod-shaped organ; o, right and left lateral eyes; p, upper lip, anterior to right.

with spines forming rows and 1 terminal beta-bristle; end joint with 3 terminal bristles.

Fifth Limb (Figure 100i): Lateral side of comb with stout, distal, exopodial bristle with tip not reaching past end of comb, and proximally, 1 long spinous bristle and 4 short bristles near ventral margin; bristles along ventral margin of comb spinous; dorsal margin of comb with hairs along distal end; tip of comb acuminate just below midheight of comb.

Sixth Limb: Both limbs fragmented on specimen examined (Figure 100j).

Seventh Limb (Figure 100k): Each limb with 16 or 17 bristles, 8 or 9 on each side; each bristle tapering (juvenile character) and with 3 or 4 bells; terminus consisting of 6 recurved spinous teeth.

Furca (Figure 100l,m): Each lamella with 3 stout primary claws followed by 3 smaller secondary claws; proximal lateral bristle absent. (Outline of furcal claws of next instar visible inside present furca.)

Rod-shaped Organ (Figure 100n): Broadening distal to middle, then tapering to rounded tip.

Eyes: Medial eye large, pigmented, bare (Figure 100n); lateral eye minute, with about 12 minute ommatidia (Figure 100b,o).

Posterior (Figure 100l): Posterior hirsute; dorsum fingerlike with long spines near tip.

Upper Lip (Figure 100p): Consisting of 2 hirsute lobes, each with anterior spine; lateral hirsute flaps on each side of lobe.

Y-Sclerite (Figure 100l): Dorsal and ventral sockets adjacent to each other, forming massive structure; sclerite unbranched.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figures 101, 102).—Carapace similar in lateral view to that of A-1 female (Figure 101).

Ornamentation: Similar to that of A-1 female except fossae better defined (Figure 101).

Infold: Anterodorsal infold above incisur with 22 long bristles followed by 3 minute bristles near anterior juncture; anterior infold below rostrum with 3 long bristles forming row parallel to valve margin; ventral infold with 3 bristles; posteroventral infold with about 26 bristles (some appearing very broad at base) along broad list and

3 long bristles between list and valve margin (Figure 102a).

Selvage: Anterior selvage above incisur with marginal fringe (fringe longer in vicinity of incisur); anteroventral selvage with short fringe; ventral selvage with long fringe; posterior selvage with short fringe.

Center Adductor Muscle Attachments: Consisting of about 13 oval fossae.

Size: USNM 157365, length 1.53 mm, height 1.07 mm.

First Antenna (Figure 102b,c): Differs from that of A-1 female in the following: dorsal margin of 2nd joint with 4 bristles; dorsal margin of 3rd joint with 1 midbristle and 3 terminal bristles; sensory bristle of 5th joint with 2 minute proximal filaments (not shown on illustrated limb) and tip with 2 distal branches, each with bifurcate tip; c-bristle of 7th joint with 3 minute proximal filaments; f-bristle of 8th joint with 1 minute proximal filament. (The b-, c-, f-, and g-bristles on both the adult and A-1 female bear minute step-like breaks in the margin similar to those at the base of the minute filaments; some of these have been interpreted herein as having once held a minute filament.)

Second Antenna (Figure 102d,e): Differs from that of A-1 female in having tip of endopodite forming long spine distal to base of long bristle (Figure 102e).

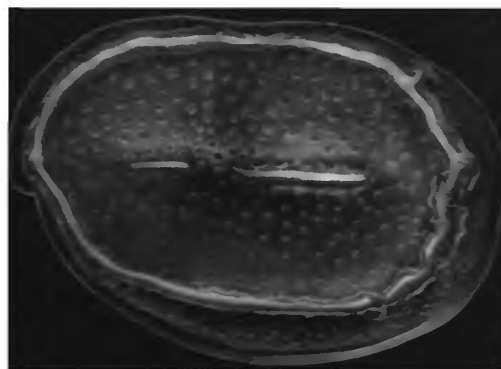


FIGURE 101.—*Asteropella punctata* Poulsen, adult female, USNM 157365, lateral view of complete specimen, length 1.53 mm.



FIGURE 102.—*Asteropella punctata* Poulsen, adult female, USNM 157365: *a*, inside view of posteroventral margin of right valve showing bristles of infold; *b*, distal end of left 1st antenna, lateral view; *c*, detail of tip of sensory bristle shown in *b*; *d*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *e*, detail of tip of endopodite of right 1st antenna, medial view; *f*, distal part of coxale endite of mandible; *g*, left 6th limb, medial view; *h*, posterior part of body showing left lamella of furca, left genital structure (represented by concentric circles), and left Y-sclerite; *i*, posterior process of body; *j*, upper lip (lateral flap not shown), anterior to right.

Mandible (Figure 102f): Differs from that of A-1 female in the following: basale endite of right limb with 5 bristles (3 of triaenid type); 1st endopodial joint of both limbs with only 3 ventral bristles; dorsal margin of 2nd endopodial joint with 8 bristles along proximal half and 3 terminal bristles; medial surface of 2nd endopodial joint near distal dorsal corner with 5 pectinate bristles forming row.

Maxilla: Differs from that of A-1 female in having a longer epipodite (tip almost reaching distal bristle on dorsal margin of basale).

Fifth Limb: Fifth limb similar to that of A-1 female.

Sixth Limb (Figure 102g): Anterior margin of trunk without suture except at juncture with skirt; anterior margin of trunk with single row of 9 short spinous bristles with bases on medial side; a 2nd row of 8 medial bristles present distally on trunk just inside distal end of single row (last 2 bristles of these longer than others). Skirt: lateral flap with 4 hirsute bristles; ventral margin of skirt with 25 spinous bristles; posterior end with 1 short hirsute bristle. No epipodial bristles present.

Seventh Limb: Differs from that of A-1 female in bristles being more cylindrical and in having up to 5 bells.

Furca (Figure 102h): Differs from that of A-1 female in having proximal lateral bristle on each lamella.

Rod-shaped Organ, Eye, Posterior of Body (Figure 102i), **Upper Lip** (Figure 102j), **Y-Sclerite** (Figure 102h): Similar to those of A-1 female.

Genitalia: Consisting of round sclerotized process on each side of body anterior to furca (Figure 102h).

31. *Asteropella scammonensis* McKenzie, 1965

FIGURES 9*o*, 103

Asteropella scammonensis McKenzie, 1965:60, pl. 1: 7-9, fig. 1.

HOLOTYPE.—USNM 110914, juvenile female, dry right valve, some appendages on slide.

TYPE-LOCALITY.—Scammon Lagoon, Baja California.

PARATYPE.—USNM 157160 (formerly on slide with dry right valve of holotype), female (possibly juvenile), on slides and in alcohol.

DISTRIBUTION (Figure 90).—Scammon Lagoon, Baja California. Depth ?-21 m.

REMARKS.—The horizontal ridge on the carapace intersects the concentric ridge anteriorly; it is not located only in the middle part of the valve as shown by McKenzie (1965, fig. 1A), but the anterior end of the horizontal ridge is very faint. I am inclined to believe that the small size of the carapace of the holotype and paratype studied herein, the relatively few bristles on the 7th limb, and relatively few secondary claws on the furca are the result of both specimens being juveniles.

DESCRIPTION OF JUVENILE FEMALE (Figure 103).—Carapace similar to that of *Asteropella trithrix* (Figure 103a); posterodorsal corner of inner concentric ridge almost evenly rounded, not flat as on *Asteropella slatteryi*.

Size: USNM 110914 (holotype), length 1.30 mm, height 0.95 mm (from McKenzie (1965:62)); USNM 157160 (paratype), length 1.45 mm, height 1.05 mm.

First Antenna (Figure 103c): 1st joint hirsute. 2nd joint: ventral margin with hairs; dorsal margin with proximal hairs and 4 dorsal bristles. 3rd joint: short ventral margin with 1 long spinous bristle; long dorsal margin with 4 bristles. 4th joint: long ventral margin with 2 terminal bristles; short dorsal margin with 1 long terminal bristle. 5th joint: sensory bristle forming 2 branches distally (1 of these with bifurcate tip, other branch on appendage examined with tip broken off). 6th joint minute, with long bristle with few spines. 7th joint: a-bristle short claw-like, bare; b-bristle bare, about 1 and three-fourths times length of a-bristle; c-bristle longer than b-bristle, with 1 short distal filament. 8th joint: d-bristle minute; e-bristle bare, with tip reaching just past tip of a-bristle; f-bristle with base bent dorsally, with 2 minute proximal projections on ventral margin, but no filaments present, with tip of bristle on appendage examined broken off; g-bristle similar to c-bristle.

Second Antenna (Figure 103d): Protopodite with



FIGURE 103.—*Asteropella scammonensis* McKenzie, juvenile female, holotype, USNM 110914: *a*, camera lucida drawing of dry right valve, length 1.31 mm; *b*, comb of right 5th limb, lateral view. Female, possibly juvenile, paratype, USNM 157160: *c*, left 1st antenna, lateral view; *d*, endopodite and distal part of protopodite of right 2nd antenna, medial view; *e*, right mandible, medial view; *f*, triaenid bristle on ventral margin of mandibular basale; *g*, left maxilla (epipodite missing), medial view; *h*, left lamella of furca, lateral view; *i*, right lateral eye; *j*, upper lip and left lateral flap, anterior to left; *k*, fingerlike posterior process on body of animal.

TABLE 24.—Intraspecific variability and comparison of adult female appendages of 4 species of *Asteropella* from the eastern Pacific (specimens identified by USNM number; n.d. = no data)

Appendage	<i>A. scammonensis</i> ^a				<i>A. slatteryi</i>					
	110914 (1.30, 0.95 ^a) ^b		157160 (1.45, 1.05)		141554 (1.87, 1.39)		156729 (1.92, 1.42)		156724 (1.94, 1.38)	
	left	right	left	right	left	right	left	right	left	right
Second antenna										
Endopodite: bristles on 2nd joint	n.d.	n.d.	0	0	0	0	0	0	0	0
Mandible										
Basale										
Ventral margin: triaenid bristles	n.d.	2	2	2	4	3	3	3	4	5
Dorsal margin: bristles	n.d.	2	2	n.d.	2	2	2	2	2	2
Endopodite, 1st joint										
Ventral margin: bristles	n.d.	6	6	6	6	6	6	6	6	6
Exopodite										
Length of exopodite as percent of terminal bristles, outer-inner	n.d.	61-69	75-100	63-n.d.	57-64	56-63	59-64	61-60	58-81	64-71
Seventh limb										
Number of bristles	n.d.	14	n.d.	n.d.	36	35	36	37	32	39

^a From McKenzie (1965:62), may be juvenile.

^b Length and height of carapace (mm).

1 long, distal, medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint short, bare; 2nd joint elongate, bare; 3rd joint long, hirsute, with long terminal bristle. Exopodite: 1st joint with minute recurved medial spine on distal margin; bristle of 2nd joint with few minute spines along ventral margin and also with natatory hairs; bristles of joints 3-8 with natatory hairs, some also with minute ventral spines; 9th joint with 2 bristles (1 long, 1 medium), both with natatory hairs; basal spines absent; spines forming row along distal margins of joints not observed.

Mandible (Figure 103e,f): Coxale endite: minute bristle present at base of ventral branch; ventral branch with spines forming 4 oblique rows; tip of branch with 3 minute teeth; ventral margin of endite proximal to ventral branch hirsute; ventral margin of dorsal branch with 2 small pointed nodes followed by 2 larger rounded nodes; posterior edge of main spine with small spines forming row; longer spines on lateral side of endite posterior to base of main spine; spines present on margin of endite between main spine and spine forming tip of endite; long, hirsute,

posterior bristle with base near tip of endite. Basale endite: tip with 4 bristles (1 broken off on illustrated limb) (2 long end-type bristles, 2 shorter triaenid bristles); 1 dwarf bristle and 1 triaenid bristle present near proximal end of endite. Basale: ventral margin with 2 triaenid bristles (1 pair of marginal teeth much longer than others); dorsal margin with 2 long terminal bristles (broken off on illustrated limb); lateral side with spines near dorsal margin; medial surface with short proximal spines. Exopodite about three-fourths length of dorsal margin of 1st endopodial joint, with 2 terminal bristles (outer bristle slightly longer than inner bristle). Endopodite: 1st joint having 6 ventral bristles; ventral margin of 2nd joint with 2 bristles (lateral of these slender, other stout); dorsal margin of 2nd joint with 7 bristles; medial surface of 2nd joint with 5 distal, spinous, cleaning bristles, and hairs forming rows; end joint with claws and bristles similar to those on *A. slatteryi*.

Maxilla (Figure 103g): Epipodite with pointed tip reaching past middle of dorsal margin of basale. Endites not distinctly separated, consist-

<i>A. kaufmani</i>						<i>A. trithrix</i>									
156934 (1.38, 0.99)		157153 (1.37, 0.98)		157154 (1.29, 0.93)		156722 (1.68, 1.18)		157158 (1.75, 1.32)		156717 (1.79, 1.29)		157164 (1.62, 1.15)		156721 (1.74, 1.27)	
left	right	left	right	left	right	left	right	left	right	left	right	left	right	left	right
0	0	0	0	0	0	3	2	3	2	0	0	3	3	3	3
2	2	2	2	2	2	3	3	2	2	3	3	3	4	2	3
2	2	2	2	2	2	n.d.	n.d.	3	3	3	3	3	3	3	3
6	6	6	6	6	6	5	5	5	5	6	6	5	6	5	5
46-46	50-56	48-57	52-56	50-56	46-57	92-72	86-71	82-70	79-73	70-65	88-72	86-75	85-74	93-76	104-85
17	19	17	18	15	17	15	n.d.	14	12	23	23	10	12	14	16

ing of 6 long bristles and possibly 1 small bristle. Basale: dorsal margin with 1 distal bristle; medial surface with 1 proximal bristle; ventral margin with 1 long, spinous, terminal bristle. Exopodite not present. Endopodite: 1st joint with hairs and long spinous beta-bristle; end joint with 4 bristles (3 long, 1 short).

Fifth Limb (Figure 103b): Lateral side of comb with 1 long proximal bristle, 2 minute bristles with base just dorsal to the long bristle, 3 minute bristles along ventral margin, and 1 long, hirsute, distal bristle near dorsal margin; tip of comb with long hairs.

Sixth Limb: Not examined in detail but, in general, similar to that of *A. slatteryi*.

Seventh Limb: Not examined, but according to McKenzie (1965:60) each limb with 14 bristles, and with terminus resembling "aristotle lantern" of an echinoid (normal type for genus).

Furca (Figure 103h): Each lamella with 7 claws: 3 long primary claws, 3 short secondary claws, and 1 slender, unringed, bristlelike claw; the latter set back from ventral margin.

Rod-shaped Organ and Medial Eye: Not observed.

Lateral Eye (Figure 103i): Minute with 4 ommatidia.

Upper Lip (Figure 103j): Similar to that of *A. slatteryi*, anterior spines not observed.

Posterior of Body (Figure 103k): Elongate finger-like process present.

COMPARISONS.—Some appendages of *A. scammonensis* are compared with those of 3 other eastern Pacific species in Table 24.

32. *Asteropella rotundicostata* (Hartmann, 1965)

Cycloleberis rotundicostata Hartmann, 1965:326, figs. 33-35.
Asteropella rotundicostata.—Kornicker, 1975a:559.

HOLOTYPE.—Hamburg Zoological Museum, K 27282.

TYPE-LOCALITY.—Bahia Inglés North Chilöe, Chile.

MATERIAL.—None examined.

DISTRIBUTION.—Collected only at type-locality at depth of 12 m (Figure 90).

REMARKS.—I have not examined this species, which resembles *Asteropella agassizii* and, if it in-

deed is not conspecific with that species, could be linked with it as a new genus or subgenus.

DIAGNOSIS.—Carapace similar to that of *A. agassizii*.

Furca: Each lamella with 3 strong primary claws followed by 4 short and weak secondary claws.

33. *Asteropella mortenseni* Poulsen, 1965

FIGURES 9u, 10a, 11j, 12a, 13a, 14a, 15c, 16a

Asteropella mortenseni Poulsen, 1965:225, figs. 76–79, 150h.

HOLOTYPE.—Female, Zoological Museum, Copenhagen.

TYPE-LOCALITY.—Virgin Islands, West Indies.

MATERIAL.—None examined.

DISTRIBUTION.—Known only from the Virgin Islands, West Indies, at depths of 20–40 m.

DIAGNOSIS.—Inner concentric ridge of carapace with 2 posterodorsal processes; 1 narrow horizontal ridge present dorsal to midridge and 2 ventral to midridge; all ridges join at anterior end of midridge where it intersects inner concentric ridge.

First Antenna: d-bristle represented by short spine; e-bristle shorter than a-claw.

34. *Asteropella maclaughlinae*, new species

FIGURES 9y, 104–107; PLATES 92–96

ETYMOLOGY.—The species is named for Dr. Patsy A. McLaughlin, who submitted the specimen selected as the holotype.

HOLOTYPE.—USNM 157608, an adult female with large unextruded eggs, length 1.72 mm.

TYPE-LOCALITY.—Anclote Anchorage, west coast of Florida off Tarpon Springs, north of Tampa, station 31, replicate 5, water depth 1.0 m (grab sample).

PARATYPES.—Anclote Anchorage: USNM 157516, 1 adult female with small unextruded eggs, sta 21, 16 Jan 1976, replicate 2 (night trawl); USNM 157489, 1 female, length 1.39 mm, height 1.04 mm, sta 14, 15 Mar 1976, replicate 3 (day trawl). USNM 157659, 1 juvenile female, Pan-

ama City Beach, Florida, sta 30–3. USNM 156655, 1 instar II, Placida Harbor, Florida, sample 3. Belize: USNM 157774, 1 adult female, sta 156.

ADDITIONAL SPECIMENS.—USNM 149326, 1 instar II, length 0.79 mm, height 0.58 mm, Alligator Harbor, Florida, sta II. (Carapace may have been dried at one time and part of midrib is absent. No indentation is present in posterodorsal corner of peripheral concentric ridge, but this could be the result of the poor condition of the specimen. The d- and e-bristles of the 1st antenna conform with those of the species; therefore, the specimen is referred to *A. maclaughlinae*, but questionably). 1 specimen, sta 4, transect III, and 1 specimen, sta 1, transect IV, from off south Texas, specimens returned to Richard D. Kalke.

DISTRIBUTION (Figure 90).—Florida: Anclote Anchorage, Panama City Beach, Placida Harbor, Alligator Harbor?; off south Texas; Carrie Bow Cay, Belize. Depth 1–5 m.

DESCRIPTION OF ADULT FEMALE (Figures 104, 105, Plates 92–94).—Carapace oval in lateral view, with incisur forming small right angle (Figure 104a, Plate 92a); carapace widest at posterior end of horizontal midrib (Plate 92d).

Ornamentation (Plates 92–94): Edge of each valve with transparent broad flange paralleling valve edge except immediately below incisur where flange narrows (Plate 92a,b). Peripheral concentric ridge paralleling outer margin of each valve except in posterodorsal corner where 2 processes separated by shallow indentation occur (Figure 104a, Plates 92a, 93a,c). Horizontal midrib, broadest and deepest at its posterior end, not intersecting peripheral ridge anteriorly (Plates 92a,b,d, 93c); midrib and peripheral ridge with squarish reticulations with minute marginal fringe (Plates 93b,d, 94d–f); valve surface between peripheral ridge and midrib with polygonal reticulations (Plates 92b, 94a,b); some of the polygonal reticulations covered by “skin” with angular edges (Plate 94a,b); oval pores not observed under surface layer. Long bristles present along anterior and ventral margins and sparsely distributed over valve surface (Plates 92a,b, 94a–c); surface bristles



FIGURE 104.—*Asteropella maclaughlinae*, new species, adult female, holotype, USNM 157608: *a*, complete carapace showing position of central adductor muscle attachments, length 1.72 mm; *b*, left 1st antenna, lateral view; *c*, endopodite, distal part of protopodite, and proximal part of 1st exopodial joint of right 2nd antenna, medial view; *d*, right mandible, medial view; *e*, right lamella of furca, lateral view; *f*, anterior of body showing right lateral eye, medial eye, rod-shaped organ, and upper lip.

emerging from open lipped pores and with small pore near base (Plate 94*b,c*).

Infold: Anterodorsal infold dorsal to incisur with 24 bristles forming row; infold immediately ventral to incisur with 2 bristles; ventral infold with 2 bristles anterior to middle; posteroventral infold with about 9 stout bristles along list and 4 or 5 long bristles between list and valve edge.

Selvae: Wide lamellar prolongation present along free margin; long marginal fringe observed along anterodorsal and ventral parts of prolongation.

Central Adductor Muscle Attachments: Consisting of about 13 oval scars in vicinity of horizontal mid-ridge.

Size: USNM 157608, length 1.72 mm, height 1.28 mm; USNM 157516, length 1.59 mm, height 1.21 mm; USNM 157774, length 1.62 mm, height 1.17 mm.

First Antenna (Figure 104*b*): 1st joint with long hairs on lateral and medial surfaces. 2nd joint: ventral margin with long hairs forming rows; dorsal margin with few, long, proximal hairs and 5 spinous bristles; lateral surface with few hairs near ventral margin. 3rd joint: ventral margin short, with 1 spinous bristle; dorsal margin long, with 5 spinous bristles (1 near middle, 4 distal). 4th joint: ventral margin long, with 2 or 3 spinous terminal bristles; dorsal margin shorter, with 1 spinous terminal bristle. 5th joint: long; sensory bristles with 2 minute proximal filaments and 2 distal branches, each with bifurcate tip. 6th joint: short; medial bristle bare with spine near tip (bristle about same length as a-bristle of 7th joint). 7th joint: a-bristle clawlike, bare; b-bristle reaching past tip of sensory bristle of 5th joint, with 3 minute marginal filaments and 1 minute spine near tip; c-bristle reaching past tip of sensory bristle, with 2 or 3 minute filaments. 8th joint: d-bristle represented by minute blunt peg; e-bristle bare, about same length as a-claw, with blunt tip; f-bristle bent dorsally near base, slightly longer than b-bristle, with 3 minute ventral filaments; g-bristle about same length as c-bristle, with 2 or 3 minute filaments, and spine near tip.

Second Antenna (Figure 104*c*): Protopodite with

rather long medial bristle. Endopodite: 1st joint short, bare; 2nd joint short, hirsute, 3rd joint long, hirsute, with long terminal bristle. Exopodite: 1st joint with minute, recurved, medial, terminal spine; 2nd joint with long bristle with ventral spines and natatory hairs; joints 3 and 4 with bristles with natatory hairs and few ventral spines; joints 5–8 with bristles with only natatory hairs; joint 9 with 2 bristles (1 long, 1 short, both with natatory hairs); distal margins of joints 2–9 without spines.

Mandible (Figure 104*d*): Coxale endite: ventral branch with spines forming 4 oblique rows, tip with 3 teeth (ventral 2 stouter than 3rd); slender medial bristle present near base of branch; dorsal branch with ventral margin with 4 low knobs between main spine and tip of ventral branch, and long spines proximal to main spine; margin between main spine and tip of dorsal branch with short spines; posterior bristle hirsute, with base proximal to tip of dorsal branch; dorsal margin of branch with few faint serrations. Basale endite with 1 dwarf bristle, 3 end bristles (1 of the end bristles of triaenid type with 1 pair of spines longer than others), and 2 triaenid bristles (these with proximal spines, then 2 or 3 paired teeth followed by 1 pair of longer teeth reaching half way to tip of bristle, and then 12 paired teeth including terminal pair). Basale: ventral margin with 2 triaenid bristles; dorsal margin with spines and 2 terminal bristles; medial side with proximal spines forming rows near dorsal margin. Exopodite hirsute with 2 terminal bristles (inner bristle slightly longer than outer bristle). Endopodite: 1st joint with 6 long ventral bristles; 2nd joint with dorsal margin and lateral surface near dorsal margin with 15 bristles (distal of these a long bristle); medial surface with 5 distal cleaning bristles near dorsal margin and long hairs forming rows; end joint with 3 claws 1 long lateral mid-bristle, and 1 short ventral bristle.

Maxilla (Figure 105*a*): Endites not well defined, consisting of 6 long bristles. Epipodite reaching well past middle of dorsal margin of basale. Basale: both medial and lateral sides with 1 short proximal bristle; dorsal margin with 1 distal bris-



FIGURE 105.—*Asteropella maclaughlinae*, new species, adult female, holotype, USNM 157608: *a*, right maxilla, medial view; *b*, comb of left 5th limb, medial view; *c*, left 6th limb, medial view; *d*, tip of 7th limb; *e*, posterior process of body; *f*, right Y-sclerite, anterior to right; *g*, adult female, paratype, USNM 157516, right lateral eye, medial eye, and proximal part of rod-shaped organ.

tle; ventral margin with 1 long terminal bristle with marginal spines. Endopodite: 1st joint with 1 long beta-bristle with marginal spines; end joint with 4 bristles (3 long with marginal spines, 1 short, bare). Exopodite absent.

Fifth Limb (Figure 105b): Lateral side of comb with 1 long, distal, spinous bristle near dorsal margin, 1 long, proximal, spinous bristle near ventral margin, 3 short bristles with bases close to ventral margin (only 2 of these shown in Figure 105b), and 2 short slender bristles with bases just dorsal to long, spinous, proximal bristle.

Sixth Limb (Figure 105c): Anterodorsal corner of trunk with 1 short medial bristle (bare or with few hairs); anterior margin of trunk with 12 short spinous bristles forming row (bases of bristles on medial side); medial side with 2 short and 2 long spinous bristles with bases posterior to row of anterior bristles; anterior margin of trunk and skirt separated by distinct suture; anterior margin of lateral flap with about 10 spinous bristles; ventral margin of skirt with about 21 spinous bristles; posterior end of skirt with 1 short hirsute bristle; limb hirsute.

Seventh Limb: Each limb with 15–18 bristles, each with up to 7 bells; terminus with 9 or 10 spinous teeth (Figure 105d).

Furca (Figure 104e): Each lamella with 3 stout main claws followed by 4 short secondary claws and then, a more slender bristlelike claw placed slightly laterally on lamella; main claws with stout teeth forming row along posterior margin; 4 secondary claws with very faint teeth along posterior margin; posterior bristlelike claw with few spines near tip; some of the proximal teeth on main claws longer than others; teeth not present near tip of main claws.

Eyes (Figures 104f, 105g): Lateral eye faint, either unpigmented or pigmented, small, with 5 or 6 minute cells (ommatidia²). Medial eye bare, unpigmented or pigmented.

Rod-shaped Organ (Figure 104f): Elongate, with suture proximal to widened middle part, tapering to rounded tip.

Upper Lip (Figure 104f): Consisting of 2 hirsute lobes, each with stout anterior process with broad

proximal part and spinelike tip; 1 or 2 anterior spines on saddle between lobes; a hirsute lateral flap present on each side of mouth.

Posterior of Body (Figure 105e): Fingerlike dorsum with terminal hairs; hairs present along posterior margin between furca and base of dorsum.

Y-Sclerite (Figure 105f): Linear without ventral branch.

DESCRIPTION OF INSTAR II (Figure 106, 107, Plates 95, 96).—Carapace oval in lateral view with small incisur forming almost a right angle with rostrum (Figure 106, Plate 95a).

Ornamentation: Broad, thin, film-like flange present just within and parallel to valve margin, with outer edge extending well past edge of valve (Plate 95a); edge of flange in area of incisur indented; an oval, continuous, concentric ridge present within outer flange (Plate 95a–c); ridge with smooth outer edge except for 2 low processes at posterodorsal corner (Plate 95a); anteroventral part of ridge in vicinity of incisur tending to be linear (Plate 95a); prominent horizontal midrib just below central adductor muscle; midrib slightly narrower in vicinity of muscles; ends of rib not reaching concentric ridge (Plate 95a,b). Concentric ridge with single row of oblong reticulations (Plate 95a); edges or reticulations with

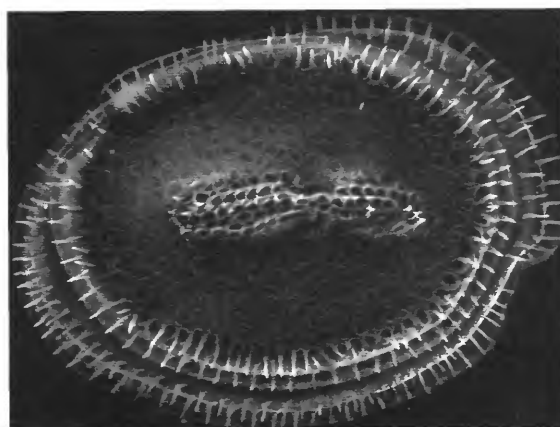


FIGURE 106.—*Asteropella macLaughlinae*, new species, instar II, paratype, USNM 156655, lateral view of complete specimen, length 0.79 mm.

minute spines (Plate 95e); midrib with 2 rows of rectangular reticulations 1 along outer edge (Plate 95a); surface of valve between ribs, ridges, and flange with polygonal reticulations forming fossae with flat bottoms (Plate 95d); long bristles along valve margins (Plate 95a) and scattered on valve surface (Plate 95a); some of surface bristles occurring in pairs (Plate 95f); these bristles appear to have pore near base (Plate 95f).

Infold: Anterodorsal infold with 8 bristles (Figure 107a); ventral infold with 2 widely spaced bristles on posterior half; posteroventral margin with 7 pairs of bristles (1 of the pairs may have an adjacent 3rd bristle) (Figure 107b); SEM micrographs of paired bristles indicated that the bristles are actually soft structures, probably tubular, similar to those on the posteroventral infolds of other genera in the family (Plate 96c-f); the anterior of the paired bristles emerges from a closed pore, whereas, the posterior bristle emerges from an open pore (Plate 96d,e).

Selvage: Wide lamellar prolongation with closely spaced striations and fringe of hairs present along anterior (Figure 107a), ventral, and posterior margins (Figure 107b); selvage divides at tip of rostrum (Plates 95a,c, 96a,b).

Central Adductor Muscle Scars: Consisting of about 13 small, closely spaced, oval scars near middle of valve.

Size: USNM 156655, length 0.79 mm, height 0.56 mm.

First Antenna (Figure 107c): First joint with long hairs forming rows on medial surface near ventral margin; 2nd joint with long hairs forming 2 clusters on ventral margin and 1 cluster proximally on dorsal margin, and 1 midbristle with long hairs on dorsal margin; 3rd joint short, triangular, with long dorsal and very short ventral margins, with 1 dorsal midbristle with few long hairs and 1 slightly longer, ventral bristle (bare or with short marginal spines) reaching past distal margin of 4th joint; 4th joint about one-half length of 2nd joint, with 1 terminal dorsal bristle with long hairs, bristle reaching distal end of 5th joint; 5th joint about same length as 2nd joint, with long sensory bristle bare or with minute

proximal filament and dividing into 2 short branches near distal end, each branch with bifurcate tip; 6th joint minute, fused to 5th, with 1 long medial bristle about equal to length of 5th joint. Seventh joint: a-claw stout, unringed, slightly shorter than bristle of 6th joint; b-bristle bare, almost twice length of a-claw; c-bristle about same length as sensory bristle of 5th joint, with 1 minute filament near middle and 1 near tip. Eighth joint: d-bristle absent; e-bristle reaching just past tip of a-claw; f-bristle with 1 or 2 short proximal filaments on dorsal margin shorter than b-bristle; g-bristle about same length as sensory bristle, bare but slightly swollen near base.

Second Antenna (Figure 107d,e): Protopodite with long medial bristle; endopodite 3-jointed: 1st and 2nd joints short, bare; 3rd joint with long, tapered, terminal bristle, joint without hairs. Exopodite: 1st joint elongate, with distal medial spine; bristles of joints 2-8 with natatory hairs, no spines; 9th joint with 2 bristles, 1 long with natatory hairs, 1 short, either bare or with few short, faint, marginal spines; spines not observed forming row along distal margins of joints, basal spines absent.

Mandible (Figure 107f): Coxale endite with minute bristle near base of ventral branch; ventral branch with spines forming 3 oblique rows, tip with 3 small teeth. Basale: endite with 1 bare, dwarf bristle and 5 longer bristles pectinate distally (3 of these shorter than others); ventral margin of basale close to endite with 1 bristle having 3 widely spaced short spines in middle part and 8 pairs of more closely spaced spines distally, these decrease in length distally on bristle, but are not distinctly triaenid type; ventral margin of basale with 2 slender terminal bristles. Exopodite about three-fourths length of dorsal margin of 1st endopodite joint, hirsute with 2 short terminal bristles reaching to about one-third length of 2nd endopodial joint on left limb and only about one-eighth length on right limb. Endopodite: ventral margin of 1st joint with 3 long bristles, 2 with long hairs, 1 with short, faint, marginal spines, or bare; ventral margin of 2nd

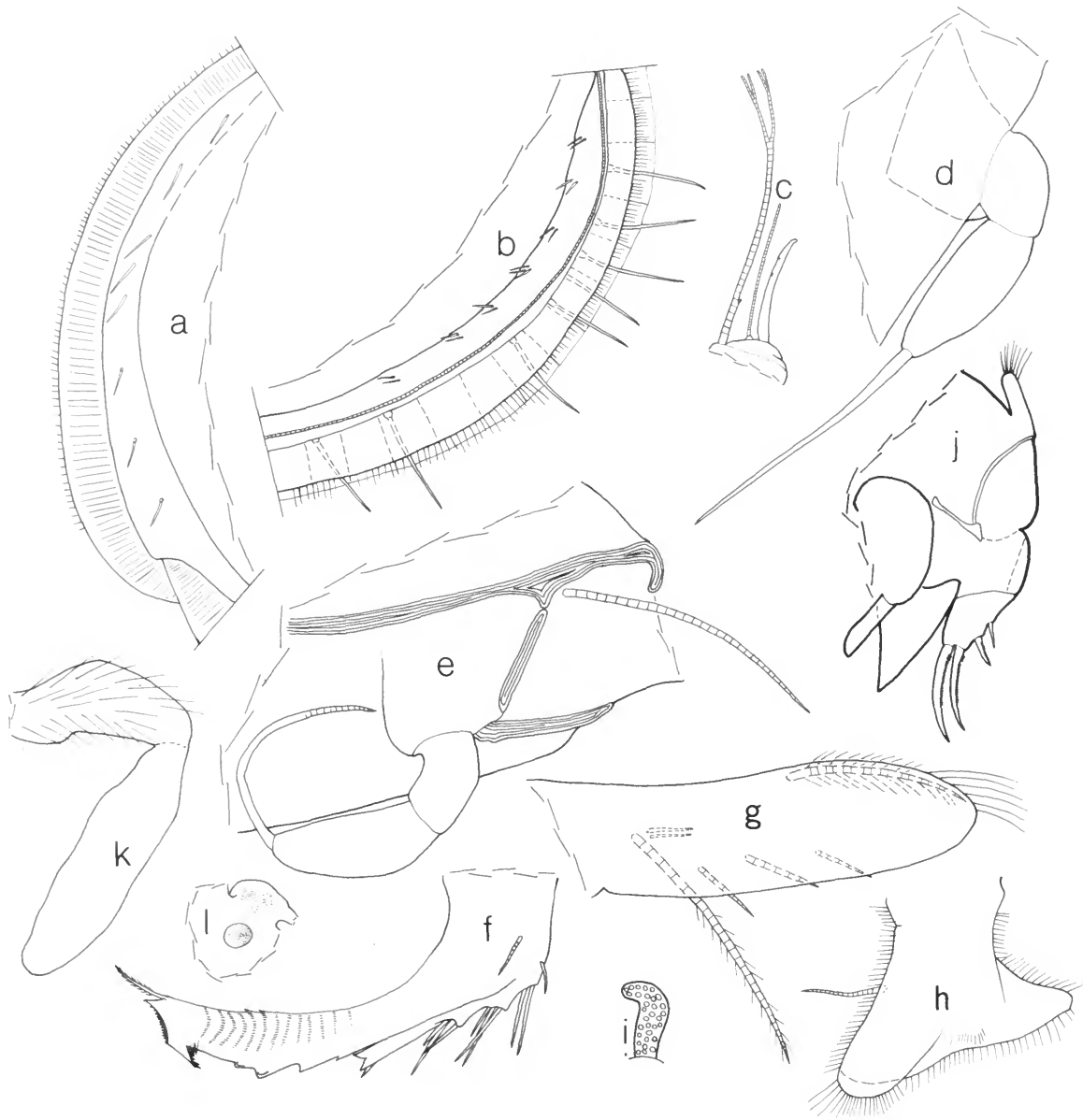


FIGURE 107.—*Asteropella maclaughlinae*, new species, juvenile (instar II), paratype, USNM 156655: *a*, inside view of rostrum and incisur of right valve; *b*, inside view of posteroventral margin of right valve; *c*, tip of left 1st antenna showing sensory bristle of 5th joint, a-claw of 7th joint, and e-bristle of 8th joint; *d*, endopodite of right 2nd antenna, lateral view; *e*, endopodite and proximal part of propodite of left 2nd antenna, medial view; *f*, coxale endite of left mandible, medial view; *g*, comb of left 5th limb, medial view; *h*, left 6th limb, lateral view; *i*, left 7th limb; *j*, posterior of body showing positions of 5th and 6th limbs, furca, posterior process, and Y-sclerite; *k*, rod-shaped organ at high magnification; *l*, right lateral eye, medial eye, and proximal part of rod-shaped organ at lower magnification than *k*.

joint with 2 short, pointed, terminal bristles (1 slender, 1 stout); dorsal margin of 2nd joint with 1 long bristle proximal to middle and 4 subterminal bristles, the more distal of these much longer than others; medial side of joint with short spines forming rows; end joint with 3 clawlike bristles (dorsal of these about one-half length of other 2), 1 very short ventral bristle, and 1 lateral bristle reaching past tip of short dorsal claw.

Maxilla: Epipodial appendage fragmented on both limbs of examined specimen; endites not distinctly separated, with total of 4 or 5 bristles. Basale: dorsal margin with 1 short distal bristle with base on medial side; ventral margin with 1 long, spinous, terminal bristle; lateral side with 1 minute proximal bristle near middle; no hairs observed on basale. Endopodite: 1st joint with few hairs distally on dorsal margin and 1 long spinous beta-bristle; end joint with 4 spinous bristles, medial of these minute, dorsal bristle about one-half length of longer 2.

Fifth Limb (Figure 107g,j): Only left limb examined. Epipodial appendage with 47 bristles. Lateral side of comb with main exopodial bristle just reaching tip of comb and with base near dorsal margin; other exopodial bristles consisting of 1 long proximal bristle near middle and 3 short bristles near ventral margin; dorsal margin of comb with distal hairs.

Sixth Limb (Figure 107h,j): Limb hirsute with 1 anterior bristle.

Seventh Limb (Figure 107i): Small, bare, observed on left side only, slightly larger than posterodorsal process and full of cells.

Furca (Figure 107j): Each lamella with 4 claws: 2 long main claws followed by 1 short main claw and 1 short secondary claw.

Rod-shaped Organ (Figure 107k): Elongate with constriction proximal to middle; proximal part hirsute, distal part with rounded tip.

Eyes (Figure 107l): Lateral eyes represented by faint pigmented sac with numerous cells, about one-half diameter of medial eye; medial eye pigmented, bare.

Posterior of Body (Figure 107j): Fingerlike dorsal process with long hairs at tip.

Gills: Well developed, about same width as posterodorsal process.

Y-Sclerite (Figure 107j): Unbranched with broad proximal part.

DESCRIPTION OF INSTAR IV FEMALE.—Carapace similar to that of adult female.

Size: USNM 157659, length 1.15 mm, height 0.91 mm.

Sixth Limb: Well developed with numerous bristles.

Seventh Limb: Well developed with tapering bristles.

COMPARISONS.—The carapace of the new species, *Asteropella maclaughlinae*, differs from that of *A. monambon* and *A. mortenseni* in that the anterior end of the midrib does not intersect the peripheral concentric ridge. Each valve of *A. maclaughlinae* has a peripheral concentric ridge with 2 posterodorsal processes, whereas the concentric ridge of *A. punctata* bears 5 or 6 posterior processes. The concentric ridge of *Asteropella* species A (Kornicker, 1975a:559) is smoothly rounded without an indentation or processes.

35. *Asteropella trithrix*, new species

FIGURES 9cc, 108–113; PLATES 97–101

ETYMOLOGY.—The specific name from the Greek *tri* (“three”) and *thrix* (“hair”) refers to the 3 bristles on the 2nd joint of the endopodite of the 2nd antenna of the female and on the dorsal margin of the mandibular basale of this species.

HOLOTYPE.—USNM 156722, 1 ovigerous female on slides and in alcohol.

TYPE-LOCALITY.—Bahia de los Angeles, sta LA 130.

ALLOTYPE.—USNM 157159, 1 adult male, sta LA 212.

PARATYPES.—From Bahia de los Angeles: USNM 156720, 1 A-1 male, sta LA 39; USNM 156719, 2 adult females, and USNM 157164, 1 adult female, sta LA 116; USNM 156721, 1 ovigerous female, and USNM 157158, 156718, 2 adult females, same sta as holotype; USNM 156717, 1 adult female, sta LA 134.



FIGURE 108.—*Asteropella trithrix*, new species, ovigerous female, paratype, USNM 156721, lateral view of complete specimen, length 1.74 mm.

DISTRIBUTION.—Bahia de los Angeles (Figure 90). Depth 6–38 m.

DESCRIPTION OF ADULT FEMALE (Figures 108–110, Plates 97–101).—Carapace oval in lateral view with small incisure at middle of anterior margin (Figures 108, 109a, Plates 97a, 98c); a narrow low ridge bordering valve edge (Plates 97b–d, 98b); inner, narrow, concentric ridge paralleling valve margin (Plates 97, 98, 99a,d, 100a); anterior end of horizontal midridge bending downward to meet concentric ridge anteriorly near incisure (Plate 98c,d); midridge posterior to bend straight or slightly curved (Figure 110g, Plate 97a); posterodorsal corner of concentric ridge not flat like that of *A. slatteryi*.

Ornamentation: Surface with numerous oval fossae (Plates 97a, 99b); fossae in vicinity of central adductor muscle attachments with border consisting of small fossae (Plates 98a, 100b); in other areas small fossae form rings (Plates 99b, 100d); some fossae forming groups of 4 or 5 fossae with bristle at center (Plates 100c,e,f, 101a,b) (bristle missing in Plate 100c); bristles have pore near base (Plate 101a,b); some fossae near middle of valve just above midridge with spokelike structures (Plates 99c, 101d); ridges on valve bordered by reticulations (Plates 97, 98, 99a,d, 100a); surface layer bearing fossae separated from lower layer by struts (Plate 101c,e); surface layer ap-

pearing granular at high magnification ($\times 21,000$) (Plate 101f); dark areas surrounded by fossae in Plate 99b probably indicate presence of fossae in under layer; diatoms present in some fossae (Plate 99d–f).

Infold: Anterodorsal infold above incisure with 17 bristles forming row; infold immediately below rostrum with 2 bristles; narrow list with broad lamellar prolongation present from point just ventral to the 2 bristles below rostrum to point near posterior margin; 3 or 4 small bristles along ventral margin just outside list; posterodorsal list broad with about 12 long bristles along inner margin, some forming pairs, and about 23 smaller bristles; a single row of 6 bristles present between inner edge of list and posterior edge of valve.

Central Adductor Muscle Attachment Scars: Consisting of about 12 individual oval scars in vicinity of horizontal midridge, with most scars being ventral to ridge.

Selvage: Broad lamellar prolongation with marginal fringe present on selvage along free margin.

Size: USNM 156721, length 1.74 mm, height 1.27 mm; USNM 157158, length 1.75 mm, height 1.32 mm; USNM 156717, length 1.79 mm, height 1.29 mm; USNM 157164, length 1.62 mm, height 1.15 mm; USNM 156719A, length 1.57 mm, height 1.18 mm; USNM 156722, length 1.68 mm, height 1.18 mm.

First Antenna (Figure 109b): Lateral and medial surface of 1st joint hirsute; 2nd joint with few proximal dorsal hairs, 5 spinous bristles near middle of dorsal margin, and hairs along ventral margin; 3rd joint triangular, with 1 spinous midbristle and 4 spinous subterminal bristles on dorsal margin, and 1 long spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 3 spinous bristles (1 dorsal, 2 ventral); sensory bristle of 5th joint with 2 minute proximal filaments (not shown in illustrated limb) and forming 2 distal branches, each branch with bifurcate tip; medial bristle of 6th joint about equal in length to combined 3rd–8th joints; lateral side of 6th joint with few short stout hairs. Seventh joint: a-claw about equal in length to combined 5th–8th joints, bare; b-bristle about same length as sensory bristle of 5th joint, with 1



FIGURE 109.—*Asteropella trithrix*, new species, ovigerous female, paratype, USNM 156721: *a*, complete specimen showing position of a few central adductor muscle attachments, length 1.74 mm; *b*, left 1st antenna, lateral view; *c*, distal bristle of protopodite and endopodite of left 2nd antenna, medial view; *d*, endopodite of right 2nd antenna, medial view; *e*, right mandible (coxale endite not shown), medial view; *f*, comb of right 5th limb, lateral view; *g*, comb of left 5th limb, medial view; *h*, medial eye and rod-shaped organ; *i*, left lateral eye.

minute filament near tip; c-bristle slightly longer than sensory bristle, with 1 minute proximal filament and 1 near tip. Eighth joint: d-bristle absent; e-bristle bare with pointed tip not reaching tip of a-claw; f-bristle bent dorsally in its proximal part, about same length as b-bristle, bare; g-bristle same length as c-bristle, with minute subterminal filament.

Second Antenna (Figure 190c,d): Protopodite with long, spinous, medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint short, bare; 2nd joint elongate, with 0–3 (usually 3) proximal ventral bristles; 3rd joint very long, without hairs with long terminal bristle. Exopodite: 1st joint elongate, with short, recurved, medial bristle on distal margin; bristles of joints 2–4 with few slender spines along middle of ventral margin; bristles of joints 2–8 with natatory hairs; 9th joint with 3 bristles (2 long, 1 medium), all with natatory hairs; basal spines absent; spines forming row along distal margins of joints not observed.

Mandible (Figure 109e): Coxale endites broken off specimens examined. Basale: endite with 4 or 5 terminal bristles (1 long and 1 short with short marginal teeth, and 2 or 3 triaenid bristles similar to those on the endite of *A. slatteryi*); 1 dwarf bristle and 1 triaenid bristle near proximal end of endite; ventral margin of basale with 2–4 (usually 3) triaenid bristles similar to those on basale of *A. slatteryi*; dorsal margin of basale with 3 subterminal bristles. Exopodite about three-fourths length of 1st endopodial joint, hirsute, with 2 terminal bristles (outer bristle shorter than inner bristle). Endopodite: 1st joint with 5 or 6 spinous ventral bristles; ventral margin of 2nd joint with 2 spinous bristles (lateral of these slender, other stout); dorsal margin of 2nd joint with about 12 bristles; medial surface of 2nd joint with 5 distal, spinous, cleaning bristles, and long hairs forming rows; end joint with claws and bristles similar to those on end joint of *A. slatteryi*.

Maxilla (Figure 110a): Similar to that of *A. slatteryi*.

Fifth Limb (Figure 109f,g): Similar to that of *A. slatteryi* (left limb of USNM 156721 with additional small bristle near ventral margin proximal to long exopodial bristle).

Sixth Limb (Figure 110b,c): Similar to that of *A. slatteryi* (left limb of USNM 156721 without posterior bristle on end joint).

Seventh Limb (Figure 110d): Each limb with 10–23 bristles, about the same number on each side, each bristle with up to 7 bells; some segments with 2 bristles, 1 on each side; terminus with 10 recurved spinous teeth.

Furca (Figure 110h): Each lamella with 8 claws: 3 long primary claws, 4 short secondary claws, and 1 slender, unringed, bristlelike claw; the latter set back from ventral margin.

Rod-shaped Organ and Medial Eye (Figure 109h), *Lateral Eye* (Figure 109i), *Upper Lip* (Figure 110f), *Y-Sclerite* (Figure 110i), *Posterior of Body* (Figure 110e): Similar to those of adult female of *A. slatteryi*.

Brushlike Organ (Figure 110i): A small lobe with about 6 minute bristles on each side of body anterior to furca.

Eggs: USNM 156721 with 17 eggs; USNM 156722 with 14 eggs.

DESCRIPTION OF ADULT MALE (Figures 111, 112).—Carapace similar to that of adult female, except smaller, and with slight concavity in posterodorsal corner of inner concentric ridge, resembling carapace of *A. slatteryi* in this respect.

Size: USNM 157159, length 1.19 m, height 0.88 mm.

First Antenna (Figure 111a,b,i): 1st joint with medial and lateral hairs. 2nd joint: ventral margin with long hairs; dorsal margin with long proximal hairs and 4 spinous bristles. 3rd joint short, triangular; dorsal margin with 4 spinous bristles; short ventral margin with 1 long spinous bristle; 3rd and 4th joints combine to form rectangle. 5th joint with short ventral margin; sensory bristle stout proximally, with about 14 long filaments near middle, and with stem dividing distally into 2 filaments, each bifurcate terminally. 6th joint longer than 6th joint on adult female, medial bristle long, bare. 7th joint: a-claw bare; b-bristle about two and one-half times length of a-claw, with 3 proximal filaments (distal of these longer than others) and bifurcate tip; c-bristle slightly longer than b-bristle, with 3 proximal filaments and bifurcate tip. 8th joint: d-



FIGURE 110.—*Asteropella trithrix*, new species, ovigerous female, paratype, USNM 156721: *a*, left maxilla (epipodial appendage displaced), medial view; *b*, left 6th limb, medial view; *c*, posterior tip of skirt of right 5th limb, medial view; *d*, 7th limb; *e*, posterior process of body; *f*, ovigerous female, USNM 156722, upper lip, anterior to right. Adult female, USNM 157164: *g*, middle ridge of right valve showing minute bristles forming row, lateral view; *h*, right lamella of furca, lateral view; *i*, right Y-sclerite and right brushlike organ.

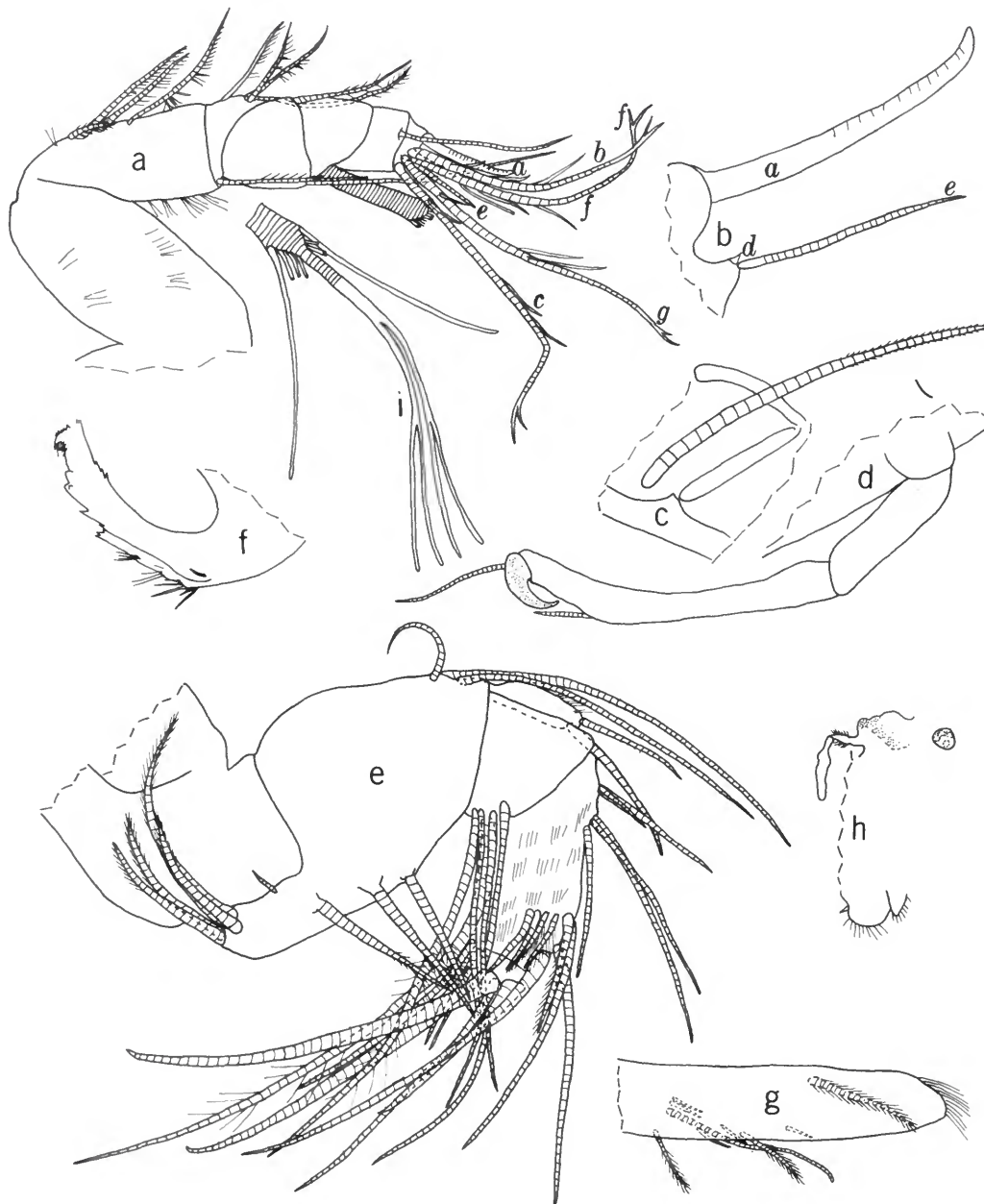


FIGURE 111.—*Asteropella trithrix*, new species, adult male, allotype, USNM 157159; *a*, left 1st antenna (distal end of sensory bristle of 5th joint not shown), medial view; *b*, *a*-bristle, *d*, and *e*-bristles of right 1st antenna, lateral view; *c*, distal bristle of protopodite of left 2nd antenna, medial view; *d*, endopodite of left 2nd antenna, medial view; *e*, left mandible (coxale endite not shown), medial view; *f*, coxale endite of left mandible (tip of dorsal branch broken off), medial view; *g*, comb of left 5th limb, medial view; *h*, anterior of body showing left lateral eye, medial eye, rod-shaped organ, and upper lip; *i*, distal part of sensory bristle of 5th joint of right 1st antenna, lateral view.

bristle represented by minute spine; e-bristle bare, shorter than a-claw; f-bristle about same length as b-bristle, with 3 proximal filaments and bifurcate tip; g-bristle slightly shorter than c-bristle, with 3 proximal filaments and bifurcate tip.

Second Antenna (Figure 111*c,d*): Protopodite with long, spinous, medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint elongate, bare; 2nd joint elongate, longer than 1st joint, with 1 short distal bristle; 3rd joint sclerotized, short, hooklike, with 1 proximal bristle. Exopodite: 1st joint with minute, recurved, medial bristle on terminal margin; joints 2–9 decreasing in size distally along limb; bristles of joints 2–8 with natatory hairs and slender, faint, ventral spines distally; 9th joint with 2 bristles (longer of these ventral and with natatory hairs and slender, faint, ventral spines, other with only natatory hairs); basal spines absent; spines forming row along distal margins of joints not observed.

Mandible (Figure 111*e,f*): Coxale endite: small bristle present near base of ventral branch; ventral branch with stout spines forming 3 oblique rows; tip of ventral branch consisting of 3 minute teeth (dorsal tooth shorter than others); ventral margin of dorsal branch with 2 pointed nodes followed by 2 rounded nodes; main spine with about 8 slender spines proximal to its base; extreme tip of dorsal branch missing on specimen examined; margin between main spine and missing tip with slender spines; dorsal margin of dorsal branch serrate near middle. Basale: endite with 1 long and 3 shorter pectinate end bristles, 1 proximal dwarf bristle, and 1 proximal triaenid bristle; ventral margin of basale with 2 triaenid bristles with 2 or 3 pairs of short, widely spaced spines followed by 1 pair of long spines followed by about 12 pairs of short, closely spaced spines; dorsal margin of basale with 3 terminal bristles (proximal of these short). Exopodite similar to that on adult female. Endopodite: 1st joint with 5 spinous ventral bristles; ventral margin of 2nd joint with 2 terminal bristles (medial of these stout, other slender); dorsal margin of 2nd joint with 9 bristles; medial side of 2nd joint with 5 distal, spinous, cleaning bristles forming row, and long hairs forming rows; end joint with 3 long

clawlike bristles, 1 short ventral bristle, and 1 long lateral bristle.

Maxilla (Figure 112*a*): Similar to that of adult female except a minute distal bristle observed on ventral margin of basale.

Fifth Limb (Figure 111*g*): In general, similar to that of adult female.

Sixth Limb (Figure 112*b*): In general, similar to that of adult female; both limbs of specimen examined with 1 hirsute bristle on tip of posterior end of skirt (hairs of bristle not shown in Figure 112*b*).

Seventh Limb: Each limb with about 11 bristles, 5 or 6 on each side; each bristle with up to 5 bells; terminus with about 6 recurved spinous teeth.

Furca: Each lamella with 7 claws: 3 long primary claws, 3 short secondary claws, and 1 slender, unringed, bristlelike claw set back from ventral margin and with wide space between it and the posterior secondary claw. Similar to that of adult female except with 1 less secondary claw.

Rod-shaped Organ, Eyes, Upper Lip (Figure 111*h*), *Posterior of Body, Y-Sclerite*: Similar to those of adult female.

Copulatory Organ: Similar to that of adult male of *A. slatteryi*.

DESCRIPTION OF A-1 MALE (Figure 113).—Carapace slightly more rounded in lateral outline than carapace of adult female; posterodorsal corner of inner concentric ridge tending to be flat, not evenly rounded as on adult female (Figure 113*a*).

Size: USNM 156720, length 1.06 mm, height 0.79 mm.

First Antenna (Figure 113*b*): Lateral and medial surfaces of 1st joint hirsute; 2nd joint with few proximal dorsal hairs, 3 spinous dorsal bristles near middle of dorsal margin, and hairs along ventral margin; 3rd joint triangular, with 1 spinous midbristle and 2 spinous subterminal bristles on dorsal margin, and 1 spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 2 spinous bristles (1 dorsal, 1 ventral); sensory bristle of 5th joint with 2 or 3 minute proximal filaments and forming 2 distal branches, each branch with bifurcate tip; 6th joint short, similar to that of adult female;



FIGURE 112.—*Asteropella trithrix*, new species, adult, male, allotype, USNM 157159: a, left maxilla, medial view; b, right 6th limb (posterodorsal part broken off), medial view.

medial bristle of 6th joint about equal in length to combined 5th-8th joints plus one-half length of 4th joint; middle of distal margin of lateral side of 6th joint with 2 short stout hairs. Seventh joint: a-claw about equal in length to combined lengths of 5th-8th joints, bare; b-bristle slightly shorter than sensory bristle of 5th joint, with 2 minute proximal filaments and 1 near tip; c-bristle slightly longer than sensory bristle, with 3 minute proximal filaments (none observed near tip). Eighth joint: d-bristle absent; e-bristle bare, about same length as a-claw, tip tapering almost to a point, but end blunt; f-bristle bent dorsally, about same length as b-bristle, bare; g-bristle

same length as c-bristle, with minute filament near tip.

Second Antenna (Figure 113c): Protopodite similar to that of adult female. Exopodite also similar except only 2 bristles on 9th joint. Endopodite 3-jointed: 1st and 2nd joints elongate, bare; 3rd joint short with 1 proximal bristle and small terminal spine.

Mandible (Figure 113d-f): Coxale endite: minute bristle present near base of dorsal branch; ventral branch with spines forming 4 oblique rows; tip of branch with 3 minute teeth; ventral margin of dorsal branch with 2 large nodes; long spines present proximal to base of short main

spine; spines present on margin of endite between main spine and protracted tip of endite; long hirsute, posterior bristle with base near tip of endite. Basale: endite with 4 terminal bristles (1 long and 1 short with short marginal teeth, and 2 triaenid bristles); 1 dwarf bristle and 1 triaenid

bristle near proximal end of endite; ventral margin of basale with 2 triaenid bristles; dorsal margin of basale with 3 subterminal bristles. Exopodite similar to that of adult female. Endopodite: 1st joint with 5 spinous ventral bristles; ventral margin of 2nd joint with 2 spinous bristles (lateral

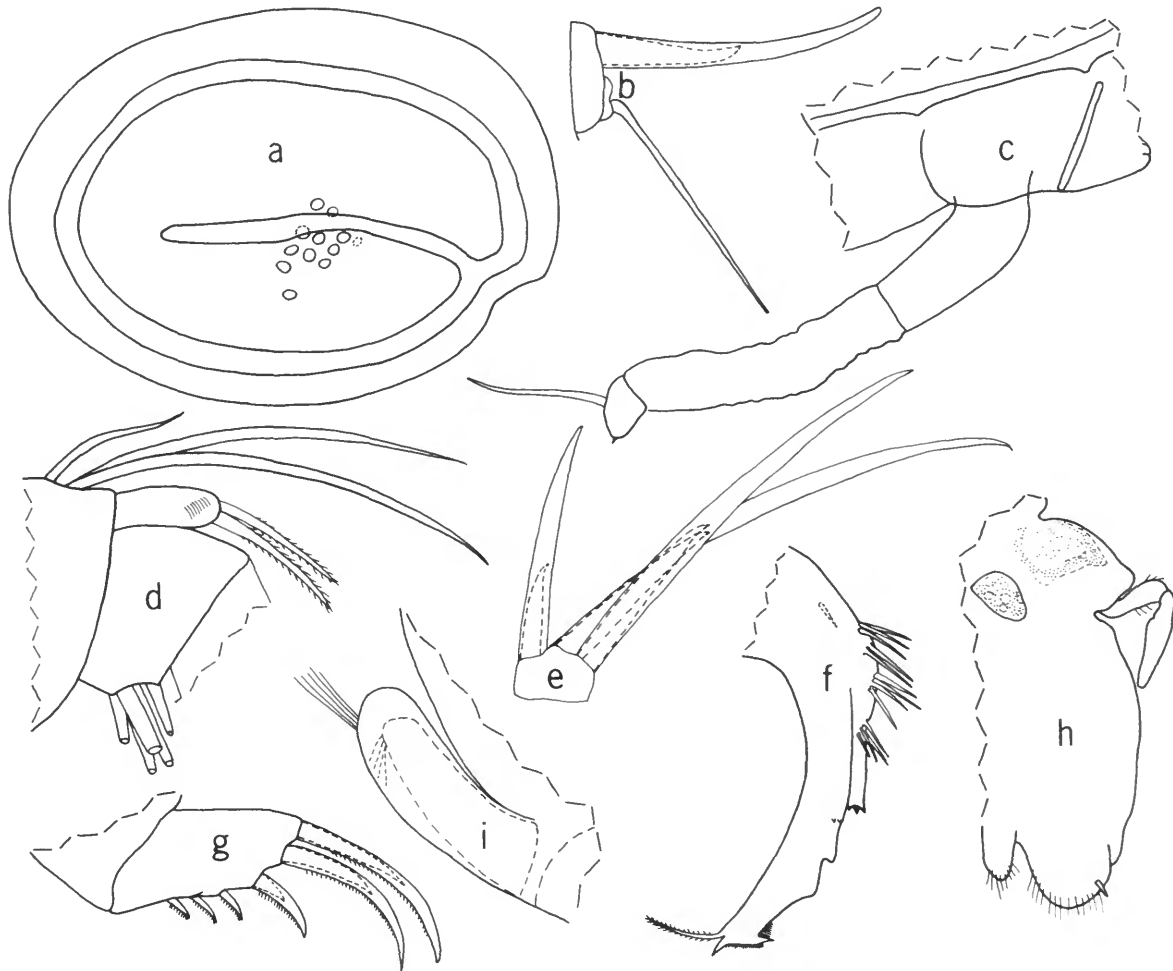


FIGURE 113.—*Asteropella trithrix*, new species, male (A-1 instar in process of molting), paratype, USNM 156720: *a*, complete carapace showing position of central adductor muscle attachments, length 1.06 mm; *b*, a-claw and e-bristle of 7th and 8th joints of right 1st antenna, lateral view (note new claw within older one); *c*, endopodite of left 2nd antenna, medial view; *d*, exopodite, distal part of basale, and 1st endopodial joint of right mandible, lateral view; *e*, claws of end joint of right mandible, lateral view (note new claws within old); *f*, coxale endite of right mandible, lateral view; *g*, right lamella of furca, lateral view (note new claws within old); *h*, anterior of body showing right lateral eye, medial eye, rod-shaped organ, and upper lip; *i*, posterior process of body (note new process within old).

of these slender, other stouter and longer); dorsal margin of 2nd joint with 7 bristles; medial surface of 2nd joint with 3 distal, spinous, cleaning bristles, and long hairs forming rows; end joint with 3 claws and 2 bristles similar to those of adult female.

Maxilla, 5th and 6th Limbs: Not examined in detail but general morphology similar to that of adult female.

Seventh Limb: Right limb with 14 strongly tapered bristles, 7 on each side, each bristle with 1–3 bells; terminus with 4 or 5 weakly developed, recurved, comb teeth.

Furca (Figure 113g): Each lamella with 6 claws (3 long primary claws, 3 shorter secondary claws); bristlelike claw present on adult female absent on A-1 male (USNM 156720).

Rod-shaped Organ, Eyes (Figure 113h), *Posterior of Body* (Figure 113i), *Y-Sclerite:* Similar to those of adult female.

Upper Lip (Figure 113h): Consisting of 2 hirsute lobes, each with weak anterior process; hirsute lateral flap on each side of mouth.

Copulatory Organ: A weakly developed lobe present on each side of body anterior to furca.

COMPARISONS.—The adult female carapace of the new species, *Asteropella trithrix*, differs from that of *A. slatteryi* in that the posterodorsal corner of the concentric inner ridge is not flat. Previously described species of *Asteropella* do not have bristles on the 2nd joint of the endopodite of the 2nd antenna of the female, whereas bristles are rarely absent on this joint on *A. trithrix*. The dorsal margin of the mandibular basale of *A. trithrix* bears 3 bristles, whereas previously described species have only 2. Whereas the ventral margin of the 1st endopodial joint of the mandibles of *A. kaufmani*, *A. scammonensis*, and *A. slatteryi* bear 6 bristles, most specimens of *A. trithrix* have only 5 bristles in this place. The outer bristle on the mandibular exopodite of *A. trithrix* is shorter than the inner bristle; on the exopodites of *A. kaufmani*, *A. scammonensis*, and *A. slatteryi*, the outer bristle is either longer, or about the same length, as the inner bristle. Some appendages of *A. trithrix* are compared with 3 other eastern Pacific species of *Asteropella* in Table 24.

36. *Asteropella slatteryi*, new species

FIGURES 9z, 114–118; PLATES 102, 103

Asteropella species.—Tuel, et al., 1976:141.

ETYMOLOGY.—The species is named for the collector Peter N. Slattery, Moss Landing Marine Laboratories.

HOLOTYPE.—USNM 141554, 1 ovigerous female on slides and in alcohol.

TYPE-LOCALITY.—Northern part of Monterey Bay, California, sta 1159, 3 May 1972.

PARATYPES.—Northern part of Monterey Bay: Sta 1105, depth about 15 m: USNM 156731, 1 juvenile, 10 Nov 1971. Sta 1152, depth about 33 m: USNM 156726, 156727, 2 ovigerous females, 24 Nov 1971; USNM 156746, 1 ovigerous female, 1 juvenile, 17 Nov 1972; USNM 156748, 1 ovigerous female, 23 Aug 1972. Sta 1153, depth about 9 m: USNM 156770, 1 juvenile, 10 May 1972. Sta 1156, depth about 35 m: USNM 156728, 1 A-1 female, 10 Nov 1971. Sta 1158, depth about 24 m: USNM 156751, 1 ovigerous female, 2 Feb 1972. Sta 1159, depth about 11 m: USNM 156725, 1 A-2 female, USNM 156730, 1 juvenile, 20 Aug 1971; USNM 156724, 156729, 2 ovigerous females, USNM 156732, 2 ovigerous females, 10 Nov 1971; USNM 156745, 1 ovigerous female, 1 adult female, 2 Feb 1972; USNM 156768, 156769, 2 juveniles, 3 May 1972. Sta 1175, depth about 35 m: USNM 141553, 1 ovigerous female, USNM 156723, 1 A-1 female, 21 Aug 1971; USNM 156750, 156771, 2 ovigerous females, 3 Feb, 1972; USNM 156747, 1 ovigerous female, 2 juveniles, 11 May 1972; USNM 156748, 1 ovigerous female, 23 Aug 1972. Sta A-3: USNM 143759, 1 ovigerous female, 11 Feb 1971 (sta A-3, Monterey Bay, California, from bottom in kelp bed off Monterey Beach; collector, E. C. Haderlie). Half Moon Bay, California: Sta 1C, June: USNM 156807, 11 specimens. Sta 5C, June: USNM 156803: 5 specimens. Sta 1A, Sept: USNM 156808, 33 specimens; USNM 156809, 1 ovigerous female. Sta 1B, Sept: USNM 156804, 27 specimens. Sta 1A, Dec: USNM 156810, 32 specimens. Sta 1B, Dec: USNM 156805, 22 specimens: USNM 156806, 1 adult male. Sta 1C, Sept: USNM 156802, 22 specimens.

DISTRIBUTION (Figure 90).—Monterey Bay and Half Moon Bay, California. Depth 6–37 m.

DESCRIPTION OF ADULT FEMALE (Figures 114–116, Plates 102, 103).—Carapace oval in lateral view (Figure 114, Plate 102a); dorsal margin convex or fairly flat, ventral margin evenly convex; small incisur forming almost right-angle just below middle of anterior margin (Plate 102i); narrow outer peripheral ridge just within valve edge parallels valve margin (Plate 102a–c); inner concentric ridge also parallels valve margin except in posterodorsal corner where it is flat or slightly concave, not convex like margin (Plate 102a,b); horizontal ridge at valve middle intersecting concentric ridge near incisur (Plate 102i), but not reaching concentric ridge posteriorly; horizontal rib not becoming wider in vicinity of central adductor muscle attachments (Plate 102a).

Ornamentation: With peripheral concentric, and horizontal ridges described above; ridges consisting of 1 or 2 rows of rectangular fossae (Plate 102c,i,l); a single row of rectangular-to-oval fossae present on either side of ridges; surface of valve with oval fossae (Plate 102g,h) covered over most of specimen examined by coating through which only few fossae are visible (Plate 102c,d,i); single bristles with pore near base emerging from unrimmed pores (Plate 102j) or rimmed pores (Plate 102e), some pores touching each other to form paired bristles (Plate 102f); bristles present



FIGURE 114.—*Asteropella slatteryi*, new species, ovigerous female, holotype, USNM 141554, lateral view of complete specimen, length 1.87 mm.

along anterior and ventral margins and scattered over valve surface.

Infold (Plate 103a–c,h–l): Anterodorsal infold above incisur with 23 bristles either single or in pairs; infold immediately below rostrum with 2 long bristles; narrow list present from point ventral to the 2 bristles below rostrum to point near posterior margin; about 18 minute bristles along ventral margin just outside list; posteroventral list broad, with about 7 pairs of long bristles and about 10 additional smaller bristles (Plate 103h–l); a single row of 5 long bristles present between broad list and posterior edge of valve.

Central Adductor Muscle Attachment Scars: Consisting of about 12 individual oval scars in vicinity of horizontal ridge, with most scars being ventral to ridge. Attachments of muscle to shell shown in Plate 103a,f,g.

Selvage: Broad lamellar prolongation present on selvage along free margin, fringed along ventral margin (Plate 103b–e).

Size: USNM 141554, length 1.87 mm, height 1.39 mm, width 1.16 mm; USNM 156724, length 1.94 mm, height 1.38 mm; USNM 156726, length 1.94 mm, height 1.45 mm; USNM 156727, length 1.92 mm, height 1.42 mm; USNM 156729, length 1.92 mm, height 1.42 mm; USNM 156732, 2 specimens, length 1.91 mm, height 1.42 mm, length 1.85 mm, height 1.31 mm; USNM 141553, length 1.97 mm, height 1.42 mm.

First Antenna (Figure 115a): Lateral and medial surfaces of 1st joint hirsute; 2nd joint with few proximal dorsal hairs, 5 spinous bristles near middle of dorsal margin, and hairs along ventral margin; 3rd joint triangular, with 1 spinous mid-bristle and 4 spinous subterminal bristles on dorsal margin, and 1 long spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 3 spinous bristles (1 dorsal, 2 ventral); sensory bristle of long 5th joint with 1 or 2 minute proximal filaments (not shown in illustrated limb) and forming 2 distal branches, each branch with bifurcate tip; medial bristle of 6th joint long, about equal in length to combined 3rd–8th joints; lateral side of 6th joint with few hairs. Seventh joint: a-claw about equal in length to combined 5th–8th joints, bare; b-bristle about



FIGURE 115.—*Asteropella slatteryi*, new species, ovigerous female, holotype, USNM 141554: *a*, right 1st antenna, lateral view; *b*, endopodite and distal bristle of protopodite of left 2nd antenna, medial view; *c*, right mandible, medial view; *d*, anterior of body showing left lateral eye, medial eye, rod-shaped organ, and upper lip.

same length as sensory bristle of 5th joint, bare except for minute filament near tip; c-bristle slightly longer than sensory bristle, with 1 or 2 minute proximal filaments and 1 near tip. Eighth joint: d-bristle absent; e-bristle bare with blunt tip reaching tip of a-claw, or slightly longer than a-claw; f-bristle bent dorsally, about same length as b-bristle, with 1 minute filament proximal and 1 near tip; g-bristle same length as c-bristle, with 1 minute filament proximal and 1 near tip.

Second Antenna (Figure 115b): Protopodite with fairly long, spinous, medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint short, bare; 2nd joint elongate, hirsute; 3rd joint very long, hirsute, with terminal bristle with few marginal spines. Exopodite: 1st joint elongate with short, recurved, medial bristle on distal margin; bristles of joints 2-3 (possibly also 4 and 5) with faint slender spines along middle of ventral margin; bristles of joints 2-8 with natatory hairs; 9th joint with 3 bristles (2 long, 1 medium), all with natatory hairs; usual row of spines not observed along distal margins of joints; basal spines absent.

Mandible (Figure 115c): Coxale endite: minute bristle present at base of ventral branch; ventral branch with spines forming 5 oblique rows; tip of branch with 3 minute teeth; ventral margin of endite proximal to ventral branch, hirsute and with glandular field; medial side of dorsal branch with 5 minute teeth near tip of ventral branch; ventral margin of dorsal branch with 2 small acute nodes followed by 2 larger more rounded nodes; main spine with few marginal spines; longer spines on endite near base of main spine; spines present on margin of endite between main spine and tip of endite; protracted tip with marginal spines; long, hirsute, posterior bristle with base near tip of endite; dorsal margin of endite with few distal serrations. Basale: tip of endite with 4 bristles: 1 long with short marginal teeth, 1 short with short marginal teeth, and 2 triaenid bristles with 4 pairs of widely spaced teeth followed by 1 pair of very long teeth followed by about 16 pairs of small teeth excluding minute triaenid tip; 1 dwarf bristle and 1 triaenid bristle near proximal end of endite; ventral margin of basale with 3-5 triaenid bristles with 5-8 pairs of

widely spaced proximal teeth followed by 1 pair of very long teeth followed by 9-11 pairs of small teeth (excluding terminal pair), the latter teeth decreasing in length distally along bristle; dorsal margin of basale with 2 long terminal bristles with short marginal spines. Exopodite about two-thirds length of 1st endopodial joint, with marginal hairs forming 2 rows, and 2 terminal bristles almost reaching middle of 2nd endopodial joint. Endopodite: 1st joint with 6 spinous ventral bristles (2 stout with long marginal spines, 4 slender with short marginal spines); ventral margin of 2nd joint with 2 spinous bristles (lateral of these slender, other stout); dorsal margin of 2nd joint with 10 bristles, most with short marginal spines; medial surface of 2nd joint with 5 distal, spinous, cleaning bristles, and long hairs forming rows; end joint with 3 stout, bare, clawlike bristles (dorsal of these about one-half length of others and with few widely spaced faint spines), 1 long lateral bristle with few short marginal spines, and 1 short ventral bristle.

Maxilla (Figure 116a): Epipodite with hairs ventrally in proximal half and pointed tip reaching past middle of basale. Endites not distinctly separated, consisting of 6 long bristles with distal spines, and 1 minute bristle. Basale: dorsal margin with proximal hairs and 1 bare distal bristle; medial surface hirsute near the ventral margin and with 1 short proximal bristle; ventral margin with 1 long, spinous, terminal bristle and 1 minute distal bristle; lateral side with 1 proximal bristle. Exopodite not present. Endopodite: 1st joint with few distal hairs and long spinous beta-bristle; 2nd joint with 4 spinous bristles (3 long, 1 short).

Fifth Limb (Figure 116b): Dorsal margin of comb with long hairs near distal end, none of these hairs stouter than others; lateral side of comb with long proximal bristle near ventral margin, 2 short slender bristles just distal to its base, 3 short bristles along middle part close to ventral margin, and 1 long spinous bristle with base near dorsal margin; latter bristle not reaching end of comb; ventral margin of comb with 40 short spinous bristles, and with hairs along medial side.

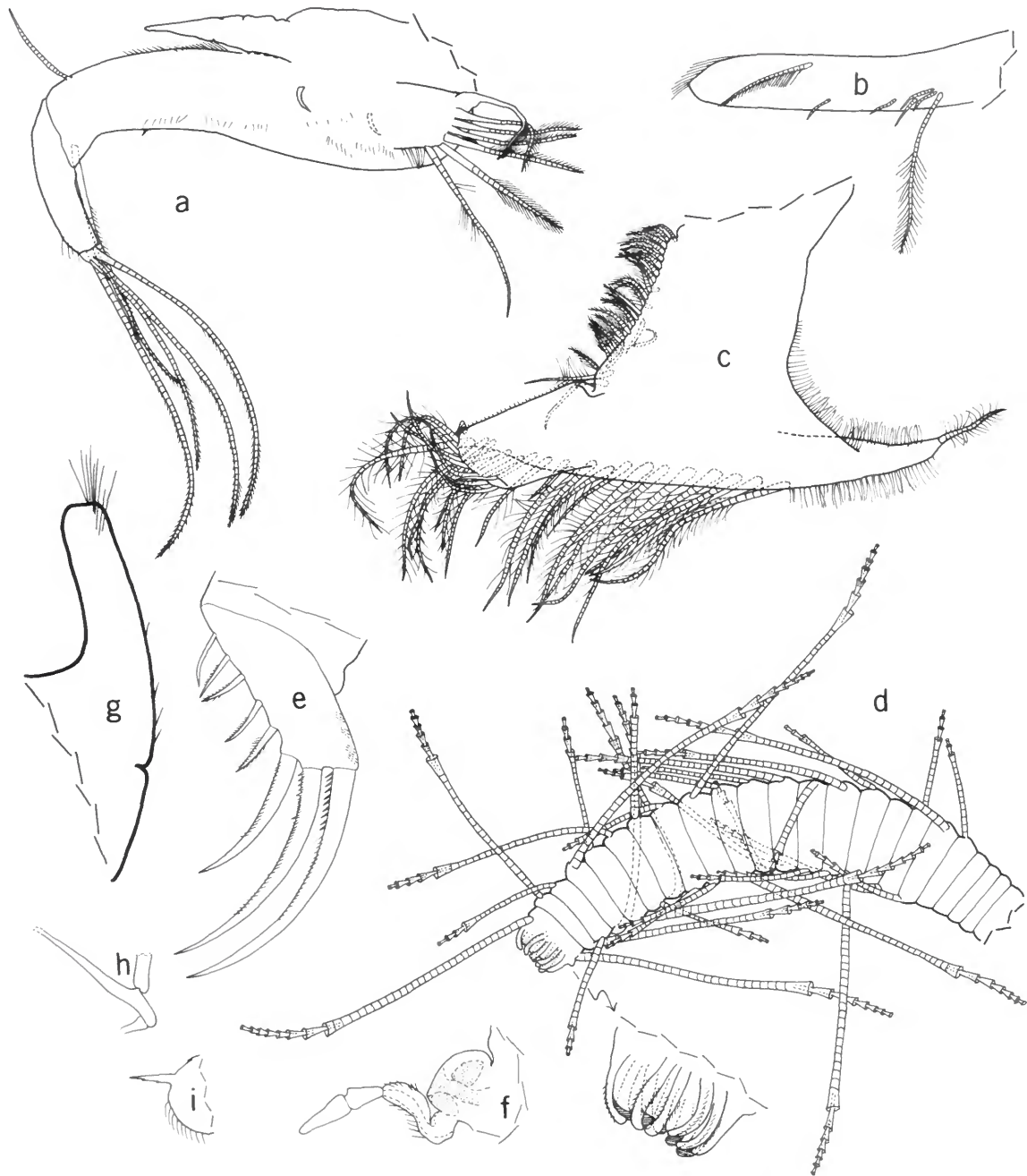


FIGURE 116.—*Asteropella slatteryi*, new species, ovigerous female, holotype, USNM 141554: *a*, right maxilla, medial view; *b*, comb of left 5th limb, lateral view; *c*, left 6th limb, lateral view; *d*, 7th limb; *e*, right lamella of furca, lateral view; *f*, medial eye and rod-shaped organ; *g*, posterior process of body; *h*, left Y-sclerite, anterior to left, *i*, USNM 156729, left lobe of upper lip, anterior to left.

Sixth Limb (Figure 116c): Protopodite (trunk) with single row of 20 short spinous bristles along anterior margin with bases on medial side; 4 short, spinous, medial bristles of same type present near middle of protopodite, with bases just posterior to anterior row; 2 longer, spinous, medial bristles present near anterior margin proximal to suture separating protopodite from wide skirt; broad lateral flap with 9 spinous bristles; anteroventral margin of skirt with 22–24 spinous bristles; posterior end of skirt prolonged, with 1 short hirsute bristle; limb hirsute, no epipodial bristles.

Seventh Limb (Figure 116d): Broad at base then becoming narrower to point near middle where it broadens to about width of base; broad part with 32–39 bristles, about an equal number on each side; each bristle with up to 7 bells; most segments of limb with 2 bristles, 1 on each side; terminus with 10 or 11 recurved spinous teeth.

Furca (Figure 116e): Each lamella with 8 claws; claws 1–3 primary with lateral and medial row of teeth along proximal two-thirds, proximal teeth longer than distal teeth; secondary claws about same length but decreasing in width distally along lamella; claws 4–7 with spines along posterior margin; claw 8 bare or with few spines, with base set slightly back from edge of lamella; all secondary claws without rings and more-or-less equally spaced along lamella; medial hairs forming clusters near anterior margin of lamella.

Rod-shaped Organ (Figures 115d, 116f): 3-jointed: 1st joint broad with faint spines; middle part short flaring; distal part tapering distally to rounded tip.

Eyes: Medial eye bare, pigmented (Figures 115d, 116f). Lateral eye small, pigmented, with about 4 small, indistinct ommatidia (Figure 115d).

Upper Lip (Figures 115d, 116i): Consisting of 2 hirsute lobes, each with anterior spinous process (anterior process absent in Figure 115d); hirsute lateral flap on each side of mouth; saddle between lobes with 4 minute anterior spines.

Posterior of Body (Figure 116g): With elongate dorsal process with long spines at tip.

Y-Sclerite (Figure 116h): Slightly sinuate at posterior end, tapering anteriorly without ventral branch.

Eggs: USNM 141554 with 11 eggs; USNM 156729 with 12 eggs; USNM 156724 with 12 eggs; USNM 156729 with 11 eggs.

DESCRIPTION OF ADULT MALE (Figure 117).—Carapace similar to that of adult female except posterodorsal corner of inner concentric ridge with distinct concavity (Figure 117a).

Central Adductor Muscle Attachment Scars: Consisting of about 14 individual oval scars in vicinity of horizontal midridge; most scars ventral to midridge.

Size: USNM 156806, length 1.34 mm, height 0.91 mm.

First Antenna (Figure 117b): Lateral and medial surfaces of 1st joint hirsute; 2nd joint with proximal dorsal hairs, 4 spinous bristles near middle of dorsal margin, and hairs along ventral margin; 3rd joint triangular, with 1 spinous midbristle and 3 spinous subterminal bristles on dorsal margin, and 1 long spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 2 spinous bristles (1 ventral, 1 dorsal); 5th joint shorter than that of female; sensory bristle of 5th joint with stout trunklike proximal part, 10 long filaments near middle, and stem forming 2 distal branches, each branch with bifurcate tip; 6th joint longer than that of female; medial bristle of 6th joint long, about equal in length to combined 3rd–8th joints, with short marginal spines. Seventh joint: a-claw about equal in length to combined lengths of 5th–8th joints, bare; b-bristle reaching tip of sensory bristle of 5th joint, with 3 fairly long proximal filaments and bifurcate tip; c-bristle slightly longer than b-bristle, with 4 fairly long proximal filaments and 1 shorter filament near tip. Eighth joint: d-bristle absent; e-bristle bare with blunt tip reaching just past tip of a-claw; f-bristle not bent dorsally, about same length as b-bristle, with 4 fairly long proximal filaments and 1 shorter filament near tip; g-bristle about same length as c-bristle, with 4 fairly long proximal filaments and 1 shorter filament near tip.

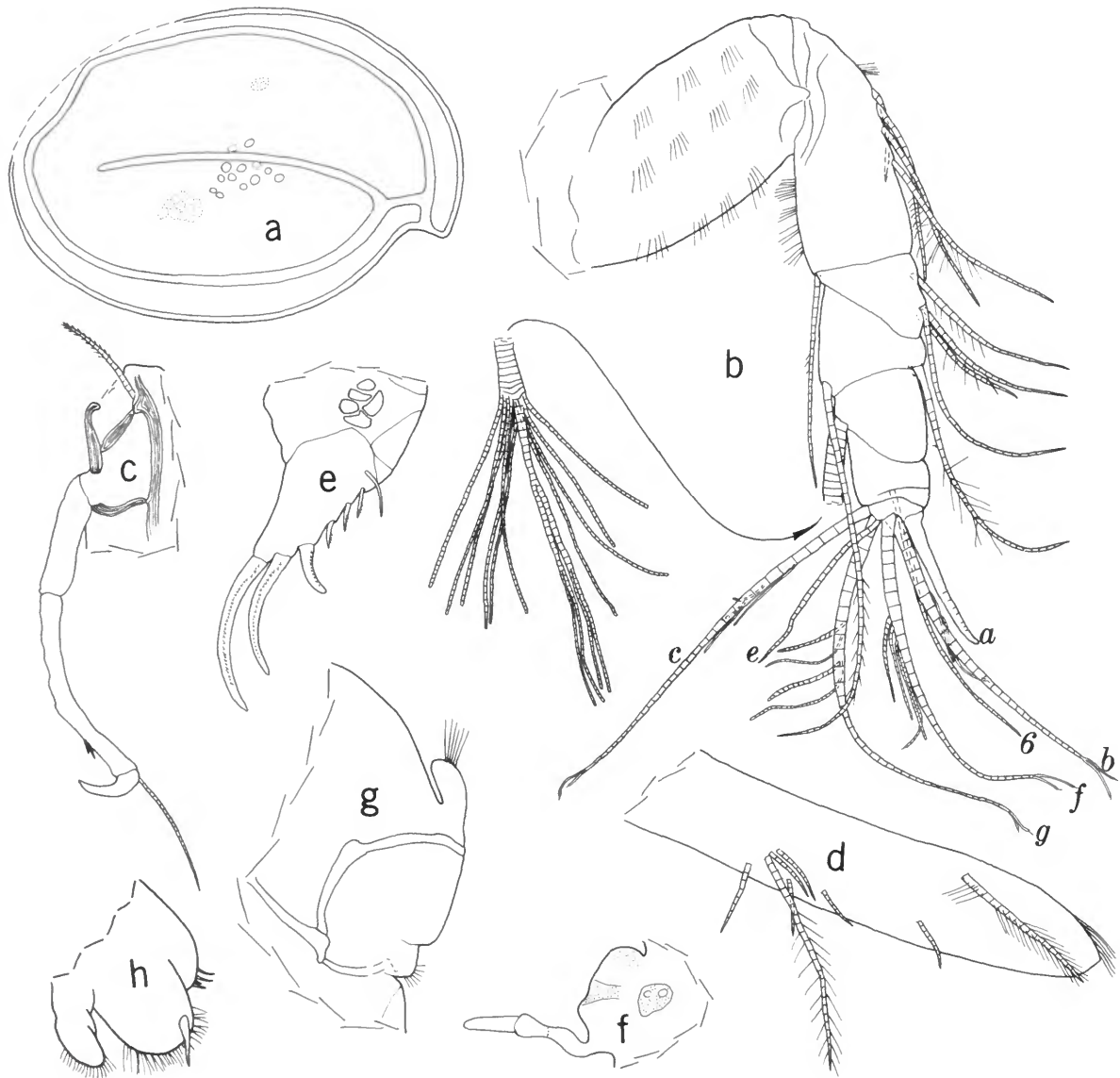


FIGURE 117.—*Astropella slatteryi*, new species, adult male, paratype, USNM 156806: *a*, complete specimen showing position of lateral eye (dots), position of central adductor muscle attachments (small circles), and representative reticulations, length 1.34 mm; *b*, right 1st antenna, lateral view; *c*, endopodite and distal bristle of protopodite of right 2nd antenna, medial view; *d*, comb of right 5th limb, lateral view; *e*, left lamella of furca, lateral view; *f*, medial eye and rod-shaped organ; *g*, posterior of body showing posterior process and sclerites including Y-sclerite; *h*, upper lip, anterior to right.

Second Antenna (Figure 117c): Protopodite and exopodite similar to that of adult female except 9th joint of exopodite with only 2 bristles. Endopodite 3-jointed; 1st joint elongate, bare; 2nd joint very long, with 2 short distal bristles; 3rd joint short, with long proximal bristle and short, recurved, terminal claw.

Mandible: Coxale endite similar to that of adult female. Basale: endite similar to that of adult female except triaenid bristles with up to 6 pairs of marginal teeth proximal to pair of long teeth and 10 or 11 pairs of teeth (excluding terminal pair) following paired long teeth; ventral margin of basale with 4 triaenid bristles similar to those of adult female; dorsal margin of basale with 2 long terminal bristles with short marginal spines. Exopodite similar to that of adult female, outer bristle longer than inner bristle. Endopodite: ventral margin of 1st joint with 5 bristles (2 with long marginal spines, 3 with short marginal spines); ventral margin of 2nd joint with 2 spinous terminal bristles (lateral of these shorter and more slender than medial bristle); dorsal margin of 2nd joint with 9 bristles, bare or with short, faint, marginal spines; medial surface of 2nd joint with 5 distal, spinous, cleaning bristles, and long hairs forming rows; end joint similar to that of adult female.

Maxilla: Similar to that of adult female.

Fifth Limb (Figure 117d): Similar to that of adult female but with additional small ventral bristle proximal to long exopodial bristle.

Sixth Limb: Bristles not counted, but limb similar to that of adult female.

Seventh Limb: One limb with 22 bristles, 10 or 11 on each side; other limb with 12 bristles on one side and many missing bristles on other side; terminus with 6 or 7 recurved spinous teeth.

Furca (Figure 117e): Each lamella with 7 claws; claws 1-3 primary, claws 4-6 secondary, claw 8 bristlelike with base set back from edge of lamella; teeth on claws similar to those of adult female.

Rod-shaped Organ, Eyes (Figure 117f), *Posterior of Body* and *Y-Sclerite* (Figure 117g): Similar to those of adult female.

Upper Lip (Figure 117h): Consisting of 2 hirsute lateral lobes, each with spinous anterior process;

anterior of medial saddle with 4 minute anterior spines proximal to anterior process of lateral lobe; hirsute lateral flap on each side of mouth.

Copulatory Appendage: Small, consisting of short lobes on both sides of body.

DESCRIPTION OF A-1 FEMALE (Figure 118a,b).—Carapace similar to that of adult female with exception of posterodorsal corner of concentric ridge being deeply concave, rather than flat or slightly concave (Figure 118a).

Size: USNM 156723, length 1.66 mm, height 1.25 mm; USNM 156728, length 1.63 mm, height 1.29 mm.

Seventh Limb: Limb with 37 strongly tapering bristles, 21 on 1 side, 16 on other; terminus with recurved comb teeth.

Furca: Each lamella with 7 claws: 3 long primary claws, 3 short secondary claws, and 1 slender, unringed, bristlelike claw; the space between claws 6 and 7 about the same, or slightly wider than space between claws 5 and 6.

Lateral Eye (Figure 118b): Small with about 4 ommatidia, pigmented brown.

DESCRIPTION OF A-2 FEMALE (Figure 118c-e).—Carapace similar to that of A-1 female (Figure 118c).

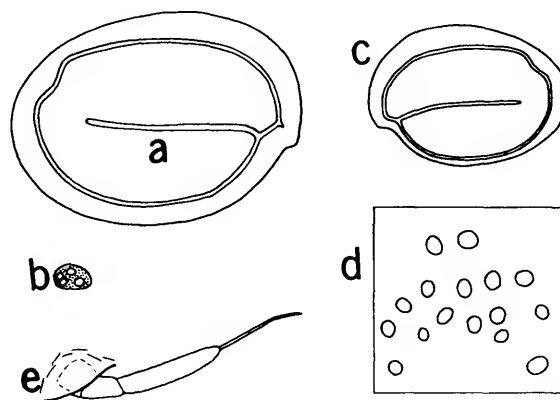


FIGURE 118.—*Asteropella slatteryi*, new species, female (A-1 instar), paratype, USNM 156723: a, complete carapace, length 1.66 mm; b, right lateral eye. Female (A-2 instar), paratype, USNM 156725: c, complete carapace, length 1.22 mm; d, central adductor muscles projecting from left side of body, anterior to left; e, endopodite of left 2nd antenna, lateral view.

Central Adductor Muscle Attachment Scars (Figure 118d): Consisting of about 16 individual oval scars in vicinity of horizontal midridge.

Size: USNM 156725, length 1.22 mm, height 0.88 mm.

First Antenna: Sensory bristle of 5th joint similar to that of adult female but minute proximal filaments not observed; e-bristle of 8th joint slightly longer than a-claw of 7th joint.

Second Antenna (Figure 118e): Endopodite similar to that of adult female, hairs not observed.

Sixth Limb: With many bristles.

Seventh Limb: With 18 tapering bristles, 9 on each side.

Furca: Each limb with 3 primary and 3 secondary claws.

Lateral Eye: Similar to that of A-1 female.

Posterior of Body: Elongate dorsal process similar to that of A-1 female and adult female.

ONTOGENY.—Juvenile carapaces differ from those of adult in having deeper concavity in posterodorsal corner of concentric ridge. Bristles of 7th limbs of juveniles tapered, not cylindrical as on adult; 7th limb of A-2 female with fewer bristles than 7th limbs of both A-1 female and adult female. The number of furcal claws increases by 1 at each stage of development: A-2 female - 6 claws; A-1 female - 7 claws; adult female - 8 claws.

COMPARISONS.—The carapace of the new species, *A. slatteryi*, differs from that of *A. scammonensis*

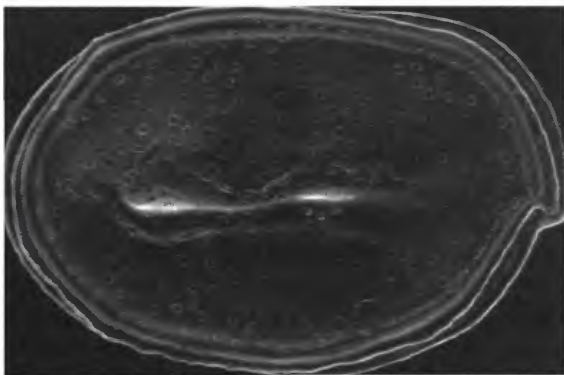


FIGURE 119.—*Asteropella kaufmani*, new species, variety A, ovigerous female, holotype, USNM 156934, lateral view of complete specimen, length 1.38 mm.

and *A. trithrix* in being larger and in having a flat or slightly concave posterodorsal corner on the inner concentric ridge. The endopodite of the 2nd antenna of the female *A. slatteryi* differs from that of *A. trithrix* in lacking bristles on the 2nd joint. The dorsal margin of the mandibular basale of *A. slatteryi* bears 2 bristles compared to 3 on *A. trithrix*. The 7th limb of *A. slatteryi* bears more bristles than are present on the 7th limbs of *A. scammonensis* or *A. trithrix*. Some appendages of *A. slatteryi* are compared with those of other species of *Asteropella* from the eastern Pacific in Table 24.

37. *Asteropella kaufmani*, new species

FIGURES 9w, 17b, 119–123; PLATES 104–109

ETYMOLOGY.—The species is named for one of the collectors, Herbert W. Kaufman, Smithsonian Institution.

HOLOTYPE.—USNM 156934, 1 adult female on slides and in alcohol.

TYPE-LOCALITY.—Station 182-3, beach at Pilot House, Naos Island, Panama.

ALLOTYPE.—USNM 157155, 1 adult male, sta 183-1, replicate A, beach of Culebra Island, Bay of Panama.

PARATYPES.—Culebra Island, Bay of Panama: USNM 157153, 1 adult female, USNM 157154, 1 ovigerous female, sta 183-1, replicate B; USNM 157150, ovigerous female, sta 183-2, replicate D. Naos Island, Bay of Panama: USNM 157151, 1 adult female, sta 182-3, replicate B; 1 ovigerous female from sta 150-B, retained by H. W. Kaufman. Southeast of Batele Point, Gulf of Panama: USNM 157170, 3 ovigerous females, 2 juveniles, sta 161-2.

NON-TYPES.—Naos Island, Bay of Panama: USNM 157202, 1 ovigerous female, and USNM 157315, 2 specimens, sta 7. Culebra Island, Bay of Panama: USNM 157152, 157156, 2 juveniles, sta 183-1, replicate D; USNM 157157, 1 juvenile female, sta 183-2, replicate A.

DISTRIBUTION (Figure 90).—Gulf of Panama at depths of 0–1 m.

DESCRIPTION OF ADULT FEMALE (variety A) (Figures 119, 120, Plates 104–107).—Carapace oval in lateral view (Figure 119, Plate 104a) dorsal

margin fairly flat or slightly convex, ventral margin evenly convex (Plate 104a); left valve extending past right valve posteriorly and dorsally; small incisur forming almost right-angle just below middle of anterior margin (Plate 104d); narrow peripheral ridge just within valve edge parallels valve margin (Plate 104b,c); inner concentric ridge also parallels valve margin, but forming small posterodorsal angle on some specimens, usually near a long pair of bristles; outer edge of concentric ridge minutely uneven (Plate 105c,d); horizontal ridge at valve middle not intersecting concentric ridge either anteriorly (Plate 104d) or posteriorly; midridge tending to be wider at each end, but especially at the posterior end, where it is also broadest when viewed dorsally (Plate 104b),

Ornamentation: Surface of valve with round fossae with stellate covering (Plates 104d, 105, 106a,b,d); bristles present along anterior and ventral margins of valves and sparsely distributed over lateral surfaces (Plates 106a-d, 107a); surface between fossae reticulate (Plate 104e); stellate areas on midridge bearing 1 or 2 bristles (Plate 106e,f).

Infold: Anterodorsal infold dorsal to incisur with 21 bristles (Plate 107a,b,e); infold immediately below rostrum with 1 bristle; list, represented by narrow ridge, present from point below single bristle below rostrum to point near posterior margin; ventral area obscure on specimen examined but with at least 5 small bristles just outside list; posterodorsal list broad, with about 9 long bristles and several short bristles (Plate 107c,d,f); 2 or 3 long bristles between broad list and posterior edge of valve.

Central Adductor Muscle Attachment Scars: Consisting of about 13 individual oval scars in vicinity of horizontal ridge, with ridge being centered over scars (Figure 120b).

Selvage: Broad lamellar prolongation present on selvage along free margin; fringe observed along edge of prolongation of ventral margin of right valve.

Size: USNM 156934, length 1.38 mm, height 0.99 mm; USNM 157150, length 1.40 mm, height 1.01 mm; USNM 157151, length 1.38 mm, height

0.98 mm; USNM 157153, length 1.37 mm, height 0.98 mm; USNM 157154, length 1.29 mm, height 0.93 mm.

First Antenna (Figure 120a): Lateral and medial surfaces of 1st joint hirsute; dorsal margin of 2nd joint with few long proximal hairs and 5 or 6 spinous bristles mostly proximal to middle; ventral margin of 2nd joint with long hairs forming clusters; 3rd joint triangular with 1 spinous midbristle and 4 spinous subterminal bristles on dorsal margin, and 1 long spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 3 spinous bristles (2 ventral, 1 dorsal); sensory bristle of long 5th joint with 2 minute proximal filaments (not shown on illustrated limb) and forming 2 distal branches, each branch with bifurcate tip; medial bristle of short 6th joint about four-fifths length of sensory bristle of 5th joint. 7th joint: a-bristle about equal in length to combined 5th-8th joints, bare; b-bristle about same length as sensory bristle, with 1 minute proximal filament; c-bristle about same length as sensory bristle, with 1 minute subterminal filament. 8th joint: d-bristle absent or minute; e-bristle about one-fourth longer than a-claw, or only slightly longer, slender, bare, with blunt tip; f-bristle bent dorsally, about same length as sensory bristle, with 2 minute proximal filaments and 1 near tip; g-bristle about same length as sensory bristle, with 1 minute proximal filament and 1 minute subterminal filament. (Limb quite similar to that of female *A. slatteryi*.)

Second Antenna (Figure 120c): Protopodite with fairly long medial bristle with very faint marginal hairs, otherwise bare. Endopodite 3-jointed: 1st joint short, bare; 2nd joint elongate, hirsute; 3rd joint very long, hirsute, with terminal bristle. Exopodite: 1st joint with small, recurved, medial bristle on distal margin; bristles of joints 2-6 with slender spines along middle of ventral margin; bristles of joints 2-8 with natatory hairs; 9th joint with 3 bristles (2 long, 1 medium), all with natatory hairs; basal spines absent, spines not observed along distal margins of joints.

Mandible (Figure 120d): Similar to that of *A. slatteryi*, except ventral margin of basale with only 2 triaenid bristles.

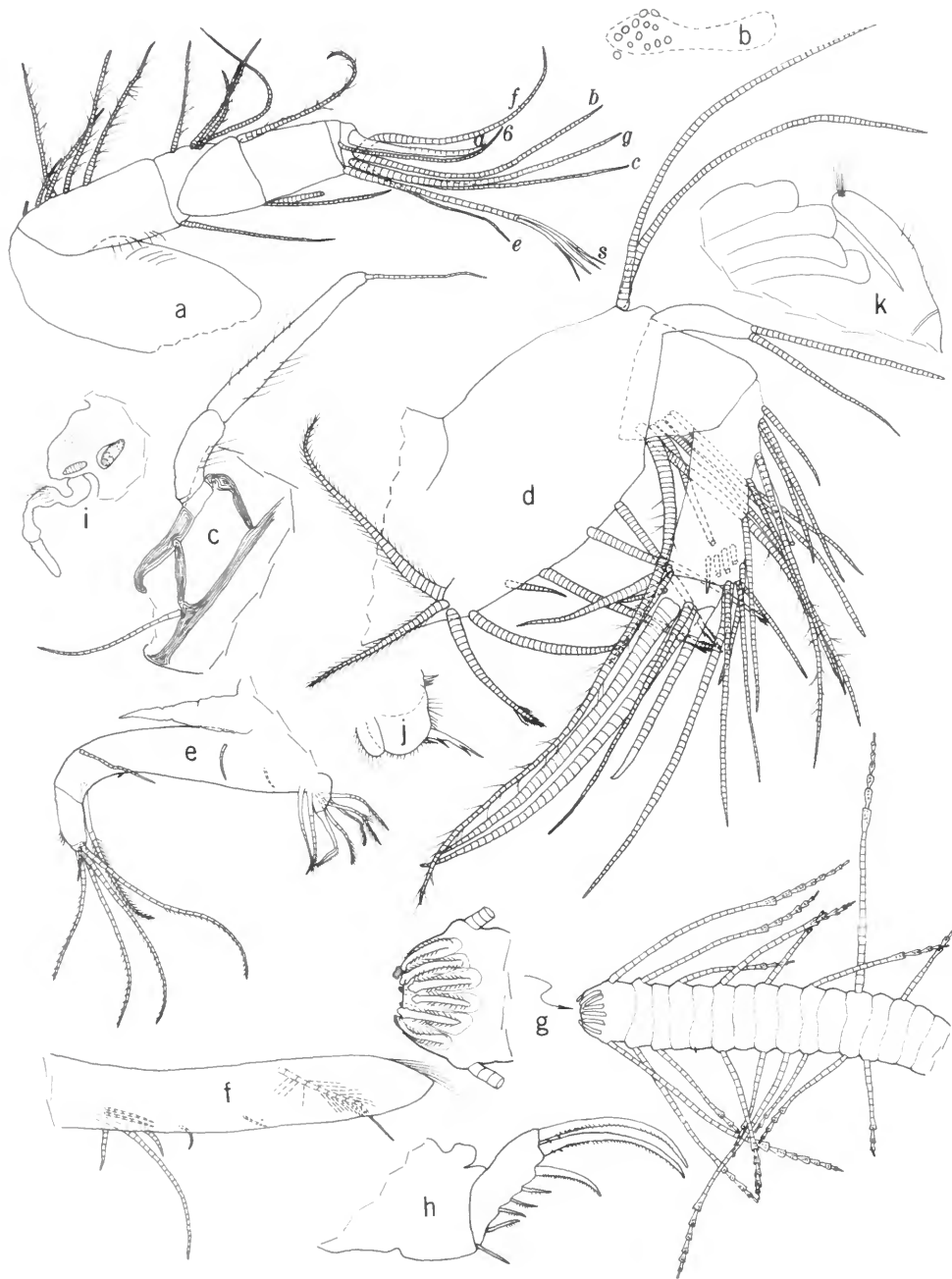


FIGURE 120.—*Asteropella kaufmani*, new species, variety A, adult female, holotype, USNM 156934: *a*, left 1st antenna, medial view; *b*, central adductor muscle attachments and midridge of left valve, anterior to left, lateral view; *c*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *d*, right mandible (coxale not shown), lateral view; *e*, right maxilla, medial view; *f*, comb of left 5th limb, medial view; *g*, 7th limb; *h*, right lamella of furca, lateral view; *i*, left lateral eye, medial eye, and rod-shaped organ; *j*, upper lip, anterior to right; *k*, posterior of body.

Maxilla (Figure 120e): Similar to that of *A. slatteryi*.

Fifth Limb (Figure 120f): Similar to that of *A. slatteryi*.

Sixth Limb: Lateral flap of USNM 156934 with 11–12 bristles, limb otherwise similar to that of *A. slatteryi* (Figure 116c).

Seventh Limb (Figure 120g): Each limb with 15–19 bristles, 8 to 10 on each side; each bristle with up to 7 bells; some segments with 2 bristles, 1 on each side; terminus with 10 or 11 recurved spinous teeth.

Furca (Figure 120h): Each lamella with 8 claws; claws 1–3 primary with lateral and medial row of teeth along posterior margins, proximal teeth longer than distal teeth; claw 3 about half length of claw 2; claws 4–7 with few spines along posterior margins; claw 8 with base set back from ventral margin, bristlelike.

Rod-shaped Organ (Figure 120i): Elongate with rounded tip and distal suture; spines present on proximal part.

Eyes (Figure 120i): Medial eye bare, pigmented. Lateral eye small, pigmented, with 3, possibly 4, ommatidia.

Upper Lip (Figure 120j): Consisting of 2 hirsute lobes with 1 long anterior process having 2 or 3 marginal spines; a short spine present near base of long process; 3 small anterior spines present on saddle between lobes.

Posterior of Body, Gills (Figure 120k): With elongate dorsal process with long spines at tip and hairs proximally and well-developed gills.

Y-Sclerite: Similar to that of *A. slatteryi*.

Eggs: USNM 156934 with about 5 large unextruded eggs; USNM 157151 with 3 eggs in marsupium; USNM 157154 with 1 large egg in marsupium and small unextruded eggs.

Parasites: USNM 156934 with female choniosomatid copepod in marsupium.

DESCRIPTION OF ADULT MALE (variety A) (Figures 121, 122).—Shape and ornamentation similar to that of adult female, but carapace smaller (Figure 121a).

Size: USNM 157155, length 0.96 mm, height 0.71 mm.

First Antenna (Figure 121b,c): Lateral and me-

dial surfaces of 1st joint hirsute. 2nd joint: dorsal margin with few proximal hairs and 4 spinous bristles; ventral margin with long hairs. 3rd joint triangular with 1 spinous midbristle and 3 spinous subterminal bristles on dorsal margin, and 1 long spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle. 4th joint with 2 spinous terminal bristles (1 ventral, 1 dorsal). 5th joint triangular with short ventral margin; sensory bristle with about 16 long filaments on stout proximal part; stem of sensory bristle distal to stout proximal part dividing into 2 branches, each with 2 terminal filaments. Long 6th joint with fairly long medial bristle (broken off on illustrated limb, Figure 121b). 7th joint: a-bristle clawlike, about same length as combined joints 5–8; b-bristle about same length as sensory bristle of 5th joint, with 3 short proximal filaments and bifurcate tip; c-bristle slightly longer than sensory bristle, with 3 proximal filaments and bifurcate tip. 8th joint: d-bristle represented by minute papilla; e-bristle bare, slender, about same length as a-bristle; f-bristle about same length as b-bristle, with 3 proximal filaments and bifurcate tip; g-bristle about same length as c-bristle, with 3 proximal filaments and bifurcate tip.

Second Antenna (Figure 121d): Protopodite similar to that of adult female. Endopodite 3-jointed: 1st joint elongate, bare; 2nd joint elongate with 1 small, faint, distal bristle; 3rd joint short, reflexed on 2nd, with 1 proximal bristle. Exopodite similar to that of adult female, except only 2 bristles on 9th joint (the longer bristle with few, slender, ventral spines in addition to natatory hairs).

Mandible (Figure 121e,f): Coxale endite broken off specimen examined, but minute bristle present near base of ventral branch. Basale: endite with 1 long end-type bristle, 3 triaenid bristles (1 pair of teeth on triaenid bristles longer than others), and 1 dwarf bristle; ventral margin of basale with 2 triaenid bristles; dorsal margin of basale with 2 subterminal bristles. Exopodite hirsute, about three-fourths length of dorsal margin of 1st endopodial joint, with 2 terminal bristles. Endopodite: 1st joint with 5 ventral bristles; 2nd joint with 14 bristles along dorsal margin (including some

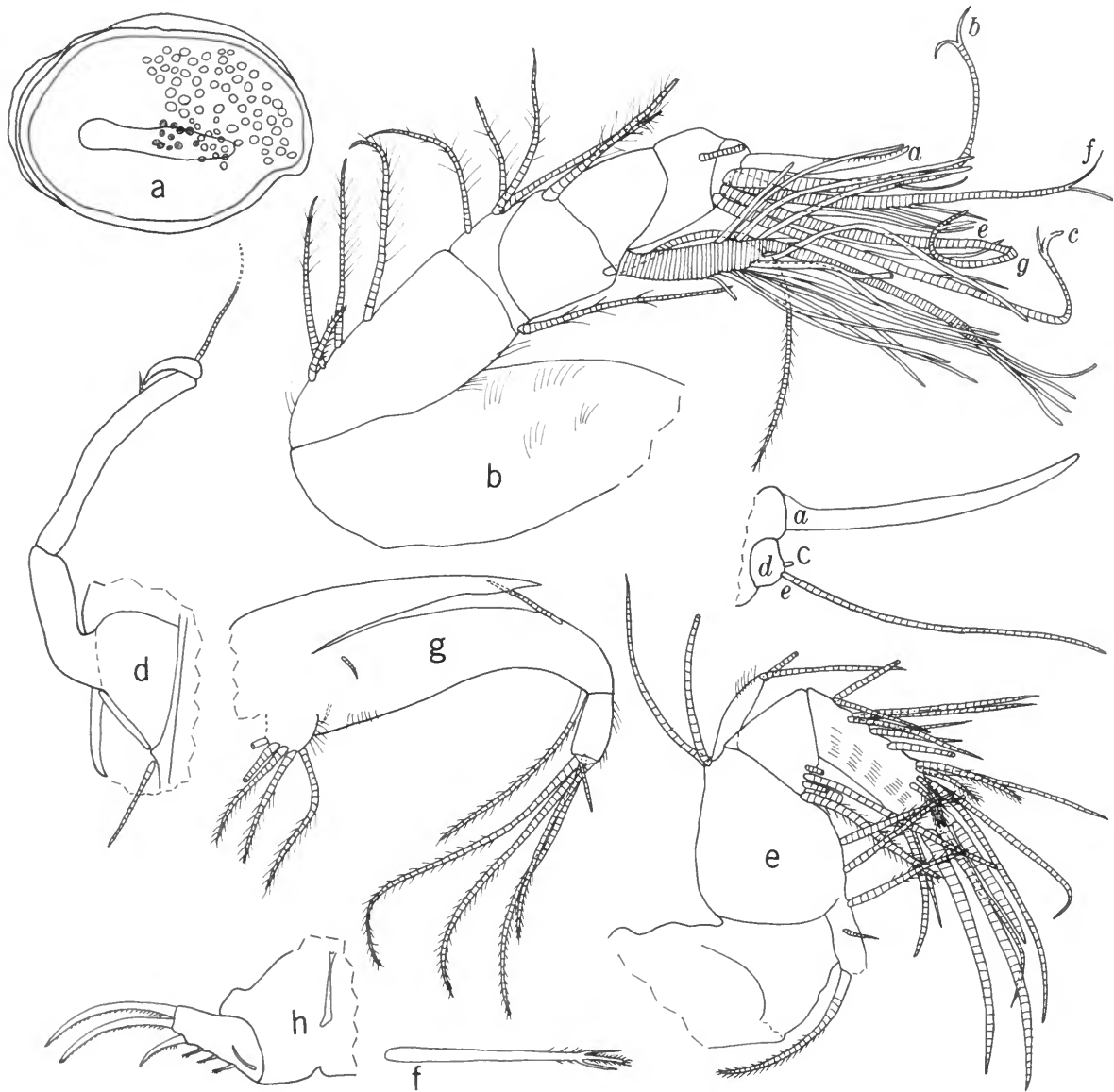


FIGURE 121.—*Asteropella kaufmani*, new species, variety A, adult male, allotype, USNM 157155: a, complete specimen showing position of central adductor muscle attachments (stippled circles near middle of midridge) and some fossae, length 0.96 mm; b, left 1st antenna, medial view; c, 7th and 8th joints of right 1st antenna showing a-claw and d- and e-bristles, lateral view; d, endopodite and distal bristle of protopodite of left 2nd antenna, medial view; e, left mandible (coxale endite and some bristles of basale endite not shown), medial view; f, triaenid bristle on ventral margin of basale of left mandible; g, left maxilla, medial view; h, left lamella of furca and left Y-sclerite.

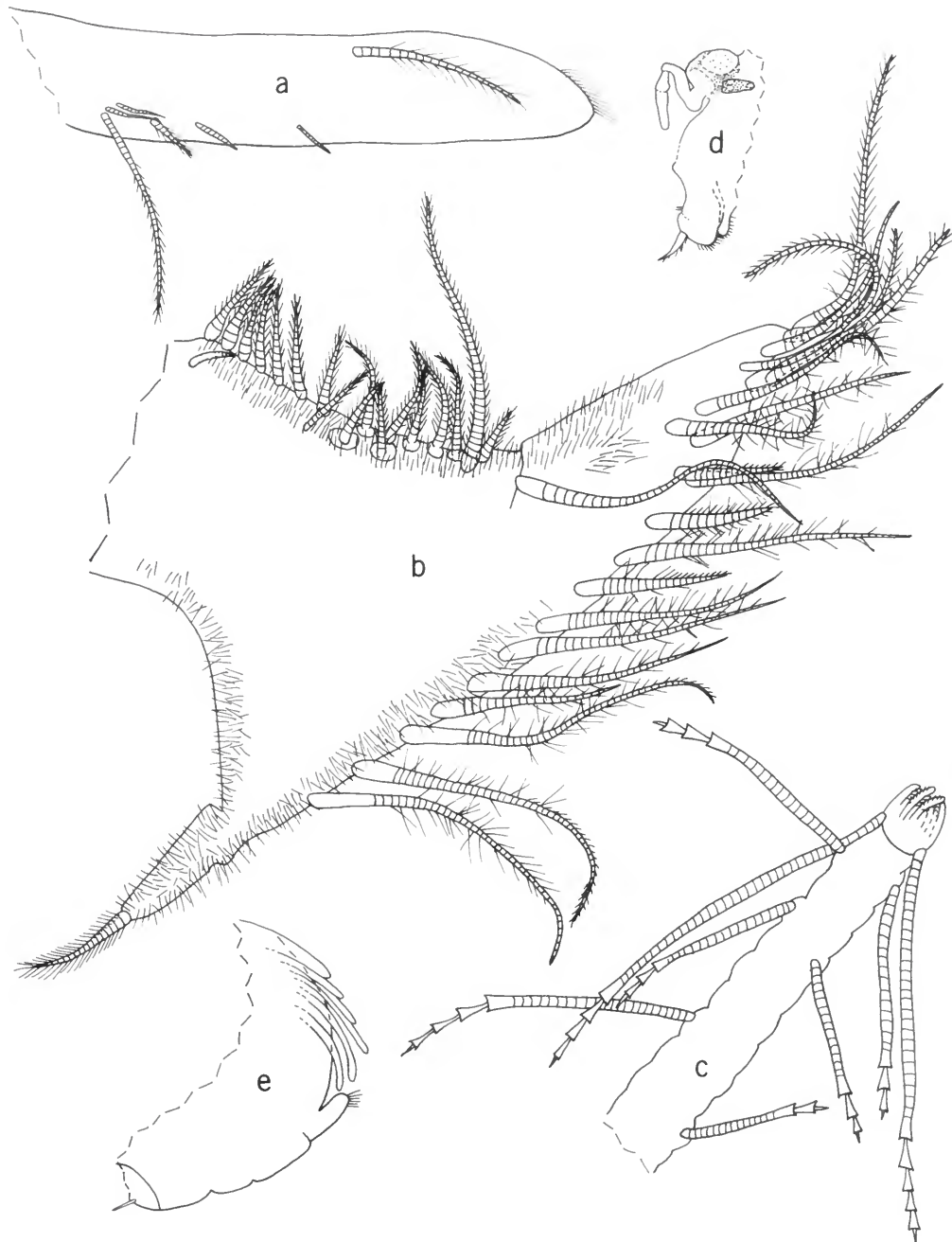


FIGURE 122.—*Asteropella kaufmani*, new species, variety A, adult male, allotype, USNM 157155: *a*, comb of right 5th limb, lateral view; *b*, left 6th limb, medial view; *c*, 7th limb; *d*, anterior showing left lateral eye, medial eye, rod-shaped organ, and upper lip; *e*, posterior of body showing posterior process, some gill-like structures, and posterior bristle of left lamella of furca.

on medial surface near dorsal margin), 2 terminal bristles on ventral margin, and spines forming rows on medial surface; end joint with 3 claws, 1 short ventral bristle, and 1 long lateral bristle.

Maxilla (Figure 121g): Epipodial appendage long, narrow, pointed, reaching past middle of dorsal margin of basale. Endites with total of about 5 stout bristles. Basale with 1 small proximal bristle on lateral side, 1 short, proximal, medial bristle near dorsal margin, 1 fairly long distal bristle on dorsal margin, and 1 long, terminal, spinous bristle on ventral margin. Endopodite: 1st joint spinous, with 1 long spinous beta-bristle; 2nd joint with 1 short and 3 long bristles. Exopodite absent.

Fifth Limb (Figure 122a): Comb with long hairs along anterior margin; lateral side of comb with 7 bristles (2 long, 5 short); 2 or 3 additional bristles with bases on lateral side present very close to ventral margin (not shown in illustrated comb).

Sixth Limb (Figure 122b): Anterior margin with single suture separating trunk from skirt; anterodorsal corner of trunk with small medial bristle; medial surface near anterior margin with bristles forming 2 rows, outer row with 14 short bristles, inner row with 3 short bristles near middle of trunk and 2 longer distal bristles near suture; skirt with total of about 21 bristles in addition to hirsute bristle at posterior tip; epipodial bristles absent.

Seventh Limb (Figure 122c): Each limb with 8 bristles, 4 on each side; each bristle with 2–5 bells; terminus with about 6 recurved spinous teeth.

Furca (Figure 121h): Each lamella with 1 less secondary claw than on adult female, otherwise similar.

Rod-shaped Organ (Figure 122d): Elongate, broadening in middle near suture, tapering to rounded tip.

Eyes, Upper Lip (Figure 122d), **Posterior of Body** (Figure 122e), **Y-Sclerite** (Figure 121h): Similar to those of adult female.

VARIETY B (Figure 123, Plates 108, 109).—Several specimens listed above as nontypes differed from typical specimens in having the anterior end of midridge on the carapace intersecting, or al-

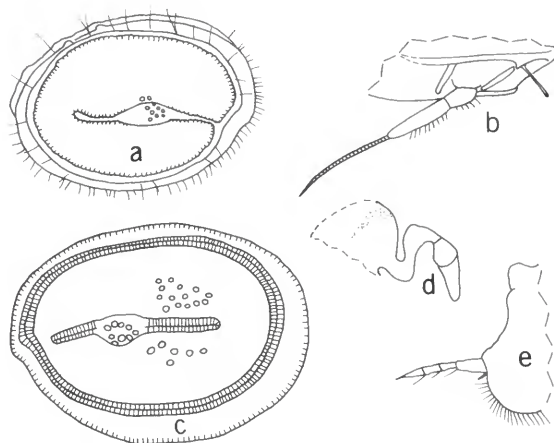


FIGURE 123.—*Asteropella kaufmani*, new species, variety B, juvenile female in process of molting, USNM 157152: *a*, complete specimen showing position of central adductor muscle attachments, length 0.91 mm, height 0.65 mm; *b*, endopodite and distal part of protopodite of left 2nd antenna, medial view. Ovigerous female, USNM 157202: *c*, complete specimen showing position of central adductor muscle attachments (circles near middle of midridge) and some fossae, length 1.32 mm; *d*, medial eye and rod-shaped organ; *e*, upper lip (lateral flap not shown).

most intersecting, the inner concentric ridge (Figure 123*a,c*, Plate 108*a,c,f*); also, the midridge and inner concentric ridge is more reticulate on the variety than on the typical specimens (Plate 108*c-f*). The appendages of an ovigerous female (USNM 157202) with 9 eggs were examined and found to be similar to that of typical specimens, except for the 7th limbs having only 10 or 11 bristles. The measurements of the carapace of USNM 157202 are length 1.32 mm, height 0.96 mm, which are similar to measurements of typical specimens. These specimens were retained in the species *A. kaufmani* because the surface of the carapaces have stellate ornamentation covering fossae similar to that on typical forms (Plate 109*a,b*). Typical specimens have been designated “variety A” and others “variety B.”

COMPARISONS.—No previously described species of *Asteropella* bears stellate ornamentation covering round fossae of the carapace. The carapace of the typical form of the adult female of

the new species, *A. kaufmani*, differs from that of both *A. scammonensis* and *A. slatteryi* in that the anterior end of the horizontal midrib does not intersect the inner concentric ridge. The 7th limb of *A. kaufmani* has about half the number of bristles present on the 7th limb of *A. slatteryi*. The endopodite of the 2nd antenna of the female *A. kaufmani* differs from that of most females of *A. trithrix* in not having any bristles on the 2nd joint. The carapace of the adult female of *A. kaufmani* is smaller than that of *A. trithrix* and *A. slatteryi*. The ventral margin of the basale of the adult female of *A. kaufmani* bears 2 triaenid bristles compared to 3 or 4 on *A. slatteryi*. Some appendages of *A. kaufmani* are compared with those of 3 other eastern Pacific species in Table 24.

38. *Asteropella* species A, Kornicker, 1975

Asteropella species A, Kornicker, 1975a:559, figs. 344-346.

MATERIAL.—None examined.

DISTRIBUTION (Figure 90).—Continental shelf off Argentina, 44-57 m.

REMARKS.—This species is known only from the carapace of a single specimen, USNM 134809.

DIAGNOSIS.—Inner concentric ridge evenly rounded in posterodorsal corner; horizontal midrib not intersecting inner concentric ridge.

Size: USNM 134809, length 1.78 mm.

39. *Asteropella* species 1

MATERIAL.—Texas continental shelf: station 4, transect III, 3 specimens; station 4, transect IV, 1 specimen. Material received from and returned to Richard D. Kalke (see Station Data).

DISTRIBUTION (Figure 90).—Continental shelf off south Texas, depth 15 m.

DIAGNOSIS.—Each valve with broad, continuous, inner concentric flange without posterodorsal indentation; anterior end of horizontal midrib not reaching concentric flange.

COMPARISONS.—Carapace similar to that of *Asteropella* species A (Kornicker, 1975:559) but with shorter midrib.

REMARKS.—I appreciate permission of Richard D. Kalke to mention the species in this monograph. He plans to formally describe this and other Ostracoda collected off South Texas jointly with James H. Baker.

Asteropella species indeterminate

FIGURE 124

MATERIAL.—USNM 157172, 3 juveniles, sta 161-2, Panama; USNM 157171, 2 juveniles, sta 20-2, Panama. Hamburg Zoological Museum 27291, 1 specimen, see discussion below.

DISTRIBUTION (Figure 90).—Sublitoral of El Salvador; Gulf of Panama, 0-1 m depth.

DISCUSSION OF SPECIMEN FROM EL SALVADOR (Figure 124).—Dr. G. Hartmann, Zoological Institute and Zoological Museum, University of

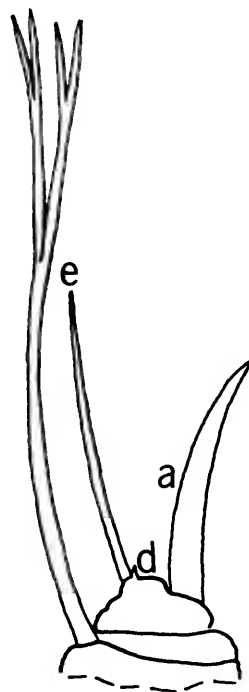


FIGURE 124.—*Asteropella* species indeterminate, Hamburg Zoological Museum 27291, tip of left 1st antenna showing sensory bristle of 5th joint, a-bristle of 7th joint, and d- and e-bristles of 8th joint, lateral view.

Hamburg, kindly forwarded at my request the female larva from the coast of El Salvador that he referred to *Cyclasterope* species (Hartmann, 1959:203, fig. 35 [fig. 33 incorrectly in text]). McKenzie (1965:60) referred that specimen to his new species, *Asteropella scammonensis*. Because of the 3 new species of *Asteropella* reported herein from the east Pacific, I believed it expedient to reexamine Hartmann's specimen. It was received in a vial containing 3 labels: "*Cyclasterope* spec., Salvador, Mej., 1955." "*Cycloleberis* spec., 27291," "27291." The vial contained a left valve (length 0.97 mm, height 0.69 mm), a left and right 1st antenna, a maxilla, and the caudal furca of the specimen, also some podocopid appendages. Details of the valve are difficult to ascertain because of debris and "recrystallization"; therefore, I have referred the specimen herein to *Asteropella* species indeterminate. The posterodorsal edge of the left valve I examined is broken off, otherwise it is as illustrated by Hartmann (fig. 35), except the posterodorsal edge of the inner concentric ridge is slightly flattened, but this could be the result of distortion. The small, posterodorsal, pointed process, just outside the inner concentric ridge in the illustration of Hartmann, is present on the left valve I examined, but I could not be certain that it is not an artifact. The d-bristle of the 1st antenna is represented by a minute spine, the e-bristle is slightly longer than the a-claw, and the sensory bristle of the 5th joint branches distally with the tip of each branch bifurcate (Figure 124).

***Asteropteron* Skogsberg, 1920**

TYPE-SPECIES.—*Asterope fusca* Müller, 1890. In the present revision, this genus is considered to be monotypic, containing only the species *Asteropteron fuscum* (Müller, 1890).

DISTRIBUTION (Figure 125).—Off Japanese coast, 18.3 m.

DIAGNOSIS.—Carapace with peripheral rim and a horizontal rib paralleling both dorsal and ventral margins; incisur well developed.

First Antenna: Female sensory bristle with 3 short marginal filaments and bifurcate tip; male sen-

sory bristle with abundant filaments. 8th joint: d-bristle minute, e-bristle well developed.

Second antenna: Endopodite weakly 3-jointed and without hairs: 1st joint short, bare in both males and females; 2nd joint elongate, bare, or with 1 bristle in adult female, 5–7 bristles in adult male; 3rd joint short with long terminal bristle in adult female, long, reflexed with 1 long proximal filament in adult male.

Mandible: Dorsal margin of basale with 2 stout terminal bristles, but without proximal or mid-bristles (always?). Ventral margin of basale with both triaenid and non-triaenid bristles.

Maxilla: Basale with relatively few bristles. Exopodite of type-species appearing to have only 1 short bristle.

Seventh Limb: Each ring with no more than 2 bristles, 1 on each side; terminus with single set of opposing combs, each with about 12 spinous teeth.

Furca: Each lamella with 3 main claws followed by 5 or 6 secondary claws.

Posterior of Body: Dorsum consisting of long, fingerlike process with spines along tip.

40. *Asteropteron fuscum* (Müller, 1890)

FIGURES 9*m*, 10*i*, 11*h*, 12*f*, 13*e*, 14*g*, 15*d*, 16*g*, 125–130;
PLATES 110–112

Asterope fusca Müller, 1890:242, pl. 25: figs. 11–13; pl. 27: figs. 19–22, 25

Cylindroleberis fusca.—Kajiyama, 1912a:22, pl. 2: fig. 8; pl. 10: figs. 1, 2, 9, 10; pl. 11: figs. 3–5, 7–10 [unpublished thesis] .—1912b:617, pl. 9: fig. 31.

Cyclasterope fusca.—Müller, 1912:48 [key], 49.

Asteropteron fuscum.—Skogsberg, 1920:443 [revision].—Poulsen, 1965: 178 [comparison].—Hanai, et al, 1977:81.—Hiruta, 1979:15–30, figs. 1–14.

HOLOTYPE.—None selected. Five syntypes at Berlin Zoological Museum.

TYPE-LOCALITY.—Off the Japanese coast, Enoshima, Fujisawa-shi, Kanagawa Pref.

MATERIAL.—Through the courtesy of Dr. H.-E. Gruner, Zoologisches Museum, Museum für Naturkunde und Der Humboldt-Universität zu Berlin, I received for study a vial containing the label, "Types, Kat. Nr. 6977, Species: *Cyclasterope*

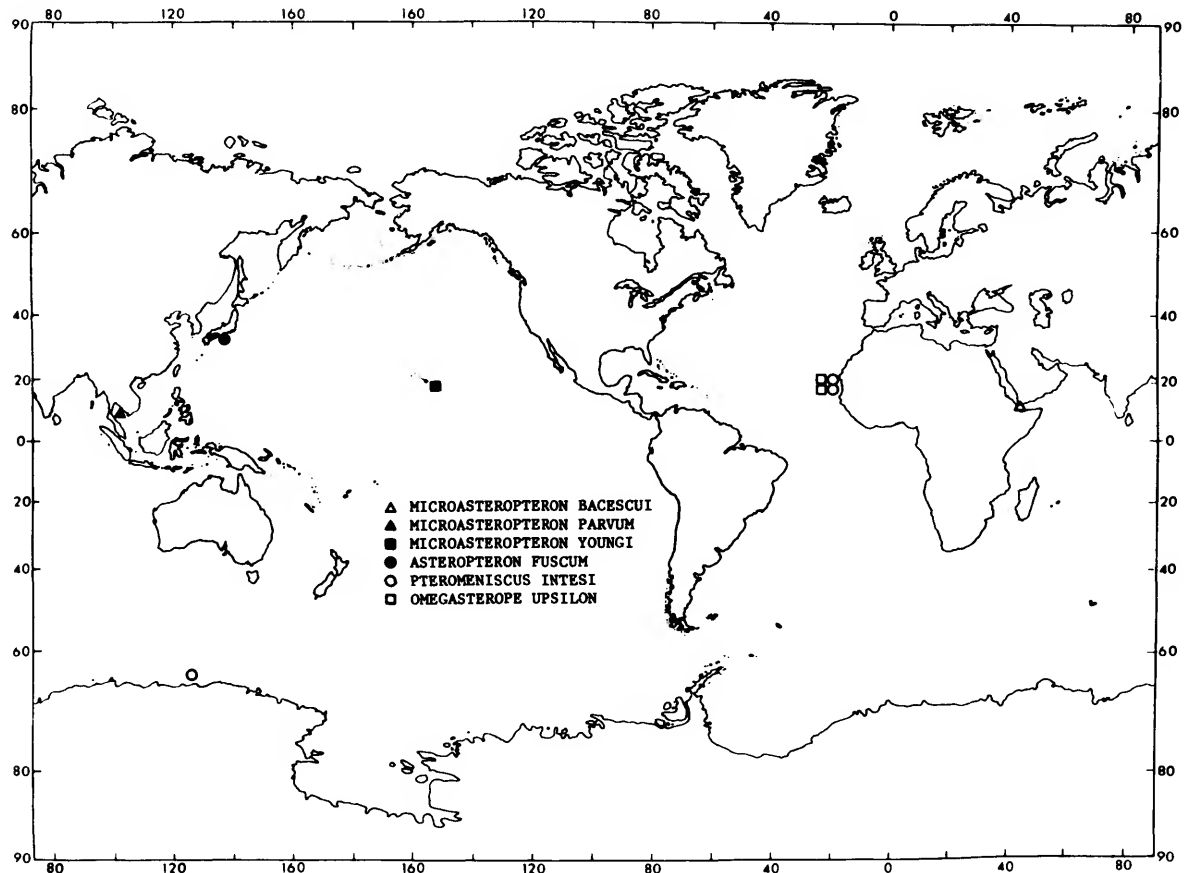


FIGURE 125.—Distribution map of species of *Microasteropteron*, *Asteropteron*, *Pteromeniscus*, and *Omegasterope*.

fusca (G. W. Müller, 1890); Fundort: coast of Japan, Enoshima, Biotop: 10 fathoms; gesammelt von: Hilgendorf; Dat.: 18 Aug. 1873; determiniert von: G. W. Müller” and the following specimens: 1 complete specimen (Figure 126), length 2.50 mm, height 1.85 mm; 1 adult ♀ without left valve (specimen 1 herein), length 2.63 mm, height 1.93 mm; 1 left valve, length 2.70 mm, height 1.96 mm; 1 complete specimen, length 2.05 mm, height 1.47 mm; 1 right valve, length 2.61 mm, height 1.82 mm; 1 left valve (distorted) length about 2.48 mm, height more than 1.74 mm; 1 left valve (posterodorsal corner missing), length 1.75 mm, height 1.39 mm; 1 flattened right valve (probably mate to left valve with posterodorsal

corner missing), length only, about 1.8 mm. The above specimens, which total 5 if separated left and right valves are matched, probably represent the 5 individuals in Müller’s collection (G. W. Müller, 1890:243). Dr. Gruner kindly gave permission for me to dissect a specimen and to prepare a valve for study with the scanning electron microscope. The appendages of the dissected specimen are described herein and the right valve in which it was contained was photographed with the SEM. The specimen is designated “specimen 1” herein and also in the vial and on the slides returned to Berlin.

Through the courtesy of Dr. I. Groth, Ernst-Moritz-Arndt-Universität, Greifswald, I received

for study a bottle sealed with wax bearing the outside label, "Acc. Cat. II, No. 25125, Fam. Cypridinidae, *Cyclasterope fusca* G. W. Müller, Enosima, Japan, Hilgendorf, Mus. Zool. Gryph." The bottle contains a small vial with a left and right valve of *Asteropteron fuscum* and several valves without appendages of other myodocopid genera. I identified *A. fuscum* by examining the valves through the bottle because I did not wish to break the wax seal.

DISTRIBUTION (Figure 125).—Known only from vicinity of Japan: Enoshima, Fujisawa-shi, Kanagawa Pref.; Misaki, Miura-shi, Kanagawa Pref. (Hanai, et al, 1977). The only reported depth is that of the type-locality (Enoshima) at 10 fathoms (18.3 m).

PREVIOUS WORK.—Müller (1890) described a juvenile male and an adult or Adult-1 female. Kajiyama in a dissertation (date unknown, but based on specimens collected in 1910–1911) described both a female and adult male, in detail, but in a publication (1912) described the species only briefly and illustrated only the carapace. It is significant that the adult male described by Kajiyama in his dissertation bears a setiferous sensory bristle on the 5th joint of the 1st antenna (Figure 126a), and a 3-jointed endopodite of the 2nd antenna with the 3rd joint reflexed on the 2nd. Thus, these limbs are similar to many, but not all, species in the family. On the male 2nd antenna, the 1st joint is bare, the 2nd has 5–7 bristles, and the 3rd has 1 proximal bristle (Figure 126b).

Hiruta (1979) redescribed the species but the paper appeared after the present paper had been in press for some time, and I found it expedient to use his excellent paper only in the section on larval development herein.

DESCRIPTION OF ADULT FEMALE (Figures 127–130, Plates 110–112).—Carapace oval in lateral view with distinct rostrum and incisor (Figure 127, Plate 110a); each valve with ventral ridge continuing along posterior margin and then bending anteriorly to form lateral ridge at distance about one-fourth height of valve from dorsal margin; ridges striate (Figure 128d); anterior

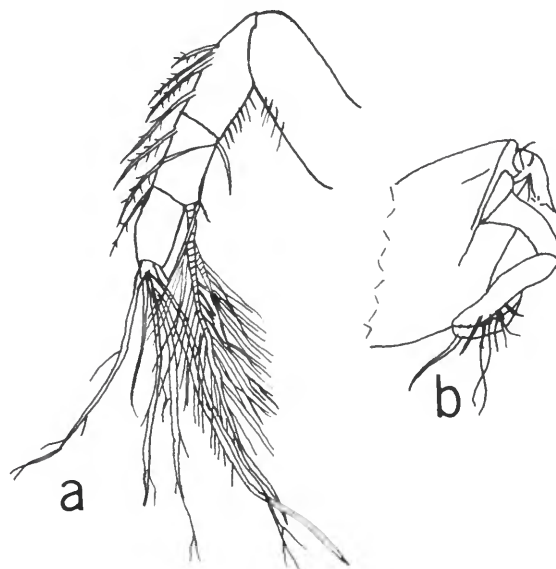


FIGURE 126.—*Asteropteron fuscum* (Müller), tracings of adult male appendages illustrated by Kajiyama (1912a, unpublished dissertation): a, 1st antenna (from plate 11:5); b, endopodite of left 2nd antenna with part of protopodite and exopodite, medial view (from plate 10:2).

end of lateral ridge not quite reaching rostrum; the ridge contains 2 posterior protuberances, one near midheight of valve and other where ridge bends to form lateral ridge; a dorsal ridge extends anteriorly around rostrum and then bends posteriorly to form lateral ridge below central adductor muscle scars; valve widest near posterior end of the ridge below the muscle scars (Plate 110c).

Ornamentation (Plate 111): Surface with fossae consisting of 2 types: type 1 with central ovoid pit surrounded by large reticulations forming several rows (Figure 128c, Plate 111a); type 2 is without surrounding reticulations and forms clusters (Plate 111b); the surface between type 2 fossae smooth but underlain by minute reticulations (Plate 111d). Fossae on ridges similar to those on valve surface between ridges, but type 1 fossae with fewer rows of reticulations surrounding pit (Plate 111e,f). Fossae in vicinity of central adductor muscle attachments with porous walls and papillae at bottom (Plate 111g–i). Valve

margins with numerous bristles (Plates 110*c,d*, 112*b*). (Valve treated for about 10 seconds with sonic vibrator prior to freeze-drying.)

Infold: Narrow along ventral margin and slightly broader along anterior and posterodorsal margins (Plate 112*a*); infold behind rostrum with about 14 bristles forming row paralleling valve margin (Figure 128*a*); anteroventral, ventral, and posterior infold of valve examined obscure, but 3 bristles and pores observed near inner margin of posteroventral infold (Figure 128*b*, Plate 112 *c-f*); valve margins with numerous bristles (Plates 110*c,d*, 112*b*).

Selvage: Wide striate lamellar prolongation without marginal fringe present along anterior, ventral, and posterior margins (Plate 112*a,b*).

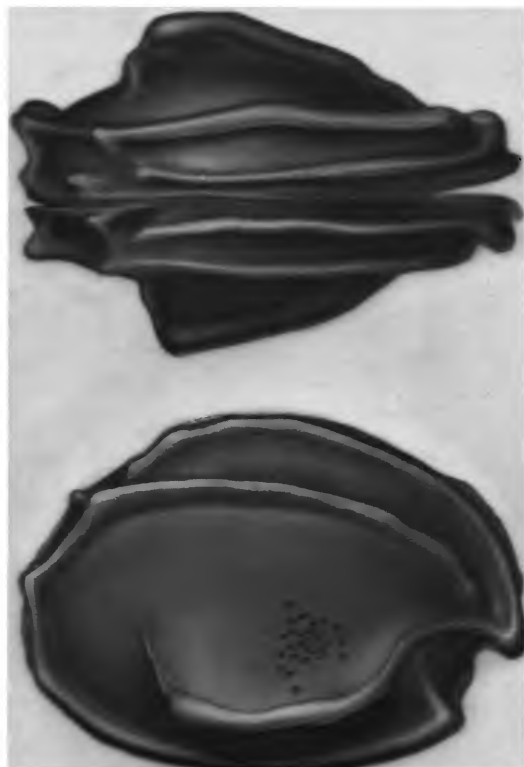


FIGURE 127.—*Asteropteron fuscum* (Müller), undissected specimen, probably adult female, syntype, Zoological Museum, Berlin 6977, all central muscle attachments not shown, length 2.50 mm, lateral and dorsal views.

Central Adductor Muscle Attachments: Consisting of about 28 oval scars just anterior to middle of valve (Figure 127, Plate 110*a,b*).

Size: Right valve of dissected specimen, length 2.63 mm, height 1.93 mm; complete specimen, length 2.50 mm, height 1.85 mm.

First Antenna (Figure 128*e*): 1st joint with long hairs on medial and lateral side near ventral margin; 2nd joint hirsute, with 1 lateral bristle with short marginal spines and 3 dorsal bristles with long proximal and short distal spines; ventral margin of 3rd joint short and with 1 bristle with short marginal spines; dorsal margin of 3rd joint about 5 times length of ventral margin and with 3 bristles (1 near middle, 2 terminal, all with long marginal spines); 4th joint with 2 terminal bristles on ventral margin (1 very short, 1 long), and 1 long terminal bristle on dorsal margin, all with marginal spines; sensory bristle of 5th joint with 3 marginal and 2 terminal filaments, including tip; medial bristle of 6th joint short, just reaching distal end of 8th joint. Seventh joint: a-claw long, bare; b-bristle with 6 filaments including bifurcate tip; c-bristle with 8 filaments, including tip. Eighth joint: d-bristle minute; e-bristle bare, about same length as b-bristle; f-bristle with 7 filaments, including tip; g-bristle with 7 filaments, including bifurcate tip.

Second Antenna (Figure 128*f,g*): Protopodite with short, spinous, distomedial bristle and few hairs along dorsal margin. Endopodite weakly 3-jointed and without hairs: 1st joint bare with well-defined distal suture; 2nd joint elongate with single bristle [this bristle not present on female illustrated by Müller (1890, pl. 27: fig. 19), or by Kajiyama (1912a, pl. 11: fig. 3)] and not separated from 3rd joint by distinct suture; 3rd joint with long terminal bristle. Exopodite: 1st joint with short medial spine on distal margin: distal margin of medial side of joints 3–5 and 9 with few short spines, basal spines absent; bristles of joints 2–8 and the 3 bristles of 9th joint with natatory hairs but without spines.

Mandible (Figure 129*a*): Coxale endite: ventral branch with 2 proximal rows of fine spines and 5 oblique rows of stouter spines; tip of branch with



FIGURE 128.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum, Berlin, 6977 (specimen 1): *a*, inside view of rostrum; *b*, inside view of posteroventral margin showing bristles on infold; *c*, detail of surface structures; *d*, structure of dorsal ridge of right valve as viewed with transmitted light, medial view, anterior towards left; *e*, left 1st antenna, lateral view; *f*, left 2nd antenna, medial view; *g*, endopodite of right 2nd antenna, medial view.

3 small teeth, dorsal of these with few minute spines; minute bristle present on endite near base of ventral branch; ventral margin of dorsal branch with 4 minute spines forming row fol-

lowed by 4 or 5 rounded teeth between main spine and tip of ventral branch; main spine with spines along posterior margin; hirsute bristle of dorsal branch with base slightly proximal and



FIGURE 129.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum, Berlin, 6977 (specimen 1): *a*, left mandible, medial view; *b*, left maxilla (endites displaced), medial view; *c*, comb and distal part of epipodial appendage of left 5th limb, lateral view; *d*, 6th limb.

dorsal to tip of branch; margin of dorsal branch between tip and main spine serrate; serrations also present on dorsal margin of branch opposite rounded teeth on ventral margin. Basale: endite with 6 end bristles with pairs of equal length spines, 5 triaenid bristles, and 1 dwarf bristle; paired spines on triaenid bristles increase and then decrease in length distally but no pair extremely longer than adjacent pair; ventral margin of basale with 4 triaenid bristles and 1 long, spinous, subterminal bristle; dorsal margin with 2 long, spinous, terminal bristles; medial surface with long hairs forming clusters near middle. Exopodite hirsute, just reaching distal margin of 1st endopodite joint, with 2 spinous subterminal bristles, proximal bristle longer than distal bristle. Endopodite: ventral margin of 1st joint with 4 slender and 2 stout spinous bristles; 2nd joint with 2 long subterminal bristles on ventral margin and about 21 bristles along dorsal margin, most with bases on medial side; end joint with 2 short bristles on ventral corner, 1 long lateral bristle, and 3 long clawlike bristles.

Maxilla (Figure 129b): Epipodite long, tapering to point with short spines; endite I with 1 short bristle and 5 stout bristles with long spines near tip and shorter spines proximally; endite II with 1 stout bristle with long spines. Basale: proximal dorsal margin obscure, distal dorsal margin with 1 or 2 short bristles; ventral margin with 1 short lateral bristle located proximally, 1 short distal bristle, and 2 terminal bristles (1 long lateral, 1 medium medial). Exopodite with 1 short bristle. Endopodite: 1st joint spinous with 1 short dorsal bristle and long spinous beta-bristle; end joint with 5 spinous bristles.

Fifth Limb (Figure 129c): Epipodial appendage with about 67 bristles. Dorsal margin of comb slightly convex distally and with long hairs on terminal end; lateral surface with long hairs and 3 minute bristles near middle of dorsal margin; lateral surface near ventral margin with stout exopodial bristle reaching just past end of comb and proximal to its base 8 bristles (1 long slender, 1 medium, 6 short).

Sixth Limb (Figure 129d): Anterior margin with

2 sutures: margin above upper suture short, spinous with about 8 bristles; medial surface above upper suture, just inward from anterior margin, with about 8 short spinous bristles; anterior margin between sutures bare; medial surface between sutures with 6 spinous bristles; anterior margin and medial surface below lower suture without bristles; lateral anteroventral flap with about 7 bristles; ventral margin and medial surface near ventral margin with about 29 bristles; limb hirsute.

Seventh Limb (Figure 130a): Each limb with 33–35 bristles, 14 to 21 on each side; most rings with 2 bristles, 1 on each side; each bristle with up to 6 bells; Terminus: each opposing comb with about 12 spinous teeth.

Furca (Figure 130b,c): Each lamella with 3 long main claws followed by 5 or 6 secondary claws; main claws with medial and lateral teeth along concave margin and hairs along convex margin; secondary claws with slender spines or hairs along margins.

Rod-shaped Organ (Figure 130d): Elongate, indistinctly segmented or wrinkled near middle, tip rounded.

Eyes: Medial eye bare, not pigmented in preserved specimens (Figure 130d); lateral eyes not observed.

Posterior of Body (Figure 130f): Posterior hirsute; dorsal process long, fingerlike, spinous.

Upper Lip (Figure 130e): Lip consisting of hirsute lobe on each side of low saddle; each lobe with 2 small anteroventral spines; a hirsute flap present on each side of mouth.

Genitalia (Figure 130g): Consisting of sclerotized ring on each side of body anterior to furca.

Y-Sclerite (Figure 130h): Anterior part slightly concave upward and without ventral branch.

Gill-Like Structures: Well developed.

Asteropterygion, new genus

TYPE-SPECIES.—*Asteropterygion thomassini*, new species.

ETYMOLOGY.—The generic name derived in part from the Greek *pterygion* (“fin”) in reference

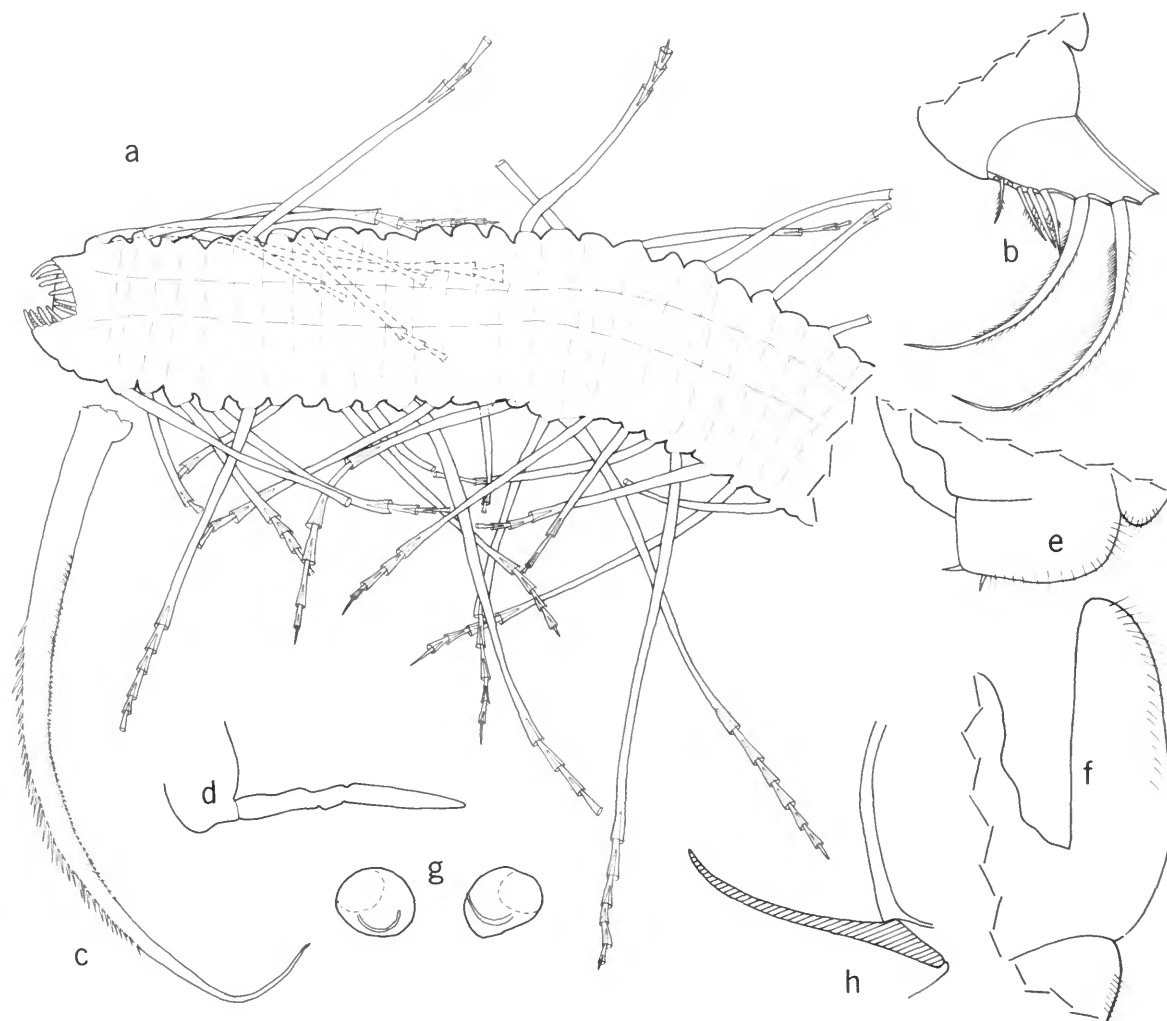


FIGURE 130.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum, Berlin, 6977 (specimen 1): *a*, 7th limb; *b*, right lamella of furca (claw 1 broken off), lateral view; *c*, claw 1 of right lamella of furca, medial view; *d*, medial eye and rod-shaped organ; *e*, upper lip, anterior to left; *f*, posterior process of body; *g*, left and right genitalia; *h*, left Y-sclerite (lined pattern), anterior to left.

to the lateral processes on the carapace of species of this genus. Gender neuter.

DISTRIBUTION (Figure 131).—Worldwide between about 34°N and 41°S at depths of 0–100 m (1100? m).

DIAGNOSIS.—Carapace with nodes, ridges, and shallow oval fossae; anterior with distinct but usually relatively small incisur.

First Antenna: Sensory bristle of 5th joint of female with 1–5 short proximal filaments and 4 to 6 or 7 long distal filaments, including stem. *d*- and *e*-bristles of 8th joint well developed. Sensory bristle of 5th joint of male generally with abundant filaments, but that of *A. oculitristis* same as on female.

Second Antenna: Protopodite with medial distal

bristle. Female endopodite 3-jointed, elongate: 1st joint short with 0–15 short bristles; 2nd joint elongate, bare; 3rd joint short, on some species not well defined and fused with 2nd joint, with 1 bristle.

Mandible: Basale dorsal margin with 2–13 bristles in addition to terminal pair; ventral margin with 2 or more triaenid bristles and 1 or more not of triaenid type.

Maxilla: Basale with numerous bristles; small exopodite with 1–3 bristles.

Fifth Limb: Dorsal margin of comb of both sexes evenly rounded without processes. Usually with minute bristles on or near dorsal margin.

Sixth Limb: With 0–4 epipodial bristles.

Seventh Limb: Each ring with 2 bristles, 1 on each side. Terminus consisting of single set of opposing combs, each with 12–25 teeth of various types (fewer in juveniles).

Furca: Each lamella with 3 (rarely 4 or 5) main claws followed by 3–10 secondary bristlelike claws.

Lateral Eye: Absent on some species, well developed with numerous ommatidia on others.

Posterior of Body: With elongate dorsal process having hirsute tip.

COMPARISONS.—The 1st antenna of the female species of *Asteropterygion* differs from that of *Asteropteron* in having a sensory bristle with 4–7 long distal filaments instead of only short filaments, and in having a well-developed d-bristle instead of a minute one. The endopodite of the female of *Asteropteron* is quite short relative to the exopodite, compared to the endopodites of species of *Asteropterygion*. The carapace of the only known species of *Asteropteron*, *A. fuscum*, has narrow, well-defined ribs, and smooth areas between the ribs, whereas the carapace of species of *Asteropterygion* have broader, generally, less well-defined ribs, and undulating areas with many fossae between ribs.

GROUPS.—The genus *Asteropterygion* is divisible into 2 groups on the basis of the morphology of the a-bristle of the 7th joint of the 1st antenna: the *A. thomassini* group and the *A. dayi* group.

The a-bristle on members of the *A. thomassini* group is distinctly clawlike, usually with a blunt tip recurved dorsally. The a-bristle on members of the *A. dayi* group is clawlike (unringed) proxi-

mally, but distally it is bristle-like, (strongly ringed, and tapering gradually to a pointed tip); it is generally relatively longer and straighter than the a-bristle of the *A. thomassini* group.

The absence of information concerning the 1st antenna of *Asteropterygion liguriae* (Granata, 1915) does not permit its referral to either of the above groups. The species has not been included in keys to the species in each group.

41. *Asteropterygion liguriae* (Granata, 1915), new combination

Cyclasterope liguriae Granata, 1915:30, fig. 5.—Skogsberg, 1920:443 [Skogsberg considered it possible that the species should be included in *Asteropteron*.]—Poulsen, 1965:175.

Asteropteron liguriae.—Poulsen, 1965:178.

Asteropella (?) *liguriae*.—Poulsen, 1965:217 [map].

HOLOTYPE.—Female, unique specimen, probably not extant.

TYPE-LOCALITY.—In bay of Thursday Island, Torres Strait, 10°35'08"S, 142°13'14"E, collected at 4 m depth, but bottom depth unknown (see "Remarks" below).

MATERIAL.—None examined. I wrote to the Istituto di Zoologia Dell'Universita, Firenze, Italy, concerning the whereabouts of Granata's material and was informed that the locality is not known. It may be presumed that they are not extant.

DISTRIBUTION (Figure 131).—Known only from type-locality.

REMARKS.—The carapace of this species, according to the drawing by Granata (1915, fig. 5), resembles that of *Asteropterygion magnum* (Poulsen, 1965), and it is possible that the 2 species are conspecific. Until *A. liguriae* is again collected in the Torres Strait area and more completely described, its relationship to *A. magnum* will remain in doubt. Poulsen (1965, fig. 73) erroneously located *A. liguriae* in the Mediterranean on the distribution map of species of *Asteropteron*, *Microasteropteron*, and *Asteropella*. In the legend to the map (p. 217) Poulsen mistakenly referred the species to *Asteropella*.

Granata (1915:26) states that the specimen was collected in a plankton net while daytime fishing to a depth of 4 meters, but does not give the bottom depth in the sampling area. When the

station is plotted on a map at the latitude and longitude given for the station position, a depth of about 13 m is obtained, but the position is close to land, and it is possible that the depth is actually less at the sampling locality. I am inclined to believe that the specimen was collected at, or very close to, the bottom, because the genus has not previously been collected in plankton nets far above the bottom.

Asteropterygion thomassini Group

COMPOSITION AND DISTRIBUTION.—The species of the *Asteropterygion thomassini* Group and their distribution are as follows: *A. thomassini*, new species, Madagascar; *A. spinosum* (Poulsen, 1965), off Mombasa, Kenya; *A. thailandicum* (Poulsen, 1965), off Thailand; *A. nodulosum* (Poulsen, 1965), off South Africa; *A. skogsbergi* (Poulsen, 1965), off Mombasa, Kenya, and Mtwara, Tanzania; *A. oculitristis* (Darby, 1965), Atlantic Ocean from

Georgia to Florida, Pacific Ocean in vicinity of Baja California, and Panama, Gulf of Mexico in vicinity of Florida and south Texas; *A. hulingsi* (Kornicker, 1975a), off Argentina; *A. setiferum* (Kornicker and Caraion, 1974), off Mauritania and Ivory Coast; *A. aff. setiferum*, south of Luanda, Angola, in shallow water; *A. romei*, new species, off Tanzania and Kenya.

Species of this group have been collected at intertidal depths and also as deep as 80 m. The type-locality of *Asteropterygion setiferum* is listed as 1100 m (Kornicker and Caraion, 1974:66), but in view of the many shallower records of that species, and the generally shallower depths (shelf depths) at which members of the genus are collected, I am inclined to consider the 1100 m record to be atypical, or possibly the result of error.

DIAGNOSIS.—The a-bristle of 1st antenna distinctly clawlike, usually with blunt tip recurved dorsally.

Key to Species in the *Asteropterygion thomassini* Group

- 1. Surface of valve with numerous minute curved spines . . . 49. ***A. spinosum***
 Surface of valve without curved spines 2
- 2. Surface of valve with rimmed fossae so abundant that rims of adjacent fossae touch each other 43. ***A. nodulosum***
 Fossae on valves without rims and generally not touching each other . . . 3
- 3. Sensory bristle of 5th joint of 1st antenna of females and juvenile males with 6 or 7 long terminal and subterminal filaments 42. ***A. thailandicum***
 Sensory bristle of 5th joint of 1st antenna of females and juvenile males with 4 or 5 long terminal and subterminal filaments 4
- 4. Many fossae on valves containing minute pustules 5
 No fossae or very few fossae on valves containing minute pustules 7
- 5. Some fossae on valves containing inwardly pointing papillae 51. ***A. romei***, new species
 No fossae on valves containing papillae 6
- 6. Each valve with prominent horizontal midrib 50. ***A. thomassini***, new species
 Each valve without prominent horizontal midrib 48. ***A. skogsbergi***
- 7. Posterodorsal margin of valve usually sharply truncate. 47. ***A. oculitristis***
 Posterodorsal margin of valve rounded 8
- 8. 2nd joint of 1st antenna with 1 lateral bristle 46. ***A. hulingsi***
 2nd joint of 1st antenna without lateral bristles 44. ***A. setiferum****

* It is possible that specimens of 45. *Asteropterygion* aff. *A. setiferum* (Kornicker and Caraion, 1974), new combination, are varieties of *A. setiferum* (see page 286).

42. *Asteropterygion thailandicum* (Poulsen, 1965), new combination

FIGURE 9f

Asteropteron thailandicum Poulsen, 1965:193, figs. 64–66, table 13.

HOLOTYPE.—Juvenile male, length 1.7 mm.

TYPE-LOCALITY.—Thailand, Koh Kam, 18 m.

MATERIAL.—None.

DISTRIBUTION (Figure 13f).—Southeast coast of Thailand, 10–30 m.

DIAGNOSIS.—Outer edge of posterior list of infold with only short bristles.

First Antenna: Sensory bristle of 5th joint with 6–7 long terminal filaments.

Second Antenna: Exopodite without basal spines.

Furca: Each lamella with 3 main claws followed by secondary claws.

Lateral Eyes: Not observed.

43. *Asteropterygion nodulosum* (Poulsen, 1965), new combination

FIGURES 13b, 13c

Asteropteron nodulosum Poulsen, 1965:201–206, figs. 67, 68, 151.

HOLOTYPE.—Mature male in collection of the University Zoological Museum, Copenhagen, Denmark, unique specimen, length 3.4 mm.

TYPE-LOCALITY.—Galathea station 169, False Bay, Cape of Good Hope, South Africa, water depth 20 m.

DISTRIBUTION (Figure 13f).—Known only from type-locality.

MATERIAL.—Through the courtesy of Dr. Torben Wolff I was able to examine the holotype.

DIAGNOSIS.—The carapace of this species bears very large rimmed fossae (Figure 132a,b); surface of carapace including bottom of fossae appearing smooth, but with minute pustules visible with $\times 20$ objective under transmitted light. Anterodorsal quarter of valve without lateral horizontal ridges. Posterodorsal part of valve with ridges with prominent posterior ends projecting past valve margin. Pustules on surface and within fossae much smaller than those of *Asteropterygion*

thomassini, new species, described herein. The rimmed fossae on the carapace of this species could be concretions, but they are more uniform in size than concretions generally appear.

44. *Asteropterygion setiferum* (Kornicker and Caraion, 1974), new combination

FIGURE 9d

Asteropteron setiferum Kornicker and Caraion, 1974:66, figs. 37–43; 1978:4–6.—Kornicker, 1975b:21, figs. 13–26.

Asteropteron species indeterminate.—Kornicker and Caraion, 1974:75 [questionable].

HOLOTYPE.—Female, number 271 in Museum of Natural History “Grigore Antipa,” Bucharest, Romania.

TYPE-LOCALITY.—Off Mauritania, 1100? m.

MATERIAL.—No new material.

DISTRIBUTION (Figure 13f).—Off Mauritania and Ivory Coast. Depth: 10–80, 1100?.

DIAGNOSIS.—Carapace fairly small, length less than 2.8 mm. Surface with numerous fossae containing numerous elongate, polygonal, tubelike, projecting processes.

Mandible: Dorsal margin of basale with 12 to 39 bristles.

45. *Asteropterygion* aff. *A. setiferum* (Kornicker and Caraion, 1974)

PLATES 113, 114

Asteropteron aff. *nodulosum* Poulsen, 1965.—Hartmann, 1974: 235, figs. 29–31 [part, only specimens from 10 km south of Luanda, Angola].

MATERIAL.—I received from the Hamburg Zoological Museum, through the courtesy of Dr. Gerd Hartmann, a vial with some appendages (K29972), and also a slide with 2 dried carapaces (K29972a) that had been collected 10 km south of Luanda, probe 24.

DISTRIBUTION.—Just south of Luanda, Angola, in shallow water.

REMARKS.—The study of one of the valves (K29972a), using the SEM, revealed that the fossae contain elongate polygonal tubes (Plates 113b, 114) similar to those of *Asteropterygion setiferum* (Kornicker and Caraion, 1974). These have

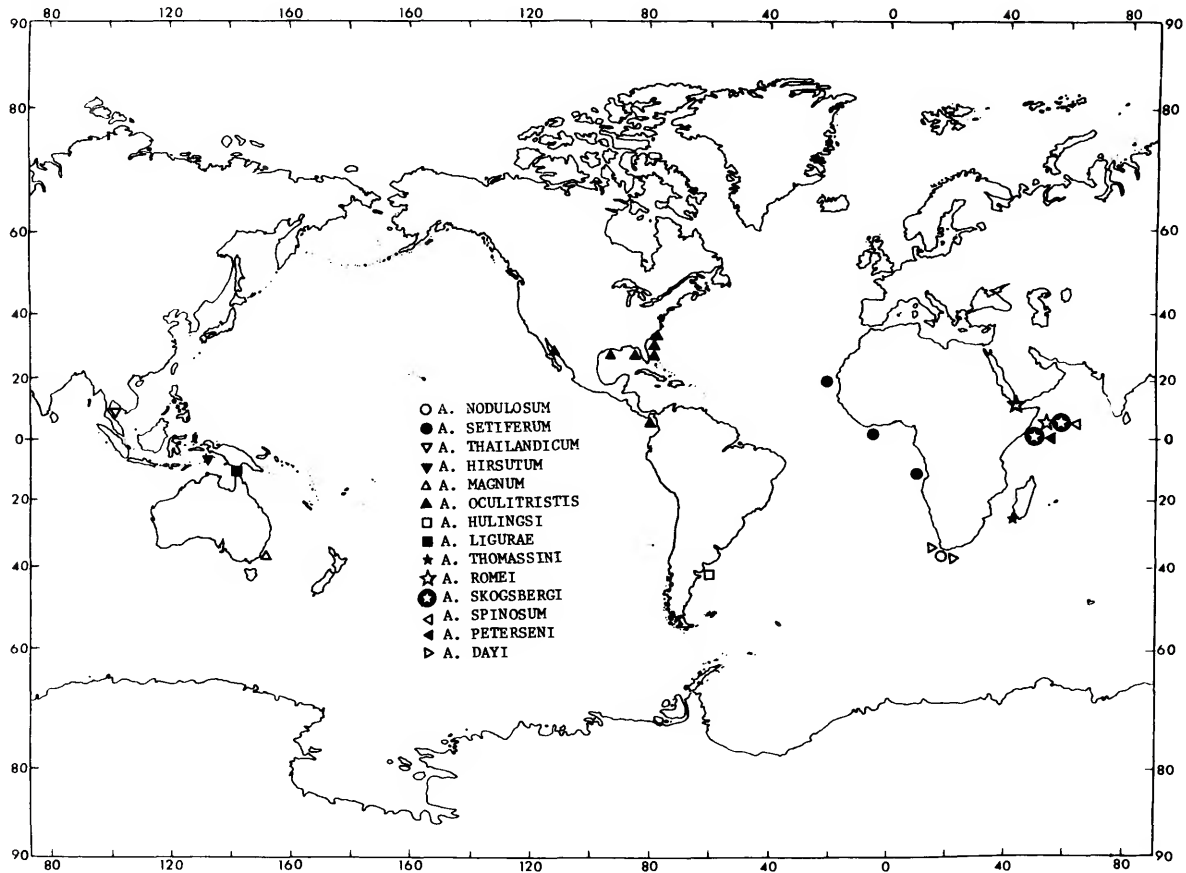


FIGURE 131.—Distribution map of species of *Asteropterygion*.

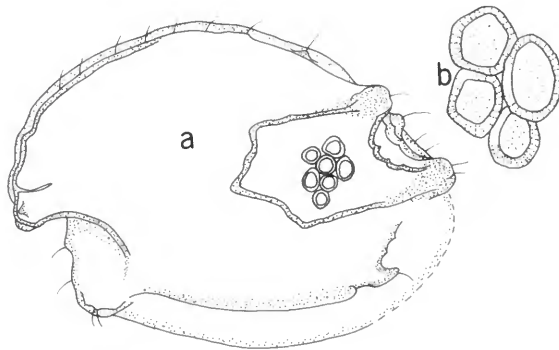


FIGURE 132.—*Asteropterygion nodulosum* (Poulsen) mature male, holotype, Zoological Museum, Copenhagen, Denmark: a, left valve, length 3.4 mm; b, detail of fossae on left valve.

not been observed on *Asteropterygion nodulosum* (Poulsen, 1965). The 2 posterodorsal processes of the Hartmann specimens appear longer than those on *A. setiferum*. Because of these similarities and differences, and because I did not study the appendages, I have referred Hartmann's specimens from south of Luanda to *A. aff. setiferum*. It is possible that the specimens are varieties of *A. setiferum*.

DESCRIPTION (Plates 113, 114).—Carapace similar in shape and ornamentation to that of *A. setiferum* except for having somewhat longer posterodorsal process.

Size of Carapace: Length of right valve examined with SEM (K29972a), 2.18 mm.



FIGURE 133.—*Asteropterygion hulingsi* (Kornicker), female, probably late instar, holotype, USNM 128680: a, left 1st antenna, lateral view; b, coxale endite of right mandible, medial view; c, right mandible (coxale endite broken off, shown in b), medial view.

**46. *Asteropterygion hulingsi* (Kornicker, 1975),
new combination**

FIGURE 9e, 133, 134; PLATES 115-120

Asteropteron new species Kornicker.—Sohn, 1974:725, fig. le,f.
Asteropteron hulingsi Kornicker, 1975a:562, figs. 347-350.

HOLOTYPE.—USNM 128680, ♀ probably late instar.

TYPE-LOCALITY.—South Atlantic, east of Argentina, 40° 11'S, 60° 27'W, 44 m.

MATERIAL.—Right valve and appendages of holotype, USNM 128680.

DISTRIBUTION (Figure 131).—Collected only at type-locality.

DIAGNOSIS.—Carapace with distinct narrow peripheral ridge having 3 posterior processes; surface with shallow fossae containing elongate po-

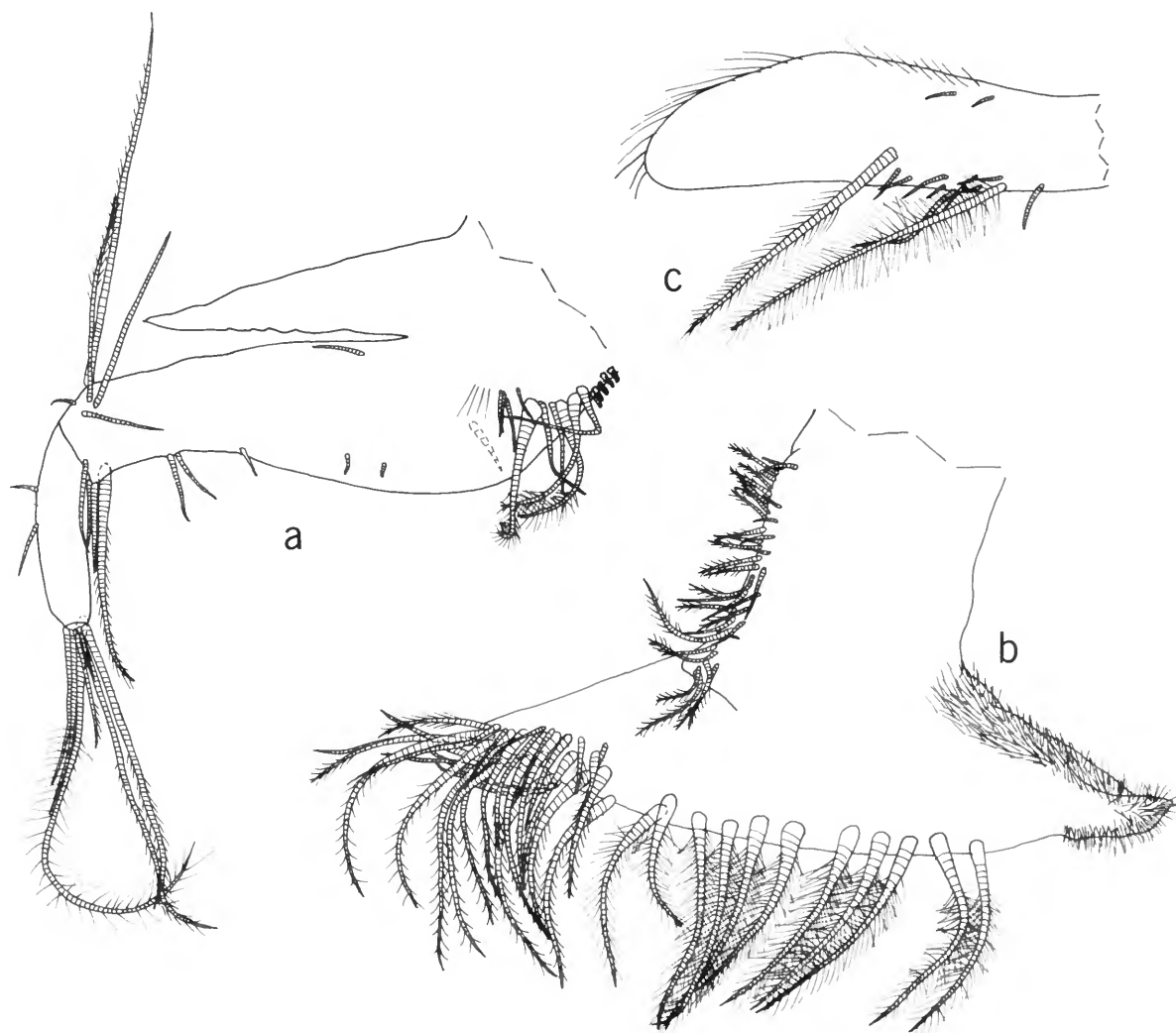


FIGURE 134.—*Asteropterygion hulingsi* (Kornicker), female, probably late instar, holotype, USNM 128680: *a*, right maxilla, medial view; *b*, right 6th limb, medial view; *c*, comb of left 5th limb, lateral view.

lygonal processes (Plate 116*d*) or reticulations (see Kornicker, 1975a, fig. 350*d,e*).

Second Antenna: 1st endopodial joint of female (probably late instar) without bristles (always?).

SUPPLEMENTARY DESCRIPTION OF HOLOTYPE.—Each valve with distinct, narrow, peripheral ridge having 3 posterior processes (Plates 115*a*, 116*a,b*); surface with shallow fossae containing elongate polygonal processes (Plates 115*b*, 116*d*); surface between fossae with irregular porous structures (Plate 115*b*) and oval areas with minute nodes (Plates 115*b*, 117*b-d*); bristles emerging from open pores with narrow lip scattered over valve surface (Plate 117*a-d*); these bristles with pore near base (Plate 117*a*) and with minute marginal papillae (Plate 117*a,c*); additional bristles emerging from either closed or open pores present along ventral and anterior margins (Plates 115*a,e,f*, 116*a,b*, 117*e*).

Infold: Infold present along anterior, ventral, and ventral half of posterior margins, being widest posterior to rostrum (Plate 115*d*); list of rostrum prominent and bearing long bristles (Plate 115*d-f*); additional bristles present on rostrum anterior to list; list along ventral infold with wide lamellar prolongation with anterior end just below inner end of incisur, and posterior end near posteroventral curvature of valve (Plates 115*d-f*, 118*a,b*); a few short bristles present between list and both ventral and anteroventral edges of valve (Plates 115*e,f*, 116*a*); ventral half of posterior margin with broad list without lamellar prolongation (Plate 118*b*); this list bearing bristles of various types—long tubular bristles (Plates 118*c,d*, 119*d-f*), short bristles with digitate tips (Plate 120*e,f*), clusters of short tubular bristles (Plate 120*a-c*), individual short tubes (Plate 120*d*); and long setose bristles present posterior to list (Plates 118*e,f*, 119*a,b*); a single row of bristles with divided tips present between broad list and posterior valve edge (Plates 118*c,d*, 119*c*).

Selvage: Selvage with wide lamellar prolongation present along anterior, ventral, and posteroventral margins (Plates 115*d-f*, 117*e,f*, 118*a,b*); edge of prolongation along ventral margin minutely digitate (Plate 117*f*); selvage divided at inner end of incisur; edge of prolongation at inner

end of incisur with fringe (Plate 115*f*).

Central Adductor Muscle Attachments: Each valve in area of central adductor muscle attachments with numerous small bare spots forming clusters (Plates 115*a,c*, 116*c*). Each spot may represent the attachment of a muscle strand, and each cluster of spots may represent a single bundle of muscles.

First Antenna (Figure 133*a*), *Mandible* (Figure 133*b,c*), *Maxilla* (Figure 134*a*), *Fifth Limb* (Figure 134*c*), *Sixth Limb* (Figure 134*b*): The limbs were described by Kornicker (1975a:563–567). Note: The sensory bristle of the 5th joint of the 1st antenna bears filaments, not bristles as stated by Kornicker (1975a:563, lapsus); a reexamination of the maxilla revealed 2 exopodial bristles on the maxilla, not 3 as given by Kornicker (1975a:565).

47. *Asteropterygion oculitristis* (Darby, 1965), new combination

FIGURES 9*h*, 135–141; PLATES 121–137

Asteropteron oculitristis Darby, 1965:29, pl. 15: figs. 3–7; pl. 16: figs. 1–8.—Kornicker, 1977a:791–796.

NOTE.—The original description of this species by Darby (1965:29) was based on 2 juvenile males. The adult male and female are described herein.

MATERIAL.—USNM 152440, 1 adult? female, sta 45e, Indian River, Florida; USNM 149327, 1 adult male, sta I, 5–2, Alligator Harbor, Florida; USNM 150281, 1 adult female, sta II, 2–2, Alligator Harbor, Florida; USNM 144003, 1 adult male, sample 2, Placida Harbor, Florida; USNM 153912, 1 adult male, sta 81b, Indian River, Florida; USNM 157203, 1 specimen, sta 190B, Indian River, Florida; USNM 151162, 1 ovigerous female, sta LA 102, Bahia Los Angeles; USNM 157300, 1 female, sta LA 102, Bahia Los Angeles; USNM 157301, 1 female, sta LA 212, Bahia Los Angeles. From Pacific side of Panama: USNM 157302, 1 adult male, sta 24; USNM 157303, 1 specimen, sta 7; USNM 157304, 2 specimens, sta 6; USNM 157305, 3 juveniles, sta 161–3; USNM 157306, 1 juvenile, sta 161–2; USNM 157307, 1 juvenile, USNM 157309, 3 specimens, USNM 157310, 2 specimens, USNM

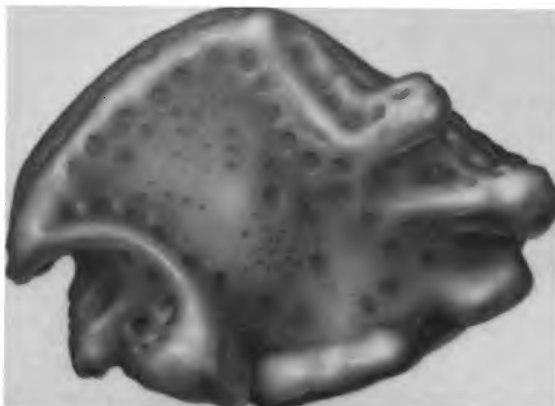


FIGURE 135.—*Asteropterygion oculitristis* (Darby), adult male, USNM 149327, lateral view of specimen from Alligator Harbor, Florida, length 1.84 mm.

157311, 1 specimen, USNM 157312, 4 juveniles, all from sta 183-1; USNM 157308, 1 juvenile, sta 182-1; USNM 157313, 1 ovigerous female, USNM 157314, all from sta 183-2. From Anclote Anchorage, Florida: USNM 157576, 1 specimen, sta 5, replicate 5; USNM 157081, 1 specimen, sta 6, replicate 4; USNM 157438, 2 specimens, sta 6, replicate 3, night; USNM 157082, 1 specimen, sta 9, replicate 5; USNM 157086, 1 specimen, sta 15, replicate 3; USNM 157085, 1 specimen, sta 16, replicate 4; USNM 157084, 1 specimen, sta 22, replicate 3; USNM 157083, 1 specimen, sta 31, replicate 5; USNM 157087, 1 specimen, sta 32, replicate 5; USNM 157088, 1 specimen, sta 32, replicate 4A. From Panama City, Florida, sta 30: USNM 157614, 2 specimens; USNM 157616, 1 specimen; USNM 157620, 1 specimen; USNM 157664, 6 specimens; USNM 157653, 2 juveniles; USNM 157661, 2 specimens; USNM 157655, 2 specimens; USNM 157660, 1 specimen; USNM 157682, 1 specimen; USNM 157691, 2 specimens; USNM 157657, 1 specimen; USNM 157659, 1 juvenile. Panama City, Florida, sta 4: USNM 157679, 1 juvenile; USNM 157682, 1 specimen; USNM 157691, 1 specimen; USNM 157678, 1 specimen; USNM 157690, 1 specimen. From the coast of south Texas (material returned to Richard D. Kalke, The University of Texas Marine

Science Institute): 1 specimen, sta 4, transect III; several specimens, sta 4, transect IV. From South Carolina: 1 specimen, sta 1B, 1 specimen, sta 3A.

DISTRIBUTION (Figure 131).—Continental shelf off southern part of Baja California, at depths of 6–16 m; beach of Panama (Pacific side) at depths of 0–1.2 m; continental shelf off South Carolina and Georgia; Indian River, Florida, at depths of 30 cm to 2 m; Placida Harbor (part of Charlotte Harbor), Florida, at depths of 1–3 m; Alligator Harbor, Florida, depth unknown (probably shallow); Anclote Anchorage, north of Tampa, Florida, at depths of 0.75–3 m; continental shelf off Panama City, Florida, at depths of 9.1–12.8 m; continental shelf off south Texas at depth of about 15 m.

DESCRIPTION OF ADULT MALE (Figures 135–138a–h, Plates 121–133).—Carapace with fairly deep incisure for genus (Figure 135, Plates 121a, 122d, 124); single lateral protuberance projecting anteriorly slightly past rostrum; similar protuberance, but broader, projecting anteriorly past shell margin below incisure (Plates 122d, 124); 3 lateral posterior protuberances projecting posteriorly and extending past shell margin (Plate 121a,b); process lateral to rostrum continuing in 2 ridges, 1 ridge continuing posteriorly to middle of dorsal margin as narrow ridge paralleling anterodorsal margin, the other ridge continuing in posteroventrally directed arch to ventral margin; wide prominent ridge, consisting of anterior and posterior parts separated by slight depression in ridge present just within ventral margin and parallel to it; carapace reaching greatest height at midlength (Figures 135, 136a); dorsal margin of left valve extending well past dorsal margin of right valve at midlength; left valve overlapping right along anterodorsal margin; incisure and part of valve immediately posterior and ventral to it slightly compressed; compressed area bounded posteriorly by crescent-shaped connection of lateral rostral process and anterior end of ventral ridge, posterior edge of valve forming right angle just ventral to middle protuberance.

Ornamentation: Surface of carapace with fossae containing long, partitioned, polygonal tubes

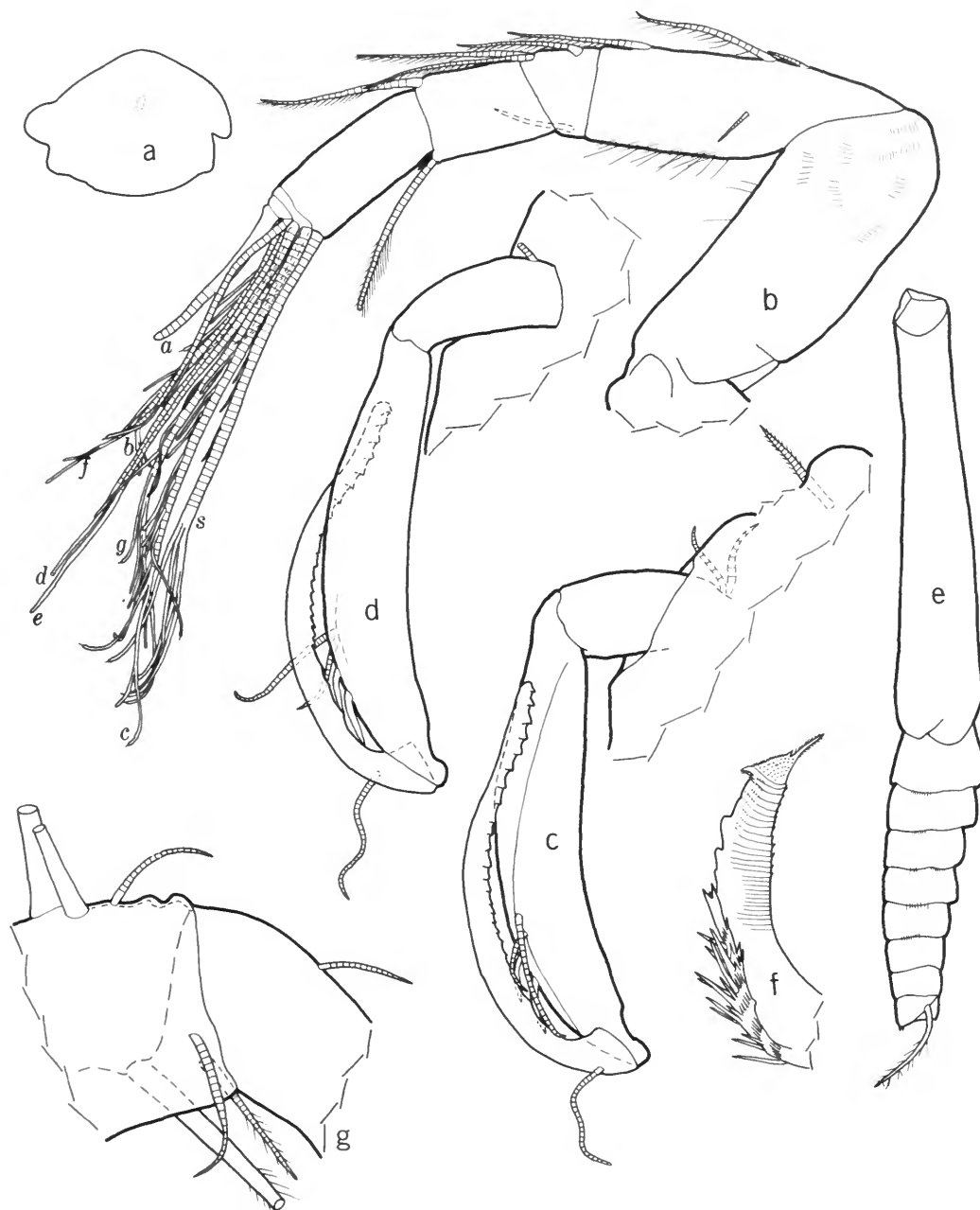


FIGURE 136.—*Astropterygion oculitristis* (Darby), adult male, USNM 149327: *a*, outline of carapace (dashed oval indicates location of lateral eye as seen through valve), length 1.84 mm; *b*, left 1st antenna, lateral view; *c*, distal part of protopodite and endopodite of left 2nd antenna, lateral view; *d*, endopodite of right 2nd antenna, medial view; *e*, exopodite of left 2nd antenna (only short bristle of 9th joint shown), lateral view; *f*, coxale endite of left mandible, (minute bristle at base of ventral branch not observed), medial view; *g*, distal part of basale and proximal part of 1st endopodite joint of left maxilla, medial view.

with longitudinal ribs on the outer surface (Plates 121*f,g*, 122*i*); muscle scar area with shallow ovoid depressions (Plate 121*d,e*); area between tubular fossae with shallow fossae containing papillae (Plates 121*i*, 122*a*); surfaces between fossae and on ridges have short tubes covered mostly by amorphous coating (epicuticle?) (Plates 121*i,j*, 122*a,b*); bristles sparsely distributed over valve surface generally between fossae (Plate 121*j*); bristles with small opening near base emerge from open-lipped pores (Plate 121*j*); few bristles emerge from closed pores (Plate 122*a*); bristles bear surface papillae (Plate 121*k*); minute raised pores separated by narrow moat from concentric lip scattered over valve surface (Plates 121*l*, 122*c*); scalloped ridge with porous construction observed along posterior margin just lateral to valve edge (Plate 122*k,l*).

Infold (Plates 122*d-h*, 123): Rostral infold with about 57 medium and long bristles and about 20 minute bristles (Plate 122*d-g*); in addition 5 short bristles forming row anterior to anterior juncture; 3 bristles present near inner end of incisur (1 above incisur, 2 below); anteroventral infold with 7 short bristles; distinct list with lamellar prolongation present near inner margin of infold extending from below incisur to posterior end of ventral margin; lamellar prolongation of list observed only anterior to middle of list (Plates 124, 133*a,b*); ventral infold without bristles; posteroventral infold with few small bristles near inner margin; posterior infold with outer row of 20 short bristles near valve edge, inner row of 11 long bristles, and middle row of about 6 long and 10 short bristles (Plates 122*h,k*, 123*a,f*, 133*c,d*). SEM photographs show that bristles of outer row emerge from open pore (Plate 123*i*) and are compound (Plate 123*i*); bristles of inner row also compound (Plate 123*b,c,g,h*); middle bristles include minute digitate processes (Plate 123*d,e*).

Central Muscle Scars: Consisting of about 30 oval to slightly elongate individual scars without ornamentation on external surface (Plate 121*d,e*).

Selvage: Lamellar prolongation broad along anterior, ventral, and posteroventral margin; selvage striate proximally; selvage along rostrum with few marginal hairs; remaining selvage minutely serrate along margin (Plate 122*j*).

Hinge Teeth: Posterior end of hingement of left valve with large tooth fitting into socket on posterior end of hingement of right valve; the teeth occur at posterior end of valve (Plates 125–129) (see detailed description in section on Cypridinacea).

Size: USNM 144003, length 1.85 mm, height 1.31 mm; USNM 149327, length 1.84 mm, height 1.17 mm; USNM 157302, length 2.12 mm, height 1.46 mm.

First Antenna (Figure 136*b*): 1st joint with long hairs forming few clusters along ventral margin and spines forming short rows distally on lateral surface; 2nd joint with long hairs along ventral margin and short spines forming rows on medial surface near ventral margin; dorsal margin with 2 or 3 bristles; lateral surface with 1 short proximal bristle; 3rd joint with 1 terminal ventral bristle and 3 dorsal bristles (1 proximal, 2 terminal); 4th joint with 3 terminal bristles (2 ventral (one of these very short), 1 dorsal); sensory bristle of 5th joint with 6 short proximal filaments and 4 long terminal filaments including stem; 6th limb with short medial bristle. Seventh joint: a-claw about same length as joints 5–8, ringed in distal part, tip rounded; b-bristle with 5 short filaments and bifurcate tip; c-bristle longer than b-bristle, with 6 short proximal filaments, 3 long distal filaments, and 1 short marginal filament near tip. Eighth joint: d- and e-bristles bare, slightly shorter than c-bristle; f-bristle slightly longer than b-bristle, with 6 marginal filaments, g-bristle same length as c-bristle, with 8 or 9 marginal filaments.

Second Antenna (Figure 136*c-e*): Protopodite with short medial bristle, few long spines or hairs on medial surface near endopodite and few long hairs proximally along ventral margin. Endopodite 3-jointed: 1st joint with 1–3 short proximal bristles; 2nd joint elongate with 2 ringed and 2 shorter unringed (except at tip) bristles near middle of ventral margin; 3rd joint reflexed on 2nd, with ringed proximal bristle; inner edge of joint with 18 distal ridges. Exopodite: 1st joint without terminal medial bristle; bristle of 2nd joint with slender spines proximally along ventral margin and natatory hairs distally on ventral margin and both proximally and distally along dorsal margin;

bristles of joints 3–8 with natatory hairs; 9th joint with 2 short and 2 long bristles, all with natatory hairs; joints 2–9 with short spines forming row along distal margin (not all spines shown in Figure 136e).

Mandible (Figures 136f, 137a): Coxale endite with small bristle near base of ventral branch on right limb, not observed on left limb; ventral branch with spines forming 6 oblique rows; tip with 3 teeth, 1 much smaller than others; ventral margin of dorsal branch with 2 or 3 very low nodes followed by 2 larger knobs; main spine small with teeth along proximal margin; margin between main spine and tip of branch serrate; dorsal corner of tip of dorsal branch with short hairs forming cluster at base of hirsute bristle; dorsal margin of dorsal branch serrate distal to middle. Basale: endite with 3 long and 1 shorter end-bristles at tip, additional short end-bristles and triaenid bristle on ventral margin near base of endite; glandular peg and 6 dwarf bristles present, 2 longer than others; ventral margin of basale with 3 triaenid bristles (one pair of spines on triaenid bristles longer than others), and 1 long, spinous, distal bristle; lateral surface with 3 minute bristles near ventral margin distal to the long spinous bristle; medial and lateral surfaces with spines forming rows on dorsal part of joint; dorsal margin with about 7 short bristles and 2 long, stout, terminal bristles. Exopodite same length as dorsal margin of 1st endopodite joint, hirsute with 2 subterminal bristles (proximal bristle almost twice length of distal bristle). Endopodite: ventral margin of 1st joint with 2 stout bristles and 4 more slender bristles, all with marginal spines; dorsal margin of joint with 2 or 3 openings (glandular?) near distal end; medial surface of 2nd joint with spines forming rows in distal half; ventral margin of joint with 3 spinous subterminal bristles; dorsal margin with about 18 bristles (some of these of triaenid type); end joint with 2 short spinous bristles on ventral corner, 1 long, lateral, spinous bristle near middle of terminal margin, 2 clawlike bristles (1 ventral, 1 dorsal); 1 long clawlike bristle medial to others (total of 3 clawlike bristles, 3 ringed bristles).

Maxilla (Figures 136g, 137b): Epipodite long, tapering to point, hirsute at tip; endite I not clearly separated from endite II: endite I with 3 long and 2 short bristles; endite II with 3 long and 3 or 4 short bristles. Basale: dorsal margin with 1–3 short proximal bristles, 3 distal bristles (one of these very long), and 2 nodes distal to bristles; ventral margin with 3 or 4 short bristles near middle and long, spinous, terminal bristle; medial surface with 1 short bristle near distal margin and long hairs forming rows; lateral surface with 1 short proximal bristle. Endopodite: medial surface of 1st joint with short spines forming rows; dorsal margin with 2 short bristles; ventral margin with 1 long spinous beta-bristle; end joint with 5 spinous bristles (3 long, 2 short). Exopodite: with 1 short bristle, without lobe.

Fifth Limb (Figure 137c): Epipodial appendage with 68 bristles; dorsal margin of comb with few hairs; lateral surface with stout, spinous, exopodial bristle reaching end of comb, 1 long, slender, spinous bristle proximal to stout bristle, 2 minute bristles between the 2 long bristles, 1 minute bristle near dorsal margin, and 2 pairs of short bristles near ventral margin.

Sixth Limb (Figure 138a): Anterior margin with only lower suture well defined; margin above poorly defined upper suture with 11 short spinous bristles forming medial row near margin, and 12 short spinous bristles forming marginal row; margin between sutures with 6 short spinous bristles; lateral anteroventral flap with 7 slender bristles; anteroventral margin starting from anterior corner with 17 bristles; 11 additional bristles forming row present on medial side at anteroventral corner of end joint; about 8 minute bristles on medial side near ventral margin; no epipodial bristles observed; limb hirsute; posterior protracted, hirsute.

Seventh Limb (Figure 138b): Each limb with 18–21 bristles, 9–12 on each side; some rings with 1 bristle on each side; each bristle with 2–6 bells. Terminus: each opposing comb with about 12 spinous teeth.

Furca (Figure 138f): Each lamella with 3 long stout claws followed by 5–6 short secondary



FIGURE 137.—*Asteropterygion oculitristis* (Darby), adult male, USNM 149327: *a*, right mandible, medial view; *b*, right maxilla, medial view; *c*, comb of right 5th limb, lateral view; *d*, USNM 144003, protistans attached to rostrum of right valve.

claws; main claws with short hairs along convex margins and teeth forming medial and lateral rows along concave margins; anterior margin of lamella with hairs and spines; ventral margin with hairs.

Rod-shaped Organ (Figure 138c): Broadening distally, with rounded tip.

Eyes (Figure 138c): Medial eye large, pigmented, bare. Lateral eye pigmented, about same size as medial eye, with about 14 ommatidia.

Posterior (Figure 138g): Posterior hairs; dorsal process fingerlike with spines near tip.

Upper Lip (Figure 138d,e): Consisting of 2 hairsute lobes, each with anterior spine; lateral hairsute flaps on each side of lobe.

Copulatory Organ: Consisting of small lobe with few bristles.

Y-Sclerite (Figure 138h): Unbranched.

Epizoa: USNM 144003 with protistans (suctoria?) on rostrum of right valve and posterior of left valve (Figure 137d).

DESCRIPTION OF ADULT FEMALE (Figures 138i–k–141, Plates 134–137).—Carapace similar to that of adult male except for being larger and

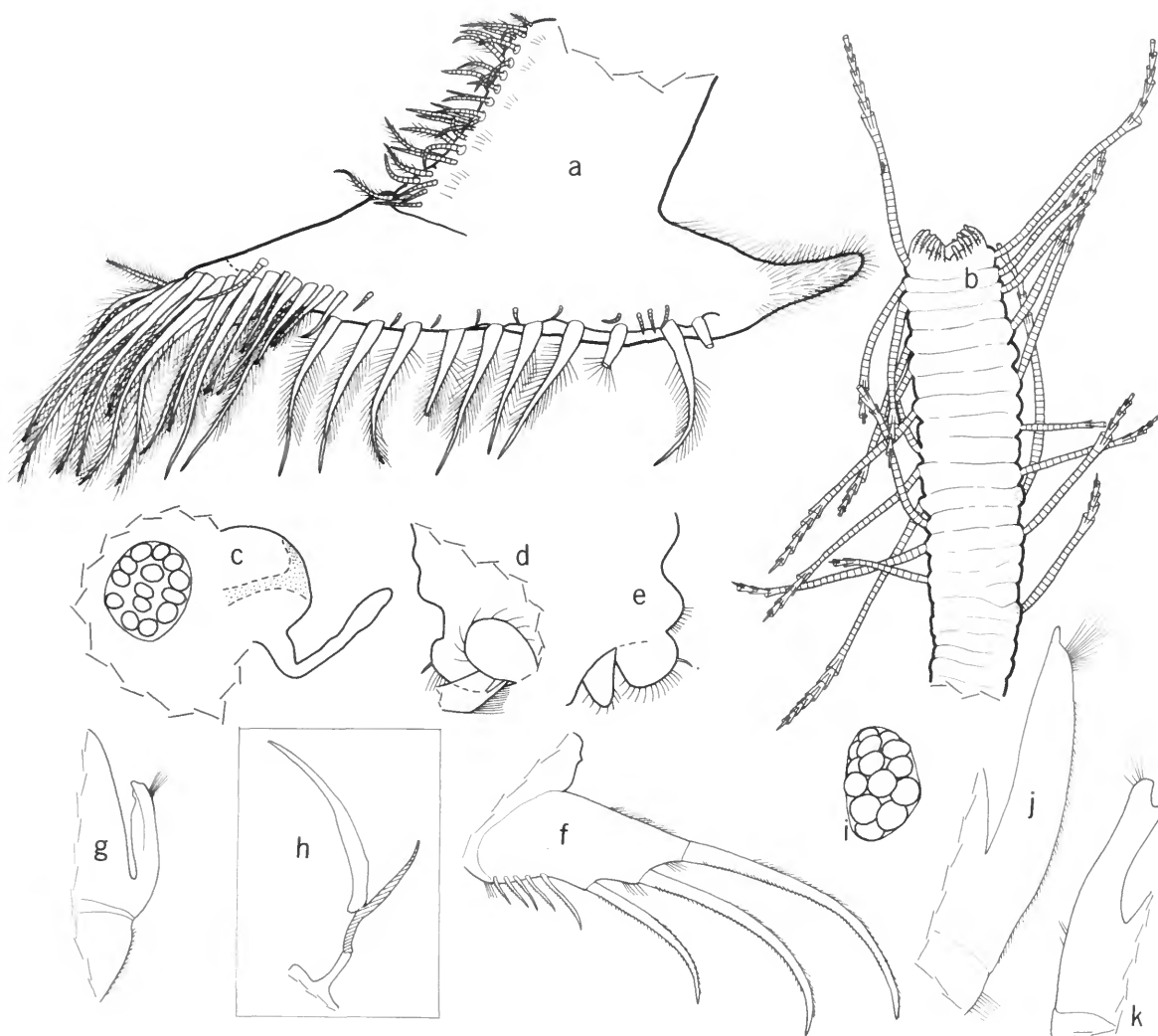


FIGURE 138.—*Asteropterygion oculitristis* (Darby), adult male, USNM 149327: *a*, right 6th limb, medial view; *b*, 7th limb; *c*, right lateral eye, medial eye, and rod shaped organ; *d*, lateral view of upper lip, anterior to left; *e*, lateral view of upper lip, anterior to right; *f*, right lamella of furca, lateral view; *g*, posterior process of body, anterior to left; *h*, lateral view of body showing Y-sclerite (lined pattern), anterior of body to right; *i*, adult female, USNM 150281, lateral eye; *j*, adult? female, USNM 152440, posterior process; *k*, adult female, USNM 157301, posterior process.

having a more evenly rounded posterodorsal margin (Figures 139, 140, Plates 134–136).

Infold: Similar to that of adult male (Plate 137).

Size: USNM 150281, length 2.70 mm, height 1.98 mm; USNM 157313, length 3.03 mm, height 2.17 mm; USNM 151162, length 3.02 mm, height 2.23 mm.

First Antenna: 1st joint with long hairs along ventral margin and shorter hairs distally on lateral surface; 2nd joint with long hairs along ventral margin and along medial distal margin; short spines forming rows on medial surface near ventral margin; dorsal margin with 4–5 spinous bristles (3–4 proximal, 1 distal); lateral surface

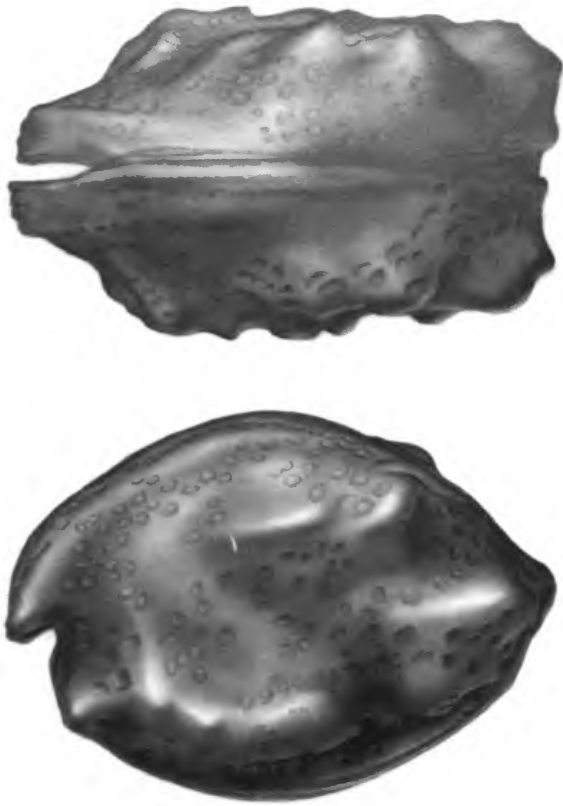


FIGURE 139.—*Asteropterygion oculitristis* (Darby), ovigerous female, USNM 151162, dorsal and lateral views of complete specimen from Bahia Los Angeles, length 3.02 mm.

with 1 short proximal bristle; 3rd joint with 1 spinous, terminal, ventral bristle and 3 spinous dorsal bristles (1 proximal, 2 terminal); 4th joint with 3 terminal bristles (2 ventral (1 of these very short), 1 dorsal); sensory bristle of 5th joint with 6 short proximal filaments and 4 long terminal filaments including stem; 6th joint with short medial bristle. 7th joint: a-claw about same length as joints 5–8, ringed in distal part, tip rounded; b-bristle with 5 short proximal filaments; c-bristle longer than b-bristle, with 6 short filaments and 3 longer distal filaments. 8th joint: d- and e-bristles bare with blunt tips, about same length as sensory bristle of 5th joint; f-bristle longer than b-bristle, with about 4 marginal fil-



FIGURE 140.—*Asteropterygion oculitristis* (Darby), ovigerous female, USNM 150281, lateral view of complete specimen from Alligator Harbor, Florida, length 2.70 mm.

aments; g-bristle with about 7 marginal filaments, about same length as c-bristle.

Second Antenna (Figure 141a): Protopodite with short, spinous, medial bristle and few short spines near ventral margin in vicinity of endopodite. Endopodite: 1st joint short with 6–12 short proximal bristles; 2nd joint elongate, bare; 3rd joint short, only weakly separated from 2nd joint, with long terminal bristle. Exopodite: 1st joint without terminal medial bristle; bristles of joints 2–8 with natatory hairs, some with ventral spines; 9th joint with 4 bristles with natatory hairs (1 short, 1 medium, 2 long); short spines forming rows along distal margins of some joints, no basal spines; proximal parts of bristles and joints near bristles with abundant minute papillae or hairs visible with oil immersion ($\times 100$ objective), but this could be foreign growth.

Mandible: Coxale endite with small bristle near base of ventral branch; ventral branch with spines forming 6 rows distal to 2 or 3 rows of short slender hairs; tip with 3 teeth, 1 much smaller than others; ventral margin of dorsal branch with low node followed by 3 larger knobs; main spine small with teeth along proximal margin; margin between main spine and tip of branch serrate; tip of branch with short spine; long hirsute bristle with base dorsal and proximal to tip of branch. Basale: endite with 5 or 6 end-bristles (some on

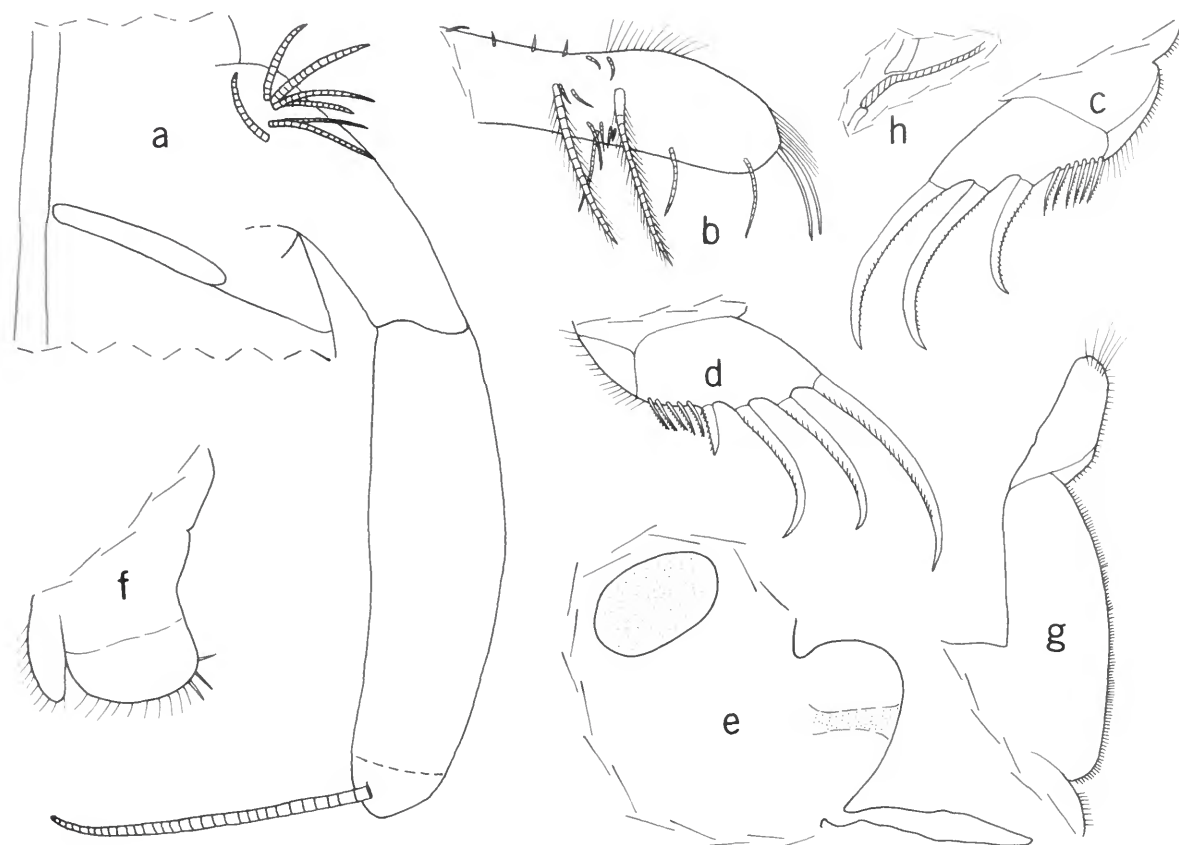


FIGURE 141.—*Asteropterygion oculitristis* (Darby), ovigerous female, USNM 151162: *a*, endopodite of left 2nd antenna, medial view; *b*, comb of right 5th limb, lateral view; *c*, *d*, left and right lamellae of furca, lateral view; *e*, outline of right lateral eye, medial eye, and rod-shaped organ; *f*, upper lip, anterior to right; *g*, posterior process of body; *h*, Y-sclerite anterior to right.

ventral margin), 2 triaenid bristles near base of endite, and 6–8 dwarf bristles; ventral margin of basale with 4 or 5 triaenid bristles (one pair of spines on triaenid bristles much longer than others), and 1 long, spinous, distal bristle; medial surface with 2 or 3 minute bristles proximally near ventral margin; dorsal margin with about 13 or less short bristles and 2 long, stout, terminal bristles; lateral surface with spines and hairs forming rows on dorsal part of joint. Exopodite: same length as dorsal margin of 1st endopodite joint, hirsute with 2 subterminal bristles (proximal bristle longer than distal bristle). Endopodite: ventral margin of 1st joint with 2 long, stout bristles, 1 medium bristle, and 3 shorter slender bristles, all

with marginal spines; dorsal margin with 2 openings (glandular?) near distal end; medial surface of 2nd joint with long spines forming rows; ventral margin of joint with 3 spinous subterminal bristles; dorsal margin of joint, including medial side near dorsal margin, with about 25 bristles; end joint with 3 clawlike bristles and 3 bristles (2 short on ventral corner, 1 long, lateral, near middle of distal margin).

Maxilla: Epipodite long, tapering to point, tip hirsute; endites I and II not clearly separated; endite I with 3 long and 2 short bristles along ventral margin and 1 short bristle proximally; endite II with 3 long and 8 short bristles. Basale: dorsal margin with 8 or 9 proximal bristles with

bases on medial side, 5–9 distal bristles, and 1 node distal to bristles; ventral margin with 3 or 4 short bristles and 1 long terminal bristle; medial surface with 1–3 distal bristles and long hairs forming rows. Exopodite with 2 short bristles, without lobe. Endopodite: medial surface and ventral margin of 1st joint with long hairs forming rows; dorsal margin with 5 or 6 short bristles; ventral margin with 1 long beta-bristle; end joint with 5 spinous bristles (3 long, 1 medium, 1 short or medium).

Fifth Limb (Figure 141b): Epipodial appendage with 61 bristles; dorsal margin of comb with few hairs near middle, more anteriorly; lateral surface with stout, spinous, exopodial bristle reaching end of comb; 1 long slender bristle proximal to stout bristle, and 2 small bristles between bases of the 2 long bristles; 4 short and 4 longer bristles near ventral margin, and about 6 minute bristles near dorsal margin.

Sixth Limb: Anterior margin with only lower suture well defined; upper suture lacking but indicated by slight angle in anterior margin and long spinous bristle; margin above angle with 10 or 11 short spinous bristles forming row near medial margin, and 13–17 short spinous bristles forming marginal row; margin between sutures with 8 short bristles (upper and lower of these longer than remainder); anterior margin between lower suture and anteroventral tip of limb with 4–16 slender bristles; lateral anteroventral flap with 9 bristles; anteroventral margin starting from anterior corner with 15 bristles; about 14 additional bristles present on medial side at anteroventral corner of end joint; about 30 minute bristles on medial side near ventral margin; no epipodial bristles present; limb hirsute; posterior protracted, hirsute, without bristles.

Seventh Limb: Each limb with 32–47 bristles, 18–24 on 1 side, 12–23 on other; some rings with 1 bristle on each side; each bristle with 2–6 bells. Terminus with opposing combs, each with about 15 spinous teeth.

Furca (Figure 141c,d): Each lamella with 3 long stout claws followed by 5 or 6 short secondary claws; anterior margin of lamella with spines and hairs; long hairs present along ventral margin of

lamella medial to claws. Right lamella of USNM 151162 unusual in having 4th strong claw (Figure 141d).

Rod-shaped Organ (Figure 141e): Broad near middle, tapering distally to rounded tip.

Eyes: Medial eye large, pigmented, bare (Figure 141e). Lateral eye pigmented, about same size as medial eye, with 14 ommatidia (Figures 138i, 141e); similar in size to lateral eye of adult male.

Posterior of Body (Figures 138j,k, 141g): Posterior hirsute, with fingerlike dorsal process with spines near tip.

Upper Lip (Figure 141f): Similar to that of adult male, with 1 to 3 anterior spines on each lobe.

Gills: Well developed.

Y-Sclerite: Typical for genus (Figure 141h).

Eggs: USNM 150281 with 1 large egg; USNM 151162 with 25 well-developed eggs.

Epizoa: USNM 150281 with abundant segmented filaments on appendages, especially on the mandible and maxilla. The abundance of the filaments is so great that they are probably deleterious to the ostracode.

REMARKS.—The Pacific population may have more bristles between the lower suture and anteroventral tip on the anterior margin of the skirt of the 6th limb than the Atlantic population; also, the carapaces of the Pacific population may be slightly larger and have less pronounced ridges and projections than the Atlantic population. It will be necessary to study more specimens to document the variability of the Atlantic and Pacific populations and to confirm that the populations are conspecific.

48. *Asteropterygion skogsbergi* (Poulsen, 1965), new combination

FIGURES 9b, 10f, 142

Asteropteron skogsbergi Poulsen, 1965:206–212, figs. 69–71, 151.
Asteropteron cf. *spinosum*.—Hartmann, 1974:235

HOLOTYPE.—Female with embryos, length 3.4 mm.

TYPE-LOCALITY.—*Galathea* sta 257, off Mombasa, Kenya, 33 m.

PARATYPES.—1 juvenile male and 1 juvenile female from same sample as holotype. 1 juvenile female from Galathea sta 259, off Mombasa, Kenya, 40 m.

MATERIAL EXAMINED.—Through the courtesy of Dr. Torben Wolff, I received 4 vials labeled "*Asteropteron skogsbergi* n.sp., station 257." One of the vials was labeled "type" and contained 1 dissected specimen; 1 vial was empty, and each of the other vials contained a dissected or partly dissected specimen. I also received the juvenile paratype from station 259. I examined only the carapaces of the specimens in the vials. Through the courtesy of Dr. Gerd Hartmann I received a specimen (Hamburg Zoological Museum, K 30107, probe 168, Mtwara) from off Tanzania that he had identified as *Asteropteron* cf. *spinosum* Poulsen, 1965. I examined only the carapace and 1st antenna.

DISTRIBUTION (Figure 131).—Mombasa, Kenya, 33–40 m; Mtwara, Tanzania, eulitoral depth.

REMARKS CONCERNING HOLOTYPE.—My measurement of the carapace of the specimen in the vial labeled "type" was about 2.6 mm, much less than the 3.4 mm given by Poulsen. Also, that vial did not contain embryos. Another of the vials from station 257 does contain embryos, and therefore, I believe that that vial contains the holotype. My measurement of a valve in that vial was about 3.2 mm, but it is possible that the specimen was longer prior to its dissection. (I have since been informed by Dr. Wolff (in litt., 1976) that he has exchanged the label "type" in the vials, but in my discussion of this species I refer to original location of the label.)

DISCUSSION.—I have not examined the carapace of *A. skogsbergi* using the SEM; however, by using the compound microscope and transmitted light it can be seen that the surface bears minute pustules in and between shallow fossae (Figure 142). The pustules are similar to those on the surface of *Asteropterygion thomassini*, new species, described herein. The distribution of the ridges on the carapace of the juvenile male paratype of *A. skogsbergi* from station 257, and also the juvenile female paratype from station 259, is similar to

the distribution of ridges on the carapace of *A. thomassini*. However, the carapace of the specimen of *A. skogsbergi* in the vial labeled "type," and also that of the specimen in the vial that I believe to contain the type (see "Remarks" above) do not bear a midridge like that on *A. thomassini*; the midridge on the latter species is an anterior extension of the middle posterior process. I should mention that the carapaces of the last 2 specimens of *A. skogsbergi* discussed above are in poor condition, but the absence of a midridge appears real. The absence of the midridge on the holotype of *A. skogsbergi* (holotype either according to label or according to my opinion) separates the species from *A. thomassini*. It is possible that the 2 juvenile paratypes of *A. skogsbergi* that bear a midridge should be referred to a different species, but I have not done so herein.

DIAGNOSIS.—Carapace of adult female with 3 posterior processes; upper and lower but not middle posterior process continuing anteriorly as horizontal ridge.

49. *Asteropterygion spinosum* (Poulsen, 1965), new combination

FIGURE 9c

Asteropteron spinosum Poulsen, 1965:212–216, fig. 72.

HOLOTYPE.—Female without embryos, length 2.2 mm, unique specimen.

TYPE-LOCALITY.—Galathea sta 257, off Mombasa, Kenya, 33 m.

MATERIAL.—According to Dr. Torben Wolff, University Zoological Museum, Copenhagen, Denmark (in litt. 1977), the holotype could not be found in the museum's type-collection or in the *Asteropteron* general collection and the specimen must be regarded as lost. No specimens were found in the present collections.

DISTRIBUTION.—Collected only at type-locality (Figure 131).

DIAGNOSIS.—Surface of carapace with many short, stout, curved spines.

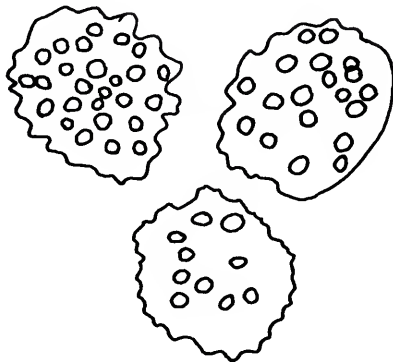


FIGURE 142.—*Asteropterygion skogsbergi* (Poulsen, 1965), drawing in transmitted light with $\times 20$ objective of 3 adjacent fossae containing pustules (represented in drawing by small circles) on the right valve of a specimen vial labeled type, Zoological Museum, Copenhagen.

50. *Asteropterygion thomassini*, new species

FIGURES 9g, 143–149; PLATES 138–148

HOLOTYPE.—USNM 151161, adult male, length 2.28 mm, on slides and in alcohol.

TYPE-LOCALITY.—Sta 734, Madagascar.

ETYMOLOGY.—The species name is from that of the collector of the holotype, Dr. Bernard A. Thomassin.

PARATYPES.—Madagascar: USNM 157222, 157169, 1 ovigerous female, station 712; USNM 157223, 1 specimen, sta 224; USNM 157224, 1 ovigerous female, sta 240; USNM 157225, 2 specimens, sta 274; USNM 157226, 1 juvenile, sta 231; USNM 157227, 1 juvenile, sta 256; USNM 157228, 1 adult ♂, sta 259; USNM 157229, 157408, 17 specimens, sta 259; USNM 157230, 1 specimen, sta 230; USNM 157231, 1 adult ♂, sta 259; USNM 157232, 1 ovigerous ♀, sta 259; USNM 157233, 1 ovigerous ♀, sta 738; USNM 157234, 5 specimens, sta 738; USNM 157235, 1 juvenile, sta 191; USNM 157236, 2 specimens, sta 274; USNM 157237, 1 specimen, sta 270; USNM 157238, 2 specimens, sta 262; USNM 157239, 3 specimens, sta 272; USNM 157240, 3 specimens, sta 778; USNM 157241, 1 specimen, sta 259; USNM 157242, 1 specimen, sta 761; USNM 157243, 2 specimens, sta 261; USNM

157244, 2 specimens, sta 737; USNM 157245, 3 specimens, sta 822; USNM 157246, 1 specimen, sta 230; USNM 157247, 1 specimen, sta 236; USNM 157248, 1 specimen, sta 779; USNM 157249, 2 specimens, sta 693; USNM 157250, 1 specimen, sta 274; USNM 157251, 1 specimen, sta 224B; USNM 157252, 3 specimens, sta 621; USNM 157253, 15 specimens, sta 259; USNM 157254, 1 specimen, sta 274; USNM 157255, 1 specimen, sta 240; USNM 157256, 1 specimen, sta 616; USNM 157257, 1 specimen, sta 734; USNM 157258, 4 specimens, sta 259; USNM 157259, 1 specimen, sta 622; USNM 157260, 1 specimen, sta 257; USNM 157261, 7 specimens, sta 259; USNM 157262, 1 specimen, sta 726; USNM 157263, 1 specimen, sta 814; USNM 157264, 1 specimen, sta 172; USNM 157265, 1 specimen, sta 227; USNM 157266, 6 specimens, sta 270; USNM 157267, 1 specimen, sta 257; USNM 157268, 1 specimen, sta 228; USNM 157269, 1 specimen, sta 191; USNM 157270, 1 specimen, sta 255; USNM 157271, 2 specimens, sta 262; USNM 157272, 2 specimens, sta 878; USNM 157273, 2 specimens, sta 880; USNM 157274, 2 specimens, sta 259; USNM 157275, 1 specimen, sta 270; USNM 157276, 1 specimen, sta 259; USNM 157277, 1 specimen, sta 263; USNM 157278, 1 specimen, sta 876; USNM 157279, 1 specimen, sta 272; USNM 157280, 1 specimen, sta 270; USNM 157281, 1 specimen, sta 330; USNM 157282, 1 specimen, sta 255; USNM 157283, 1 specimen, sta 623; USNM 157284, 1 specimen, sta 228; USNM 157285, 1 specimen, sta 600; USNM 157286, 2 specimens, sta 236; USNM 157287, 1 specimen, sta 617; USNM 157288, 1 specimen, sta 240; USNM 157289, 1 specimen, sta 678. Sent to Museum of National History Paris: 1 specimen sta 172; 1 specimen, sta 227; 2 specimens, sta 263; 1 specimen, sta 691; 2 specimens, sta 712.

DISTRIBUTION (Figure 131).—Collected only in the Tuléar coral reef complex, southwest Madagascar at depths of up to 60 m.

DESCRIPTION OF ADULT MALE (Figures 143–146, Plates 138–142).—Carapace with evenly rounded ventral margin and dorsal margin tapering pos-



FIGURE 143.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, lateral view of complete specimen, length 2.28 mm.

teriorly (Figure 143, Plate 138a); valve highest at midlength, longest at midheight, and widest in vicinity of ventral rib; outer edge of valves fairly deeply indented except along middle part of anterior edge of rostrum; lateral protuberance projecting past lower corner of rostrum; low rib lying just within anterodorsal valve edge extending from rostrum to valve midlength; a larger rib lying parallel and ventral to anterodorsal rib extending from rostrum to just past valve midlength and terminating in 1 or 2 small processes; large midrib branching from previous rib just posterior to rostrum and extending almost to valve midlength where it branches to form 2 ribs that continue almost to posterior end of valve where each terminates in stout protuberance; a lower, very large rib lying just within and parallel to ventral margin terminating at each end in processes extending well past valve edge; 3 low

vertical ribs connecting ventral rib and midrib, 1 near anterior end of valve, 2 near posterior end; 2 small backward-pointing processes present near posterior edge of valve (1 between posterior ends of branches of midrib and 1 near posterior end of lower branch of midrib) (Plates 138a-c).

Ornamentation: Surface with large fossae (Plates 138, 139a,c); single row of fossae between low anterodorsal rib and larger rib lying ventral to low rib; 2 rows of fossae between the 2 posterior branches of midrib; 3-4 rows of fossae between midrib and ventral rib; 1 or 2 rows of fossae between ventral rib and ventral edge of valve; surface of fossae with minute pustules (Plates 138d,e, 139a-d); long bristles scattered over valve surface and forming row along anterodorsal, anterior, ventral, and posterior valve margins (Plates 138b,e, 139c-f, 140); bristles more abundant along edges of rostrum and incisur; some bristles with pore near base (Plate 139e), with tube exiting from pore (Plate 140a-c), and some with papillae (Plate 140f).

Infold: Rostral infold with 18 long bristles forming row paralleling valve edge (Figure 144a, Plate 141a-d); 7 shorter bristles present between row of long bristles and anterior valve margin; several minute bristles and pores present posterior to row of long bristles; 6 small bristles present on anterodorsal infold forming continuation of row of long rostral bristles; 5 small bristles forming row present on infold posterior to inner end of incisur; list extending from anteroventral infold to near posterior end of ventral margin; 22 bristles present along anteroventral and ventral infold (these bristles ventral to list on anterior part of ventral infold and on list on posterior part of ventral infold); about 4 minute bristles or pores present on anteroventral infold near valve edge; posterior infold broad with bristles forming 3 rows (Figure 144b, Plate 141e): outer row with about 11 long and 5 shorter bristles (Plates 141e, 142a,b); middle row with about 11 slender setose bristles smaller than long bristles in outer row (Plates 141e, 142a,c,e); inner row with about 21 stout tubular bristles (about 12 of these longer than others) (Plates 141e, 142a,c,d,f,g).

Selvaige: Broad lamellar prolongation present

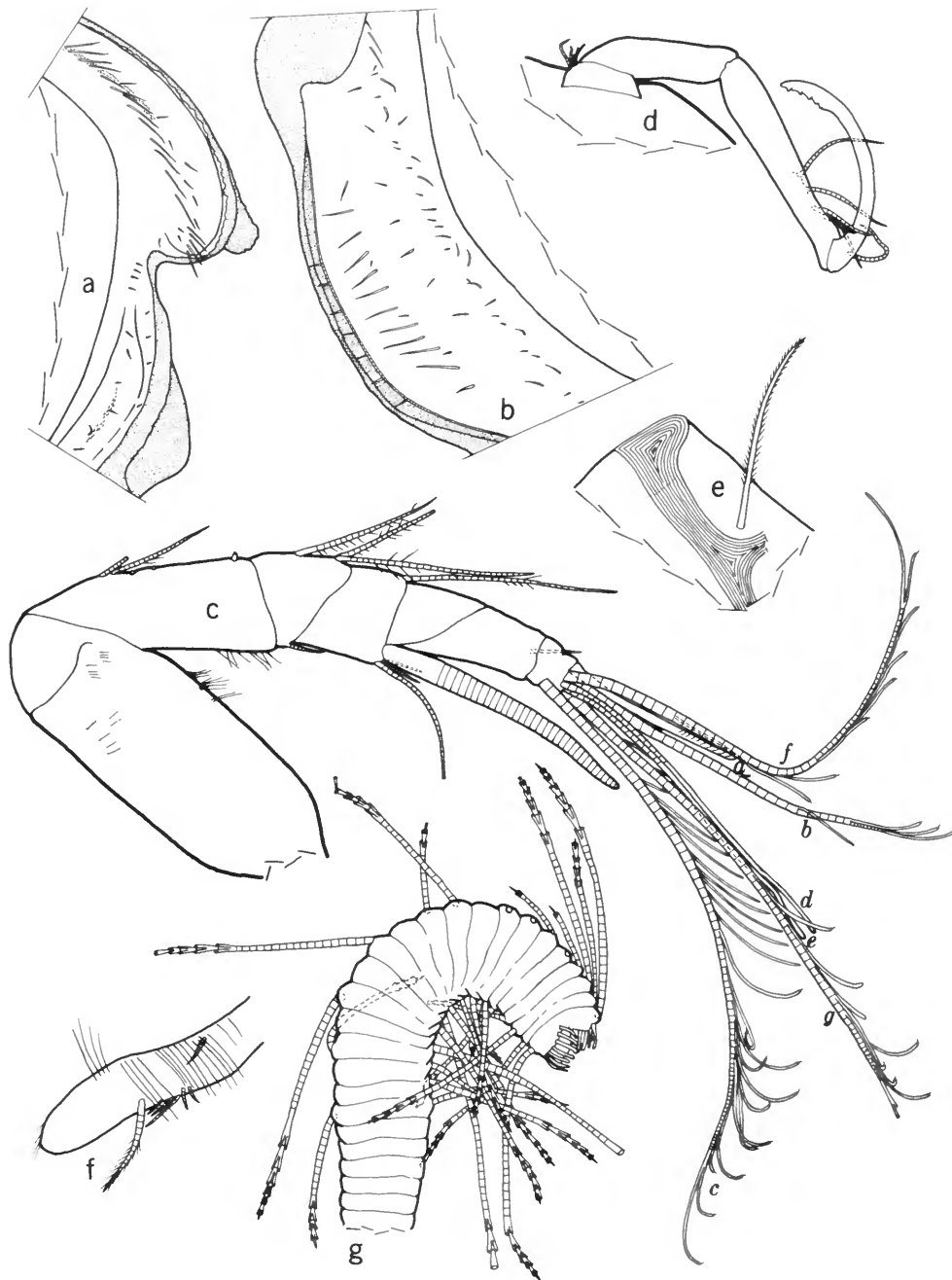


FIGURE 144.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161: *a*, inside view of anterior of carapace; *b*, inside view of posterior margin showing bristles of infold; *c*, right 1st antenna (filaments of sensory bristle omitted), lateral view; *d*, endopodite of left 2nd antenna, medial view; *e*, distal bristle of protopodite of left 2nd antenna, medial view; *f*, comb of left 5th limb, lateral view; *g*, 7th limb.

along anterior, ventral, and posterior margins (Plate 141a); fringe present on outer edge of prolongation along anterodorsal margins, posterior three-fourths of ventral margin and along posterior margin (Plate 141e,f), possibly elsewhere, but many valves apparently without fringe.

Size: USNM 151161, length 2.28 mm, height 1.70 mm; USNM 157228, length 2.43 mm, height 1.76 mm; USNM 157231, length 2.25 mm, height 1.62 mm.

First Antenna (Figure 144c): 1st joint with lateral and medial spines; second joint with 5 dorsal bristles (4 proximal, 1 distal) and spines on medial side near ventral and distal margins; 3rd joint short, triangular, with 1 short ventral bristle and 3 dorsal bristles (1 near middle, 2 subterminal); 4th joint short, with 4 terminal bristles (1 dorsal, 3 ventral (1 long, 2 short)); 5th joint triangular with stout filamentous sensory bristle; 6th joint elongate with short medial bristle. 7th joint: a-claw smooth with weak rings distally; b-bristle slightly more than twice length of a-claw, with 6 marginal filaments excluding stem; c-bristle about 3-times length of a-claw, with 20 marginal filaments excluding stem. 8th joint: d- and e-bristles bare with blunt tips, shorter than b-bristle; f-bristle curved dorsally near base, about same length as c-bristle, with 7 marginal filaments excluding stem; g-bristle with tip missing on specimen examined, remaining part about same length as c-bristle, with about 14 marginal filaments excluding stem.

Second Antenna (Figure 144d,e): Protopodite with spinous medial bristle but without spines. Endopodite 3-jointed: 1st joint with short proximal and long distal part, with 5 short proximal bristles; 2nd joint elongate with 5 distal ventral bristles; 3rd joint reflexed on 2nd, curved, with 1 short proximal bristle on convex margin; tip with 6 stout teeth. Exopodite: bristles of joints 2-8 with natatory hairs and few widely separated, slender, ventral spines; 9th joint with 5 bristles with natatory hairs (2 short, 3 long); no basal spines present.

Mandible (Figure 145a,b): Coxale endite with

small bristle near base of ventral branch; ventral branch with 11 oblique rows of hairs (proximal) and spines and tip with 2 stout teeth with several minute spines forming row between them; dorsal branch with 5 teeth projecting ventrally along ventral margin; main spine short with hairs along anterior margin; tip of dorsal branch with short spine with long hirsute bristle near its base (long bristle broken on illustrated endite, Figure 145b); margin between main spine and tip serrate; dorsal margin of dorsal branch serrate opposite distal teeth on ventral margin. Basale: endite with 6 pectinate end bristles, 5 triaenid bristles (one pair of spines very long), and 2 subequal, short, slender bristles; ventral margin of basale with 2 long spinous bristles, 2 triaenid bristles (one pair of spines very long), and 1 short spinous bristle; dorsal margin of basale with 5 slender proximal bristles, 1 short, slender, subterminal bristle, and 2 long, stout, terminal bristles; medial side with spines forming clusters on dorsal half. Exopodite with hirsute tip reaching distal end of 1st endopodite joint, with 2 subterminal ventral bristles. Endopodite: 1st joint with 5 ventral bristles (2 near middle of ventral margin, 3 terminal on ventral margin (bases on medial side)); ventral margin of 2nd joint with 4 long subterminal bristles; dorsal margin with numerous bristles; medial side with spines forming rows; end joint with 3 stout claws and 3 bristles; ventral and middle claws of end joint about same size, dorsal claw about 79 percent length of other claws.

Maxilla (Figure 145c,d): Epipodite long, slender; endite I with 4 long stout bristles and 2 minute bristles; endite II with 1 long stout bristle and 4 short slender bristles. Basale: ventral margin with 7 short slender bristles and 1 long, stout, terminal bristle with base of bristle on lateral side; dorsal margin with 4 or 5 proximal bristles (2-3 long, 1-3 short) and 6 or 7 distal bristles (2-3 long, 4-5 short); medial side hirsute, with 1 distal bristle. Endopodite: 1st joint hirsute, with 3 short dorsal bristles and 1 long hirsute beta-bristle terminally on ventral margin, end joint with 5 terminal bristles. Exopodite not observed.

Fifth Limb (Figure 144f): Dorsal margin of



FIGURE 145.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161: *a*, left mandible-coxale endite (not shown), medial view; *b*, coxale endite of right mandible, lateral view; *c*, left maxilla, medial view; *d*, endite bristles of right maxilla, medial view; *e*, anterior of body showing right lateral eye, medial eye and rod-shaped organ, and upper lip; *f*, right lateral eye; *g*, posterior of body showing posterior process and tips of 2 of the gill-like structures (2 posterior furcal bristles at bottom of illustration); *h*, right Y-sclerite, anterior to right.

comb hirsute with bases of hairs on lateral side; lateral side with 1 short proximal bristle near dorsal margin, 1 stout, hirsute, exopodial bristle, and about 5 short slender bristles just posterior to stout bristle, and closer to ventral margin.

Sixth Limb (Figure 146a): Anterior margin with single distinct suture; margin above suture with medial bristles forming inner row and outer row; inner row with 10 short bristles with long hairs along proximal two-thirds; outer row with 14 longer hirsute bristles; margin below suture with 6 or 7 short, slender, hirsute bristles; about 13 stout spinous bristles present medial to lateral flap (some of these bristles could be considered to be on anterior part of ventral margin); ventral margin posterior to lateral flap with 8 spinous bristles; lateral flap with 2 fairly stout hirsute bristles followed by 6 short, slender, hirsute bristles; hirsute posteroventral margin tapering to rounded tip; distal end of posterior edge of narrow proximal part of limb with 1 short, hirsute, epipodial bristle; medial surface near ventral margin

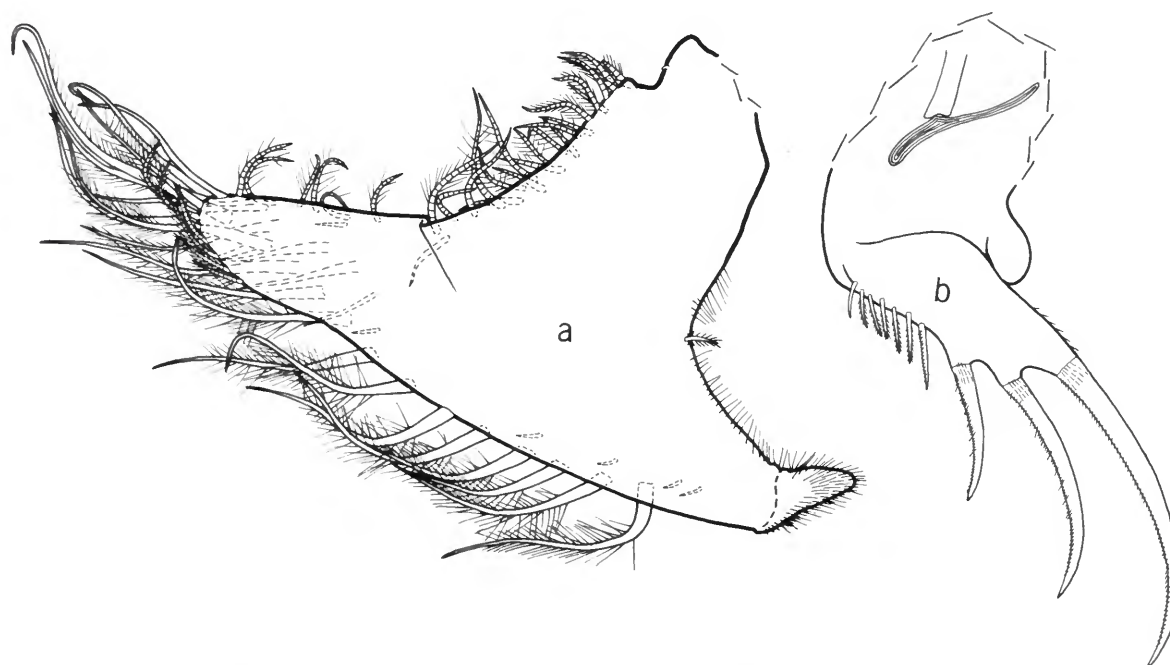
of limb with several minute bristles near ventral margin.

Seventh Limb (Figure 144g): Each limb with about 31 bristles, about 14 on one side and 17 on other side, some segments with 2 bristles (1 on each side); each bristle with 1 to 7 bells but no marginal spines; terminus with opposing combs, each with total of 13–16 A- and B-teeth (see Kornicker, 1975b:13, fig. 8, for description of A- and B-teeth).

Furca (Figure 146b): Each lamella with 3 long stout claws followed by 7 short, slender, secondary claws; main claws with medial and lateral teeth forming rows along posterior margin; secondary teeth with slender teeth or spines along posterior and anterior margins; anterior margin of lamella with slender spines; long hairs present medially on lamellae at bases of main claws.

Rod-shaped Organ (Figure 145e): Elongate, broadening near middle, with rounded tip.

Eyes: Medial eye large, pigmented, bare (Figure 145e). Lateral eye about same size as medial eye,



limb, lateral view; b, right lamella of furca and right Y-sclerite, lateral view.

pigmented, with about 16 ommatidia (some embedded in pigment difficult to discern) (Figure 145e,f).

Posterior (Figure 145g): Hirsute; dorsal process fingerlike with spinous lobe at tip.

Upper Lip (Figure 145e): Consisting of hirsute lobe on each side of saddle; each lobe with about 3 anterior spines; a hirsute flap posterior to each lobe.

Brush-like Organ: Not observed.

Genitalia: Copulatory organ small.

Y-Sclerite (Figure 145h): Slightly sinusoidal.

Gill-like Structures: Well developed (tips of 2 gills shown in Figure 145g).

DESCRIPTION OF ADULT FEMALE (Figures 147–149, Plates 143–148).—Carapace similar to that of adult male except for being larger and having more rounded posterodorsal margin (Plates 143a,b, 146a).

Ornamentation: Surface with large fossae with minute papillae on bottom (Plates 143c,d, 144b,d, 146c); surface between papillae with minute processes having digitate tips (Plate 144d,e); surface of papillae within fossae pustulose (Plate 144e); surface of valve between fossae with papillae in some areas (Plate 143c) and with vesicular structure in other areas (Plate 144a,c).

Infold: Rostral infold with about 54 bristles forming row paralleling valve edge (Plates 145a–c, 146d); about 60 shorter bristles present between row of long bristles and anterior valve margin; list extending from point posterior to incisur to point near posterior end of ventral margin; about 46 small bristles present between list and anteroventral and ventral margins of valve (Plate 147a); posterior infold broad with bristles present in 3 areas (Plates 145d, 146d, 147b,c); outer area with about 22 long and 17 short bristles (Plates 145d, 146b,d, 147b,c,f, 148a–c); middle area with about 11 short bristles (Plate 147b–e); inner area with about 24 bristles of which about 10 are longer than others (Plates 147b,c, 148d,e).

Selvage: Similar to that of adult male (Plates 145c,d, 147a–c).

Size: USNM 157169, length 3.29 mm, height, 2.53 mm; USNM 157224, length 4.03 mm, height

2.96 mm; USNM 157232, length 3.00 mm, height 2.29 mm; USNM 157223, length 3.61 mm, height 2.59 mm.

First Antenna (Figure 147a,b): 1st joint with lateral and medial spines. 2nd joint with 5 dorsal bristles (4 proximal, 1 distal) and spines on medial side near ventral and distal margins. 3rd joint short, triangular, with 1 short ventral bristle and 3 dorsal bristles (1 near middle, 2 terminal). 4th joint short, with 5 bristles (1 dorsal, 4 ventral (1 very long, 3 short)). 5th joint long; sensory bristle with 4 or 5 short proximal filaments, 2 long subterminal filaments, and with tip of stem consisting of 2 long terminal filaments. 6th joint short with small medial bristle with spine at tip. 7th joint: a-claw smooth with weak rings distally; b-bristle about twice length of a-claw, with 5 marginal filaments excluding stem; c-bristle about one-fourth longer than b-bristle, with 7 marginal filaments excluding stem. 8th joint: d- and e-bristles bare with blunt tips, about same length as b-bristle; f-bristle curved dorsally near base, slightly shorter than c-bristle, with 8 marginal filaments excluding stem; g-bristle slightly longer than c-bristle, with 9 marginal filaments excluding stem.

Second Antenna (Figures 147c, 149a): Protopodite with medial bristle and long hairs along ventral margin. Endopodite 3-jointed: 1st joint weakly divided into proximal and distal parts on some specimens, with 5–21 proximal bristles; 2nd joint elongate, bare; suture between 2nd and 3rd joints indicated by slight restriction along margin; 3rd joint short with relatively short subterminal bristle. Exopodite: 1st joint with minute, recurved, medial bristle on distal margin; bristles of joints 2–8 with stout ventral spines and natatory hairs; 9th joint with 3 long ventral bristles with ventral spines and natatory hairs, and 2 shorter bristles with only natatory hairs; neither basal spines nor short spines forming rows along distal margins of joints present.

Mandible: Coxale endite (Figures 147d, 149b): small bristle present near base of ventral branch; ventral branch with spines and hairs forming about 10 oblique rows; hairs present on coxale

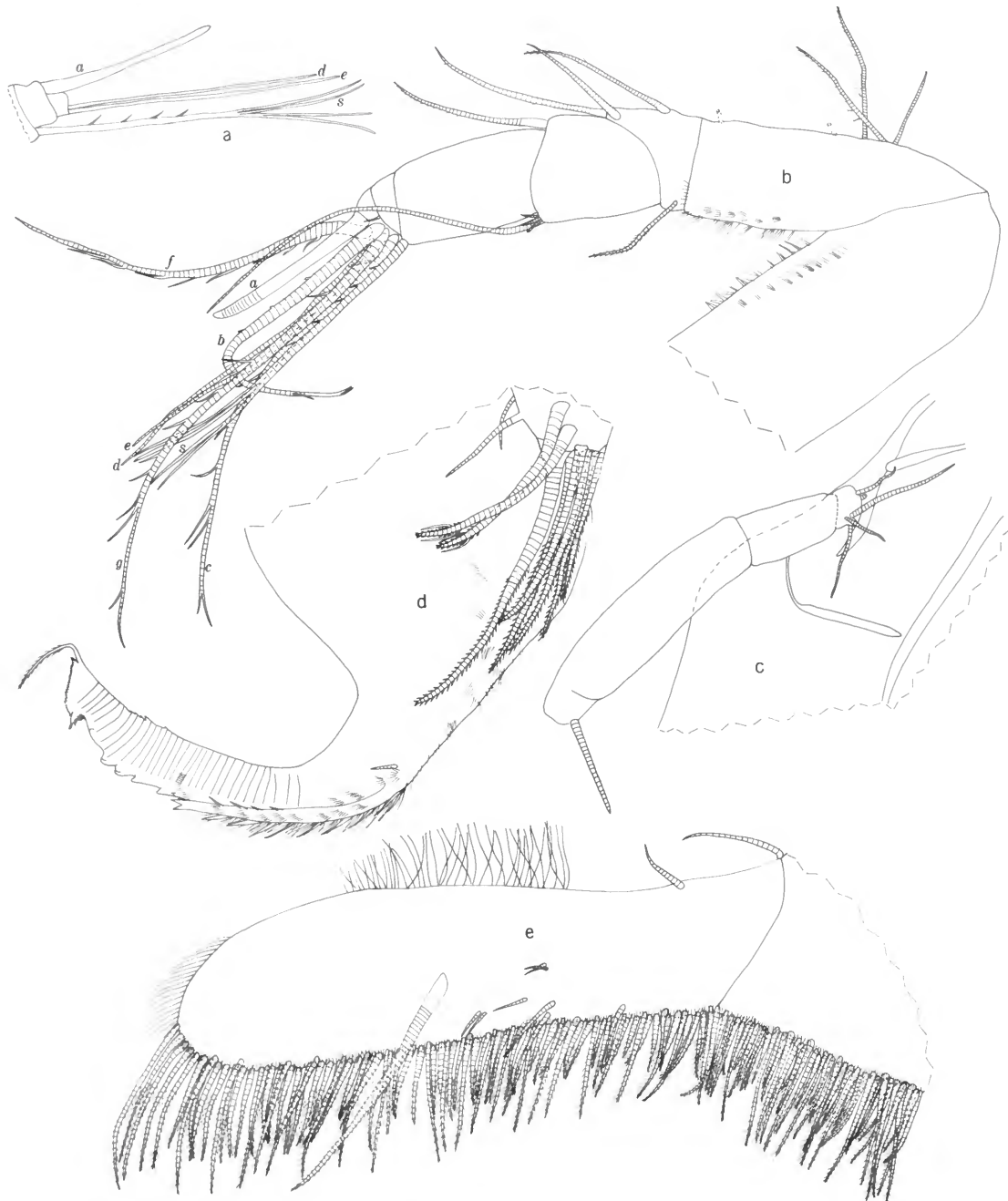


FIGURE 147.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157232: *a*, right 1st antenna showing sensory bristle of 5th joint, a-bristle of 7th joint, and d- and e-bristles of 8th joint, lateral view. USNM 157169: *b*, right 1st antenna, medial view; *c*, distal part of protopodite and endopodite of right 2nd antenna; *d*, basale endite and coxale endite of left mandible, medial view; *e*, comb of left 5th limb, lateral view.

proximal to ventral branch; tip of ventral branch with 2 stout teeth and 1 minute dorsal tooth (dorsal tooth with minute lateral spines); dorsal branch with 4–5 teeth along ventral margin; main spine with short hairs along anterior margin; tip of dorsal branch with short spine with long hirsute bristle near its base; margin between main spine and tip serrate; ventral margin of dorsal branch serrate opposite teeth on ventral margin. Basale: endite with 5 or 6 pectinate end bristles, 6–9 triaenid bristles (1 pair of spines very long), 3–5 subequal, short, slender bristles and 2 glandular processes; ventral margin of basale with 4 or 5 triaenid bristles (1 pair of spines very long), 1 long spinous bristle and 2 or 3 small bristles (the distal 1 or 2 of these with bases on lateral side); USNM 157244 with 1 or 2 short proximal bristles near ventral margin; dorsal margin of basale with 4–10 slender proximal bristles, 1–4 short, slender, subterminal bristles, and 2 long, stout, terminal bristles; medial side with spines forming rows on dorsal half. Exopodite similar to that on adult male. Endopodite: 1st joint with 6 ventral bristles; ventral margin of 2nd joint with 3 long subterminal bristles; dorsal margin with numerous bristles; medial side with spines forming rows and numerous cleaning bristles; end joint with 3 stout claws (dorsal claw about 70 percent of other claws) and 3 bristles (2 short, ventral, 1 long, lateral).

Maxilla (Figures 148a, 149c): Epipodite long, slender, hirsute ventrally and distally; endite I with 3 long stout bristles and 1 minute bristle; endite II with 2 long stout bristles and 1 short slender bristle; endite III with 1 long stout bristle, about 10 medium-to-long slender bristles, and 3 or 4 short slender bristles (USNM 157169 with fewer bristles on endite III; not all endites shown in Figure 148a). Basale: ventral margin with 5–7 slender bristles and 1 long, stout, spinous, terminal bristle; dorsal margin with 8–16 proximal bristles of various lengths and 6–12 distal bristles of various lengths; lateral side with 1 proximal bristle; medial side hirsute with 1 distal bristle. Exopodite minute with 3 bristles (1 fairly long, 2 short). Endopodite: 1st joint hirsute, with 1 or 2

short dorsal bristles, and 1 long hirsute beta-bristle terminally on ventral margin; end joint with 5 terminal bristles.

Fifth Limb (Figures 147e, 149d): Dorsal margin of comb hirsute with bases of hairs on lateral side, and 1–4 bristles at proximal end; lateral side with 1 short proximal bristle and 0 to 4 short distal bristles near dorsal margin, 1 stout, hirsute, epipodial bristle, 2 short bristles near middle posterior to base of stout epipodial bristle, and 5 or 6 short bristles near ventral margin posterior to stout epipodial bristle; ventral margin with hirsute bristles forming 2 rows except for about 6 distal bristles that form single row (bristles forming lateral row longer but fewer in number than bristles forming medial row).

Sixth Limb (Figure 149e): Anterior margin with single distinct suture; margin above suture with bristles forming 2 rows, inner medial row with about 12 bristles with long hairs proximally and short spines distally, outer row with about 30 longer, hirsute bristles (bristle near suture longer than others); margin below suture with single medial row of about 13 hirsute bristles; about 18 bristles present medial to lateral flap; ventral margin posterior to lateral flap with 8 or 9 spinous bristles; lateral flap with about 12 hirsute bristles (these decreasing in length posteriorly along edge of flap); hirsute posterior margin of skirt tapering to rounded tip with 0 or 1 short hirsute bristle; medial surface of skirt with numerous minute bristles near ventral and anterior margins; 1 or 2 short hirsute bristles present in place of epipodial appendage.

Seventh Limb: Each limb with 58–69 bristles, 24–32 on one side, 29–38 on the other, many segments with 2 bristles (1 on each side); some segments with 3 bristles (1 on one side, 2 on the other), each bristle with up to 8 bells; terminus with opposing combs, each with 16–22 teeth (Figure 149f).

Furca: Each lamella with 3 long stout claws followed by 6–10 slender secondary claws, otherwise similar to furca of adult male.

Rod-shaped Organ (Figures 148b, 149g): Elongate, broadening near middle, tapering to



FIGURE 148.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157169: a, right maxilla, medial view; b, anterior of body showing left lateral eye, medial eye and rod-shaped organ, and upper lip; c, right lateral eye; d, posterior process of body.



FIGURE 149.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157224: *a*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *b*, coxale endite of right mandible, medial view; *c*, left maxilla, medial view; *d*, comb of right 5th limb, lateral view; *e*, right 6th limb, medial view; *f*, terminus of 7th limb; *g*, medial eye and rod-shaped organ; *h*, right lateral eye; *i*, upper lip, anterior to right.

rounded tip, some specimens with suture proximal to middle.

Eyes (Figures 148*b,c*, 149*g,h*), *Posterior of Body* (Figure 148*d*); *Y-Sclerite*, *Gill-like Structures*: Similar to those of adult male, but exact number of ommatidia in lateral eye difficult to determine because of pigment.

Upper Lip (Figures 148*b*, 149*i*): Similar to that of adult male except anterior spines not observed.

Brush-like Organ: Not observed.

Number of Eggs in Marsupium: USNM 157232—19; USNM 157169—21, USNM 157224—19.

Protistans: Stalked protistans abundant along anterior margin of USNM 157224 (Plate 145*a-c,e,f*).

COMPARISONS.—Two species of *Asteropterygion* have been described from east Africa, both from the vicinity of Mombasa: *A. skogsbergi* (Poulsen, 1965) and *A. spinosum* (Poulsen, 1965). The carapace of *A. thomassini* differs from that of *A. spinosum* in not having short curved spines on its outer surface. The carapace of *A. thomassini* bears more ribs than that of *A. skogsbergi*. One species of *Asteropterygion* has been described from the Union of South Africa—*A. nodulosum* (Poulsen, 1965). That species has rimmed fossae touching each other and no central ribs in anterior half of valves.

51. *Asteropterygion romei*, new species

FIGURES 9*f*, 150–154; PLATES 149–157

ETYMOLOGY.—The species is named for Dom Remacle Rome.

HOLOTYPE.—USNM 157703, ovigerous female, on slides and in alcohol.

TYPE-LOCALITY.—Sta 105, off Tanzania.

PARATYPES.—From off Tanzania: USNM 157704, adult male, sta 111?; USNM 157705, A-1 male, sta 59; USNM 157506, ovigerous female, USNM 157712, 2 specimens, sta 80; USNM 157707, 1 specimen, sta 79; USNM 157708, 3 specimens, sta 107; USNM 157709, 1 specimen, sta 81; USNM 157710, 1 specimen, sta 9M; USNM 157711, 2 specimens, sta 54; USNM

157713, 1 specimen, Traverse Kunduchi; USNM 157714, 2 specimens, sta 64; USNM 157715, 4 specimens, sta 24.

NON-TYPES.—USNM 157413, 1 A-1? female, sta LK-29, off Mombasa; USNM 157718, 1 early instar, sta LK-28, off Mombasa; USNM 157804, 1 juvenile, sta 103, Bab el Mandeb.

DISTRIBUTION (Figure 131).—Continental shelf off Tanzania at depths of 0.71–6 m; continental shelf off Mombasa, Kenya, at depths of 1/3–4 m; Bab el Mandeb at 24 m.

DESCRIPTION OF ADULT FEMALE (Figures 150–152).—Carapace with rib paralleling dorsal margin, rib paralleling ventral margin, and horizontal rib starting on rostrum and branching near valve middle to form 2 ribs terminating near posterior margin of valve (lateral outline of carapace shown in Figure 150*a*).

Ornamentation: Similar to that of A-1 male described herein.

Infold: Similar to that of A-1 male and A-1? female illustrated herein.

Size: USNM 157703, length 3.17 mm, height 2.41 mm, USNM 157706, length 3.35 mm, height 2.56 mm.

First Antenna (Figure 150*b*): 1st joint with medial and lateral hairs. 2nd joint: ventral margin with long hairs; dorsal margin with proximal hairs and 5 bristles (4 proximal, 1 distal). 3rd joint: short ventral margin with 1 short bristle; long dorsal margin with 1 proximal and 2 terminal bristles. 4th joint: short dorsal margin with 1 terminal bristle; long ventral margin with 4 short terminal bristles. 5th joint: sensory bristle with 5 short proximal filaments, 2 long distal filaments, and 2 terminal filaments, including tip of stem. 6th joint with minute medial bristle and lateral hairs along distal margin. 7th joint: a-bristle about same length as 5th joint, clawlike with rounded tip; b-bristle about same length as sensory bristle of 5th joint, with 4 marginal filaments and bifurcate tip; c-bristle reaching just past tip of sensory bristle, with 6 short marginal filaments and bifurcate tip. 8th joint: d- and e-bristles bare with blunt tips, about same length as sensory bristle; f-bristle bent dorsally in proximal part, with 6 ventral filaments and bifurcate



FIGURE 150.—*Asteropterygion romei*, new species, ovigerous female, holotype, USNM 157703: *a*, outline of carapace, anterior to right, length 3.17 mm; *b*, right 1st antenna, lateral view; *c*, endopodite and distal part of protopodite of left 2nd antenna, medial view; *d*, left Y-sclerite, anterior to left.

tip; g-bristle longer than c-bristle, with 8 marginal filaments and bifurcate tip.

Second Antenna (Figure 150c): Protopodite with hairs along ventral and dorsal margins and on medial surface near both margins, and with 1 spinous, distal, medial bristle. Endopodite: 1st joint with 11 or 12 bristles; 2nd joint elongate, weakly separated from 3rd joint; 3rd joint short, with subterminal bristle with blunt tip. Exopodite: 1st joint with medial spine on distal margin; bristle of 2nd joint long, with natatory hairs and ventral spines; bristles of joints 3–8 with natatory hairs and ventral spines; 9th joint with 5 or 6 bristles (3 with natatory hairs and ventral spines, 2 or 3 with only natatory hairs); no basal spines or minute spines along distal margins of joints.

Mandible (Figure 151a): Coxale endite: no bristle present near base of ventral branch; ventral branch with proximal hairs and spines forming about 8 oblique rows; tip with 3 or 4 minute spines; ventral margin of dorsal branch with 4 or 5 low nodes proximal to small main spine; tip of dorsal branch with minute spine ventral to posterior bristle; margin between main spine and tip serrate; dorsal margin of branch with few serrations. Basale endite: tip with about 5 end-type bristles; ventral margin with 7 triaenid bristles with 1 pair of teeth much longer than others; 4 or 5 dwarf bristles present (distal of these much longer than others). Basale: ventral margin with 5 triaenid bristles (all but distal of these with 1 pair of teeth much longer than others), 1 long, spinous, distal bristle, and 4 small distal bristles; medial surface with 1 or 2 small proximal bristles near ventral margin, and long hairs forming rows near dorsal margin; dorsal margin with 7 short proximal bristles (these have bases on lateral side) and 4 distal bristles (2 long, 2 short). Exopodite hirsute, reaching distal end of 1st endopodial joint, with 2 ventral bristles (distal of these shorter than other). Endopodite: ventral margin of 1st joint with 6 bristles (2 long, proximal, 4 shorter, distal); ventral margin of 2nd joint with bristles forming 2 distal groups, each with 2 bristles; dorsal margin and medial surface near dorsal margin with numerous bristles; some of the clean-

ing bristles with broad marginal spines; medial surface with spines forming rows; 3rd joint with 3 long claws (2 of these with ventral spines), 1 long lateral bristle, and 2 small ventral bristles.

Maxilla (Figure 151b): Hirsute tip of epipodial appendage reaching distal bristles on dorsal margin of basale. Endite I with 3 long stout bristles and 1 minute bristle; endite II with 2 long and 2 shorter bristles; endite III with 1 long stout bristle and about 13 shorter bristles in vicinity of base of stout bristle. Basale: dorsal margin with 11 proximal bristles with bases on medial side and 6 or 7 distal bristles; medial side with 4 distal bristles (only 1 of these near ventral margin); ventral margin with 10 short bristles and 1 long terminal bristle. Exopodite with 3 bristles (1 longer than others). Endopodite: 1st joint with 3 anterior bristles and 1 long spinous beta-bristle; end joint with 5 bristles.

Fifth Limb (Figure 152): Dorsal margin of comb with 5 proximal and 6 distal bristles; hairs along middle part of dorsal margin longer than those along anterior margin; lateral side with 1 long, stout, spinous, exopodial bristle, 5 bristles near ventral margin proximal to base of stout bristle, and 2 distal bristles near ventral margin.

Sixth Limb: Anterior margin with distinct suture separating trunk and skirt, and 2nd faint suture separating dorsal to skirt; anterior margin of trunk dorsal to upper suture with spinous bristles forming 2 rows (10 bristles in inner row; 18 or 19 longer bristles in outer row, distal of these longer than others); margin between sutures with 4 bristles in inner row and 5 in outer row (distal of these longer than others); anterior margin of skirt just ventral to lower suture with 5 or 6 slender spinous bristles forming row parallel to anterior margin; anterior tip and ventral margin of skirt with numerous bristles; posterior tip of skirt protracted, hirsute; medial side of skirt with numerous minute bristles; 1 small spinous bristle in place of epipodial appendage. Limb similar in shape to that of adult male.

Seventh Limb: Each limb with 65 bristles, 28–38 on each side; each bristle with up to 7 bells; most joints with 2 bristles, 1 on each side, but distal



FIGURE 151.—*Asteropterygion romei*, new species, ovigerous female, holotype, USNM 157703: *a*, right mandible, medial view; *b*, left maxilla, medial view; *c*, terminus of 7th limb; *d*, left lamella of furca, lateral view; *e*, medial eye and rod-shaped organ; *f*, left lateral eye.

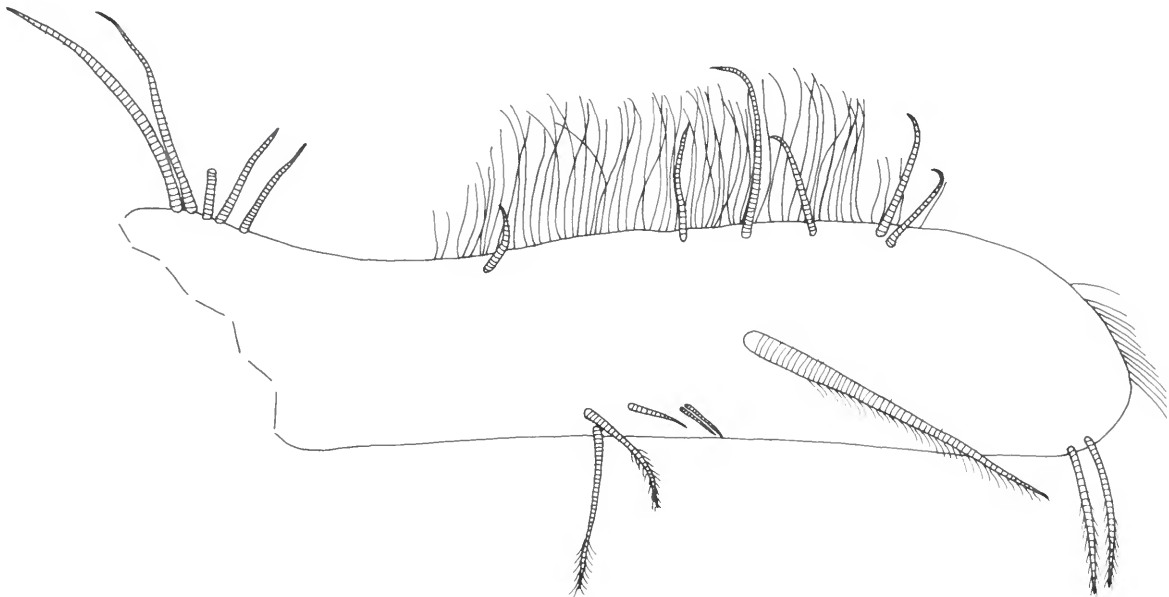


FIGURE 152.—*Asteropterygion romei*, new species, ovigerous female, holotype, USNM 157703, comb of right 5th limb, lateral view.

joints with 4 bristles, 2 on each side, rarely with 5 bristles; the 2 bristles on 1 side of joint generally consisting of 1 long and 1 short bristle; terminus consisting of opposing combs, each with about 22 spinous teeth of various types (Figure 151c).

Furca (Figure 151d): Each lamella with 3 main claws followed by 6–10 secondary claws; main claws with teeth forming medial and lateral row along posterior margin; teeth consisting of large teeth separated by several smaller teeth; secondary claws with few teeth along anterior margin in addition to teeth along posterior margin; long medial hairs present on lamella near bases of main claws; hairs also present along edge of lamella following main claws.

Rod-shaped Organ (Figure 151e): Elongate with distinct suture proximal to widened middle part; tip narrow subrounded.

Eyes: Medial eye bare, with black pigment (Figure 151e). Lateral eye about same size as medial eye, with black pigment and about 17 ommatidia (Figure 151f).

Upper Lip: Each lobe hirsute and with anterior

spines; hirsute lateral flap present on each side of mouth; middle saddle obscure on USNM 157703.

Posterior of Body (Figure 151g): Hirsute, with tapering dorsal process with long hairs at tip.

Y-Sclerite (Figure 150d): Typical for genus.

Eggs: USNM 157703 with 24 eggs in marsupium; USNM 157706 with 26 eggs in marsupium.

DESCRIPTION OF ADULT MALE (Figures 153, 154).—Carapace similar to that of adult female except for tapering posterodorsal margin (Compare male outline Figure 153a, with that of female outline, Figure 150a).

Size: USNM 157704, length 2.68 mm, height 1.94 mm.

First Antenna (Figure 153b,c): 1st joint with hairs along ventral margin. 2nd joint: ventral margin with distal hairs; dorsal margin with 5 spinous bristles. 3rd joint: short ventral margin with 1 short bristle; dorsal margin with 1 midbristle and 2 terminal bristles. 4th joint: ventral margin with 3 terminal bristles; dorsal margin with 1 terminal bristle. 5th joint: triangular; sensory bristle extremely stout, with abundant narrow filaments



FIGURE 153.—*Asteropterygion romei*, new species, adult male, paratype, USNM 157704: *a*, outline of complete carapace, length 2.68 mm; *b*, left 1st antenna, lateral view; *c*, joints 6–8 right 1st antenna, medial view; *d*, right mandible (coxale endite not shown), medial view; *e*, coxale endite of right mandible, lateral view; *f*, medial eye and rod-shaped organ; *g*, left lateral eye; *h*, anterior view of upper lip showing 2 spines on middle saddle, a few spines on the left and right lobe, and hairs on the lateral flaps; *i*, posterior of body showing the posterior process.

with rings near base. 6th joint long, narrow, with small medial bristle near dorsal margin. 7th joint: a-bristle clawlike, about same length as ventral margins of combined joints 6–8; b-bristle about twice length of a-bristle, with 5 marginal filaments and bifurcate tip; c-bristle about three times length of a-bristle, with 14 marginal filaments and bifurcate tip. 8th joint: d- and e-bristles long bare (tips broken off on USNM 157704); f-bristle bent slightly dorsally, longer than b-bristle, with about 11 marginal filaments and bifurcate tip; g-bristle similar to c-bristle.

Second Antenna (Figure 154a): Protopodite with short, distal, medial bristle, otherwise bare. Endopodite 3-jointed: 1st joint with 3 short proximal bristles; 2nd joint elongate with 5 distal bristles;

3rd joint elongate, sclerotized, with 1 long proximal filament and tip with about 7 ridges. Exopodite: 1st joint elongate with small, straight, medial spine on distal margin; 2nd joint only slightly longer than 3rd joint; bristle of 2nd joint long, with natatory hairs and few small, slender, ventral spines; bristles of joints 3–8 with natatory hairs and few small, slender, ventral spines; 9th joint with 5 bristles (3 long with natatory hairs and few ventral spines, 1 medium, and 1 short with only natatory hairs); joints 2–8 with long hairs along inner distal margin.

Mandible (Figure 153d,e): Coxale endite: no bristle present near base of ventral branch; ventral branch with spines forming 8 oblique rows, and tip with 3 minute teeth (Figure 153e); ventral



FIGURE 154.—*Asteropterygion romei*, new species adult male, paratype, USNM 157704: a, endopodite and distal part of protopodite of left 2nd antenna, medial view; b, right 6th limb, medial view.

margin of dorsal branch with 6 low nodes and small main spine; tip of dorsal branch ending in small spine ventral to posterior bristle; dorsal margin of branch with few serrations; margin between main spine and tip of dorsal branch serrate. Basale endite: tip with about 4 end-type bristles; ventral margin with about 7 triaenid bristles with 1 pair of teeth much longer than others; 2 dwarf bristles present (distal of these longer than other). Basale: ventral margin with 4 triaenid bristles, 1 long, spinous, distal bristle, and 3 small distal bristles; dorsal margin with 2 or 3 small proximal bristles and 3 distal bristles (2 long, 1 short). Exopodite hirsute, reaching just past distal end of 1st endopodial joint, with 2 ventral bristles (distal of these shorter than other). Endopodite: 1st joint with 6 or 7 ventral bristles; ventral margin of 2nd joint with distal bristles forming 2 groups, each with 2 bristles; dorsal margin and medial side near dorsal margin with numerous bristles; medial surface with faint spines forming rows; end joint with 3 stout claws, 1 long lateral bristle, and 2 short ventral bristles.

Maxilla and 5th Limb: Not examined in detail.

Sixth Limb (Figure 154b): In general, similar to that of female.

Seventh Limb: Each limb with about 30 bristles, 11–19 on each side; each bristle with up to 7 bells; many joints with 2 bristles, 1 on each side; terminus consisting of opposing combs, each with about 14 spinous teeth of various types.

Furca: Each lamella with 3 main claws followed by 6 secondary claws, otherwise similar to that of adult female.

Rod-shaped Organ (Figure 153f): Elongate, with suture proximal to widened middle part; tip rounded.

Eyes: Medial eye bare, pigmented black, with indentation in middle of anterior margin (Figure 153f). Latera! eye larger than medial eye, pigmented black, with about 24 ommatidia (Figure 153g).

Upper Lip (Figure 153h): Each lobe hirsute and with anterior spines; middle saddle with anterior spines; hirsute lateral flap present at each side of mouth.

Posterior of Body (Figure 153i): Similar to that of adult female.

DESCRIPTION OF A-1? FEMALE (Plates 149–152).—Carapace similar to that of adult female.

Ornamentation (Plates 150–152a,b): Similar to that of A-1 male described herein.

Infold (Plate 152c,d): Normal for genus.

Size: USNM 157413, length 2.31 mm, height 1.75 mm.

Posterior of Body: Fingerlike dorsal process cylindrical.

REMARKS.—Unlike the specimens from Tanzania, the posterior process of the examined specimen from Mombasa has a cylindrical rather than a tapered posterior process. This raises the possibility that the Mombasa specimens are not conspecific with the population living off Tanzania. For this reason, the Mombasa specimens are not designated paratypes.

DESCRIPTION OF A-1 MALE (Plates 153–157).—Carapace similar in shape to that of adult female (Plate 153a–d).

Ornamentation: Surface of valves with shallow fossae having pustules (Plates 153b,e, 154) and deeper fossae having long-branching papillae (Plates 153b,e, 155b–e, 156a–d); surface between fossae with small nodes and minute reticulations (Plate 155a–e); surface of the pustules with minute pits and small rounded depressions (Plate 154d); bottom of those fossae containing branching papillae bear minute pimples (Plates 155f, 156a); small areas with reticulations poorly developed present adjacent to pustules (Plate 154c,e); area between pustules in shallow fossae reticulate (Plate 154c); over some parts of valve surface, ridges forming the reticulations appear as rows of small pustules (Plate 155a); bristles emerging from open pores sparsely distributed over valve surface (Plate 156e,f); small pore present in bristle near base (Plate 156e,f).

Infold: Normal for genus but bristles missing from pores in outer row of posteroventral infold (Plate 157).

Size: USNM 157705, length 2.30 mm, height 0.78 mm.

COMPARISONS.—The carapace of the new spe-

cies, *A. romei*, differs from that of *A. peterseni* and *A. skogsbergi* in having a prominent horizontal midrib that is subdued or missing on the other species. The carapace of *A. romei* differs from those of previously described species in having fossae with branching papillae. The 1st antenna of *A. romei* does not have the extremely long terminal bristle present on the ventral margin of the 4th joint of *A. thomassini*. The 1st antenna of *A. romei* differs from that of *A. peterseni* in having a clawlike a-bristle.

Astropterygion dayi Group

COMPOSITION AND DISTRIBUTION.—The species of the *Astropterygion dayi* Group and their distribution are as follows: *A. dayi*, new species, off South Africa; *A. hirsutum* (Poulsen, 1965), Malayan Archipelago; *A. peterseni*, new species, off Tanzania; *A. magnum* (Poulsen, 1965), off Australia. Species of this group have been collected at intertidal depths and as deep as 100 m.

DIAGNOSIS.—The a-bristle of 1st antenna clawlike proximally, bristlelike distally, tapering gradually to pointed tip.

Key to Species in the *Astropterygion dayi* Group

1. Carapace with vertical ridge anterior to central adductor muscle attachments 52. *A. magnum*
Carapace with out vertical ridge anterior to central adductor muscle attachments 2
2. Furca with 5 main claws on each lamella 53. *A. hirsutum*
Furca with 3 main claws on each lamella 3
3. Fossae on valve surface with minute pustules 55. *A. peterseni*, new species
Fossae on valve surface with polygonal network. 54. *A. dayi*, new species

52. *Astropterygion magnum* (Poulsen, 1965), new combination

FIGURES 9a, 11i, 12b, 14b, 15a, 16b, 17a, 150h, 155;
PLATES 158–161

Astropteron magnum Poulsen, 1965:178, figs. 57–60.—Kornicker, 1975a:562.

HOLOTYPE.—Female with eggs in ovaries, carapace length 4.0 mm.

TYPE-LOCALITY.—Off Disaster Bay, southeast Australia, 65–90 m.

MATERIAL.—USNM 157762, 1 female, probably A-1 instar, sta III, dredge sta 903, off New South Wales, Australia.

DISTRIBUTION (Figure 131).—Continental shelf off southern end of New South Wales, Australia, at depths of 65–100 m.

SUPPLEMENTARY DESCRIPTION OF FEMALE (probably A-1 instar) (Figure 155, Plates 158–161).—Carapace with overhanging rostrum, projecting process on anteroventral margin, 3 projecting

posterior processes, a vertical rib posterior to anterior margin, and several horizontal ribs (Figure 155, Plates 158, 159).

Ornamentation: Surface with elongate fossae along ventral and anterodorsal margins and ovoid fossae in remaining parts (Plate 158a,b); fossae with processes projecting inward from sides and upwards from bottom (Plate 160); bottom also with minute papillae (Plates 160c, 161c); surface of valve between fossae with numerous pores, some forming clusters (Plate 161a,b); bristles abundant along anterior and ventral margins (Plate 158); bristles emerging from open pores sparsely distributed on valve surface, some with pore near base and marginal papillae (Plate 161d,e).

Size: USNM 157762, length 3.22 mm, height 2.56 mm.

First Antenna: Differs from that of the adult female described by Poulsen in having 3 dorsal bristles on the 2nd joint, and 3 dorsal bristles (1 midbristle, 2 terminal bristles) on the 3rd joint.



FIGURE 155.—*Asteropterygion magnum* (Poulsen), female (probably A-1 instar), USNM 157762, lateral view of complete specimen, length 3.22 mm.

Second Antenna: Endopodite differs from that of the adult female described by Poulsen in having 2 proximal bristles on the 1st joint. Exopodite without hairs on inner distal corners of joints 2–8.

Mandible: Coxale endite broken off limb examined. Basale endite differs from that of adult female described by Poulsen in having 4 bare dwarf bristles of which proximal 2 are about twice length of distal 2. Basale differs from that of adult female described by Poulsen in having on ventral margin 4 triaenid bristles followed by 1 long spinous bristle and 1 minute bristle, and on medial surface 1 small bristle near ventral margin, and on dorsal margin 1 short bare bristle near 2 long, spinous, terminal bristles. Last endopodite joint with 3 long claws, 1 long lateral bristle, and 2 ventral bristles (1 of these very small).

Maxilla: Basale ventral margin differs from that described by Poulsen in having about 12 short bristles (mostly in pairs) and 2 terminal bristles (medial of these reaching distal end of 1st endopodite joint; lateral of these reaching well past tip of 2nd endopodial joint).

Fifth Limb: Not examined.

Sixth Limb: Anterior margin of stem with 1 bare bristle followed by 24 short spinous bristles forming 2 rows; upper anterior margin of skirt with 4

bristles, no additional bristles along anterior margin; limb with 1 epipodial bristle; bristles of ventral margin of skirt not counted, but appearing similar to those of adult female described by Poulsen.

Seventh Limb: Covered by debris on specimen examined.

Furca: Differs from that of adult female described by Poulsen in having 8 secondary claws on right lamella.

Eyes, Rod-shaped Organ, Upper Lip, Posterior of Body: Similar to those of adult female described by Poulsen.

Y-Sclerite: Typical for genus.

53. *Asteropterygion hirsutum* (Poulsen, 1965), new combination

FIGURES 9k, 10g

Asteropteron hirsutum Poulsen, 1965:187, figs. 61–63.

HOLOTYPE.—Immature male, unique specimen.

TYPE-LOCALITY.—Malayan Archipelago, sta 77, Danish Key Island Expedition, 30 m.

MATERIAL.—None examined.

DISTRIBUTION.—Collected only at type-locality (Figure 131).

DIAGNOSIS.—Surface of valves with shallow fossae containing radial structure or processes (see Poulsen, 1965, fig. 61a').

Second Antenna: Exopodite with basal spines.

Furca: Each lamella with 5 main claws followed by 4 or 5 secondary claws.

54. *Asteropterygion dayi*, new species

FIGURES 9i, 156–159; PLATES 162–170

Asteropteron aff. *nodulosum* Poulsen, 1965.—Hartmann, 1974: 235 [part, only specimens from Knysna Estuary.]

ETYMOLOGY.—The species is named for Dr. J. H. Day, who collected some of the specimens.

HOLOTYPE.—USNM 151923, 1 ovigerous female, on slides and in alcohol, length 3.40 mm.

TYPE-LOCALITY.—Langebaan Lagoon, South Africa, sta LB-579P.

PARATYPES.—Langebaan Lagoon: 1 specimen, sta LB-209, and 1 specimen, sta LB-218 returned

to J. H. Day; USNM 157221, 4 specimens, sta LB-573Z; USNM 157219, 1 specimen, sta LB-582J; USNM 157220, 1 specimen, sta LB-586S; USNM 157218, 18 specimens, sta LB-588H; USNM 157213, 1 ovigerous female and 1 adult female, sta LB-592M; USNM 157214, 1 female, sta LB-593E; USNM 157211, 1 juvenile, sta LB-595E; USNM 157208, 1 adult female, USNM 157209, 15 juveniles, sta LB-596G; USNM 157216, 1 adult female, sta LB-600N; USNM 157215, 1 ovigerous and 1 adult female, sta LB-601N; USNM 157212, 9 juveniles, sta LB-604P; USNM 157210, 1 juvenile, sta LB-605J. Saldanha Bay: USNM 157217, 1 specimen, sta SB-410F.

NON-TYPES.—I received from the Hamburg Zoological Museum, through the courtesy of Dr. Gerd Hartmann, a vial containing appendages and 4 valves (K 30025) of specimens that had been collected in the Knysna Estuary, probe 116a. These specimens had been identified as *Asteropteron* aff. *nodulosum* Poulsen by Hartmann (1974: 235).

DISTRIBUTION (Figure 131).—South Africa: Langebaan Lagoon, Saldanha Bay, Knysna Estuary. Depth: intertidal to 24 m.

DESCRIPTION OF ADULT FEMALE (Figures 156–159, Plates 162–168).—Carapace oval in lateral view with 2 major processes, one in posterodorsal corner and one near middle of posterior margin

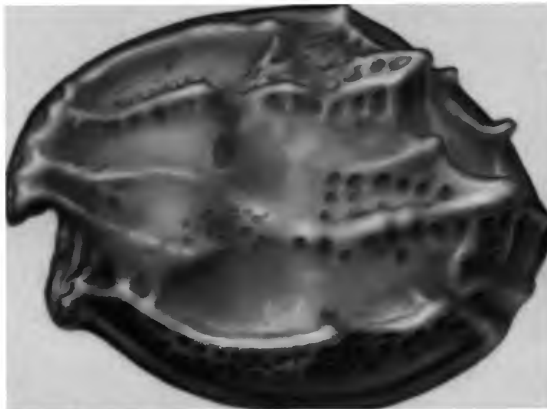


FIGURE 156.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923, lateral view of complete specimen, length 3.40 mm.

(Figure 156, Plate 162*a,c*); rostrum overhanging (Plate 162*d*); posteroventral corner of valve rounded; a small posterior process present between the 2 major processes; 2 small processes near posterodorsal margin; a horizontal ventral ridge paralleling ventral margin; 2 additional horizontal ridges extending from rostral area to the 2 major posterior processes; a discontinuous low horizontal ridge extending from rostral area to small posterior process between the 2 major processes; a low anterodorsal ridge also present.

Ornamentation: Surface with numerous fossae containing polygonal network (Plates 162*d,e*, 163*b–d*, 164); some polygons covered by thin “skin” (Plate 164*d–f*); bristles present in some polygons covered by the “skin” (Plate 164*e*); walls of polygons with honeycomb-like internal structure (Plate 164*b*); surface between fossae with oval areas covered by “skin” (Plates 162*e*, 163*d*), some with bristles (Plate 164*a*); smaller open oval fossae present between the skin-covered ovals (Plates 162*e*, 163*d*); smaller open pits present between the small oval fossae (Plate 164*c*); numerous long bristles along anterior, ventral, and posteroventral margins (Plate 162*b,d*).

Infold: Rostral infold with 15 long bristles, 29 medium bristles, and about 60 short bristles (Plate 165*a,b*); 1 short bristle present just dorsal to inner end of incisur; 4 short bristles forming row just posterior to incisur (ventral to inner end of incisur); anteroventral infold with about 27 short bristles between list and valve edge; anteroventral list with lamellar prolongation (posterior end of prolongation not observed, but occurring anterior to posterior end of ventral margin) (Plate 165*b*); posterodorsal infold with stout bristles and small tubular processes along list, about 15 long bristles forming row just within posteroventral valve edge, and numerous smaller bristles between row of 15 bristles and list (Figure 157*a*, Plate 165*a, c–f*).

Selvage: Broad selvage with long fringe present along anterodorsal margin (Plate 165*b*); ventral and posterior selvage broad but may have smooth outer edge.

Central Muscle Attachment Scars: Consisting of 15–19 individual oval scars (Plate 162*a*).



FIGURE 157.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151293: *a*, inside view posteroventral corner of right valve showing positions of infold bristles; *b*, left 1st antenna, lateral view; *c*, distal bristle of protopodite of right 2nd antenna, medial view; *d*, endopodite of left 2nd antenna, medial view; *e*, comb of right 5th limb, lateral view; *f*, distal end of 7th limb.

Size: USNM 151923, length 3.40 mm, height 2.60 mm; USNM 157208, length 3.49 mm, height 2.64 mm; USNM 157213, 2 specimens, length 3.56 mm, height 2.72 mm, length 3.45 mm, height 2.69 mm; USNM 157215, 2 specimens, length 3.49 mm, height 2.72, length 3.48 mm, height 2.65 mm.

First Antenna (Figure 157*b*): 1st joint with hairs on lateral and medial surfaces and along ventral margin, a few short spines proximally on lateral surface. 2nd joint: dorsal margin with few proximal hairs, 4 spinous bristles near middle and 1 spinous terminal bristle; ventral margin with proximal hairs; lateral and medial surfaces with hairs near ventral margin. 3rd joint short, triangular, with 1 short, spinous, ventral bristle and 3 spinous dorsal bristles (1 near middle, 2 terminal). 3rd plus 4th joint forming rectangle. 4th joint: ventral margin with 5 terminal bristles (1 long, 4 short); dorsal margin with 1 long terminal bristle. 5th joint about equal in length to combined lengths of joints 3 and 4; sensory bristle of 5th joint with 1 short proximal filament and forming 2 distal branches, each dividing into 2 long filaments with small process at tips. 6th joint with short medial bristle. 7th joint: a-bristle clawlike proximally but ringed distally, about equal in length to combined lengths of joints 3 to 8; b-bristle shorter than sensory bristle of 5th joint, with 2 short marginal filaments and bifurcate tip; c-bristle longer than sensory bristle, with 8 or 9 filaments including tip. 8th joint: d- and e-bristles slightly longer than a-bristle, bare with blunt tips; f-bristle bent slightly dorsally, with 8 filaments including tip; g-bristle same length as c-bristle, with about 10 filaments including tip.

Second Antenna (Figure 157*c,d*): Protopodite: with short distomedial bristle with short marginal spines; long hairs present along dorsal and ventral margins. Endopodite: 1st joint divided into proximal and distal parts by suture, proximal part with about 13 short bristles, distal part bare; 2nd and 3rd joints fused, with long subterminal bristle. Exopodite: 1st joint with small, terminal, medial spine with digitate tip; bristles of joints 2–8 with ventral spines near middle and natatory

hairs; 9th joint with 5 bristles, all with natatory hairs, some with ventral spines near middle (2 dorsal bristles shorter than others); some joints with faint spines or hairs along distal margins, no basal spines.

Mandible (Figure 158*a,b*): Coxale endite: ventral branch with spines forming about 6 oblique rows, tip with 2 large teeth and 1 smaller tooth (Figure 158*b*); small bristle present near base of ventral branch; dorsal branch obscure or broken on specimen examined. Basale endite: terminal end with 1 long and 6 shorter bristles with marginal spines; ventral margin of endite with 7 triaenid bristles (triaenid bristles with 2–4 pairs of spines followed by 1 long pair of spines, and then 8–10 pairs of smaller spines excluding terminal pair); endite also with 5 short bristles forming row (bristles terminate in minute tubelike process). Basale: dorsal margin with 8 slender proximal bristles, 3 short distal bristles, and 2 long, stout, spinous, terminal bristles; ventral margin with 6 or 7 triaenid bristles similar to those on endite, 1 long spinous bristle, and 8 or 9 short bare bristles; dorsal half of medial surface hirsute. Exopodite reaching just past distal end of 1st endopodial joint, with 2 spinous subterminal bristles (distal of these about half length of other). Endopodite: ventral margin of 1st joint with 2 long and 3 or 4 medium bristles, all with marginal spines; dorsal margin may have glandular opening distally; dorsal margin of second joint and medial surface near dorsal margin with numerous bristles, some triaenid; ventral margin of 2nd joint with 3 long terminal bristles with short marginal spines; medial surface of 2nd joint with hairs forming rows; end joint with 3 long claws (dorsal of these shorter than others and with few ventral spines), and 3 bristles (medial bristle of ventral pair very small and with marginal spines).

Maxilla (Figure 159*a*): Epipodial appendage reaching distal bristles on dorsal margin of basale, pointed, hirsute at tip. Endite I with 3 stout bristles and 1 minute bristle; endite II with 2 stout bristles and 1 minute bristle (the latter between the endites); endite III with 1 stout



FIGURE 158.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923: *a*, left mandible (coxale endite not shown), medial view; *b*, tip of ventral branch of coxale endite of mandible; *c*, right 6th limb, medial view; *d*, right lamella of furca, lateral view; *e*, right Y-sclerite, anterior to right.

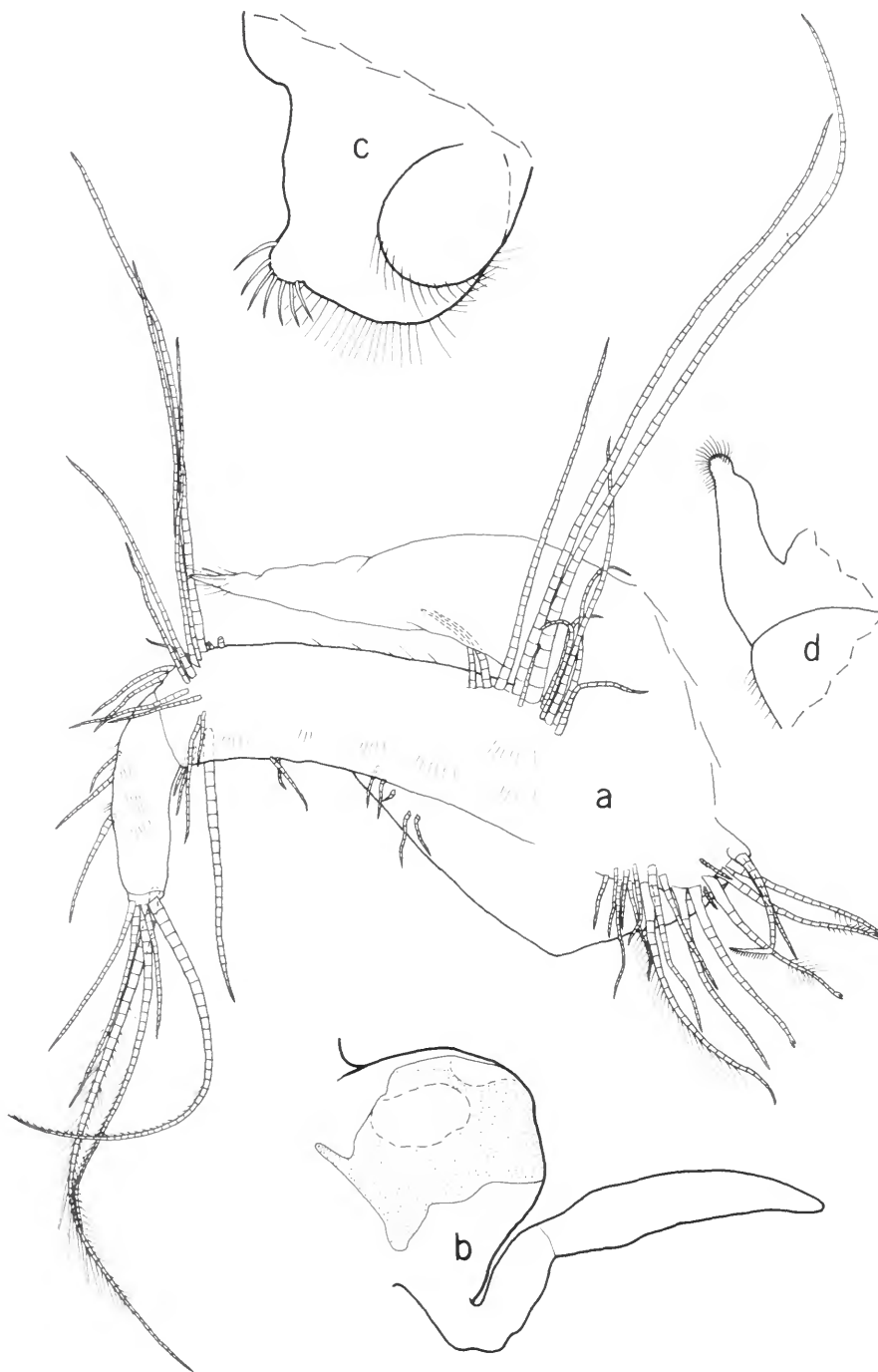


FIGURE 159.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923: *a*, right maxilla, medial view; *b*, medial eye and rod-shaped organ; *c*, upper lip, anterior to left. Adult female, USNM 157208, *d*, posterior process of body.

bristle and 8 shorter bristles. Basale: ventral margin with 7–9 short bristles along middle part and 1 long terminal bristle; dorsal margin hirsute, with 10–12 bare proximal bristles with bases on medial side, and 10–13 distal bristles, some with bases on medial side; medial side hirsute, with 4 distal bristles. Exopodite consisting of 2 small bristles without lobe. Endopodite: dorsal margin of 1st joint hirsute, with 3 short bare bristles; ventral margin with long spinous beta-bristle; end joint with 5 spinous bristles.

Fifth Limb (Figure 157e): Dorsal margin of comb with hairs near middle and distally, and 8 short, bare bristles, some with bases on lateral side; lateral side closer to ventral margin with 1 stout spinous bristle reaching past end of comb, 5 short bare bristles, and 3 spinous short bristles; ventral margin of comb with bristles forming 2 rows (lateral row with widely separated marginal hairs separated by space from closely spaced hairs near distal end; medial row with closely spaced proximal hairs separated by space from closely spaced distal hairs).

Sixth Limb (Figure 158c, Plate 166): Anterior margin of stem with 2 distinct sutures; margin proximal to upper suture with short hirsute bristles forming 2 rows (medial row with 10 bristles; bristle nearest suture longer than others; outer row with 16 bristles; bristles of outer row longer than those in inner row); margin between sutures with 4 bristles in outer row and 2 in inner row. Anterior margin of skirt ventral to suture with about 8 slender spinous bristles; margin of lateral flap with about 11 hirsute bristles; anterior end of skirt with about 11 long and short hirsute bristles, some with bases on medial surface; ventral margin of skirt with about 12 stout bristles with stiff marginal spines; medial side of skirt near ventral margin with about 34 minute bristles with short marginal spines; posterior end of skirt rounded, without bristles; 1 short hirsute bristle in place of epipodial appendage; posterior part of medial side of stem and skirt with abundant long hairs; long hairs also present on medial side of skirt near ventral margin; fewer hairs present on medial side in remaining parts of skirt and stem.

Seventh Limb (Figure 157f): Each limb with 55

or 56 bristles, 24–32 on each side; each bristle with up to 7 bells and without marginal spines. Terminus with opposing combs, each with about 16 spinous and alate teeth.

Furca (Figure 158d): Each lamella with 3 stout primary claws followed by a space and then 7 or 8 slender secondary claws; primary claws and most secondary claws with teeth along convex margin, teeth fairly equal in size, but often a small tooth between 2 slightly larger ones; medial hairs near base of primary claws and along edge of lamella medial to secondary claws, also following secondary claws; anterior margin of lamella and anterior edges of primary claws with hairs.

Eyes: Lateral eyes well developed, with black pigment and about 15 ommatidia, about same size as medial eye (Figure 156 shows eye through shell). Medial eye with black pigment, bare (Figure 159b).

Rod-shaped Organ (Figure 159b): Elongate with 2 sutures, broadening at middle, tapering distally to rounded tip.

Upper Lip (Figure 159c, Plates 167, 168): Lip consisting of 2 lobes with saddle in-between; each lobe hirsute and with several slender anterior spines; a hirsute lateral flap on each side of mouth.

Posterior of Body (Figure 159d): Fingerlike dorsum with hirsute tip.

Y-Sclerite (Figure 158e): Normal for genus.

Eggs: USNM 151923 with 19 eggs in marsupium.

DESCRIPTION OF JUVENILE CARAPACE (Plates 169, 170).—Carapace similar to that of adult but with larger reticulations and smaller posterodorsal processes.

Size: K 30025, 2 specimens (separated valves) from Hamburg Zoological Museum: left valve, length 1.05 mm, height 0.78 mm (scanned with SEM); right valve, length 1.05 mm, height 0.82 mm; right valve, length only 1.06 mm.

COMPARISONS.—The fine network covering fossae on the surface of the carapace of the new species *A. dayi* has not been reported on any previously described species of the genus. The network is easily visible with the X10 objective using transmitted light.

55. *Asteropterygion peterseni*, new species

FIGURES 9j, 160–163; PLATES 171–175

ETYMOLOGY.—The species is named for Hans Petersen, Institute of Zoology, University of Hamburg.

HOLOTYPE.—USNM 157702, ovigerous female in alcohol.

TYPE-LOCALITY.—Off Tanzania, in vicinity of Kunduchi, exact water depth unknown, between 0–25 m, sample probably collected from about 0.5 m; collected 17 Jan 1974.

PARATYPE.—USNM 157701, ovigerous female on slides and in alcohol, from same sample as holotype; USNM 157716, 1 specimen, sta 107, from off Tanzania; USNM 157717, 1 specimen, sta 54, from off Tanzania.

DISTRIBUTION (Figure 131).—Continental shelf of Tanzania, probable depth 0–25 m.

DESCRIPTION OF ADULT FEMALE (Figures 160–163, Plates 171–175).—Each valve with 2 prominent horizontal ribs; upper of these linear, other slightly concave dorsally (Plate 171a–d). A 3rd narrow rib paralleling dorsal margin. The 2 prominent ribs terminating posteriorly in small backward-pointing process. A long backward-pointing process present at midheight of valve between the 2 prominent horizontal ribs; posterior margin of valve with small caudal process, and a posterior process just ventral to posterior process of upper prominent horizontal rib; tip of rostrum pointed and extending past valve edge; area of valve ventral to rostrum depressed and with anterior process extending past edge of valve.

Ornamentation: Surface with numerous shallow fossae containing small pustules (Plates 171e, 172a,d); Surface between fossae with minute fenestella and pustules (Plate 172b,c).

Infold (Plates 172e,f, 173a–d): Normal for genus.

Size: USNM 157701, length 2.69 mm, height 2.04 mm; USNM 157702, length 2.76 mm, height 2.01 mm.

First Antenna (Figure 160a): 1st joint with long medial and lateral hairs forming rows near ventral margin. 2nd joint: ventral margin with long

hairs; medial side with hairs forming rows near ventral margin and along distal margin; dorsal margin with proximal hairs and 5 bristles (4 proximal, 1 distal). 3rd joint: short ventral margin with 1 short bristle; long dorsal margin with 1 proximal and 2 terminal bristles. 4th joint: short dorsal margin with 1 terminal bristle; long ventral margin with 4 small terminal bristles. 5th joint: sensory bristle with 5 short proximal filaments, 2 long, distal, marginal filaments, and bifurcating tip. 6th joint with small medial bristle. 7th joint: a-bristle about same length as dorsal margin of joints 4–8; distal end ringed and drawn out to pointed tip, bristle-like; b-bristle reaching past tip of a-bristle, with 4 marginal filaments and bifurcate tip; c-bristle slightly longer than sensory bristle of 5th joint, with 9 marginal filaments and bifurcate tip. 8th joint: d- and e-bristle about same length as b-bristle, bare with blunt tips; f-bristle slightly bent dorsally in proximal part, slightly longer than b-bristle, with 7 ventral filaments and bifurcate tip; g-bristle slightly longer than c-bristle, with 8 marginal filaments and bifurcate tip.

Second Antenna (Figure 160b): Protopodite with hairs along ventral and dorsal margins and on medial surface near ventral margin, and medial bristle about same length as longest bristle on 1st endopodial joint. Endopodite 3-jointed: 1st joint with 15 bristles; 2nd joint bare, weakly delimited from 3rd joint; 3rd joint with long subterminal bristle and very faint, minute, terminal spine. Exopodite: 1st joint with minute medial spine on distal margin; bristle of 2nd joint very long, with natatory hairs and slender ventral spines; bristles of joints 3–8 with natatory hairs and slender ventral spines; 9th joint with 5 bristles (3 with natatory hairs and slender ventral spines, 2 with only natatory hairs); joints 2–8 with long hairs along inner distal margin; basal spines absent.

Mandible (Figure 161): Coxale endite: small medial bristle present near base of ventral branch; ventral branch with proximal hairs, spines forming about 8 oblique rows, and tip with 3 minute teeth; ventral margin of dorsal branch with 5 nodes and small main spine; tip with small pointed process posterior to base of long dorsal



FIGURE 160.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701: *a*, left 1st antenna, medial view; *b*, endopodite and part of protopodite of left 2nd antenna, medial view; *c*, terminus of 7th limb; *d*, right lamella of furca, lateral view; *e*, medial eye and rod-shaped organ; *f*, lateral eye; *g*, upper lip, anterior to right; *h*, upper lip, anterior to left; *i*, left Y-sclerite, anterior to left.



FIGURE 161.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701, right mandible, medial view.

bristle; margin between main spine and tip serrate; dorsal margin of branch serrate. Basale endite: tip with 6 end-type bristles; ventral margin with 7 triaenid bristles having 1 pair of teeth much longer than others; 6 dwarf bristles present (distal of these about three times length of others). Basale: ventral margin with 2 proximal triaenid bristles, 1 long, spinous, distal bristle, and 4 small bristles; dorsal margin with 4–5 short proximal bristles and 5 distal bristles (3 short, 2 very long);

medial surface with long hairs near dorsal margin. Exopodite reaching distal margin of 1st endopodial joint, hirsute, with 2 ventral bristles (exopodite of right limb of 157701 with proximal bristle shorter than distal bristle, but distal bristle shorter than proximal bristle on left limb). Endopodite: 1st joint with 6 ventral bristles; ventral margin of 2nd joint with bristles forming 2 groups, each with 2 bristles; dorsal margin and medial surface (near dorsal margin) of 2nd joint

with numerous bristles (a few of the cleaning bristles with broad marginal spines not shown in illustrated limb); medial surface with spines forming rows; end joint with 3 claws (dorsal of these shorter than others and with ventral spines), 1 long lateral bristle, and 2 short ventral bristles.

Maxilla (Figure 162): Epipodial appendage hirsute, tip reaching distal bristles on dorsal margin

of basale. Endites I and II each with 2 long stout bristles and 1 minute bristle; endite III with 1 or 2 long stout bristles and about 10 shorter bristles (some of these may be on basale). Basale: dorsal margin spinous, with 13 proximal bristles with bases on medial surface, and 11 distal bristles (some of these with bases on medial surface); ventral margin with 5-7 short bristles and 1 long



FIGURE 162.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701, left maxilla, medial view.

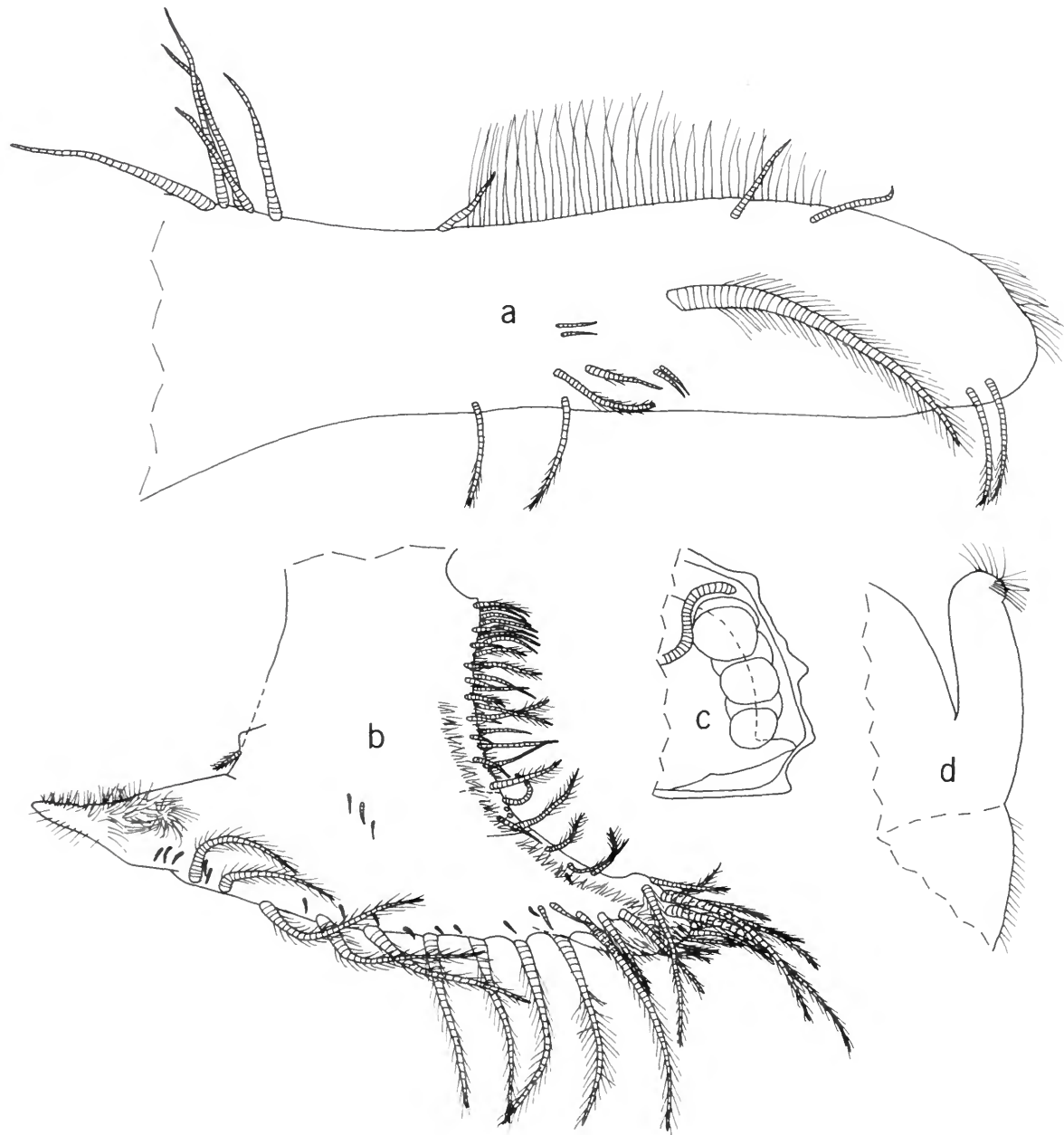


FIGURE 163.—*Asteroptyrigion peterseni*, new species, ovigerous female, paratype, USNM 157701: *a*, comb of right 5th limb, lateral view; *b*, left 6th limb, medial view. Ovigerous female, holotype, USNM 157702: *c*, inside view of posterior of right valve with specimen in place showing position of 7th limb, eggs, and posterior process ventral to eggs; *d*, posterior process of body.

terminal bristle (base of latter on lateral surface); medial surface with 1 distal bristle near ventral margin. Exopodite consisting of 1 long and 2 shorter bristles. Endopodite: 1st joint spinous, with 4 anterior bristles and 1 long spinous beta-bristle; end joint with 5 bristles.

Fifth Limb (Figure 163a): Dorsal margin of comb hirsute near middle and distally, with 5 proximal and 3 distal short bristles; lateral surface with long, stout, spinous bristle almost reaching end of comb, about 7 short bristles proximal and ventral to base of stout bristle, and 2 short distal bristles with bases almost on ventral margin.

Sixth Limb (Figure 163b): Anterior margin with distinct suture separating trunk from skirt and more proximal faint suture; anterior margin of trunk dorsal to upper suture with spinous bristles forming 2 rows (9 bristles in inner row, 16 longer bristles in outer row); margin between sutures with 1 bristle in inner row and 4 bristles in outer row; anterior margin of skirt ventral to lower suture with 3 bristles; lateral flap with about 10 slender spinous bristles; anterior end and ventral margin of skirt with about 15 spinous bristles; posterior end of skirt hirsute, without bristles; medial surface of skirt with many minute bristles; a single spinous bristle in place of epipodial appendage.

Seventh Limb (Figure 160c): Each limb with 51–57 bristles, 25–32 on each side; each bristle with up to 6 bells; some joints with up to 4 bristles, 2 on each side; terminus with opposing combs, each with about 18 spinous teeth of various types.

Furca (Figure 160d): Each lamella with 3 main claws followed by 8 unringed secondary claws; main claws with anterior hairs and posterior teeth consisting of 2 rows of stout teeth separated by several smaller teeth; secondary claws with teeth along posterior margin and hairs and few teeth along anterior margin; anterior margin of lamella with short hairs; long hairs present on medial side of lamellae near bases of main claws, and along edge of lamella following main claws.

Rod-shaped Organ (Figure 160e, Plates 173e,f, 174a,b): Elongate with suture proximal to widened middle part; tip narrow, rounded.

Eyes: Medial eye bare, with black pigment (Figure 160e, Plate 173e,f). Lateral eye about same size as medial eye, with black pigment and about 17 ommatidia (Figure 160f).

Upper Lip (Figure 160g,h, Plates 173e, 174a,c, 175): Each lobe hirsute, with anterior spines; middle saddle with anterior spines; hirsute lateral flap present on each side of mouth.

Posterior of Body (Figure 163d): Posterior hirsute, with fingerlike dorsum with long hairs at tip.

Y-Sclerite (Figure 160i): Normal for genus.

Eggs: USNM 157701 with 20 eggs in marsupium; USNM 157702 with 10 eggs in marsupium (Figure 163c).

COMPARISONS.—The carapace of the new species, *A. peterseni*, is similar to that of *Asteropterygion skogsbergi* (Poulsen, 1965). Based on the description of the latter species by Poulsen (1965:206), differences between the 2 species are as follows:

	<i>A. skogsbergi</i>	<i>A. peterseni</i>
a-bristle of 1st antenna	–	+
short and clawlike (–), long and bristle-like distally (+)		
Coxale endite of mandible	–	+
without basal bristle (–), with basal bristle (+)		
Upper lip without spines	–	+
on middle part (–), with spines on middle part (+)		
Posterior of body with	–	+
strongly tapering process very wide at middle (–), with cylindrical process (+).		

***Pteromeniscus*, new genus**

TYPE SPECIES.—*Pteromeniscus intesi*, new species, herein, monotypic.

ETYMOLOGY.—Generic name derived from the Greek *ptero* (wing or fin) plus *meniskos* (crescent) in reference to the crescent-shaped alar projection on the valves of the type-species. Gender masculine.

DISTRIBUTION.—Continental slope of Mauritania at depths of 270–699 m (Figure 125).

DIAGNOSIS.—Carapace with broad flange parallel to, and just within, valve margins, except in vicinity of minute incisur, where it is absent; crescentlike lateral ridge with midpart ventral to central adductor muscle attachment area.

First Antenna: Sensory bristle of female (known only from instar III) with few, short, proximal filaments, 1 long filament near middle reaching tip of stem, and 3 shorter terminal filaments including stem. Medial bristle of 6th joint fairly long. Eighth joint: d- and e-bristles well developed but not longer than a-bristle of 7th joint.

Second Antenna: Endopodite 3-jointed: 1st and 2nd joints short, bare; 3rd joint elongate, hirsute, with long terminal bristle.

Mandible: Ventral margin of basale only with triaenid bristles.

Maxilla: End joint of endopodite with 3 bristles.

Fifth Limb: Lateral side of comb with 2 long and several short bristles.

Sixth Limb: Without epipodial bristle. Posterior end of skirt with 1 short bristle on type-species.

Seventh Limb: Terminus with recurved teeth of similar type.

Furca: Each lamella of type-species with 7 primary claws: claws 1 and 2 similar in length, remaining claws decreasing in length proximally along lamella.

Lateral Eye: Absent on type species.

Upper Lip: Each lobe of lip of type-species with stout anterior process.

Posterior of Body: With hirsute thumblike process.

COMPARISONS.—The carapace of *Pteromeniscus* differs from that of *Asteropella* in having a crescentic rib ventral to the central adductor muscle attachment area rather than a linear rib going through, or just dorsal to, the attachment area. The 1st antenna of female *Pteromeniscus* (known only from instar III) differs from the 1st antennae of species of *Asteropella* in having a sensory bristle with a long filament near the middle, in having a bristlelike rather than a clawlike a-bristle, and in having a d-bristle almost the same length as

the e-bristle (the latter is rarely present in *Asteropella*). The claws on the caudal furca of *Pteromeniscus* are not as sharply separated into primary and secondary claws as those on the caudal furca of species of *Asteropella*, nor does each lamella of the furca of *Pteromeniscus* bear a long, laterally placed, proximal bristle such as those present on many species of *Asteropella*. Claws 1 and 2 are closer together than these claws on the furca of *Asteropella*. The endopodite of the 2nd antenna of *Pteromeniscus* is quite small relative to the exopodite when compared with the endopodite and exopodite of species of *Asteropella*.

The 1st antenna of female *Pteromeniscus* differs from that of *Asteropteron* in having a sensory bristle with a long filament near the middle and in having a well-developed d-bristle. The endopodite of the 2nd antenna of female *Pteromeniscus* is much longer relative to the exopodite when compared with those of *Asteropteron*. The general appearance of the peripheral ridge on the carapace of *Pteromeniscus* resembles that on the carapace of species of *Asteropella* rather than that on the carapace of species of *Asteropteron*. Claws 1 and 2 of the furca are closer together on *Pteromeniscus* than they are on *Asteropteron*. The carapace of *Pteromeniscus* does not resemble those of *Asteropterygion*. Claws 1 and 2 of the furca are closer together on *Pteromeniscus* than they are on *Asteropterygion*.

56. *Pteromeniscus intesi*, new species

FIGURES 9t, 10d, 11f, 12d, 13d, 14e, 15f, 16f, 17d, 164–169;
PLATES 176–179

Asteropteron *upsilon* Kornicker and Caraion [part], 1974:61, figs. 34e–q, 36 [Instar II?].

HOLOTYPE.—USNM 156610, adult male, not dissected, in alcohol.

TYPE-LOCALITY.—Discovery station 7811.

ETYMOLOGY.—The species is named for Dr. A. Intes of the Centre de Recherches Oceanographiques, Abidjan, Ivory Coast.

PARATYPES.—USNM 150286B, 150286C, an adult male and a juvenile male, respectively, from same sample as holotype; USNM 150287A,

USNM 150287B, an adult male and a juvenile female from *Discovery* station 7810.

DISTRIBUTION (Figure 125).—Continental slope of Mauritania at depths of 270–699 m.

DESCRIPTION OF ADULT MALE (Figures 13*d*, 164–167).—Carapace oval in lateral view except in vicinity of small incisure (Figures 164, 165*a*, 167*a*); viewed medially incisur forming small right angle; broad flange present just within and parallel to valve edge except opposite incisur; lateral ridge present with concave upper margin and with midpart ventral to central adductor muscle attachment area.

Ornamentation: Outer edge of lateral ridge consisting of pores forming 4 rows; similar pores forming rows present along outer edge of peripheral flange; long bristles abundant along valve edge and sparsely distributed on lateral surface; some of lateral bristles emerging from paired pores.

Infold: Anterodorsal infold with short bristle just above incisur and 25 long bristles forming row parallel to anterodorsal edge of valve; anteroventral infold with 10 bristles forming row parallel to anteroventral margin of valve; ventral infold with 3 bristles; posteroventral infold with about 41 long and short bristles; anteroventral and ventral infold with list bearing wide lamellar prolongation.

Selvage: Broad lamellar prolongation present along free margin of valve; prolongation fringed along ventral margin of valve.

Adductor Muscle Attachment Scars (Figure 167*b*): Consisting of about 15 individual ovoid scars.

Size: USNM 150286B, length 2.31 mm, height 1.79 mm; USNM 150287A, length 2.28 mm, height 1.65 mm; USNM 156610, length 2.47 mm, height 1.92 mm.

First Antenna (Figure 165*b*): 1st and 2nd joints with short spines and long hairs on medial and

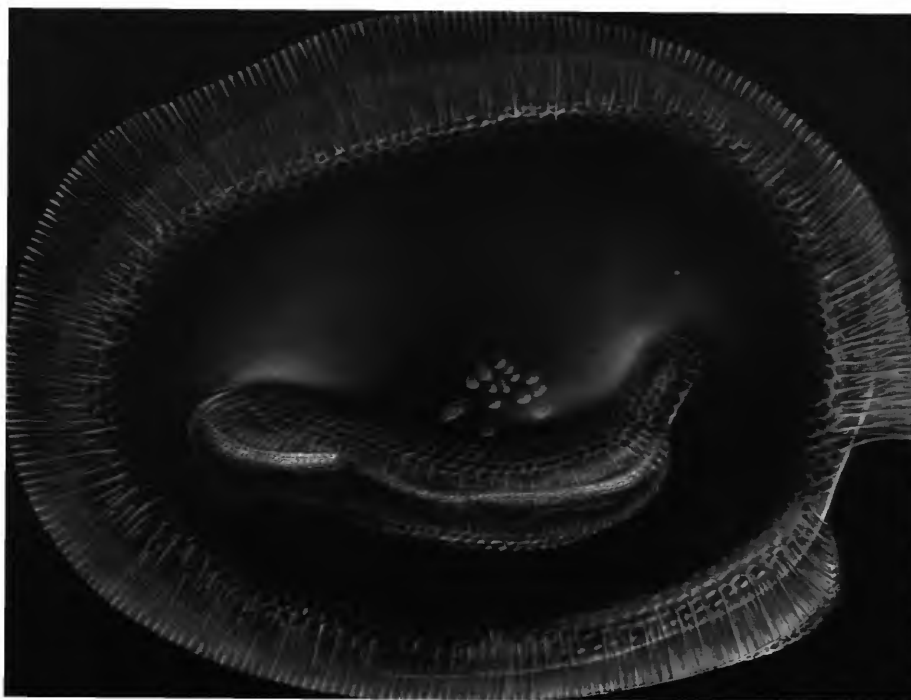


FIGURE 164.—*Pteromeniscus intesi*, new species, adult male, holotype, USNM 156610, lateral view of complete specimen, length 2.47 mm.



FIGURE 165.—*Pteromeniscus intesi*, new species, adult male, paratype, USNM 150286B: *a*, complete carapace, anterior to left (dashed oval indicates position of central adductor muscle attachments), length 2.31 mm; *b*, right 1st antenna, lateral view; *c*, distal bristle of protopodite of left 2nd antenna, medial view; *d*, endopodite of left 2nd antenna, medial view; *e*, right mandible, medial view; *f*, tip of dorsal branch of coxale endite shown in *e*; *g*, tip of ventral branch of coxale endite shown in *e*; *h*, tip of triaenid bristle on ventral margin of basale of mandible shown in *e*; *i*, left lamella of furca, lateral view.

lateral surfaces; 2nd joint with 4 bristles at the middle of the dorsal margin; 3rd joint short with 1 ventral and 2 dorsal bristles; 4th joint short with 3 terminal bristles (2 ventral, 1 dorsal); 5th joint very short ventrally and almost same length as dorsal edge of 6th joint dorsally; sensory bristle of 5th joint with abundant thin filaments; 6th joint with slender medial bristle. Seventh joint: a-bristle about 3 times length of bristle of 6th joint, with rings on distal two-thirds; b-bristle slightly longer than a-bristle, with 3 marginal filaments and bifurcate tip; c-bristle longer than b-bristle, with 7 marginal filaments and bifurcate tip. Eighth joint: d- and e-bristle bare, d-bristle slightly shorter and more slender than e-bristle, e-bristle about same length as a-bristle; f-bristle longer than b-bristle but shorter than c-bristle, with 5 marginal filaments and bifurcate tip; g-bristle about same length as f-bristle, with 5 or 6 marginal filaments and bifurcate tip.

Second Antenna (Figure 165c,d): Protopodite with medial bristle and few short spines forming rows on dorsal half of medial surface. Endopodite 3-jointed: 1st joint bare; 2nd joint elongate with 3 or 4 distal ventral bristles (2 long, 1 or 2 short); 3rd joint reflexed with 1 long proximal bristle and knifelike tip; slot present on medial surface just proximal to tip. Exopodite: 1st joint with hairs forming 6 clusters on medial surface near ventral margin and minute, terminal, medial spine; 2nd joint about twice length of 3rd; bristle of 2nd joint reaching past 9th joint, with proximal spines and distal natatory hairs along ventral margin and just natatory hairs along dorsal margin; bristles of joints 3–8 with natatory hairs, some with faint ventral spines near middle; 9th joint with 3 bristles (2 long, 1 short), all with natatory hairs; joints 2–9 with short slender spines forming row along distal margin, no basal spines.

Mandible (Figure 165e–h): Coxale endite: minute bristle present medially near base of ventral branch; ventral branch spines forming about 7 oblique rows along ventral margin and tip with 2 stout teeth on ventral half and short faint spines on dorsal half (Figure 165g); ventral margin of dorsal branch with 3 or 4 low processes proximal to short main spine; tip of branch with 3 projec-

tions (Figure 165f): middle and ventral processes with short spines, dorsal process with long hirsute bristle; dorsal margin of dorsal branch with few serrations. Basale: endite with 2 long end bristles with numerous marginal spines, 5 triaenid bristles with about 12 pairs of marginal spines excluding terminal pair, and 1 dwarf bristle; ventral margin of basale with 6 triaenid bristles with 12–15 marginal spines excluding terminal pair (spines decrease in length distally along bristle) (Figure 165h); dorsal margin with 1 minute bristle and 2 long terminal bristles; medial and lateral surfaces with long hairs near dorsal margin. Exopodite hirsute, almost reaching distal margin of 1st endopodite joint, with 2 terminal bristles with short marginal spines. Endopodite: ventral margin of 1st joint with 7 spinous bristles; medial surface with few long hairs forming rows near dorsal margin; dorsal margin and medial surface of 2nd joint near dorsal margin with numerous bristles; ventral margin of 2nd joint with 3 spinous subterminal bristles (2 long, 1 medium); medial surface with numerous spines forming rows; end joint with 5 bristles (1 short ventral bristle with short marginal spines, 1 long, ventral, clawlike bristle, 1 long clawlike bristle at middle of terminal margin, and 2 medium dorsal bristles).

Maxilla (Figure 166a): Epipodial appendage long pointed, hirsute at tip and along dorsal margin; 2 short bristles present near base of adz-like bristle; endite I with 3 long bristles; endite II with 1 short and 3 long bristles; ventral margin of basale with long, spinous, terminal bristle with base on lateral side; dorsal margin and medial side hirsute; medial side with 1 medium terminal bristle near ventral margin and 1 short proximal bristle near middle; no exopodite observed but 1 short bristle present in its place. Endopodite: 1st joint hirsute with 1 short slender midbristle on dorsal margin and long beta-bristle with short marginal spines; end joint with 3 terminal bristles with short marginal spines.

Fifth Limb (Figure 166b): Epipodial appendage with 66 bristles; dorsal margin of comb bare except for hairs along terminal margin; lateral side of comb with 7 exopodial bristles: 1 long, distal, spinous bristle near dorsal margin, 1

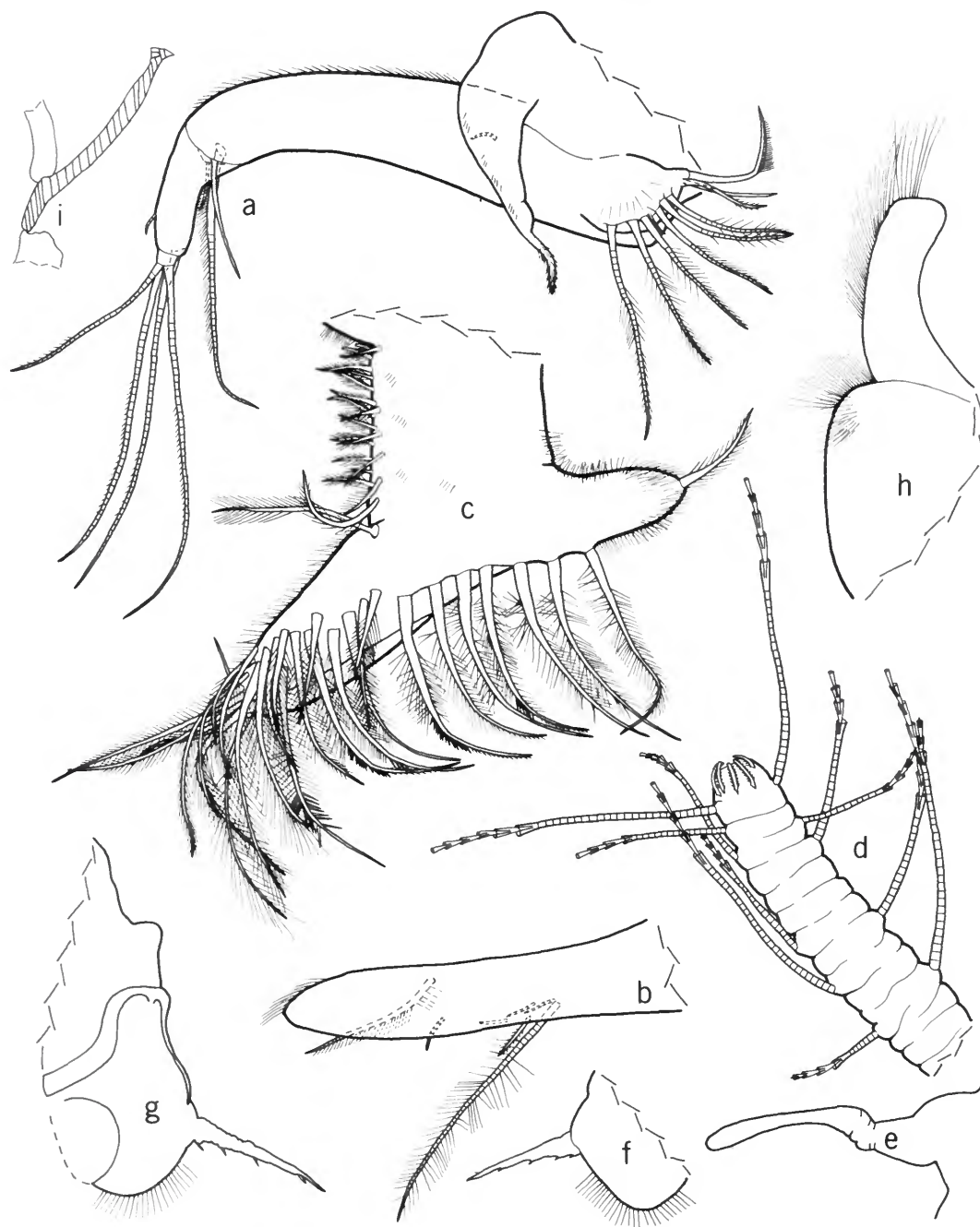


FIGURE 166.—*Pteromeniscus intesi*, new species, adult male, paratype, USNM 150286B: *a*, right maxilla, medial view; *b*, comb of right 5th limb, medial view; *c*, right 6th limb, medial view; *d*, 7th limb; *e*, medial eye and rod-shaped organ; *f*, upper lip (lateral flap not shown), anterior to left; *g*, anterior of body and upper lip, anterior to right; *h*, posterior process, anterior to right; *i*, right Y-sclerite (lined pattern), anterior to right.

longer, proximal, spinous bristle near ventral margin, and 5 short bristles between the 2 long bristles.

Sixth Limb (Figure 166c): No epipodial bristles present; anterior margin of narrow stem with about 19 bristles (1 medial, proximal, short, spinous; 12 short spinous with bases on anterior margin; 4 short, spinous, distal with bases on medial surface; 2 longer, spinous, distal with bases on medial surface near broad skirt); a short suture present at intersection of stem and skirt; anterior and ventral part of skirt with about 31 bristles; posterior end of skirt prolonged, with 1 short hirsute bristle; limb hirsute.

Seventh Limb (Figure 166d): Each limb with 11 bristles, 5 on one side, 6 on other; each bristle with 3–5 bells and no marginal spines; terminus with 8 spinous recurved teeth.

Furca (Figure 165i): Each lamella with 7 claws: claws 1 and 2 about same size, claws 3–7 decrease in size proximally along lamella; all claws with teeth along posterior margins; teeth decrease in size distally along claw.

Eyes and Rod-shaped Organ: Lateral eyes absent; medial eye unpigmented, hairs not observed (Figure 166e); rod-shaped organ narrow in middle part, tip rounded (Figures 166e, 167c).

Upper Lip (Figure 166f,g): Consisting of 2

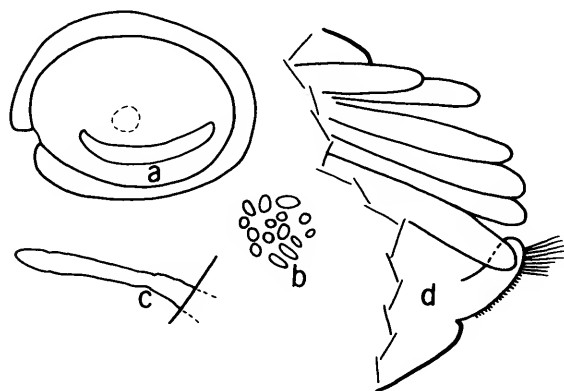


FIGURE 167.—*Pteromeniscus intesi*, new species, adult male, paratype, USNM 150287A: a, complete carapace, anterior to left, length 2.28 mm; b, central adductor muscle scars of left valve, anterior to left; c, rod-shaped organ; d, posterior of body showing posterior process and gill-like structures.

rounded hirsute lobes, each with long, stout, anterior process with marginal spines; hirsute lateral flaps present.

Posterior of Body (Figures 166h, 167d): Posterior hirsute with hirsute, thumblike, dorsal process.

Genitalia: Copulatory organ minute.

Gills (Figure 167d): Well developed, long, narrow.

Y-Sclerite (Figure 166i): Typical for family.

Parasites: USNM 156610 with cyproniscid isopod in marsupium.

DESCRIPTION OF FEMALE (Instar III) (Figures 168, 169, Plates 176–179).—Carapace oval in lateral view (Figure 168a, Plate 176a); anterior with minute incisur forming right angle; broad concentric flange present just within edge of valve except in vicinity of incisur where it forms right angle (Plate 176b); curving ridge with concave upper edge present with middle of ridge ventral to central adductor muscle attachments (Plates 176a, 177c).

Ornamentation: Carapace with peripheral flange and subcentral ridge described above; edge of flange and subcentral ridge with several rows of pores; outer and inner edges of pores tending to be convex; other edges linear (Plates 176c–e, 177d); surface between flange and ridges smooth with some visible reticulations (Plate 176f); bristles abundant along valve edge and sparsely distributed on lateral surface; lateral bristles emerging from open pores with marginal lip, some paired (Plates 177a, b).

Infold (Plate 178): Anterodorsal infold with 15 bristles forming row; anteroventral infold with 2 bristles ventral to incisur (Figure 168c); list present along ventral margin with anterior end just ventral to the 2 anteroventral bristles below incisur; anterior part of list with wide lamellar prolongation with smooth edge; posterior end of lamellar prolongation unknown, but prolongation continues at least to middle of ventral margin; ventral infold with 1 or 2 bristles; posteroventral infold with about 22 bristles and small processes, some of the bristles and processes tube-like with open ends, some bristles paired (Figure 168d, Plate 178b–f).

Selvae: Broad lamellar prolongation along free

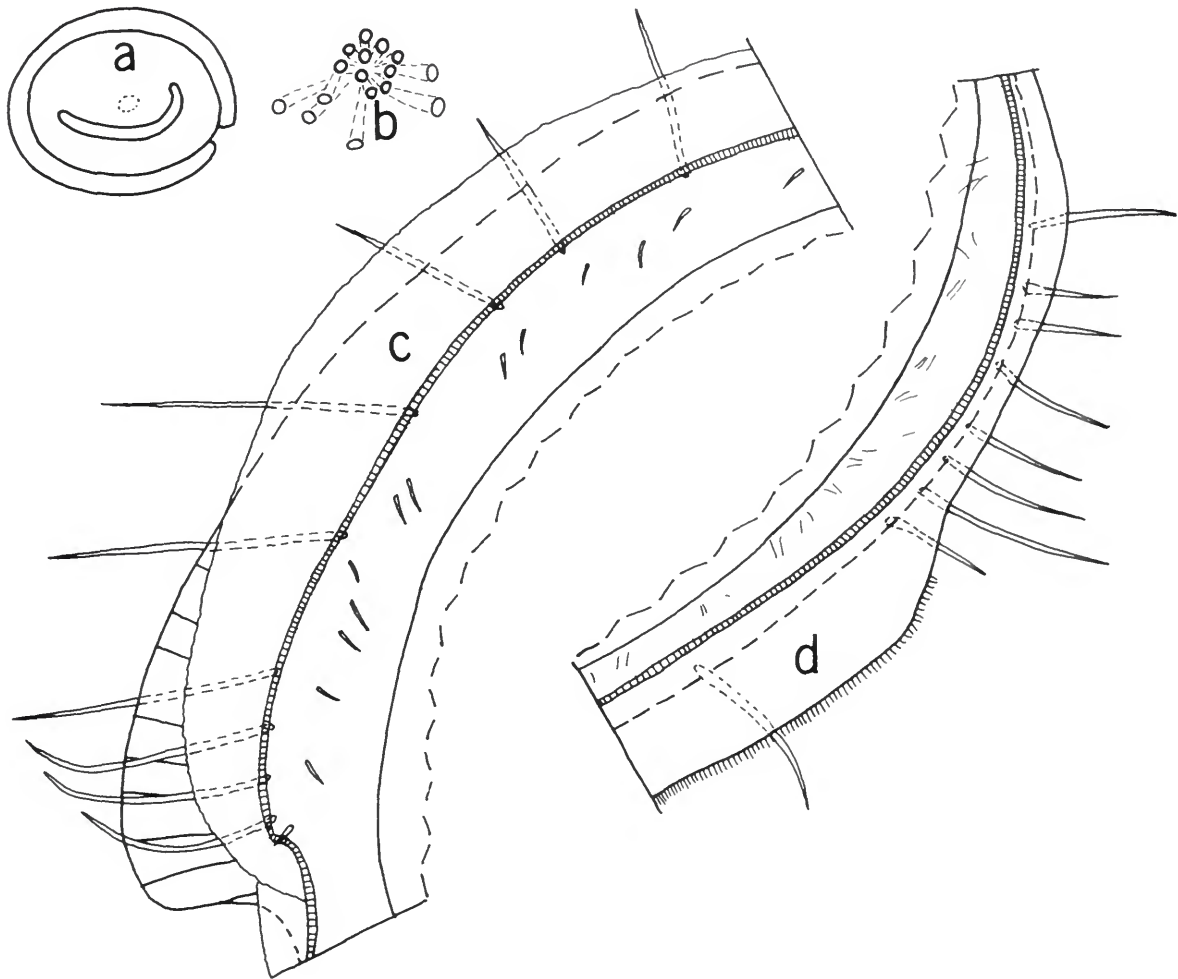


FIGURE 168.—*Pteromeniscus intesi*, new species, female (instar III), paratype, USNM 150287B: *a*, complete specimen showing position of central adductor muscle attachments (dotted circle), length 1.89 mm; *b*, lateral view of central adductor muscles projecting from left side of body, anterior to left; *c*, inside view of anterodorsal margin; *d*, inside view of posteroventral margin.

margin of valve; prolongation fringed along ventral margin of valve (Figure 168*d*, Plate 178*a*).

Adductor Muscle Attachment Scars (Figure 168*b*): Consisting of about 16 individual oval scars.

Size: USNM 150287B, length 1.89 mm, height 1.54 mm.

First Antenna (Figure 169*a*): 1st and 2nd joints hirsute; 2nd joint with 2 spinous bristles near middle of dorsal margin; 3rd joint short, with 1 ventral and 2 dorsal bristles, all spinous; medial

side of 3rd joint with few minute spines; 4th joint with 2 spinous terminal bristles (1 ventral, dorsal); 5th joint about equal in length to combined lengths of 3rd and 4th joints, with hairs on medial surface; sensory bristle of 5th joint with 2 very small proximal filaments, 1 long filament near middle reaching tip of stem, and 3 shorter terminal filaments including tip of stem; 6th joint very short, with hairs on lateral surface, and medial bristle with length about 55 percent

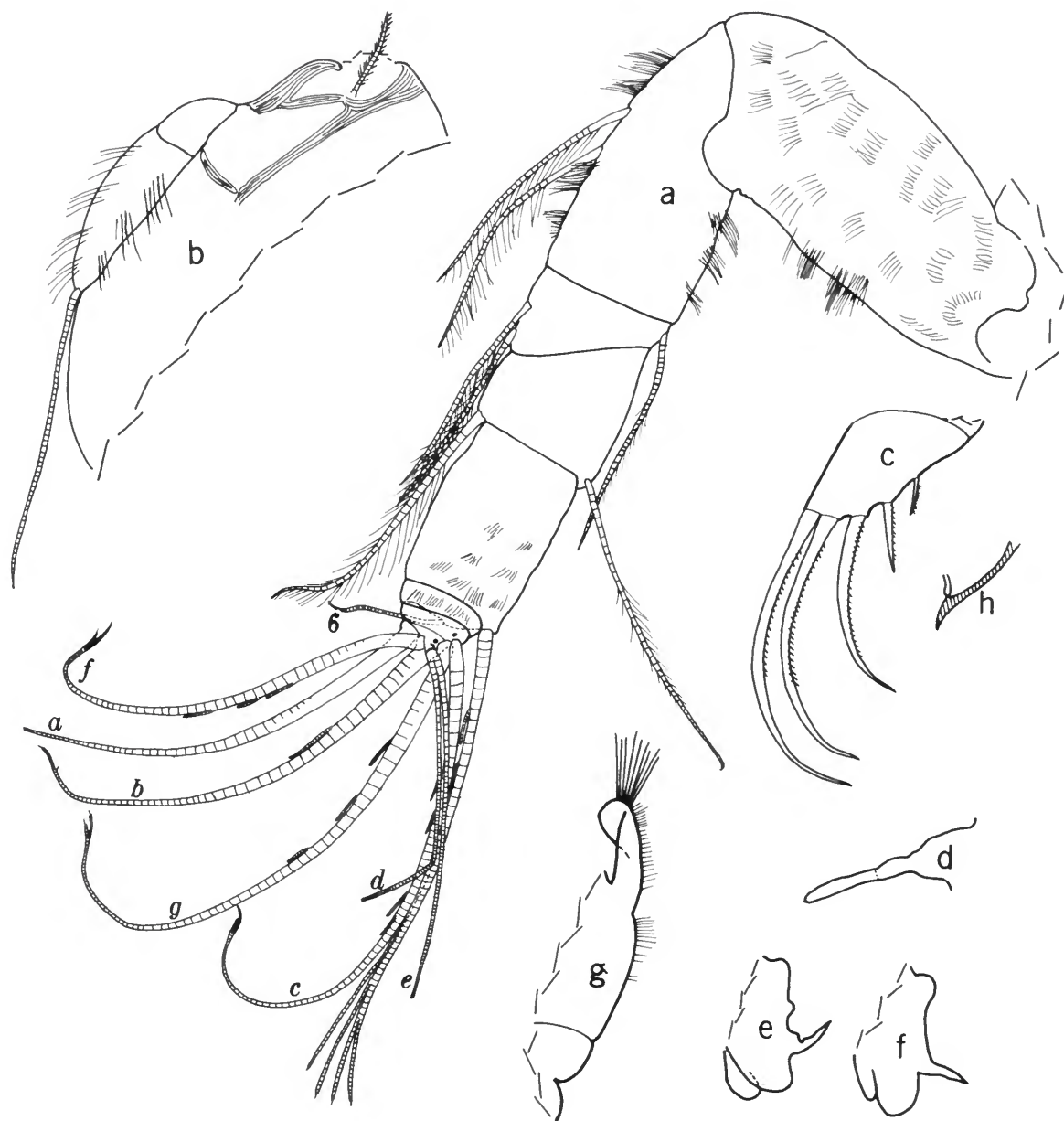


FIGURE 169.—*Pteromeniscus intesi*, new species, female (instar III), paratype, USNM 150287B: a, left 1st antenna, lateral view; b, distal part of protopodite and endopodite of right 2nd antenna, medial view; c, left lamella of furca, lateral view; d, medial eye and rod-shaped organ; e, left lobe of upper lip and lateral flap, medial view; f, right lobe of upper lip and lateral flap, lateral view; g, posterior of body showing posterior process; h, right Y-sclerite, anterior to right.

length of joints 5–7. Seventh joint: a-bristle long, bare, with pointed tip; b-bristle about three and three-quarters length of bristle of 6th joint, with 1 short proximal filament and 1 minute spine or filament near tip; c-bristle about same length as b-bristle, with 4 proximal filaments and 1 near tip. Eighth joint: d- and e-bristles bare, d-bristle slightly shorter than e-bristle, e-bristle slightly shorter than a-bristle; f-bristle longer than a-bristle but shorter than c-bristle, with 3 proximal filaments and 1 near tip; g-bristle about same length as f-bristle, with 3 proximal filaments and 1 minute filament near tip.

Second Antenna (Figure 169b): Protopodite with medial bristle with short marginal spines; few short spines forming rows on dorsal half of medial surface. Endopodite 3-jointed: 1st and 2nd joints short, bare; 3rd joint elongate, hirsute, with long terminal bristle. Exopodite: 1st joint with minute, terminal, medial spine; 2nd joint about same length as 3rd joint; bristles on joints 2–8 with faint slender spines near middle of ventral margin, and natatory hairs all along ventral and posterior margins; 9th joint with 3 bristles (2 long, 1 short), all with natatory hairs; joints 2–9 with short, slender spines forming row along lateral side of distal margin, no basal spines.

Mandible: Coxale endite: tip of dorsal branch broken off on both limbs of USNM 150287B, otherwise endite similar to that of adult male. Basale: endite with 2 end bristles (1 long, 1 short) with short marginal spines, 3 triaenid bristles (the proximal of these longer than others, and with few slender proximal hairs or spines), each with 10–11 pairs of spines excluding terminal pair (spines decrease in length distally along bristle), and 1 dwarf bristle distal to proximal triaenid bristle; ventral margin of basale with 2 triaenid bristles with 11 pairs of spines excluding terminal pair, and widely spaced, slender, proximal hairs or spines; dorsal margin of basale with 2 long, spinous, terminal bristles; 1 minute bristle present on medial surface close to terminal bristles of dorsal margin; medial surface with long hairs forming rows on dorsal half; lateral surface with long hairs forming rows near both dorsal and

ventral margins. Exopodite hirsute, about two-thirds length of dorsal margin of 1st endopodial joint, with 2 terminal bristles with short marginal spines (outer bristle slightly shorter than inner bristle, both similar in length to those of adult male). Endopodite: ventral margin of 1st joint with 4 spinous bristles; medial surface of 1st joint bare; dorsal margin of 2nd joint with 2 long spinous bristles proximal to middle, and 5 spinous subterminal bristles (2 or 3 of these with bases on medial side; one of the medial bristles of triaenid type); medial surface of 2nd joint with numerous long spines forming rows; dorsal margin of 2nd joint with 2 spinous bristles of equal length (lateral of these more slender than other); end joint with 5 bristles similar to those of adult male.

Maxilla and 5th Limb: Similar to that of adult male.

Sixth Limb: No epipodial bristles present; anterior margin of narrow stem with 12 bristles (1 medial, proximal, short, spinous; 7 short spinous with bases on anterior margin; 2 short, spinous, distal, with bases on medial surface near broad skirt; 2 longer, spinous, distal, with bases on medial surface near broad skirt); a suture present at anterior intersection of stem and skirt; anterior, rounded margin of lateral flap with 6 hirsute bristles; ventral margin of skirt with 11 bristles, either hirsute or with long proximal hairs and short distal spines; posterior end of skirt with 1 short hirsute bristle similar to that of adult male.

Seventh Limb: Elongate but without bristles; terminus consisting of 2 lobes without teeth.

Furca (Figure 169c): Each lamella with 5 claws; claws 1 and 2 about same size; claw 3 slightly shorter than claw 2; claws 4 and 5 short; all claws with teeth along posterior margins.

Eyes and Rod-shaped Organ (Figure 169d): Lateral eyes absent; medial eye unpigmented, bare; rod-shaped organ with weak suture near middle, tip rounded.

Upper Lip (Figure 169e, f, Plate 179): Consisting of 2 rounded, hirsute lobes, each with long, stout, anterior process; hirsute lateral flaps present.

Gills: Well developed, long, narrow.

Y-Sclerite (Figure 169h): Typical for family.

Omegasterope, new genus

TYPE-SPECIES.—*Astropteron* *upsilon* Kornicker and Caraion, 1974, monotypic.

ETYMOLOGY.—The generic name is derived in part from the Greek *Omega*, in reference to the similarity of the lateral ridge on the carapace of the type-species to the capital of the Greek letter. Gender feminine.

DISTRIBUTION.—Continental shelf off Mauritania at depths of 35–82 m (Figure 125).

REMARKS.—Kornicker and Caraion (1974) described the type-species of *Omegasterope* as *Astropteron* *upsilon* Kornicker and Caraion. They recognized that the species probably should be referred to a new genus because it differed considerably from most species that had been referred to *Astropteron*, but they did not propose a new genus for their species because the morphology of *Astropteron* *fuscum* (Müller, 1890), the type-species of *Astropteron*, was poorly known, and therefore, the relationship of *upsilon* and *fuscum* was uncertain. The restudy of *Astropteron* *fuscum* herein permitted comparison of that species with *upsilon*. Based on this comparison, a new genus is proposed for *upsilon*.

DIAGNOSIS.—Carapace of adult with small rostrum and incisur reflected in indentation in peripheral ridge, and lateral U-shaped ridge with central adductor scars in area within ridge.

Infold: Infold behind rostrum with 13–14 bristles; posterior infold with numerous bristles.

First Antenna: Sensory bristle of 5th joint consisting of stem with bifurcate tip and 2 filaments near middle almost reaching tip of stem; d-bristle of eighth joint well developed, spinous; e-bristle minute.

Second Antenna: Protopodite without medial bristle; endopodite relatively short, reaching about middle of protopodite; suture separating 2nd and 3rd joints poorly defined on adults, distal to middle; endopodite without hairs; terminal bristle longer than limb.

Mandible: Ventral margin of basale with only triaenid bristles.

Maxilla: Ventral margin of basale bears 1 short

midbristle and 2 terminal bristles (1 long, 1 short).

Fifth Limb: Dorsal margin of comb without bristles.

Sixth Limb: No bristles present in place of epipodial appendage.

Seventh Limb: With relatively few bristles (18–19) and comb teeth (4).

Furca: Each lamella with 3 long, closely spaced claws followed by 3 shorter claws and a laterally placed bristle near posterior end of lamella.

Rod-shaped Organ and Medial Eye: Rod-shaped organ elongate with rounded tip; medial eye pigmented, bare.

Lateral Eye: Small with 4 ommatidia.

Upper Lip: Each lateral lobe of lip of type-species with long anterior spine.

Posterior of Body: Dorsum consisting of long process with hairs along tip.

COMPARISONS.—The U-shaped rib on the carapace of *Omegasterope* does not appear on other genera in the subfamily. The 1st antenna of the female *Omegasterope* has a well-developed d-bristle (spinous on the type-species), and a minute e-bristle; this combination is not found on other genera in the subfamily. The endopodite of the female 2nd antenna is relatively short compared to those of *Asteropella* and *Pteromeniscus*. The caudal furca differs from that of *Pteromeniscus* in having a laterally placed proximal bristle.

57. *Omegasterope* *upsilon* (Kornicker and Caraion, 1974), new combination

FIGURES 9s, 10e, 11g, 12e, 14d, 15g, 16e, 17c, 170, 171;
PLATES 180, 181

Astropteron *upsilon* Kornicker and Caraion, 1974 [part]:59, figs. 32, 33, 34a–d, 35 [not figs. 34e–q, 36].

HOLOTYPE.—Adult female, length 1.74 mm, in collection of Museum of Natural History “Grigore Antipa” 275, Bucharest, Romania (Figure 170).

TYPE-LOCALITY.—Off coast of Mauritania, 20°17'03"N, 17°36'06"W, 82 m. depth.

MATERIAL.—USNM 142386, paratype, adult?



FIGURE 170.—*Omegasterope epsilon* (Kornicker and Caraion), adult female, holotype, dorsal and lateral views of complete specimen (from Kornicker and Caraion, 1974, fig. 32).

female, from near type-locality (Kornicker and Caraion, 1974:59).

DISTRIBUTION.—Continental shelf of Mauritania at depths of 35–82 m (Figure 125).

REMARKS.—An early juvenile included by Kornicker and Caraion (1974:59) in *Asteropteron epsilon* is referred to *Pteromeniscus intesi*, new species, herein (page 334).

SUPPLEMENTARY DESCRIPTION OF ADULT? FEMALE PARATYPE, USNM 142386 (Figure 171, Plates 180, 181).—Carapace with broad peripheral ridge with 2 posterodorsal projections, 6 lower projections along ventral margin, and shallow concavity in vicinity of incisure (Figure 171a); ridges formed by radial cylinders with terminal

pore with low border having 4–6 inwardly pointing teeth (Plate 180b–e); U-shaped ridge (similar in construction to peripheral ridge) present laterally on each valve (partly broken off on Plate 180a); ridge terminating in pores (Plate 180f). Surface of valve between ridges smooth, with single and double rimmed pores, each with long bristle with small opening near base (Plate 180g–j).

(Prior to photographing the left valve illustrated in Plates 180, 181, it was cleaned in a sonic vibrator for a few seconds. Unfortunately, the upper part of the U-shaped ridge and segments of the peripheral ridge were broken off by the vibrations. In Plate 180 the original outlines of the ridges are indicated by white-and-black lines. It is interesting to note that the surface of the valve where the ridges had once been superimposed are smooth and without openings. This suggests that the ridges are unconnected by pores to the haemocoel of the animal.)

Infold (Plates 180k,l, 181): Rostral infold with 12 bristles forming row paralleling valve edge (Plate 180l); ventral infold with 7 widely spaced bristles; posteroventral infold with 3 bristles close to outer edge of valve; inner edge of posteroventral infold with 4 bristles followed by 2 groups of bristles; each group of bristles with a long bristle emerging from open pore and 2 short tubular bristles emerging from closed pores (Figure 171b, Plate 181c,d,f); short tubular bristle present between the 2 groups of bristles and slightly posterior to them (Plate 181c,e).

Selvage: Wide lamellar prolongation with marginal fringe present along anterior, ventral, and posteroventral margins (Plate 181a,b); selvage continuous along incisure.

Size: USNM 142386, length 1.60 mm, height 1.24 mm, width 1.19 mm.

First Antenna (Figure 171c–e): 2nd joint with 4 spinous bristles along middle of dorsal margin; short triangular 3rd joint with 3 spinous bristles (1 proximal, 2 terminal) on dorsal margin, and 1 long, slender, spinous bristle on ventral margin; 3rd and 4th joints combine to form rectangle; 4th joint with 1 spinous terminal bristle on dorsal

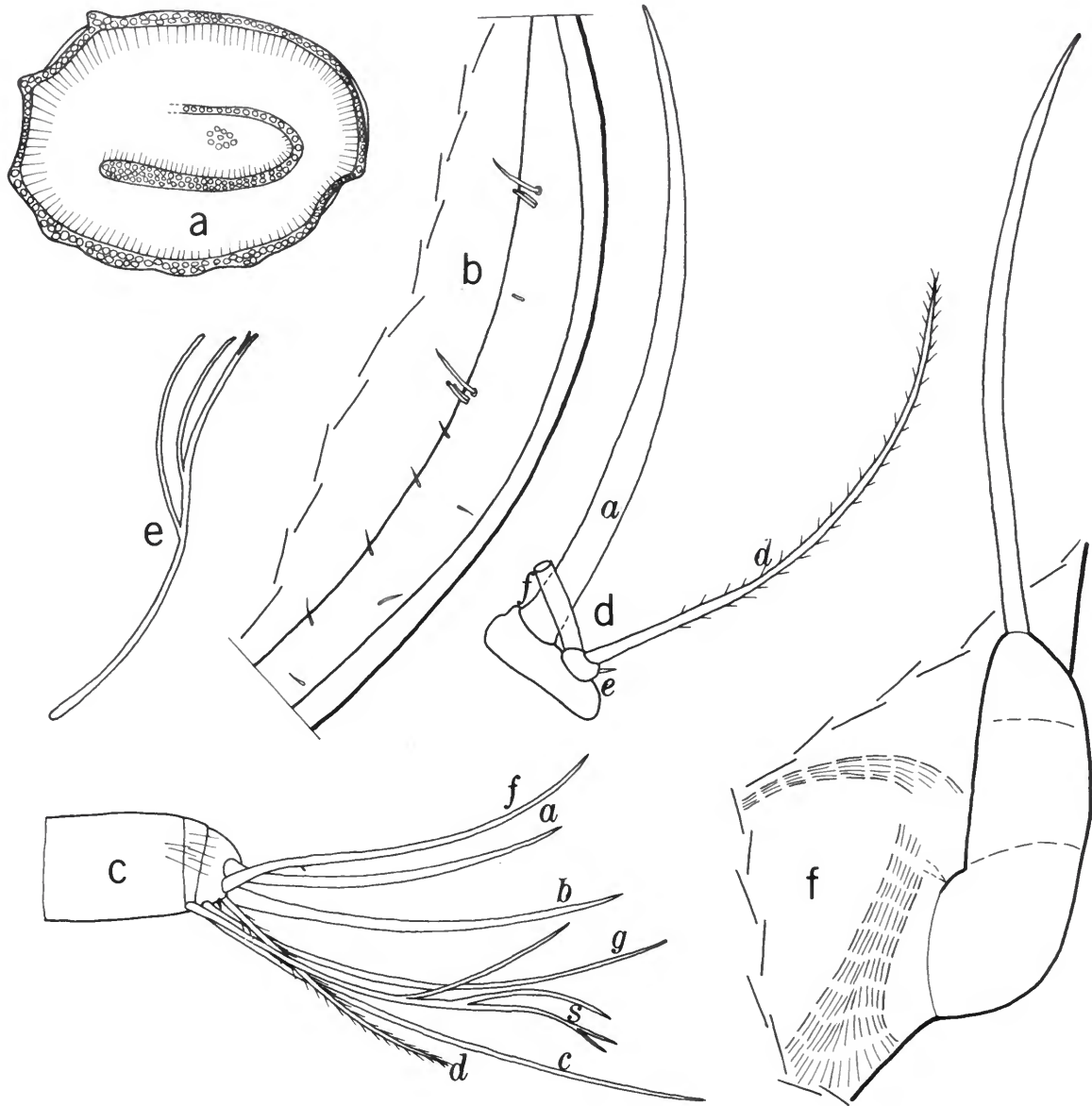


FIGURE 171.—*Omegasterope upsilon* (Kornicker and Caraion), adult(?), female paratype, USNM 142386: *a*, right valve, lateral view, length 1.60 mm; *b*, inside view of posteroventral margin of right valve showing bristles of infold; *c*, distal joints of right 1st antenna showing sensory bristle of 5th joint, and bristles of 7th and 8th joint, lateral view; *d*, detail from *c* showing a-bristle of 7th joint, d- and e-bristles and proximal part of f-bristle of 8th joint; *e*, detail from *c* showing sensory bristle of 5th joint; *f*, endopodite of left 2nd antenna, lateral view.

margin, none on ventral margin; lateral surface of long 5th joint with 3 long hairs; sensory bristle of 5th joint with 1 minute proximal filament (not shown in illustrated limb), 2 long filaments near middle, and stem with bifurcate tip (Figure 171*e*); 6th joint with few lateral hairs, but no medial bristle. Seventh joint: a-bristle long, bare, tending to be clawlike; b-bristle longer than sensory bristle, with 1 minute proximal filament and 1 near tip; c-bristle slightly less stout and slightly longer than b-bristle and longer than sensory bristle. Eighth joint: d-bristle spinous, about 80 percent length of a-bristle; e-bristle minute; f-bristle bent dorsally in proximal part, about same length as sensory bristle, with 1 minute proximal filament; g-bristle about same length as f-bristle, may have minute proximal filament.

Second Antenna (Figure 171*f*): Endopodite 3-jointed with long terminal bristle on 3rd joint.

Microasteropteron Poulsen, 1965

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

DISTRIBUTION (Figure 125).—*M. parvum*, Thailand; *M. youngi*, Hawaii; *M. bacescui*, Bab el Mandeb.

COMPOSITION.—The genus contains 3 species: *M. parvum* Poulsen, 1965; *M. youngi* Kornicker, 1976b; and *M. bacescui*, new species.

DIAGNOSIS.—Carapace very small, length of adult females of known species smaller than 0.85

mm; incisur small, indicated by small projection of rostrum.

Ornamentation: Surface of valves with round fossae, low ridges, and posterior processes.

Infold: Rostral infold with relatively few bristles (4–8 on known species); posterior infold with 2 or 3 long tubular bristles and 2 or 3 setose bristles.

First Antenna: Sensory bristle of female 5th joint without filaments, but tip may be bifurcate; a-bristle of 7th joint bristlelike; d-bristle of 8th joint absent; e-bristle bare, bristlelike, with pointed tip.

Second Antenna: Protopodite with fairly long medial bristle. Endopodite 1-jointed, either with 2 short bristles or without bristles. Exopodite: joints without basal or lateral spines; 9th joint with only 1 bristle.

Mandible: Exopodite minute, length not more than one-fourth length of dorsal margin of 1st endopodial joint. Endopodite with relatively short 2nd joint and relatively long end joint; ventral margin of 2nd joint either without bristles or with 1 terminal bristle; end joint with 5 bristles.

Fifth Limb: Comb with 1 long exopodial bristle and 1 or more small lateral bristles.

Sixth Limb: Anterior margin with 2 to 4 bristles.

Seventh Limb: Limb with 6 to 10 bristles on known species; terminus with 2 large rounded teeth in addition to smaller teeth or pegs.

Furca: Each lamella of known species with 7 claws.

Posterior of Body: With small thumblike process; gill-like structures small.

Upper Lip: With anterior process on *M. youngi* and *M. bacescui*, and without process on *M. parvum*.

Key to Species of *Microasteropteron*

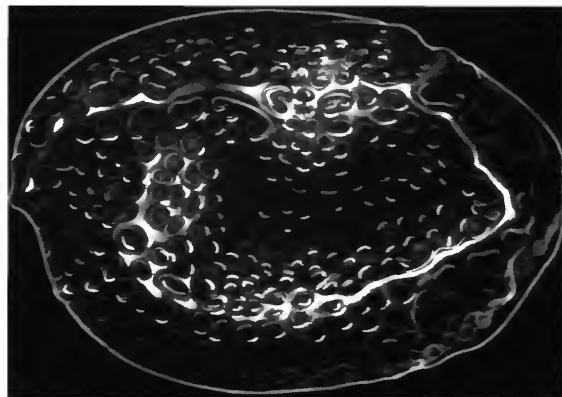
1. a-bristle of 1st antenna pectinate; dorsal margin of 2nd joint of 1st antenna with 3 bristles; ventral margin of 2nd endopodial joint of mandible with 1 terminal bristle 60. ***M. bacescui***, new species
- a-bristle of 1st antenna bare; dorsal margin of 2nd joint of 1st antenna with 2 bristles; 2nd endopodial joint of mandible with bare ventral margin 2
2. Endopodite of 2nd antenna with 2 bristles 58. ***M. parvum***
- Endopodite of 2nd antenna without bristles 59. ***M. youngi***

58. *Microasteropteron parvum* Poulsen, 1965

FIGURES 9n, 12g, 14c, 15b

Microasteropteron parvum Poulsen, 1965:217, fig. 74, 75.**HOLOTYPE.**—Female with embryos, length 0.64 mm, Zoological Museum, Copenhagen.**TYPE-LOCALITY.**—Koh Kam, Thailand, depth 18 m.**MATERIAL.**—No new material, no specimens examined.**DISTRIBUTION** (Figure 125).—Thailand, depth 9–18 m.**DIAGNOSIS.**—Second antenna: Endopodite with 2 short bristles.*Seventh Limb:* Each limb with 6 bristles.*Lateral Eyes:* Absent.*Upper Lip:* Without anterior process or spine.**59. *Microasteropteron youngi* Kornicker, 1976**

FIGURES 10h, 11d, 16c, 17f

Microasteropteron youngi Kornicker, 1976b:15, figs. 14–19.**HOLOTYPE.**—Adult female, USNM 151580.**TYPE-LOCALITY.**—Between reef and Paiko Peninsula, Maunaloa Bay, Oahu, Hawaii.**MATERIAL.**—No new material.**DISTRIBUTION** (Figure 125).—Only collected at type-locality. Depth 30–58 cm.FIGURE 172.—*Microasteropteron bacescui*, new species, ovigerous female, paratype, USNM 157775, lateral view of complete specimen, length 0.80 mm.**DIAGNOSIS.**—Second antenna: Endopodite without bristles.*Seventh Limb:* Each limb with 8 bristles.*Lateral Eye:* Small, darkly pigmented, without ommatidia.*Upper Lip:* With long spinous anterior process.**CORRECTION OF ORIGINAL DESCRIPTION.**—Illustrated 1st antenna (Kornicker, 1976b, fig. 19f) shows ringed bristles on the 4th and 5th joints, these are actually hairs. Upper lip was described (page 23) as having a single lobe with large process; this probably should have been 2 lobes, each with anterior process.**60. *Microasteropteron bacescui*, new species**

FIGURES 172–174, PLATES 182–185

ETYMOLOGY.—The species is named for the collector, Dr. Mihai (Micael) Bačescu.**HOLOTYPE.**—Ovigerous female deposited in the Museum of Natural History “Grigore Antipa,” Bucharest, Romania.**TYPE-LOCALITY.**—Sta 103, R/V *Thalassa*, Bab el Mandeb.**PARATYPES.**—USNM 157773, 157775, 157788, 7 ovigerous females; 1 ovigerous female deposited with holotype in Romania; all paratypes from same sample as holotype.**DESCRIPTION OF ADULT FEMALE** (Figures 172, 173, Plates 182–185).—Carapace oval in lateral view with minute incisur and rostrum (Figures 172, 173a, Plates 182, 183a); 2 low lateral ribs (1 near dorsal margin and 1 near ventral margin) meet near middle of dorsal margin to form continuous U-shaped rib; minute protuberance present near posterodorsal edge of valve; carapace widest posterior to middle and longest and highest near middle; each valve with posterodorsal bulge forming marsupium capable of holding 2 eggs (Figure 173a).**Ornamentation:** Surface with numerous shallow fossae, some with narrow rim (Plates 182, 183a); fossae in vicinity of central adductor muscle attachments smaller than others (Plate 182a); some fossae with pustules at bottom (Plates 183c, 184b); valve surface in vicinity of fossae minutely re-

ticulate (Plate 183*b-d*); surface between fossae with patterned structure of low ridges and inset pits (Plates 183*c-e*, 184*a,c*).

Pores: Long bristles emerging from open pores with smooth but unraised edge sparsely distributed over valve surface (Plate 184*a,c*); small pore present near base of some of the bristles (Plate 184*c*); additional bristles emerging from closed pores also present, often paired with a bristle emerging from open pore (Plates 183*b-d*, 184*a,c*), these bristles appear to have open tips (Plates 183*d*, 184*a*).

Infold: Posteroventral infold with 3 stout bristles, but only 1 of these visible in specimen examined with SEM (Plate 185*e,f*); minute processes visible near base of stout bristles when viewed under light microscope; setose bristles not observed under light microscope, but could be present; 3 slender bristles present near posterior end of ventral infold ventral to the 3 stout posteroventral bristles; infold above shallow incisure with 5 long bristles (Plates 184*d,e*, 185*a-c*); a minute tubular pore present just posterior to incisure (Plates 184*f*, 185*d*).

Selva: Wide lamellar prolongation present along anterior, ventral, and posterior margins of valves, fringed along anterior margin and possibly elsewhere (Plates 184*d-f*, 185*a,b*).

Central Adductor Muscle Attachments: Consisting of about 13 individual ovoid muscle ends reflected in carapace by small oval fossae just anterior to valve middle (Figure 173*a*, Plate 182*a*).

Size: Holotype, length 0.83 mm, height 0.56; paratype deposited in Romania, length 0.84 mm, height 0.56 mm; USNM 157773, length 0.84 mm, height 0.59 mm; USNM 157775, length 0.80 mm, height 0.57 mm.

First Antenna (Figure 173*b*): 1st joint with long ventral hairs. 2nd joint with ventral hairs, proximal dorsal hairs, and 3 spinous dorsal bristles (2 proximal, 1 distal). 3rd joint short with 2 dorsal bristles. 4th joint with ventral hairs and 2 spinous bristles (1 ventral, 1 dorsal); bare sensory bristle of long 5th joint finely ringed distally; 5th joint with long lateral hairs. 6th joint with minute, faint, medial bristle. 7th joint: a-bristle pectinate along distal ventral margin; b-bristle bare, shorter

than sensory bristle of 5th joint; c-bristle bare, slightly longer than sensory bristle. 8th joint: d-bristle absent; e-bristle bare, bristlelike, about same length as a-bristle; f-bristle bare, about same length as a-bristle; g-bristle bare, about same length as c-bristle.

Second Antenna (Figure 173*c*): Protopodite with long, distal, medial bristle, and few long hairs on dorsal margin. Endopodite consisting of slight bulge without bristles. Exopodite 9-jointed: 1st joint with minute, medial, terminal spine; bristles of joints 2-8 long, with natatory hairs and minute, slender, proximal, ventral spines; 9th joint small, with single natatory bristle; joints 3-5 with faint minute spines along medial distal margin.

Mandible (Figures 173*d,e,i*, 174*a*): Coxale endite: ventral branch with about 4 oblique rows of spines and 3 small terminal teeth; ventral margin of dorsal branch with 3 teeth proximal to small main spine; tip of dorsal branch with 2 spinous bristles (1 near middle, 1 near dorsal corner (latter appears broken on illustrated endite)); dorsal margin of dorsal branch serrate distally. Basale: endite with 4 pectinate end bristles, 1 dwarf bristle, and 1 ventral triaenid bristle with about 12 paired teeth decreasing in length distally along bristle; ventral margin of basale with 1 triaenid bristle near base of endite (bristle with 8-12 small paired spines proximal to about the same number of slightly stouter paired spines), 1 similar triaenid bristle near middle of margin, and a longer spinous bristle just distal to base of triaenid bristle; dorsal margin of basale with 2 long terminal bristles. Exopodite short with 1 long bristle extending past distal end of 1st endopodial joint, and 1 shorter outer bristle (Figure 173*i*). Endopodite: ventral margin of 1st joint with 3 long bristles (2 proximal of these longer than other and with long spines); dorsal margin of 2nd joint with bristles forming 2 groups (2 in proximal group, 4 in distal group); ventral margin with 1 long terminal bristle; medial surface with spines forming rows; end joint with 1 short and 4 long bristles, some with ventral spines (not shown on illustrated limb); medial surface with long spines forming rows.

Maxilla (Figure 173*f-h*): Epipodite pointed,

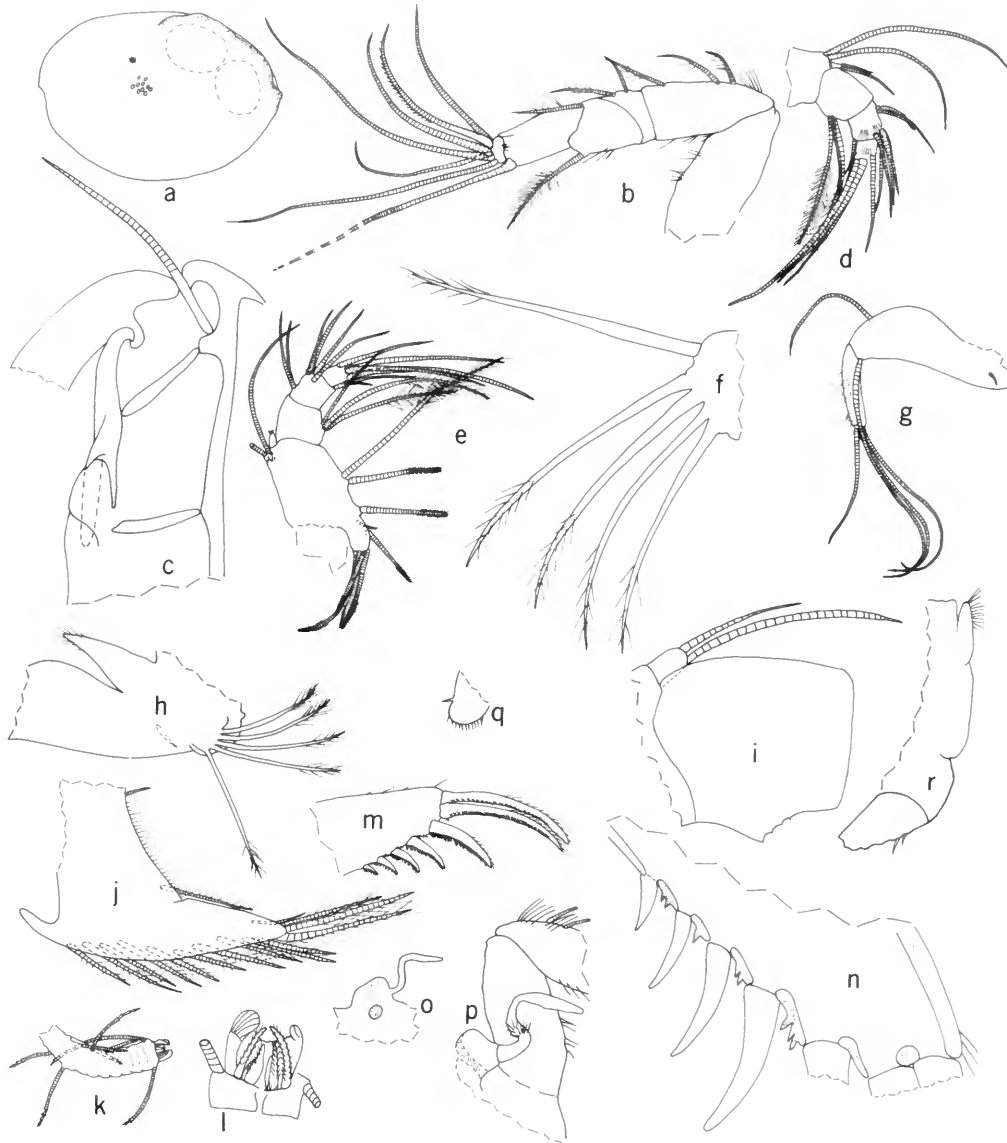


FIGURE 173.—*Microasteropteron bacescui*, new species, ovigerous female, paratype, USNM 157773: *a*, complete specimen showing left lateral eye, central adductor muscle attachments, and positions of 2 eggs, length 0.84 mm; *b*, left 1st antenna, lateral view; *c*, distal part of protopodite, endopodite, and proximal part of 1st exopodial joint of right 2nd antenna, medial view; *d*, distal part of right mandible showing part of basale, exopodite, and endopodite, lateral view; *e*, left mandible (coxale endite broken off), medial view; *f*, endite of right maxilla, medial view; *g*, distal part of left maxilla, lateral view; *h*, proximal part of right maxilla, medial view; *i*, comb of left 5th limb, medial view; *j*, right 6th limb, lateral view; *k*, 7th limb; *l*, detail of tip of 7th limb (not limb shown in *k*); *m*, right lamella of furca; *n*, detail from *m*; *o*, right lateral eye, medial eye and rod-shaped organ; *p*, medial eye, rod-shaped organ, and proximal part of left 1st antenna; *q*, left view of upper lip; *r*, posterior of body showing posterior process and 2 posterior claws of left lamella of furca.

with distal hairs. Endite consisting of 5 long spinous bristles. Basale with 1 short proximal bristle on lateral side near ventral margin, 1 long distal bristle on dorsal margin, and 1 long terminal bristle on ventral margin. Endopodite: 1st joint with dorsal hairs and long beta-bristle; 2nd joint with 3 long bristles.

Fifth Limb (Figure 174b): Epipodite with about 52 bristles. Comb with long hairs along distal end of dorsal margin; hirsute exopodial bristle not reaching end of comb; 1 short bristle proximal and dorsal to base of exopodial bristle, and 4 small bare bristles near ventral margin; ventral margin of comb with 23 spinous bristles, some with long terminal hairs.

Sixth Limb (Figures 173j, 174c): Anterior margin with 3 or 4 bristles (1 or 2 short proximal, 1 short near middle, 1 long distal (middle bristle missing on limb illustrated in Figure 173j)); narrow lateral flap hirsute but without bristles; anteroventral and ventral margin with 14–16 hirsute bristles; posterior end of skirt projecting backward, terminating in short process.

Seventh Limb (Figure 173k,l): Each limb with 2 terminal bristles, 1 on each side, and 5 to 8 proximal bristles, 4 on one side, and 1 to 4 on

other side; each bristle with up to 4 bells; terminus with 2 large processes, and proximally to these 8 spinous teeth, 4 on each side. (USNM 157773 with 5–6 proximal bristles; USNM 157775 with 8 proximal bristles.)

Furca (Figure 173m,n,r): Each lamella with 7 claws; claws 1 and 2 set close together and about same length; claws 3–7 decreasing in width and length distally along lamella; all claws with teeth forming lateral row except at very tip, which is bare; teeth of similar length except for proximal few being stouter; on some specimens sclerotized segments between bases of claws 2–7 with 1–3 minute teeth; hairs present along anterior margins of lamella and claws 1–3.

Rod-shaped Organ (Figure 173o,p): Elongate, widening distally, with spines on proximal half, tip rounded.

Eyes: Lateral eye small, darkly pigmented, with 3 amber ommatidia (Figure 173o); medial eye about 3 times diameter of lateral eye, pigmented (Figure 173o,p).

Posterior of Body (Figure 173r): Thumblike hirsute dorsum present.

Gill-like Structures: Present.

Upper Lip (Figures 173q, 174d): Anterior saddle

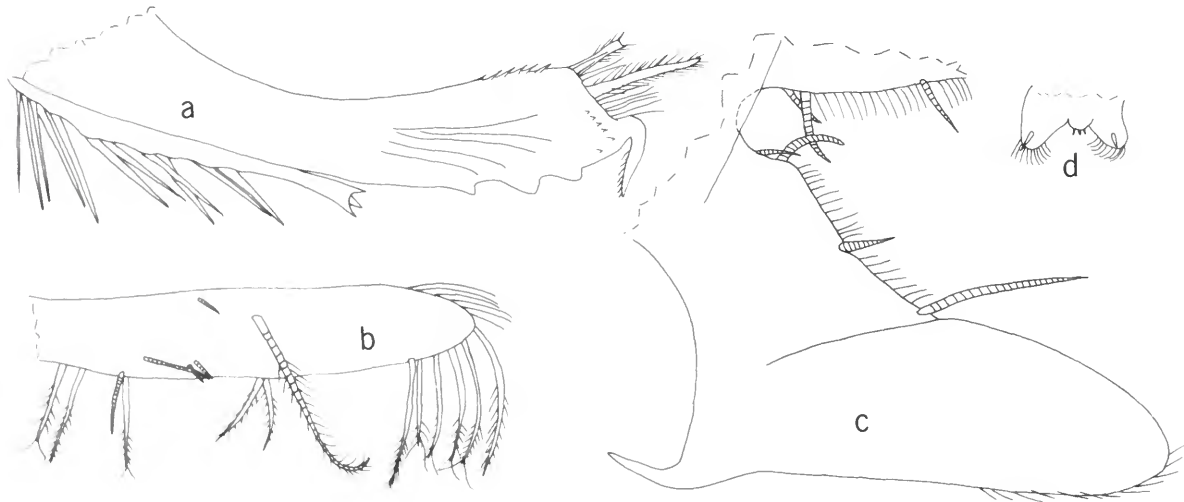


FIGURE 174.—*Microasteropteron bacescui*, new species, ovigerous female, paratype, USNM 157775: a, coxale endite of mandible; b, comb of right 5th limb, lateral view, not all ventral bristles shown; c, left 6th limb (ventral bristles not shown) and proximal part of anterior margin of right 6th limb showing them joined together, medial view; d, dorsal view of upper lip (not under cover slip).

with 3 minute spines; 2 hirsute lobes present, each with anterior spine larger than those on anterior saddle.

Eggs: USNM 157773 and USNM 157775 each with 4 eggs in marsupium and with additional smaller unextruded eggs. Holotype and paratype deposited in Romania, and also 4 paratypes (USNM 157788), each with 4 eggs in marsupium. (Each valve with posterodorsal bulge capable of holding 2 large eggs.)

COMPARISONS.—The 1st antenna of *M. bacescui*, new species, differs from that of the 2 previously described species in having 3 instead of 2 bristles on the dorsal margin of the 2nd joint, and in having a pectinate instead of bare a-bristle on the 7th joint. The mandible of *M. bacescui* bears on the ventral margin of the 2nd endopodial joint a long terminal bristle that is absent on other species in the genus.

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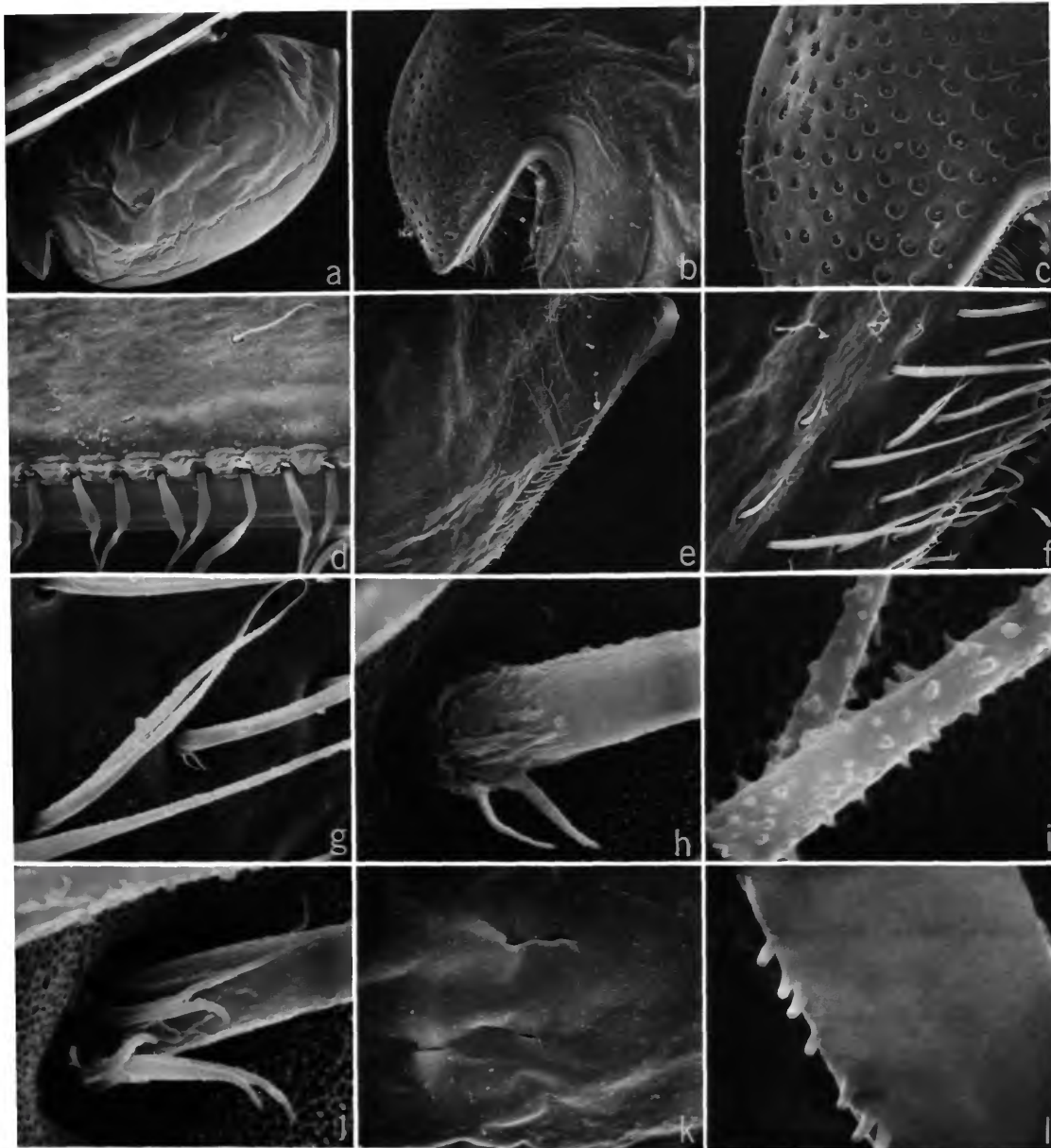


PLATE 1.—*Cyclostephe fascigera* Brady, adult female, left valve, outside views: *a*, lateral view of valve (ventral margin tilted forward about 20°), $\times 19$; *b*, incisur and rostrum, from *a*, $\times 58$; *c*, detail from *b*, $\times 116$; *d*, edge of valve near middle of ventral margin, ventral view, $\times 580$; *e*, posteroventral part of valve, from *a*, $\times 60$; *f*, bristles along posteroventral margin shown in *e*, $\times 1500$; *g*, bristles shown in *f*, $\times 1500$; *h*, base of bristle shown in *g*, $\times 7500$; *i*, distal part of upper bristles shown in *g*, $\times 15,000$; *j*, base of bristles near bottom of *f*, $\times 7500$; *k*, surface near middle of valve, $\times 60$; *l*, edge of a bristle along ventral margin, from *d*, $\times 11,500$. (Micrographs reduced to 53%.)

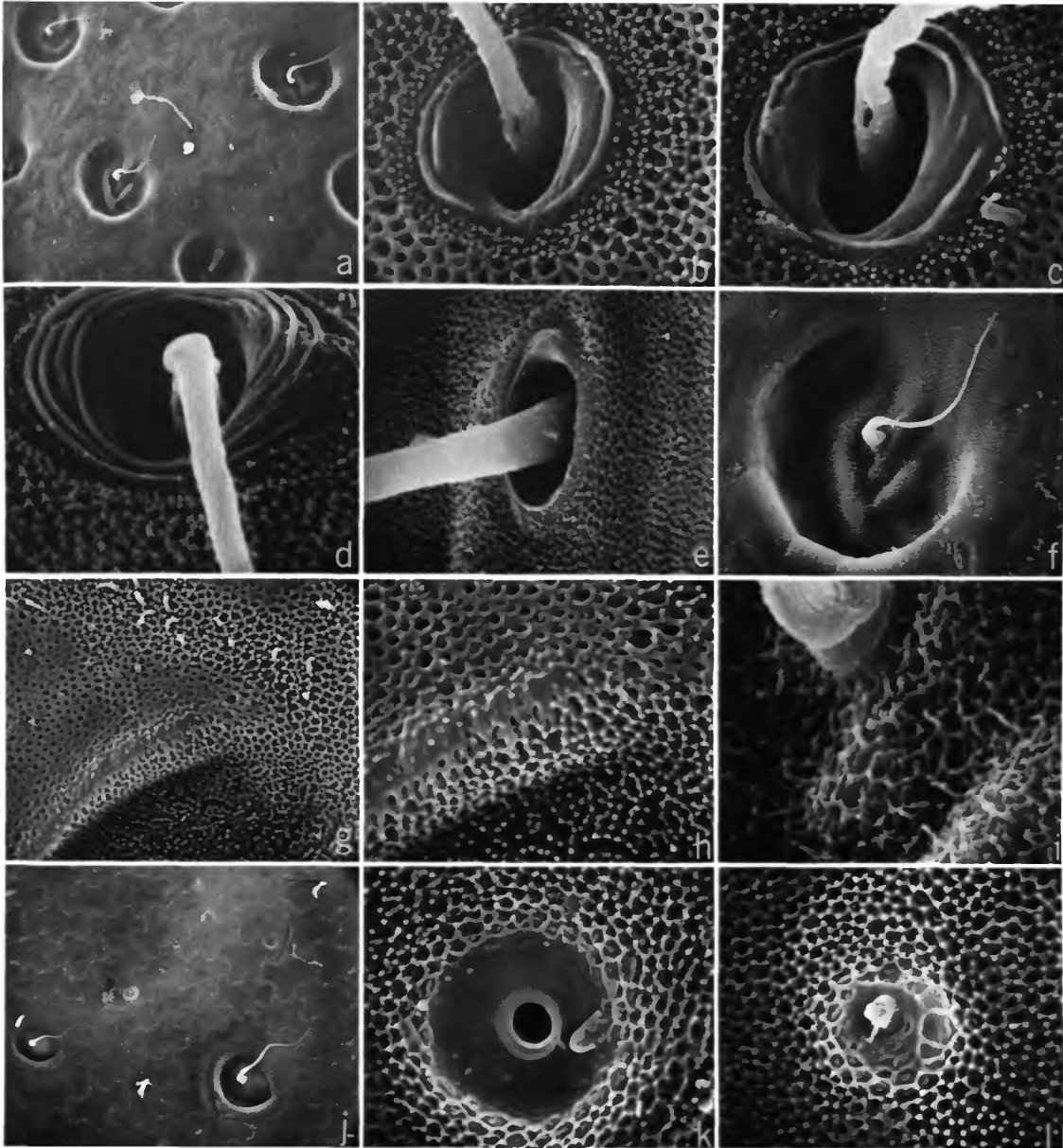


PLATE 2.—*Cyclasterope fascigera* Brady, adult female, left valve, outside views: *a*, fossae, bristles, and pores on rostrum shown in Plate 1*c*, $\times 580$; *b*, rimmed pore with bristle shown in *a*, $\times 10,000$; *c*, rimmed pore with bristle on rostrum, from Plate 1*c*, $\times 10,000$; *d*, rimmed pore with bristle on anterior part of valve, $\times 10,000$; *e*, pore with bristle on inner margin of incisur, from Plate 1*b*, $\times 5000$; *f*, fossa with bristle, from *a*, $\times 1700$; *g*, surface around upper margin of fossa shown in *f* (note elongate papillae near upper margin of micrograph), $\times 5000$; *h*, detail of *g*, $\times 10,000$; *i*, surface near base of bristle shown in *f*, $\times 10,000$; *j*, fossae, bristles and pores near middle of valve, $\times 580$; *k*, pore with smooth margin, from *j*, $\times 10,000$; *l*, minute raised process near bottom of *j*, $\times 10,000$. (Micrographs reduced to 53%.)

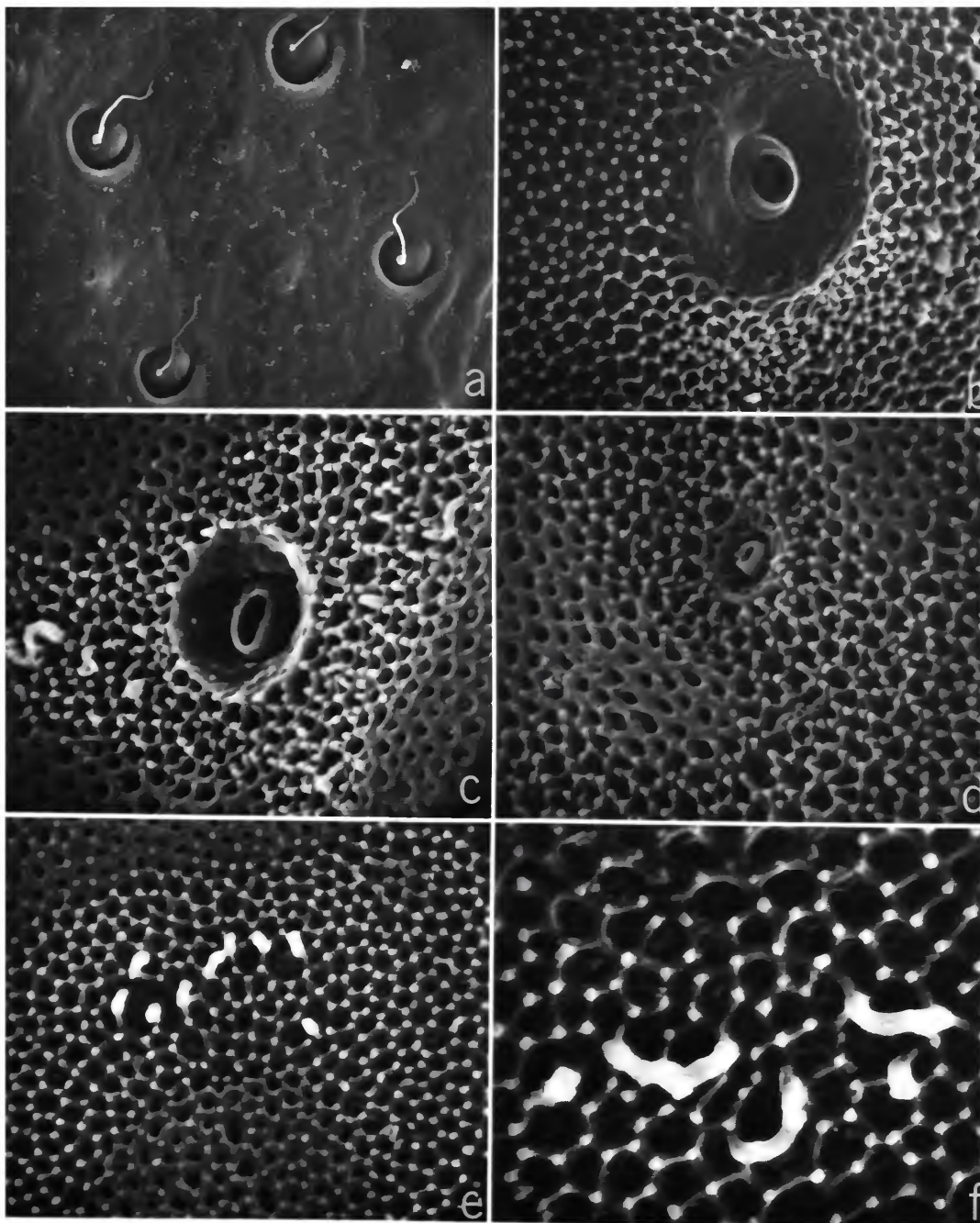


PLATE 3.—*Cyclasterope fascigera* Brady, adult female, left valve, outside views: *a*, fossae, bristles, and pores on posterior part of valve, from Plate 1*e*, $\times 580$; *b*, detail of pore in *a*, $\times 10,000$; *c*, pore from anterior part of valve, $\times 10,000$; *d*, minute pore on rostrum, from Plate 1*a*, $\times 10,000$; *e*, detail of papillae, from Plate 2*j*, $\times 10,000$; *f*, detail of papillae and pits near middle of valve, $\times 20,000$. (Micrographs reduced to 77%.)

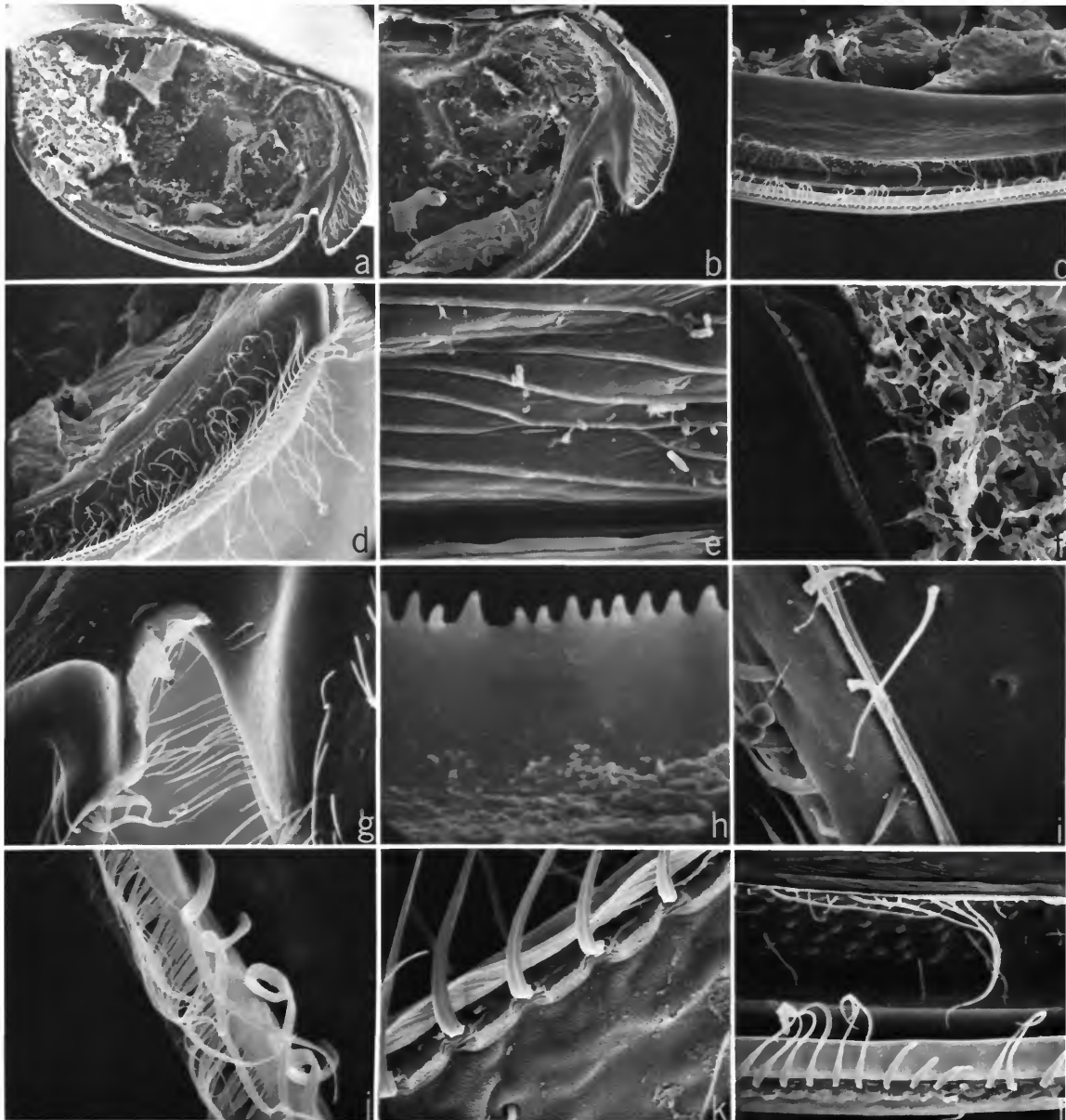


PLATE 4.—*Cyclasterope fascigera* Brady, adult female, left valve, inside views: *a*, medial view of valve, $\times 19$; *b*, anterior, from *a*, $\times 30$; *c*, ventral margin, from *a*, $\times 90$; *d*, anteroventral margin, from *a*, $\times 100$; *e*, striae on infold proximal to list along ventral margin, from *l*, $\times 3600$; *f*, posteroventral margin showing infold, from *a*, $\times 100$; *g*, incisur, from *b*, $\times 200$; *h*, serrated margin of lamellar prolongation of selvage along ventral margin, from *l*, $\times 11,000$; *i*, posterior edge of valve, from *f*, $\times 1000$; *j*, lamellar prolongation of selvage, anterodorsal margin of rostrum, from *b*, $\times 500$; *k*, anteroventral margin of valve, from *d*, $\times 100$; *l*, middle of ventral margin, from *c*, $\times 90$. (Micrographs reduced to 53%.)

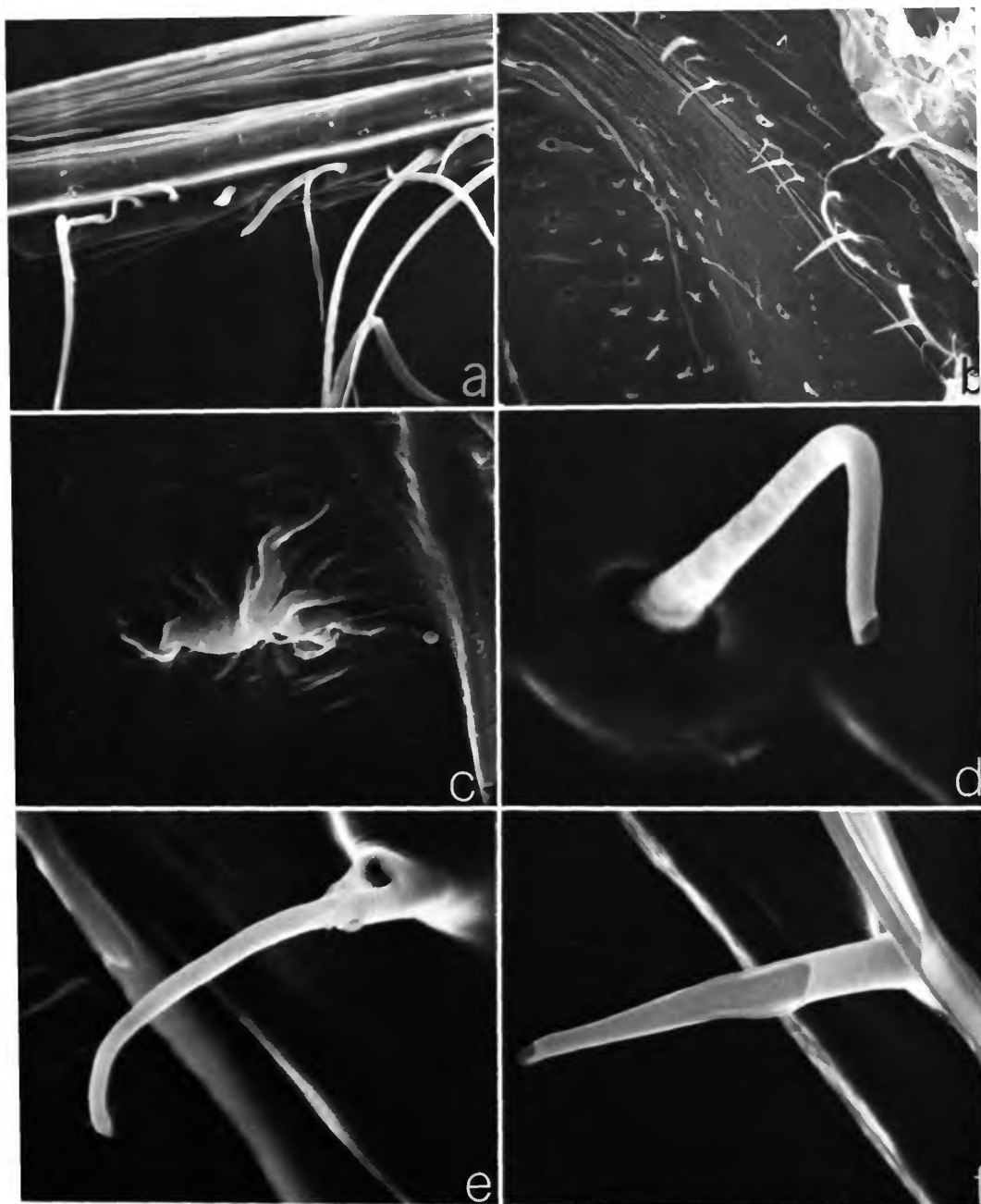


PLATE 5.—*Cyclasterope fascigera* Brady, adult female, left valve, inside views: *a*, list of infold about one-quarter valve length from anterior margin, from Plate 4*a*, $\times 1000$; *b*, dorsal end of posteroventral infold, from Plate 4*f*, $\times 500$; *c*, process on infold in lower left part of *b*, $\times 5000$; *d*, bristle on infold proximal to list in upper part of *b*, $\times 10,000$; *e*, bristle near middle of list in *b*, $\times 7500$; *f*, bristle near lower end of list in *b*, $\times 4500$. (Micrographs reduced to 75%.)

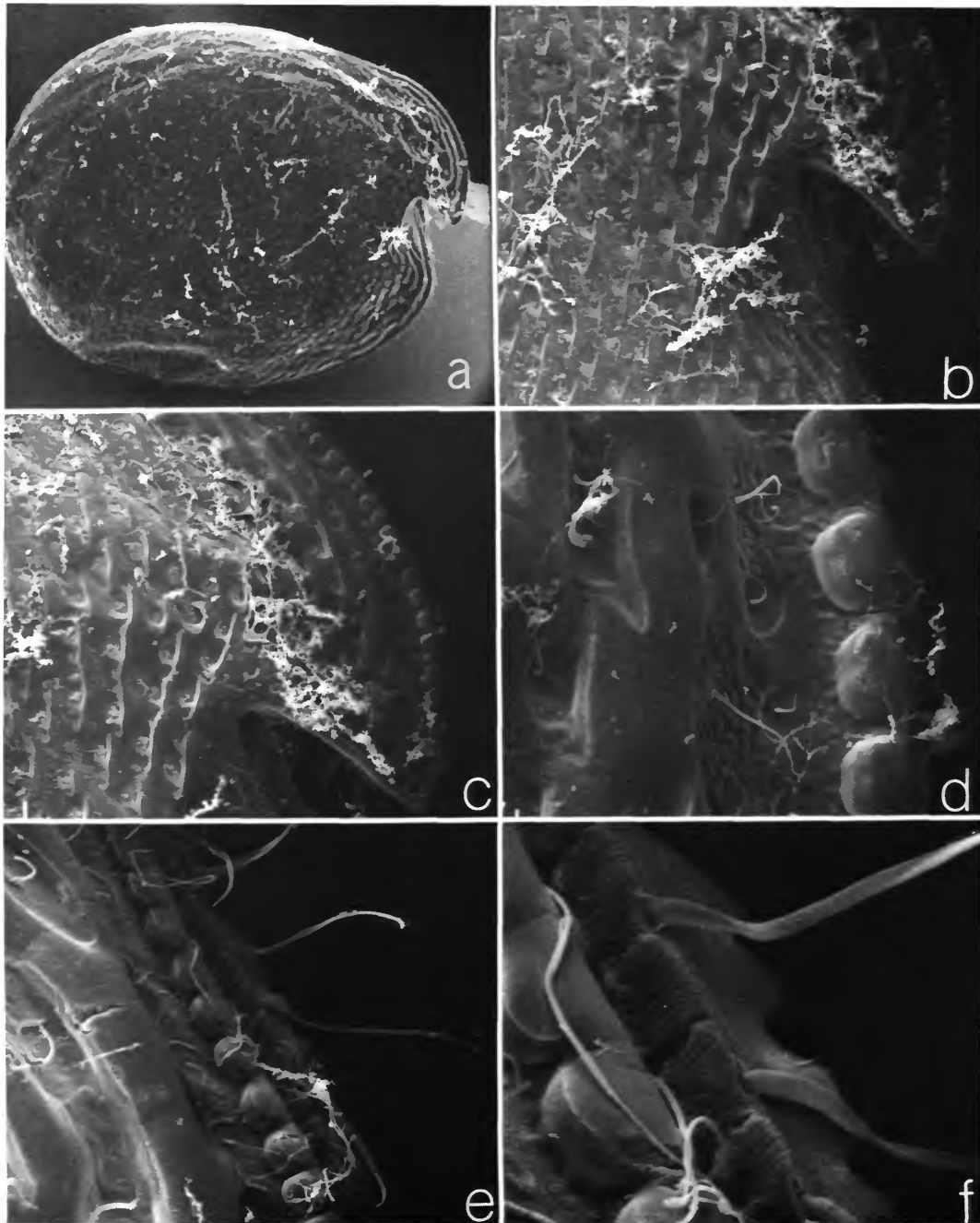


PLATE 6.—*Cycloleberis galatheae* Poulsen, ovigerous female, USNM 157409, right valve, outside views: *a*, lateral view, $\times 20$; *b*, anterior of valve, from *a*, $\times 76$; *c*, rostrum, from *b*, $\times 100$; *d*, detail of scalloped border of rostrum, from *c*, $\times 470$; *e*, anterior margin ventral to incisor, from *b*, $\times 385$; *f*, detail margin in *e*, $\times 1220$. (Micrographs reduced to 84%.)

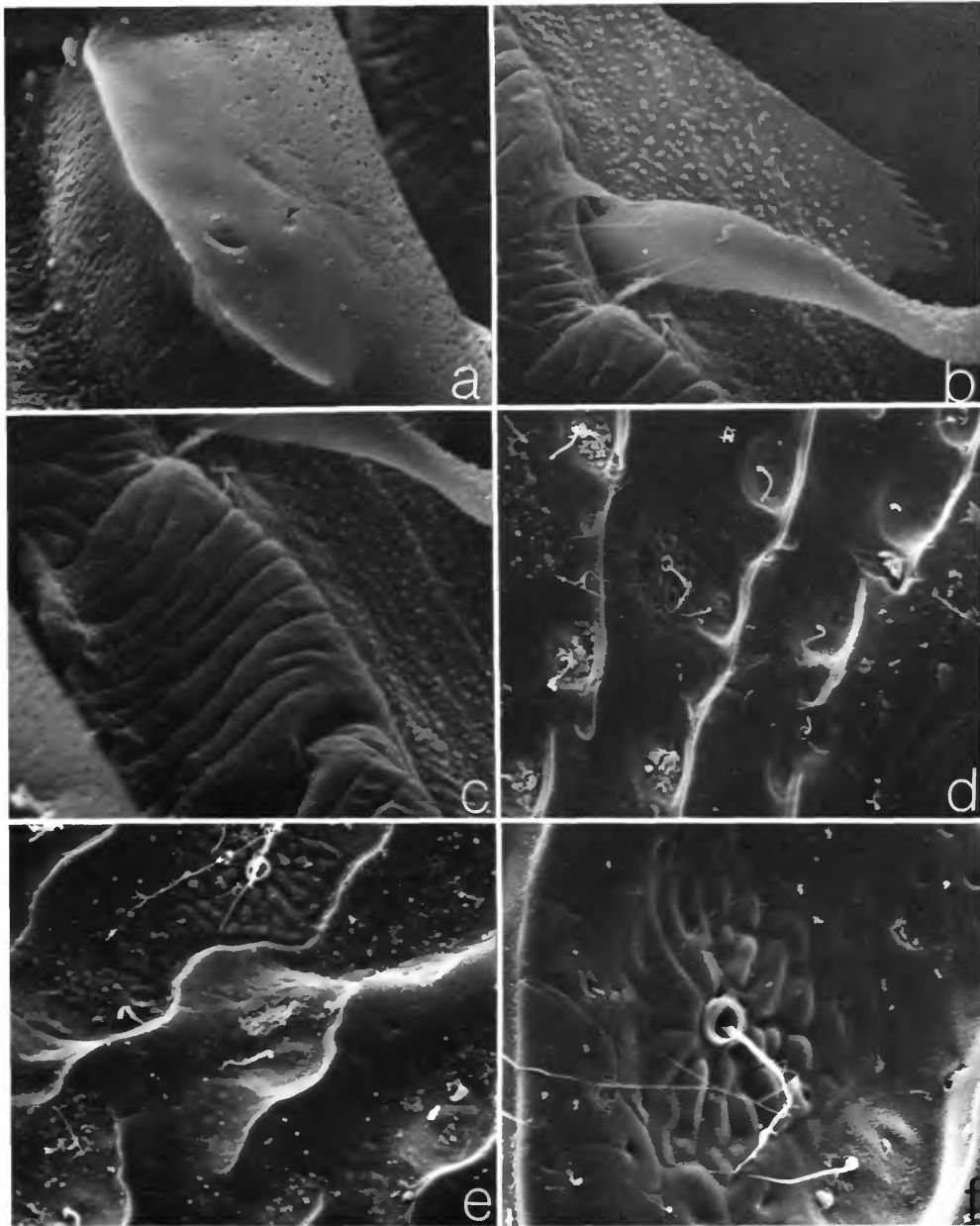


PLATE 7.—*Cycloleberis galathea* Poulsen, ovigerous female, USNM 157409, right valve, outside views: *a*, detail of single marginal scallop in upper part of Plate 6*f*, $\times 3800$; *b*, detail of bristle and lamellar prolongation of selvage shown in Plate 6*f*, $\times 3800$; *c*, detail of striated marginal structure shown in Plate 6*f*, $\times 3800$; *d*, fossae, bristles, and ridges on anterior part of valve just posterior to incisur, from Plate 6*c*, $\times 330$; *e*, fossae, bristles, and ridges on posterodorsal part of valve, from Plate 6*a*, $\times 510$; *f*, detail of pore with emerging bristle, from near middle of *d*, $\times 1000$. (Micrographs reduced to 78%.)

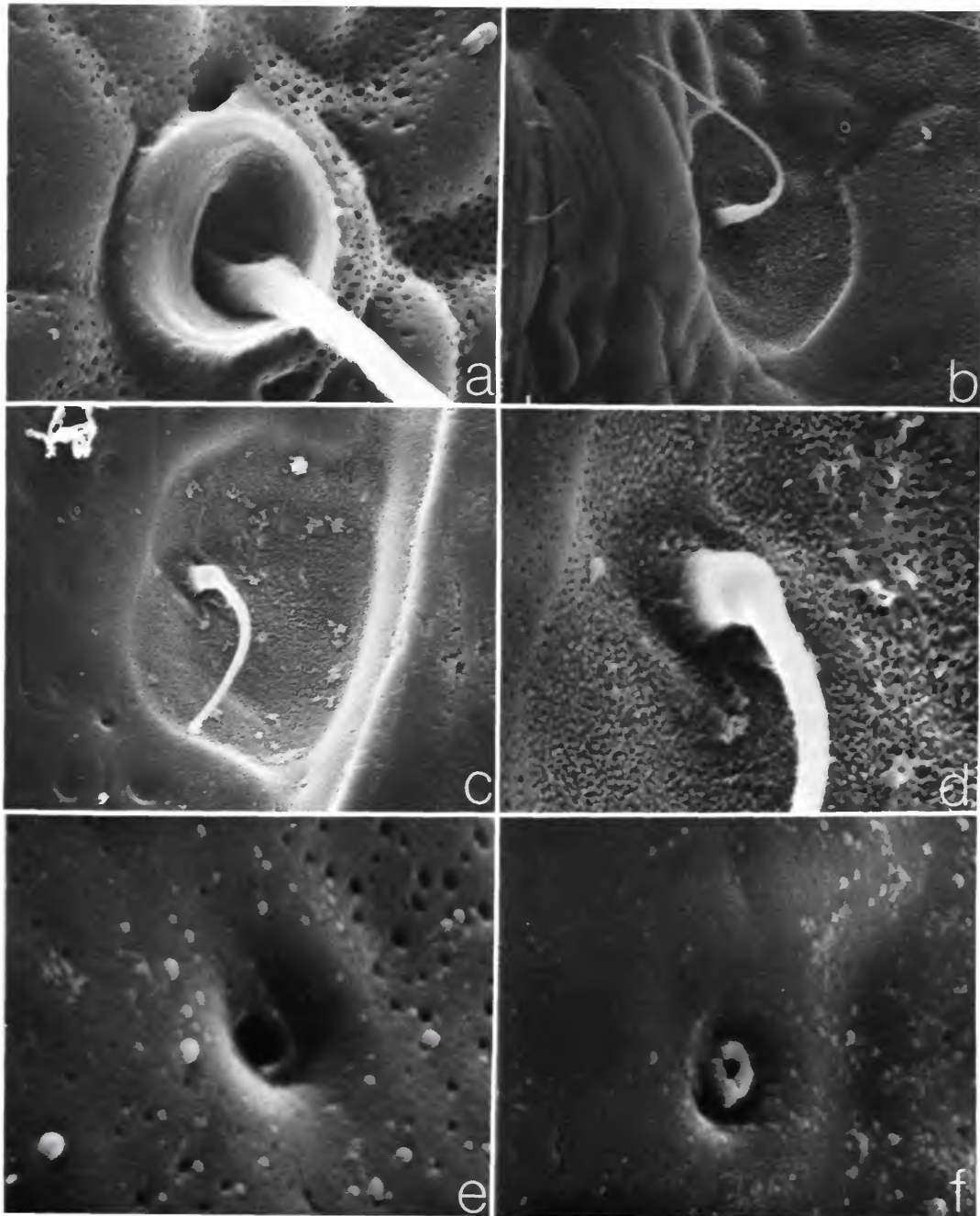


PLATE 8.—*Cycloleberis galathea* Poulsen, ovigerous female, USNM 157409, right valve, outside views: *a*, detail of pore and bristle shown in Plate 7*f*, $\times 5600$; *b*, fossa with bristle, from middle of Plate 6*d*, $\times 2000$; *c*, fossa and bristle, from Plate 7*d*, $\times 1520$; *d*, detail from *c*, $\times 4580$; *e*, detail of minute open pore in lower left of *c*, $\times 11,600$; *f*, detail of minute open pore in upper left of *c*, $\times 11,600$. (Micrographs reduced to 84%.)

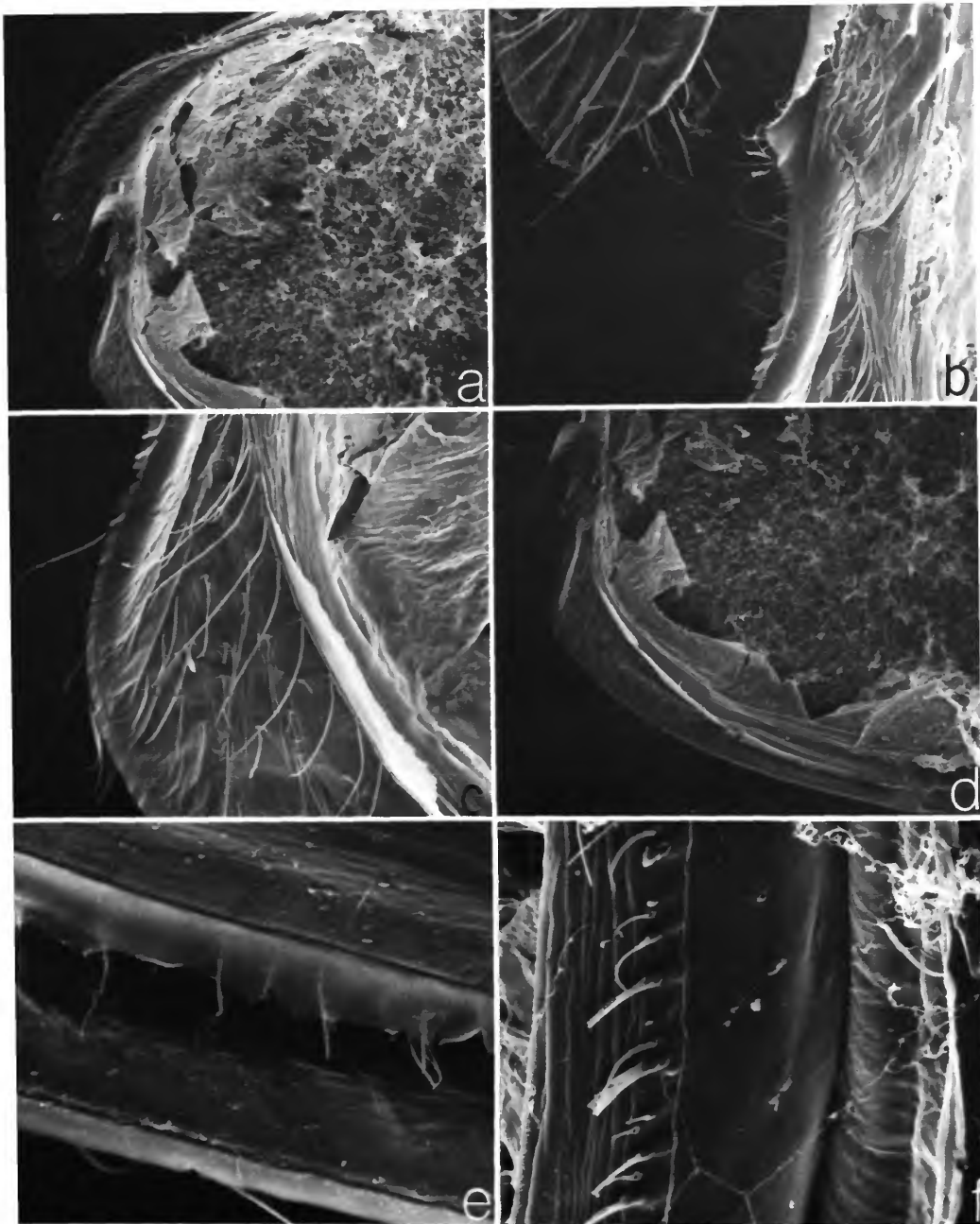


PLATE 9.—*Cycloleberis galathea* Poulsen, ovigerous female, USNM 157409, right valve, inside views: *a*, anterior part of valve, $\times 39$; *b*, rostrum and incisur, from *a*, $\times 188$; *c*, anteroventral infold, from *d*, $\times 188$; *d*, anteroventral part of valve, from *a*, $\times 44$; *e*, anterior end of ventral margin, from *d*, $\times 436$; *f*, segment of posterior margin, $\times 400$. (Micrographs reduced to 82%.)

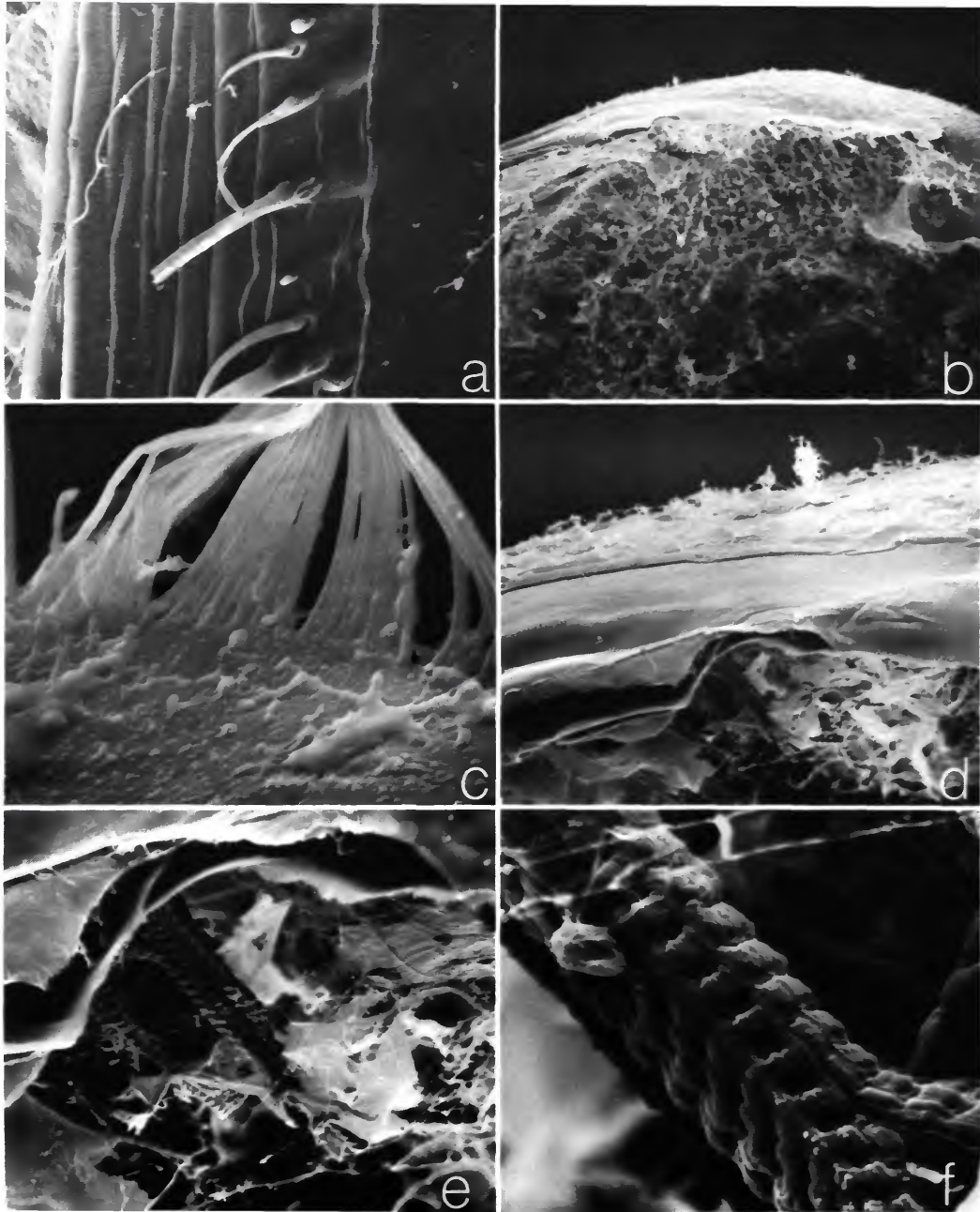


PLATE 10.—*Cycloleberis galathea* Poulsen, ovigerous female, USNM 157409, right valve, inside views: *a*, bristles on list of posterior infold, from Plate 9f, $\times 800$; *b*, dorsal margin $\times 40$; *c*, lamellar prolongation of selvage along dorsal margin anterior to anterior juncture, $\times 4750$; *d*, dorsal margin showing end of dorsal muscle near middle of micrograph, from *b*, $\times 197$; *e*, detail of *d*, $\times 498$; *f*, detail of muscles in *e*, $\times 2000$. (Micrographs reduced to 82%.)

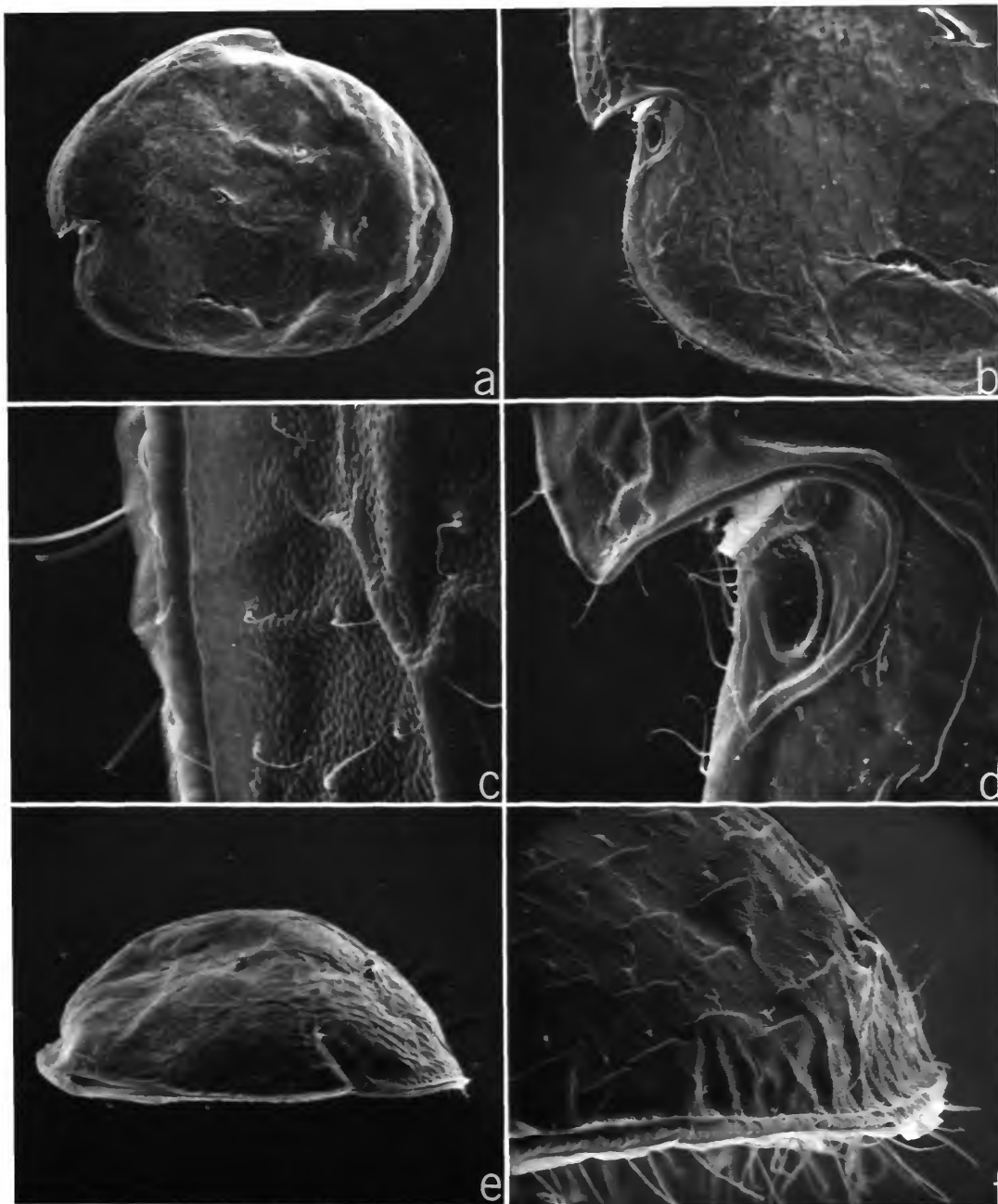


PLATE 11.—*Leuroleberis orbicularis* (Brady), Hamburg Zoological Museum 27285, left valve, outside views: *a*, lateral view of valve, $\times 40$; *b*, anteroventral part of valve, from *a*, $\times 85$; *c*, anterior margin of rostrum, from *b*, $\times 735$; *d*, detail of incisur, from *a*, $\times 300$; *e*, anterior view of valve, $\times 53$; *f*, dorsal view of anterior end of valve, $\times 300$. (Micrographs reduced to 76%.)

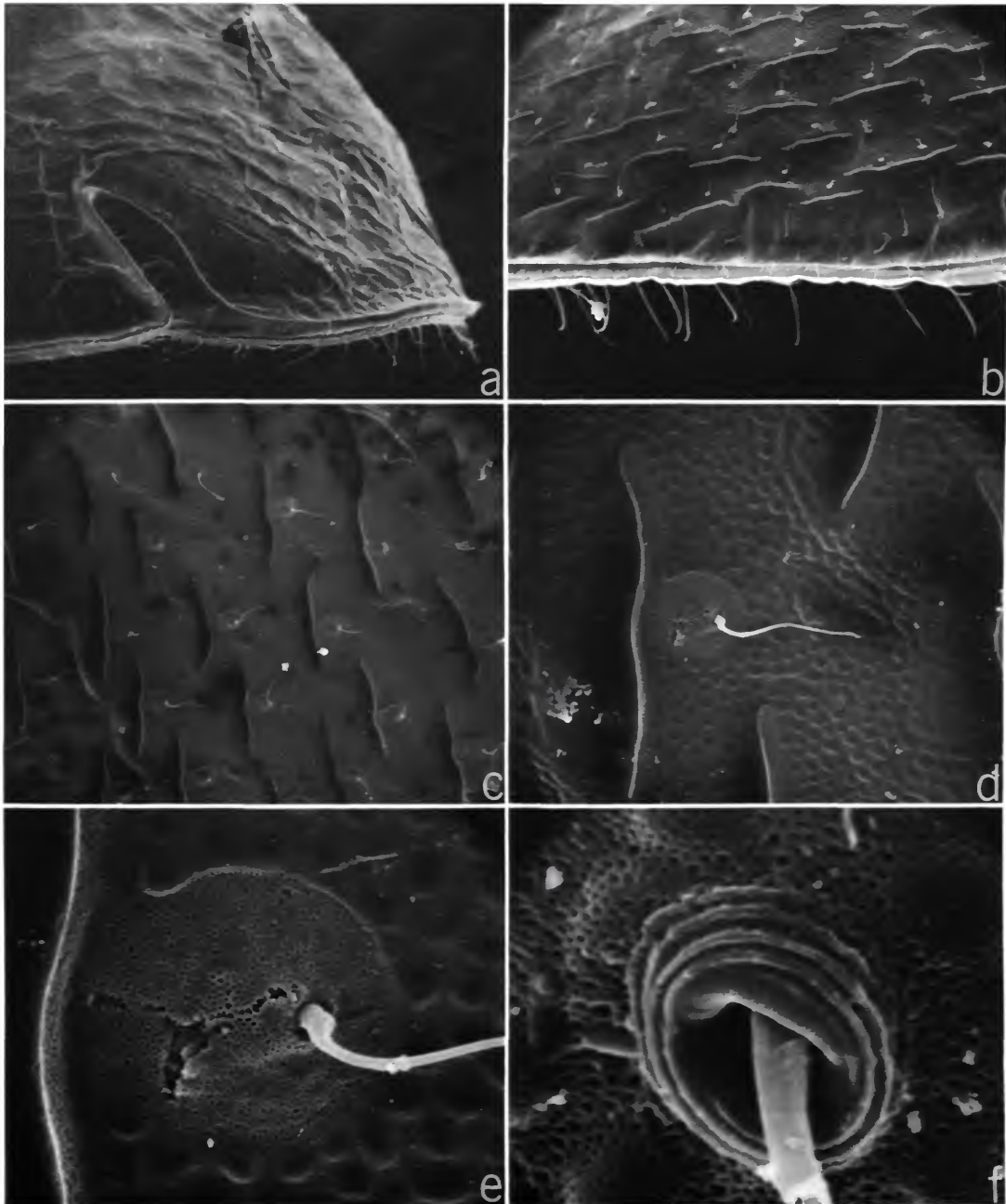


PLATE 12.—*Leuroleberis orbicularis* (Brady), Hamburg Zoological Museum 27285, left valve, outside views: *a*, anterior view of incisur, from Plate 11*e*, $\times 130$; *b*, anterior view of anterior edge of valve, from Plate 11*e*, $\times 200$; *c*, ridges, fossae, and bristles on anteroventral part of valve, from Plate 11*b*, $\times 300$; *d*, detail from *c*, $\times 1000$; *e*, detail of fossa and bristle in *d*, $\times 3150$; *f*, bristle emerging from pore with concentric rings, from area between fossae, $\times 10,000$. (Micrographs reduced to 76%.)

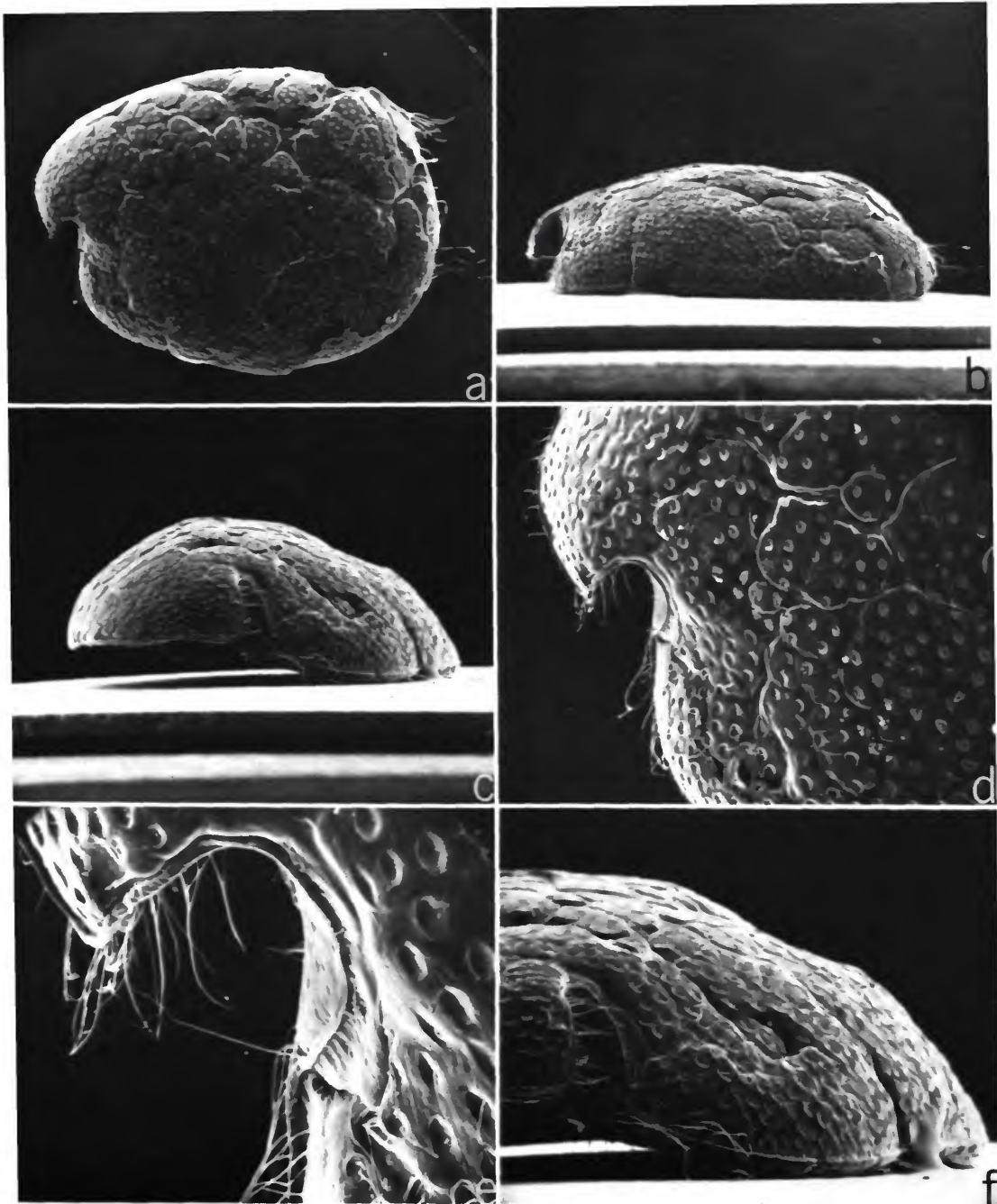


PLATE 13.—*Leuroleberis sharpei*, new species, adult male, paratype, USNM 156930, left valve, outside views: *a*, lateral view, $\times 20$; *b*, ventral view, $\times 22$; *c*, anterior view, $\times 28$; *d*, anterior part of valve, from *a*, $\times 50$; *e*, incisur, from *d*, $\times 150$; *f*, anteroventral part of valve, from *c*, $\times 50$. (Micrographs reduced to 78%.)

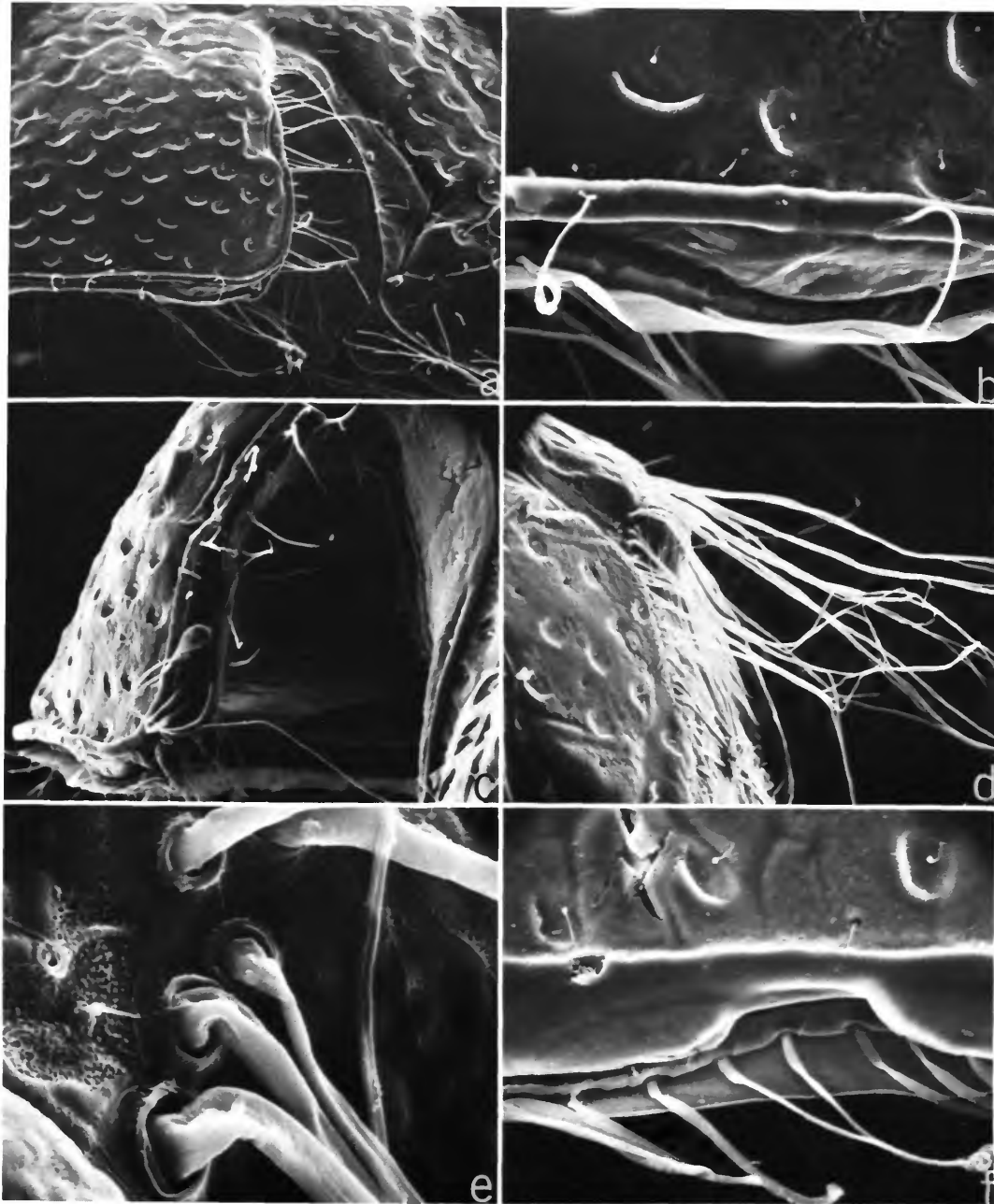


PLATE 14.—*Leucoleberis sharpei*, new species, adult male, paratype, USNM 156930, left valve, outside views: *a*, rostrum and incisur, anterior view, ventral edge to right, from Plate 13*c*, $\times 100$; *b*, anterior margin of rostrum, from *a*, $\times 500$; *c*, ventral view of incisur, from Plate 13*b*, $\times 200$; *d*, posterodorsal corner of valve, from Plate 13*a*, $\times 200$; *e*, bases of bristles shown in *d*, note small bristle emerging from closed pore, $\times 2000$; *f*, ventral edge of valve near middle, ventral view, from Plate 13*b*. (Micrographs reduced to 75%.)

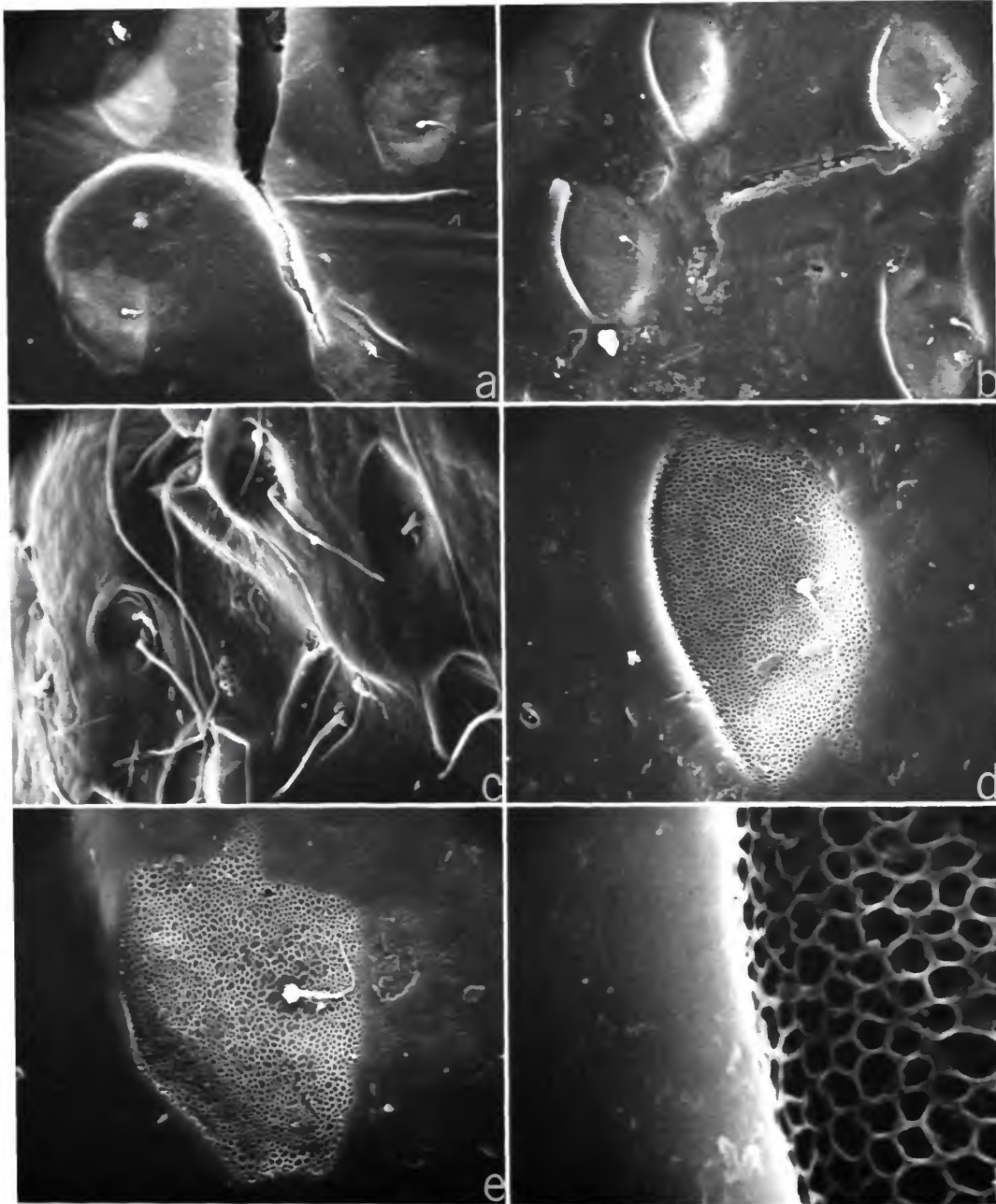


PLATE 15.—*Leuroleberis sharpei*, new species, adult male, paratype, USNM 156930, left valve, outside views: *a*, fossae with bristles near middle of valve, from Plate 13*a*, $\times 500$; *b*, fossae and bristles on anterior part of valve, from Plate 13*d*, $\times 500$; *c*, fossae and bristles on anterior part of valve just below incisur, from Plate 13*e*, $\times 500$; *d*, fossa and bristle on upper left of *b* (note pore on lower left of micrograph), $\times 1400$; *e*, fossa and pore on lower left of *a*, $\times 1500$; *f*, detail of left edge of fossa in *e*, $\times 10,000$. (Micrographs reduced to 75%.)

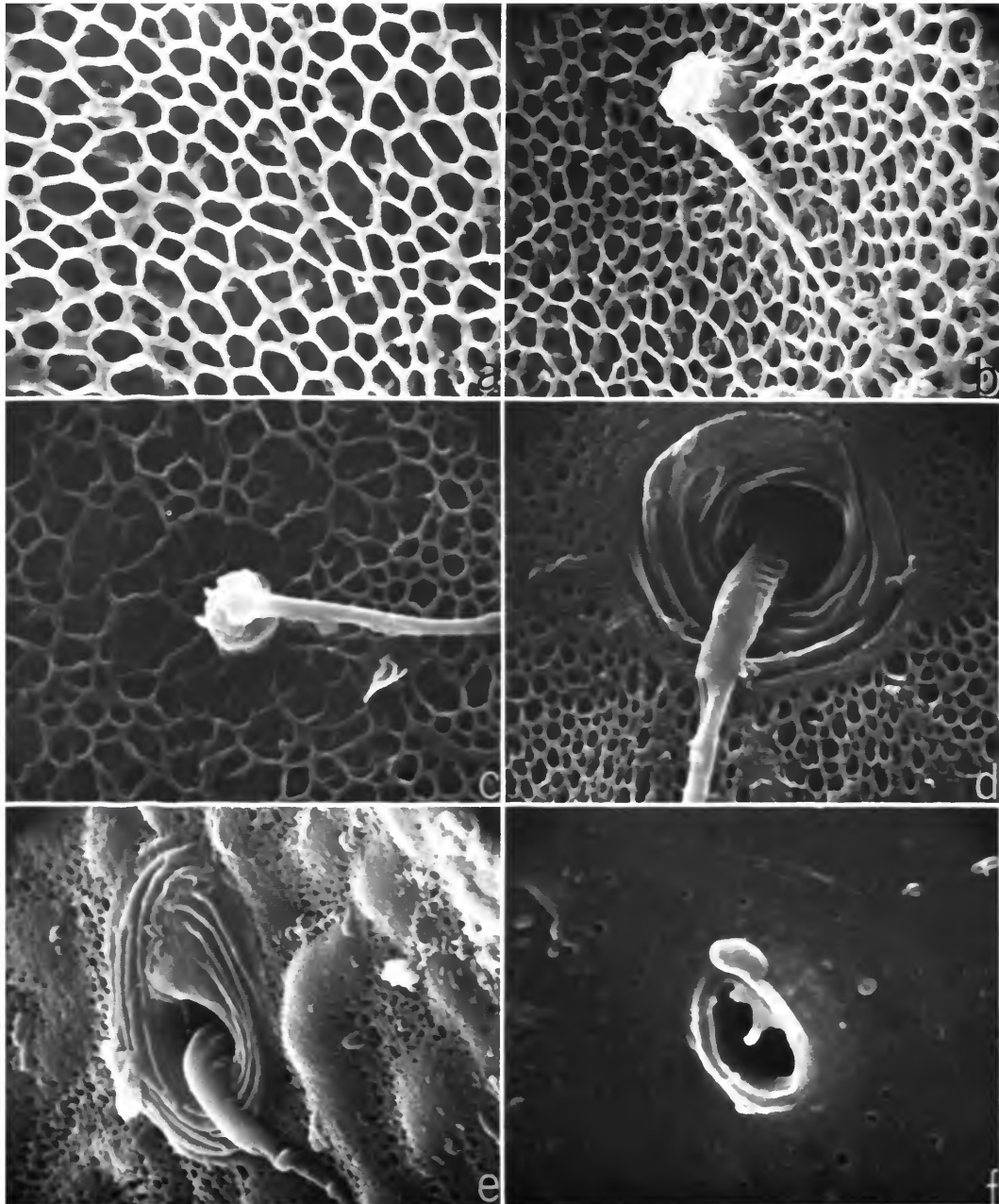


PLATE 16.—*Leuroleberis sharpei*, new species, adult male, paratype, USNM 156930, left valve, outside views: *a*, detail of reticulations at base of fossa shown in *b*, $\times 10,000$; *b*, detail of bristle in fossa shown in Plate 15*d*, $\times 7500$; *c*, detail of bristle and reticulation in fossa shown in Plate 15*e*, $\times 7500$; *d*, bristle emerging from ringed pore on surface of valve between fossae, from Plate 14*f*, $\times 7500$; *e*, detail of bristle emerging from ringed pore near middle of Plate 15*e*, $\times 5000$; *f*, detail of minute pore shown in lower left of Plate 15*d*, $\times 10,000$. (Micrographs reduced to 75%.)

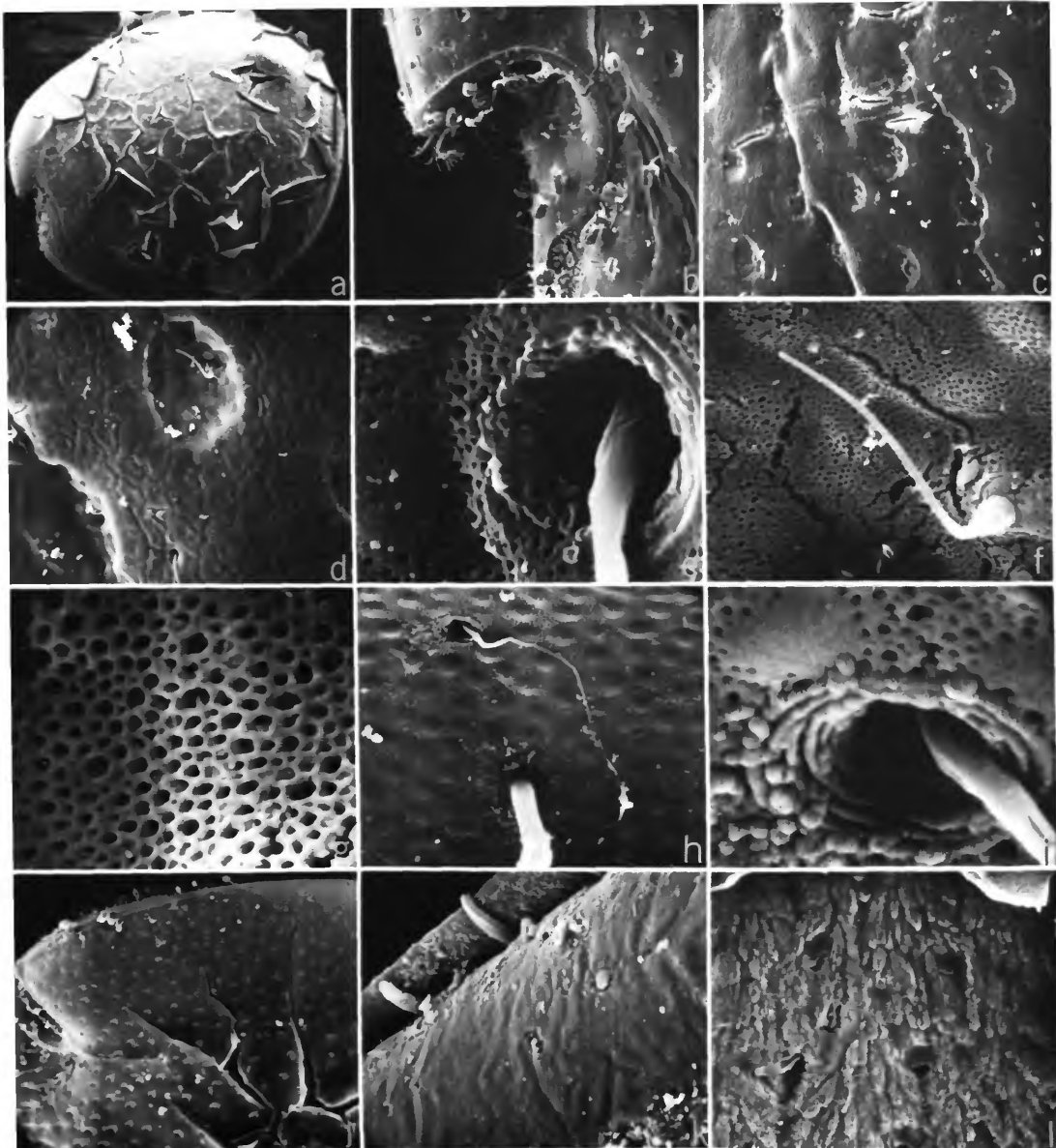


PLATE 17.—*Leuroleberis sharpei*, new species, A-1 female, paratype, USNM 139286, left valve, outside views: *a*, lateral view, $\times 22$; *b*, incisur area with attached protists, from *a*, $\times 150$; *c*, fossae and linear ridges in posteroventral part of valve, from *a*, $\times 220$; *d*, fossa with bristle, and pore with bristle (near lower edge of micrograph), from *c*, $\times 660$; *e*, detail of pore with bristle near lower edge of *d*, $\times 10,400$; *f*, detail of bristle in fossa shown in *d*, $\times 4160$; *g*, detail of pitted surface at bottom of fossa, from *f*, $\times 15,000$; *h*, bristle emerging from ringed pore and stalk of protistan, $\times 275$; *i*, detail of pore in *h*, $\times 11,300$; *j*, edge of rostrum, oblique view, dorsal margin of valve to upper right, $\times 55$; *k*, detail of edge of rostrum, from *j*, $\times 1100$; *l*, surface of valve with outer layer removed, from bottom of *a*, $\times 275$. (Micrographs reduced to 51%.)

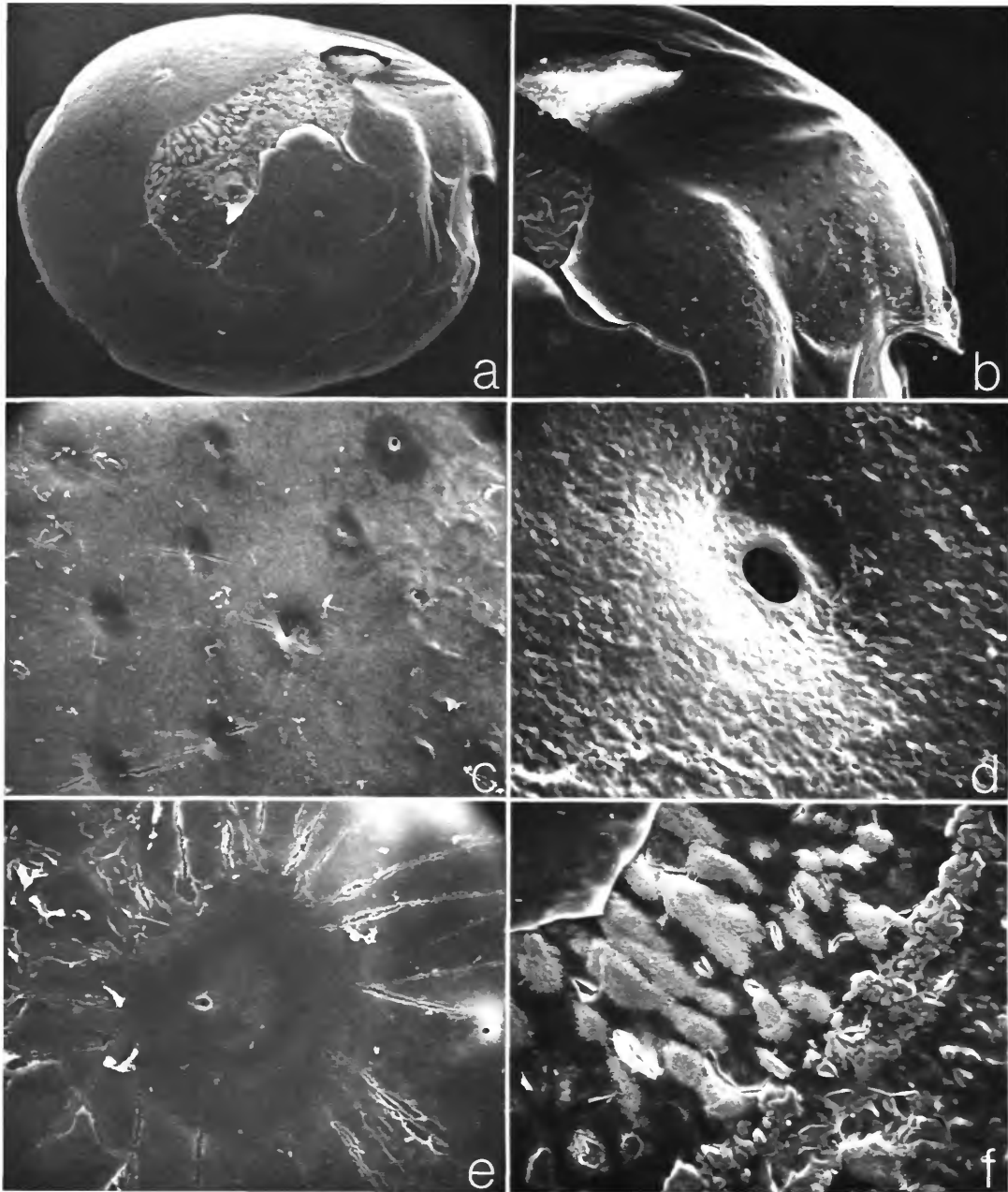


PLATE 18.—*Lewoleberis sharpei*, new species, A-1 female, paratype, USNM 139286, right valve boiled for 15 minutes in dilute potassium hydroxide, outside views: *a*, lateral view, $\times 21$; *b*, anterodorsal part of valve, from *a*, $\times 50$; *c*, fossae with pores from which bristles have been dissolved, from *b*, $\times 270$; *d*, detail of pore and surface of fossa in lower left of *c*, $\times 10,000$; *e*, pore and fossa near middle of *a*, $\times 700$; *f*, radiating concretionary structure on part of valve from which surface layers have peeled, from *a*, $\times 140$. (Micrographs reduced to 75%.)

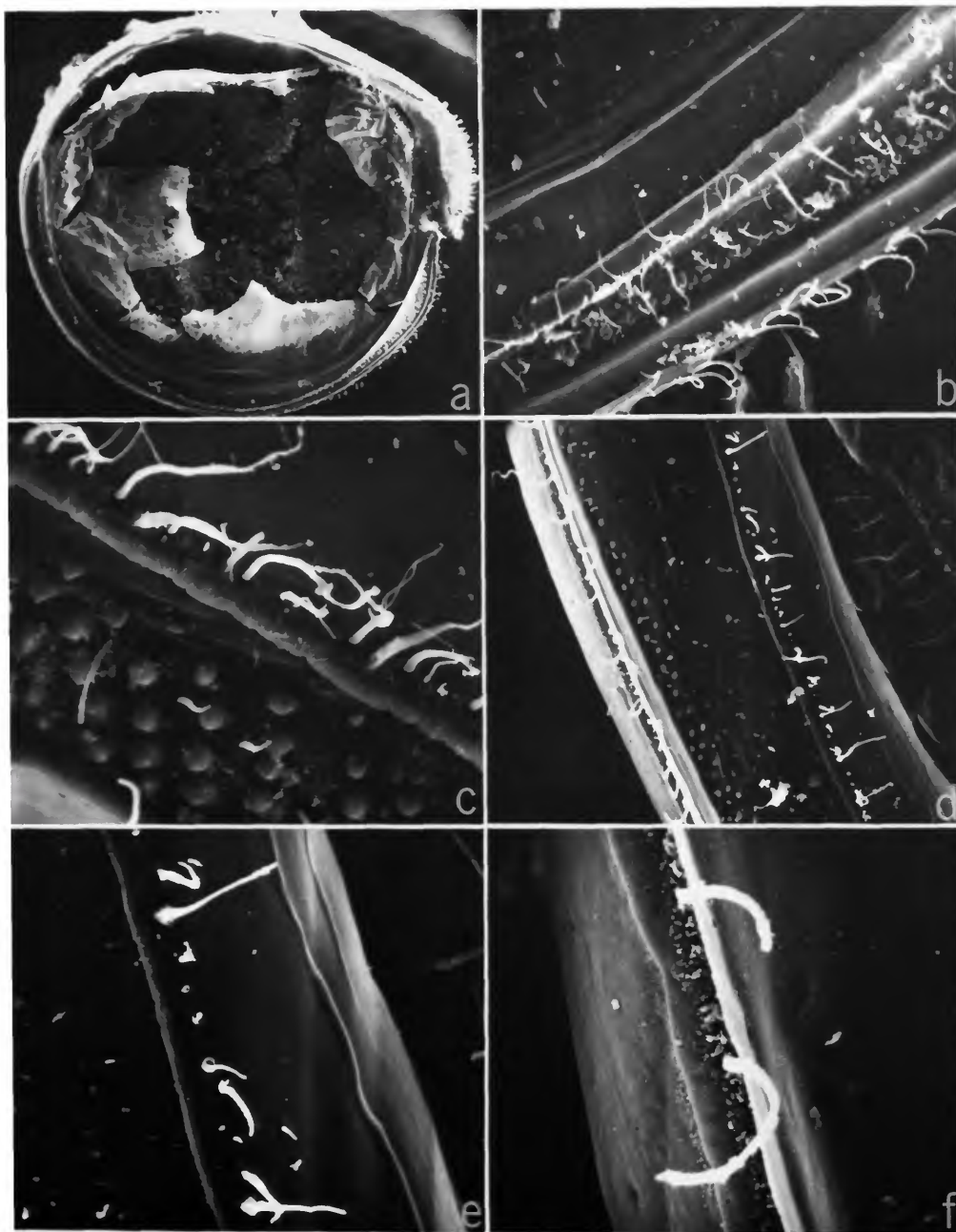


PLATE 19.—*Lewoleberis sharpei*, new species, A-1 female, paratype, USNM 139286, left valve, inside views: *a*, medial view, $\times 20$; *b*, anteroventral margin, stalked protists along outer edge, from *a*, $\times 210$; *c*, ventral margin posterior to middle, from *a*, $\times 620$; *d*, posteroventral margin, from *a*, $\times 215$; *e*, bristles along list near upper end of *d*, $\times 620$; *f*, bristles along posterior edge of valve, from *d*, $\times 1100$. (Micrographs reduced to 71%.)

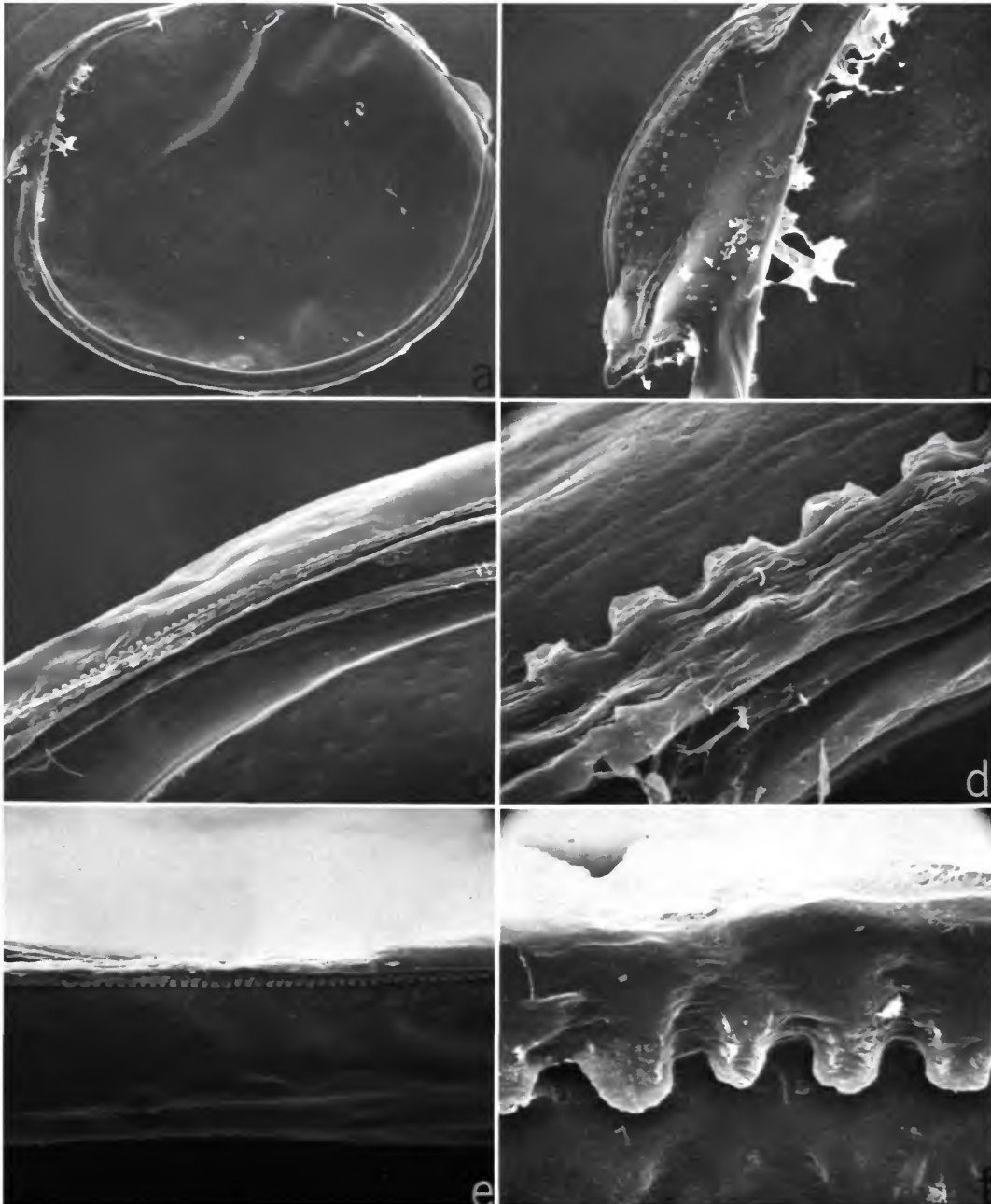


PLATE 20.—*Lewoleberis sharpei*, new species, A-1 female, paratype, USNM 139286, right valve treated with potassium hydroxide which removed bristles, muscles and vestment, inside views: *a*, medial view, $\times 20$; *b*, rostrum, from *a*, $\times 65$; *c*, anterior end of dorsal margin showing teeth forming row, from *a*, $\times 200$; *d*, detail of teeth in *c*, $\times 2000$; *e*, dorsal view of teeth shown in *c*, $\times 220$; *f*, detail of teeth shown in *e*, $\times 2200$. (Micrographs reduced to 76%.)

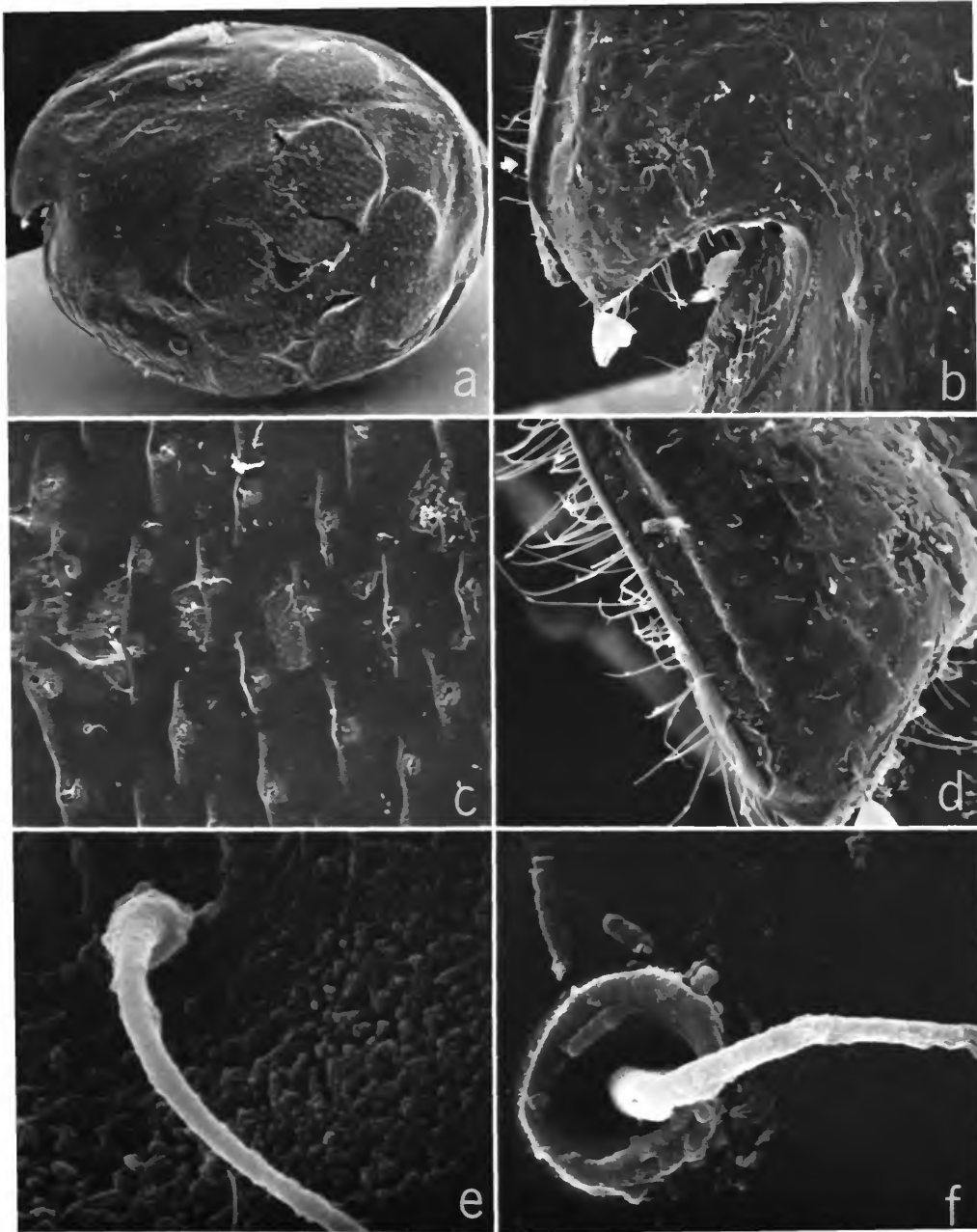


PLATE 21.—*Leuroleberis mackenziei*, new species, adult or A-1 female, paratype, USNM 156967, left valve, outside views: *a*, lateral view, $\times 19$; *b*, anterior of valve, stalked protistan on rostrum, from *a*, $\times 100$; *c*, fossae, bristles and ridges from near anterior of *a*, $\times 190$; *d*, anterior view of rostrum, ventral margin of valve to lower right, $\times 150$; *e*, detail of bristle in fossa in middle left of *c*, $\times 5000$; *f*, bristle emerging from pore between fossae, from lower left of *c*, $\times 5000$. (Micrographs reduced to 78%.)

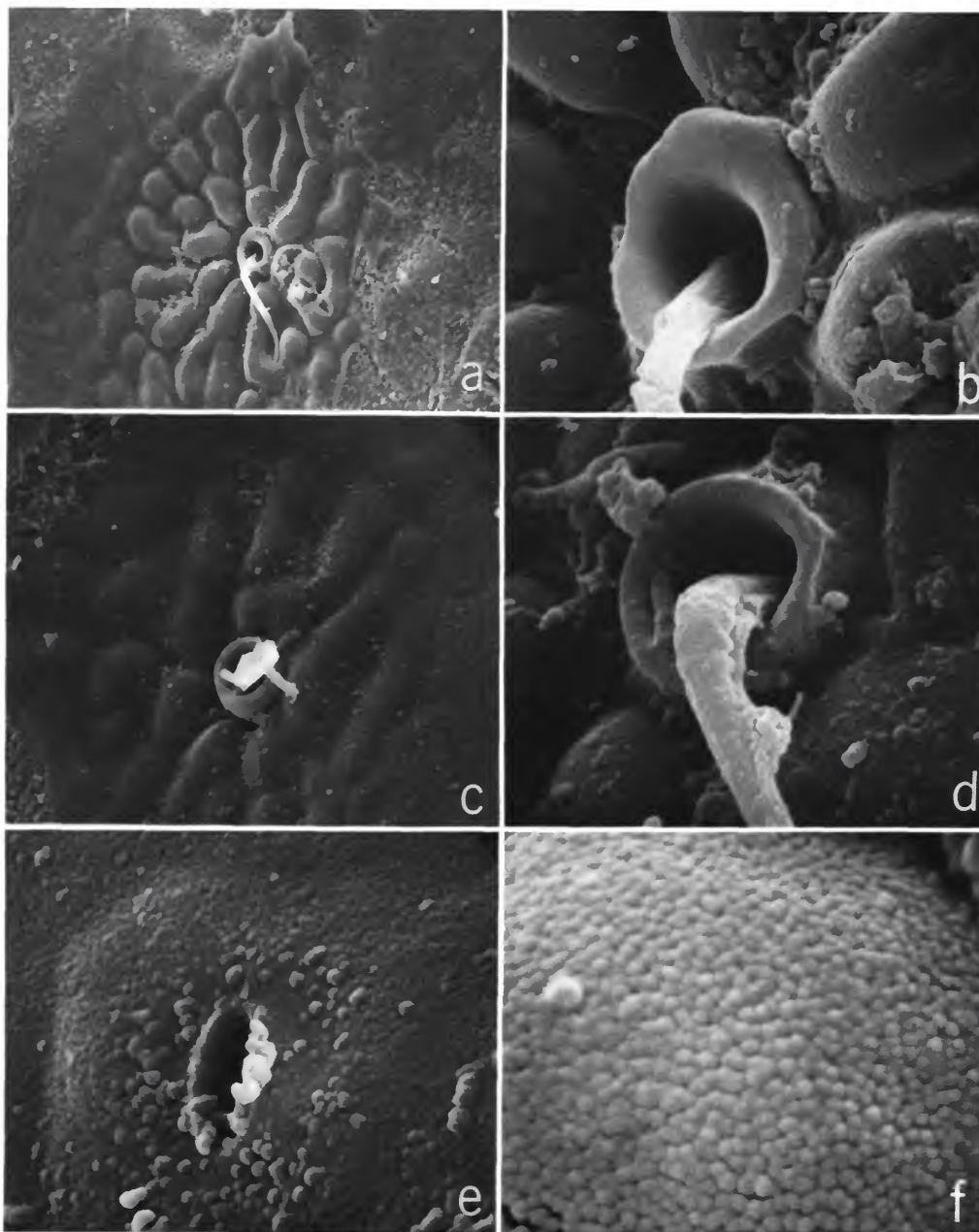


PLATE 22.—*Leuoleberis mackenziei*, new species, adult or A-1 female, paratype, USNM 156967, left valve, outside views: *a*, bristle emerging from open pore, from Plate 21*b*, $\times 1000$; *b*, detail of pore in *a*, $\times 6000$; *c*, bristle emerging from small open pore in anterodorsal part of valve, $\times 2000$; *d*, bristle emerging from open pore, from Plate 21*a*, $\times 6000$; *e*, minute pore without bristle in anterodorsal part of valve, $\times 10,000$; *f*, detail of valve surface, from *b*, $\times 20,000$. (Micrographs reduced to 78%.)

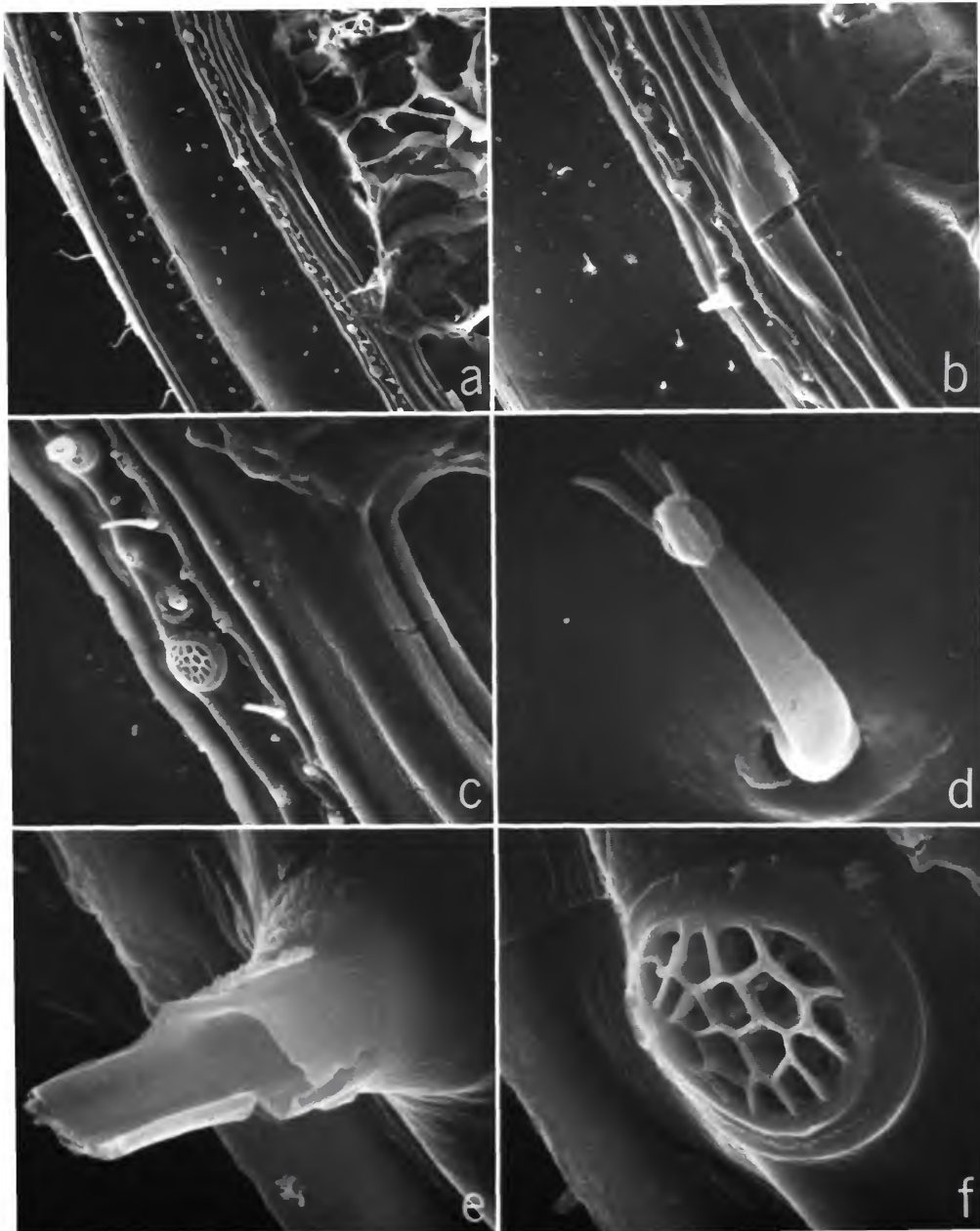


PLATE 23.—*Leuroleberis mackenziei*, new species, adult or A-1 female, paratype, USNM 156967, left valve, posterodorsal infold: *a*, posterodorsal margin showing infold, $\times 195$; *b*, segment of infold from middle part of *a*, $\times 500$; *c*, list showing bristles and reticulate pores from which bristles have been broken off, from *b*, $\times 1000$; *d*, bristle posterior to list, from lower middle of *b*, $\times 10,000$; *e*, broken stump of stout tubular bristle on list, from near middle of *b*, $\times 5000$; *f*, reticulate pore on list from which a stout tubular bristle has been broken off, from *c*, $\times 5000$. (Micrographs reduced to 77%.)

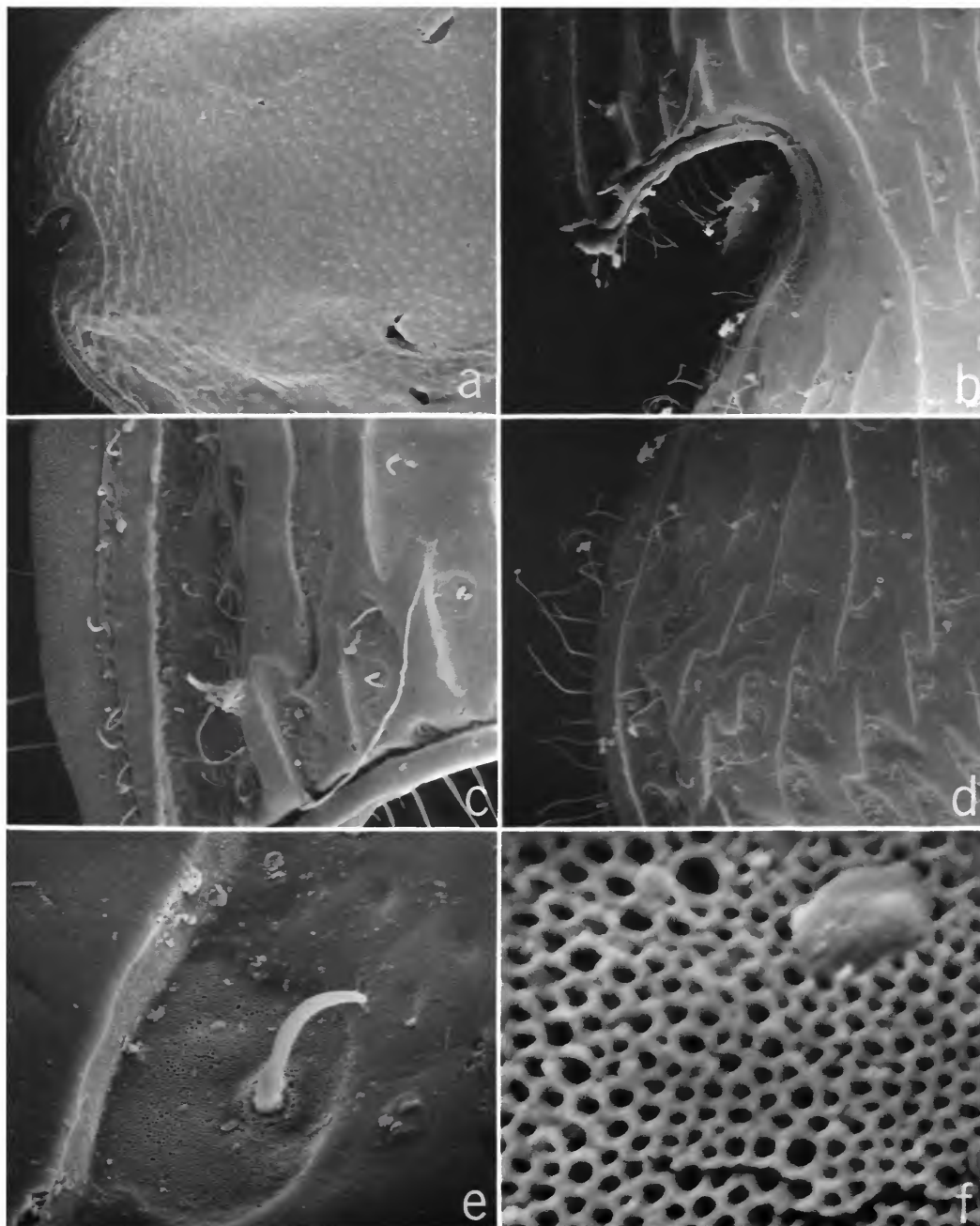


PLATE 24.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410, left valve, outside views: *a*, anterior part of valve, $\times 40$; *b*, rostrum and incisur, from *a*, $\times 186$; *c*, anterior margin of rostrum, from *b*, $\times 387$; *d*, anterior margin ventral to incisur, from *a*, $\times 190$; *e*, fossae, bristle, and ridge, from *b*, $\times 2050$; *f*, detail of surface of fossa in *e*, $\times 18,000$. (Micrographs reduced to 81%.)

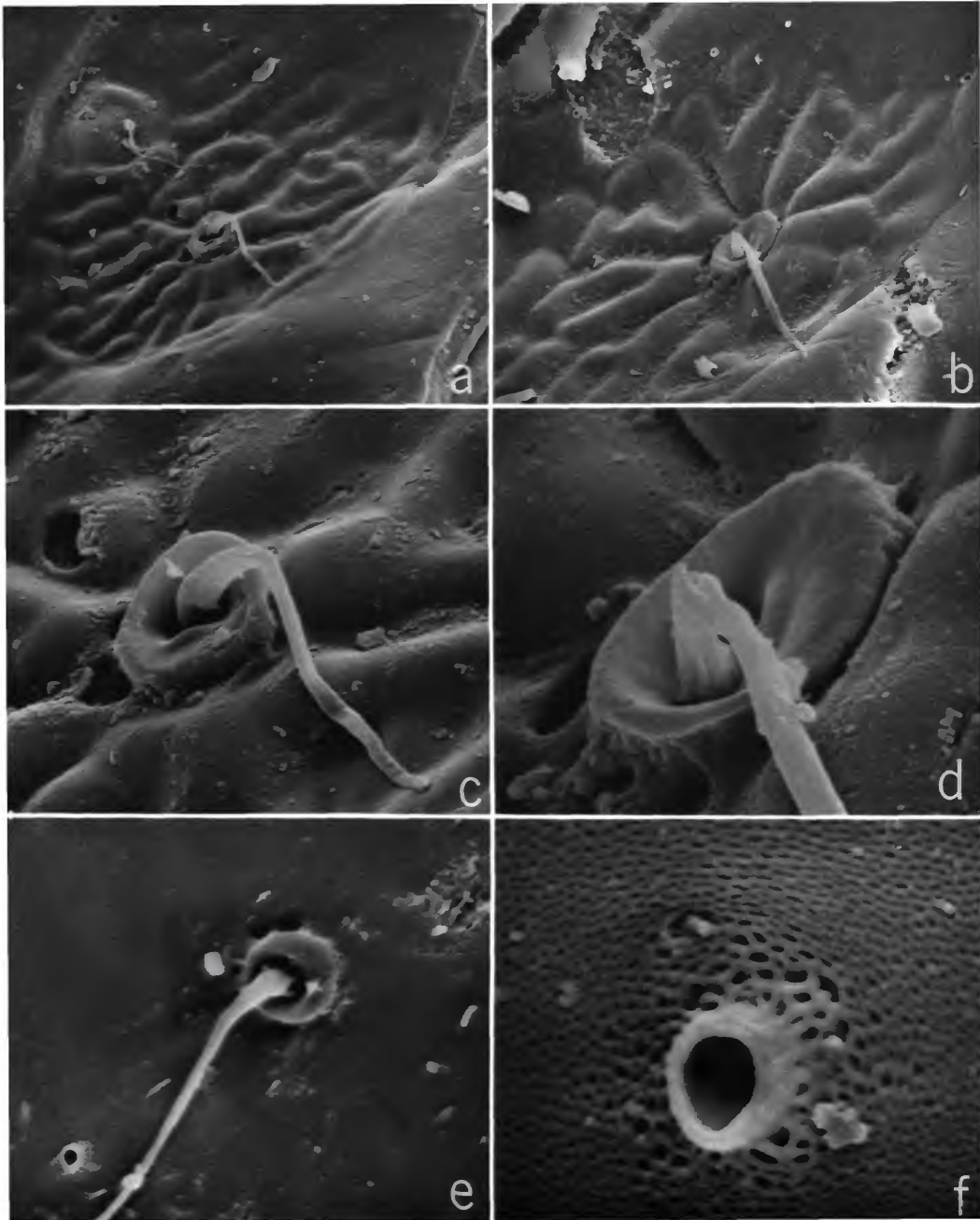


PLATE 25.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410, left valve, outside views: *a*, *b*, bristles emerging from minute open pores near anterodorsal margin, $\times 1212$, 1820 ; *c*, detail of *a*, $\times 4010$; *d*, detail of *b*, $\times 8570$; *e*, bristle and pores, from Plate 24*b*, $\times 3270$; *f*, detail of pore in lower left of *e*, $\times 18,000$. (Micrographs reduced to 81%.)

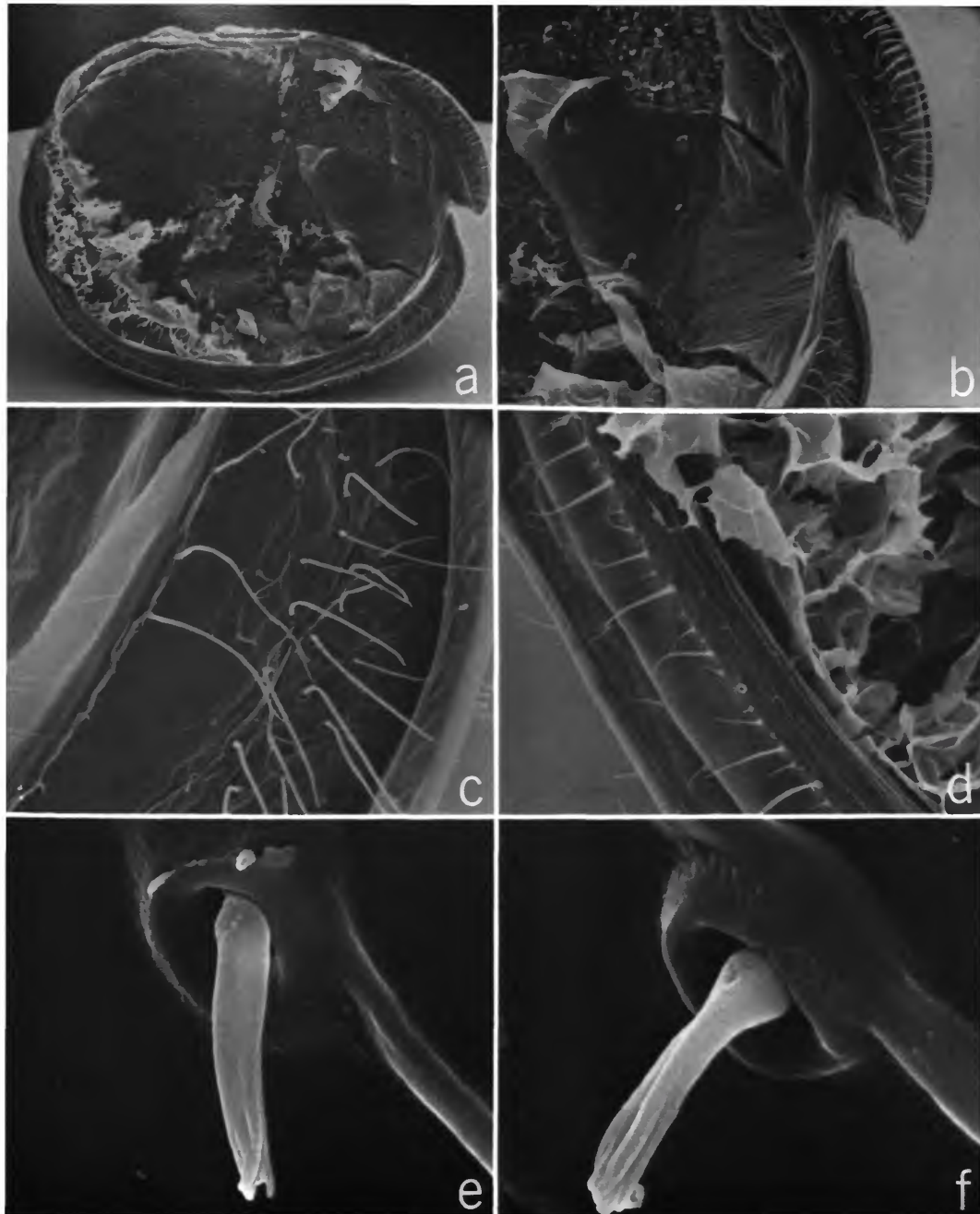


PLATE 26.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410, left valve, inside views: *a*, complete valve, $\times 25$; *b*, anterior, from *a*, $\times 55$; *c*, anteroventral margin, from *b*, $\times 280$; *d*, posteroventral margin showing bristles of infold, from *a*, $\times 185$; *e*, *f*, bristles on anterior part of posteroventral list near middle of *d*, $\times 7500$, $10,000$. (Micrographs reduced to 82%.)

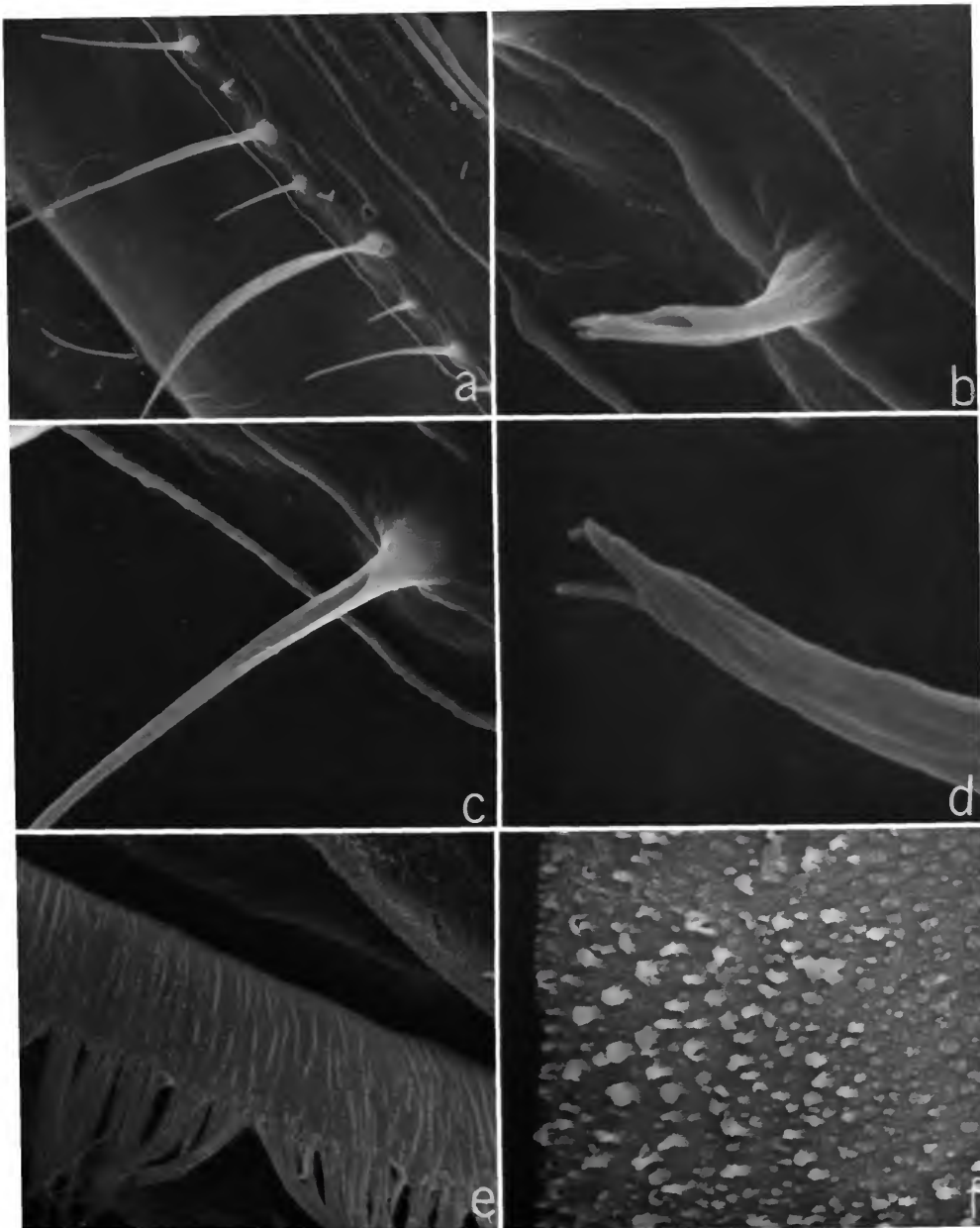


PLATE 27.—*Alphaleberis alphathrix*, new species, ovigerous female, holotype, USNM 157410, left valve: *a*, segment of posteroventral infold, from Plate 26*d*, $\times 630$; *b*, detail of bristle on list, from lower right corner of *a*, $\times 6000$; *c*, short tubular bristle on list, from middle of *a*, $\times 3200$; *d*, tip of bristle posterior to list, from lower left of *a*, $\times 16,000$; *e*, outer side of lamellar prolongation of selvage along anterodorsal margin, from Plate 26*a*, $\times 3000$; *f*, outer side of lamellar prolongation of selvage on anterior margin of rostrum, from Plate 24*c*, $\times 3870$. (Micrographs reduced to 77%.)

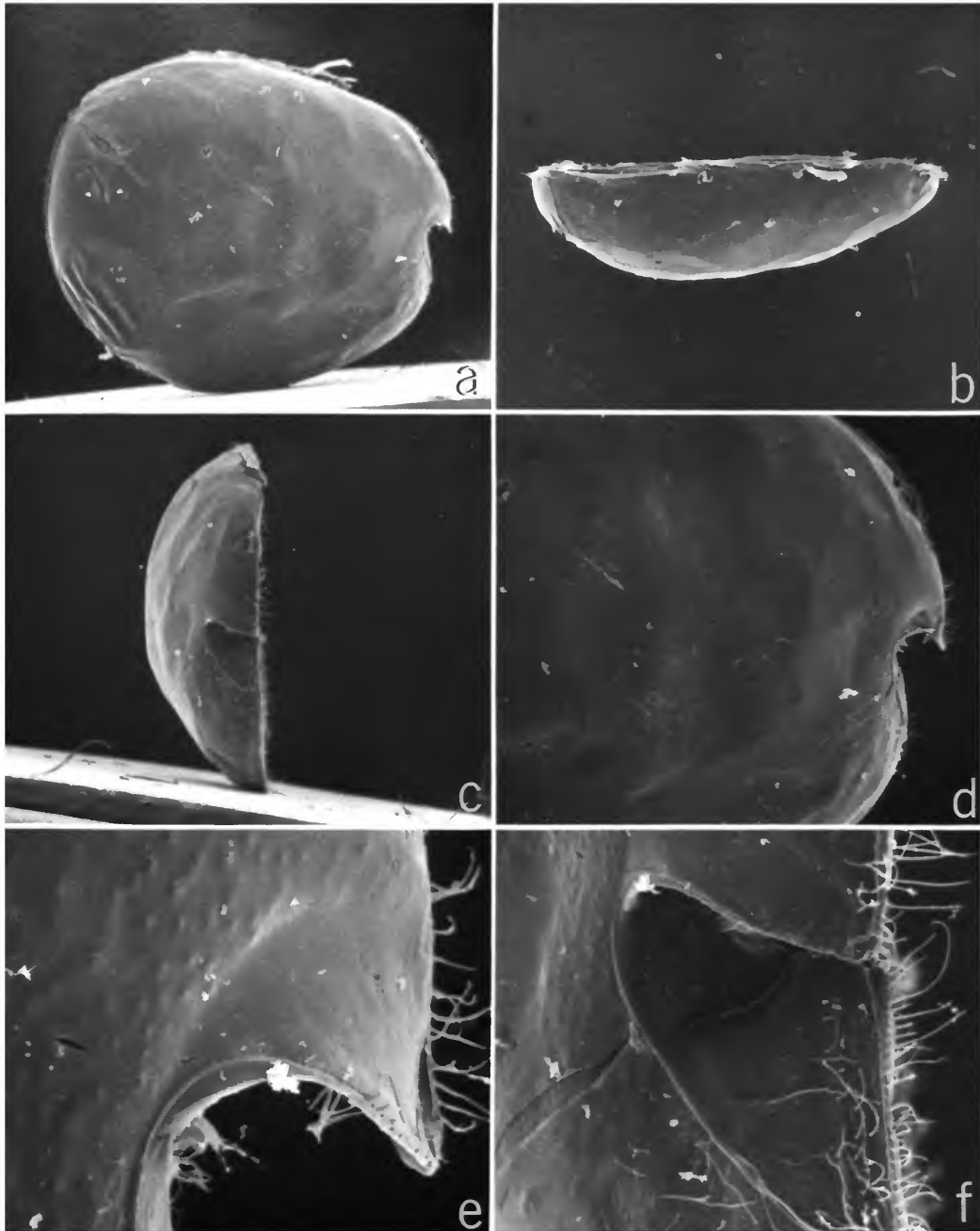


PLATE 28.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, right valve, outside views: *a*, lateral view $\times 26$; *b*, dorsal view, anterior to right, $\times 25$; *c*, anterior view, $\times 27$; *d*, anterior of valve, from *a*, $\times 42$; *e*, rostrum and incisor, from *d*, $\times 240$; *f*, anterior view of rostrum and incisor, from *c*, $\times 140$. (Micrographs reduced to 80%.)

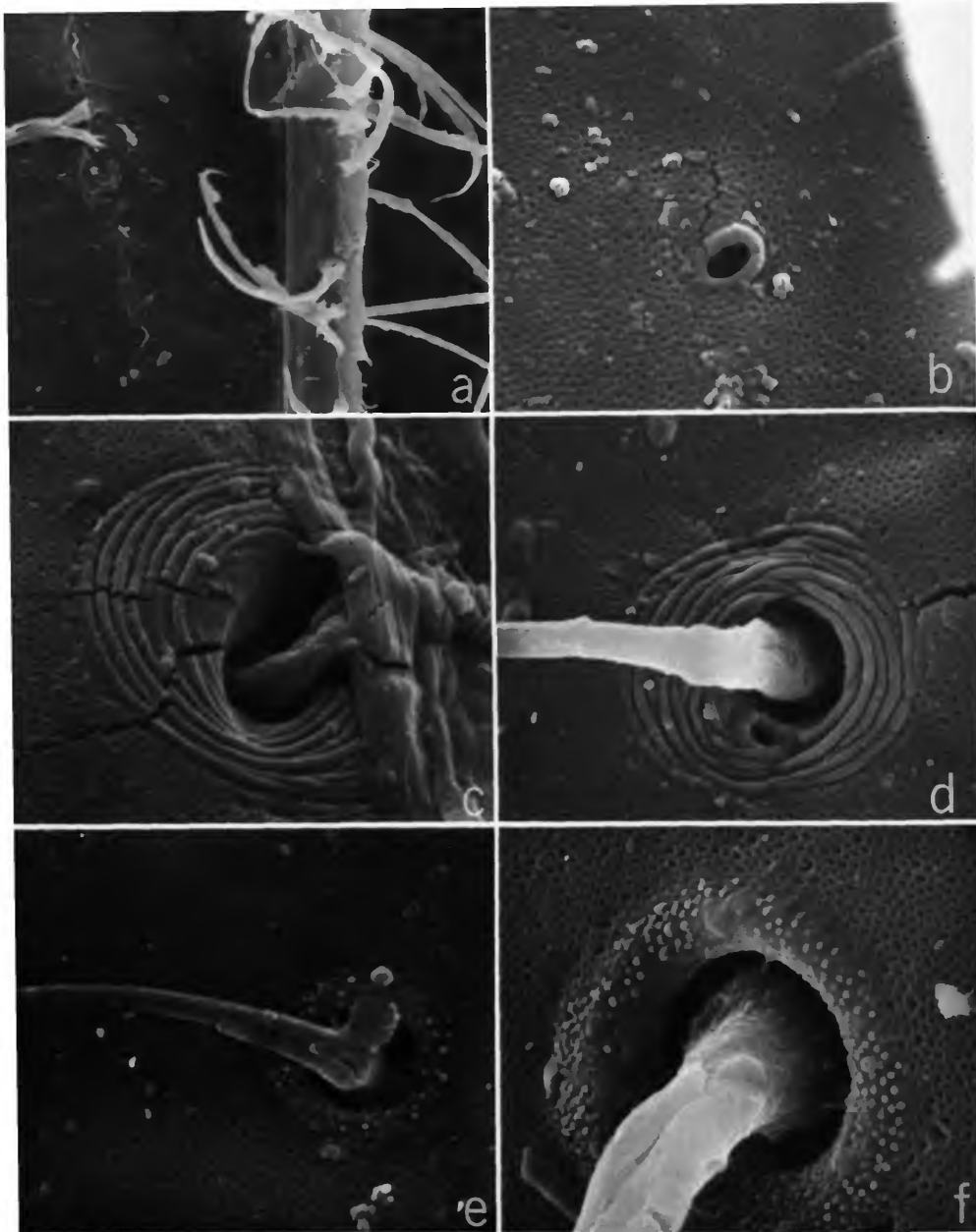


PLATE 29.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, right valve, outside views: *a*, anterior view of edge of rostrum, from Plate 28*c*, $\times 700$; *b*, simple pore with bare rim, from near middle of *a*, $\times 9800$; *c*, ringed pore with bristle partly covered by debris, from upper left of *a*, $\times 9800$; *d*, bristle emerging from ringed pore having minute simple pore in lower part, from Plate 28*c*, $\times 9800$; *e*, bristle emerging from pore with pustulose rim, from lower left of *a*, $\times 9800$; *f*, bristle emerging from pore with slightly raised pustulose rim, from Plate 28*f*, $\times 9800$. (Micrographs reduced to 76%.)

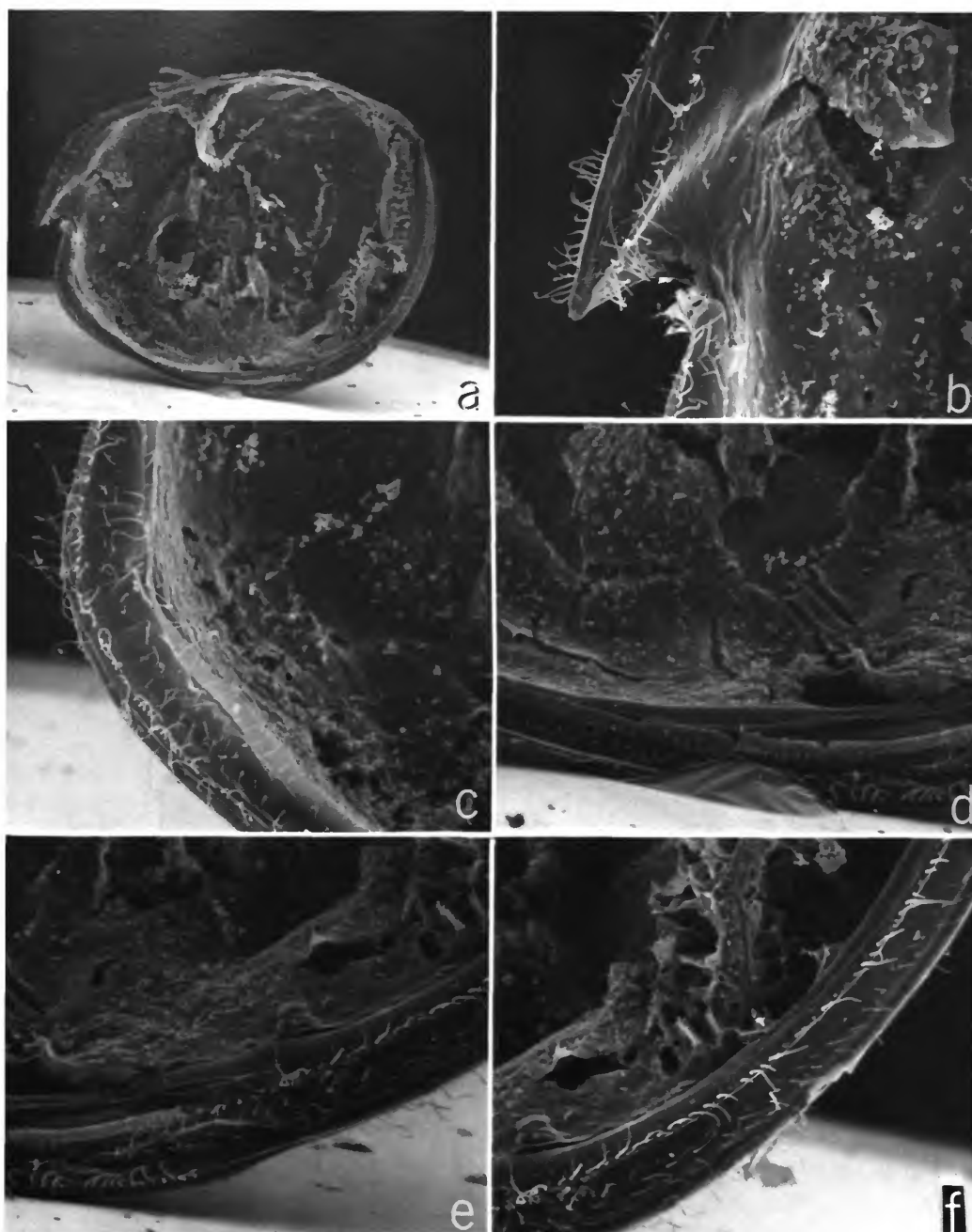


PLATE 30.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, right valve, inside views: *a*, complete valve, $\times 23$; *b*, anterior, from *a*, $\times 100$; *c*, anteroventral margin showing infold, from *a*, $\times 100$; *d*, ventral margin, from *a*, $\times 100$; *e*, *f*, posteroventral margin, from *a*, $\times 100$. (Micrographs reduced to 80%.)

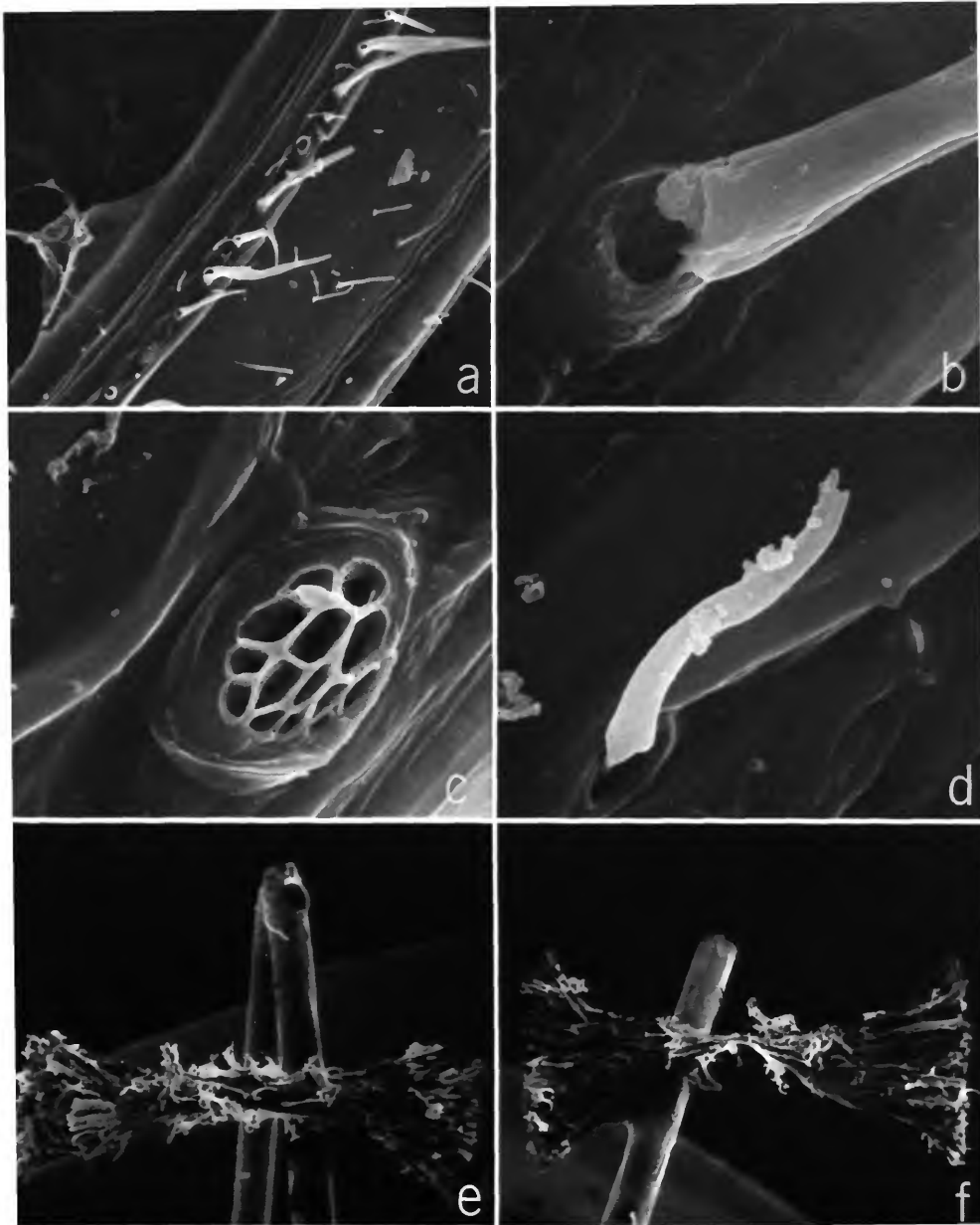


PLATE 31.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, right valve, inside views: *a*, segment of posteroventral margin showing bristles of infold, from Plate 30*f*, $\times 100$; *b*, bristle on list of posteroventral infold with base partly severed showing reticulations in pore, from below middle of *a*, $\times 5000$; *c*, pore on list of posteroventral infold with bristle broken off, from near bottom of *a*, $\times 5000$; *d*, bristle emerging from open pore on list of posteroventral infold, from below middle of *a*, $\times 6000$. Central adductor muscle mounted on wire: *e*, ventral view, $\times 56$; *f*, either anterior or posterior view, $\times 56$. (Micrographs reduced to 76%.)

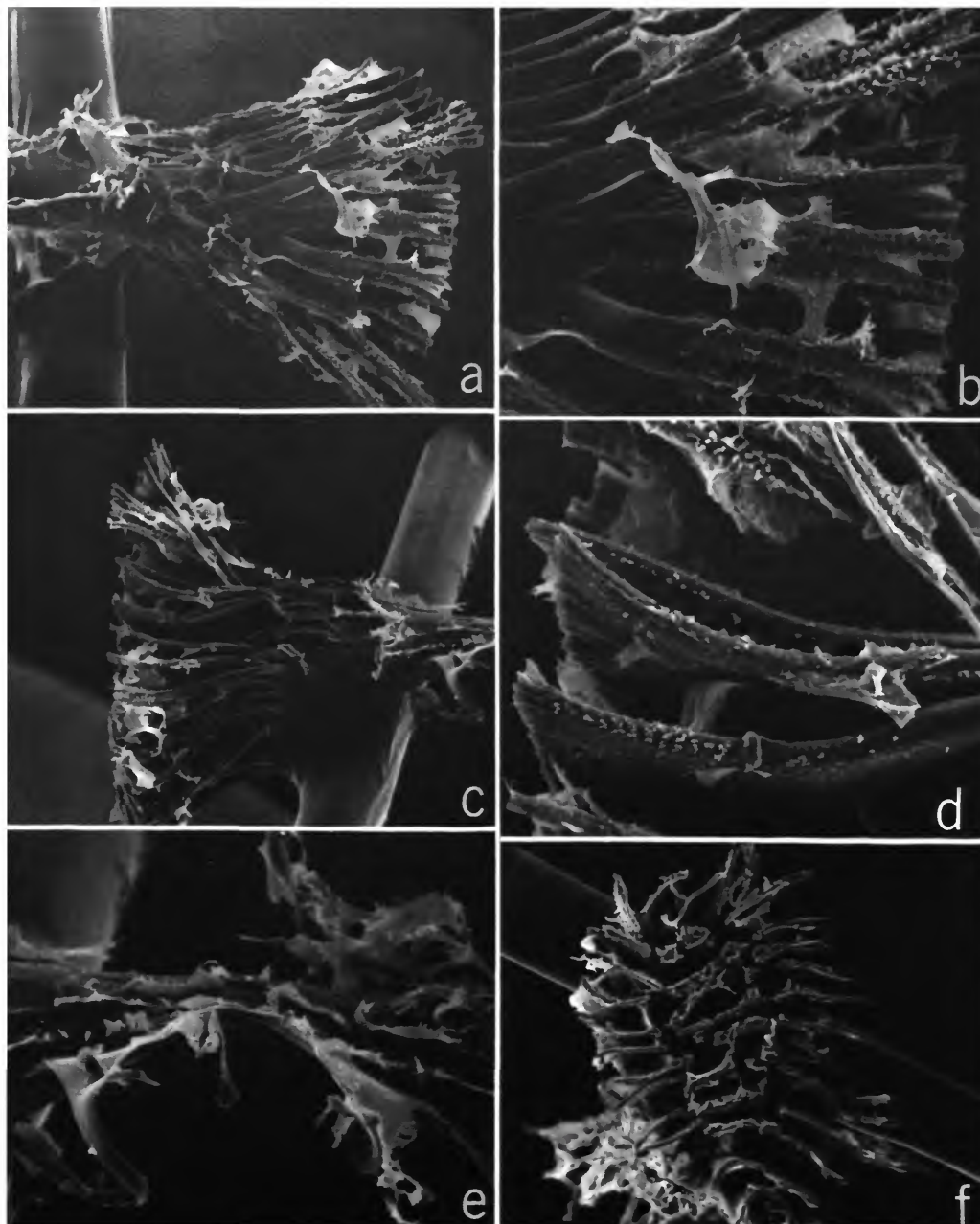


PLATE 32.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, central adductor muscle mounted on wire: *a*, detail of right end shown in Plate 31, $\times 130$; *b*, detail from *a*, $\times 300$; *c*, detail of left end shown in Plate 31*f*, $\times 220$; *d*, detail of *c*, $\times 400$; *e*, detail of center part shown in Plate 31*f*, $\times 220$; *f*, end view of muscles shown in *a*, ventral end towards lower right, $\times 100$. (Micrographs reduced to 80%.)

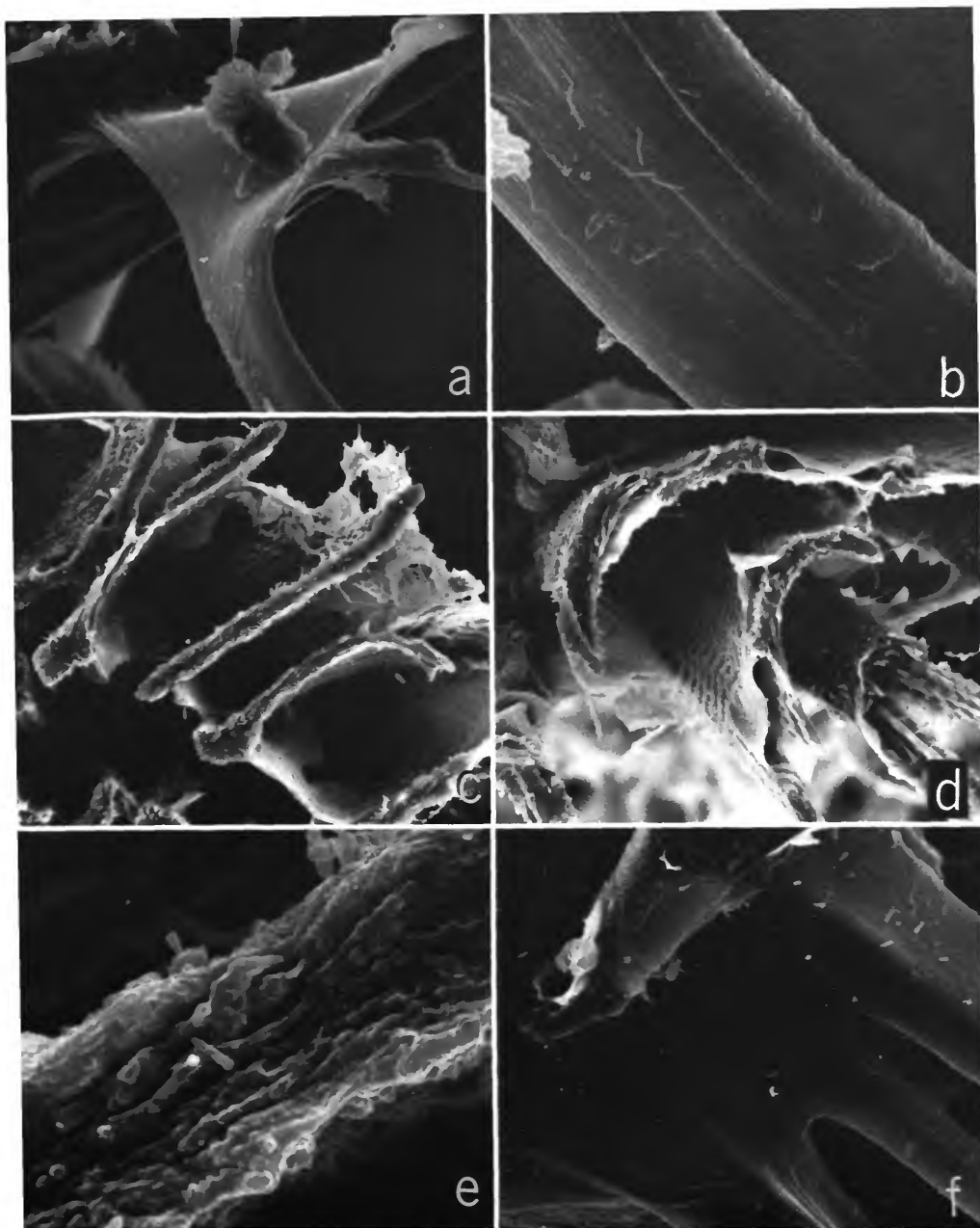


PLATE 33.—*Tetraleberis brevis* (Müller), adult or A-1 female, syntype, Zoological Museum Berlin 6909, central adductor muscles: *a*, detail of attachment of muscle perpendicular to central adductor muscle, from left of Plate 32*c*, $\times 810$; *b*, detail of lower end of *a*, $\times 3200$; *c*, detail of ends of muscles on middle left of Plate 32*f*, $\times 500$; *d*, detail of ends of muscles on lower right of Plate 32*f*; *e*, detail of end of middle muscle in *c*, $\times 500$; *f*, detail of branching muscles on lower middle of Plate 32*a*, $\times 1250$. (Micrographs reduced to 78%.)

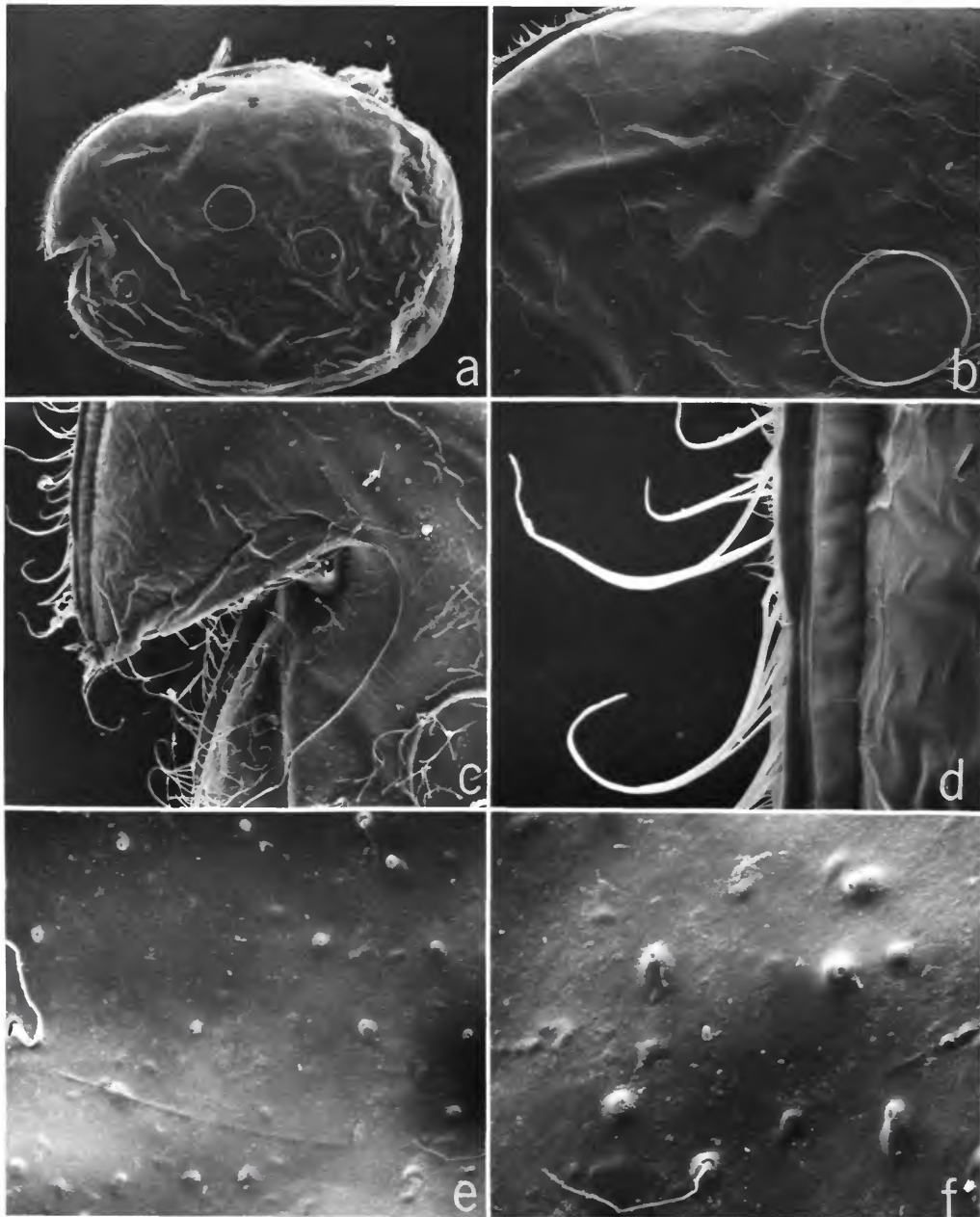


PLATE 34.—*Tetraleberis maddocksae*, new species, juvenile female in process of molting, holotype, USNM 157626, left valve, outside views: *a*, lateral view, $\times 26$; *b*, anterodorsal margin, from *a*, $\times 95$; *c* rostrum and incisur, from *a*, $\times 142$; *d*, anterior margin of rostrum, from *c*, $\times 629$; *e*, detail of surface on anterodorsal part of valve, from *b*, $\times 717$; *f*, same, near anterior margin of rostrum, from *d*, $\times 1470$. (Micrographs reduced to 80%.)

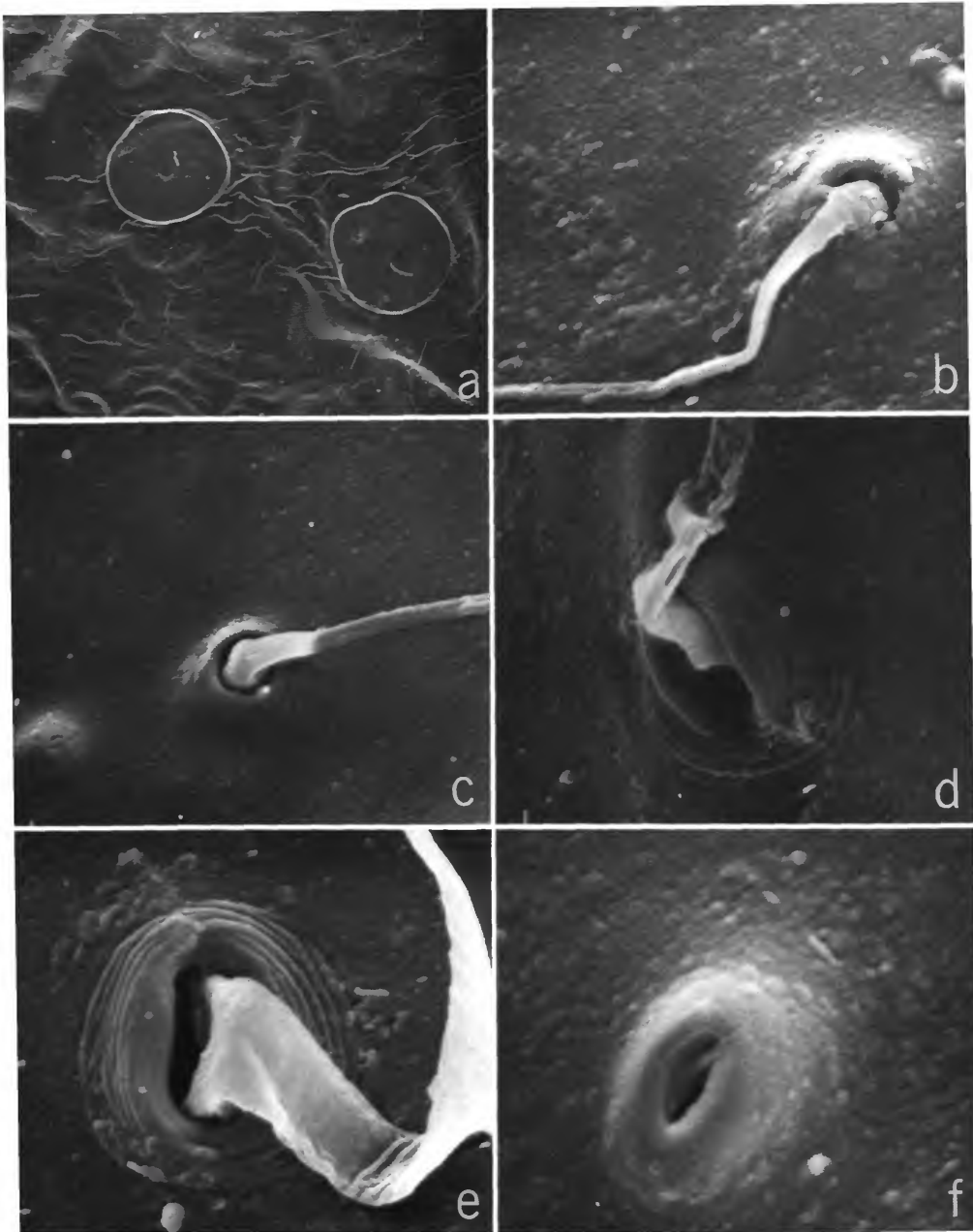


PLATE 35.—*Tetraleberis maddocksae*, new species, juvenile female in process of molting, holotype, USNM 157626, left valve, outside views: *a*, surface near middle of valve showing microconcretions, $\times 75$; *b*, detail of bristle and pore in Plate 34*f*, $\times 10,050$; *c*, detail of bristle and pores near bottom of Plate 34*e*, $\times 7340$; *d*, detail of ringed pore and bristle from Plate 34*d*, $\times 8390$; *e*, detail of ringed pore and bristle in Plate 34*d*, $\times 7620$; *f*, detail of pore in lower left of *c*, $\times 17,500$. (Micrographs reduced to 77%.)

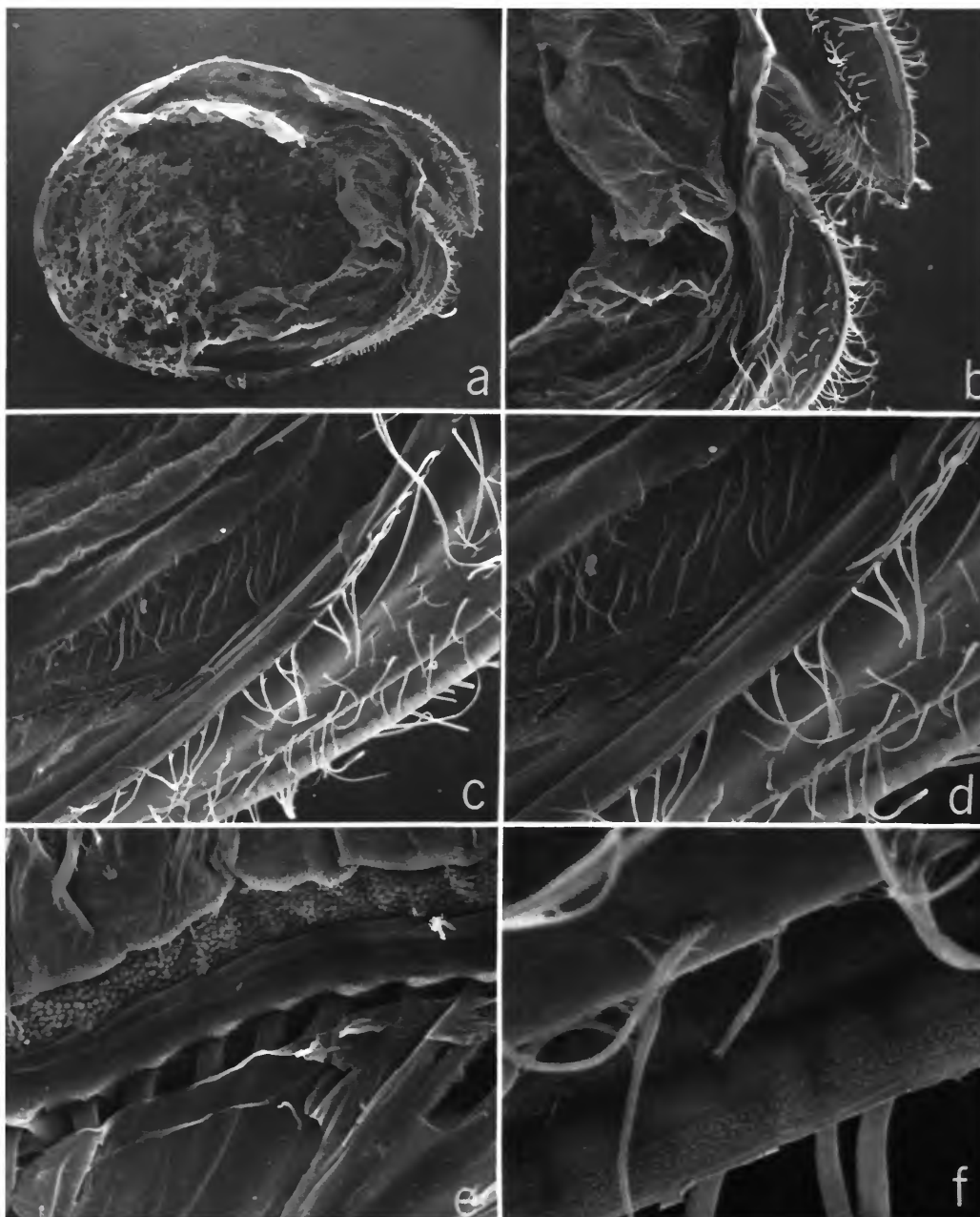


PLATE 36.—*Tetraleberis maddocksae*, new species, juvenile female in process of molting, holotype, USNM 157626, left valve, inside views: *a*, complete valve, $\times 30$; *b*, anterior of valve, from *a*, $\times 82$; *c*, anteroventral margin (new valve and old valve of molting specimen visible), $\times 200$; *d*, detail from *c*, $\times 325$; *e*, edge of new valve, note serrate lamellar prolongation of selvage, from *c*, $\times 1500$; *f*, edge of old valve, from *c*, $\times 1500$. (Micrographs reduced to 79%.)

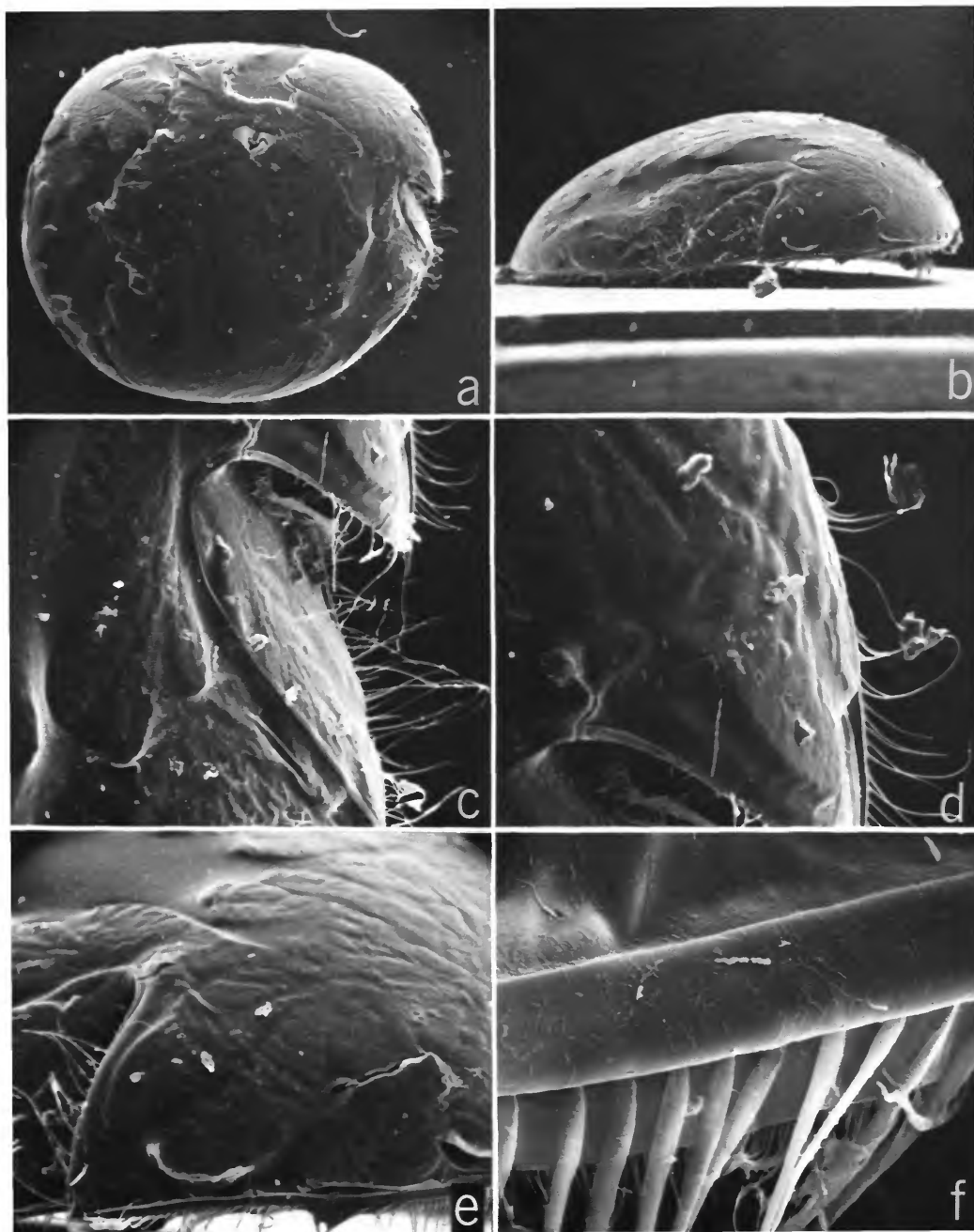


PLATE 37.—*Tetraleberis tanzania*, new species, 1 female (adult or A-1 instar), holotype, USNM 157414, right valve, outside views: *a*, lateral view, $\times 24$; *b*, anterior view, ventral margin to left, $\times 32$; *c*, incisur area, from *a*, $\times 120$; *d*, rostrum, from *a*, $\times 200$; *e*, anterior margin of rostrum, from *b*, $\times 100$; *f*, anterior margin of rostrum, from *e*, $\times 100$. (Micrographs reduced to 80%.)

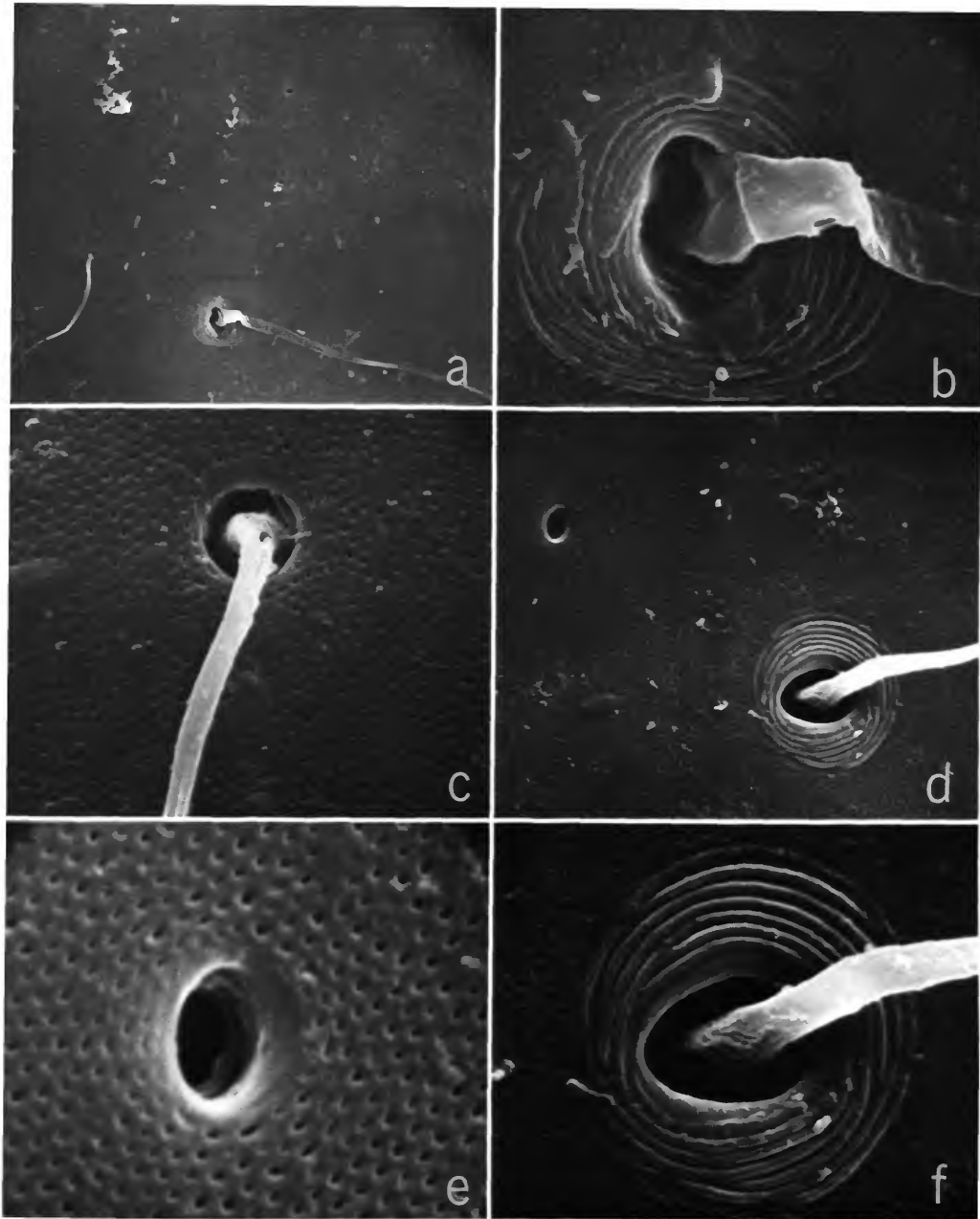


PLATE 38.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414, right valve, outside views: *a*, bristles and pores on anteroventral part of valve, from Plate 37*a*, $\times 1100$; *b*, detail of ringed pore in middle of *a*, $\times 7500$; *c*, bristle emerging from simple pore, $\times 10,000$; *d*, bristle and pores near dorsal margin, from Plate 37*a*, $\times 4000$; *e*, detail of simple pore in *d*, $\times 20,000$; *f*, detail of ringed pore in *d*, $\times 10,000$. (Micrographs reduced to 78%.)

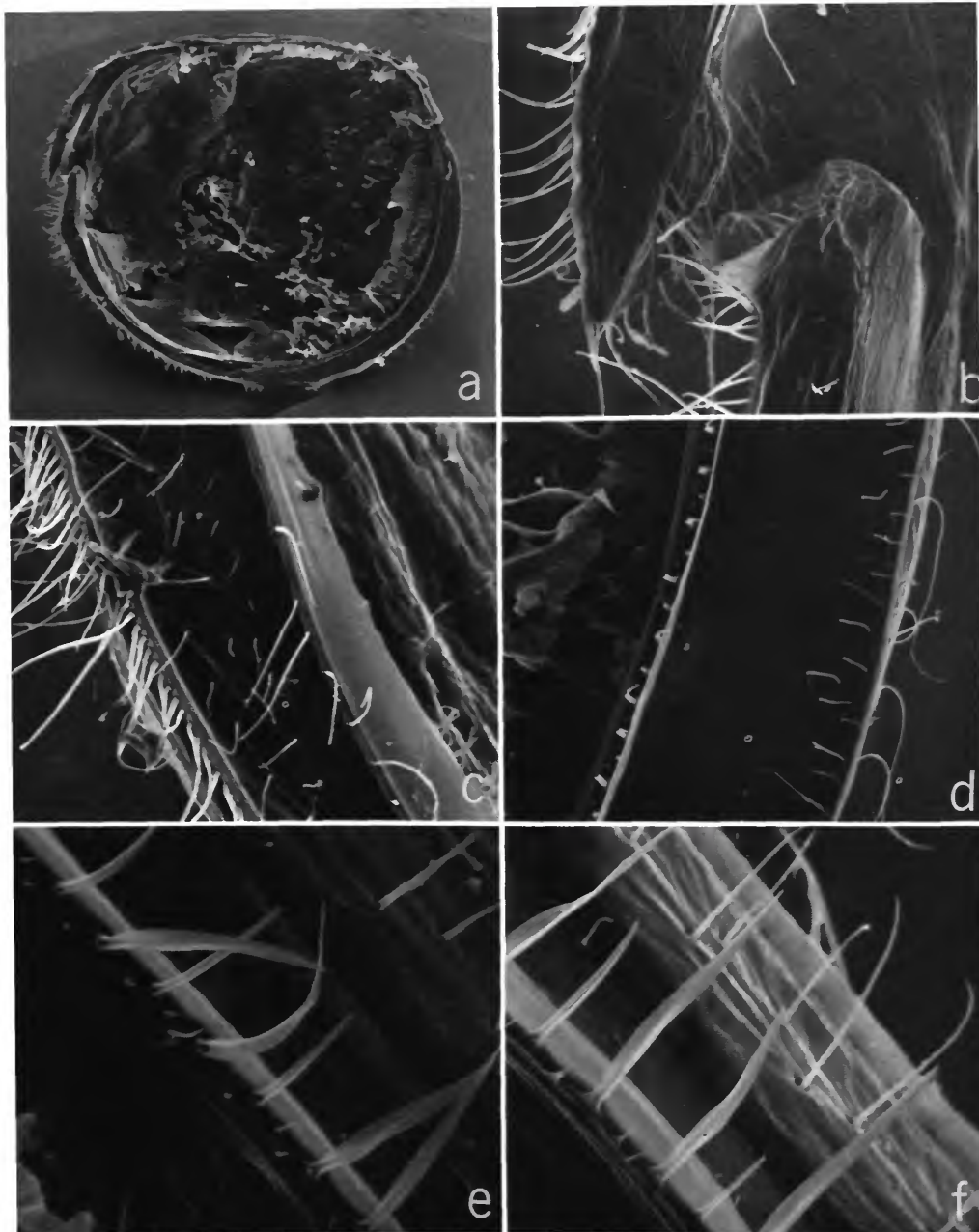


PLATE 39.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414, right valve, inside views: *a*, complete valve, $\times 25$; *b*, rostrum and incisur, from *a*, $\times 255$; *c*, anteroventral margin, from *a*, $\times 255$; *d*, posterior margin, from *a*, $\times 255$; *e*, bristles on list of posterior infold (valve tilted with ventral margin toward top of micrograph, and posterior toward right), $\times 630$; *f*, posterior margin with valve tilted (ventral margin of valve towards top of micrograph), $\times 700$. (Micrographs reduced to 79%.)

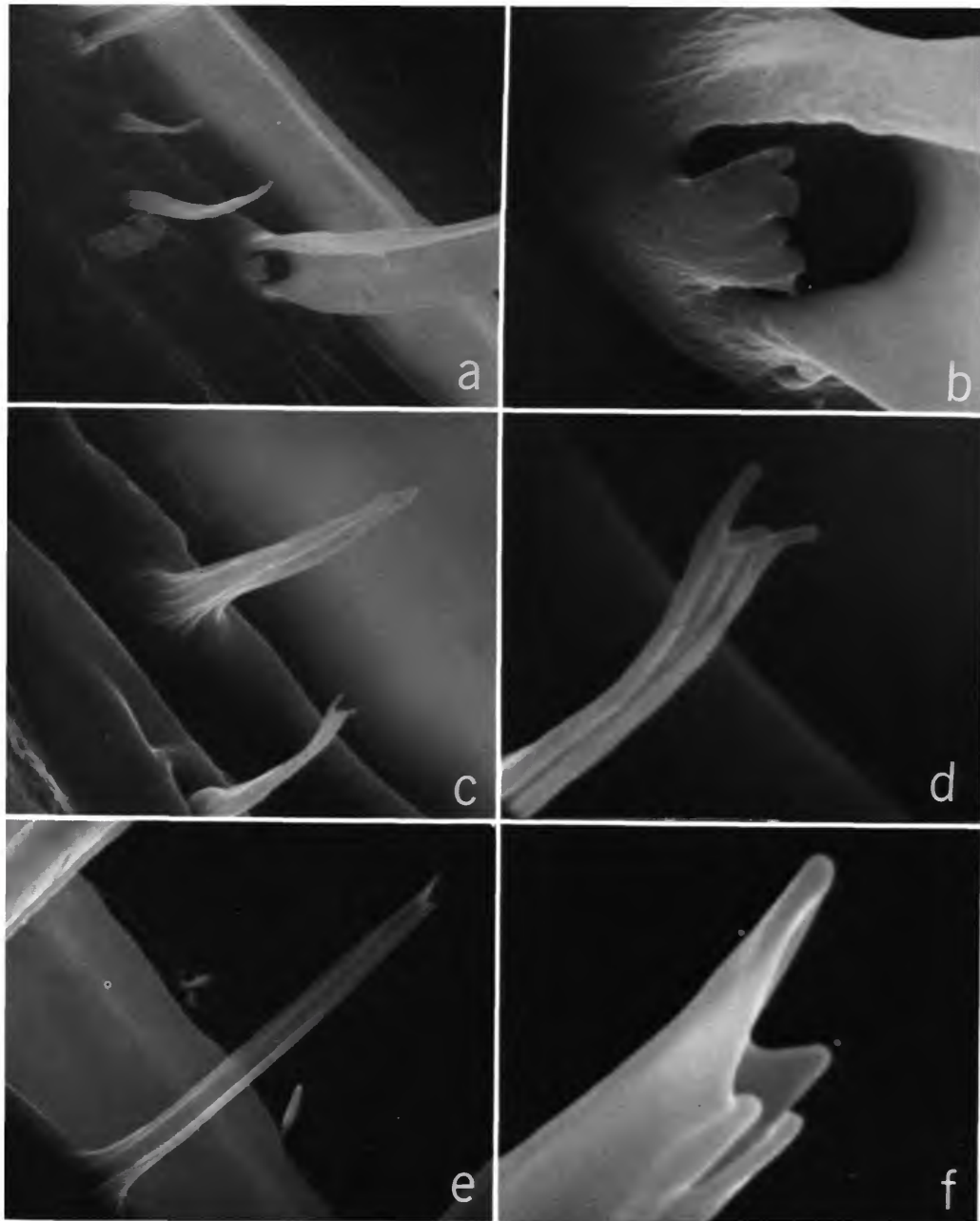


PLATE 40.—*Tetraleberis tanzania*, new species, female (adult or A-1 instar), holotype, USNM 157414, right valve, inside views: *a*, detail of bristle on posterior list of infold, from Plate 39*e*, $\times 2550$; *b*, detail of base of bristle in *a*, $\times 15,000$; *c*, detail of 2 small bristles on posterior list, from near middle of Plate 39*e*, $\times 7000$; *d*, tip of lower bristle in *e*, $\times 30,000$; *e*, short bristle on list, from near bottom of Plate 39*f*, $\times 7000$; *f*, tip of bristle in *e*, $\times 30,000$. (Micrographs reduced to 79%.)

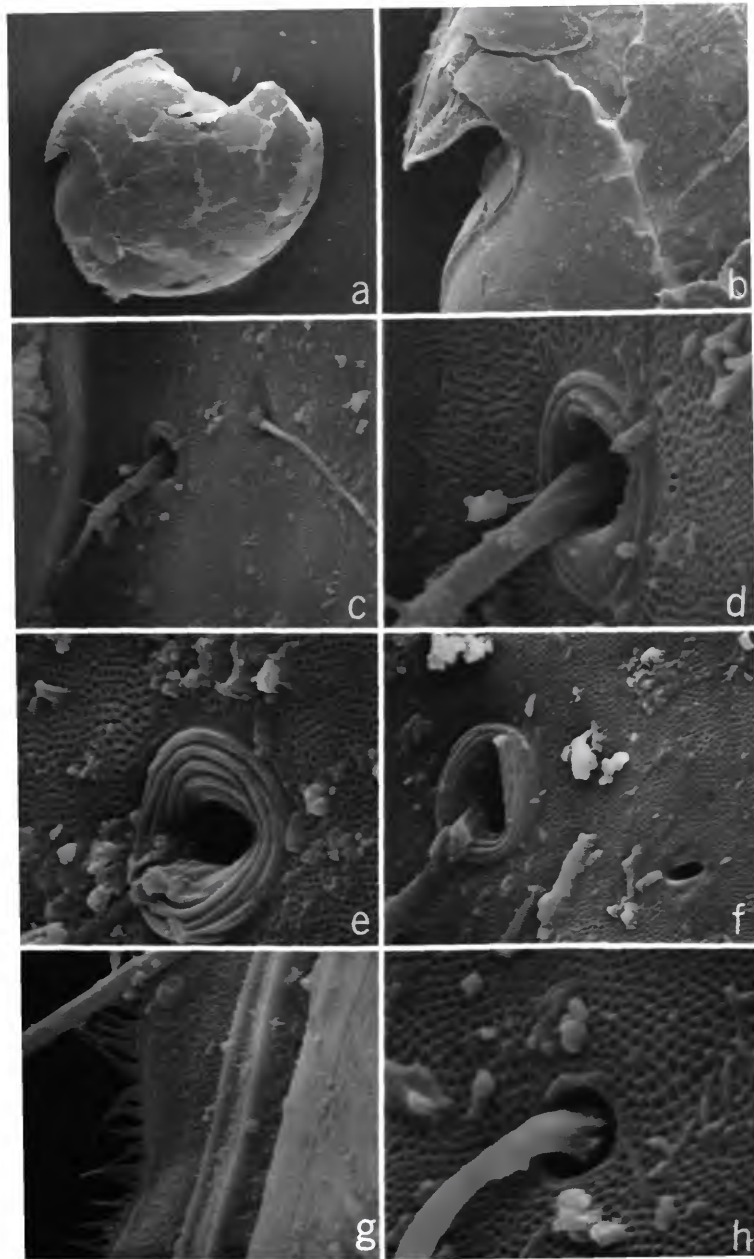


PLATE 41.—*Tetraleberis* species 1, female (instar I), USNM 157416, left valve, outside views: *a*, lateral view (posterodorsal part of shell broken off), $\times 70$; *b*, rostrum and incisur, from *a*, $\times 290$; *c*, bristles and pores just posterior to incisur, from *b*, $\times 4870$; *d*, detail of ringed pore and bristle in *c*, $\times 13,500$; *e*, *f*, bristles and pores, from *b*, $\times 11,550$, 7190 ; *g*, anterior margin of rostrum, from *b*, $\times 3980$; *h*, bristle emerging from open pore, and detail of surface of valve, from *b*, $\times 19,100$. (Micrographs reduced to 58%.)

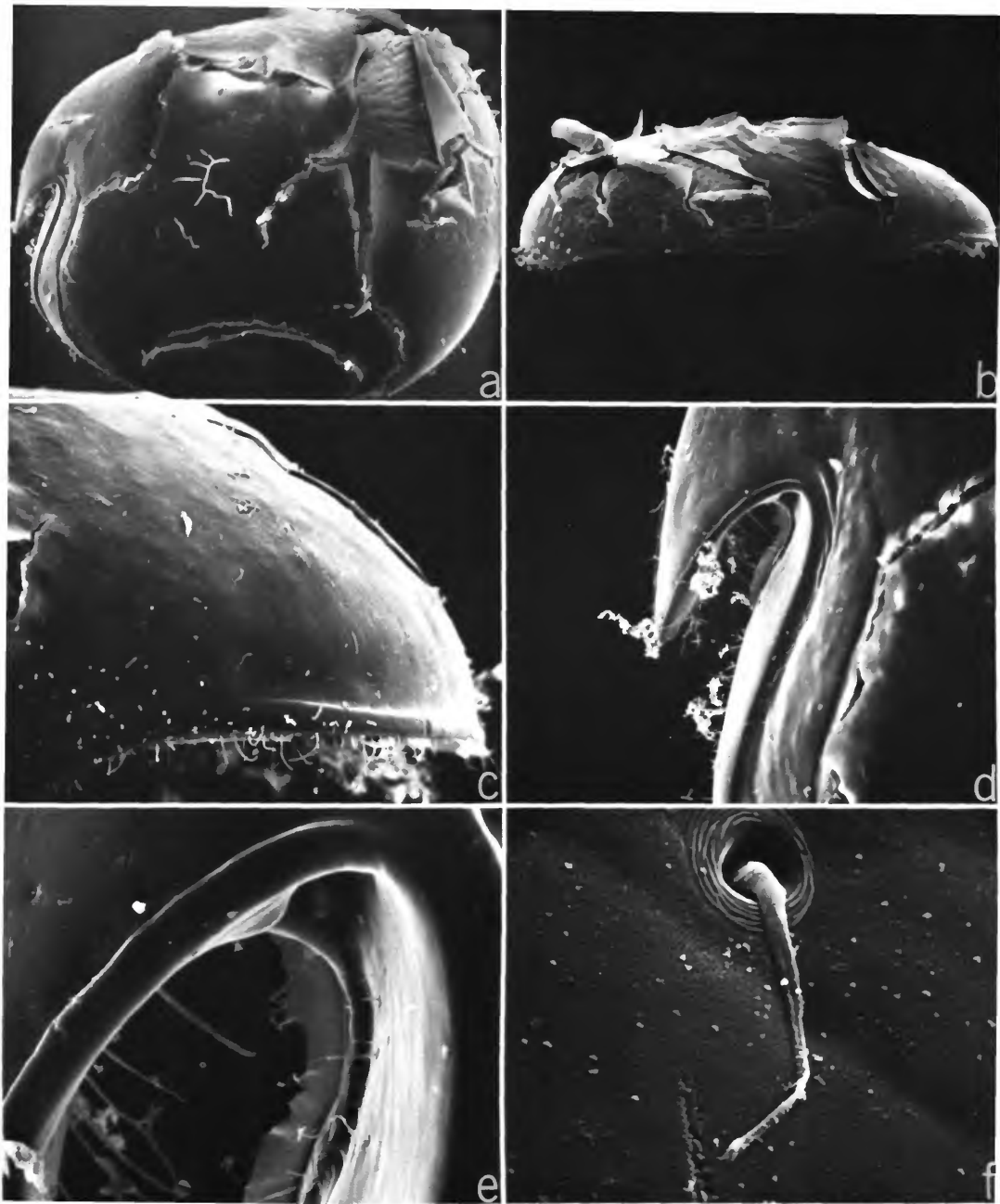


PLATE 42.—*Amboleberis americana* (Müller), ovigerous female, USNM 150290A, left valve, outside views (surface of valve peeled during freeze-drying process): *a*, lateral view of valve, $\times 35$; *b*, dorsal view of valve, anterior to right, $\times 37$; *c*, dorsal view of anterior end of valve, from *b*, $\times 155$; *d*, incisur area, from *a*, $\times 120$; *e*, detail of incisur, from *d*, $\times 550$; *f*, bristle emerging from ringed pore, from *c*, $\times 6000$. (Micrographs reduced to 76%.)

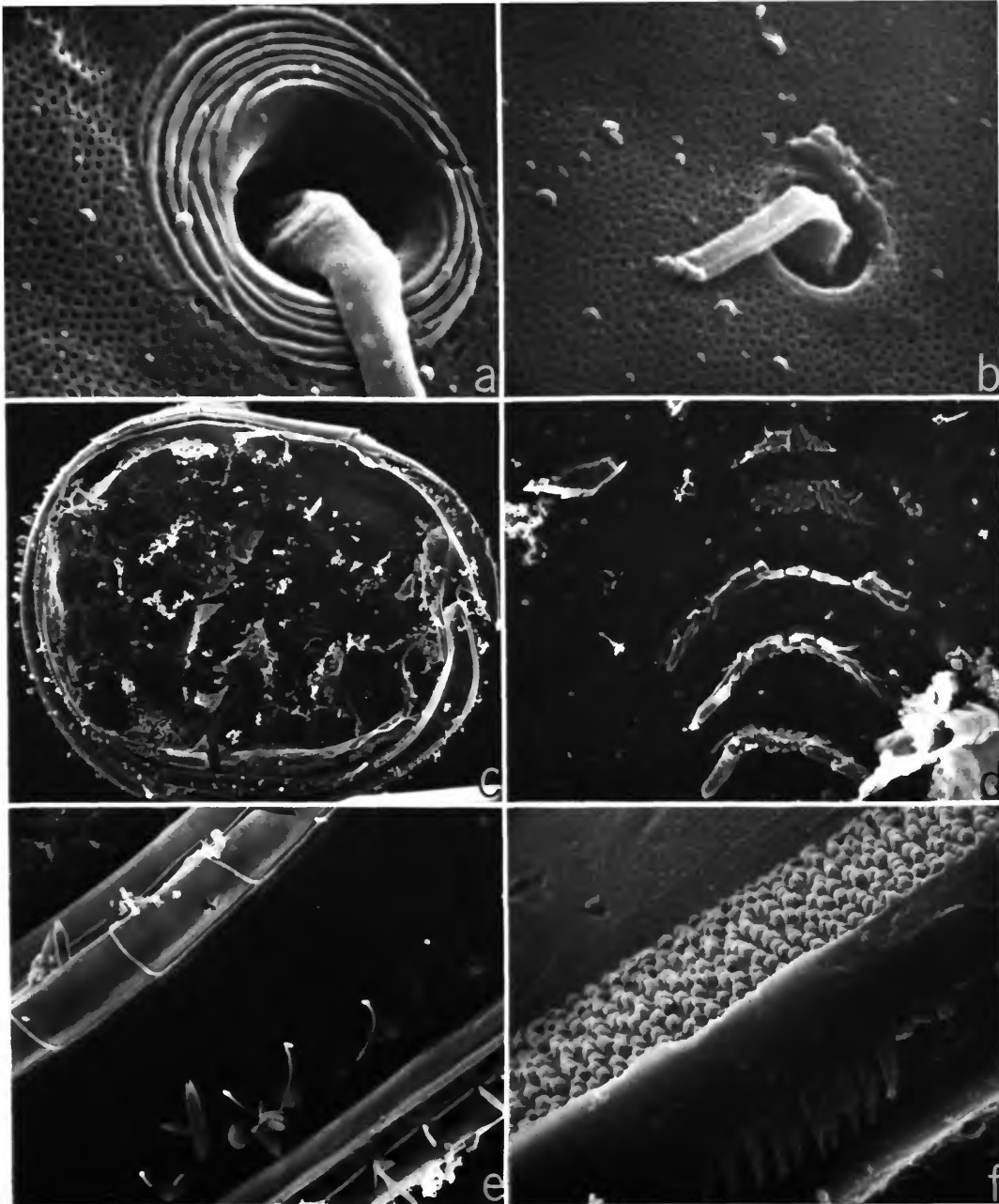


PLATE 43.—*Amboleberis americana* (Müller), ovigerous female, USNM 150290A, left valve: *a*, detail of ringed pore, from Plate 42*f*, $\times 15,800$; *b*, bristle emerging from unringed pore on valve surface, from Plate 42*c*, $\times 14,100$; *c*, inside view of valve, stalked protists along posterior valve margin, $\times 35$; *d*, detail of several central adductor muscles where attached to valve, from *e*, $\times 290$; *e*, anteroventral edge of valve, from *c*, $\times 525$; *f*, detail of papillae and selvage along anteroventral edge of valve, from *e*, $\times 5250$. (Micrographs reduced to 75%.)

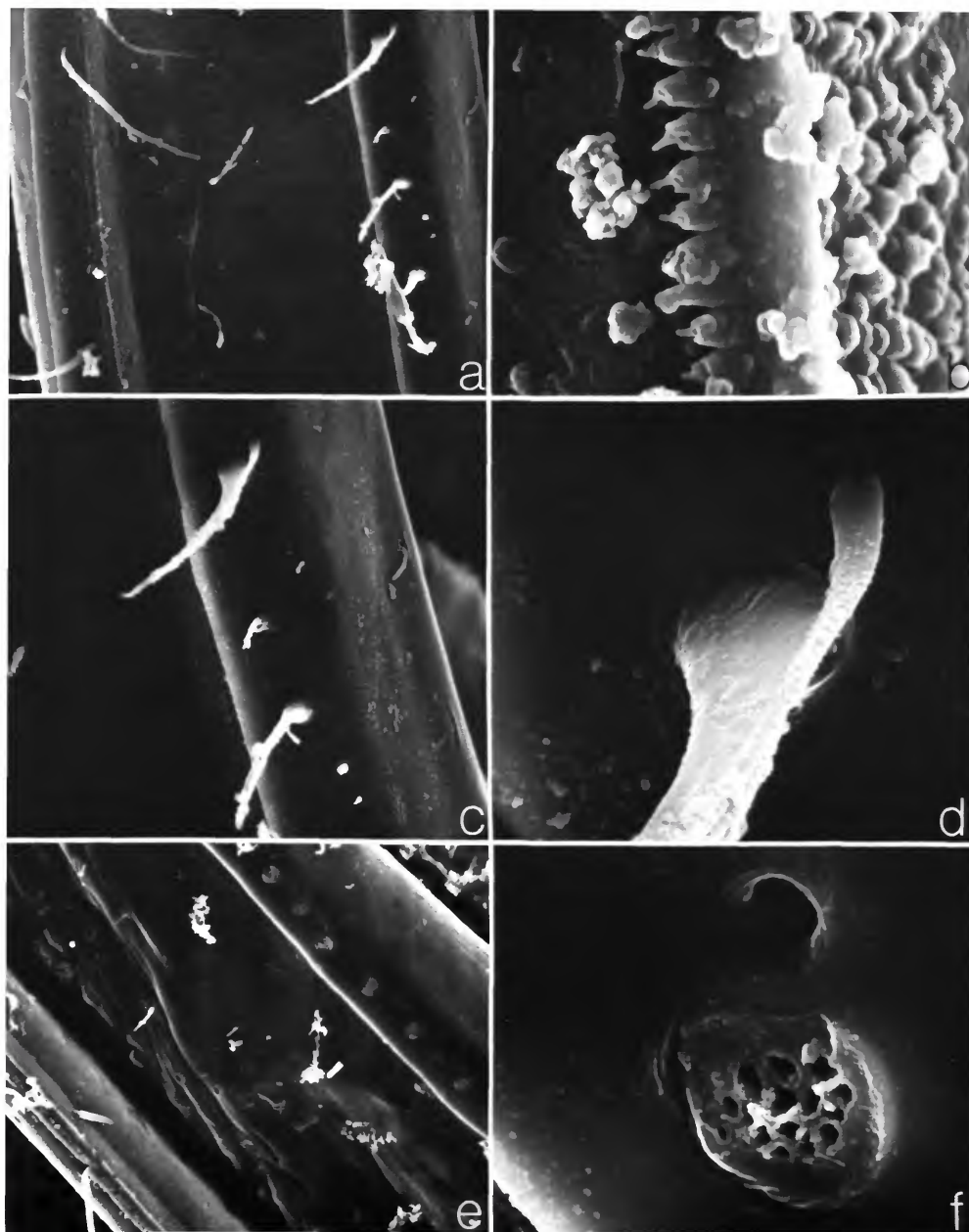


PLATE 44.—*Amboleberis americana* (Müller), ovigerous female, USNM 150290A, left valve, inside views of posterior margin: *a*, part of posterior edge, from Plate 43*c*, $\times 722$; *b*, detail of selvage along posterior valve edge, from *a*, $\times 10,500$; *c*, detail of list showing bristles, from *a*, $\times 1270$; *d*, bristle on upper part of list shown in *c*, $\times 6340$; *e*, posteroventral edge of valve, from Plate 43*c*, note bristles broken off on list, $\times 520$; *f*, pores at base of missing bristle on list shown in *c*, $\times 6450$. (Micrographs reduced to 70%.)

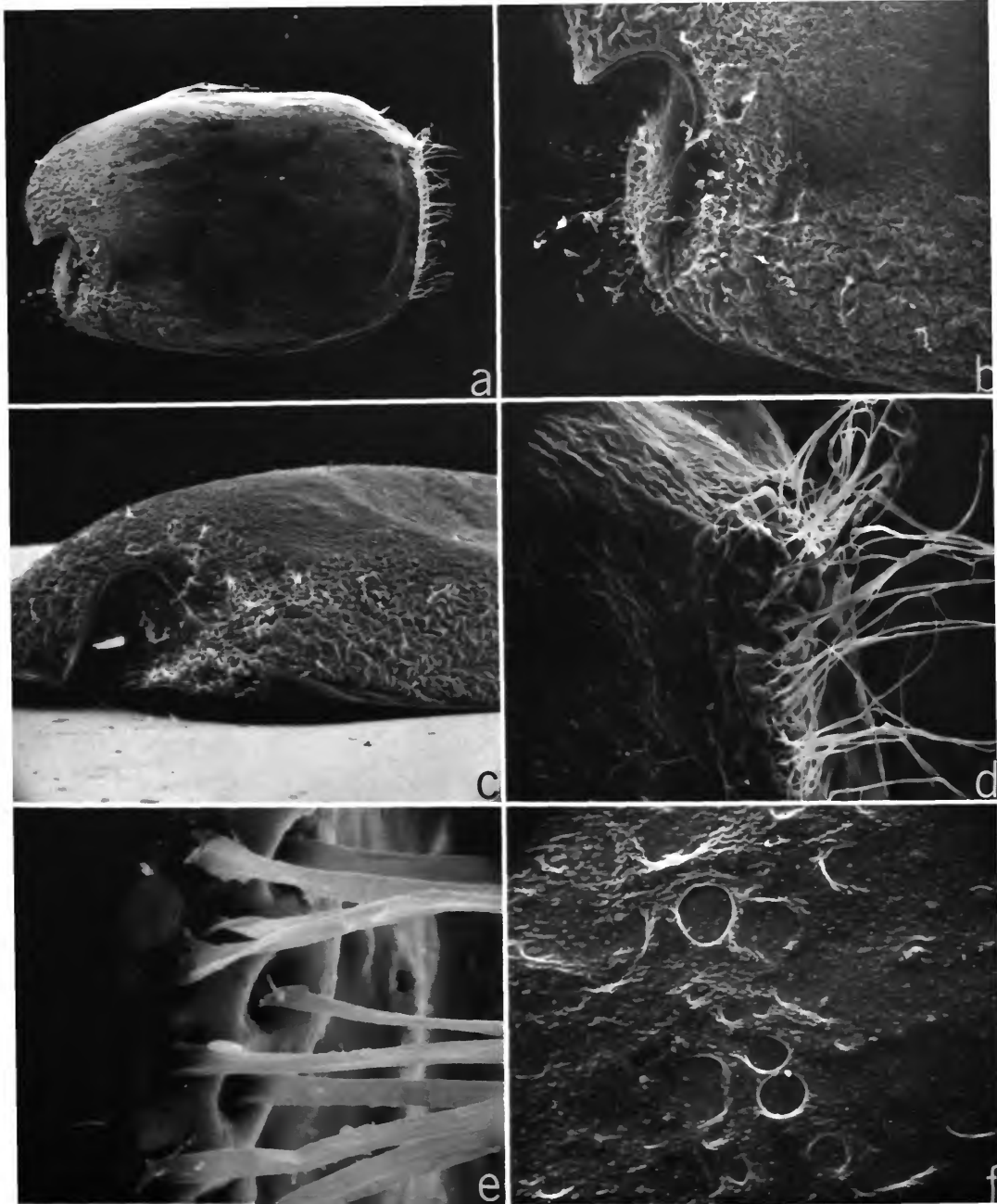


PLATE 45.—*Amboleberis americana* (Müller), adult male, USNM 150296, left valve, outside views: *a*, lateral view of whole valve, $\times 25$; *b*, anteroventral part of valve, note S-shaped ridge near middle of micrograph, $\times 70$; *c*, anteroventral view, $\times 70$; *d*, dorsal end of posterior margin, from *a*, $\times 210$; *e*, detail of pores of posterior hairs, from *d*, $\times 2100$; *f*, oval depressions near middle of dorsal part of valve, from *a*, $\times 300$. (Micrographs reduced to 76%.)

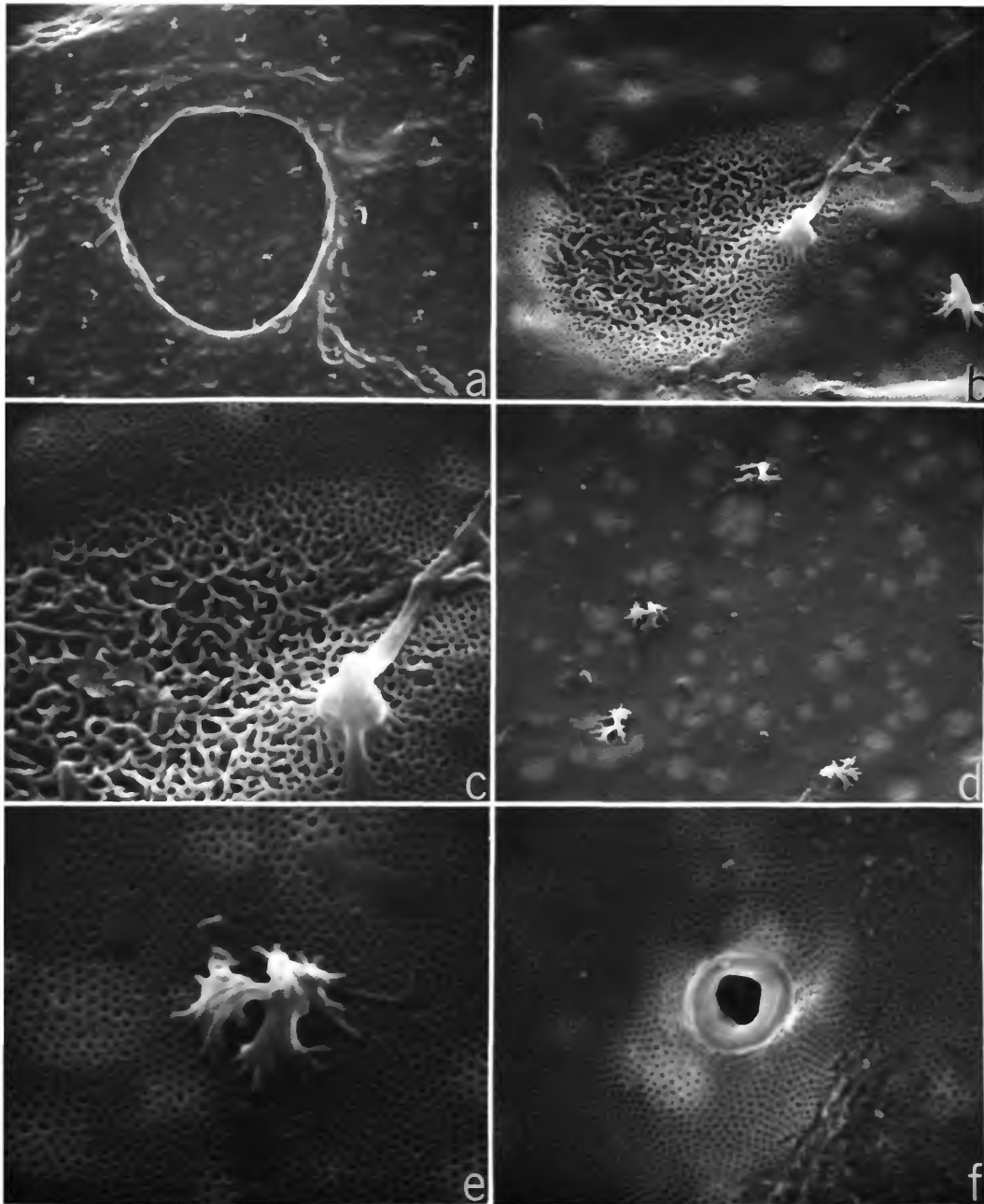


PLATE 46.—*Amboleberis americana* (Müller), adult male, USNM 150296, left valve, outside views: *a*, oval depression near dorsal margin, from Plate 45*a*, $\times 1150$; *b*, shallow reticulate area with bristle, from upper right of *a*, $\times 5250$; *c*, detail of reticulate area in *b*, $\times 10,500$; *d*, surface to left of oval depression in *a* showing minute branching structures, $\times 3050$; *e*, detail of branching structure near middle of *d* (note pitted surface of valve), $\times 11,500$; *f*, detail of valve surface showing minute pore with smooth rim, $\times 10,500$. (Micrographs reduced to 75%.)

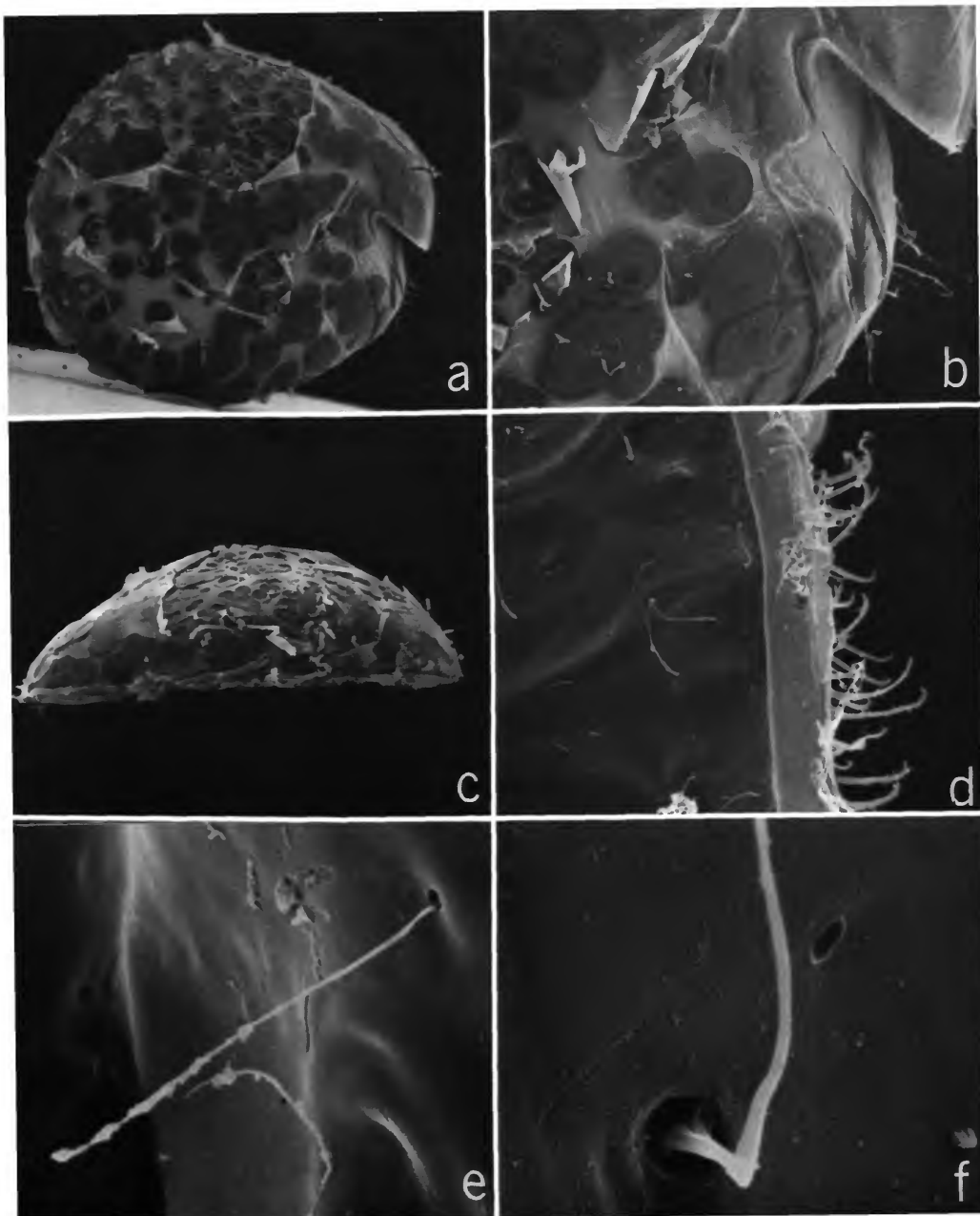


PLATE 47.—*Amboleberis antyx*, new species, juvenile female (instar IV?), holotype, USNM 157625, right valve, outside views: *a*, lateral view (part of outer layer flaked off during freeze-drying process, oval areas on valve represent microconcretions), $\times 45$; *b*, anterior of valve showing vertical ridge posterior to incisur area, from *a*, $\times 125$; *c*, dorsal view, anterior to left, $\times 45$; *d*, anterior view of anterodorsal margin, $\times 575$; *e*, bristle and pore on anterodorsal part of valve, from *a*, $\times 2200$; *f*, bristle and pores on valve surface, $\times 7000$. (Micrographs reduced to 79%.)

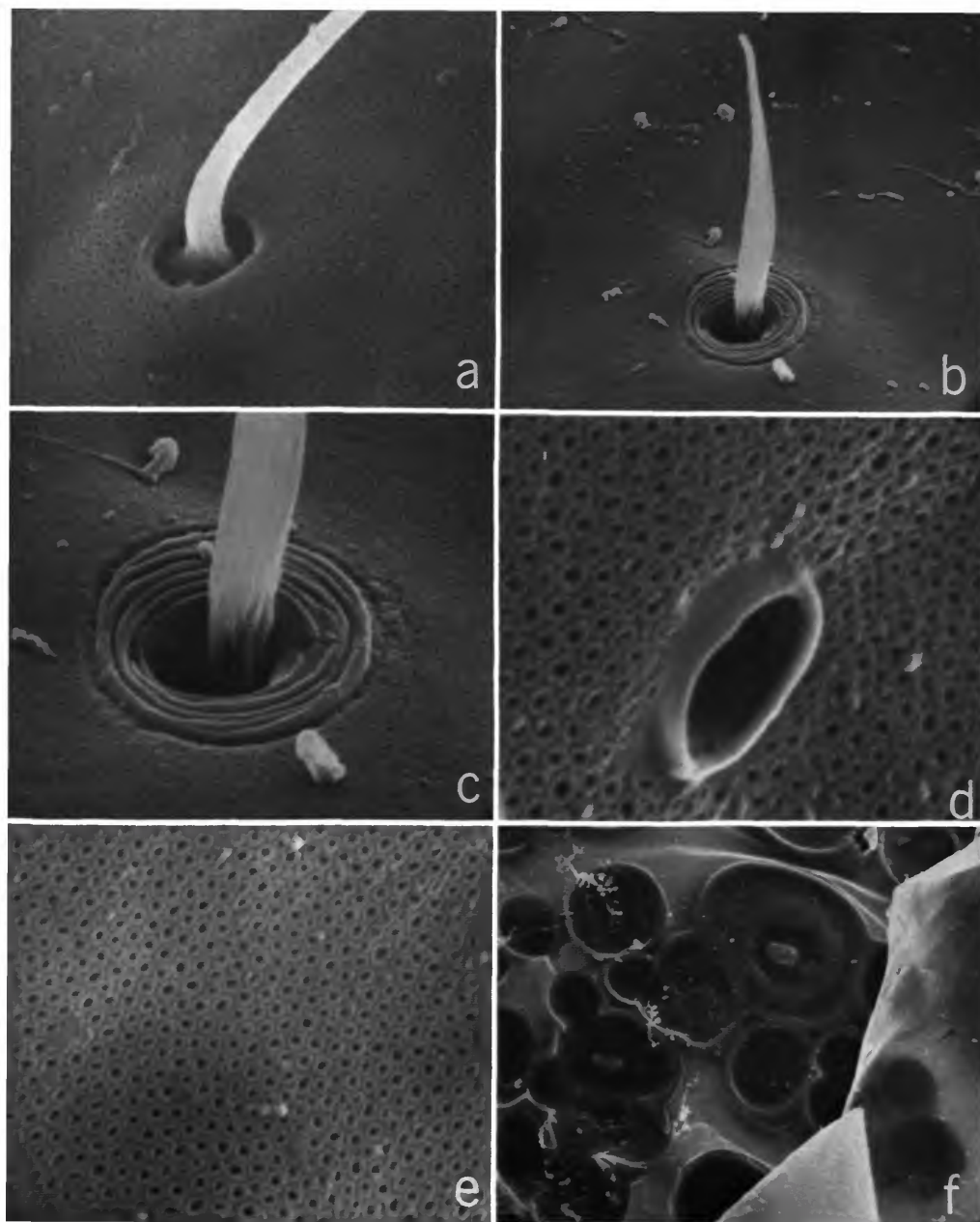


PLATE 48.—*Amboleberis antyx*, new species, juvenile female (instar IV?), holotype, USNM 157625, right valve, outside views: *a*, bristle emerging from pore in anteroventral part of valve, $\times 11,000$; *b*, bristle emerging from ringed pore in anterodorsal part of valve, $\times 4800$; *c*, detail from *b*, $\times 11,000$; *d*, detail of pore and valve surface, from Plate 47*d*, $\times 30,000$; *e*, detail of valve surface, from *a*, $\times 20,000$; *f*, detail of concretions (outer shell layer present only in lower right), from Plate 47*a*, $\times 280$. (Micrographs reduced to 78%.)



PLATE 49.—*Amboleberis antyx*, new species, juvenile female (instar IV?), holotype, USNM 157625, right valve, inside views: *a*, complete valve, $\times 45$; *b*, rostrum and incisur, from *a*, $\times 290$; *c*, margin below incisur, from *a*, $\times 640$; *d*, posterior margin, from *a*, $\times 370$; *e*, bristles on list of posterior infold, from *d*, $\times 1850$; *f*, bristles on list of posteroventral infold, $\times 9500$. (Micrographs reduced to 81%.)

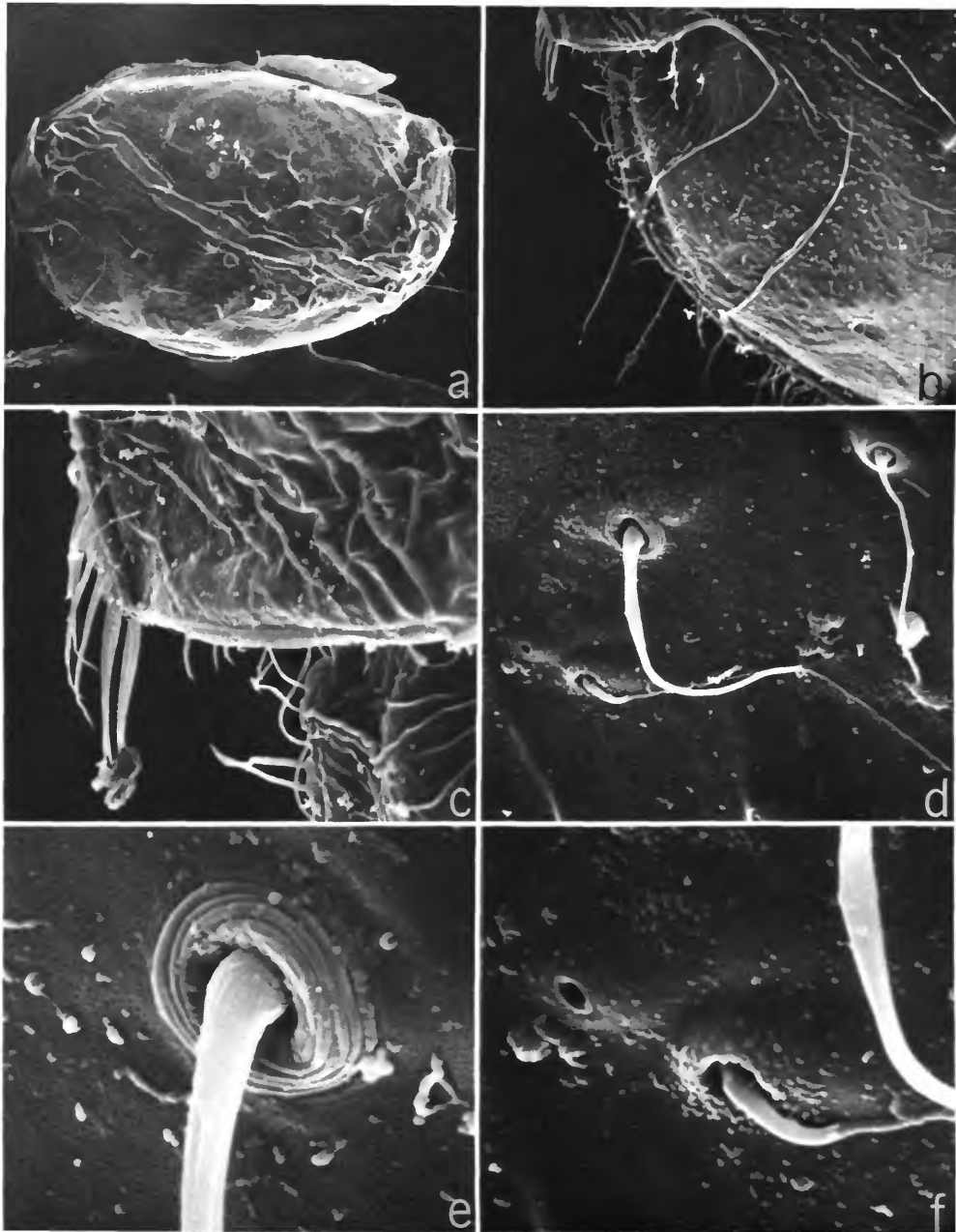


PLATE 50.—*Amboleberis antyx*, new species, adult male, paratype, USNM 157728, left valve, outside views: *a*, lateral view, $\times 39$; *b*, anterior, from *a* (note vertical ridge posterior to anterior margin below incisur), $\times 150$; *c*, rostrum, from *b*, $\times 470$; *d*, bristles and pores, from *b*, $\times 3000$; *e*, detail of ringed pore and bristle, from *d*, $\times 10,000$; *f*, detail of open pore and bristle emerging from simple pore, from *d*, $\times 7000$. (Micrographs reduced to 75%.)

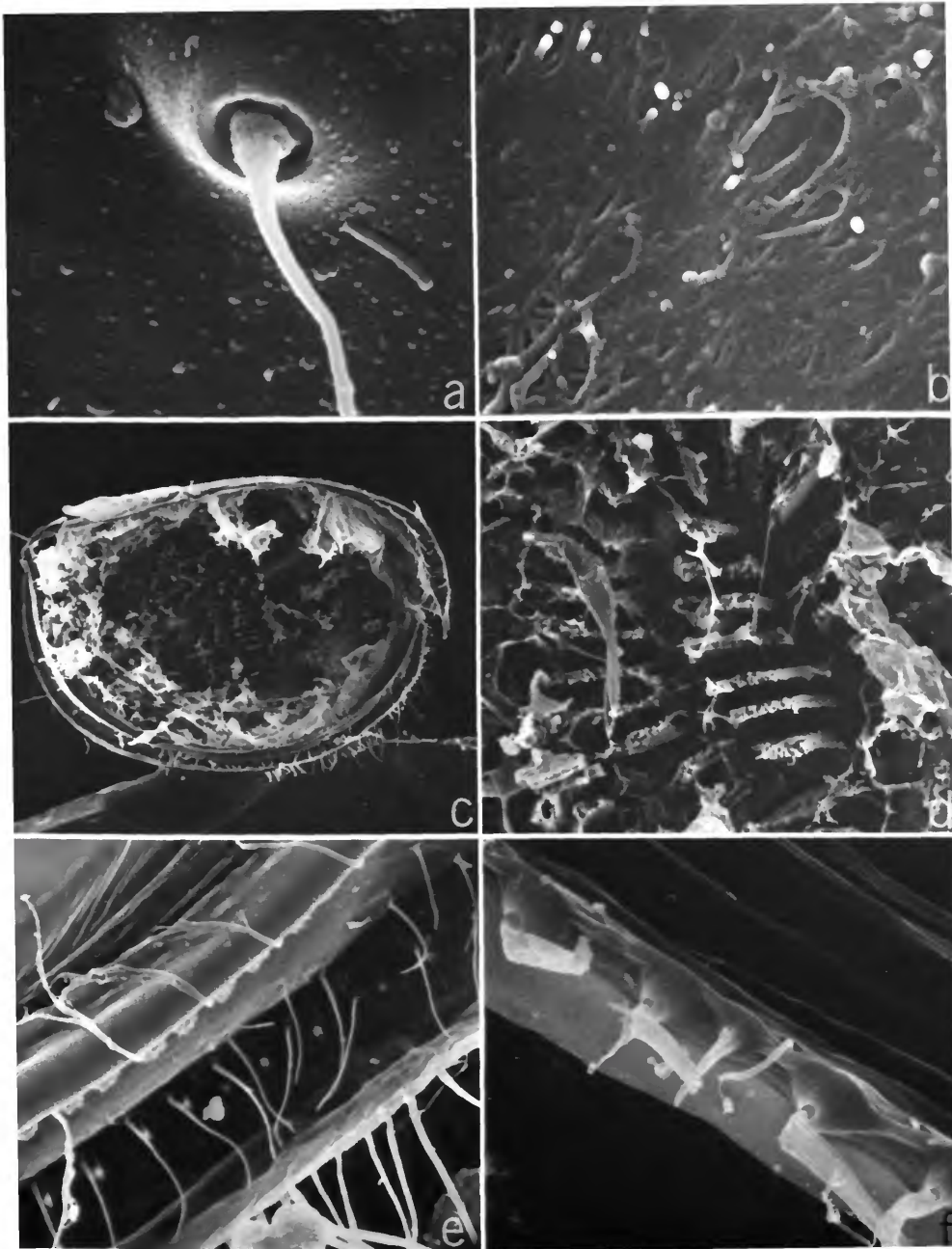


PLATE 51.—*Amboleberis antyx*, new species, adult male, paratype, USNM 157728, left valve: *a*, bristle emerging from closed pore, from Plate 50*d*, $\times 10,000$; *b*, detail of surface where outer layer of shell is missing, from Plate 50*a*, $\times 10,000$; *c*, inside view of valve, $\times 39$; *d*, central adductor muscle attachments, from *c*, $\times 120$; *e*, anteroventral margin, from *c*, $\times 550$; *f*, bristles on list of posteroventral infold, from *c*, $\times 535$. (Micrographs reduced to 76%.)

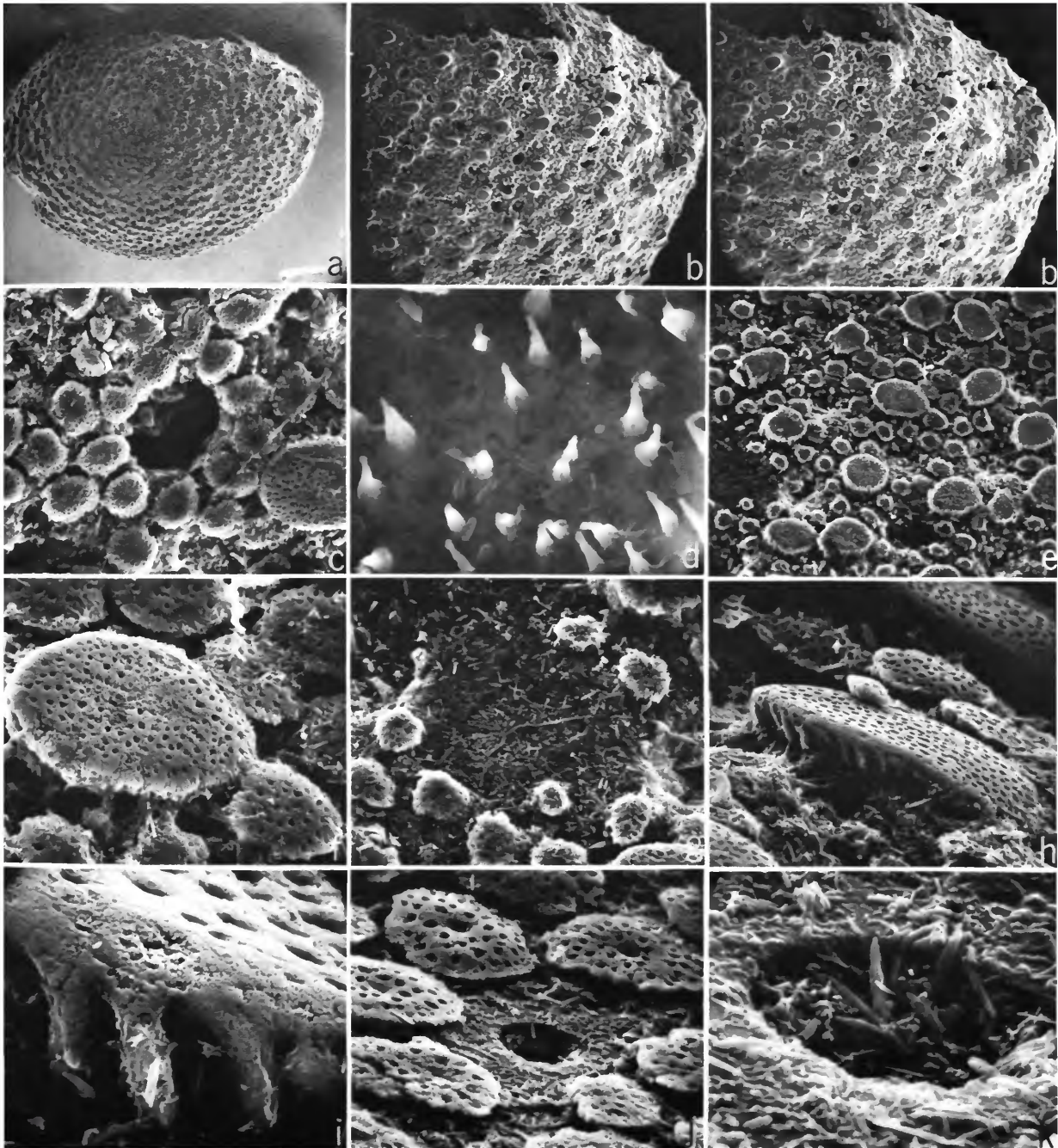


PLATE 52.—*Actinoseta chelisparsa* Kornicker, adult female, USNM 150283, left valve, outside views: *a*, lateral view, $\times 40$; *b*, posterodorsal corner of valve, from *a*, stereoscopic pair, $\times 95$; *c*, discs and fossa, from *b*, $\times 700$; *d*, spines at bottom of fossa in *c*, $\times 8000$; *e*, detail of surface, from *a*, $\times 330$; *f*, disc near middle of *e*, $\times 3300$; *g*, fossa filled with aragonite needles (Drewite), note long slender bristle near middle, from lower left of *e*, $\times 1000$; *h*, disc near ventral margin of valve, from *a*, $\times 1350$; *i*, edge of disc in *h*, $\times 6700$; *j*, discs and fossa near ventral margin of valve, from *a*, $\times 2000$; *k*, fossa in *j* (note aragonite needles in and around fossa), $\times 6800$. (Micrographs reduced to 53%.)



PLATE 53.—*Actinoseta chelisparsa* Kornicker, adult female, USNM 150283, left valve, outside views: *a*, ventral view of valve, anterior to left, $\times 33$; *b*, bristle and discs along ventral margin, from *a*, $\times 330$; *c*, detail of bristle and discs in *b*, $\times 2000$; *d*, base of bristle and aragonite needles, from *c*, $\times 10,000$. Inside views: *e*, posterodorsal corner of valve (valve layers have separated and part of toothed section is missing), $\times 95$; *f*, teeth and sockets shown in *e*, $\times 400$; *g*, detail of tooth and sockets shown in *f*, $\times 2000$; *h*, central adductor muscles where attached to valve, $\times 260$; *i*, stump of muscles to left of middle of *h*, $\times 2300$; *j*, bristles along posterior infold, from *e*, $\times 1000$; *k*, branching bristle shown in *j*, $\times 2000$; *l*, tubular bristles of posterior list, from lower right of *j*, $\times 7500$. (Micrographs reduced to 51%.)

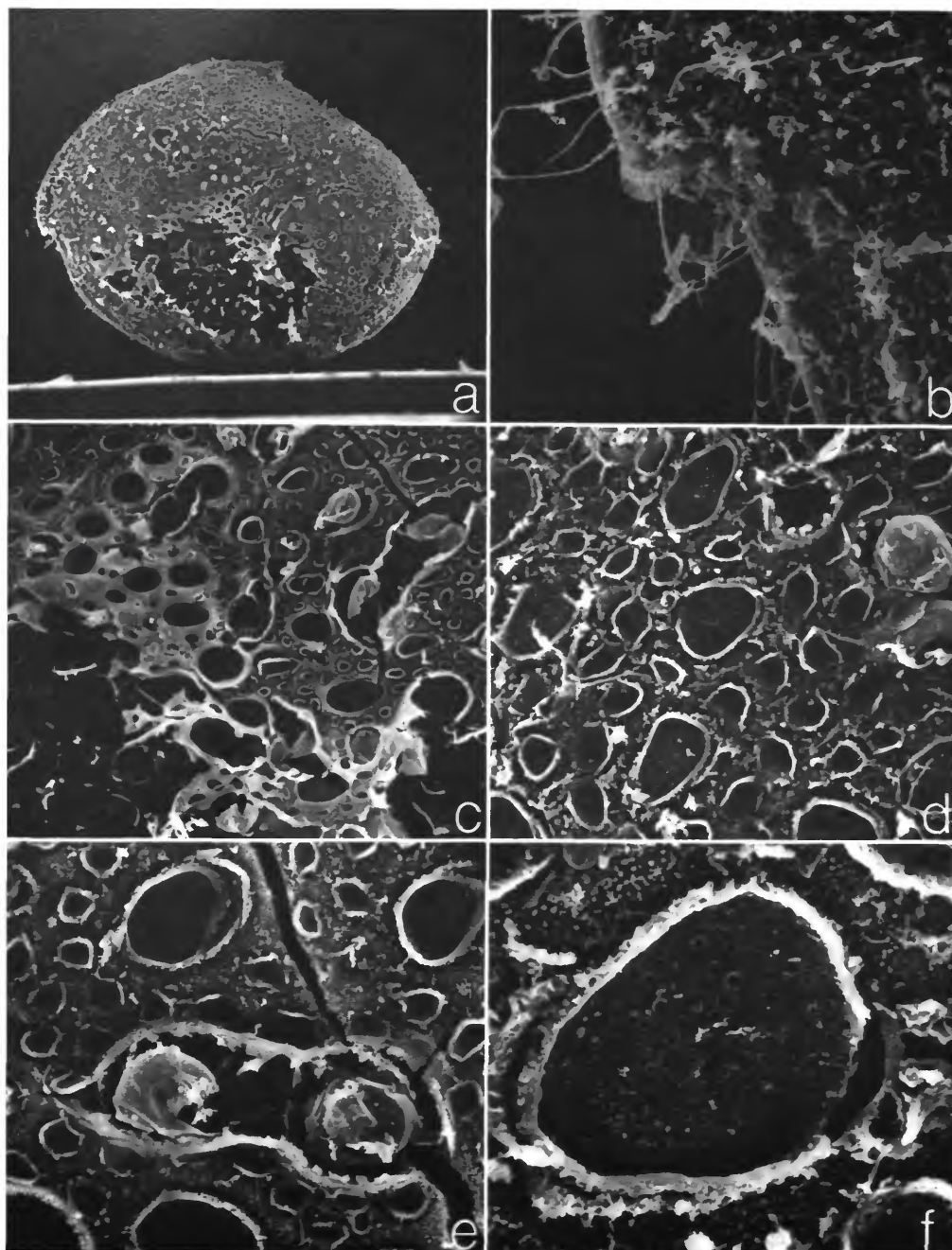


PLATE 54.—*Actinoseta chelisparsa* Kornicker, ovigerous female, USNM 150294, left valve, outside views: *a*, lateral view, $\times 35$; *b*, rostrum and incisur, from *a*, $\times 350$; *c*, detail of surface at valve middle, from *a*, $\times 200$; *d*, detail of surface near dorsal margin, from *a*, $\times 500$; *e*, detail of surface, from *a*, $\times 600$; *f*, detail from middle of *d*, $\times 2000$. (Micrographs reduced to 77%.)

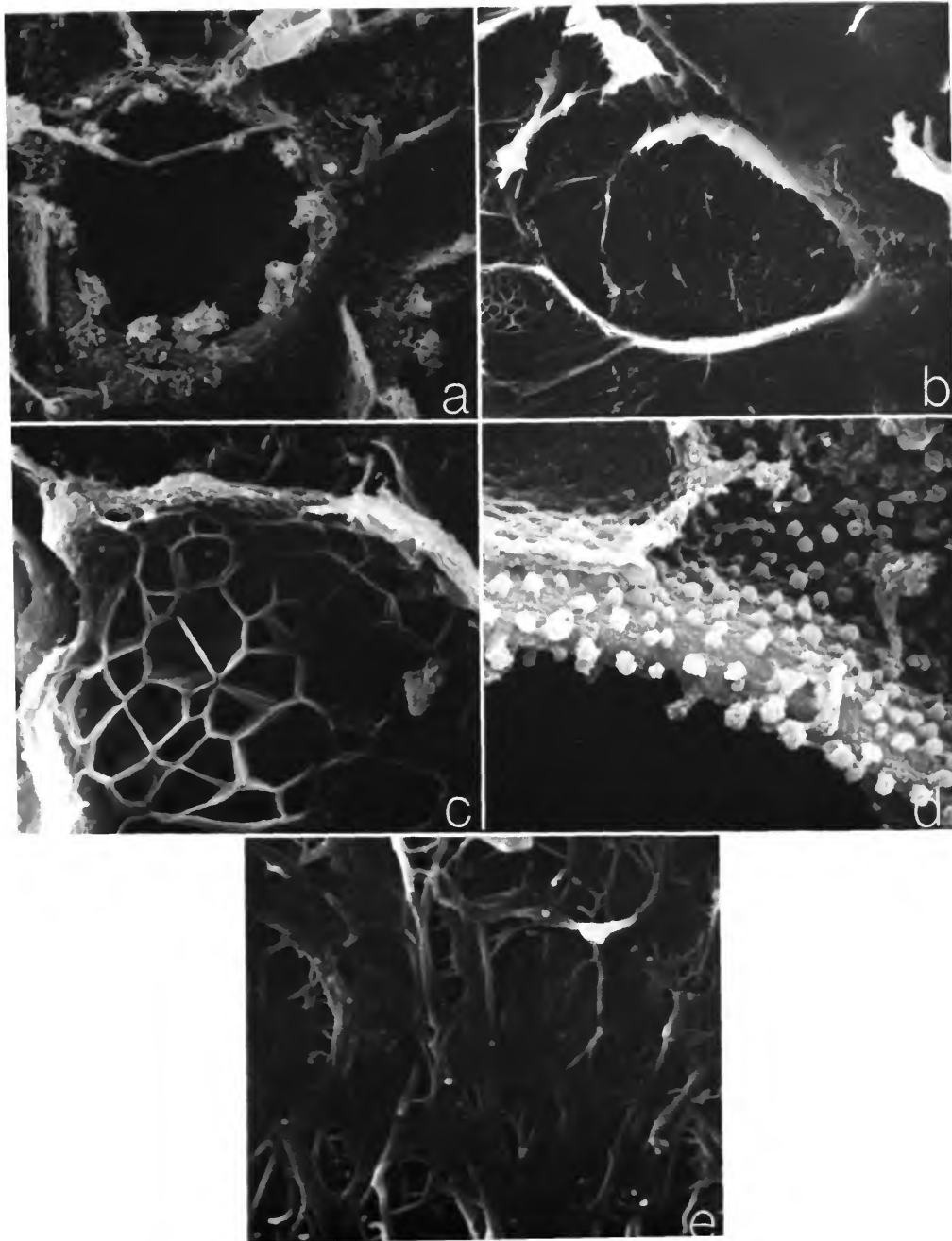


PLATE 55.—*Actinoseta chelisarsa* Kornicker, ovigerous female, USNM 150294, left valve, outside views: a, detail of fossa in upper right of Plate 54d, $\times 2000$; b, detail of surface with outer layer missing, from Plate 54a, $\times 1200$; c, reticulate structure in lower left of b, $\times 6000$; d, edge of fossae in lower left of Plate 54e, $\times 6000$; e, detail of surface with outer layer of shell removed, from middle of b, $\times 12,000$. (Micrographs reduced to 76%.)

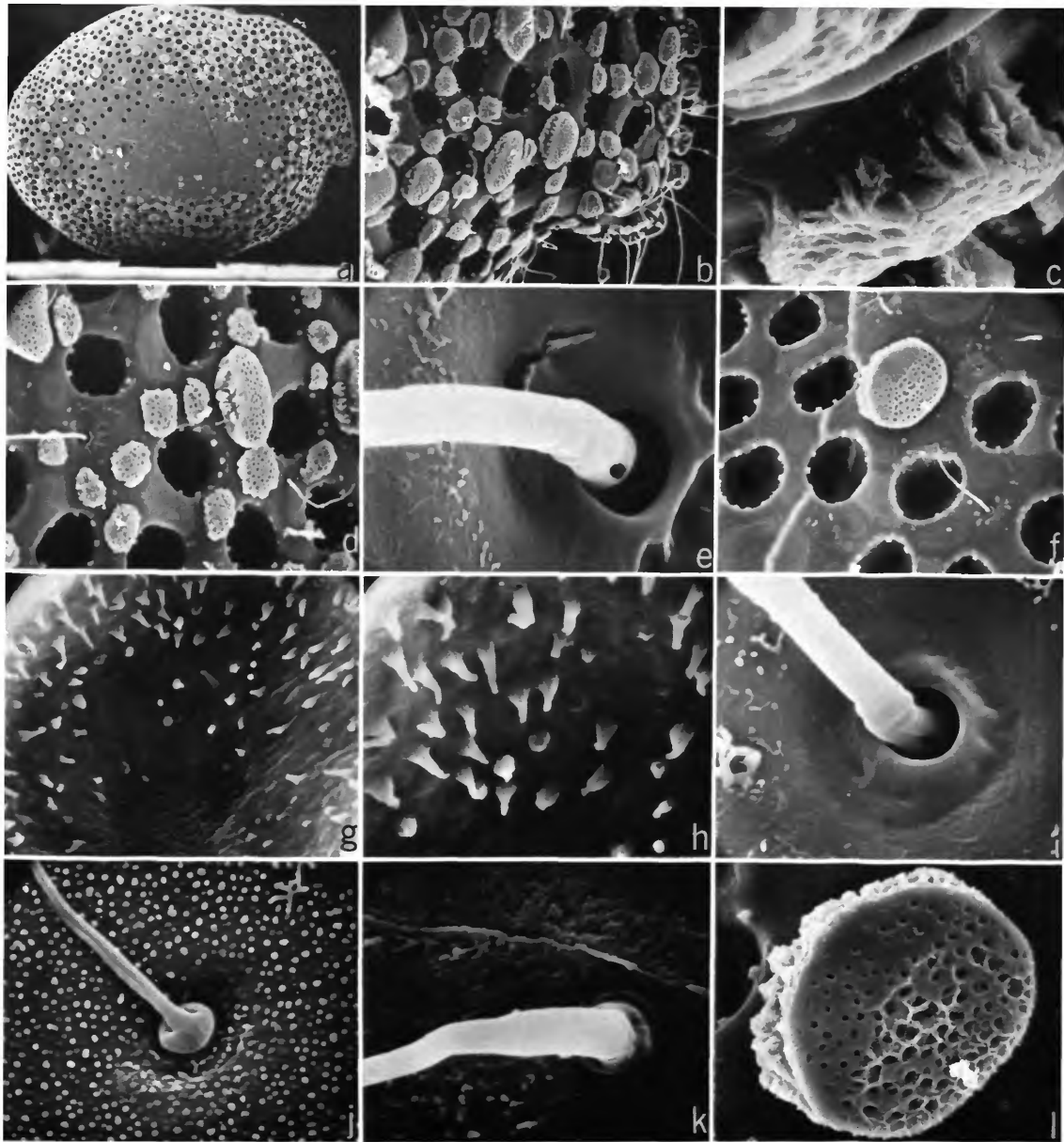


PLATE 56.—*Actinoseta chelisparsa* Kornicker, juvenile female, paratype, USNM 122898, right valve, outside views: *a*, lateral view, $\times 65$; *b*, rostrum, from *a*, $\times 400$; *c*, disc on lower edge of rostrum in *b*, $\times 4000$; *d*, fossae, discs, and bristles near anterior margin, from *a*, $\times 600$; *e*, base of bristle shown in *d*, $\times 10,000$; *f*, fossae, disc, and bristles, posterodorsal part of valve shown in *a*, $\times 650$; *g*, inner surface of fossa right of middle in *f*, $\times 4800$; *h*, detail of spines in *g*, $\times 10,000$; *i*, base of bristle shown in lower left of *f*, $\times 10,000$; *j*, split bristle in upper right of *f*, $\times 10,000$; *k*, short bristle in upper right corner of *f*, $\times 10,000$; *l*, disc shown in *f*, $\times 2000$. (Micrographs reduced to 53%.)

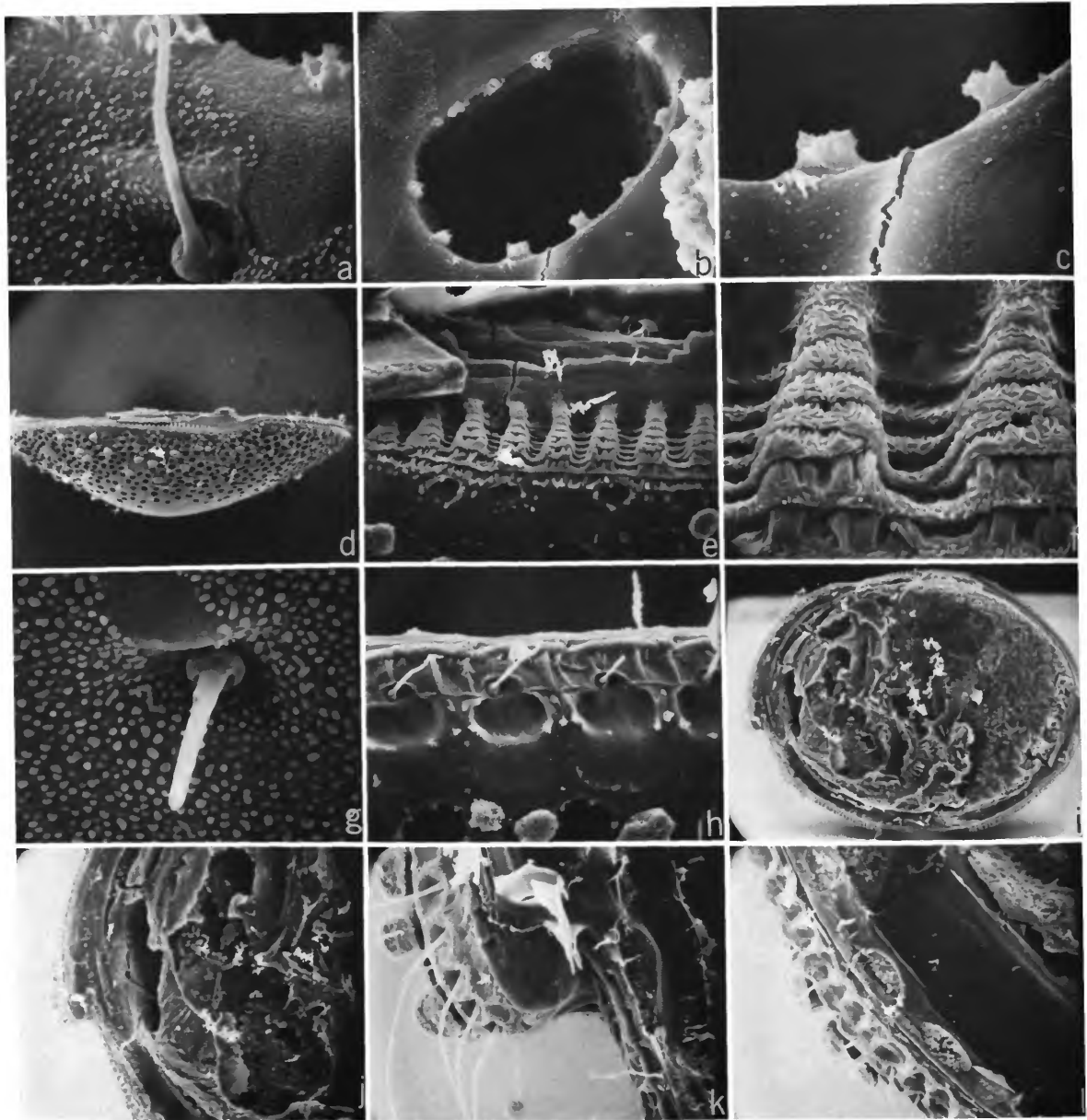


PLATE 57.—*Actinoseta chelisparsa* Kornicker, juvenile female, paratype, USNM 122898, right valve, outside views: *a*, single bristle near posterior end of valve, note edge of fossa in upper right, $\times 10,000$; *b*, fossa to left of disc shown in Plate 56*f*, $\times 2600$; *c*, lower edge of fossa in *b*, $\times 6500$; *d*, dorsal view of valve, anterior to right, $\times 65$; *e*, teeth and sockets at middle of dorsal margin, from *d*, $\times 650$; *f*, detail of *e*, $\times 2000$; *g*, broken bristle in lower right of *e*, $\times 10,000$; *h*, edge of valve near anterior end, from *d*, $\times 1000$. Inside views: *i*, complete valve, $\times 65$; *j*, anterior of valve, from *i*, $\times 130$; *k*, rostrum shown in *j*, $\times 700$; *l*, anteroventral margin, from *j*, $\times 500$. (Micrographs reduced to 52%.)

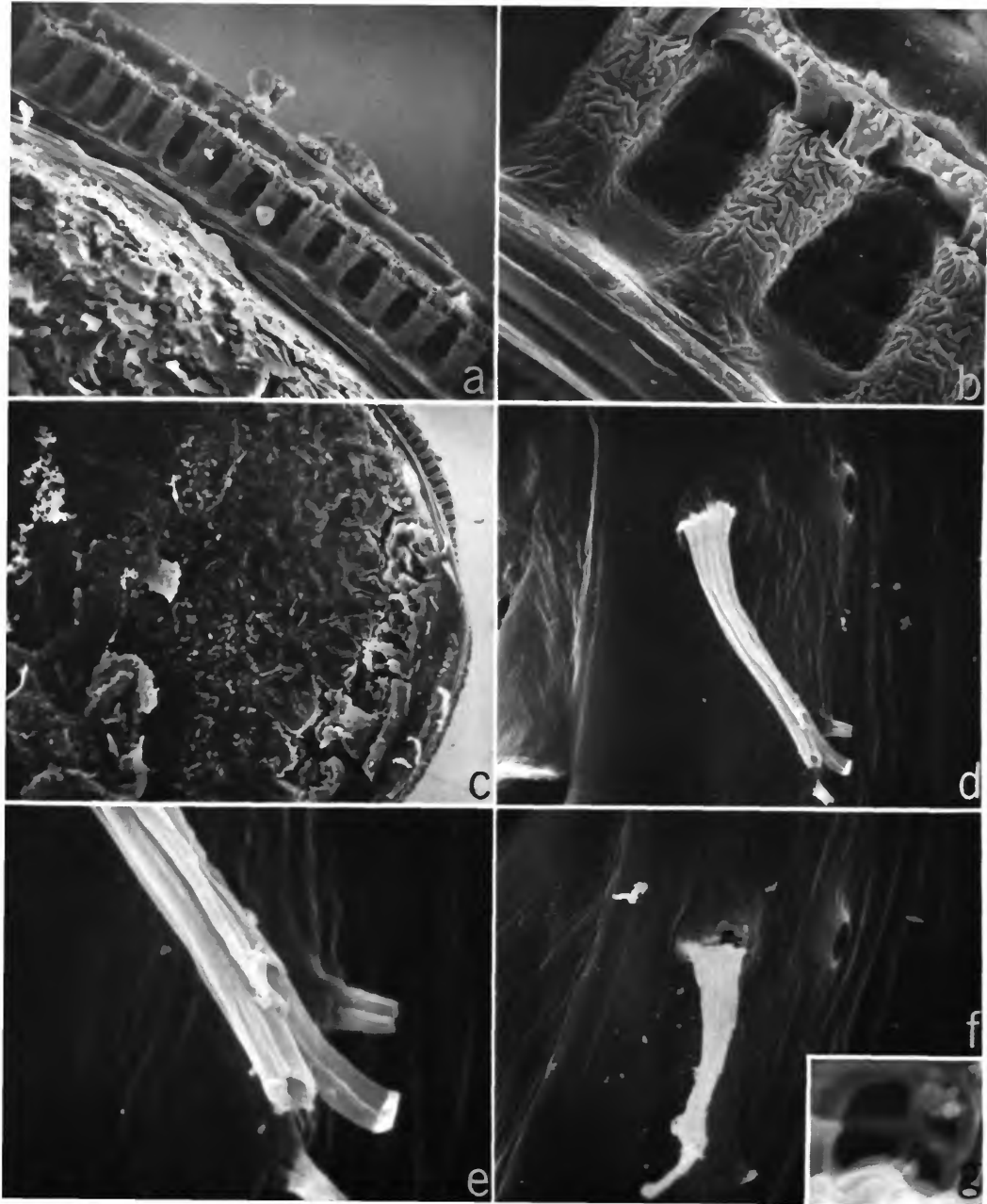


PLATE 58.—*Actinoseta chelisparsa* Kornicker, juvenile female, paratype, USNM 122898, right valve, inside views: *a*, teeth and sockets along posterodorsal margin, from Plate 57i, $\times 650$; *b*, detail of *a*, $\times 2600$; *c*, posterior margin of valve, from Plate 57i, $\times 260$; *d*, bristle on list of posterior infold, from *c*, $\times 2800$; *e*, tip of bristle shown in *d*, $\times 7500$; *f*, bristle on list of posterior infold, from *c* (note quadratate pore visible at broken base of bristle), $\times 2600$; *g*, detail of quadratate pore exposed at base of bristle in *f*, $\times 15,000$. (Micrographs reduced to 74%.)

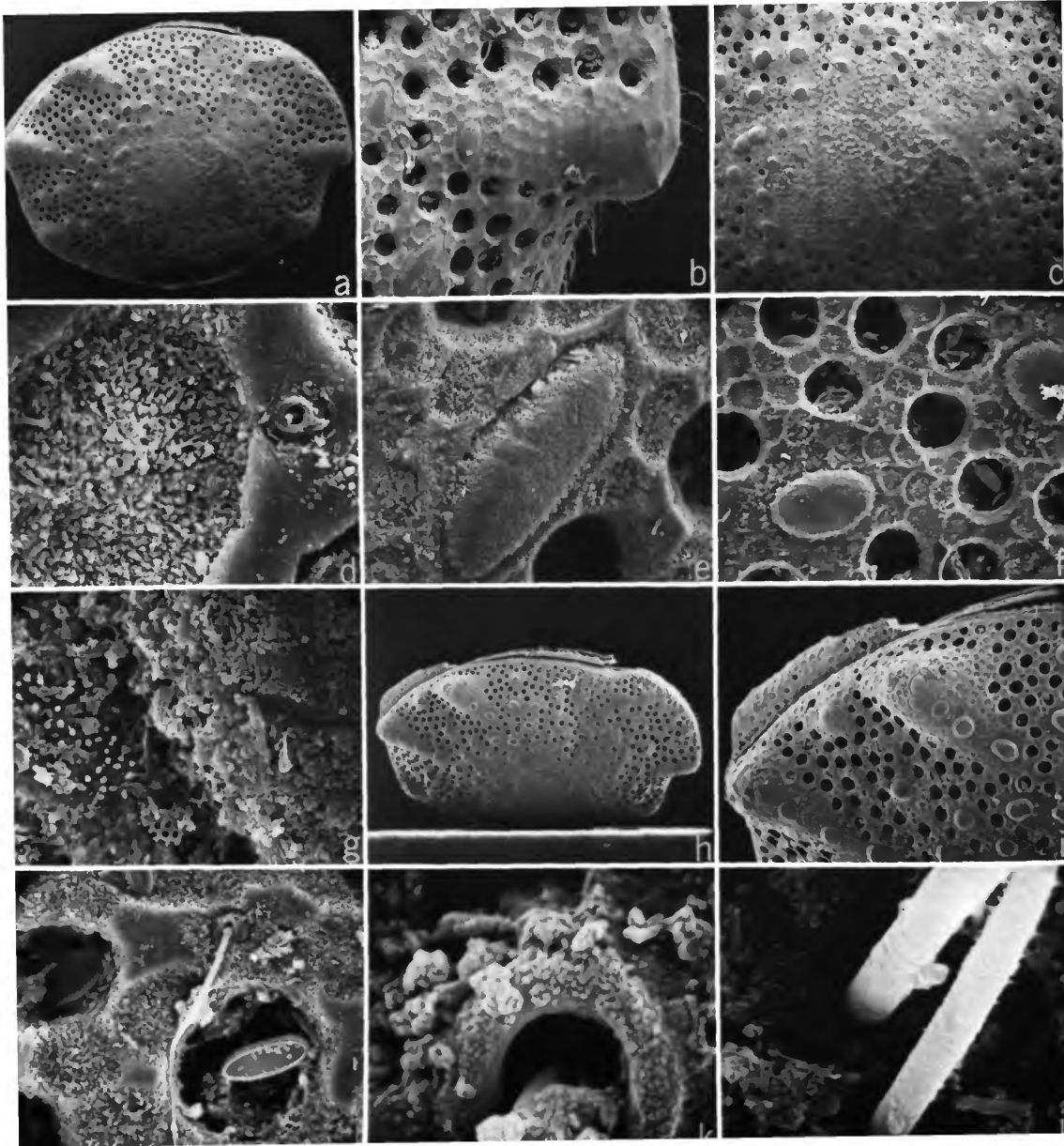


PLATE 59.—*Actinoseta hummelincki*, new species, adult female, USNM 150295, paratype, right valve, outside views (specimen not cleaned by vibrator): *a*, lateral view, $\times 44$; *b*, anterior, from *a*, $\times 105$; *c*, surface near valve middle, from *a*, $\times 83$; *d*, shallow fossa and pore with stump of bristle, from *c*, $\times 3400$; *e*, disc, shallow and deep fossae, from *c*, $\times 450$; *f*, discs and fossae, $\times 450$; *g*, detail of lower left edge of disc in upper right of *f*, $\times 3600$; *h*, oblique view of valve, $\times 45$; *i*, detail of elongate nodes on posterodorsal corner, from *h*, $\times 90$; *j*, bristle, shallow fossae, and deep fossae with diatoms, $\times 1125$; *k*, base of bristle shown in *j* (note pore in bristle), $\times 17,500$; *l*, pair of bristles, from *h*, $\times 8400$. (Micrographs reduced to 53%.)

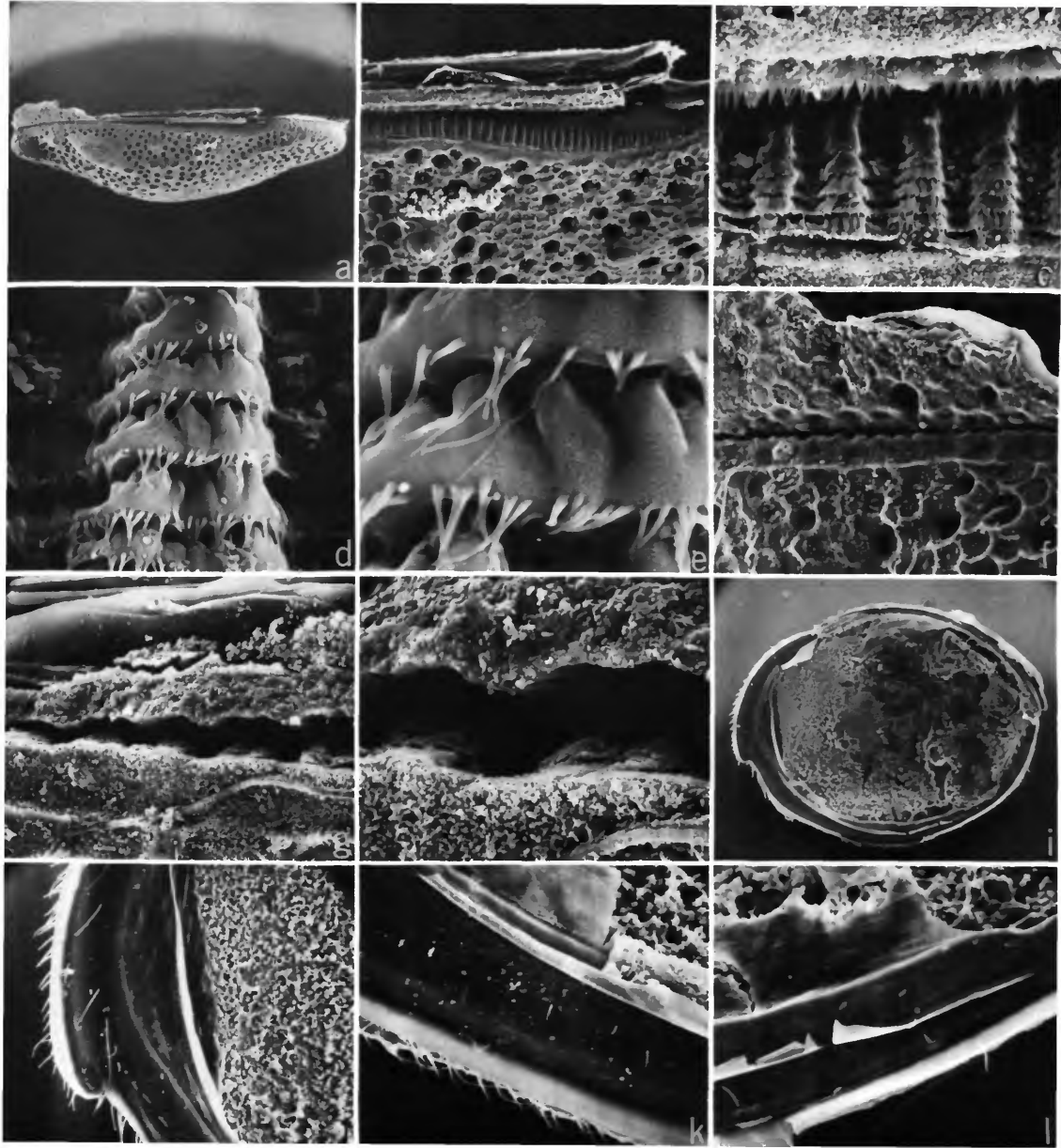


PLATE 60.—*Actinoseta hummelincki*, new species, adult female, paratype, USNM 150295, right valve and fragment of left valve attached dorsally to right valve, outside views: *a*, dorsal view, anterior to right, $\times 45$; *b*, segment of dorsal margin, from *a*, $\times 190$; *c*, detail from left part of *b*, $\times 1100$; *d*, detail of tooth in *c*, $\times 3930$; *e*, detail from middle of tooth in *d*, $\times 9800$; *f*, enmeshed teeth near left end of *a*, $\times 395$; *g*, slightly parted teeth of dorsal margin just to right of *f*, from *a*, $\times 980$; *h*, detail from middle of *g*, $\times 2660$. Inside views: *i*, complete valve, $\times 40$; *j*, rostrum and incisur, from *i*, $\times 135$; *k*, anteroventral margin, from *i*, $\times 350$; *l*, segment near posterior end of ventral margin showing posterior end of lamellar prolongation of list, from *i*, $\times 300$. (Micrographs reduced to 53%.)

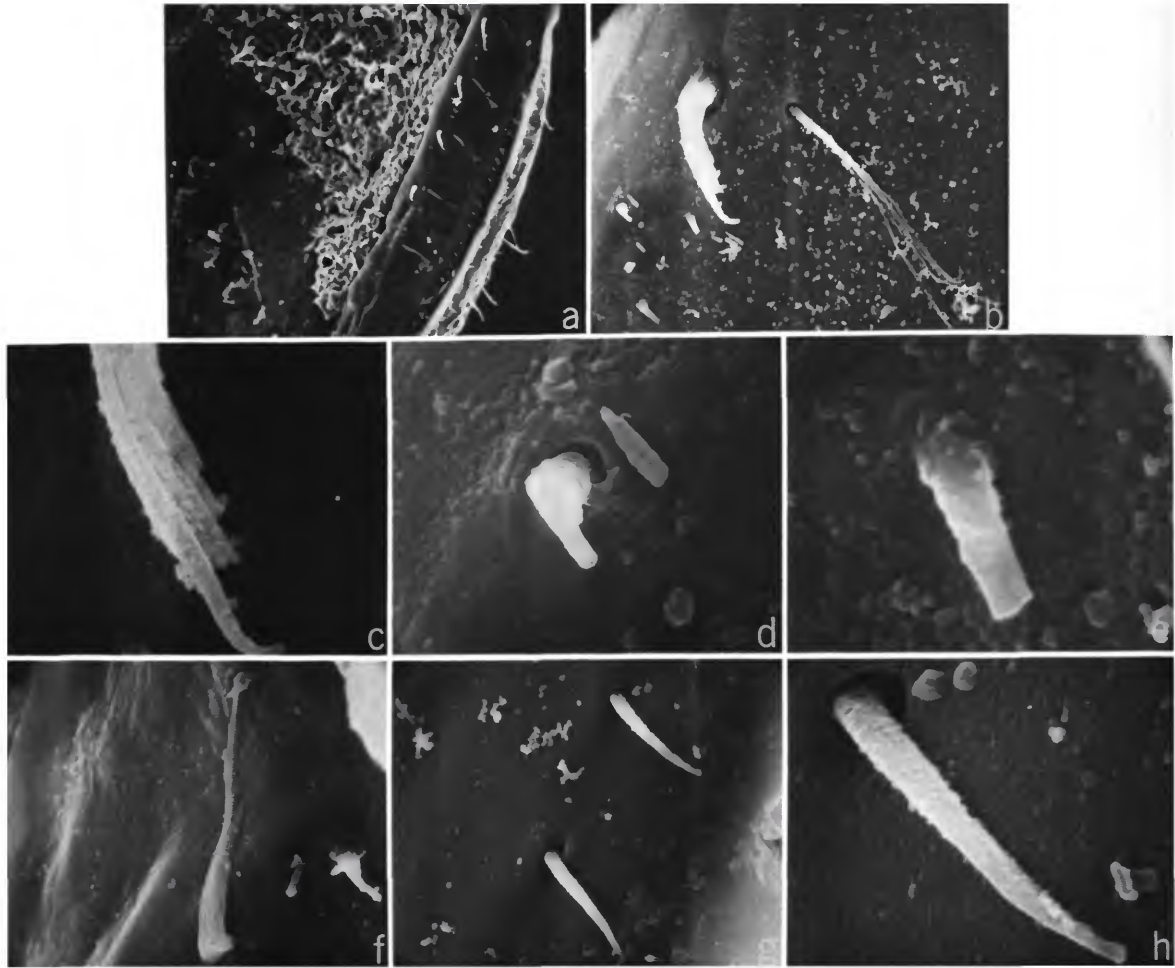


PLATE 61.—*Actinoseta hummelincki*, new species, adult female, paratype, USNM 150295, inside views: *a*, posterior infold, from Plate 60*i*, $\times 210$; *b*, bristles and tubes near middle of *a*, $\times 1575$; *c*, tip of stout bristle shown in *b*, $\times 5250$; *d*, short tubular bristle on left of stout bristle shown in *b*, $\times 10,500$; *e*, short tubular bristle just below stout bristle shown in *b*, $\times 14,900$; *f*, bristles on posterior list just dorsal to segment shown in *a*, $\times 1985$; *g*, 2 bristles in the row on posterior infold near dorsal margin of valve, from *a*, $\times 3200$; *h*, upper bristle shown in *g*, $\times 10,500$. (Micrographs reduced to 55%.)

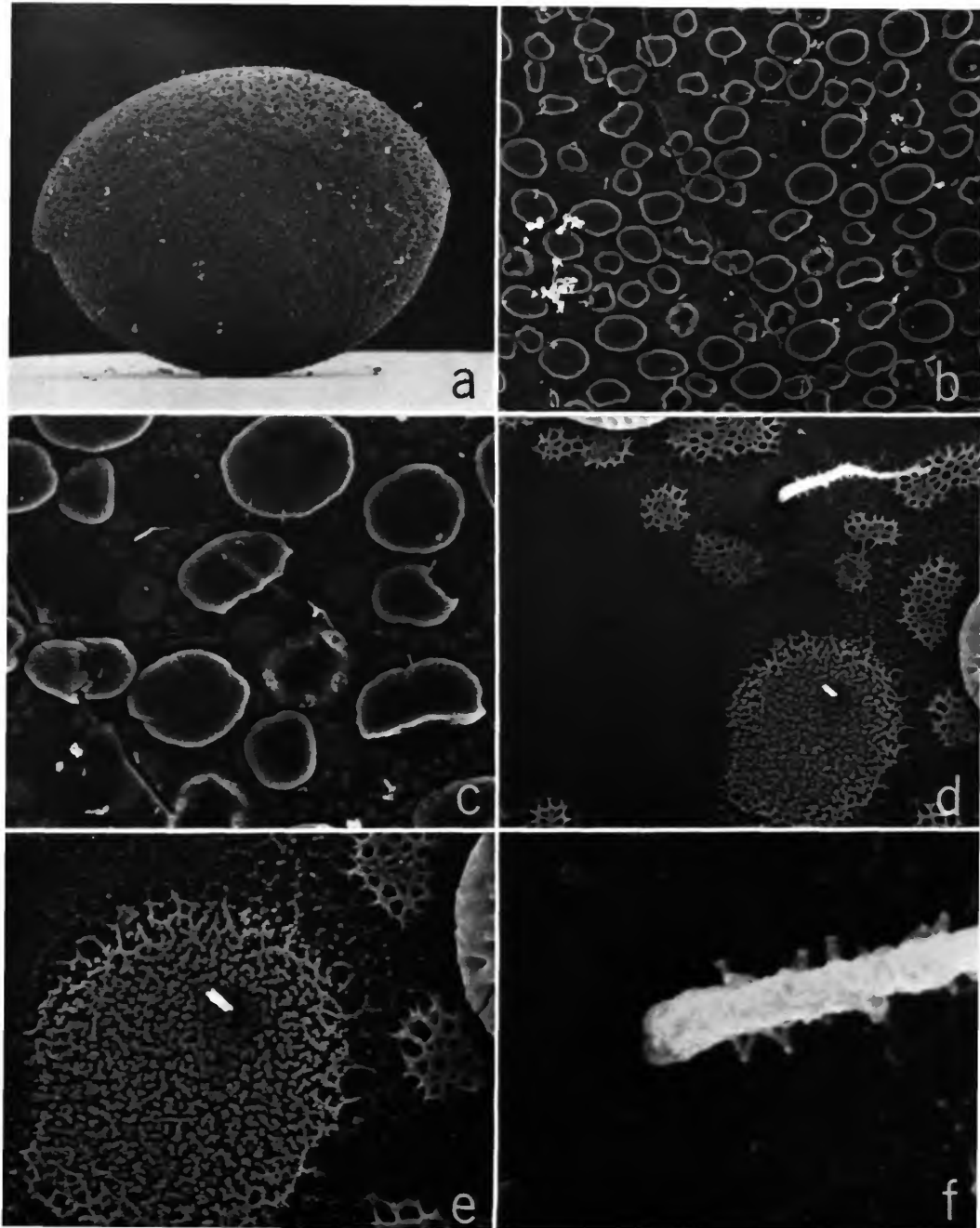
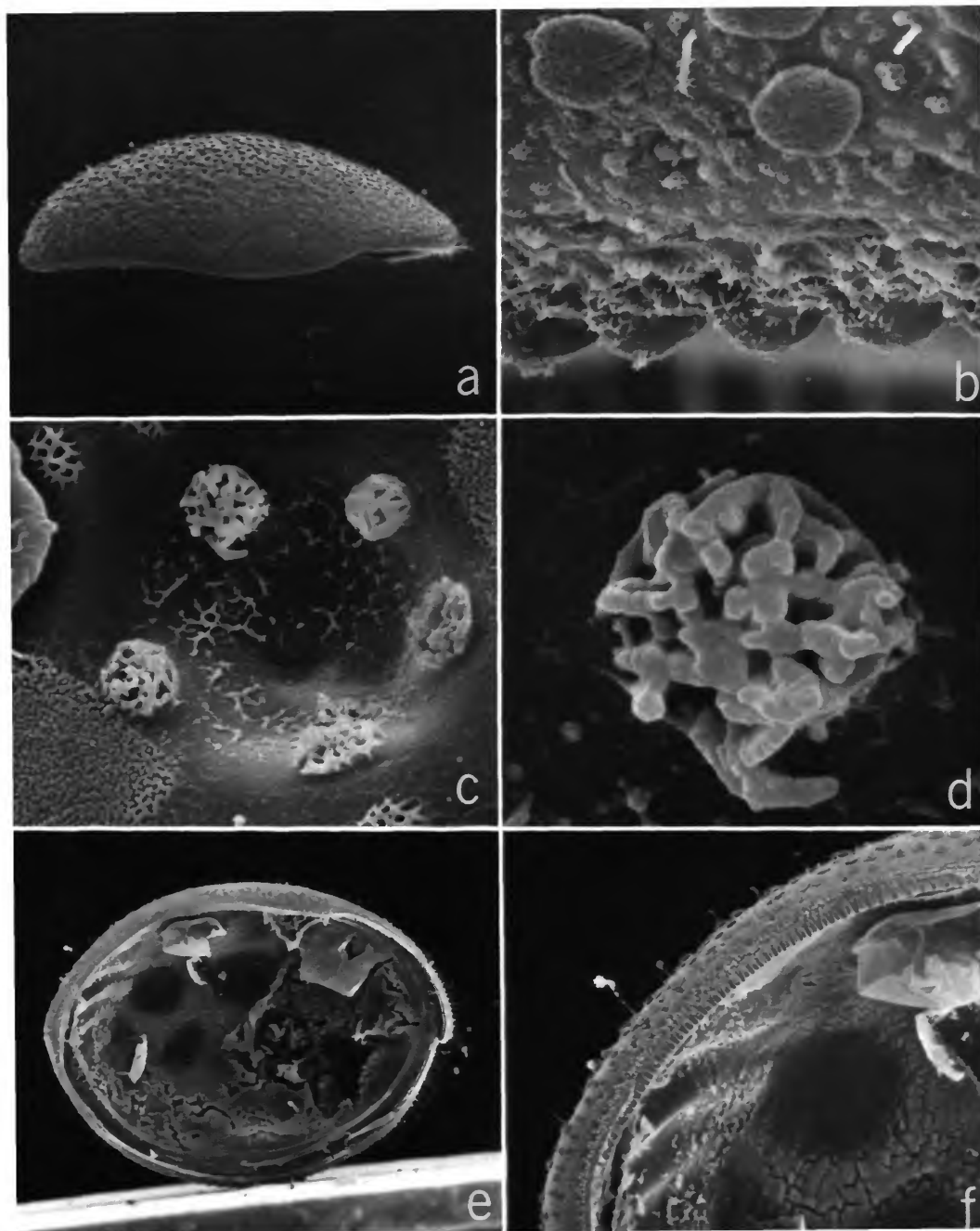


PLATE 62.—*Actinoseta jonesi*, new species, ovigerous female, holotype, USNM 157636, left valve, outside views: *a*, lateral view, $\times 36$; *b*, detail of surface near middle, from *a*, $\times 200$; *c*, detail from near middle of *b*, $\times 500$; *d*, detail from middle left of *c*, $\times 2000$; *e*, detail from lower right of *d*, $\times 3600$; *f*, bristle in *d*, $\times 10,000$. (Micrographs reduced to 82%.)



PLATES 63.—*Actinoseta jonesi*, new species, ovigerous female, holotype, USNM 157636, left valve: *a*, dorsal view, anterior to right, $\times 36$; *b*, dorsal edge near posterior end of valve, from *a*, $\times 1000$; *c*, detail of surface just posterior to middle of valve, from *a*, $\times 2000$; *d*, detail of process shown in *c*, $\times 10,000$; *e*, medial view of valve, $\times 35$; *f*, posterodorsal edge of valve, from *e*, $\times 100$. (Micrographs reduced to 82%.)

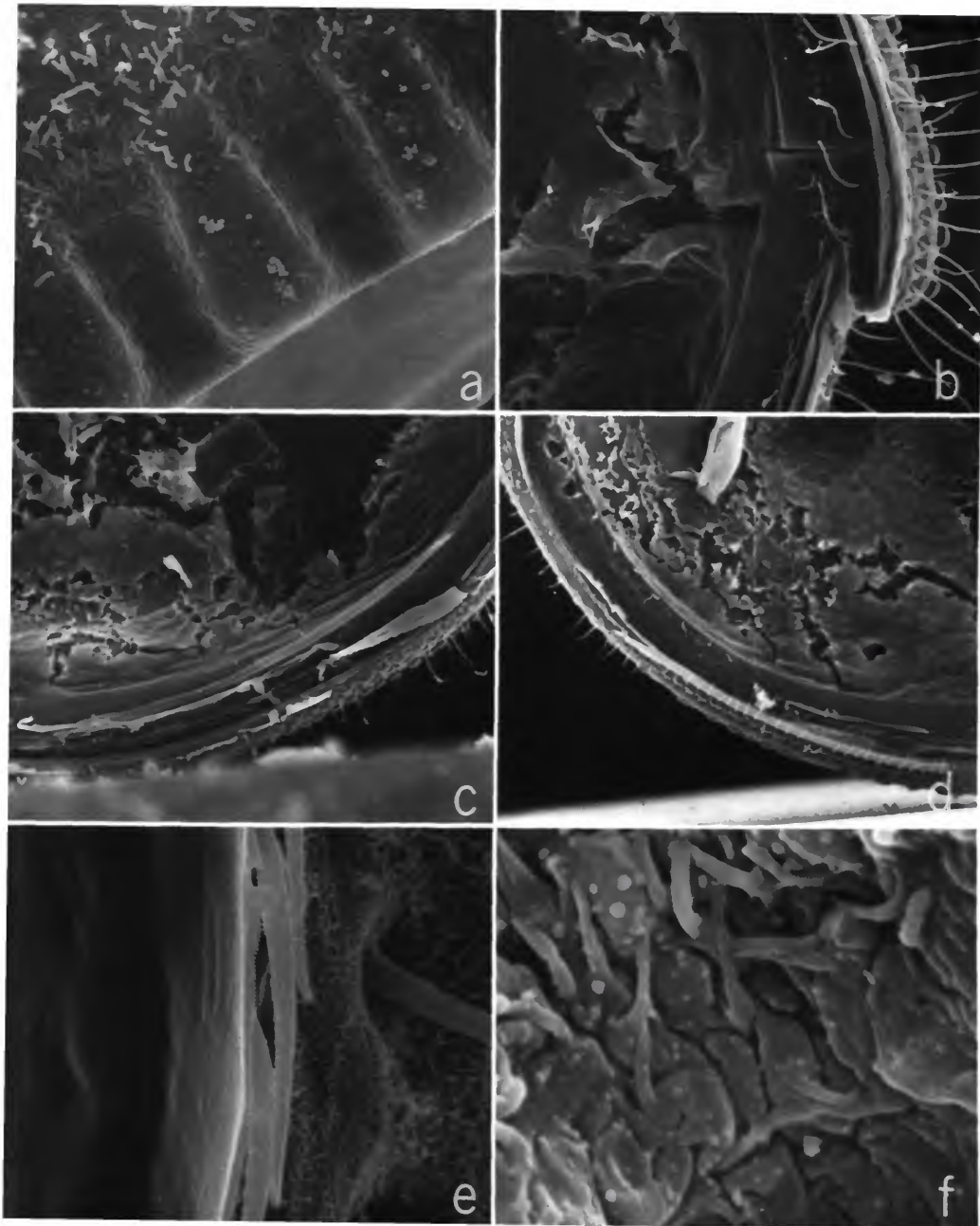


PLATE 64.—*Actinoseta jonesi*, new species, ovigerous female, holotype, USNM 157636, left valve, inside views: *a*, postero-dorsal tooth-and-socket structures, from Plate 63*f*, $\times 2000$; *b*, anterior end of valve, from Plate 63*e*, $\times 200$; *c*, antero-ventral margin, from Plate 63*e*, $\times 100$; *d*, postero-ventral margin, from Plate 63*e*, $\times 100$; *e*, anterior edge of rostrum, from *b*, $\times 2000$; *f*, proximal surface of socket shown in *a*, $\times 10,000$. (Micrographs reduced to 80%.)

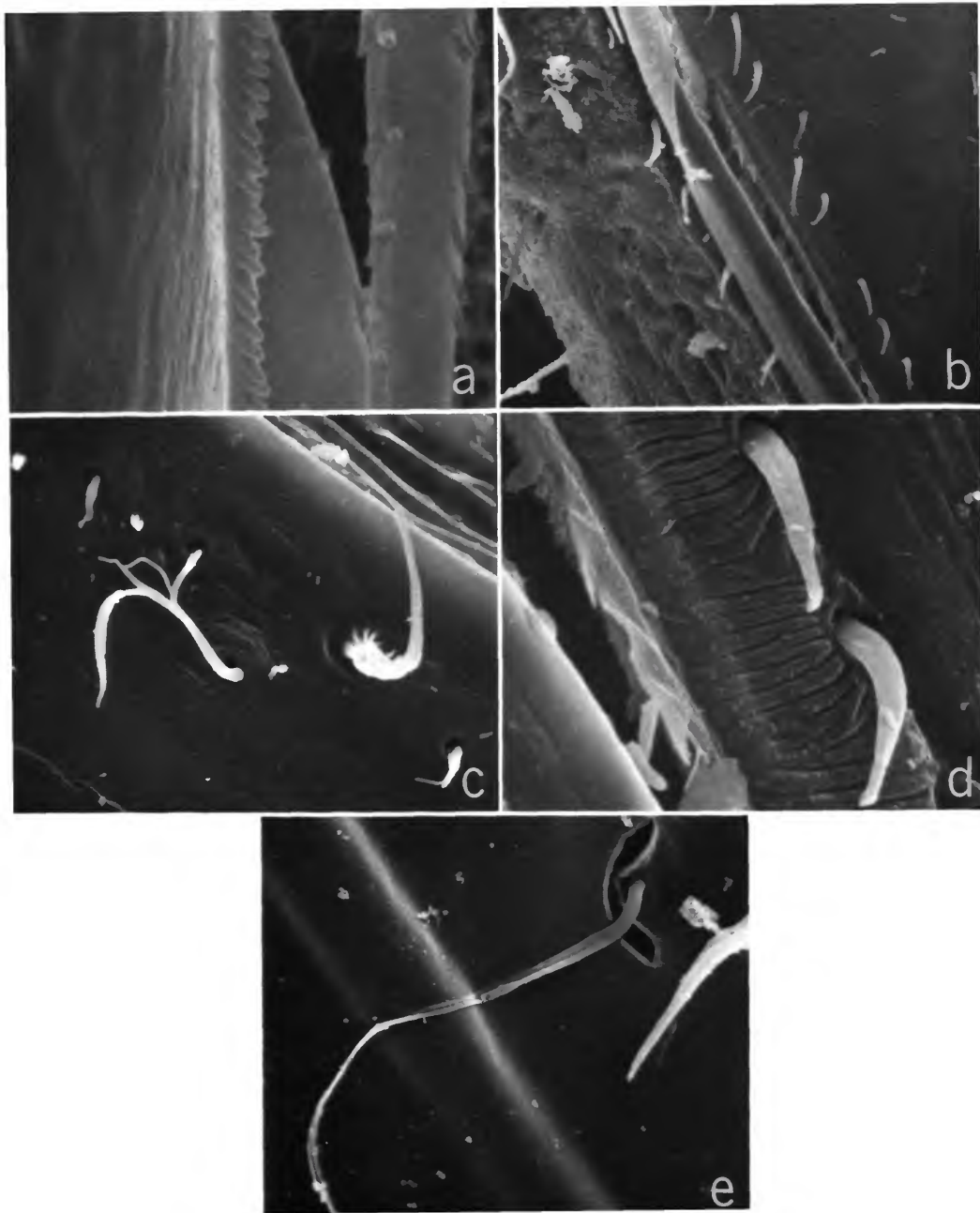


PLATE 65.—*Actinoseta jonesi*, new species, ovigerous female, holotype, USNM 157636, left valve, inside views: *a*, serrate selvage along margin of rostrum, from Plate 64*b*, $\times 10,000$; *b*, posteroventral edge of valve, from Plate 64*d*, $\times 1000$; *c*, bristles on list of posteroventral infold, from Plate 64*d*, $\times 2000$; *d*, detail of bristles and crenulations in *b*, $\times 5000$; *e*, bristle on list of posteroventral infold near upper part of Plate 64*d*, $\times 2000$. (Micrographs reduced to 80%.)

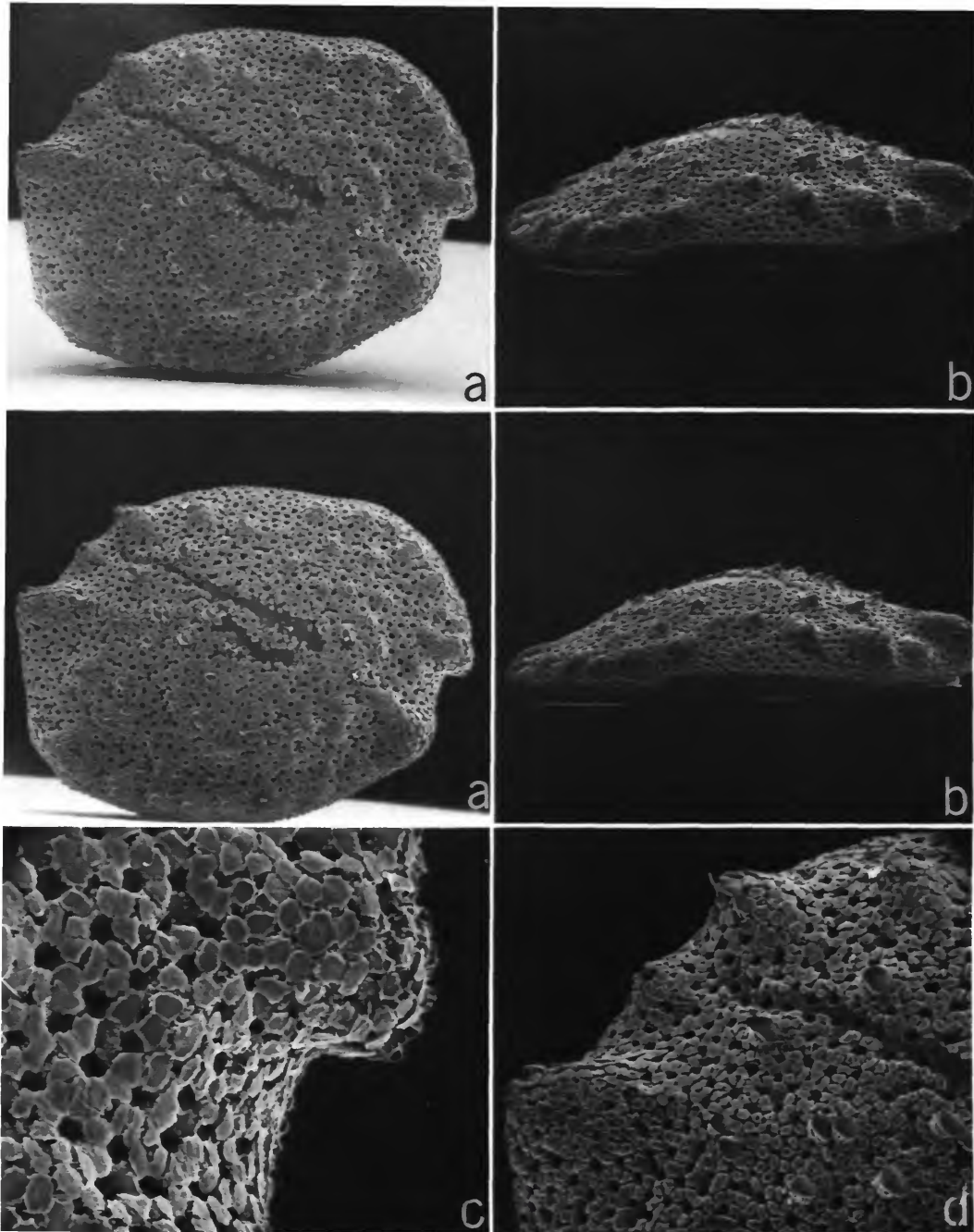


PLATE 66.—*Actinoseta nodosa*, new species, juvenile female, holotype, USNM 157417, right valve, outside views: *a*, lateral view, stereoscopic pair, $\times 45$; *b*, dorsal view, anterior to left, stereoscopic pair, $\times 44$; *c*, rostrum and incisur, from *a*, $\times 200$; *d*, posterodorsal corner of valve, from *a*, $\times 100$. (Micrographs reduced to 81%.)

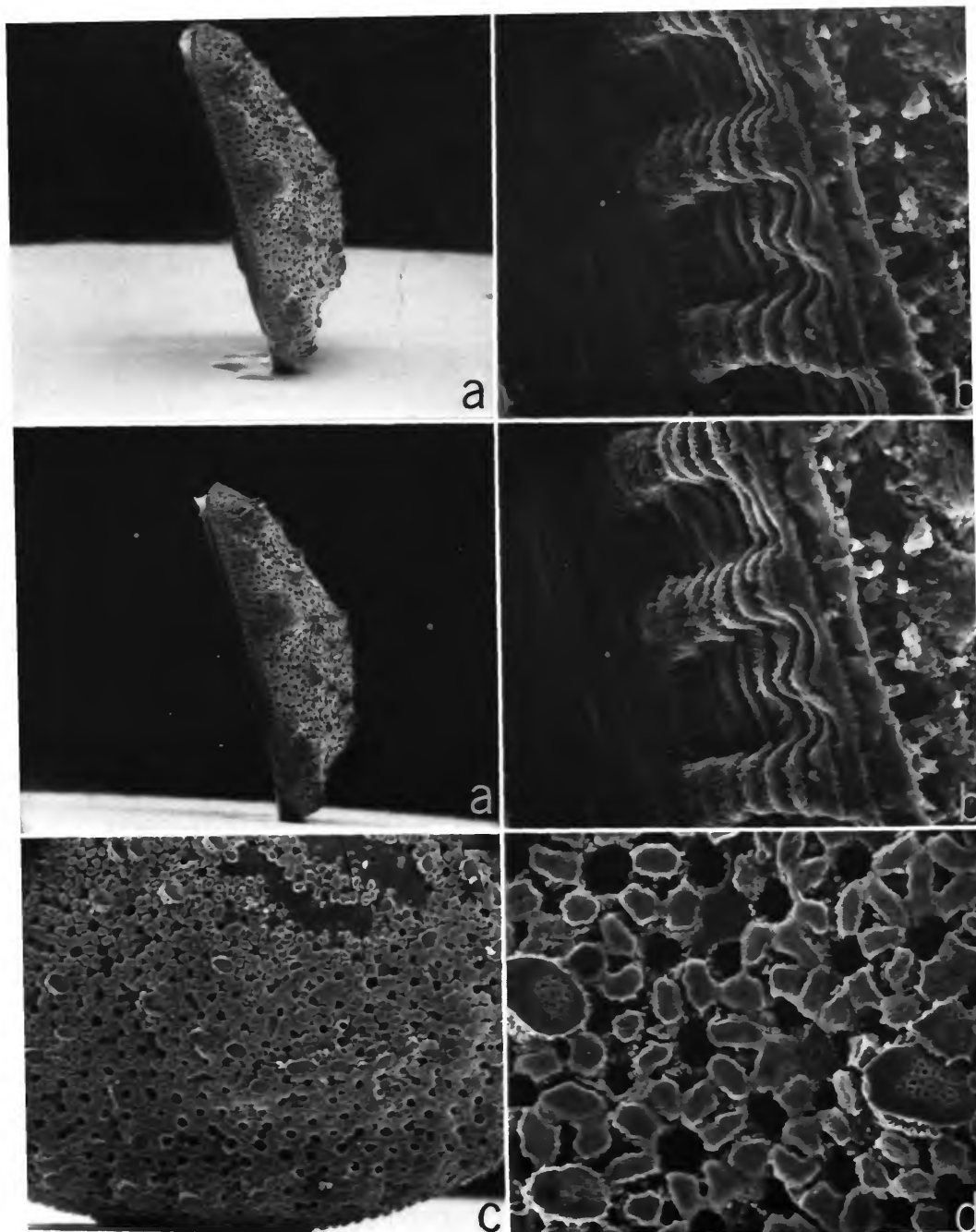


PLATE 67.—*Actinoseta nodosa*, new species, juvenile female, holotype, USNM 157417, right valve: a, posterior view, stereoscopic pair, $\times 45$; b, detail of teeth and sockets along dorsal margin, inside view from Plate 69c, stereoscopic pair, $\times 950$; c, bottom half of valve, from Plate 66a, $\times 75$; d, detail of surface near left end of c, $\times 300$. (Micrographs reduced to 80%.)

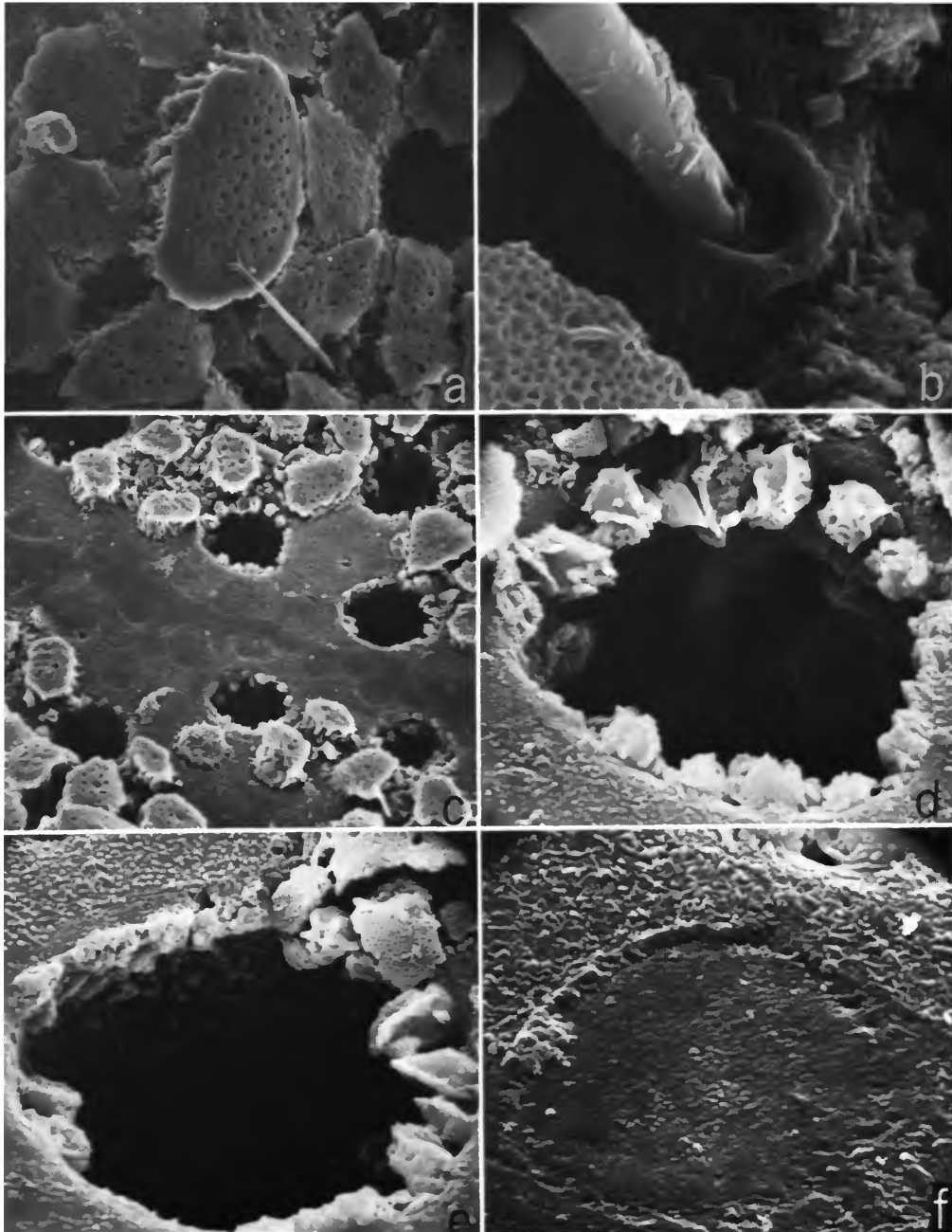


PLATE 68.—*Actinoseta nodosa*, new species, juvenile female, holotype, USNM 157417, right valve, outside views: *a*, discs and bristle, from Plate 66*c*, $\times 900$; *b*, detail of base of bristle in *a*, $\times 10,000$; *c*, detail of surface of valve, from Plate 66*a* (note impression of discs in bare area), $\times 550$; *d*, *e*, detail of fossa in *c*, $\times 2600$; *f*, detail of impression of disc in *c*, $\times 5000$. (Micrographs reduced to 77%.)

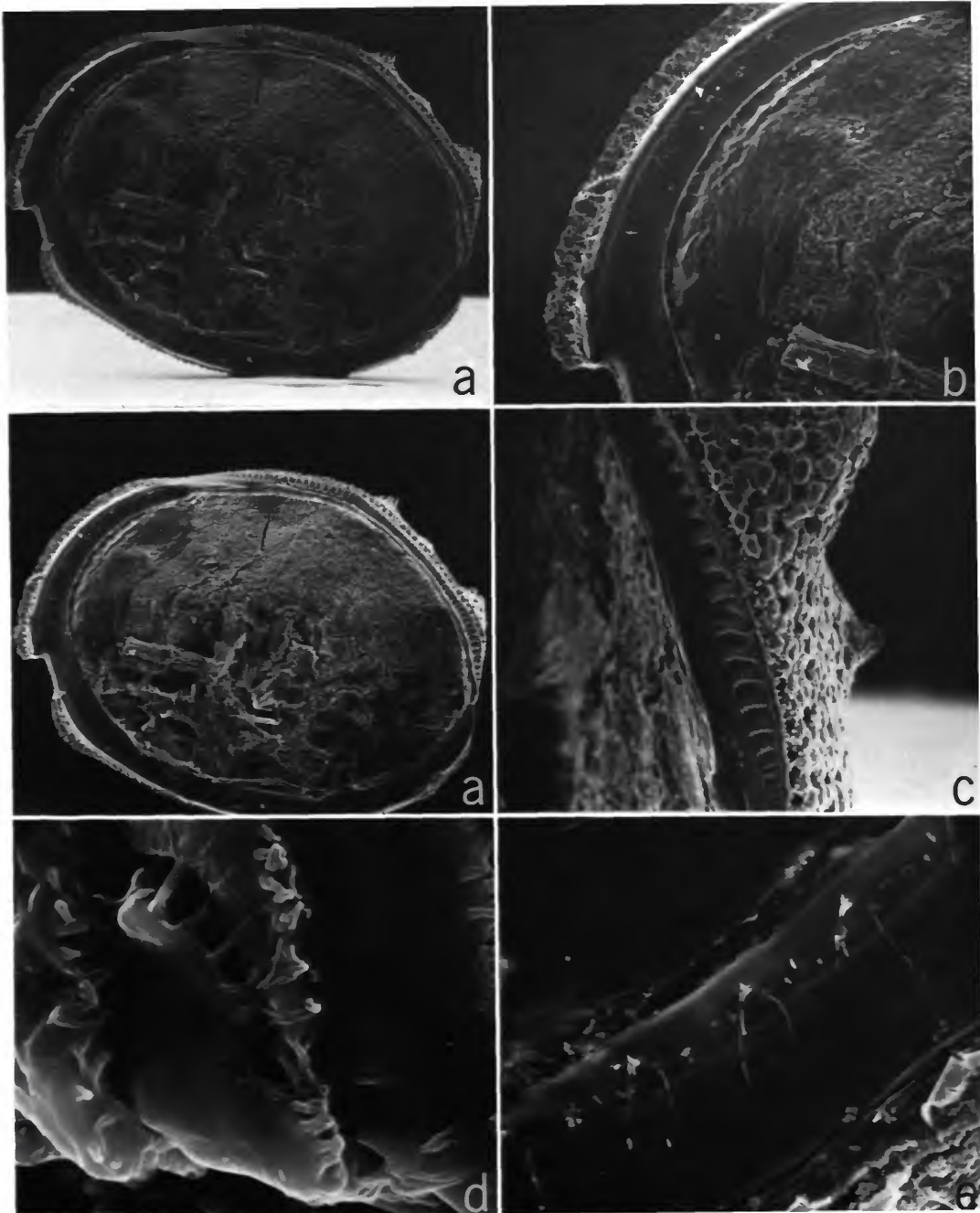


PLATE 69.—*Actinoseta nodosa*, new species, juvenile female, holotype, USNM 157417, right valve, inside views: *a*, complete valve, stereoscopic views, $\times 50$; *b*, anteroventral margin, from *a*, $\times 110$; *c*, segment of posterodorsal margin, from *a*, $\times 190$; *d*, detail of lower tooth in Plate 67*b*, $\times 6000$; *e*, bristles of posteroventral infold, from *a*, $\times 500$. (Micrographs reduced to 80%.)

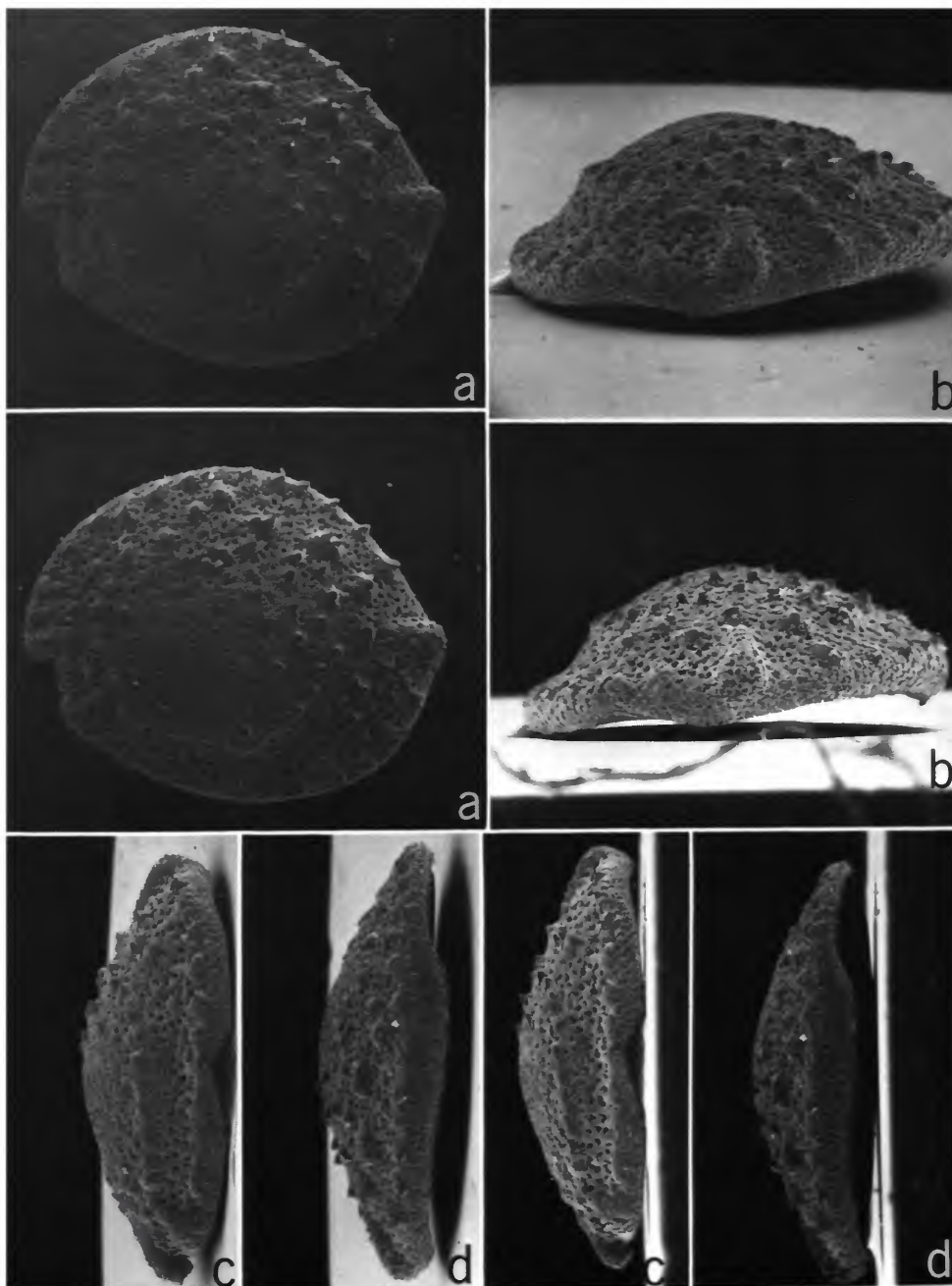


PLATE 70.—*Actinoseta nodosa*, new species, juvenile, USNM 157418A, left valve, stereoscopic pairs: *a*, lateral view, $\times 40$; *b*, posterior view ventral margin to left, $\times 55$; *c*, ventral view (triangular chip missing near middle of margin), anterior towards bottom, $\times 40$; *d*, dorsal view; anterior towards top, $\times 40$. (Micrographs reduced to 75%.)

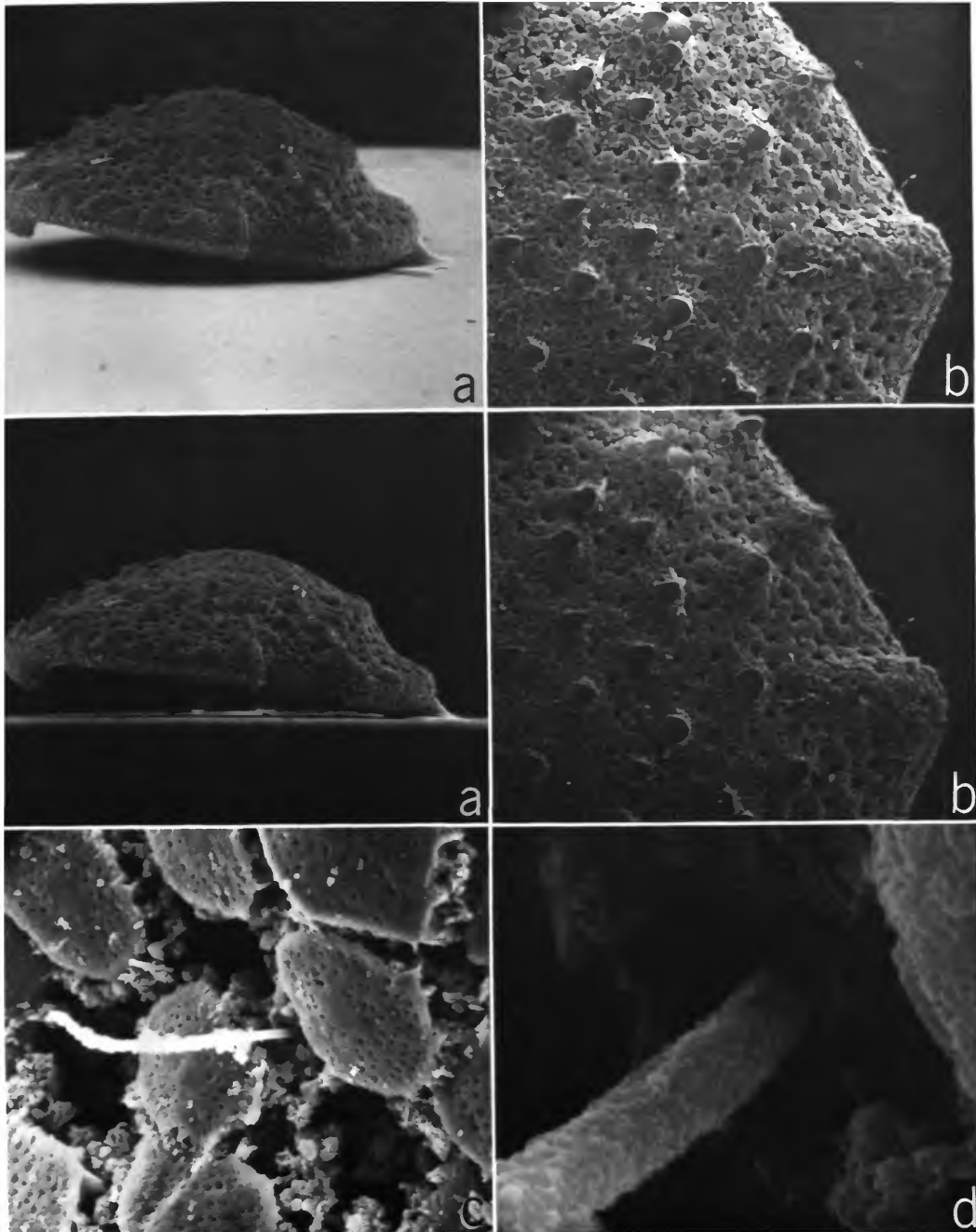


PLATE 71.—*Actinoseta nodosa*, new species, juvenile, USNM 157418A, left valve, outside views: *a*, anterior view, ventral margin to right, stereoscopic pair, $\times 55$; *b*, segment of dorsal margin from Plate 70*a*, stereoscopic pair, $\times 95$; *c*, detail of discs and a bristle just posterior to rostrum, from Plate 70*a*, $\times 1050$; *d*, base of bristle in *c*, $\times 10,000$. (Micrographs reduced to 80%.)

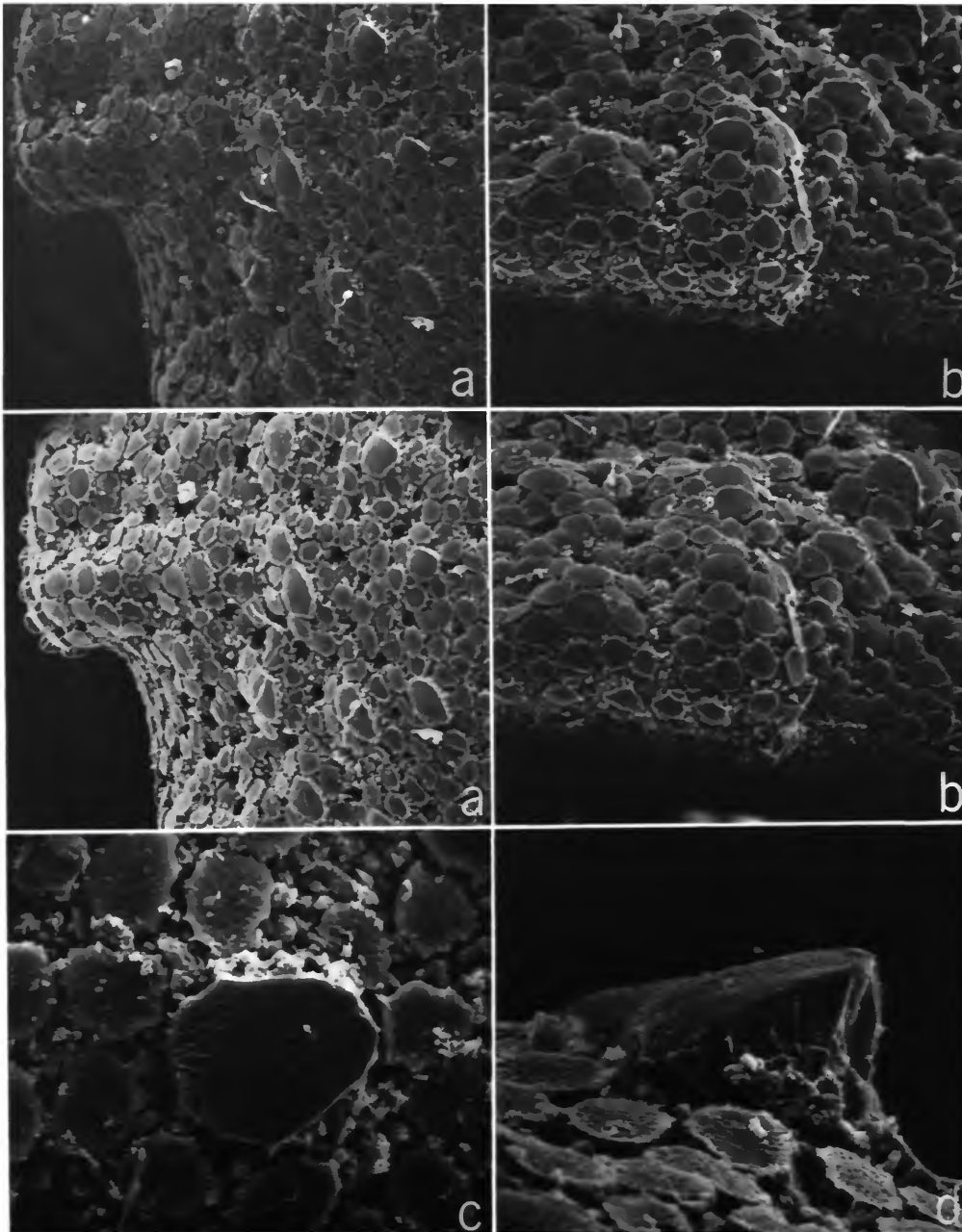


PLATE 72.—*Actinoseta nodosa*, new species, juvenile, USNM 157418A, left valve, outside views: *a*, rostrum and incisur, from Plate 70*a*, stereoscopic pair, $\times 150$; *b*, anterior view of rostral area, from Plate 71*a*, stereoscopic pair, $\times 220$; *c*, detail showing large disc surrounded by smaller discs, from near middle of Plate 71*b*, $\times 95$; *d*, ventral view of disc near posterior end of valve, from Plate 70*c*, $\times 800$. (Micrographs reduced to 78%.)

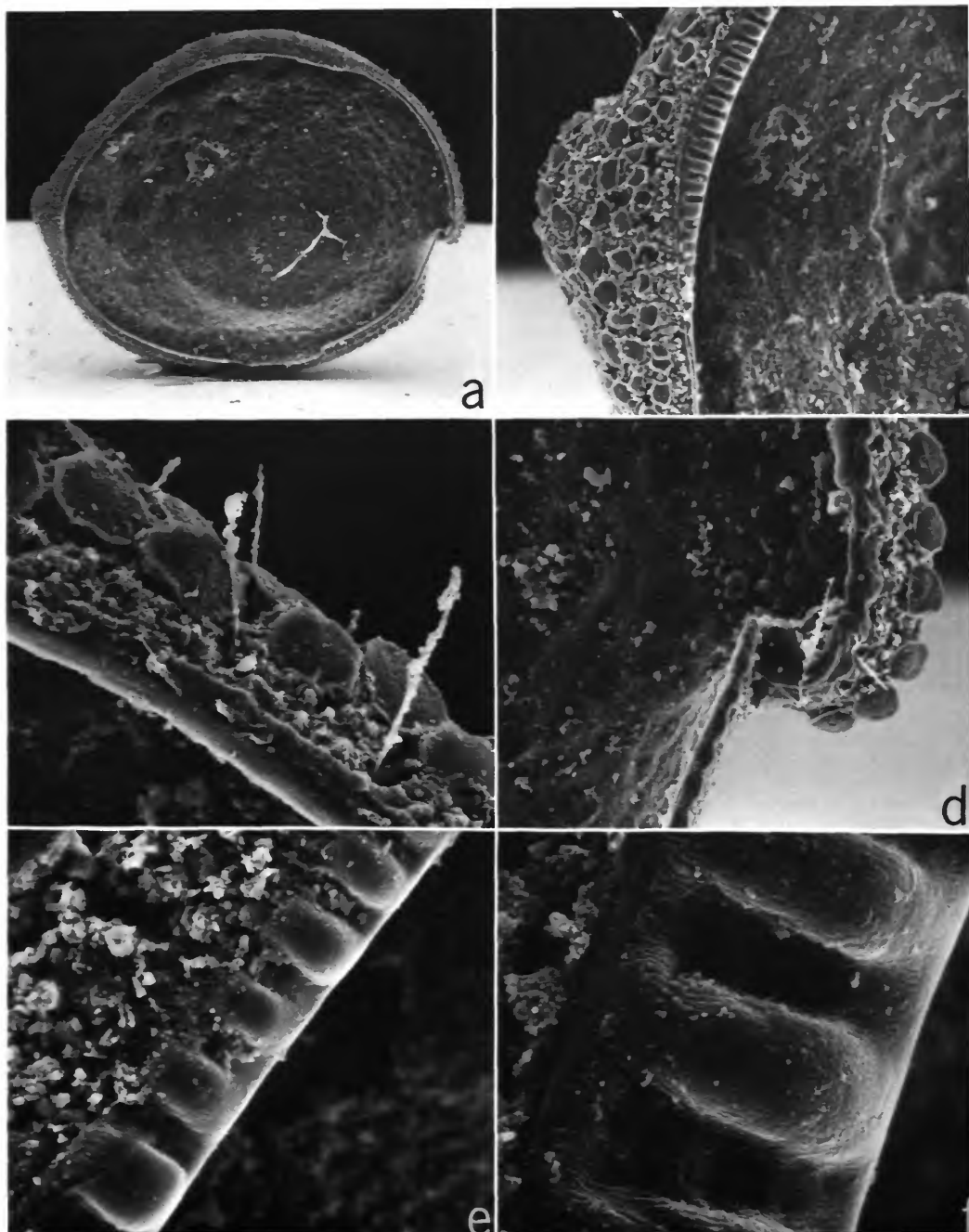


PLATE 73.—*Actinoseta nodosa*, new species, juvenile, USNM 157418A, left valve, inside views: *a*, complete valve, $\times 40$; *b*, segment of posterior margin, from *a*, $\times 200$; *c*, anteroventral edge of valve, from *a*, $\times 650$; *d*, rostrum and incisur, from *a*, $\times 300$; *e*, teeth and sockets forming row along posterodorsal margin, from *a*, $\times 1000$; *f*, detail of teeth and sockets in *b*, $\times 2000$. (Micrographs reduced to 80%.)

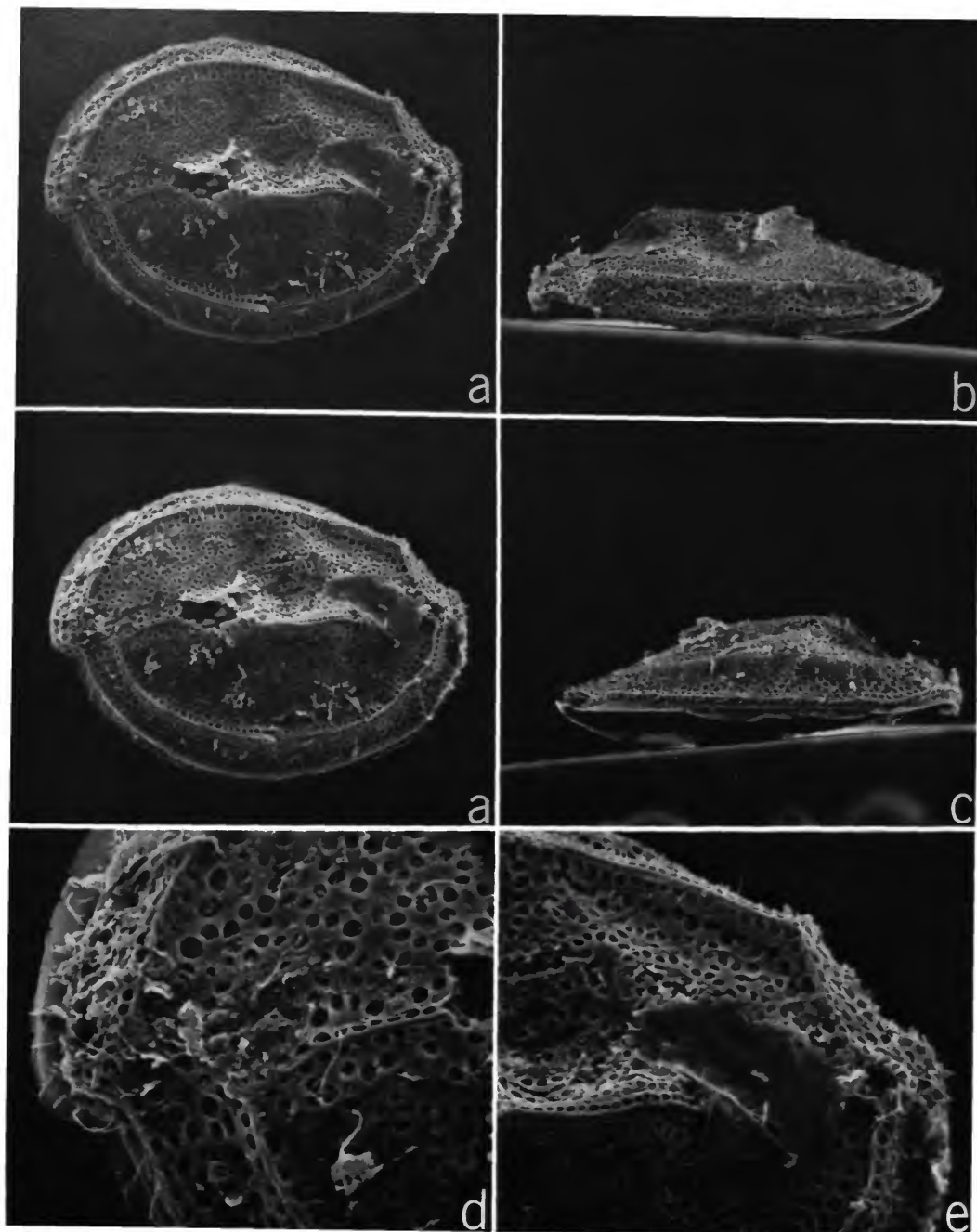


PLATE 74.—*Asteropella monambon* (Kornicker), adult male, holotype, USNM 122899, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 66$; *b*, dorsal view, anterior to right, $\times 66$; *c*, ventral view, anterior to left, $\times 66$; *d*, anterior of valve, from *a*, $\times 200$; *e*, posterodorsal part of valve, from *a*, $\times 155$. (Micrographs reduced to 80%.)

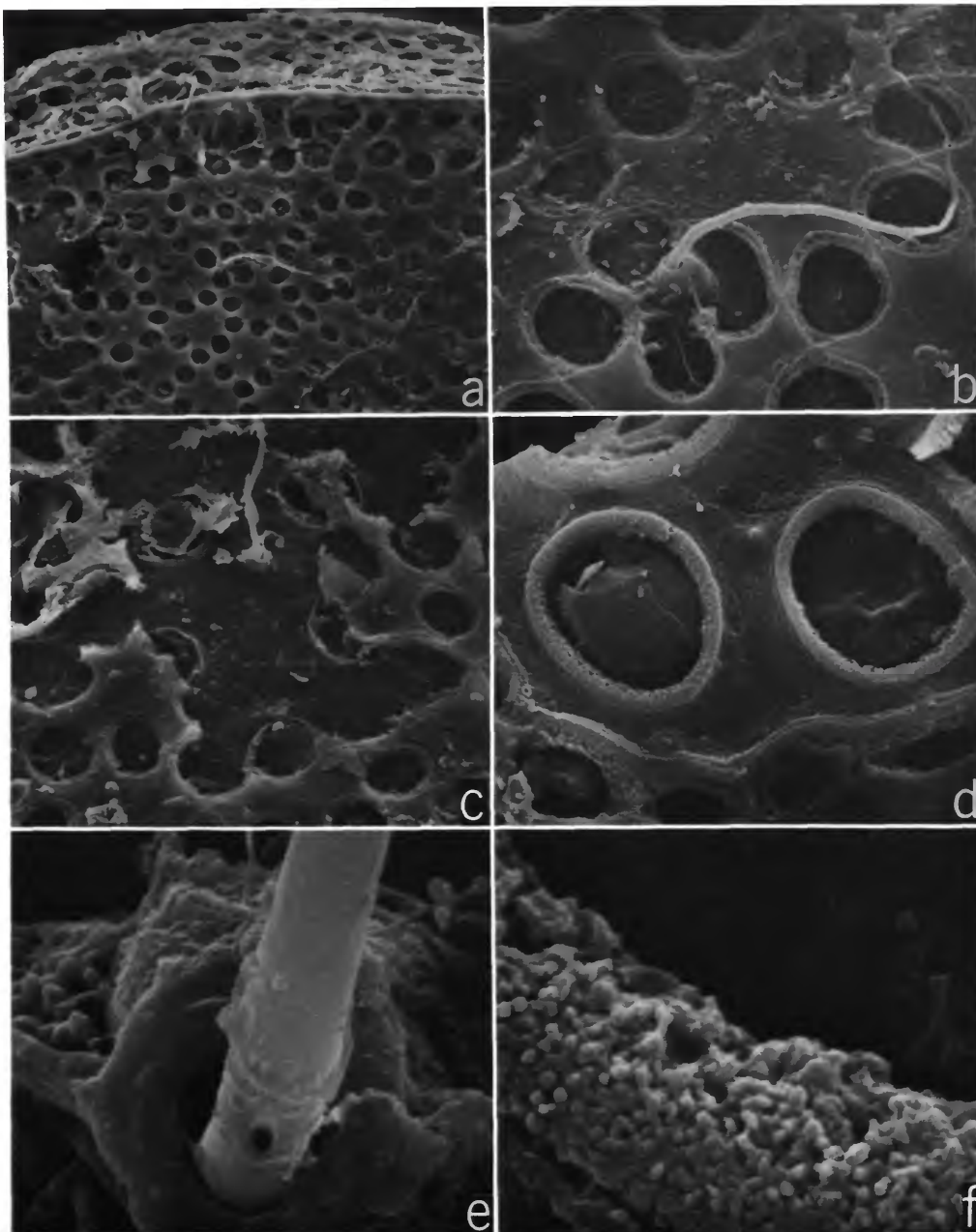


PLATE 75.—*Asteropella monambon* (Kornicker), adult male, holotype, USNM 122899, left valve, outside views: *a*, fossae and concentric ridge in dorsal part of valve, from Plate 74*a*, $\times 300$; *b*, fossae with central bristle, $\times 1250$; *c*, area from Plate 74*a* where surface layer of shell is missing (note oval depressions in surface with shell layer missing), $\times 750$; *d*, oval fossae in area of central adductor muscle attachments, from Plate 74*a*, $\times 1500$; *e*, bristle with pore near base, $\times 10,000$; *f*, edge of fossae in *d*, $\times 15,000$. (Micrographs reduced to 77%.)

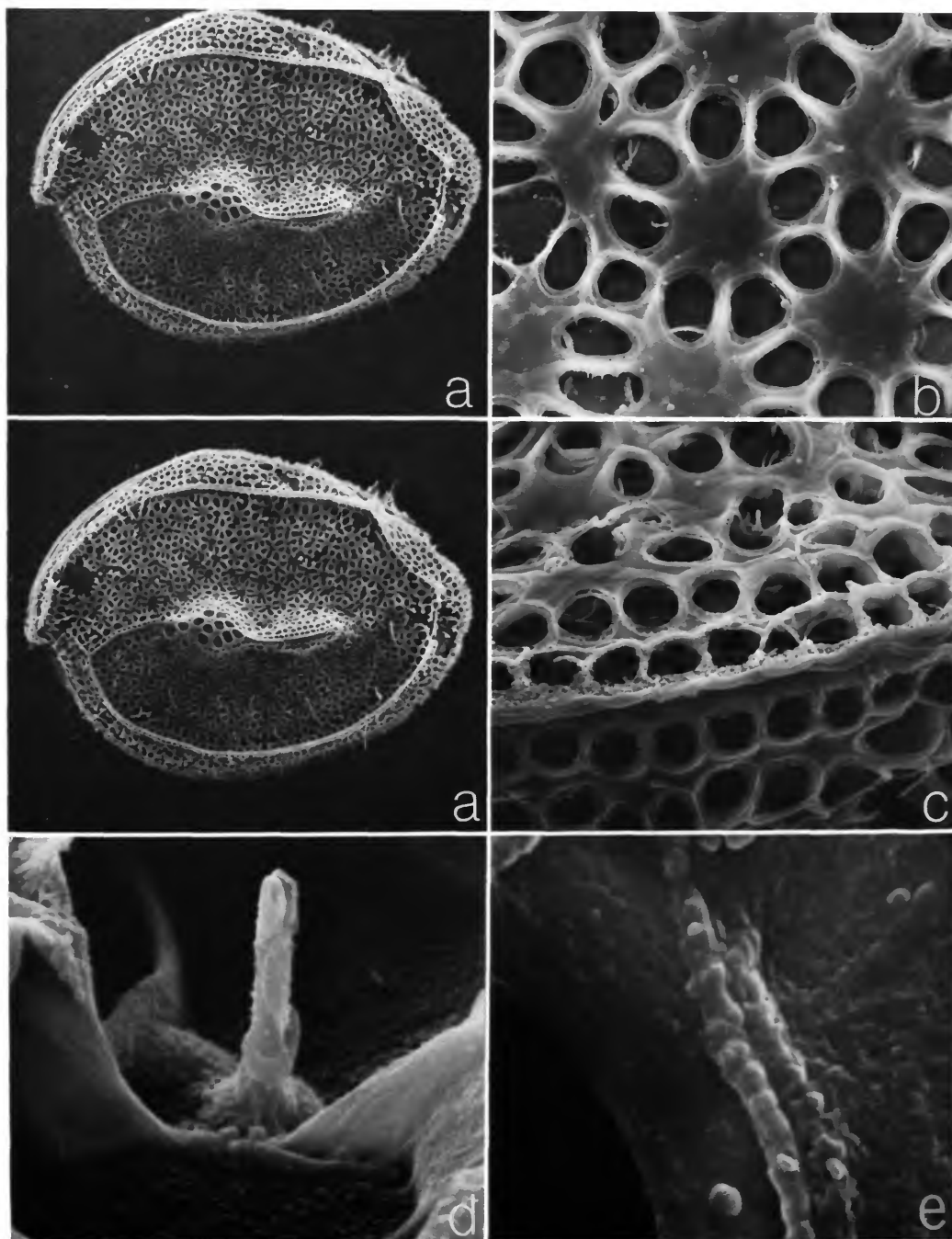


PLATE 76.—*Asteropella monambon* (Kornicker), adult male, USNM 157366A, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 75$; *b*, fossae on surface, from *a*, $\times 750$; *c*, segment of horizontal midridge near posterior end, from *a*, $\times 820$; *d*, detail of bristle in *c*, $\times 8200$; *e*, detail of margin of fossa on right side of Plate 77*d*, $\times 10,000$. (Micrographs reduced to 77%.)

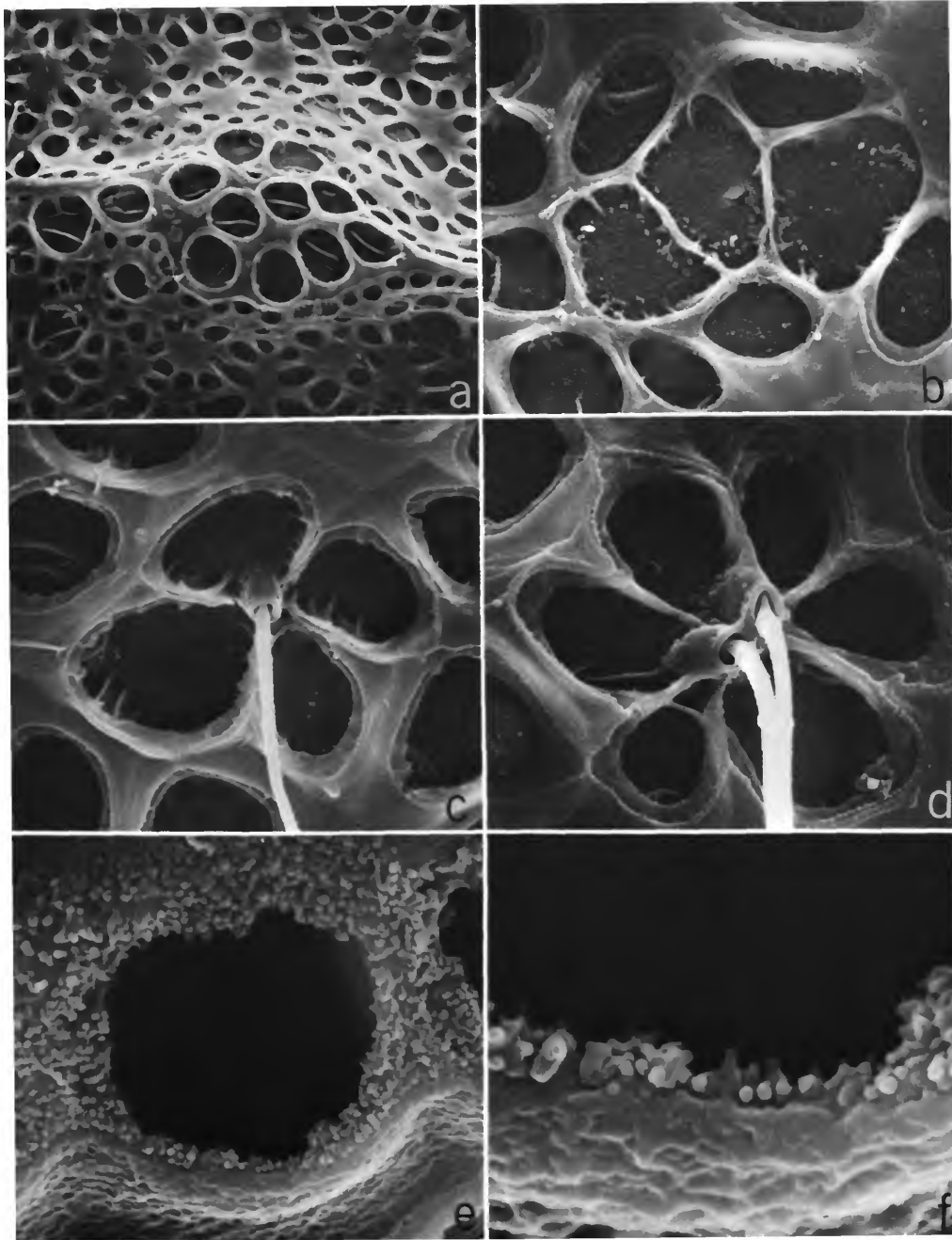


PLATE 77.—*Asteropella monambon* (Kornicker), adult male, USNM 157366A, left valve, outside views: *a*, fossae in area of central adductor muscle attachments, from Plate 70*a*, $\times 340$; *b*, fossae in left part of Plate 76*b*, $\times 1500$; *c*, *d*, fossae with 1 and 2 central bristles, from Plate 76*a*, $\times 1500$, 1750; *e*, fossae just below midridge, from Plate 76*c*, $\times 5000$; *f*, detail of margin of fossa in *e*, $\times 15,000$. (Micrographs reduced to 76%.)

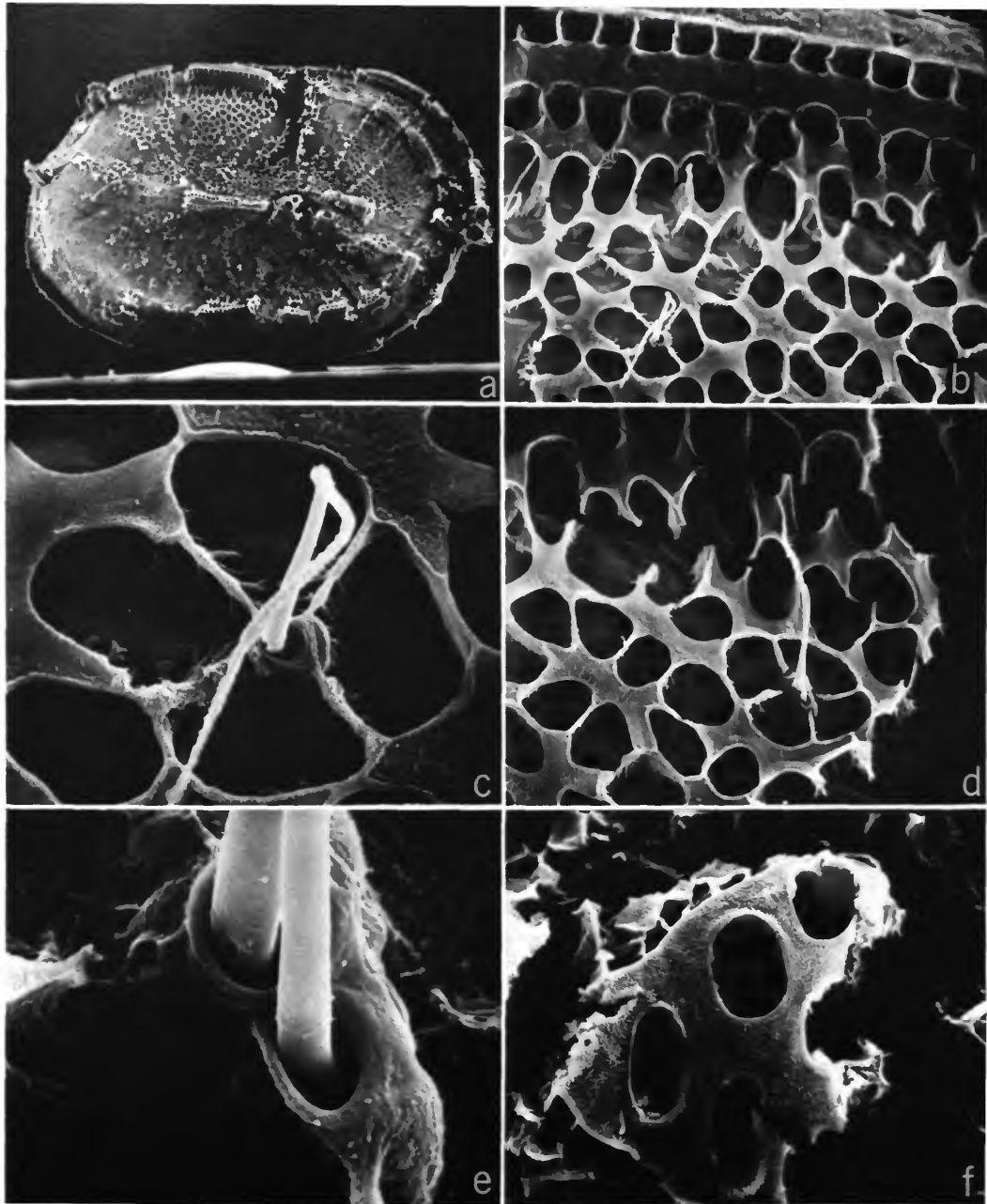


PLATE 78.—*Asteropella monambon* (Kornicker), ovigerous female, USNM 150285, right valve with some of surface features missing, outside views: *a*, lateral view, $\times 63$; *b*, part of peripheral ridge near dorsal margin, from *a*, $\times 450$; *c*, fossae and bristle, from *b*, $\times 1620$; *d*, fossae and bristle near dorsal to middle of valve, from *a*, $\times 620$; *e*, detail of pores and bases of bristles in *d* (note pore near base of upper bristle), $\times 6300$; *f*, oval fossae in area of central adductor muscle attachments, from *a*, $\times 660$. (Micrographs reduced to 74%.)

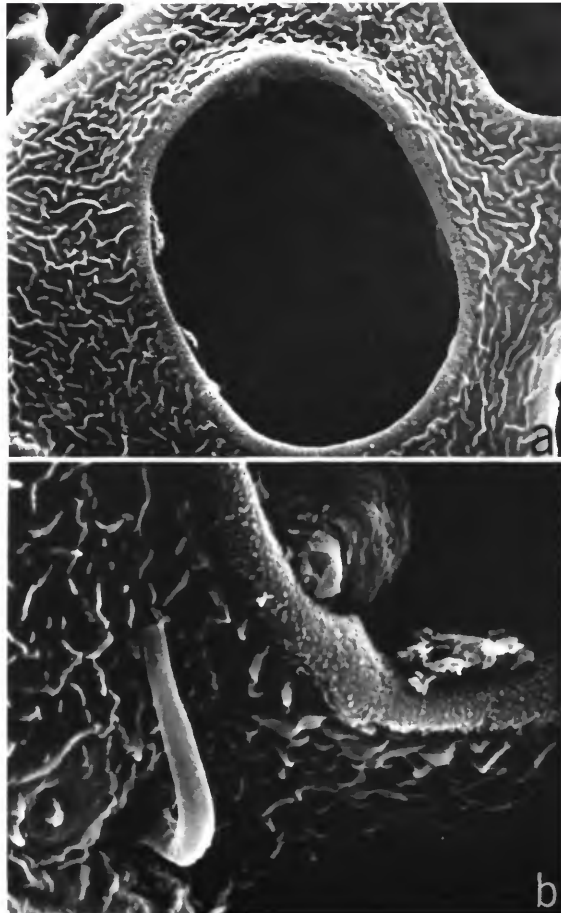


PLATE 79.—*Asteropella monambon* (Kornicker), ovigerous female, USNM 150285, right valve, outside views: *a*, detail of fossa in area of central adductor muscle attachments, from Plate 78*f*, $\times 2500$; *b*, bristle in vicinity of central adductor muscle attachments, from Plate 78*f*, $\times 5400$. (Micrographs reduced to 79%.)

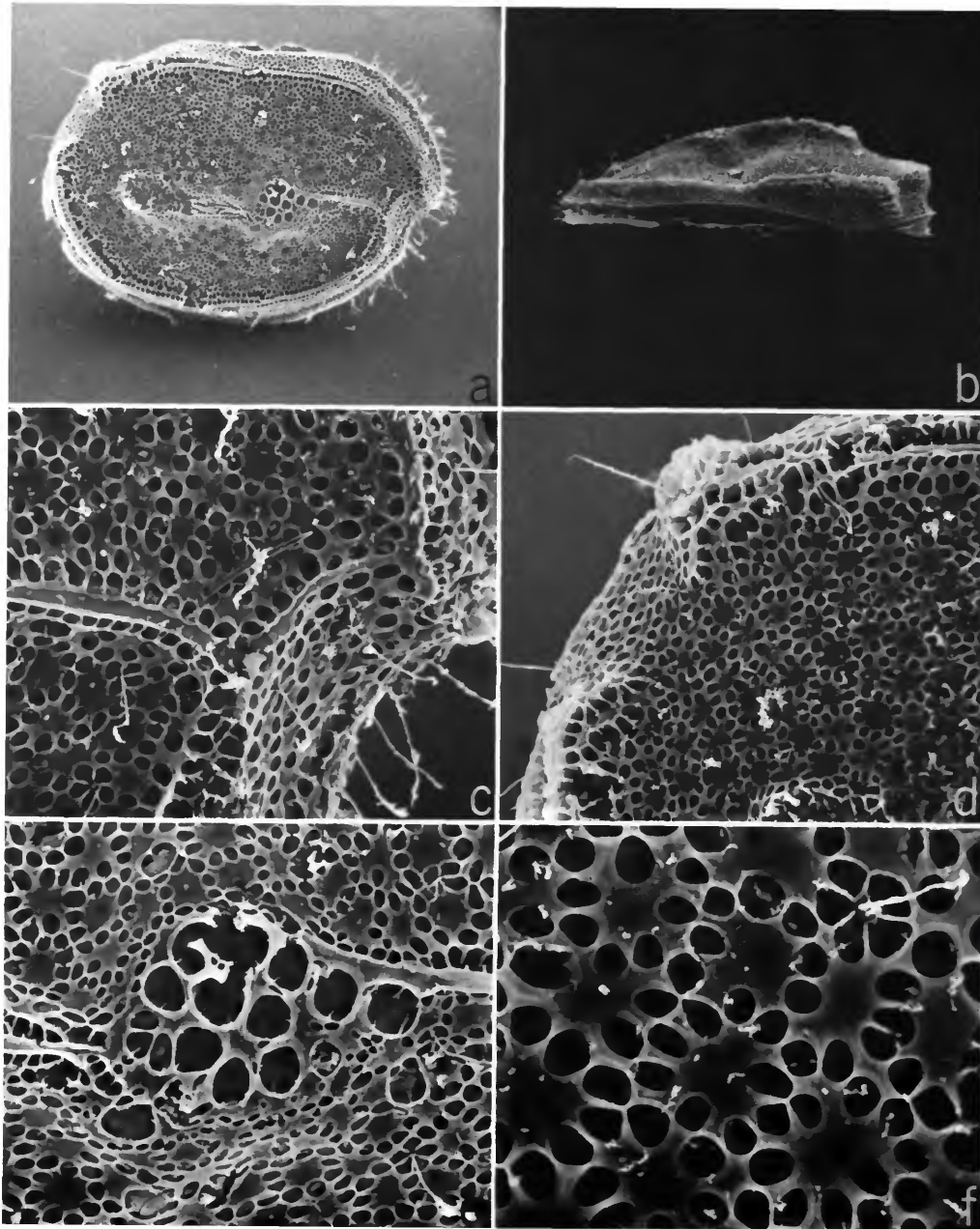


PLATE 80.—*Asteropella monambon* Kornicker, adult female, USNM 157646, right valve, outside views: *a*, lateral view, $\times 42$; *b*, dorsal view, anterior to left, $\times 40$; *c*, incisur area, from *a*, $\times 200$; *d*, posterodorsal area showing 2 protuberances on concentric ridge, from *a*, $\times 140$; *e*, area of central adductor muscle attachments, from *a*, $\times 200$; *f*, fossae and bristles on valve surface, from *a*, $\times 400$. (Micrographs reduced to 77%.)

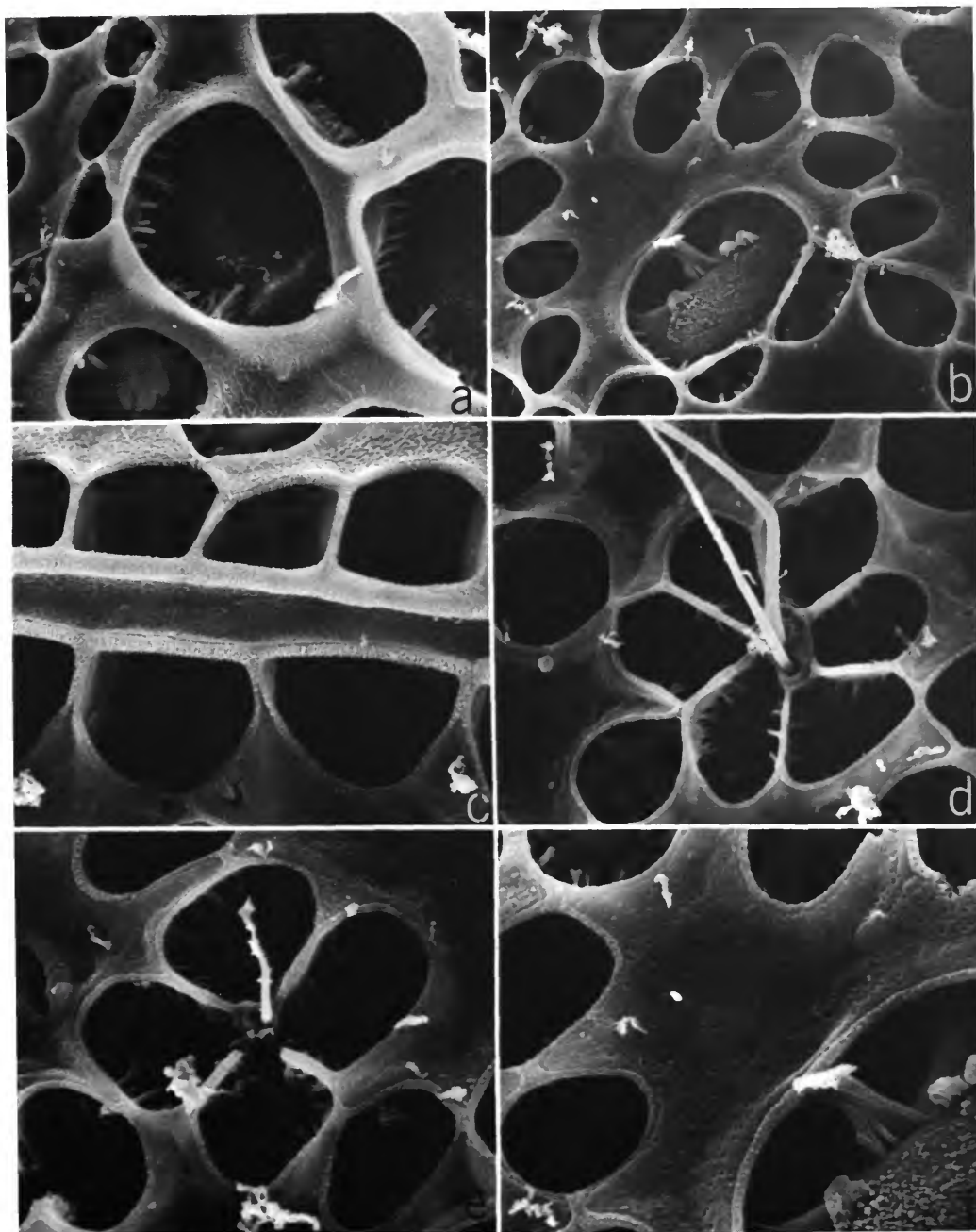


PLATE 81.—*Asteropella monambon* (Kornicker), adult female USNM 157646, right valve, outside views: *a*, detail of fossae in area of central adductor muscle attachments, from Plate 80e, $\times 1000$; *b*, fossae on upper left of Plate 80e (note pores visible beneath covering layer), $\times 1000$; *c*, detail of dorsal segment of concentric ridge, from Plate 80a, $\times 1500$; *d*, *e*, detail of fossae with central bristle, from Plate 80d, $\times 1200$; *f*, detail from *b* showing pore beneath outer layer, $\times 2000$. (Micrographs reduced to 78%.)

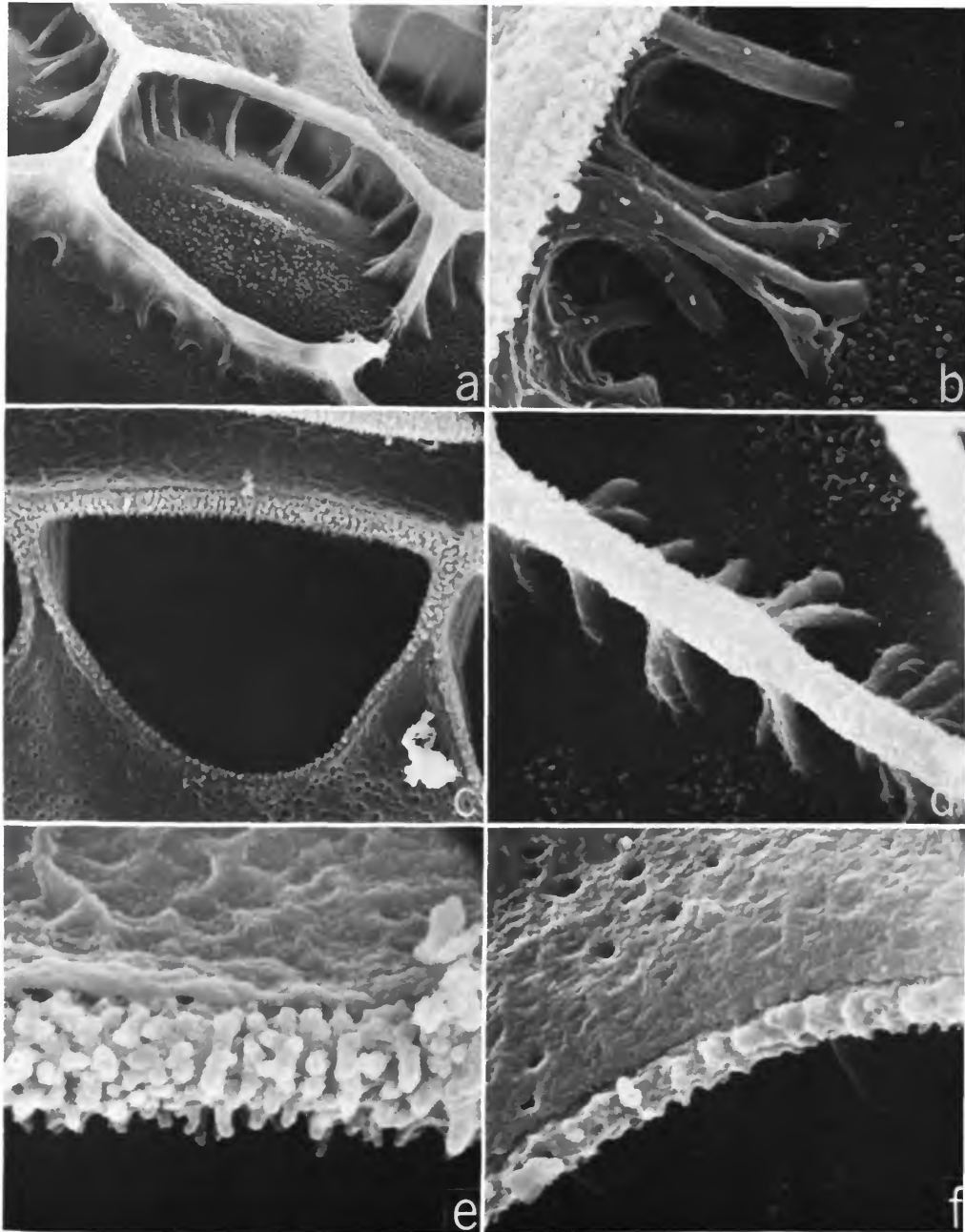


PLATE 82.—*Asteropella monambon* (Kornicker), adult female, USNM 157646, right valve, outside views: *a*, detail of fossae showing struts, from Plate 84*b*, $\times 1500$; *b*, detail of struts in fossa in middle of Plate 81*a*, $\times 7500$; *c*, detail of fossa adjacent to concentric ridge in lower right of Plate 81*c*, $\times 3000$; *d*, detail of struts, from Plate 81*d*, $\times 7000$; *e*, edge of fossa in *c*, $\times 15,000$; *f*, edge of fossa in upper left of Plate 81*e*, $\times 10,000$. (Micrographs reduced to 78%.)

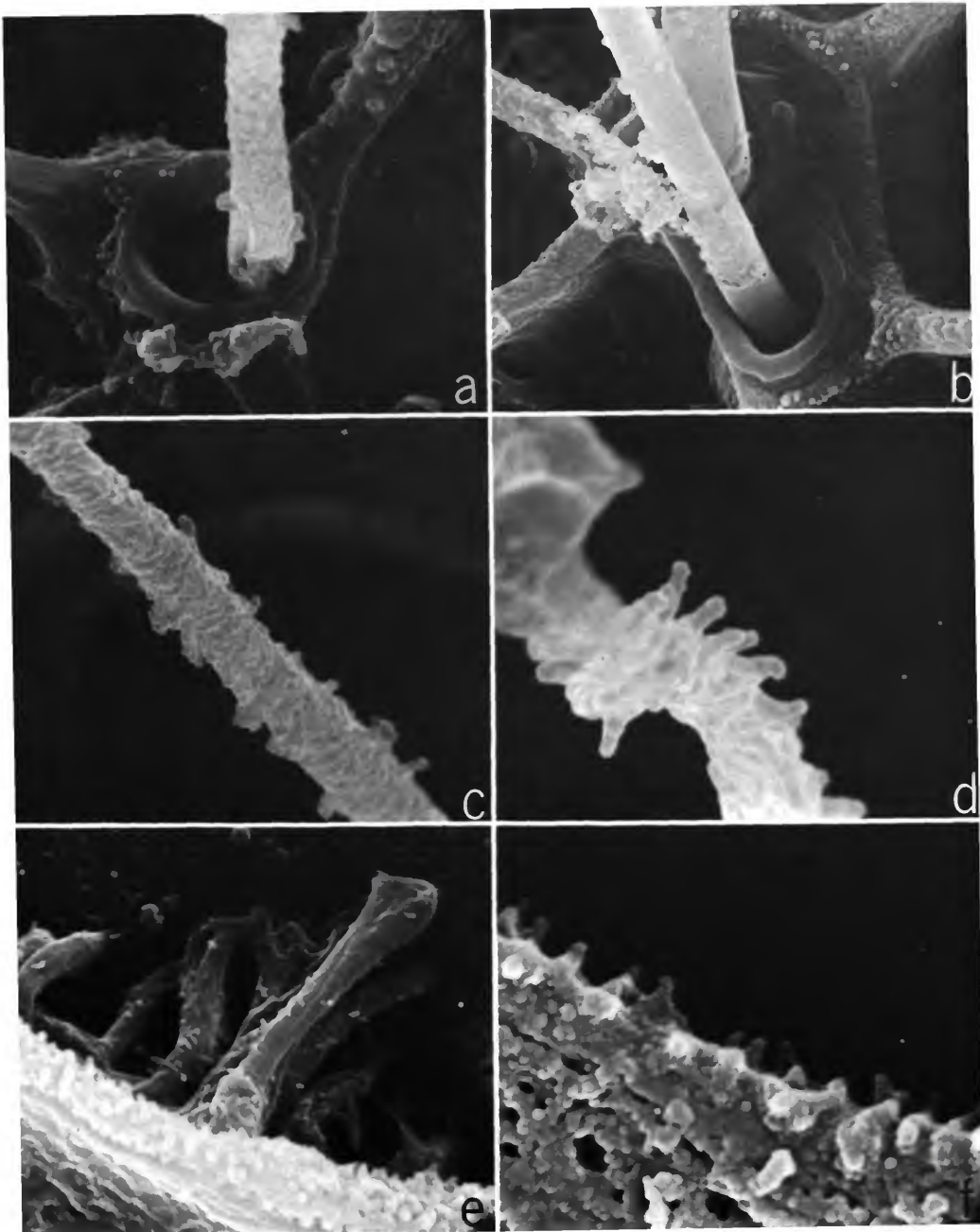


PLATE 83.—*Asteropella monambon* (Kornicker), adult female, USNM 157646, right valve, outside views: *a*, detail of pore and base of bristle in Plate 81*e*, $\times 10,000$; *b*, detail of paired bristles in Plate 81*d*, $\times 5900$; *c*, detail of segment of bristle in *b*, $\times 10,000$; *d*, detail of segment of bristle in *a*, $\times 20,000$; *e*, detail of struts in middle fossa shown in Plate 81*a*, $\times 7500$; *f*, detail of papillae along edge of fossa shown in Plate 81*e*, $\times 20,000$. (Micrographs reduced to 78%.)

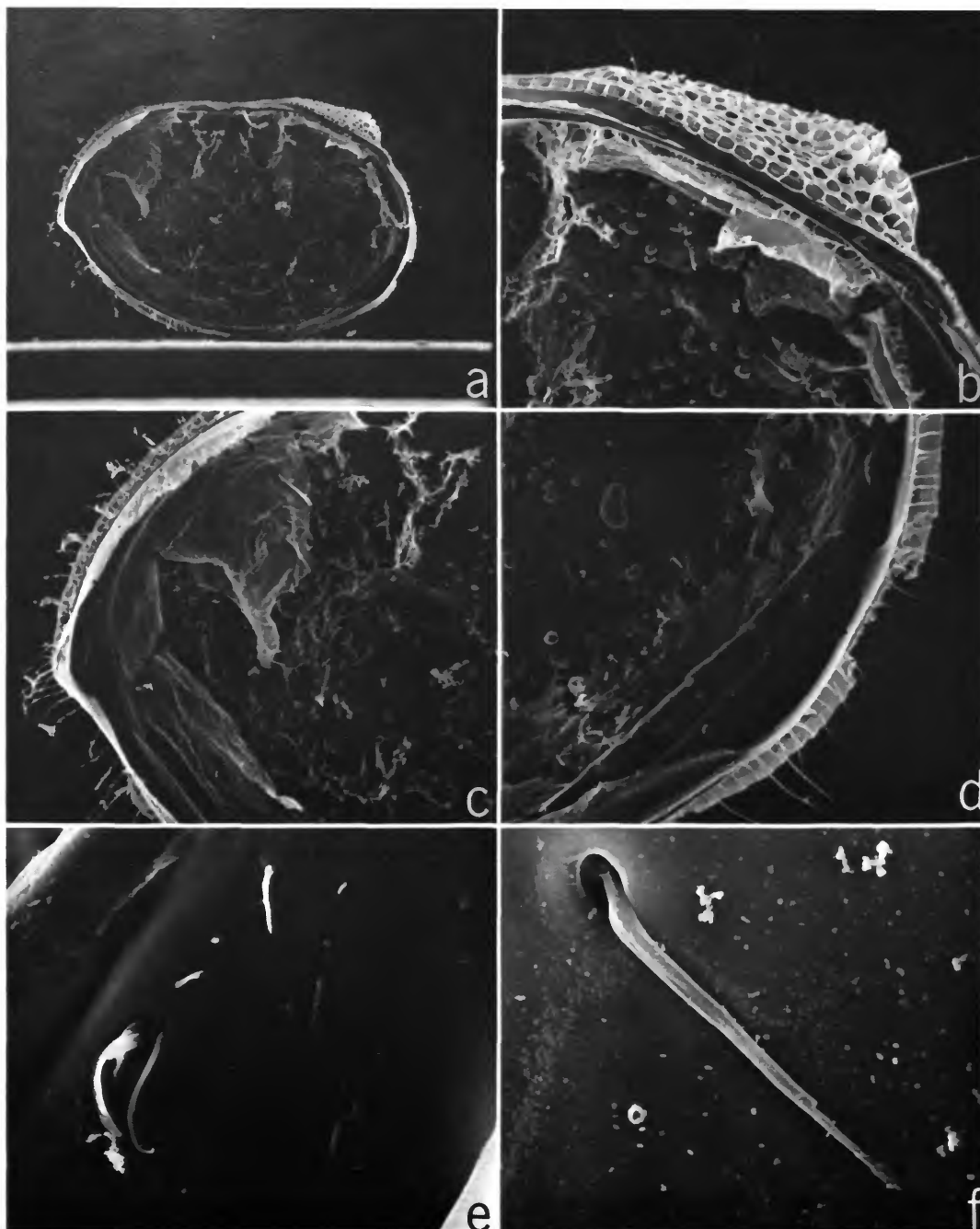


PLATE 84.—*Asteropella monambon* (Kornicker), adult female, USNM 157646, right valve, inside views: *a*, complete valve, $\times 36$; *b*, posterodorsal margin, from *a*, $\times 90$; *c*, anterior, from *a*, $\times 90$; *d*, posteroventral margin, from *a*, $\times 170$; *e*, detail of bristles on posteroventral infold, from *d*, $\times 1250$; *f*, detail of bristle on posteroventral infold, $\times 4350$. (Micrographs reduced to 80%.)

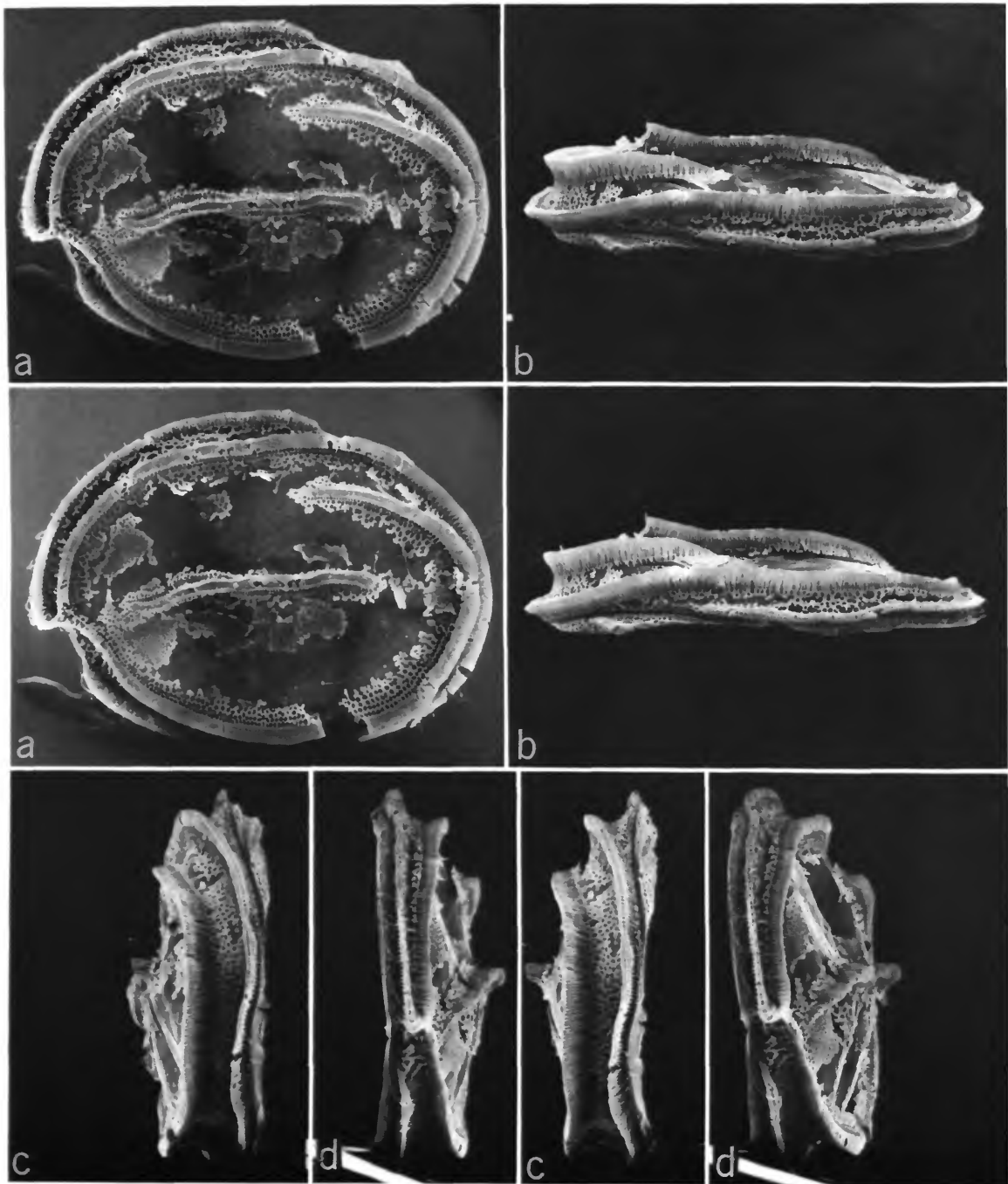


PLATE 85.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B, left valve, outside views, stereoscopic pairs: *a*, lateral view, $\times 50$; *b*, dorsal view, $\times 50$; *c*, posterior view, $\times 60$; *d*, anterior view, $\times 60$. (Micrographs reduced to 81%.)

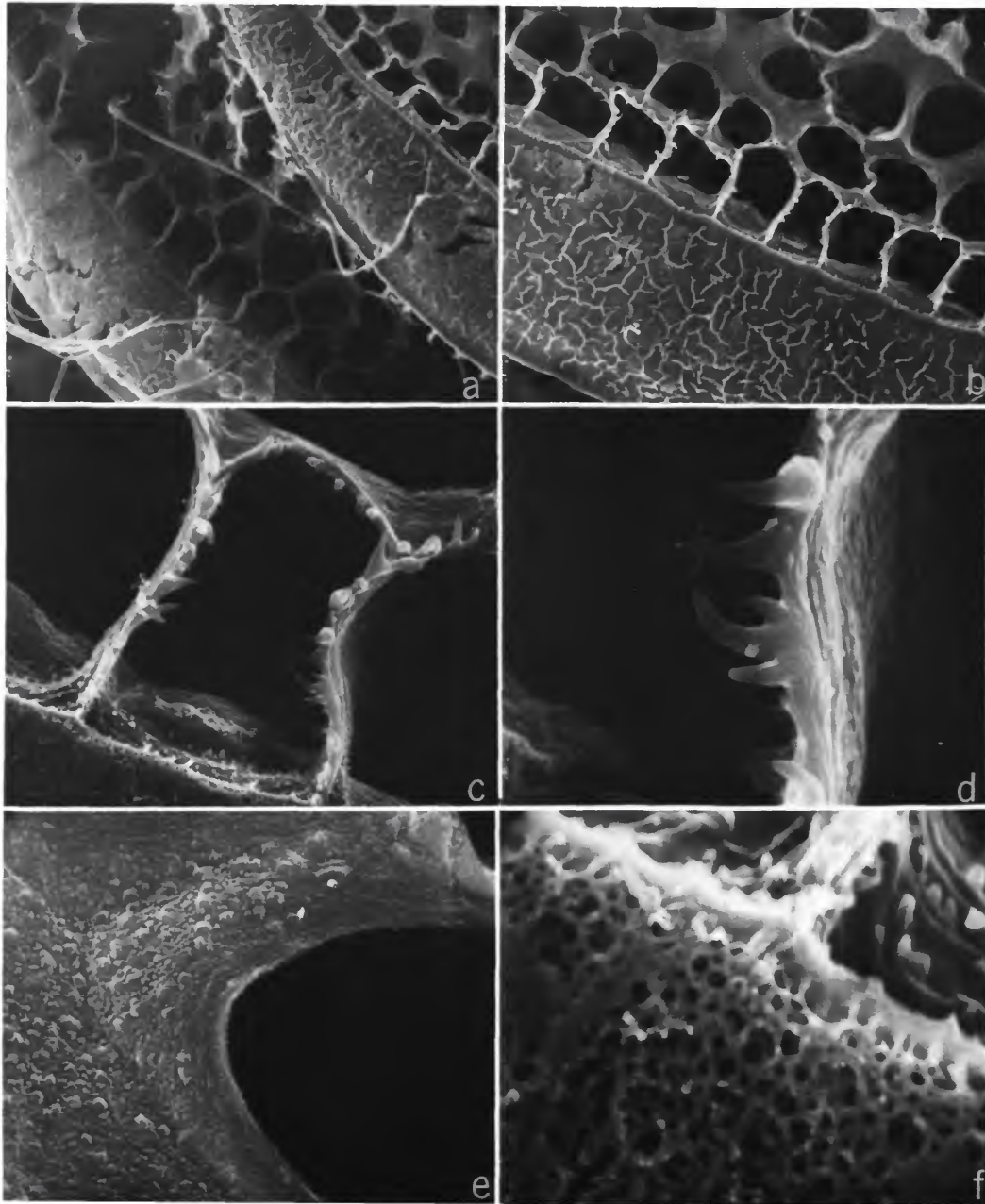


PLATE 86.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B, left valve, outside views: *a*, anteroventral part of valve, from Plate 85*a*, $\times 500$; *b*, detail of inner flange in *a*, $\times 750$; *c*, detail of reticulation adjacent to flange, from *b*, $\times 3400$; *d*, spines along edge of reticulation in *c*, $\times 10,400$; *e*, part of oval fossa in upper middle part of *b*, $\times 5000$; *f*, detail of upper edge of surface of flange, from *c*, $\times 16,500$. (Micrographs reduced to 74%.)

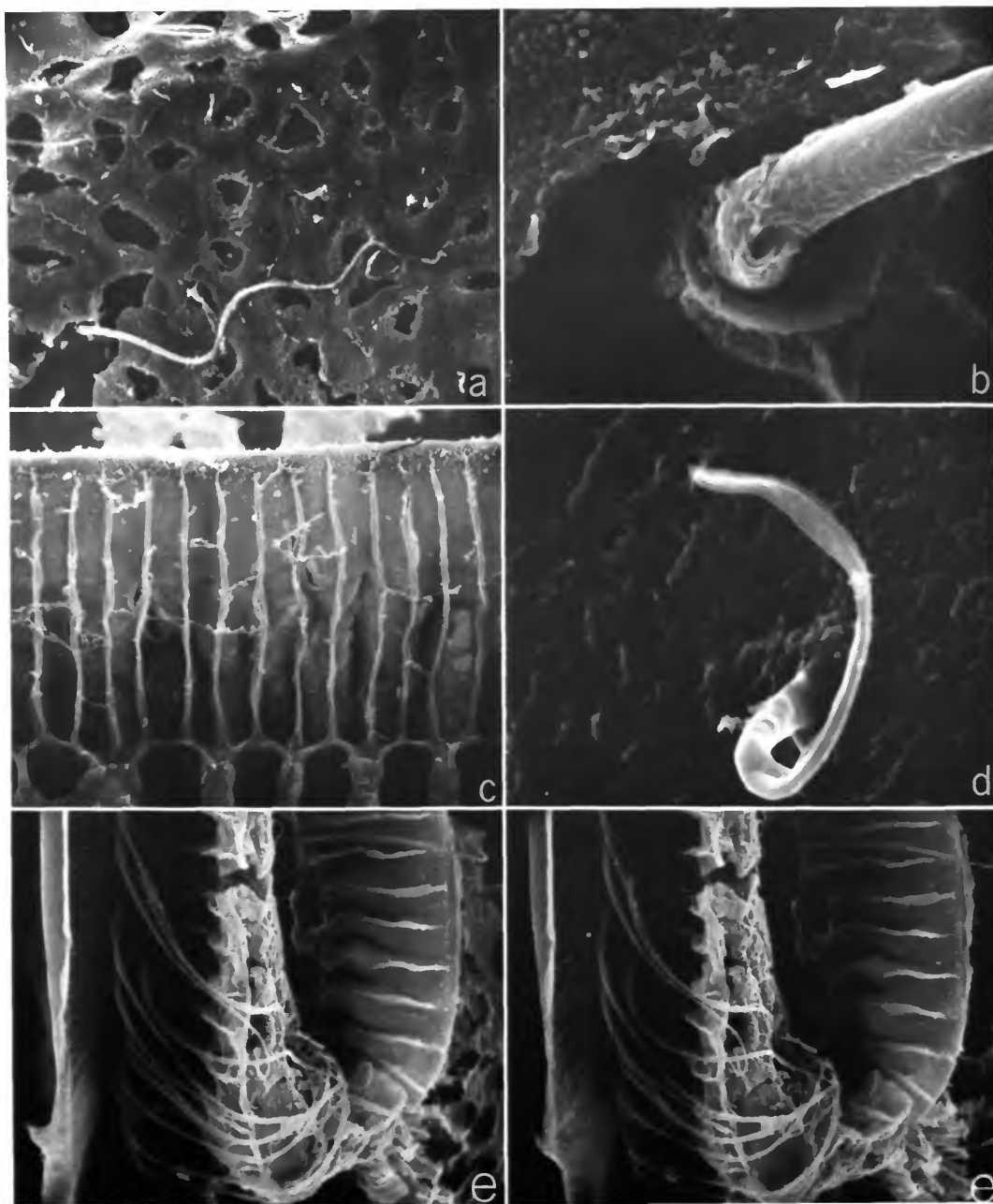


PLATE 87.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B, left valve, outside views: *a*, surface and bristle ventral to anterior end of horizontal midridge, from Plate 85*a*, $\times 830$; *b*, detail of base of bristle in *a*, $\times 10,000$; *c*, dorsal view of middle part of flange, from Plate 85*b*, $\times 900$; *d*, detail of bristle in lower right corner of *a*, $\times 10,000$; *e*, anterior view of rostrum, from Plate 85*d*, stereoscopic views, $\times 490$. (Micrographs reduced to 74%.)

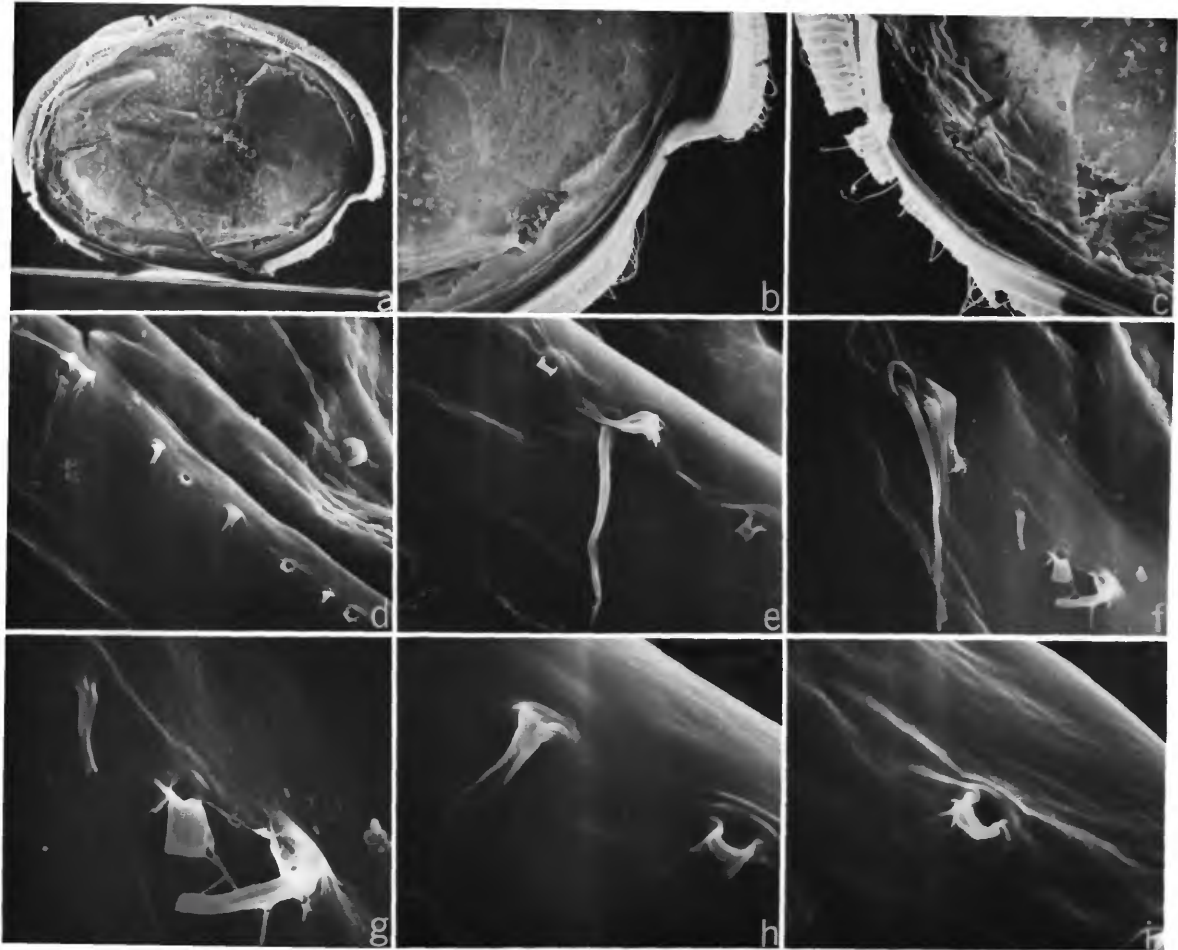


PLATE 88.—*Asteropella agassizii* (Müller), ovigerous female, USNM 150288B, left valve, inside views: *a*, complete valve, $\times 50$; *b*, anterior from *a*, $\times 160$; *c*, posteroventral edge of valve showing infold, from *a*, $\times 200$; *d*, bristles along list of posteroventral infold, from *c*, $\times 1470$; *e*, bristles and tubes near ventral end list on posteroventral infold shown in *c*, $\times 2415$; *f*, bristles and tubes near dorsal end of list on posteroventral infold shown in *c*, $\times 2415$; *g*, bristles and tubular pores in lower part of list on posteroventral infold shown in *c*, $\times 6040$; *h*, long and short tubular pores on posteroventral infold, from *c*, $\times 7350$; *i*, short tubular pore in lower part of *d*, $\times 7350$. (Micrographs reduced to 55%.)

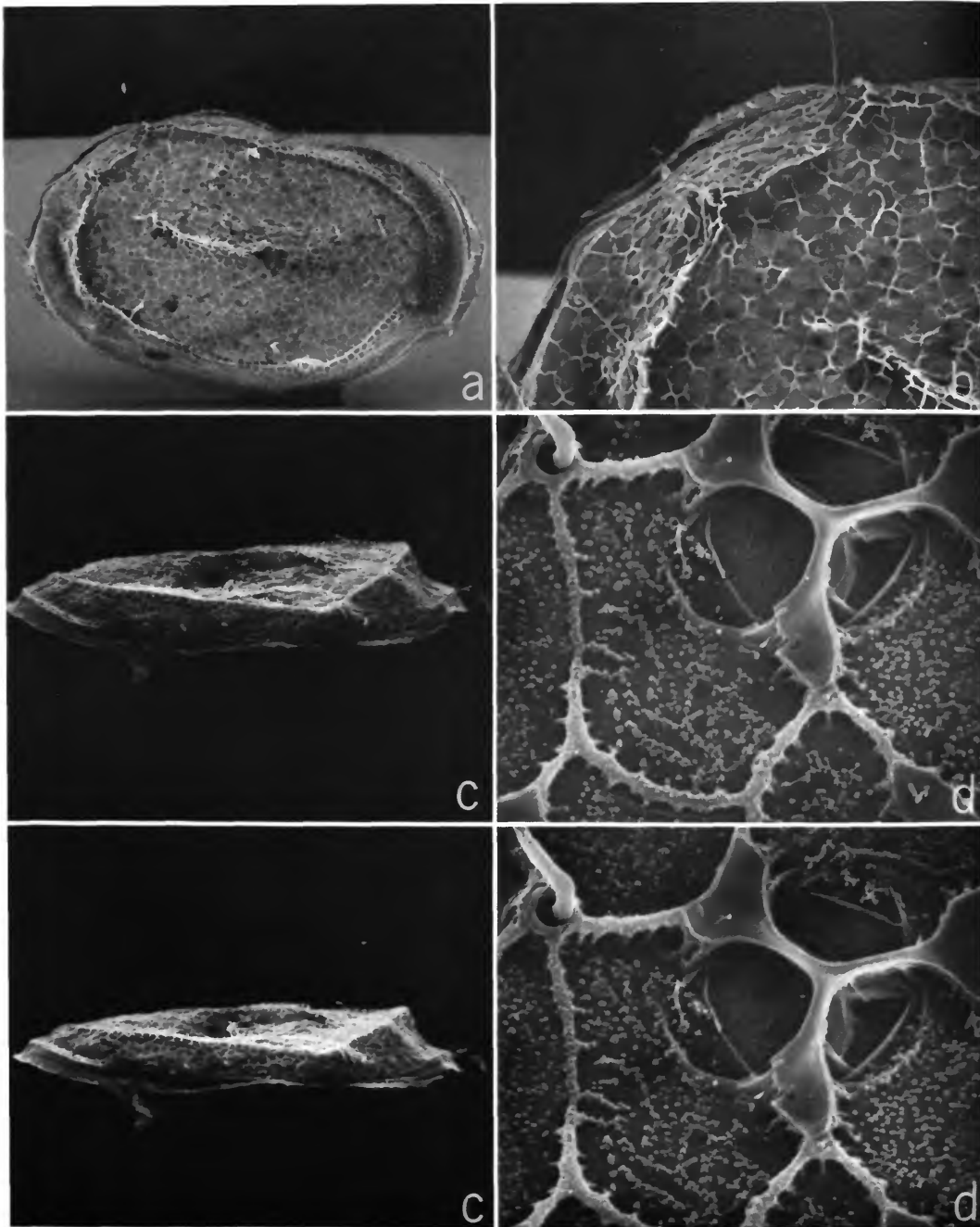


PLATE 89.—*Asteropella punctata* Poulsen, female (A-1 instar), USNM 157165, right valve, outside views: *a*, lateral view, $\times 75$; *b*, posterdorsal margin showing several protuberances on concentric ridge, from *a*, $\times 190$; *c*, dorsal view, anterior to left, stereoscopic pair, $\times 75$; *d*, detail of valve surface, stereoscopic view, from Plate 90*b*, $\times 2000$. (Micrographs reduced to 80%.)

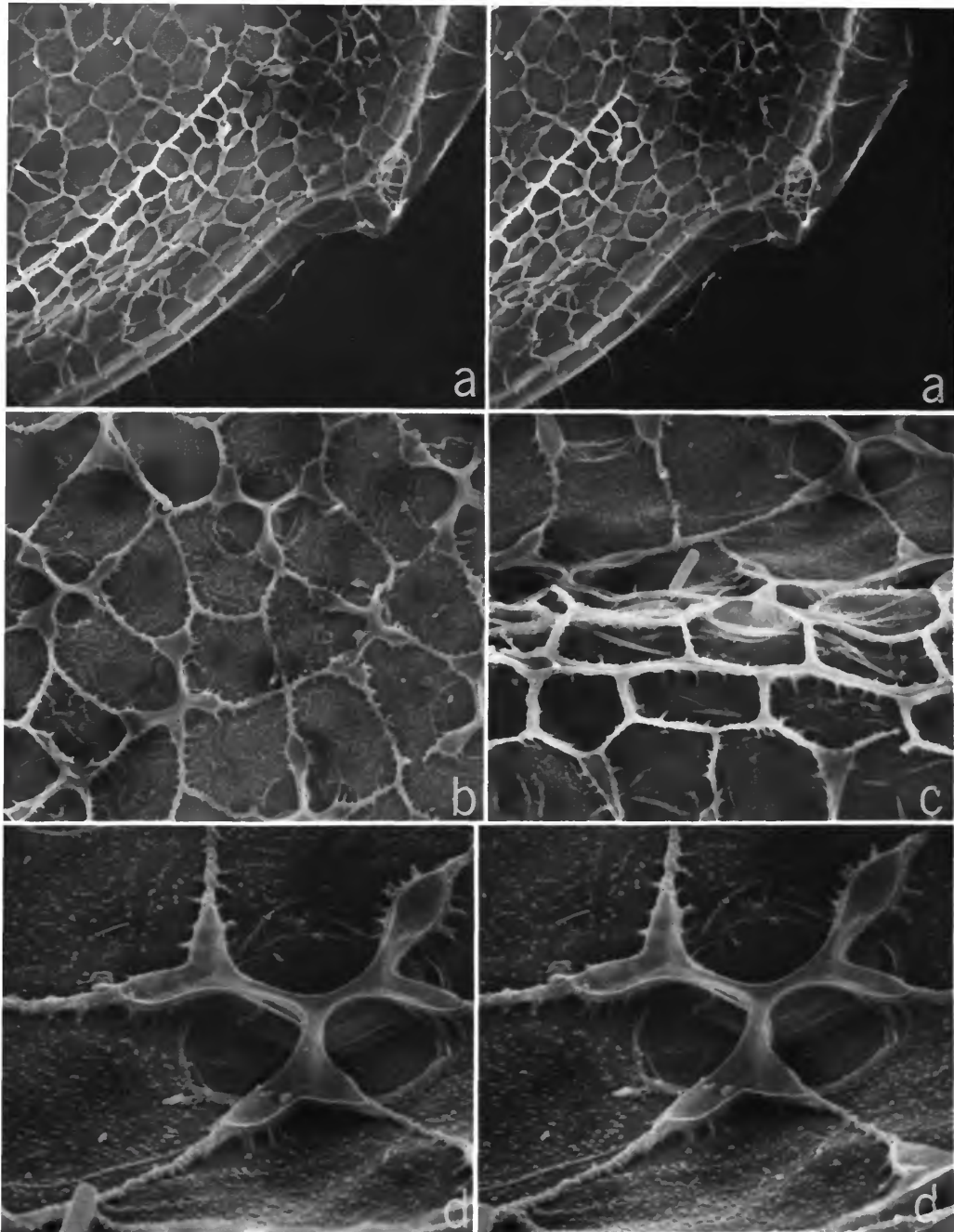


PLATE 90.—*Asteropella punctata* Poulsen, female (A-1 instar), USNM 157165, right valve, outside views: *a*, lateral view of anteroventral part of valve, stereoscopic pair, $\times 300$; *b*, surface structures, $\times 750$; *c*, segment of midridge near posterior end, from Plate 89*a*, $\times 1000$; *d*, detail of surface structure in upper right of *c*, stereoscopic pair, $\times 2000$. (Micrographs reduced to 80%.)

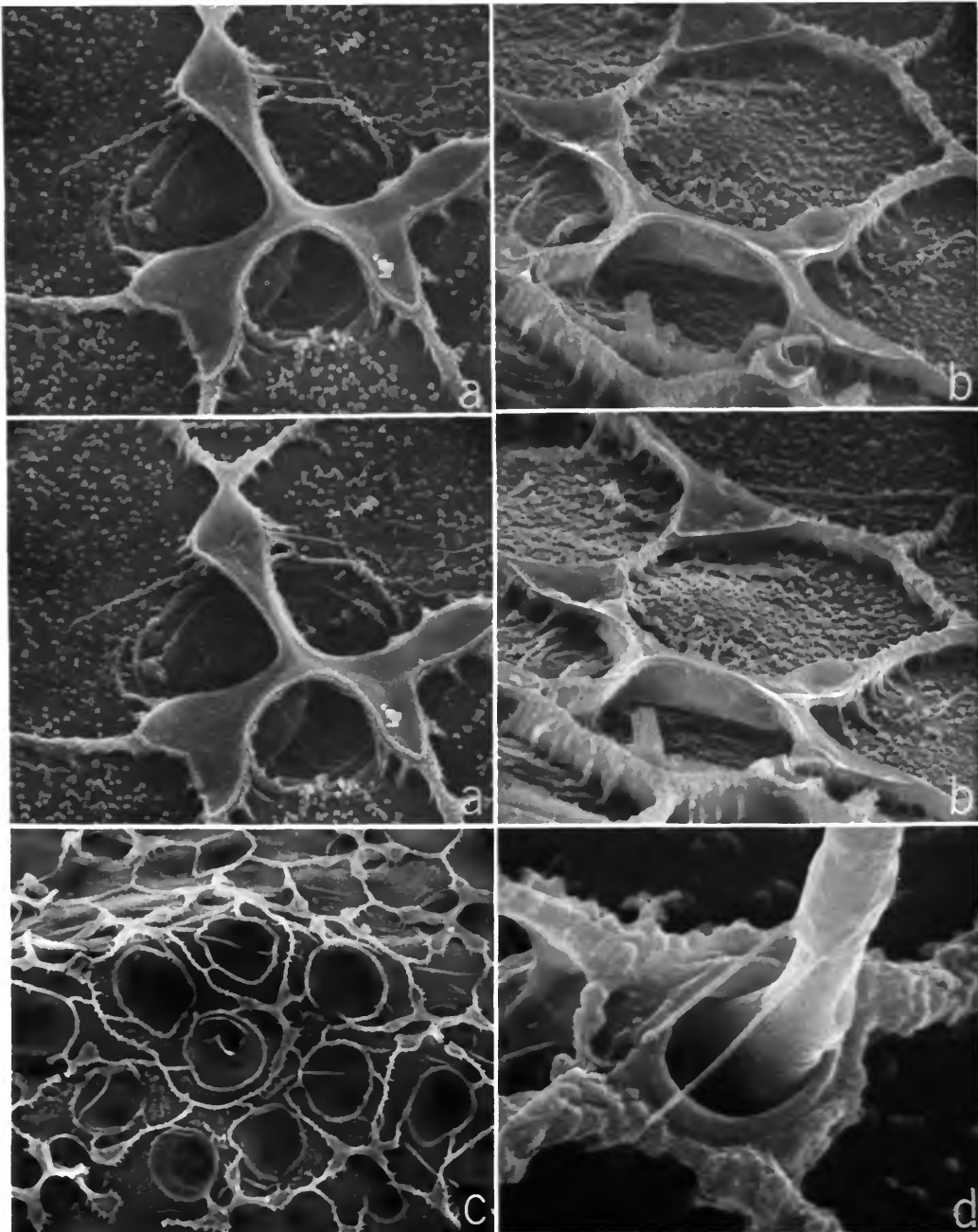


PLATE 91.—*Asteropella punctata* Poulsen, female (A-1 instar), USNM 157165, right valve, outside views: *a*, detail of stellate structure in left part of Plate 90*b*, stereoscopic pair, $\times 2000$; *b*, detail of surface structures near anterodorsal margin, from Plate 89*a*, stereoscopic pair, $\times 2500$; *c*, oval fossae in area of central adductor muscle attachments, from Plate 89*a*, $\times 620$; *d*, bristle and pore, $\times 10,000$. (Micrographs reduced to 78%.)

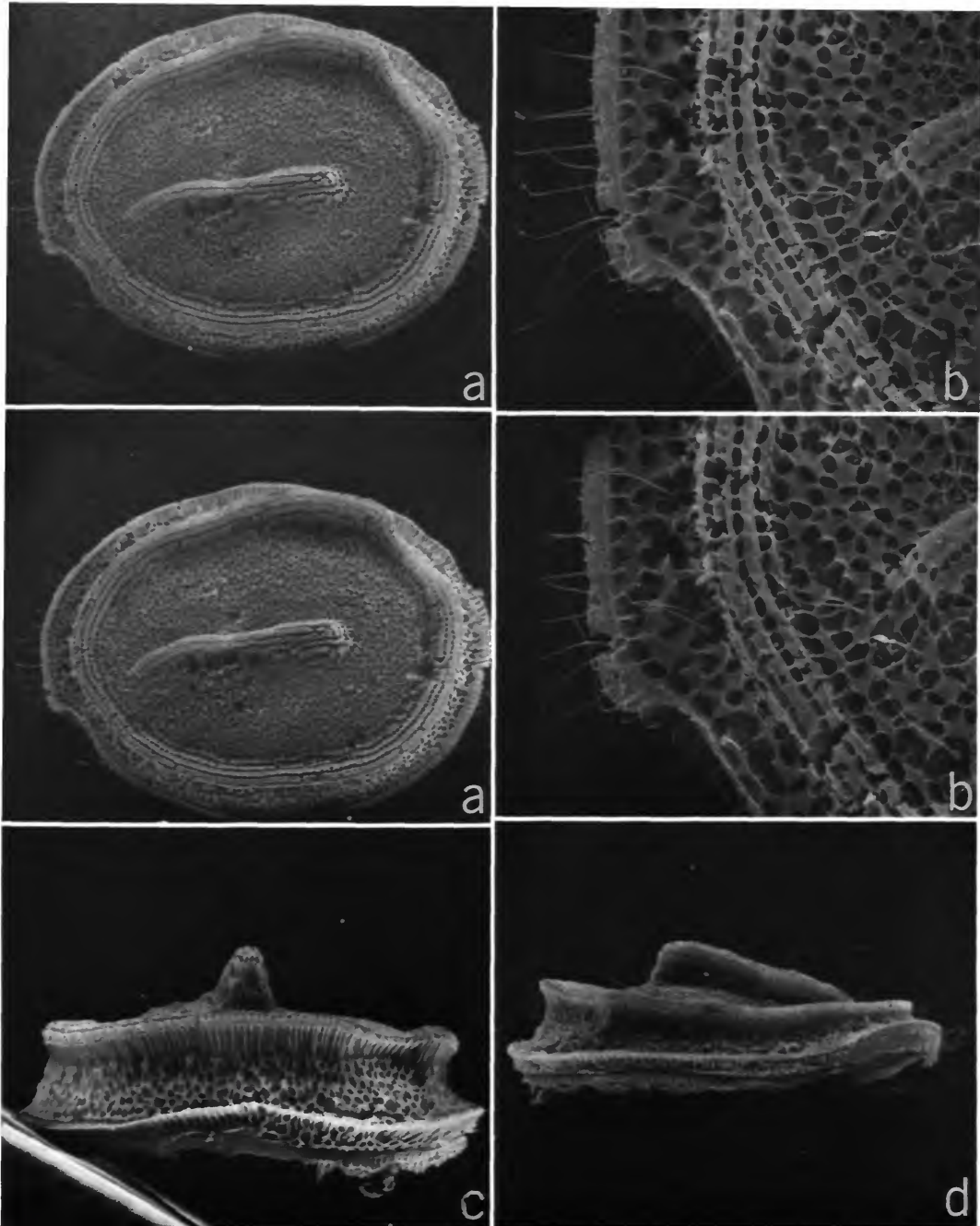


PLATE 92.—*Asteropella maclaughlinae*, new species, adult female, holotype, USNM 157608, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 50$; *b*, anterior, from *a*, stereoscopic pair, $\times 200$; *c*, posterior view, ventral margin to left, $\times 70$; *d*, dorsal view, anterior to right, $\times 50$. (Micrographs reduced to 81%.)

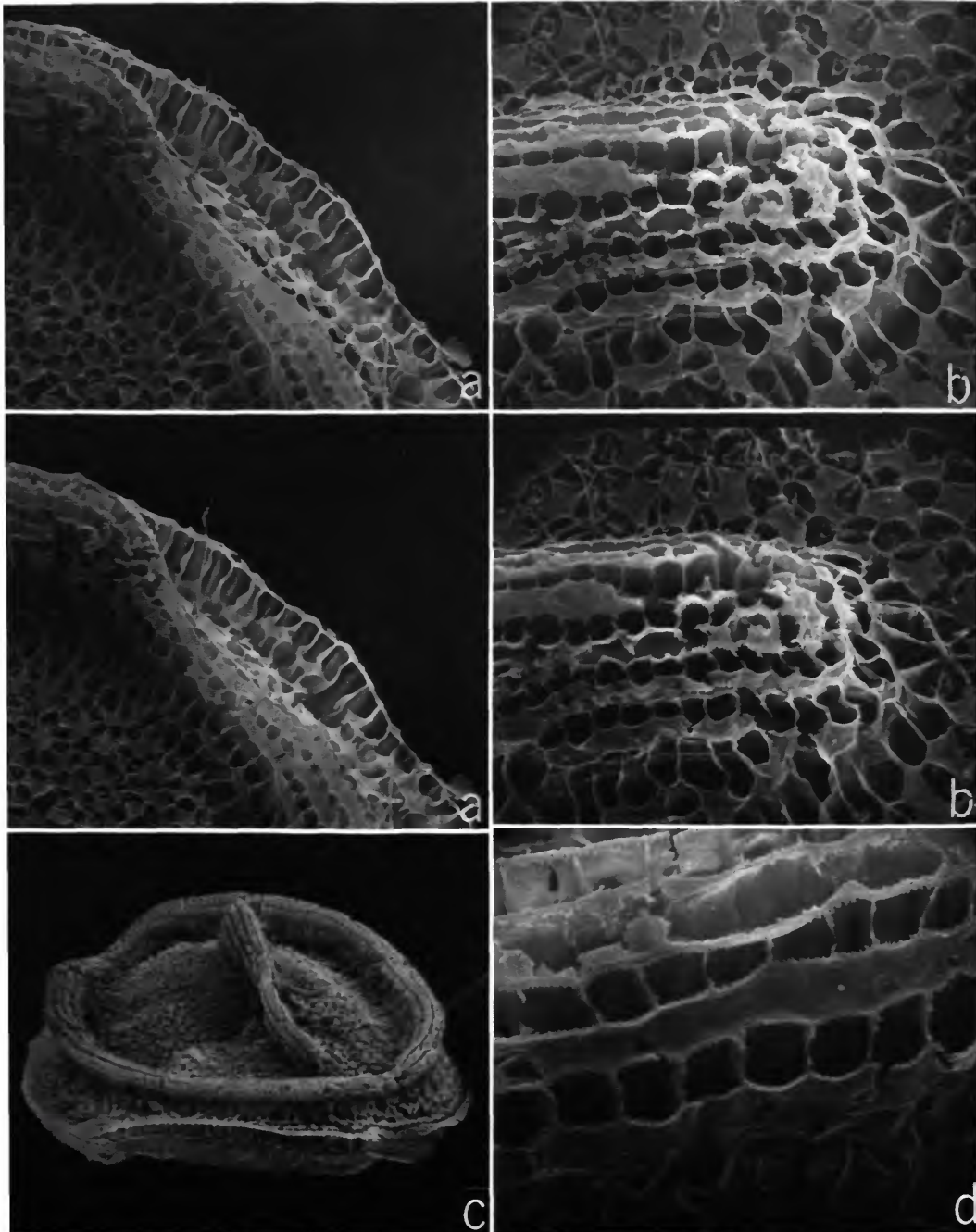


PLATE 93.—*Asteropella maclaughlinae*, new species, adult female, holotype, USNM 157608, left valve, outside views: *a*, posterodorsal margin, from Plate 92*a*, stereoscopic pair, $\times 2000$; *b*, posterior end of horizontal midridge, from Plate 92*a*, stereoscopic pair, $\times 350$; *c*, oblique view of valve from anterior, $\times 70$; *d*, inner peripheral ridge along anterior of dorsal part, from Plate 92*a*, $\times 725$. (Micrographs reduced to 80%.)

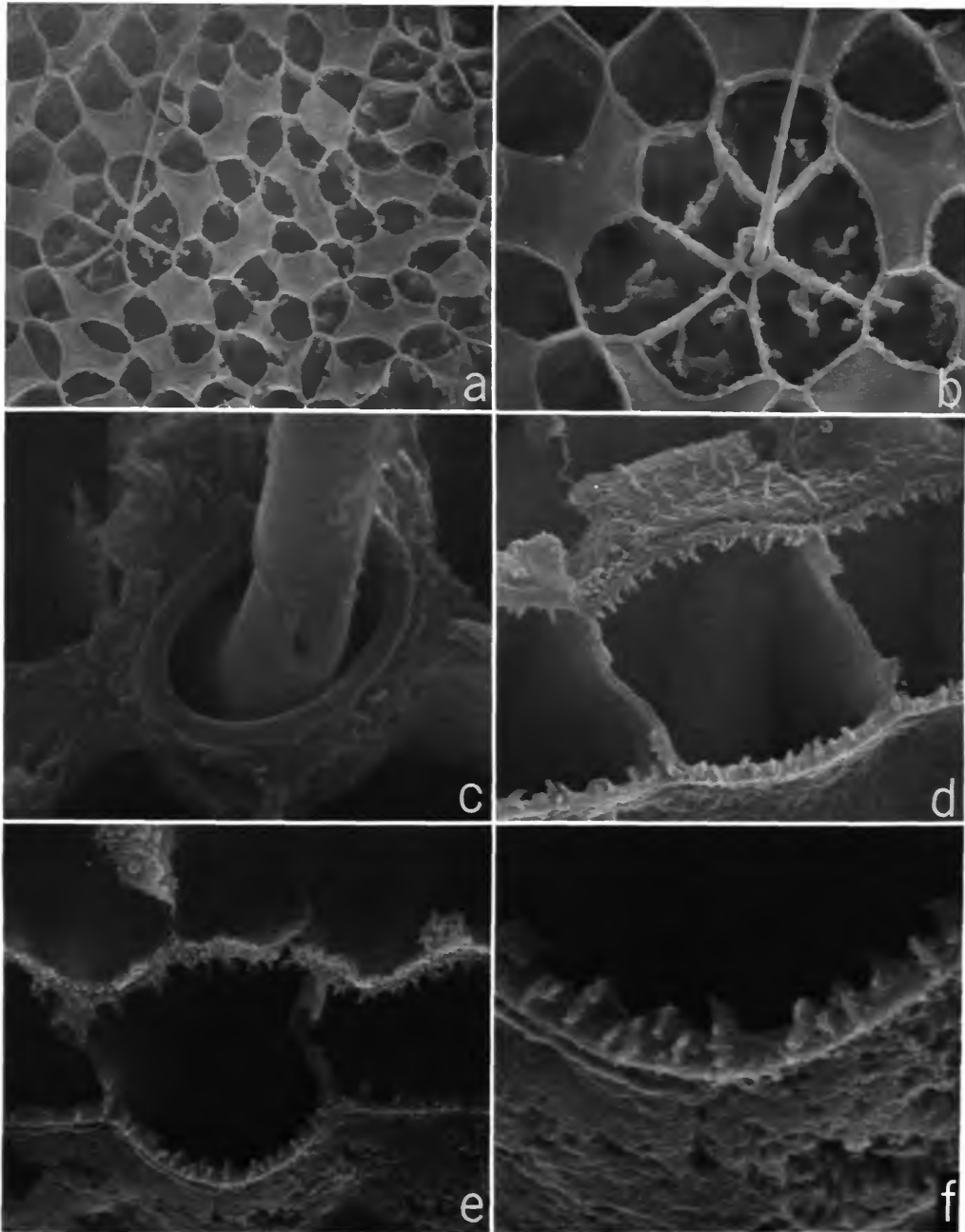


PLATE 94.—*Asteropella maclaughlinae*, new species, adult female, holotype, USNM 157608, left valve, outside views: *a*, detail of surface between inner peripheral ridge and horizontal midridge, from Plate 92*a*, $\times 500$; *b*, detail of fossa and bristle in *a*, $\times 1100$; *c*, base of bristle in *b*, $\times 5000$; *d*, detail of fossae of peripheral ridge, from Plate 93*d*, $\times 3000$; *e*, detail of fossae of horizontal midridge, from Plate 93*b*, $\times 3000$; *f*, lower edge of middle fossa in *e*, $\times 10,000$. (Micrographs reduced to 78%.)

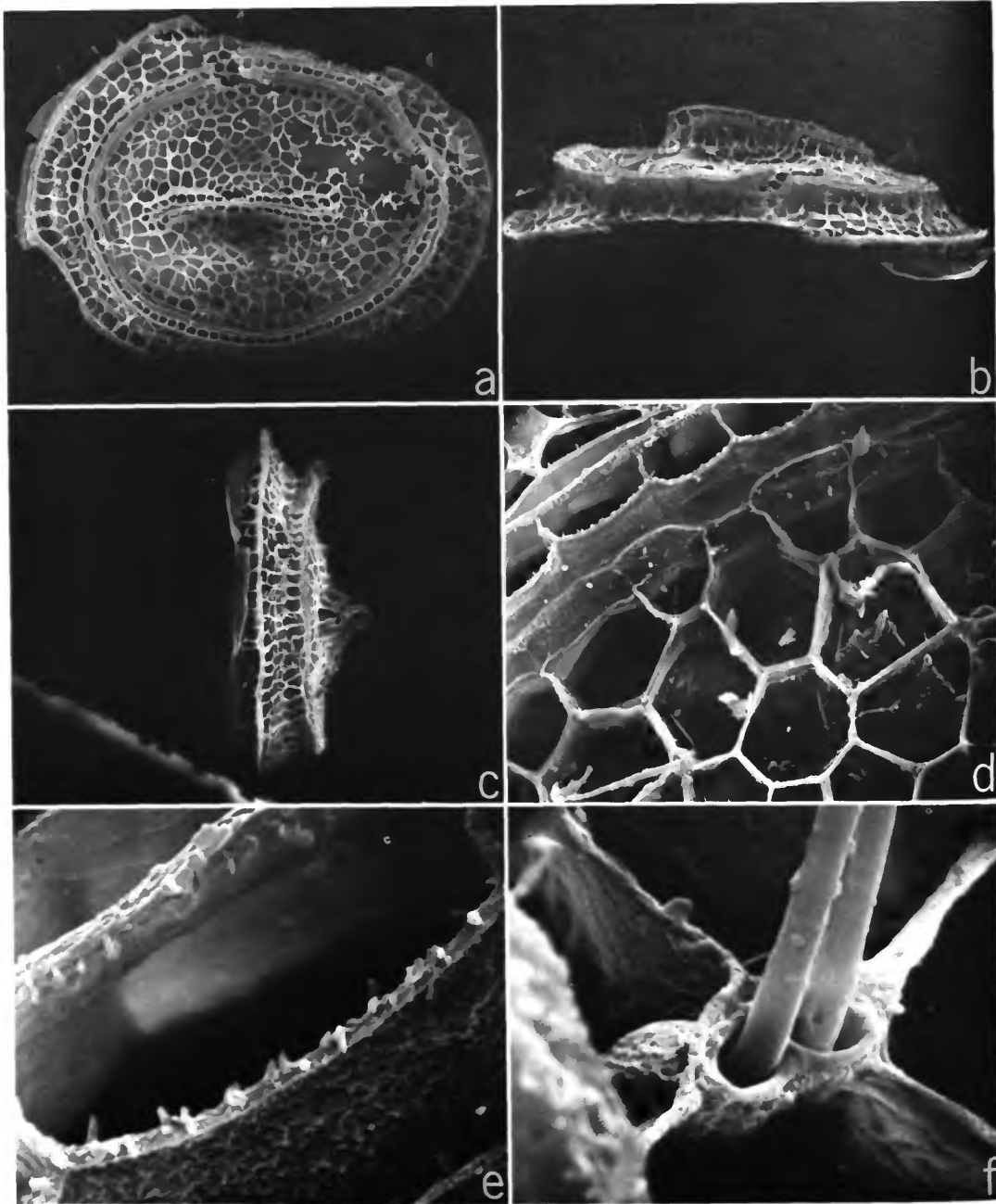


PLATE 95.—*Asteropella maclaughlinae*, new species, instar II, paratype, USNM 156655, left valve, outside views: *a*, lateral view, part of dorsal margin missing, $\times 135$; *b*, dorsal view, $\times 145$; *c*, anterior view, $\times 135$; *d*, part of anterodorsal inner concentric ridge and reticulations inward from ridge, $\times 1000$; *e*, detail of reticulation of ridge shown in *d* (note spines along edge of reticulations), $\times 5000$; *f*, bristles in posterodorsal part of valve, from *a*, $\times 5000$. (Micrographs reduced to 75%.)

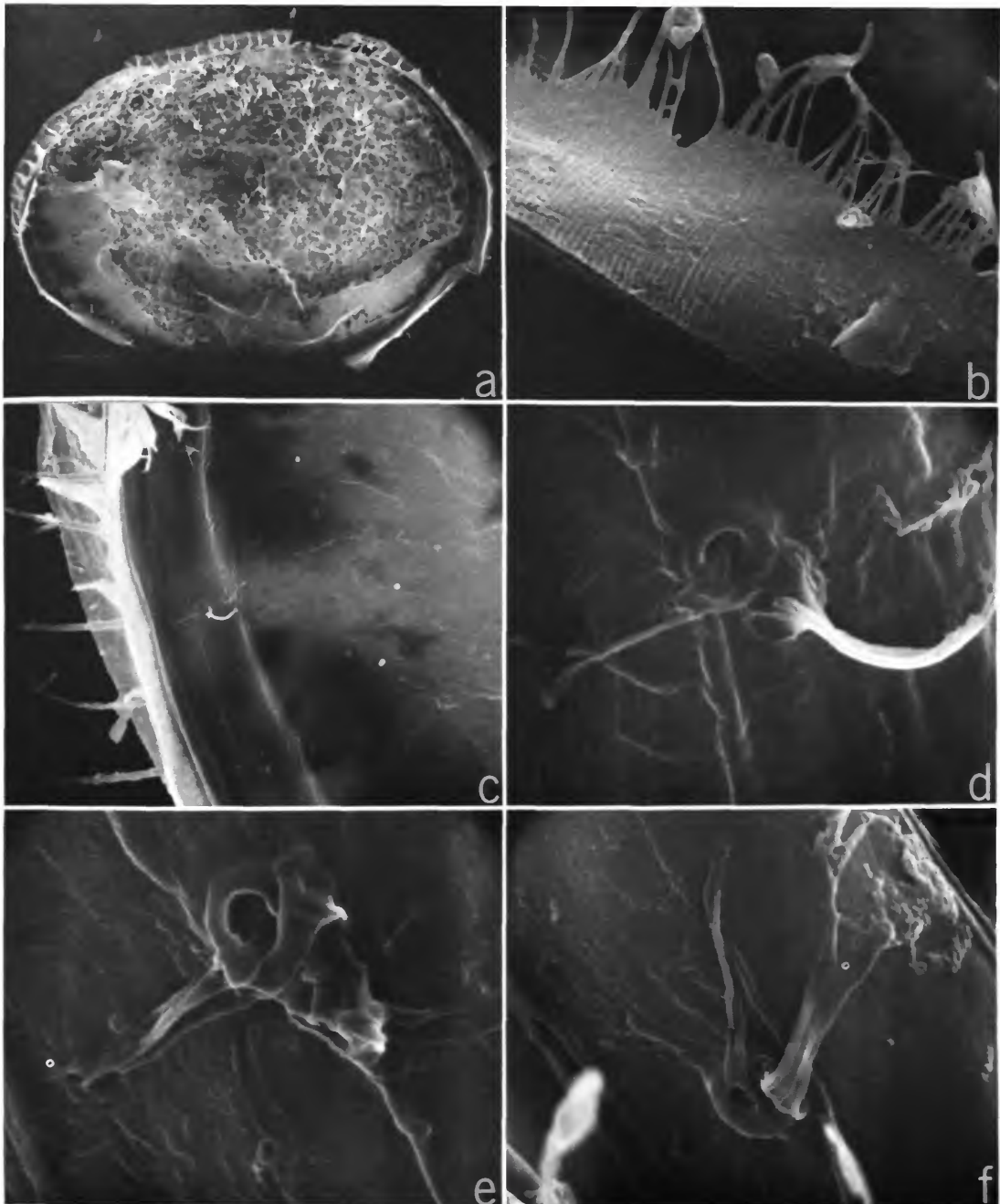


PLATE 96.—*Asteropella maclaughlinae*, new species, instar II, paratype, USNM 156655, left valve, inside views: *a*, medial view, $\times 130$; *b*, lamellar prolongation of selvage along posteroventral margin, from *a*, $\times 2000$; *c*, posterior margin showing infold, $\times 1000$; *d*, *e*, bristles on list of infold shown in *c*, $\times 7900$; *f*, bristles on posterior infold ventral to those shown in *c*, $\times 5000$. (Micrographs reduced to 77%.)

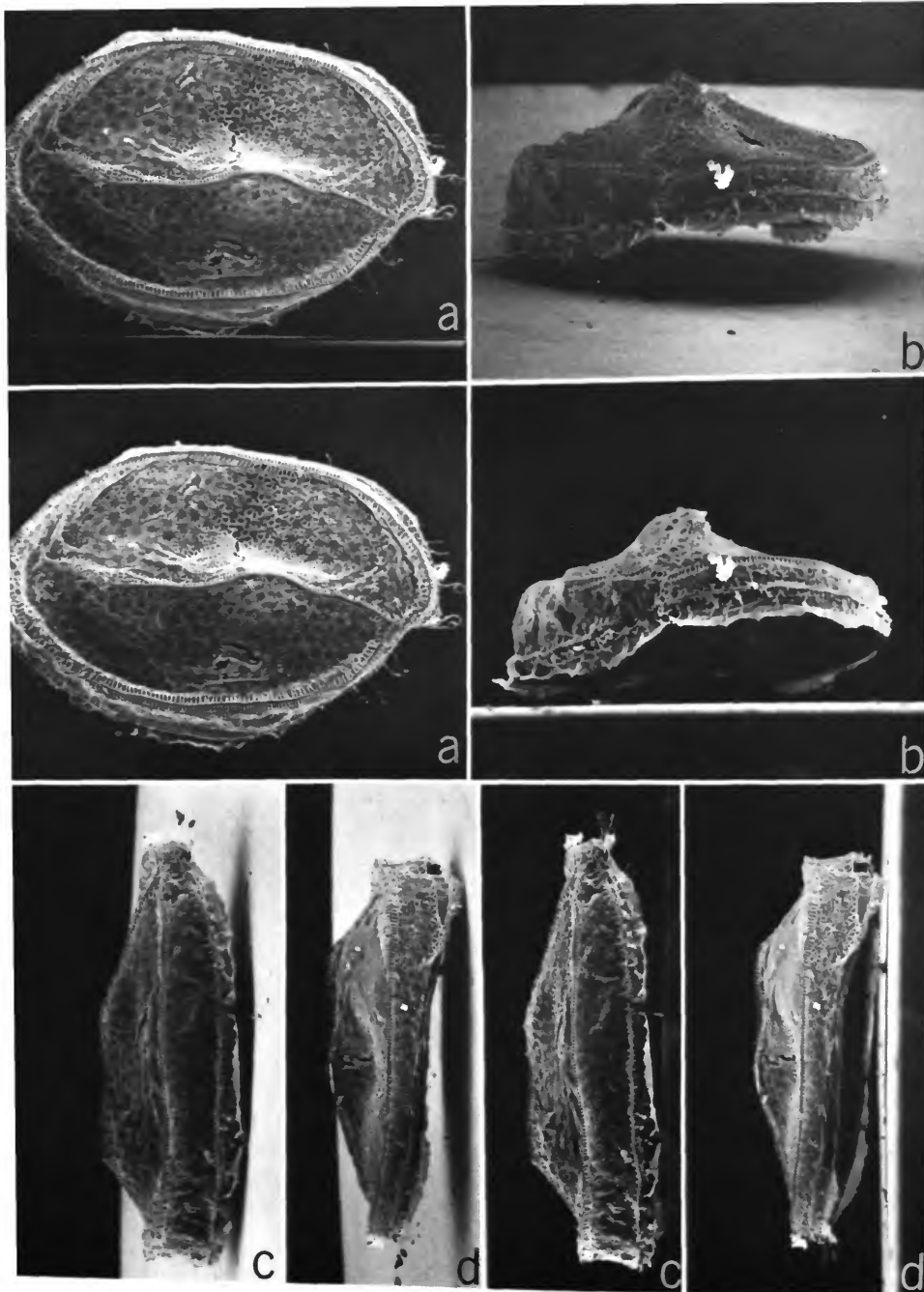


PLATE 97.—*Asteropella trithrix*, new species, adult female, paratype, USNM 157164, right valve, outside views, stereoscopic pairs: *a*, lateral view, $\times 60$; *b*, anterior view, ventral margin to left, $\times 75$; *c*, ventral view, anterior to top, $\times 55$; *d*, dorsal view, anterior to bottom, $\times 50$. (Micrographs reduced to 73%.)

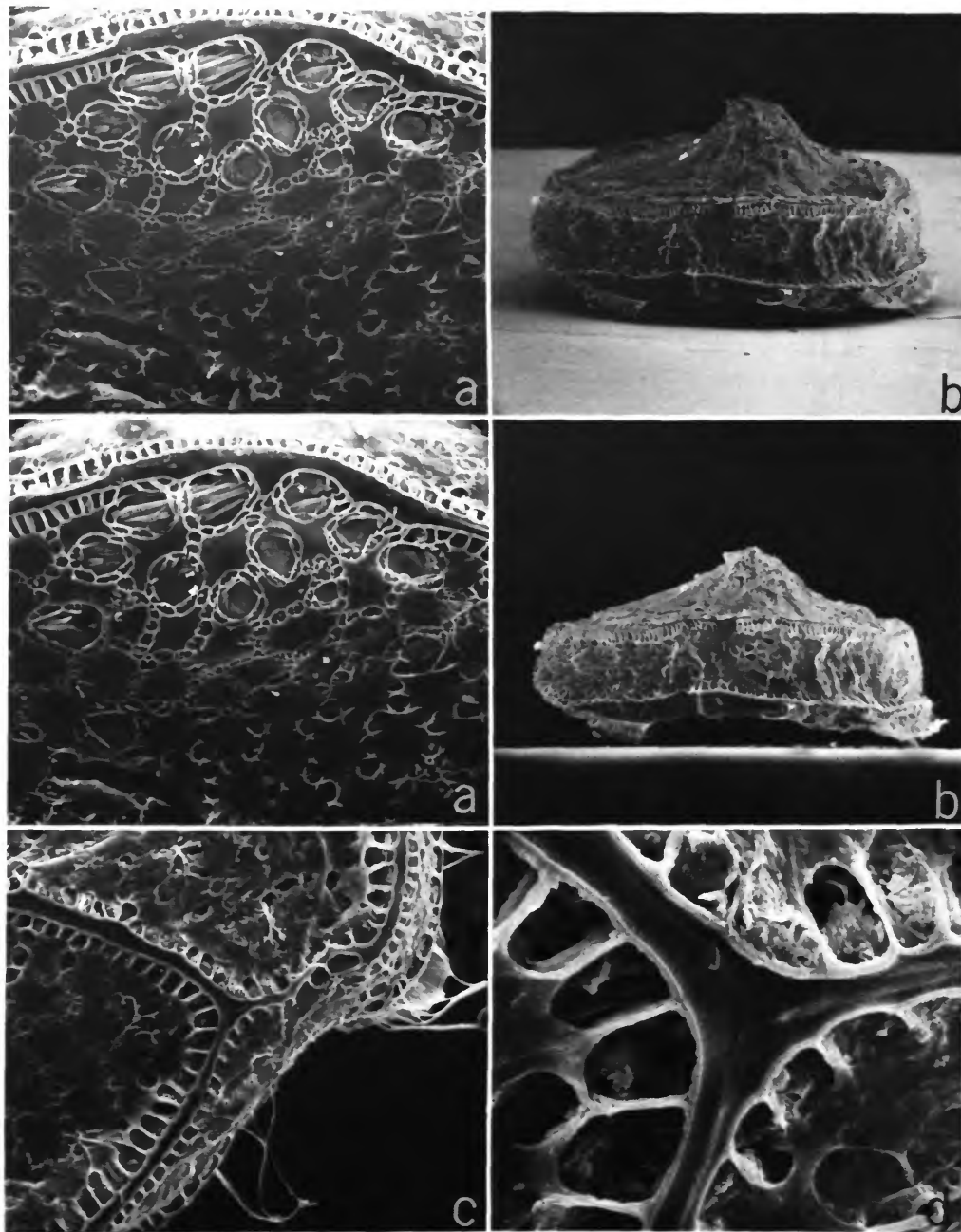


PLATE 98.—*Asteropella trithrix*, new species, adult female, paratype, USNM 157164, right valve, outside views: *a*, area of central adductor muscle attachments below midridge, from Plate 97*a*, stereoscopic pair, $\times 250$; *b*, posterior view, ventral margin to right, stereoscopic pair, $\times 75$; *c*, anterior of valve, from Plate 97*a*, $\times 230$; *d*, intersection of horizontal and concentric ridge just posterior to incisur, from *c*, $\times 1050$. (Micrographs reduced to 78%.)

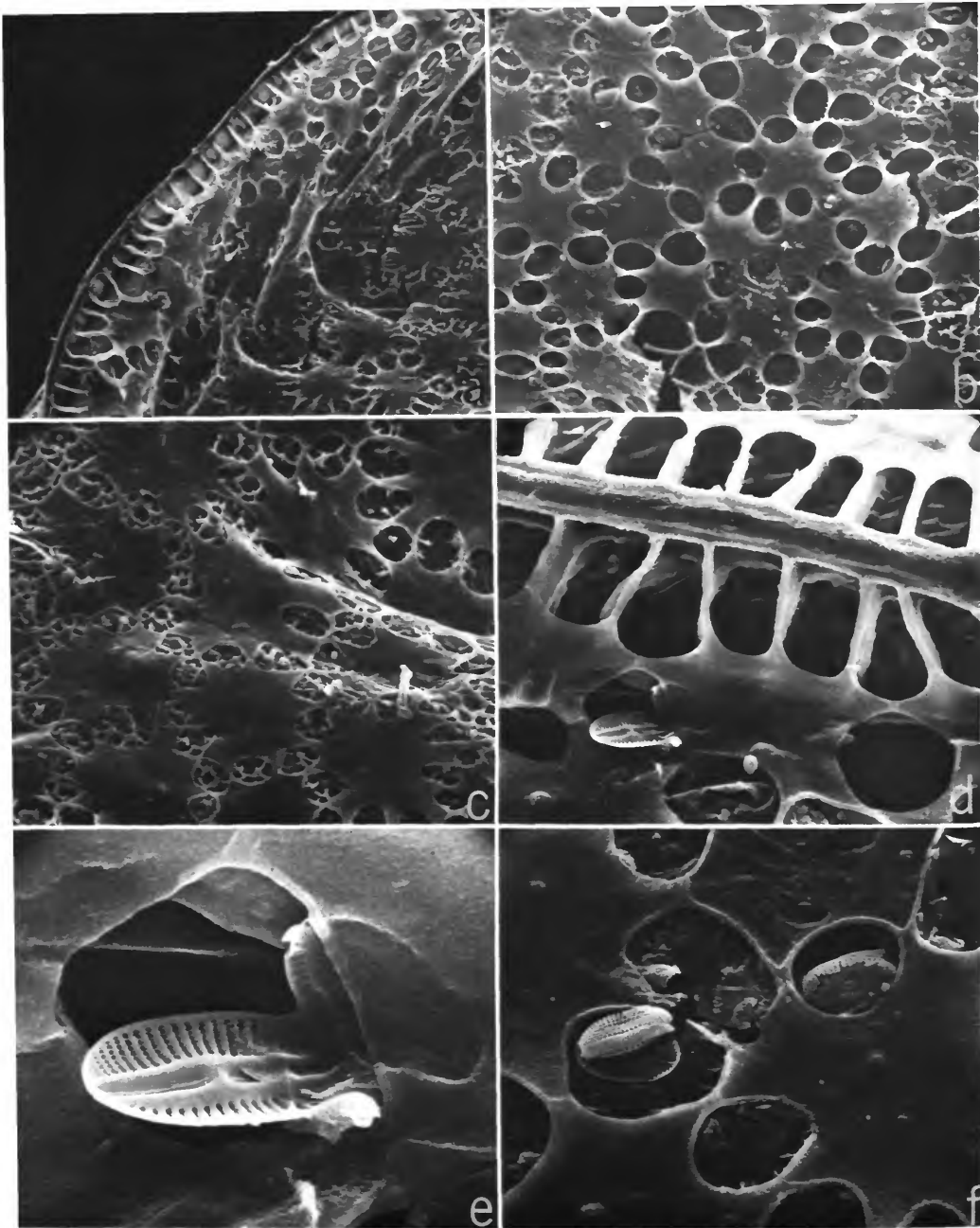


PLATE 99.—*Asteropella trithrix*, new species, adult female, paratype, USNM 157164, right valve, outside views: *a*, posterodorsal margin, $\times 260$; *b*, fossae near middle dorsal to midridge, from Plate 97*a*, $\times 330$; *c*, fossae just dorsal to midridge and near middle of valve, from Plate 97*a*, $\times 525$; *d*, dorsal segment of inner concentric ridge, from Plate 97*a*, $\times 1050$; *e*, detail of diatom in *d*, $\times 3300$; *f*, diatoms within fossae, $\times 1300$. (Micrographs reduced to 78%.)

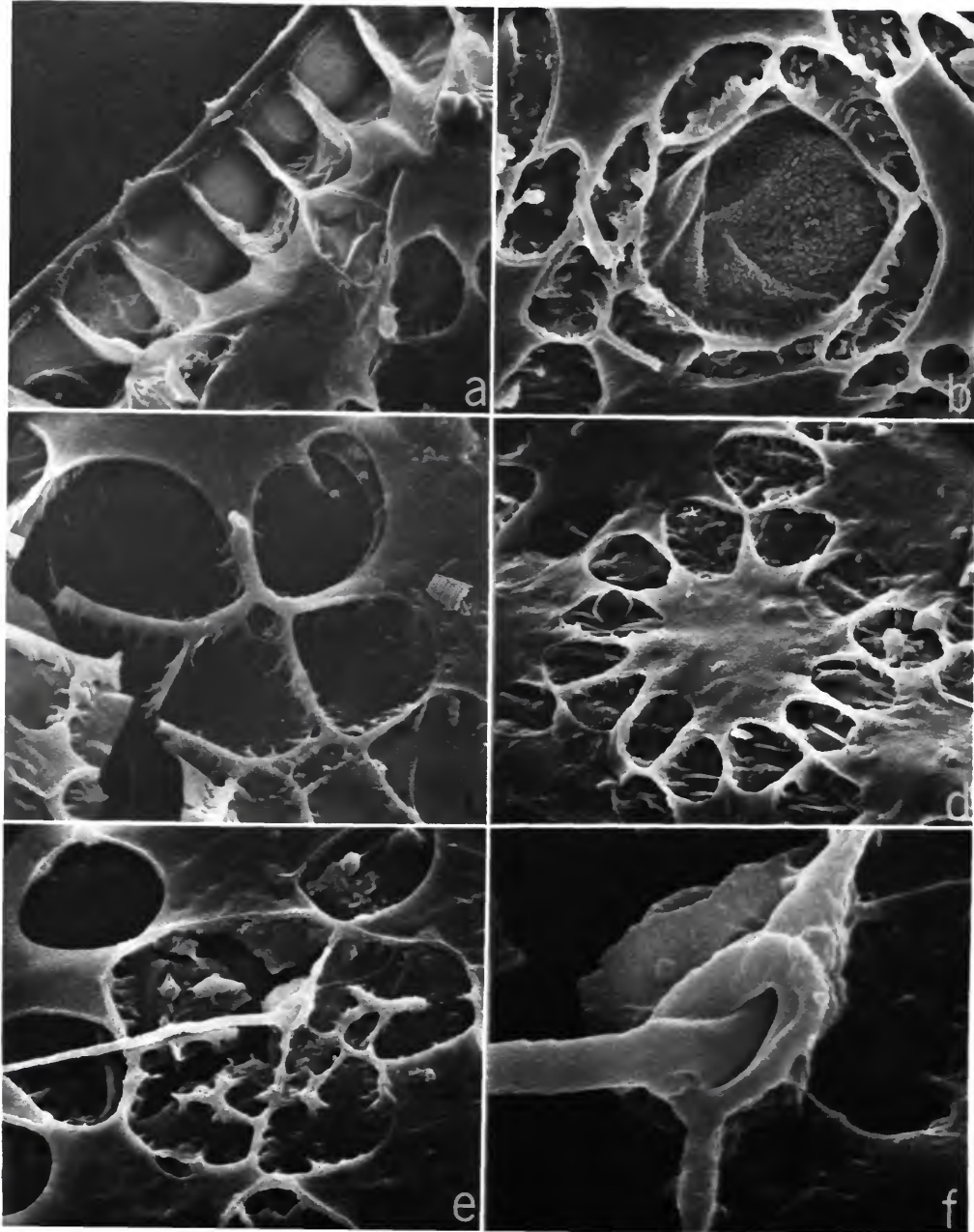


PLATE 100.—*Asteropella trithrix*, new species, adult female, paratype, USNM 157164, right valve, outside views: *a*, detail of inner concentric ridge along posterodorsal margin, from Plate 99*a*, $\times 1050$; *b*, detail of fossa in Plate 98*a*, $\times 1500$; *c*, fossae in lower left of Plate 99*b* (bristle missing in center), $\times 1260$; *d*, fossae forming ring, from lower right of Plate 99*a*, $\times 1050$; *e*, fossae with bristle at center of group, from lower right of 99*b*, $\times 1300$; *f*, detail of base of bristle in *e*, $\times 6450$. (Micrographs reduced to 77%.)

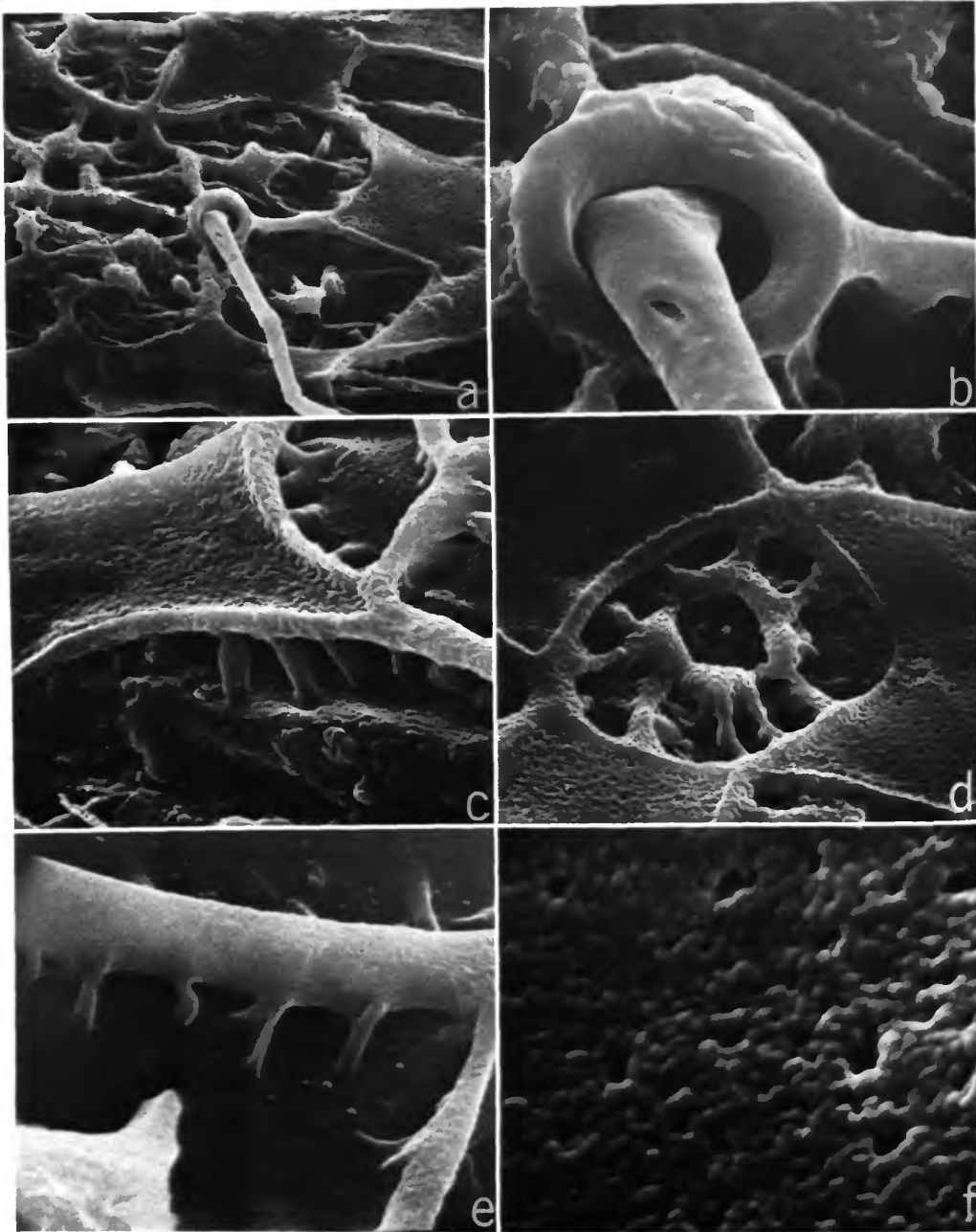


PLATE 101.—*Asteropella trithrix*, new species, adult female, paratype, USNM 157164, right valve, outside views: *a*, fossae with bristle, from area to right of that shown in Plate 99*c*, $\times 2100$; *b*, detail of base of bristle and pore in *a*, $\times 10,500$; *c*, detail of struts at edge of fossa, from top of Plate 100*d*, $\times 5250$; *d*, detail of fossa in Plate 99*c*, $\times 3800$; *e*, detail of struts in Plate 100*c*, $\times 6300$; *f*, detail of surface structure in *d*, $\times 21,000$. (Micrographs reduced to 77%.)

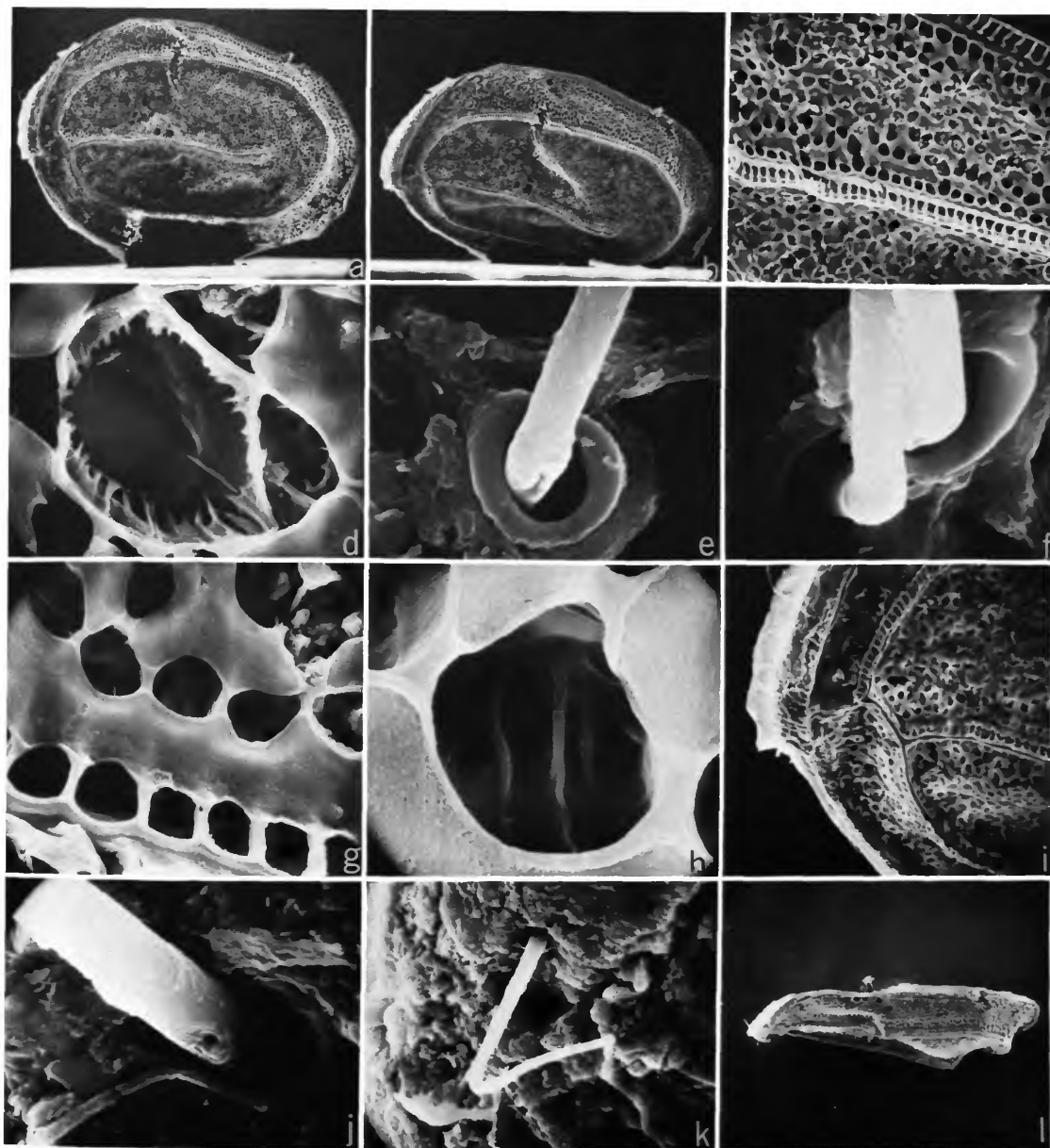


PLATE 102.—*Asteropella slatteryi*, new species, ovigerous female, holotype, USNM 141554, left valve, outside views: *a*, lateral view of valve, $\times 60$; *b*, oblique view, $\times 60$; *c*, posterodorsal part of valve, from *b*, $\times 240$; *d*, large fossa in upper left part of *c*, $\times 1750$; *e*, bristle in upper left part of *c*, $\times 10,000$; *f*, pair of bristles, from *c*, $\times 10,000$; *g*, fossae in posterodorsal part of valve (bottom row of fossae is just above inner peripheral ridge), from *b*, $\times 1200$; *h*, fossa in *g*, $\times 4200$; *i*, anterior of valve, from *b*, $\times 185$; *j*, bristle in upper left of *i*, near anterior margin, $\times 10,000$; *k*, bristle near anterior edge of rostrum, from *i*, $\times 2000$; *l*, dorsal view of valve, distorted anterior margin to left, $\times 50$. (Micrographs reduced to 51%.)



PLATE 103.—*Asteropella slatteryi*, new species, ovigerous female, holotype, USNM 141554, left valve, inside views: *a*, complete valve (distorted), $\times 50$; *b*, anterior end from *a*, $\times 185$; *c*, posteroventral margin, from *a*, $\times 200$; *d*, lamellar prolongation of selvage at posteroventral corner of valve, from *c*, $\times 2500$; *e*, surface texture on lamellar prolongation shown in *d*, $\times 12,500$; *f*, attached ends of central adductor muscles, from *a*, $\times 500$; *g*, base of muscle on left of *f*, $\times 2000$; *h*, bristles on list of posteroventral infold, from *c*, $\times 1500$; *i*, bristle in upper part of *h*, $\times 3000$; *j*, bristles near middle of *h*, $\times 5000$; *k*, bristles on posteroventral infold just below those shown in *h*, $\times 3000$; *l*, bristle shown in *k*, $\times 7000$. (Micrographs reduced to 53%.)

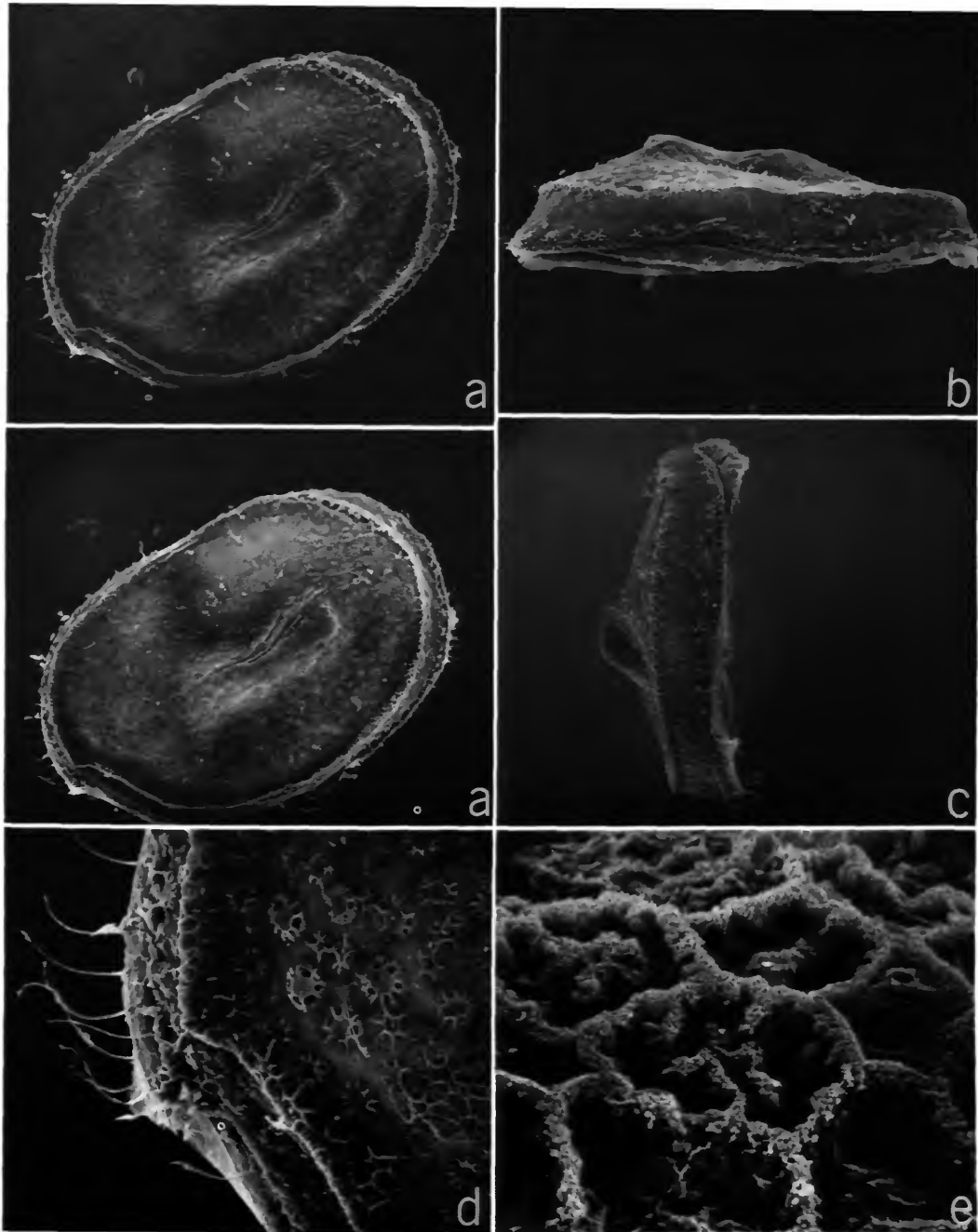


PLATE 104.—*Asteropella kaufmani*, new species, variety A, adult female, holotype, USNM 156934, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 60$; *b*, dorsal view, anterior to right, $\times 70$; *c*, posterior view, $\times 80$; *d*, anterior end of valve, lateral view, $\times 240$; *e*, detail of surface, $\times 2400$. (Micrographs reduced to 80%.)

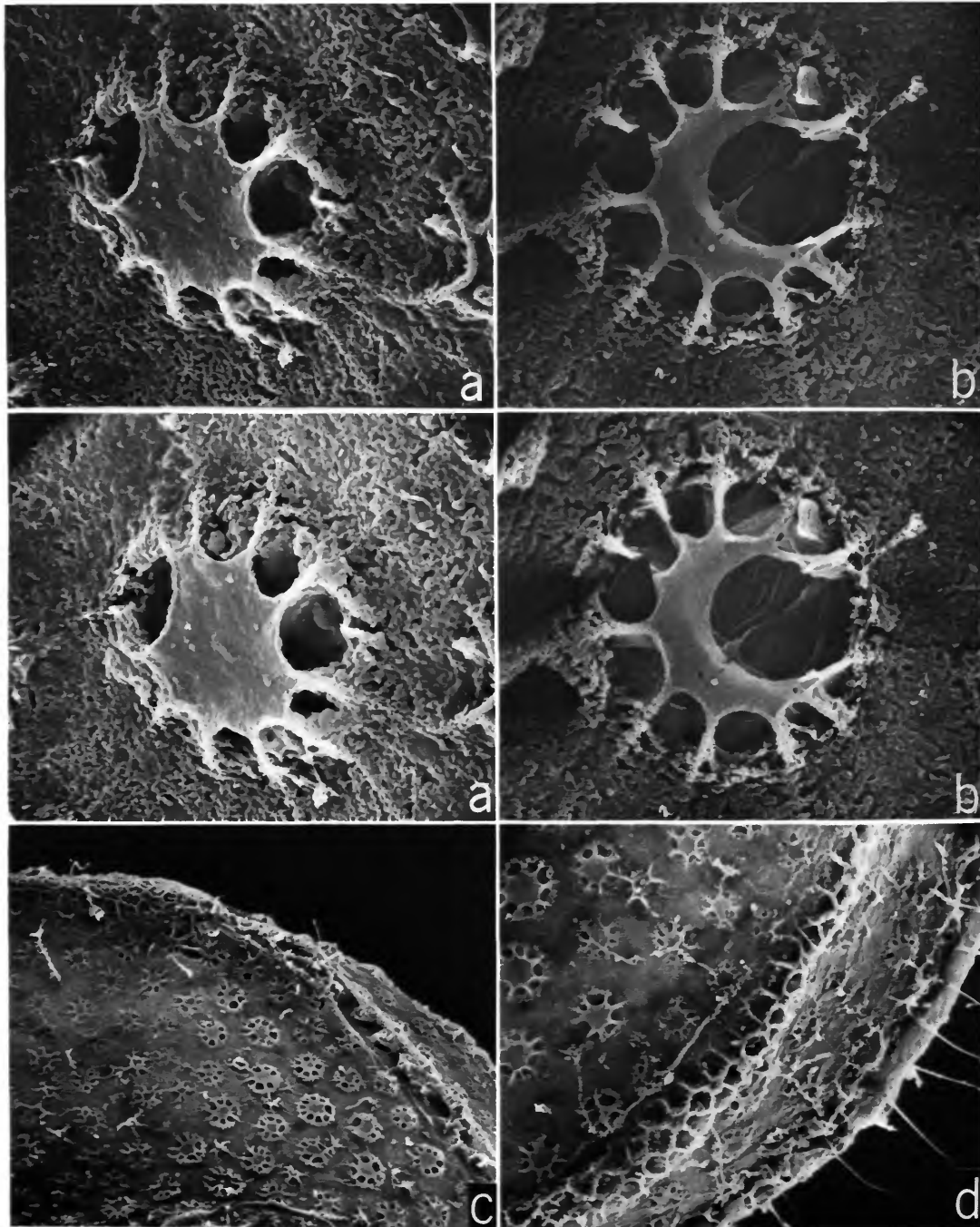


PLATE 105.—*Asteropella kaufmani*, new species, variety A, adult female, holotype, USNM 156934, left valve, outside views: *a*, *b*, detail of stellate structures on valve surface, stereoscopic pairs, $\times 1600$, 1400 ; *c*, posterodorsal margin of valve, $\times 200$; *d*, posteroventral margin of valve, $\times 300$. (Micrographs reduced to 81%.)

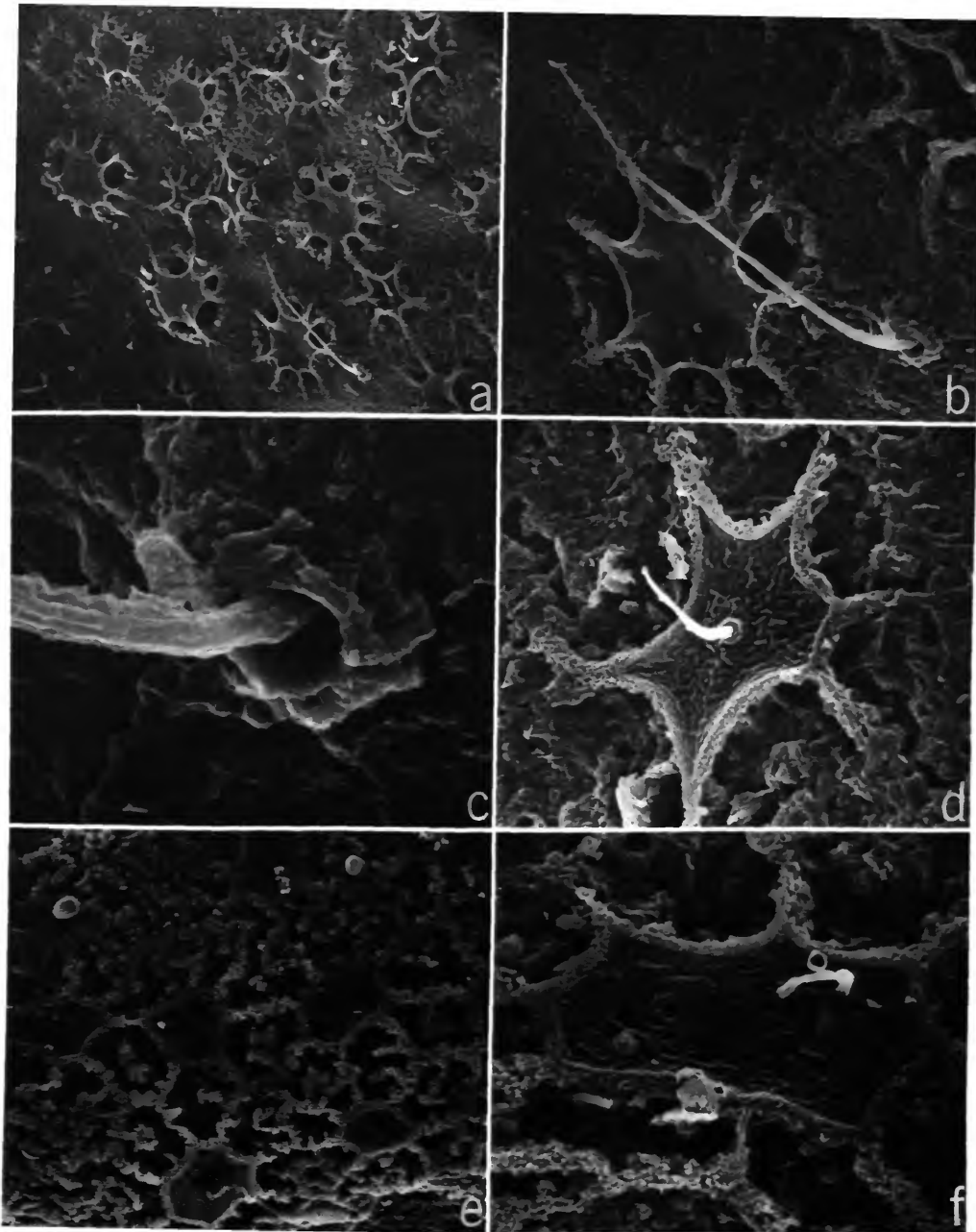


PLATE 106.—*Asteropella kaufmani*, new species, variety A, adult female, holotype, USNM 156934, left valve, outside views: *a*, valve surface near anterior, from Plate 104*d*, $\times 550$; *b*, detail of bristle and stellate structure in *a*, $\times 1600$; *c*, detail of pore and bristle in *b*, $\times 8000$; *d*, detail of stellate structure with bristle, from middle of *a*, $\times 2650$; *e*, surface structure of horizontal midridge, lateral view, $\times 1100$; *f*, stellate structure and bristle on horizontal midridge, $\times 2800$. (Micrographs reduced to 77%.)

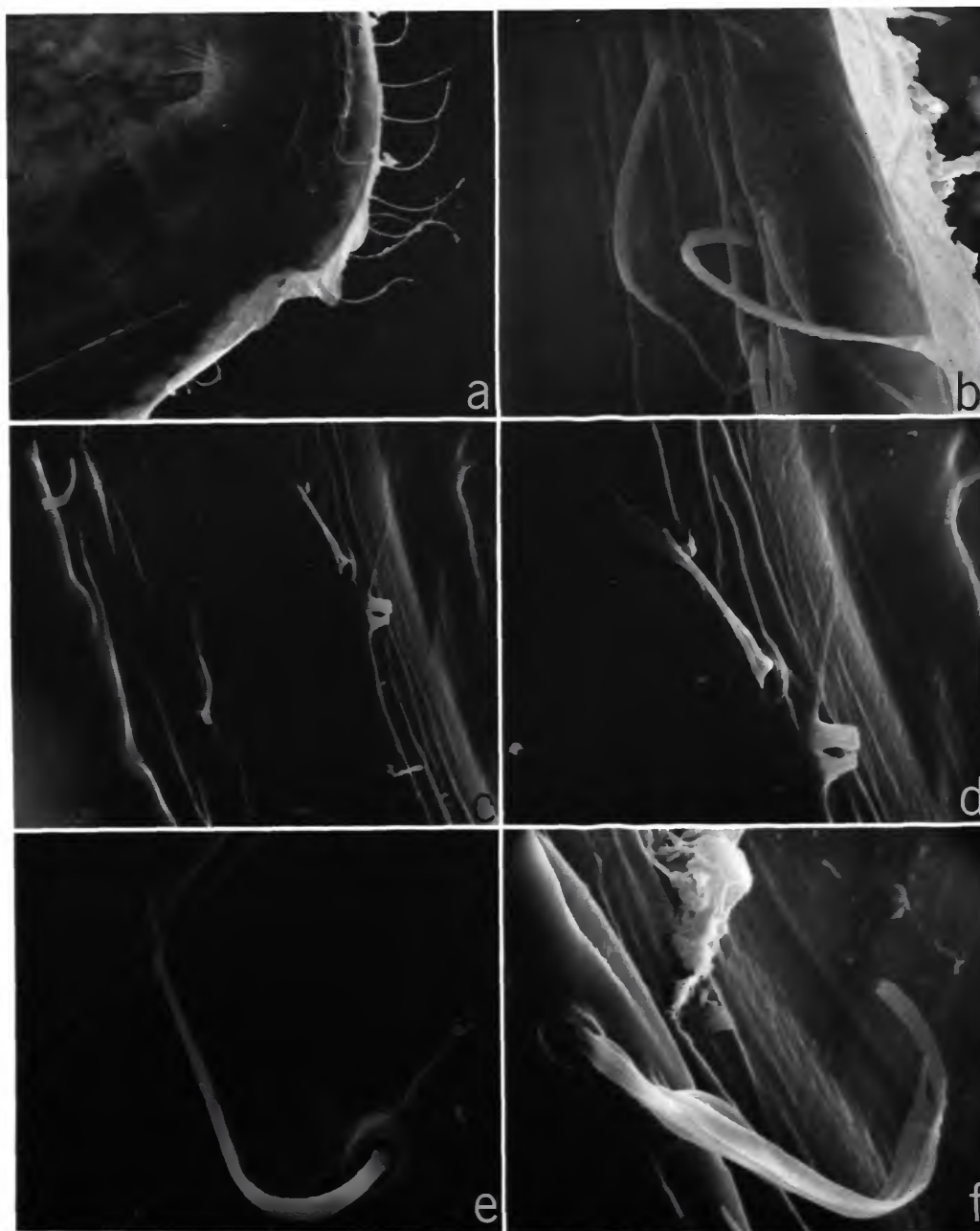


PLATE 107.—*Asteropella kaufmani*, new species, variety A, adult female, holotype, USNM 156934, left valve, inside views: *a*, anterior of valve showing minute incisor and rostrum, $\times 220$; *b*, detail of bristle on infold of rostrum, from *a*, $\times 1800$; *c*, posterior infold showing bristles, $\times 2000$; *d*, detail of bristles on list of infold shown in *c*, $\times 3400$; *e*, bristle posterior to incisor shown in *a*, $\times 3800$; *f*, bristle on posterior list, $\times 50$. (Micrographs reduced to 77%.)

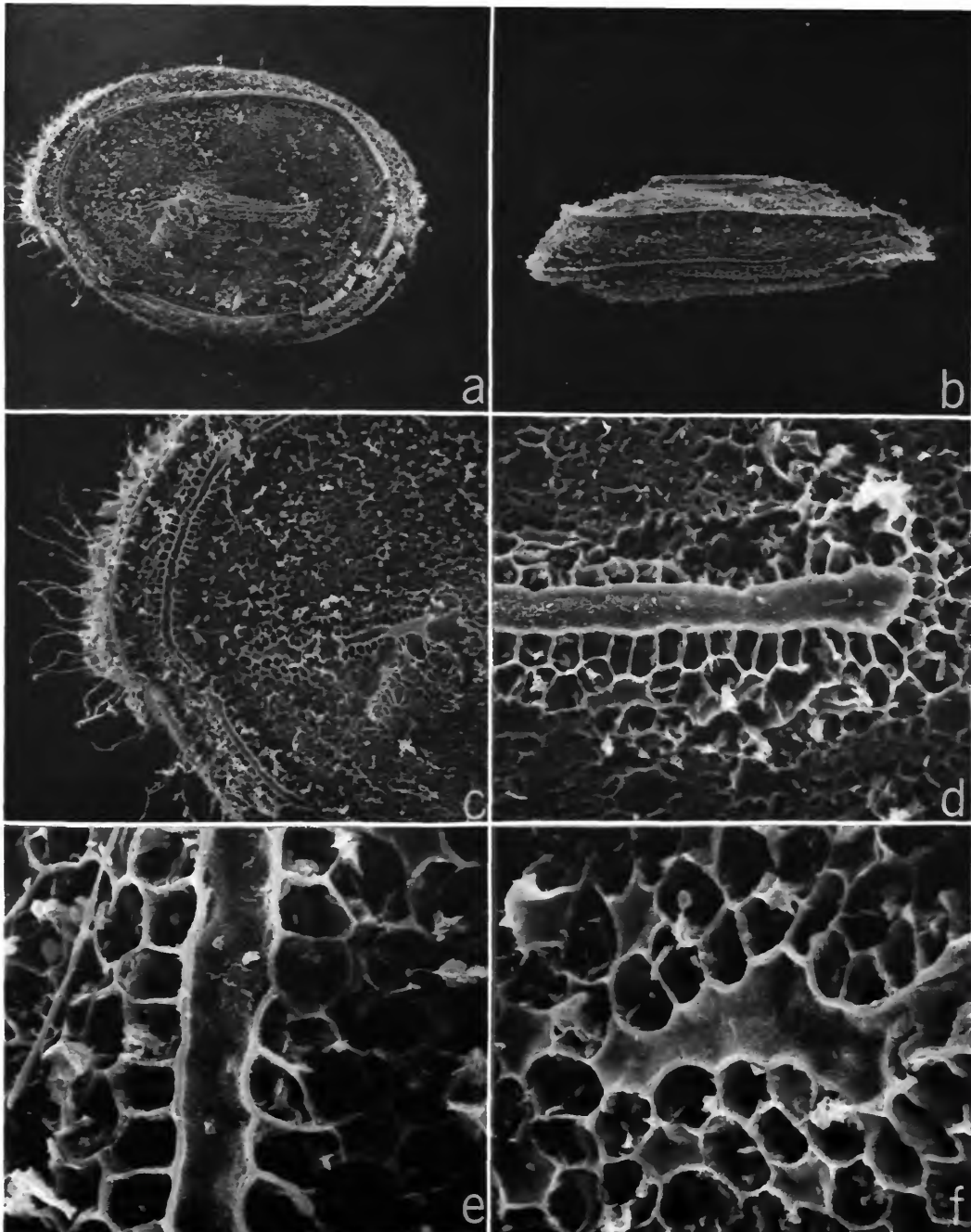


PLATE 108.—*Asteropella kaufmani*, new species, variety B, ovigerous female, USNM 157202, left valve, outside views: *a*, lateral view, $\times 60$; *b*, dorsal view, anterior to right, $\times 60$; *c*, anterior of valve, from *a*, $\times 135$; *d*, posterior end of horizontal midridge, from *a*, $\times 500$; *e*, anterior end of inner concentric ridge, from *c*, $\times 1000$; *f*, anterior end of horizontal midridge, from *c*, $\times 750$. (Micrographs reduced to 80%.)

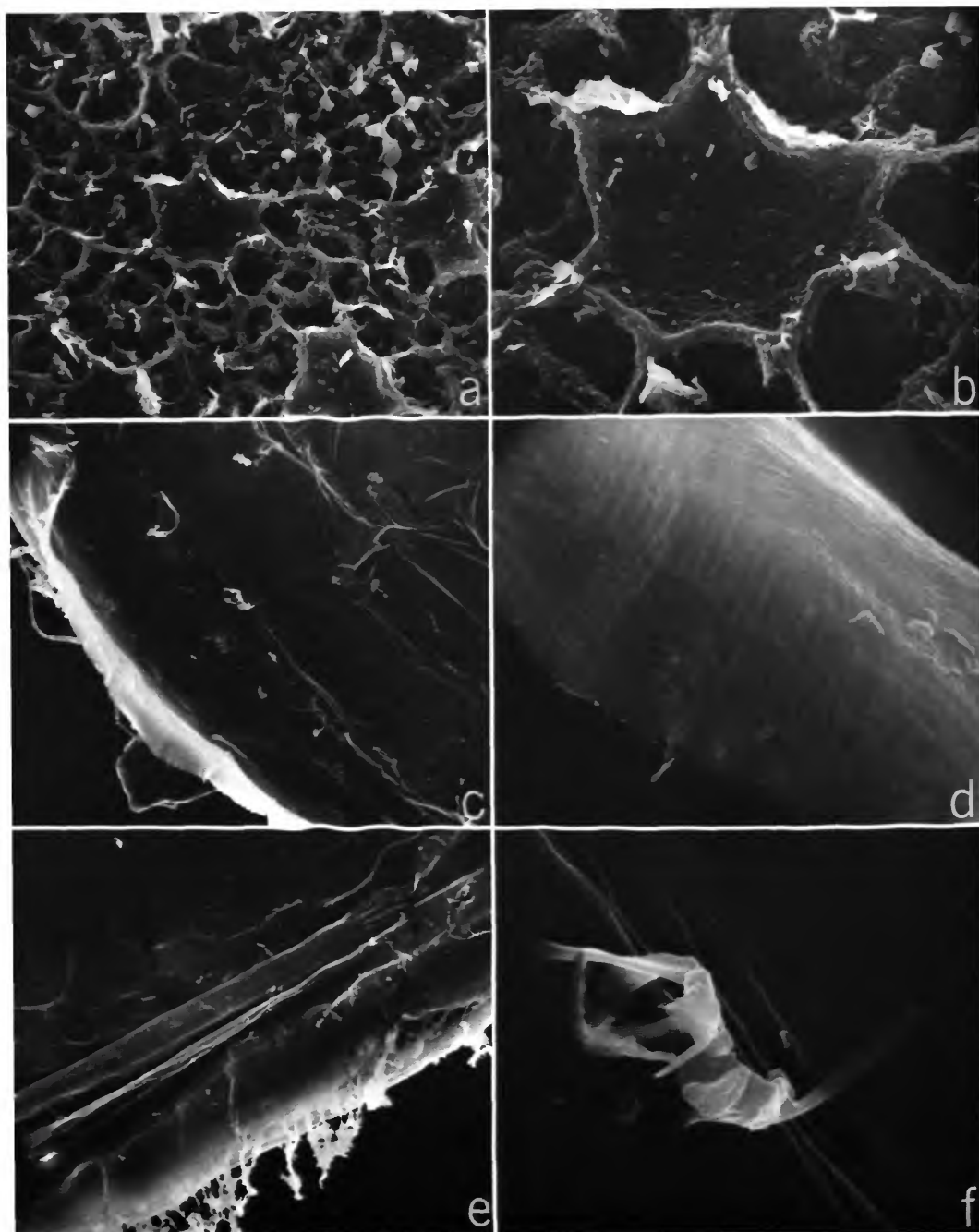


PLATE 109.—*Asteropella kaufmani*, new species, variety B, ovigerous female, USNM 157202, left valve: *a*, detail of surface, from Plate 108*a*, $\times 1000$; *b*, detail from *a*, $\times 2700$; *c*, posteroventral margin from inside, $\times 600$; *d*, lamellar prolongation of selvage, from *c*, $\times 5000$; *e*, anteroventral margin of valve from inside, $\times 500$; *f*, bristles on list of posteroventral infold, from *c*, $\times 5000$. (Micrographs reduced to 80%.)

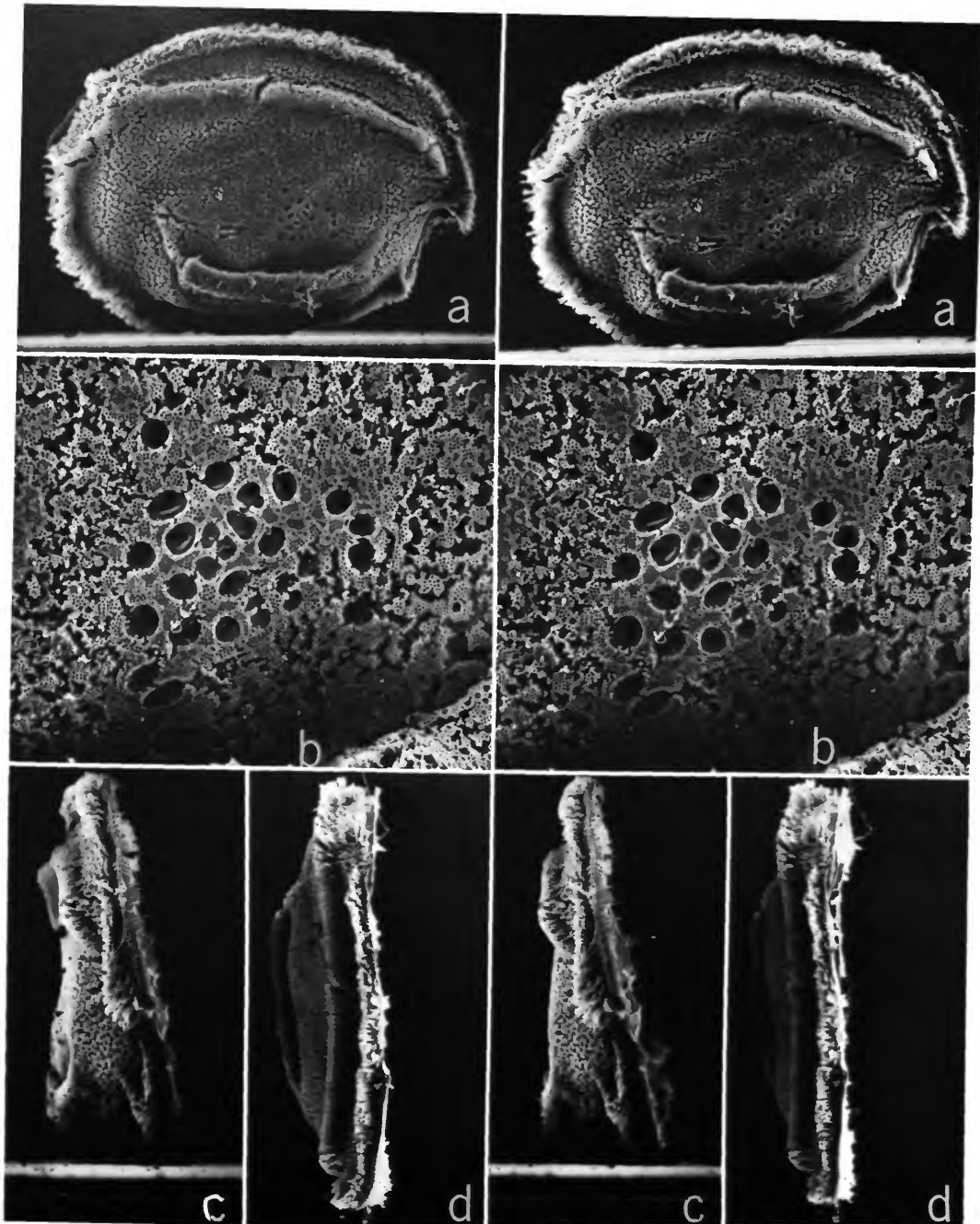


PLATE 110.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum Berlin 6977 (specimen 1), right valve, outside views, stereoscopic pairs: *a*, lateral view, $\times 36$; *b*, area of central adductor muscle scars, from *a*, $\times 150$; *c*, anterior view, $\times 50$; *d*, dorsal view, $\times 35$. (Micrographs reduced to 76%.)

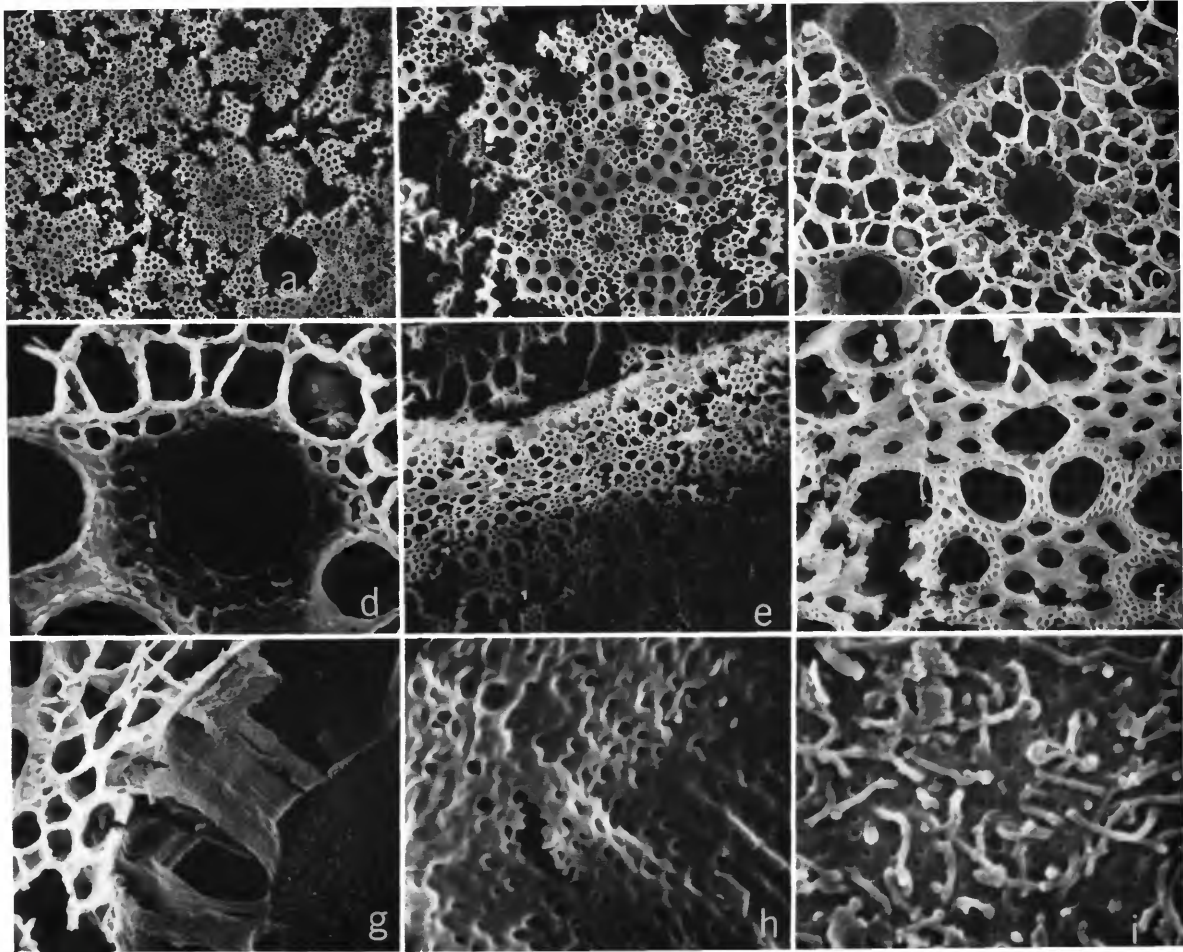


PLATE 111.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum Berlin 6977 (specimen 1), right valve: *a*, surface near middle of valve, from Plate 110*a*, $\times 360$; *b*, detail or surface, from *a*, $\times 1000$; *c*, detail of surface, from *b*, $\times 4000$; *d*, detail of surface, from *c*, $\times 10,000$; *e*, detail of upper ridge near posterior end, from Plate 110*a*, $\times 360$; *f*, detail of surface, from *e*, $\times 1800$; *g*, detail of edge of fossa in vicinity of central adductor muscle attachments, from lower right of *a*, $\times 4000$; *h*, detail of surface of border of fossa, from middle of *g*, $\times 25,000$; *i*, from bottom of fossa shown in *g*, $\times 25,000$. (Micrographs reduced to 55%.)

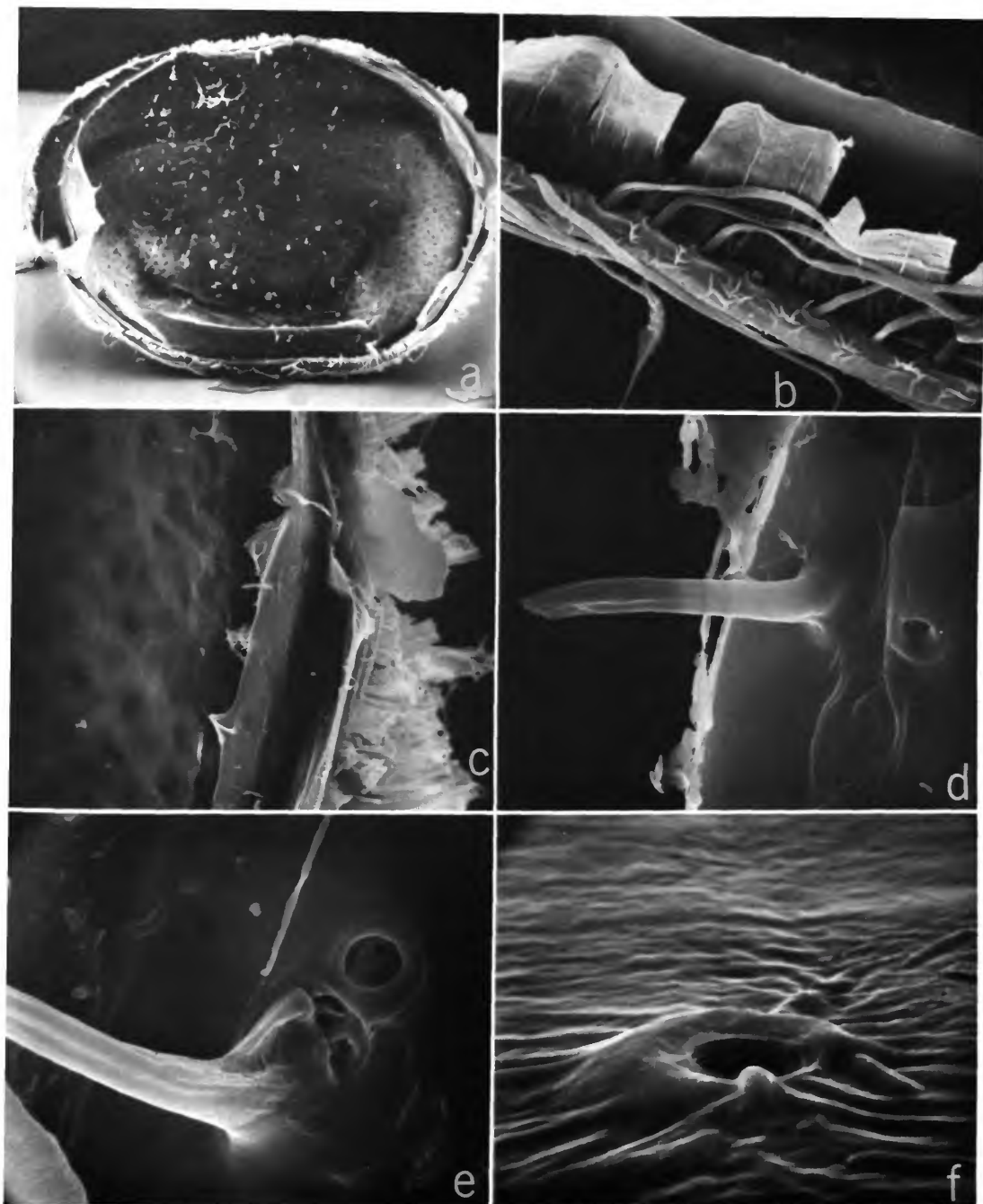


PLATE 112.—*Asteropteron fuscum* (Müller), adult female, syntype, Zoological Museum Berlin 6977 (specimen 1), right valve, inside views: *a*, medial view, $\times 38$; *b*, anteroventral margin of valve, from *a*, $\times 700$; *c*, posteroventral margin showing infold, $\times 260$; *d*, *e*, bristles on list of posteroventral infold, from *c*, $\times 2600$, $\times 5000$; *f*, pore on inside of valve just dorsal to lower peripheral ridge, $\times 10,000$. (Micrographs reduced to 77%.)

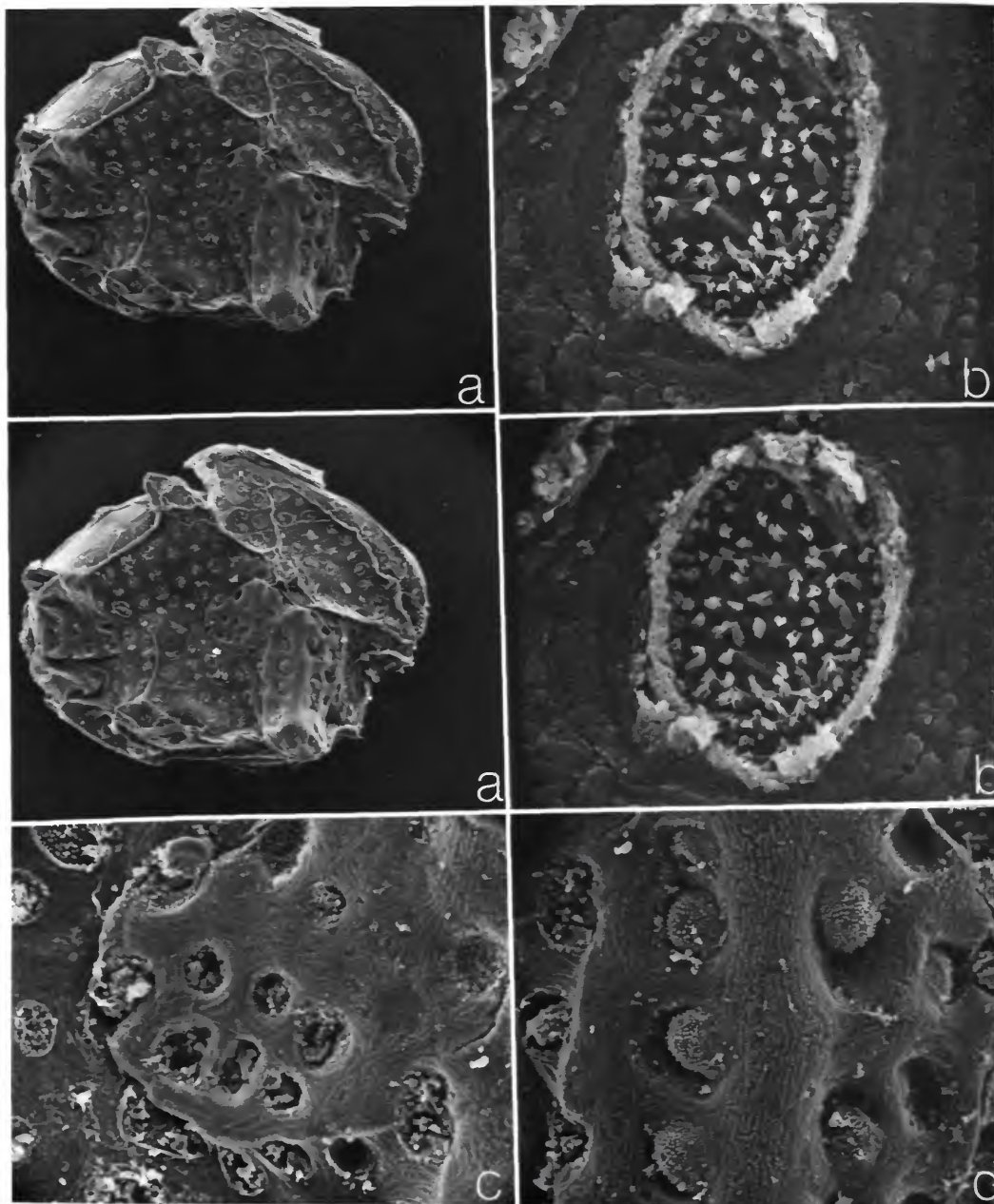


PLATE 113.—*Asteropterygion* aff. *A. setiferum* (Kornicker and Caraion), probably late juvenile, Hamburg Zoological Museum K 29972a, lateral views of right valve: *a*, complete valve (tear near middle of dorsal margin), concretions near middle and extending from middle to anteroventral margin, stereoscopic pair, $\times 36$; *b*, detail of fossa just posterior to valve center, from *a*, stereoscopic pair, $\times 1000$; *c*, fossae in vicinity of central adductor muscle attachments, from *a*, $\times 200$; *d*, fossae on concretion extending from middle to anteroventral margin, from *a*, $\times 200$. (Micrographs reduced to 75%.)

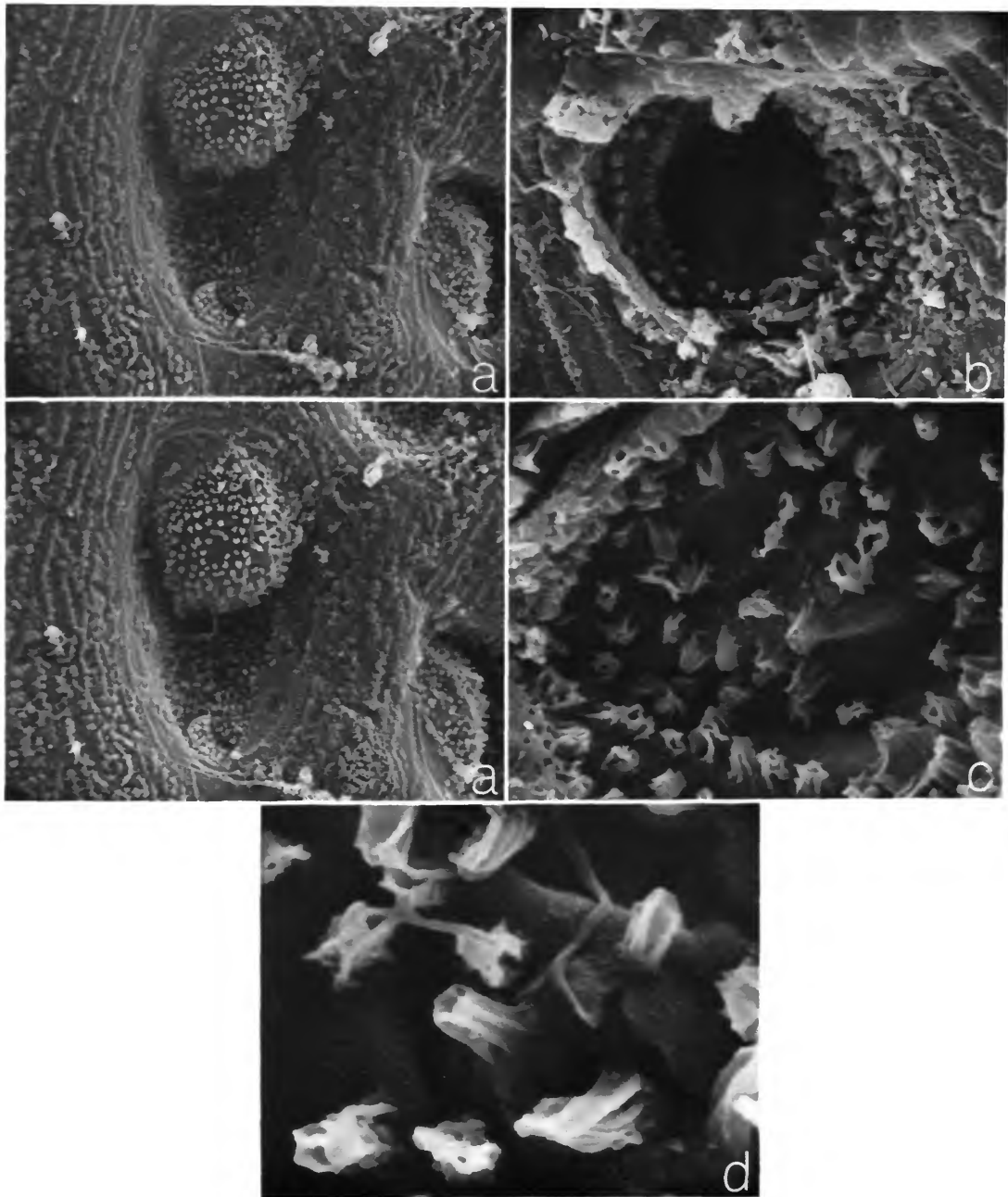


PLATE 114.—*Asteropterygion* aff. *A. setiferum* (Kornicker and Caraion), probably late juvenile, Hamburg Zoological Museum K 29972a, lateral views of right valve: *a*, detail of fossae in Plate 113*d*, stereoscopic pair, $\times 500$; *b*, detail of fossa in lower part of Plate 113*c*, $\times 1300$; *c*, polygonal tubes at bottom of fossa in upper part of Plate 113*c*, $\times 2200$; *d*, polygonal tubes at bottom of fossa shown in Plate 113*b*, $\times 5000$. (Micrographs reduced to 77%.)

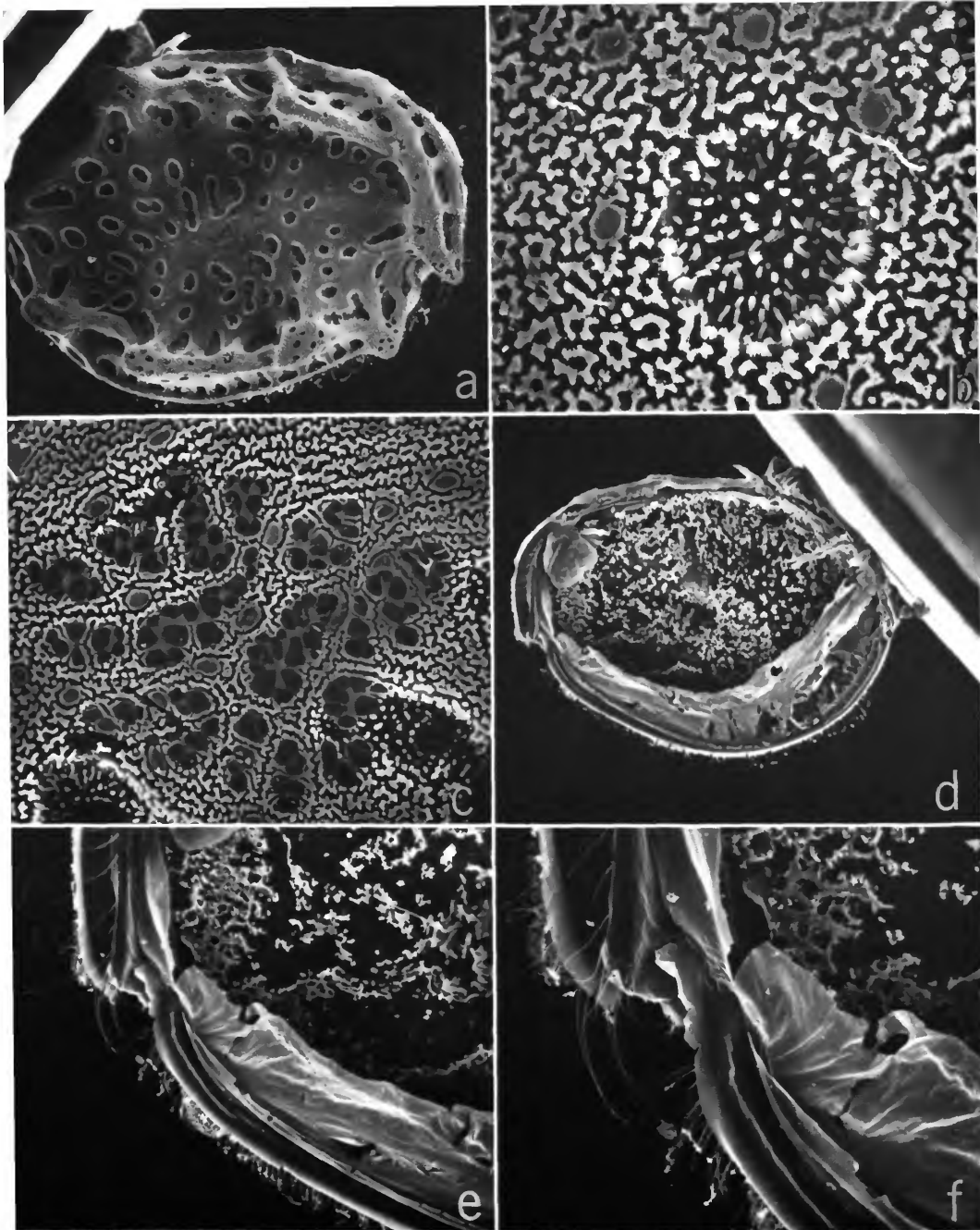


PLATE 115.—*Astropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, right valve: *a*, lateral view, $\times 33$; *b*, detail of surface in anterior part of valve, $\times 500$; *c*, area of central adductor muscle attachments, from near center of *a*, $\times 250$; *d*, inside view, $\times 26$; *e*, anteroventral part of valve, from *d*, $\times 65$; *f*, rostrum and incisor from *e*, $\times 130$. (Micrographs reduced to 80%.)

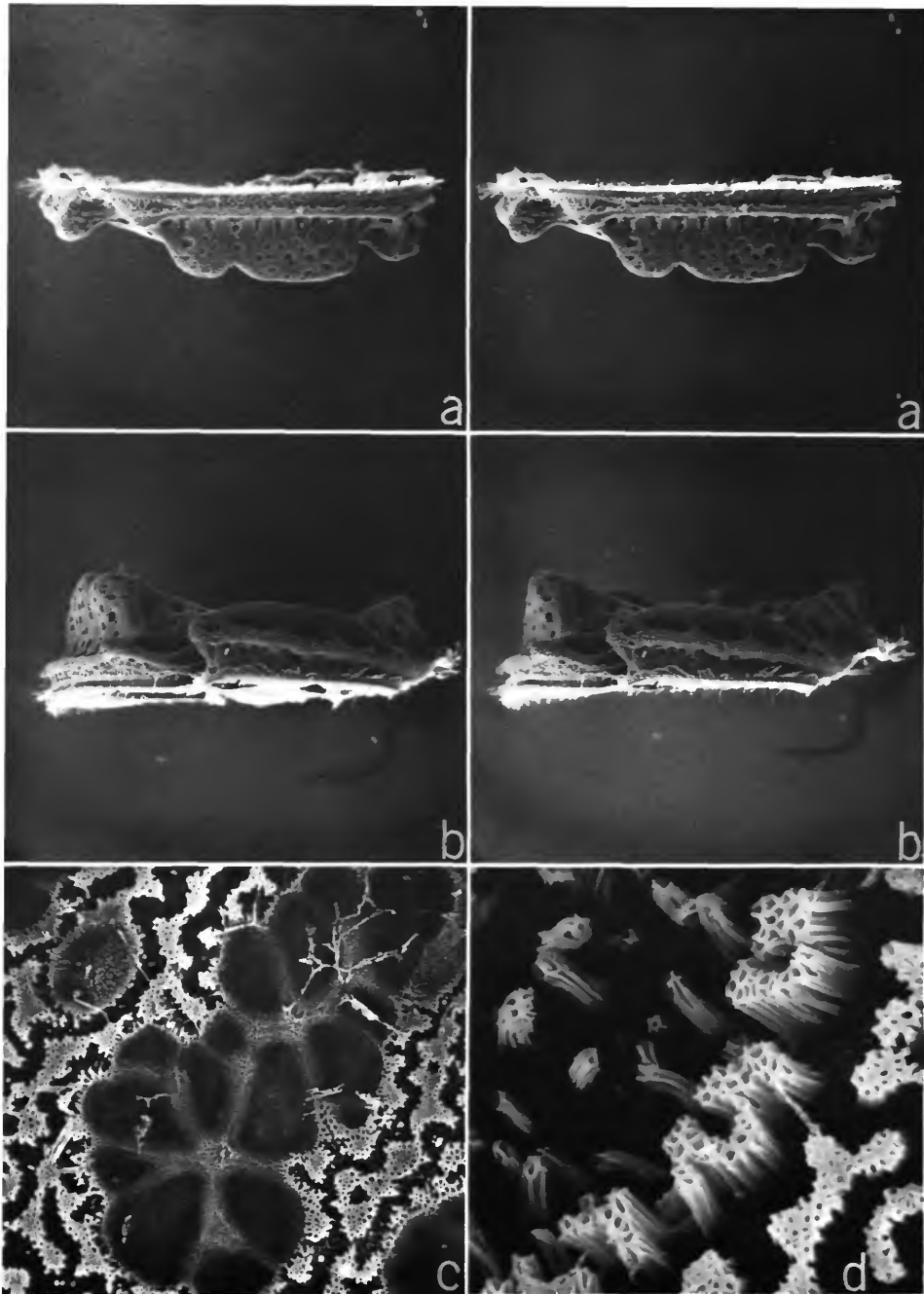


PLATE 116.—*Asteropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, right valve: *a*, ventral view, anterior to left, stereoscopic pair, $\times 27$; *b*, anterior view, ventral margin to left, stereoscopic pair, $\times 37$; *c*, detail of central adductor muscle attachment area, from Plate 115*c*, $\times 1000$; *d*, detail of lower left segment of fossa shown in Plate 115*b*, $\times 2000$. (Micrographs reduced to 77%.)

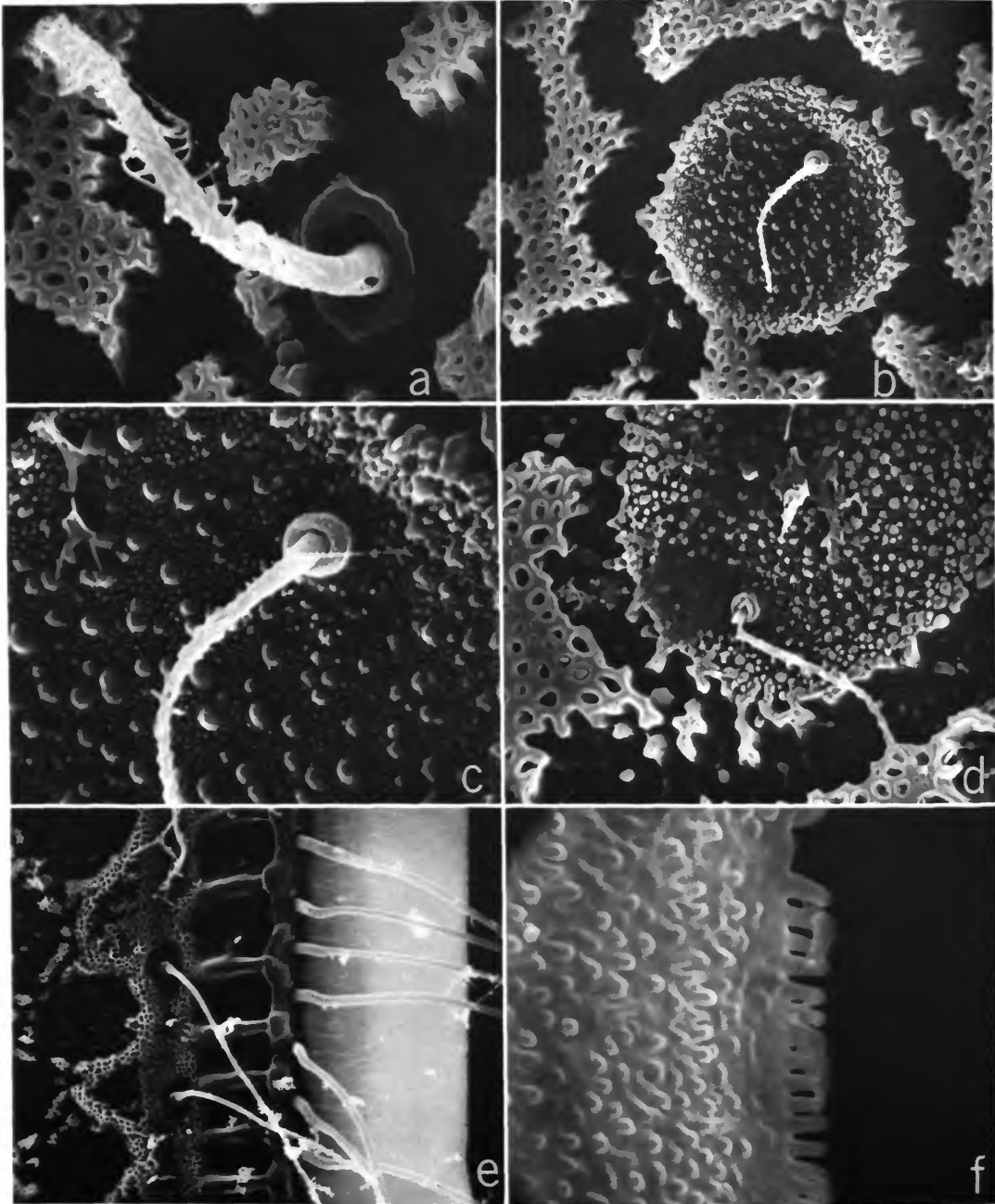


PLATE 117.—*Asteropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, outside views: *a*, bristle shown in Plate 115*b*, $\times 370$; *b*, bristle in shallow fossae, from Plate 115*c*, $\times 3700$; *c*, detail of bristle in *b*, $\times 10,000$; *d*, bristle and shallow fossa, from Plate 116*c*, $\times 5000$; *e*, segment of ventral margin, from Plate 116*a*, $\times 680$; *f*, edge of lamellar prolongation of selvage shown in *e*, $\times 13,650$. (Micrographs reduced to 75%.)

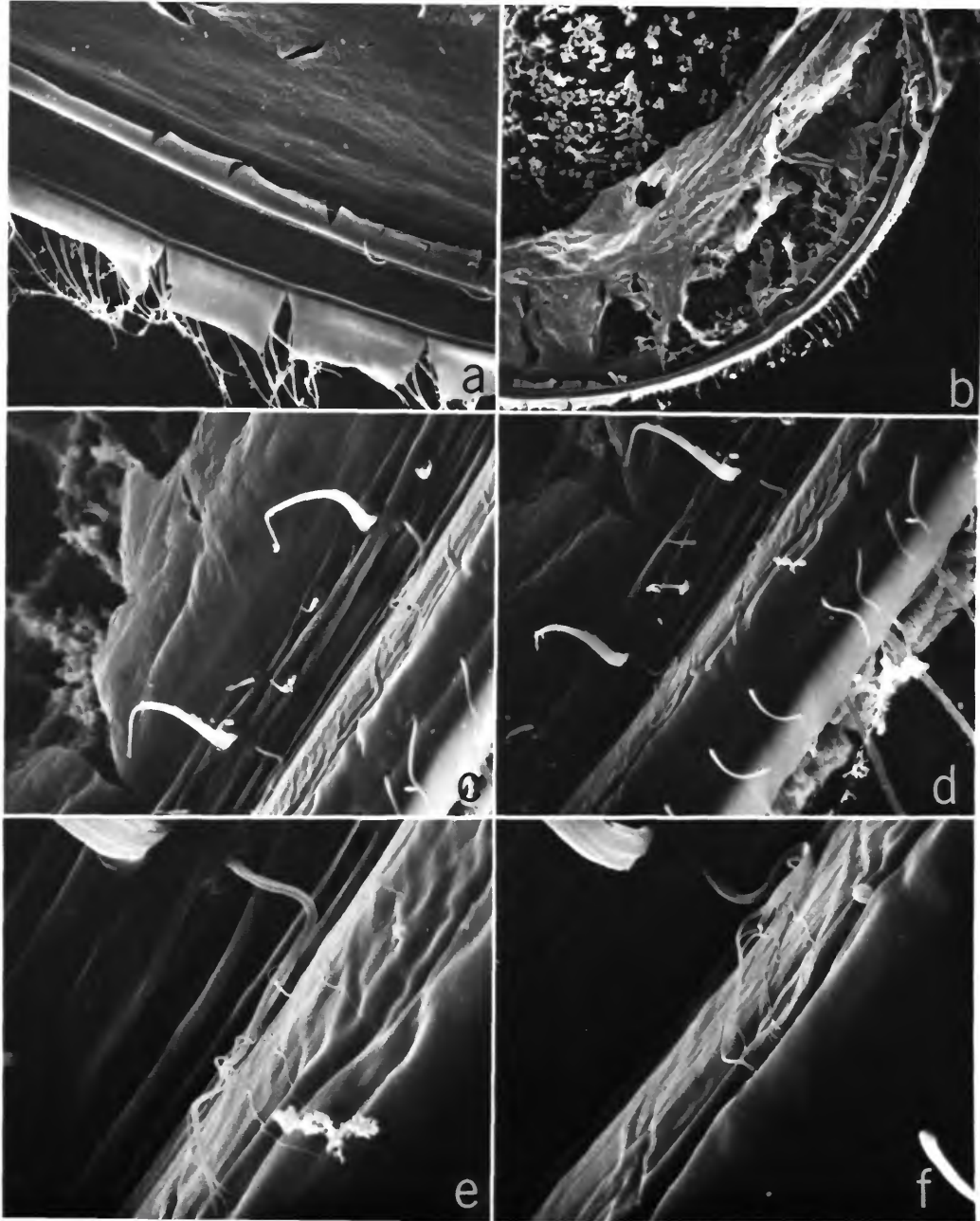


PLATE 118.—*Astropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, right valve, inside views: *a*, anteroventral margin of valve, from Plate 115*d*, $\times 260$; *b*, posteroventral margin of valve, from Plate 115*d*, $\times 65$; *c*, posteroventral infold, from *b*, $\times 650$; *d*, continuation of posteroventral infold in *c*, from *b*, $\times 650$; *e*, flagellate bristle from lower edge of *c*, $\times 2100$; *f*, setose bristle from just below middle of *d*, $\times 2100$. (Micrographs reduced to 78%.)

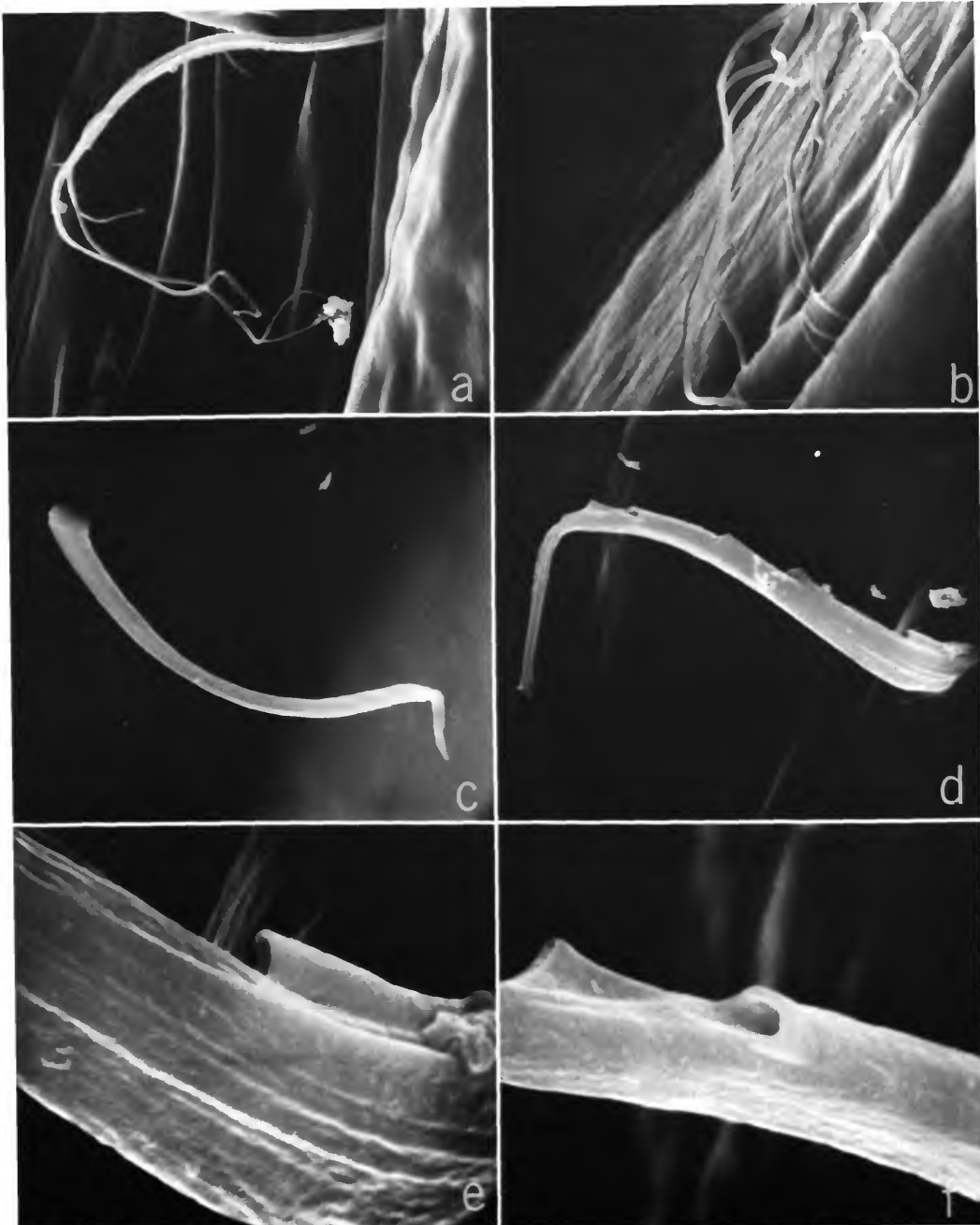


PLATE 119.—*Asteropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, right valve, inside views: *a*, setose bristle from posterior infold ventral to segment shown in Plate 118*d*, $\times 3000$; *b*, distal end of setose bristle shown in Plate 118*f*, $\times 5250$; *c*, bristle in posterior row of posteroventral infold, from Plate 118*d*, $\times 5000$; *d*, stout tubular bristle of list, from bottom of Plate 118*c*, $\times 2600$; *e*, *f*, proximal and distal segments of bristle shown in *d*, $\times 13,000$. (Micrographs reduced to 78%.)

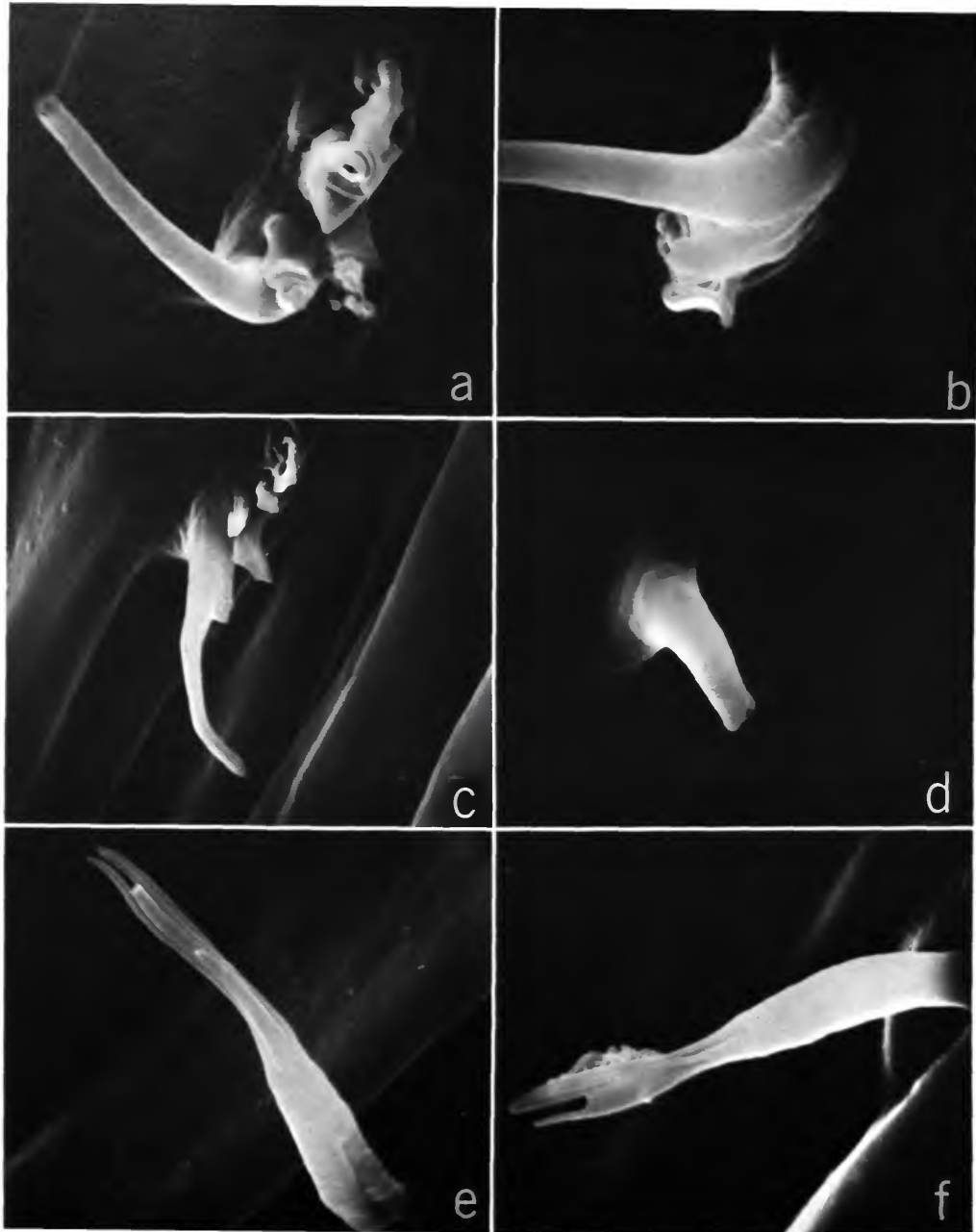


PLATE 120.—*Asteropterygion hulingsi* (Kornicker), female (probably late instar), holotype, USNM 128680, bristles and tubular pores on posteroventral infold of right valve: *a*, from upper edge of Plate 118*d*, $\times 10,500$; *b*, from middle part of Plate 118*d*, $\times 10,500$; *c*, from infold just ventral to segment shown in Plate 118*d*, $\times 10,500$; *d*, tubular pore near middle on Plate 118*d*, $\times 16,000$; *e*, bristle on list dorsal to segment shown in Plate 118*c*, $\times 10,000$; *f*, bristle from upper part of Plate 118*d*, $\times 10,000$. (Micrographs reduced to 77%.)

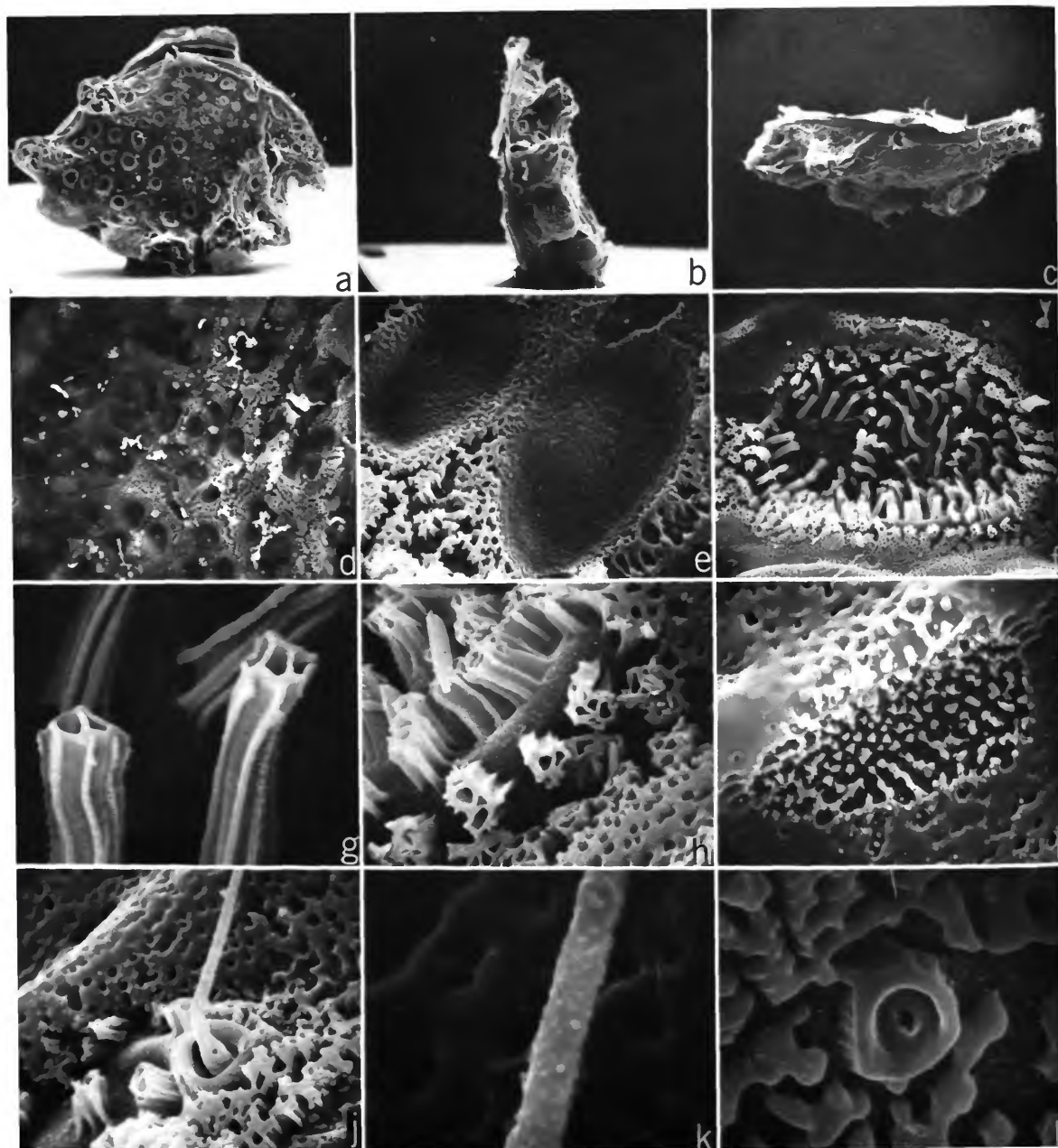


PLATE 121.—*Astropterygion oculitristis* (Darby), adult male, USNM 149327, right valve, outside views: *a*, lateral view of valve (flap at top is piece of left valve; right valve torn in ventral and anterior parts), $\times 55$; *b*, posterior view of valve, $\times 62$; *c*, dorsal view of valve (distorted), $\times 52$; *d*, central adductor muscle attachment area near middle of valve, from *a*, $\times 500$; *e*, detail of 2 scar reflections shown in *d*, $\times 3700$; *f*, fossa at base of posterodorsal node, from *c*, $\times 1100$; *g*, tubular processes from near middle of *f*, $\times 11,000$; *h*, detail of structures near lower right of *f*, $\times 5500$; *i*, shallow fossa shown in upper left of *f*, $\times 7150$; *j*, bristle emerging from open pore (note minute pore in bristle near base), from part of valve near *f*, $\times 5500$; *k*, detail of bristle shown in *j*, $\times 22,000$; *l*, pore in part of valve near *f*, $\times 11,000$. (Micrographs reduced to 55%.)

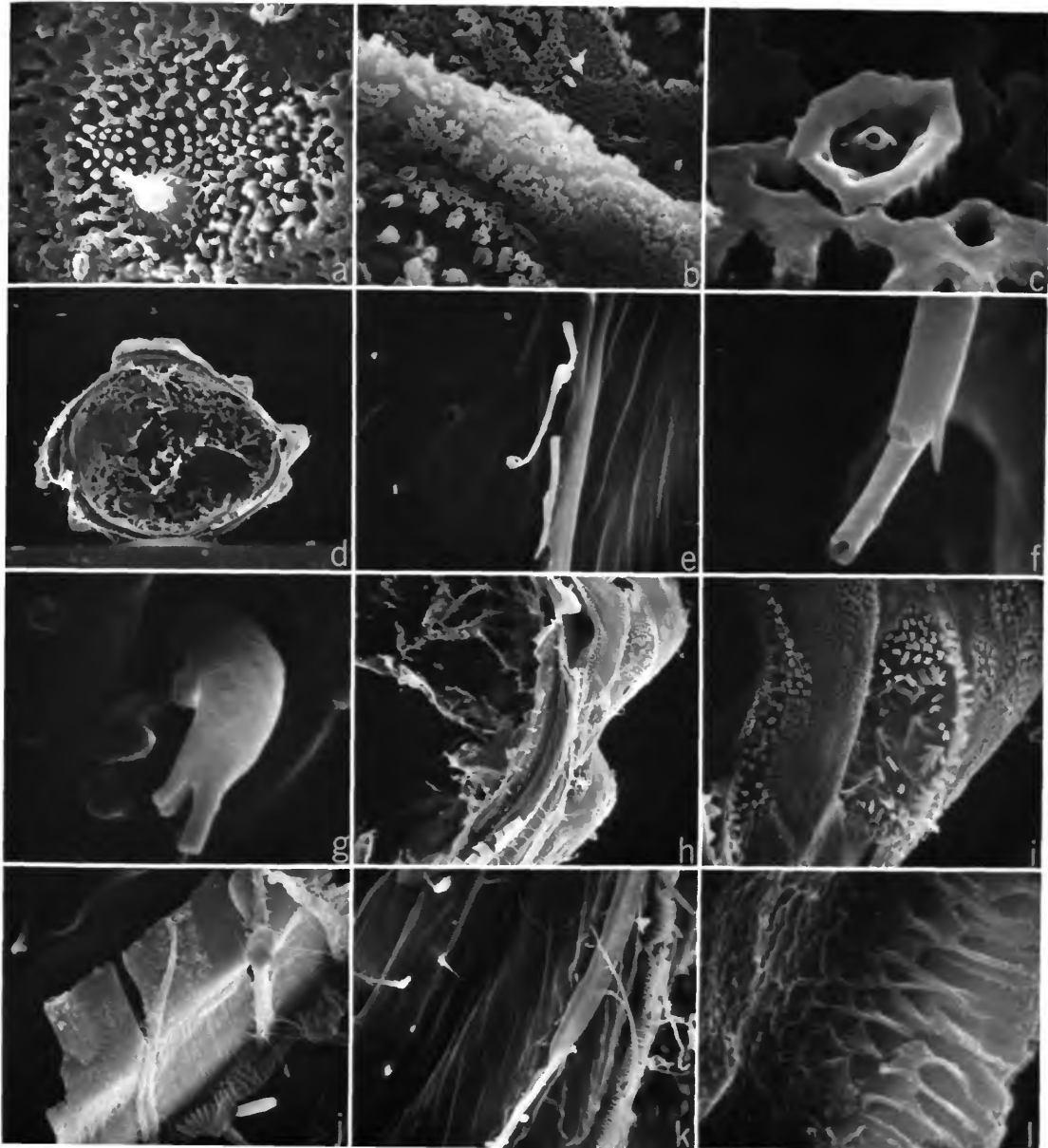


PLATE 122.—*Astropterygion oculitristis* (Darby), adult male, USNM 149327, right valve: *a*, shallow fossa with minute process, from upper right of Plate 121*f*, $\times 7150$; *b*, anterodorsal ridge, from Plate 121*a*, $\times 1850$; *c*, pore in lower left of *b*, $\times 18,000$; *d*, inside view of valve, $\times 100$; *e*, part of rostral infold, from *d*, $\times 1400$; *f*, distal parts of 2 lower bristles with broken tips shown in *e*, $\times 7500$; *g*, minute process on rostral infold anterior to bristles, from *e*, $\times 30,000$; *h*, posterior end of valve shown in *d*, note bristles forming row along posterior infold, $\times 200$; *i*, fossa on posterior node, from *h*, $\times 750$; *j*, lamellar prolongation of selvage and hirsute bristles along posteroventral valve edge, from *h*, $\times 2000$; *k*, posterior margin near middle of *h*, $\times 1000$; *l*, grill-like ridge near bottom right of *k*, $\times 10,000$. (Micrographs reduced to 52%.)

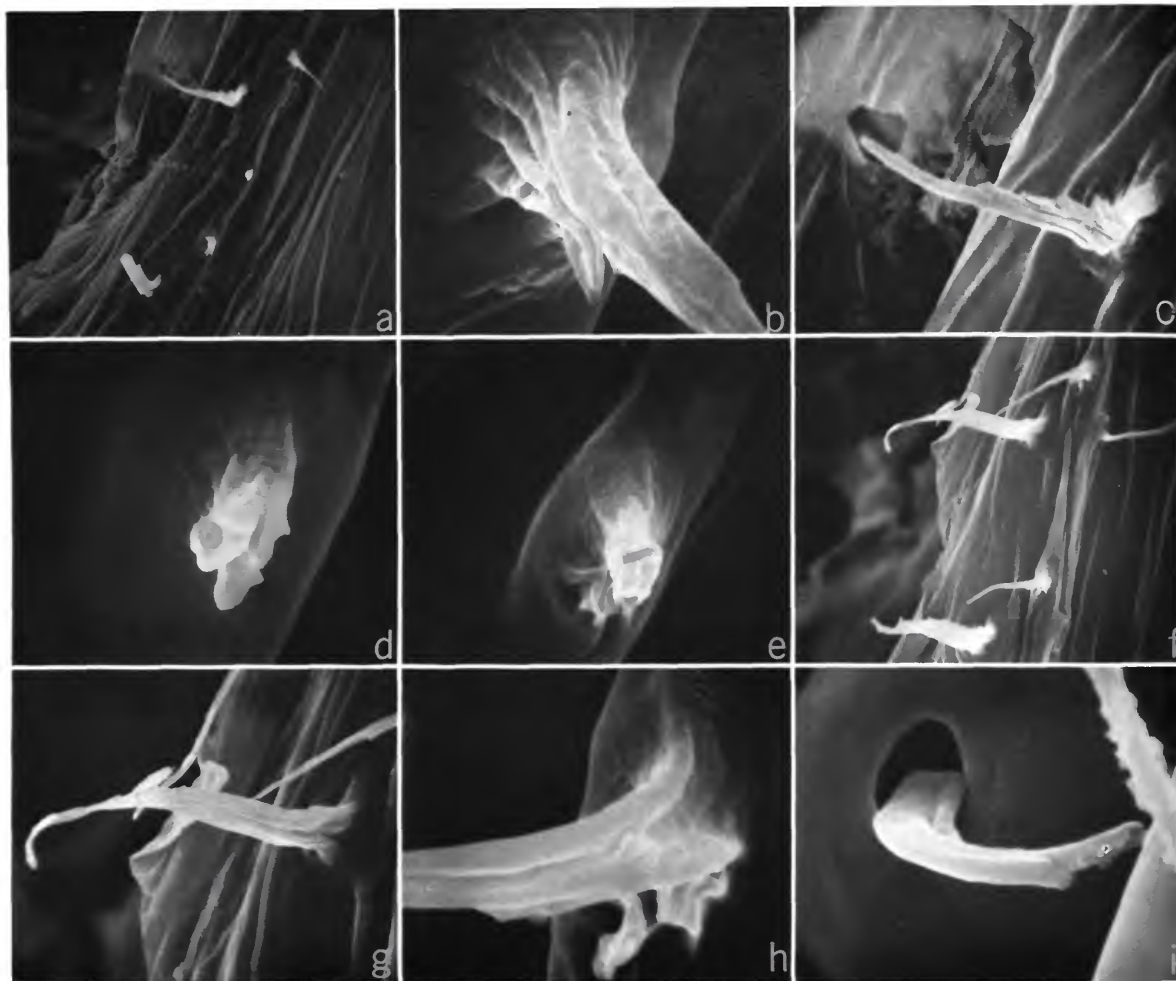


PLATE 123.—*Asteropterygion oculitristis* (Darby), adult male, USNM 149327, right valve, inside views, posterior infold: *a*, bristles and processes on infold (note 2 empty pores of right of list), from Plate 122*k*, $\times 1500$; *b*, proximal part of upper bristle in *a*, $\times 20,000$; *c*, bristle near top of *a*, $\times 5000$; *d*, minute process in middle of *a*, $\times 20,000$; *e*, minute process in lower right of *a*, $\times 10,000$; *f*, bristle and processes on infold, from middle of Plate 122*h*, $\times 2000$; *g*, bristle in upper left of *f*, $\times 4000$; *h*, base of bristle in lower part of *f*, $\times 20,000$; *i*, bristle on infold just proximal to selvage, from Plate 122*k*, $\times 20,000$. (Micrographs reduced to 55%.)

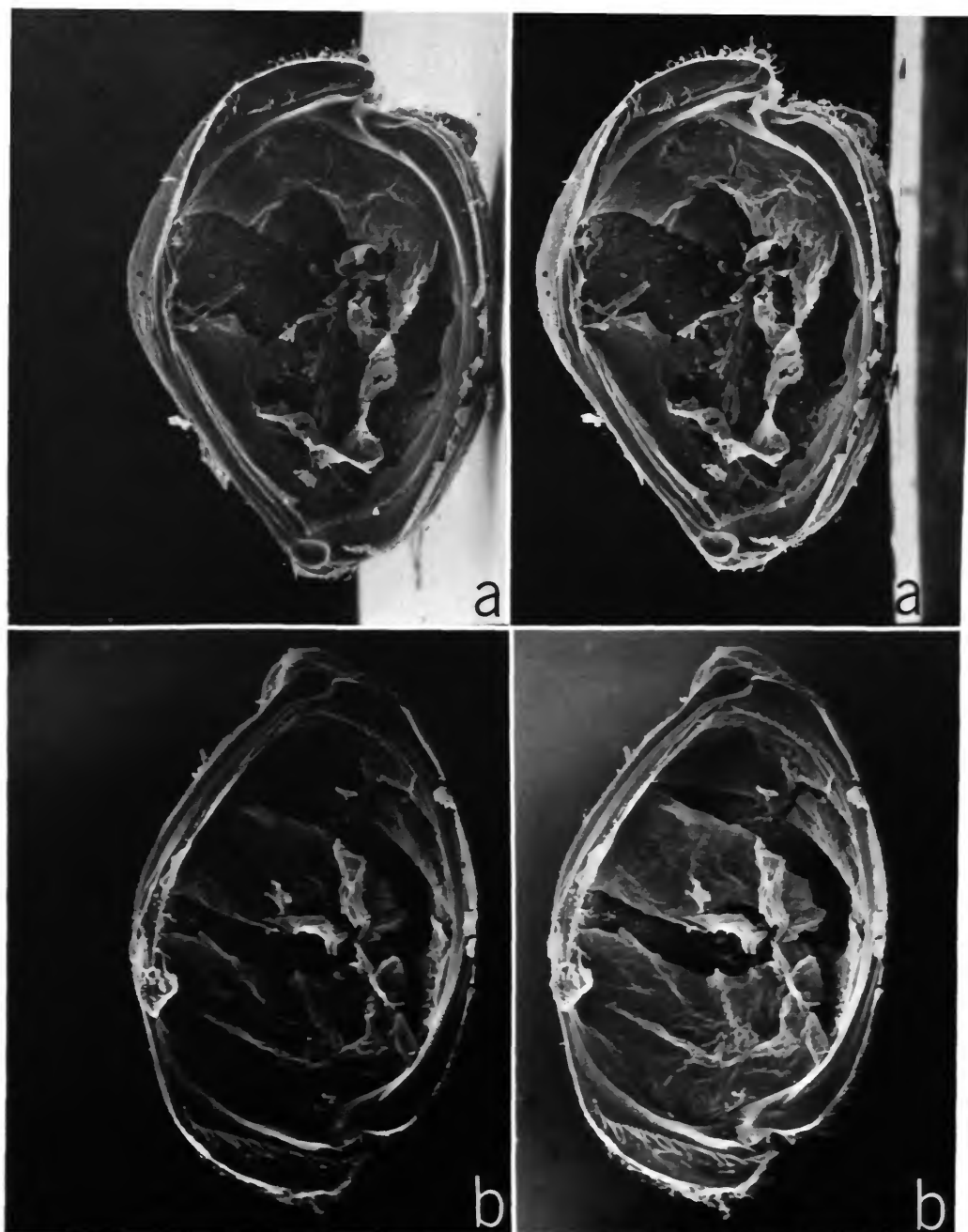


PLATE 124.—*Asteroptyrion oculitristis* (Darby), adult male, USNM 157302, inside views, stereoscopic pairs: *a*, left valve, $\times 38$; *b*, right valve, $\times 44$. (Micrographs reproduced at 100%.)

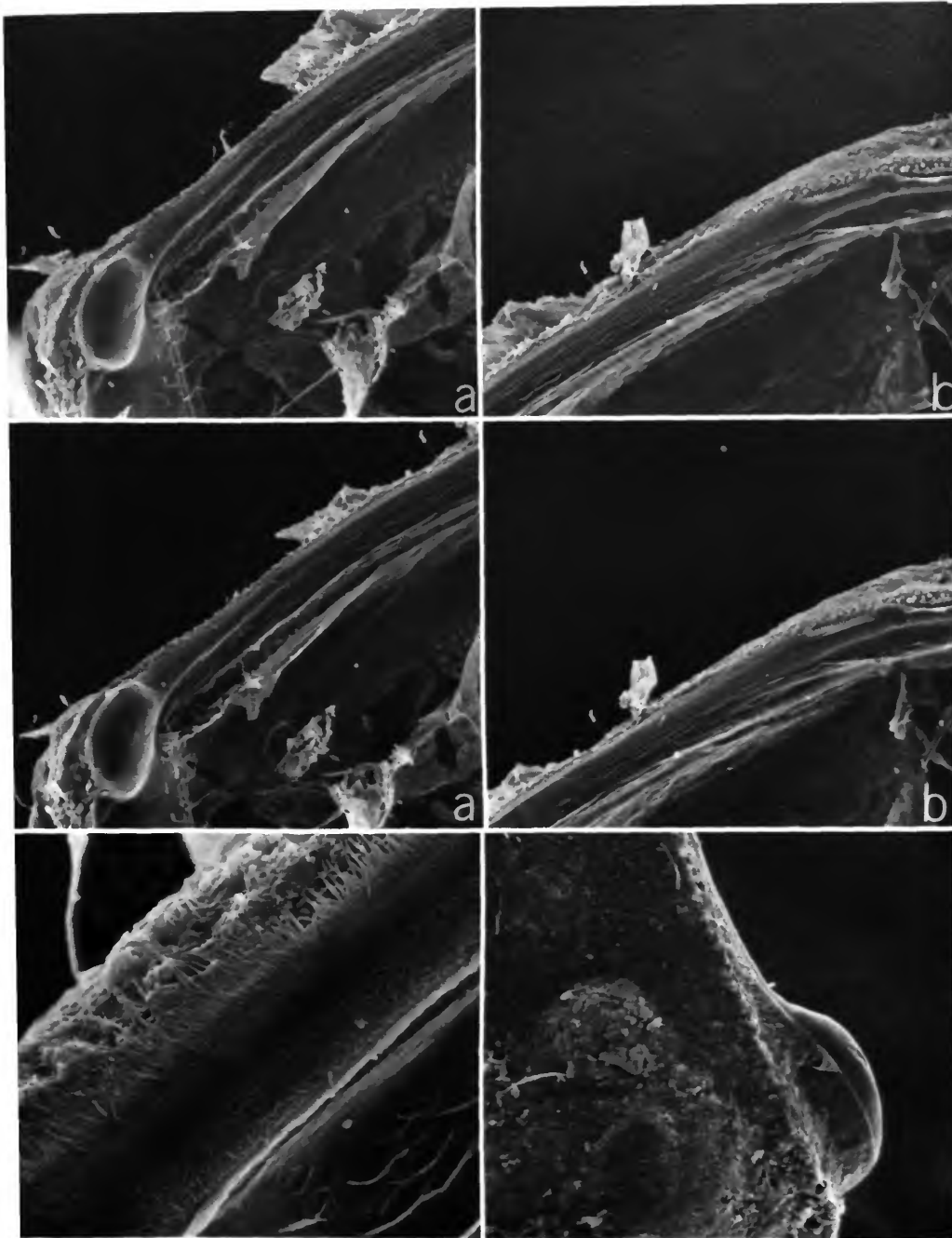


PLATE 125.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, left valve: *a*, posterior hinge tooth, dorsal hinge bar, posterior juncture, and ligament, stereoscopic pair, from Plate 124*a*, $\times 160$; *b*, anterior segment of dorsal margin showing hinge bar, anterior juncture, ligament, and lamellar prolongation of selvage, stereoscopic pair, from Plate 124*a*, $\times 160$; *c*, detail of hinge bar and lamellar prolongation of selvage covering bar, from left end of *b*, $\times 1600$; *d*, dorsal view of posterior hinge tooth, anterior of valve towards top of micrograph (note lamellar prolongation of selvage on tooth), $\times 300$. (Micrographs reduced to 77%.)

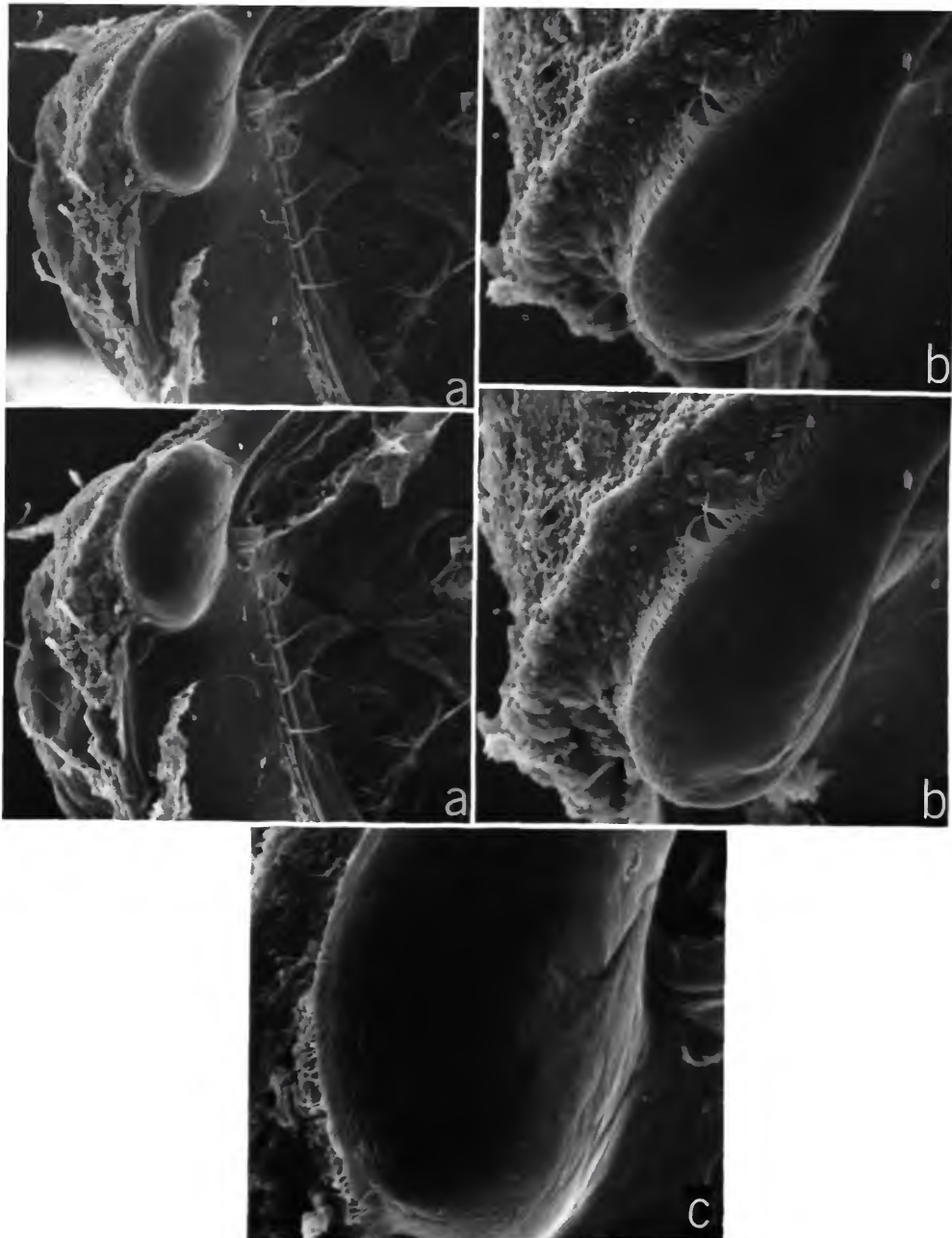


PLATE 126.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, left valve, inside views: *a*, posterodorsal margin showing hinge tooth, posterior juncture, and dorsal part of infold, stereoscopic pair, from Plate 125*a*, $\times 250$; *b*, posterior hinge tooth showing lamellar prolongation of selvage and rows of fine hairs perpendicular to margin of selvage, stereoscopic pair, $\times 600$; *c*, detail from *b*, showing rows of fine hairs on tooth, $\times 800$. (Micrographs reduced to 75%.)

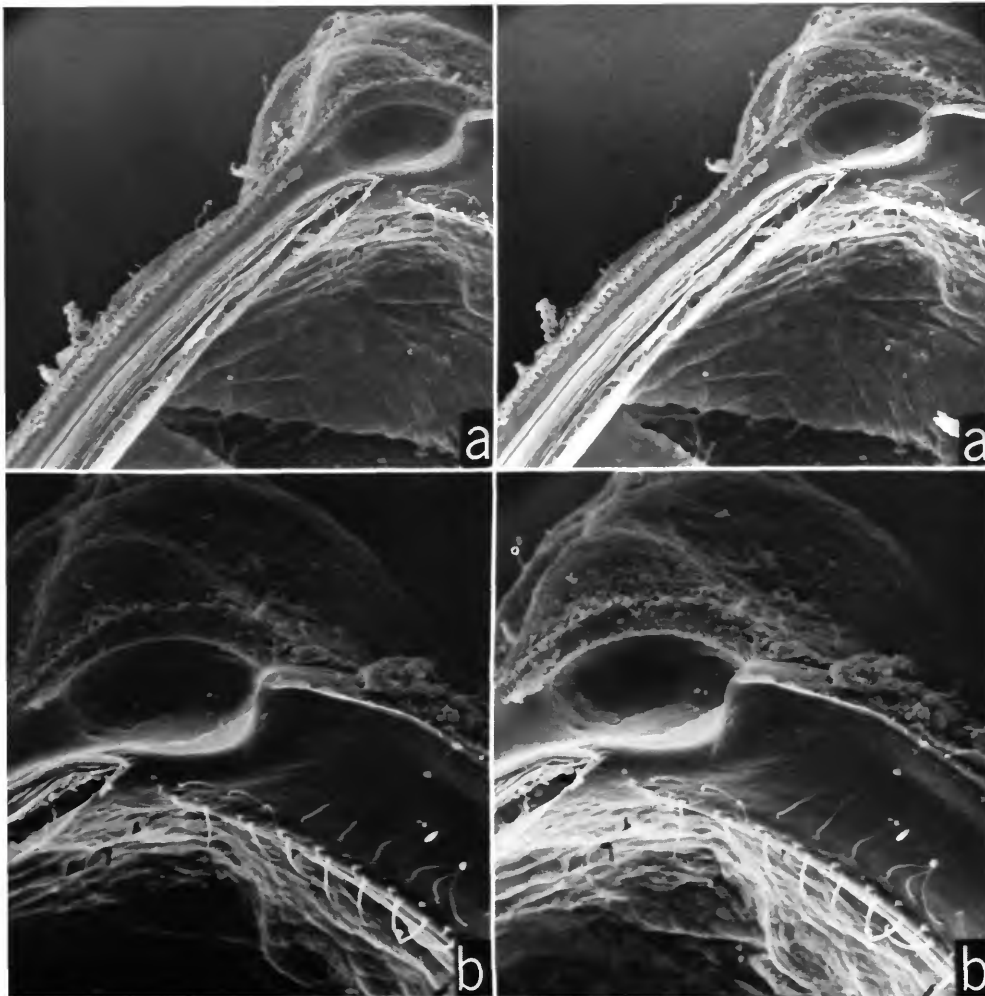


PLATE 127.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, posterior dorsal edge of valve: *a*, posterior hinge area showing socket, hinge groove, ligament, and posterior juncture, stereoscopic pair, from Plate 124*b*, $\times 160$; *b*, detail of *a*, stereoscopic pair, $\times 250$. (Micrographs reduced to 82%.)

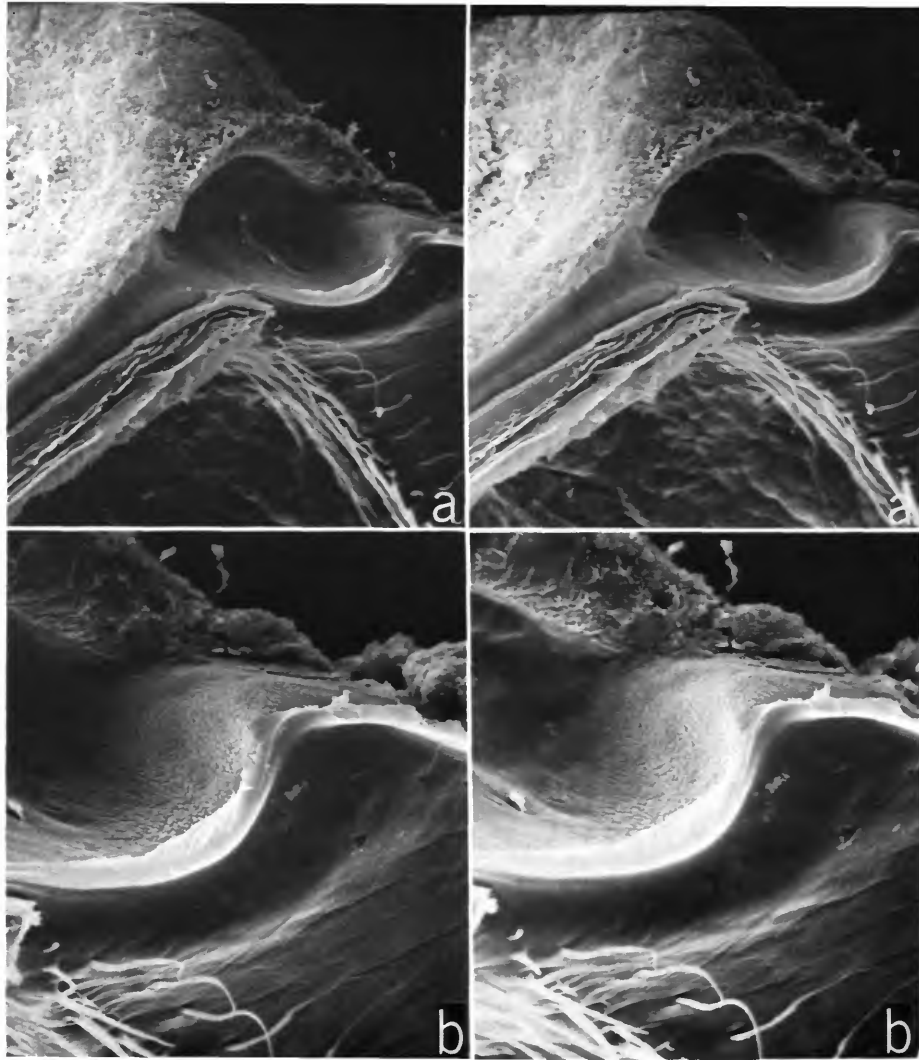


PLATE 128.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, stereoscopic pairs showing posterior end of hingement: *a*, socket, hinge groove, posterior junction, ligament, lamellar prolongation of selvage along ventral margin of socket, $\times 300$; *b*, detail of *a* showing socket and continuation of selvage along posterior edge of valve, $\times 600$. (Micrographs reduced to 78%.)

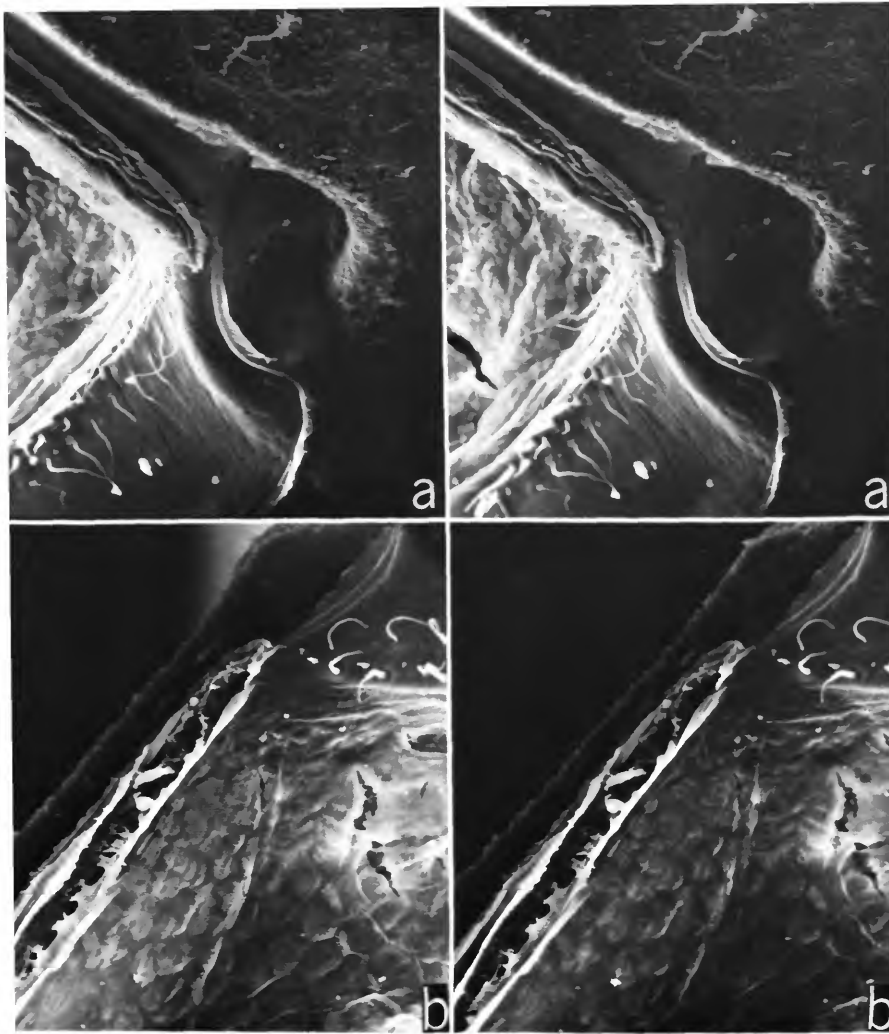


PLATE 129.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, stereoscopic pairs showing posterior end of hingement (socket), hinge groove, posterior juncture, ligament, and lamellar prolongation of selvage along ventral edge of socket, $\times 300$: *a*, view perpendicular to valve; *b*, ventral oblique view. (Micrographs reduced to 78%.)

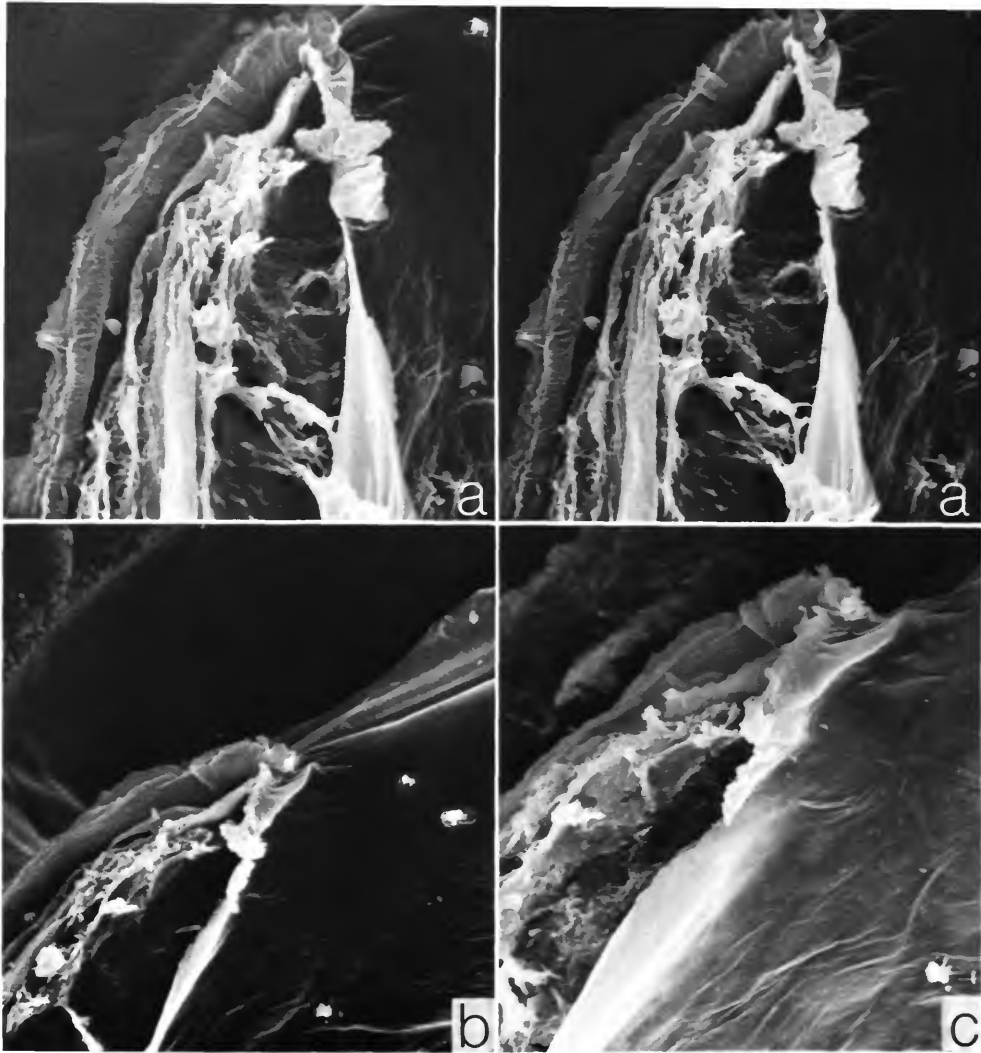


PLATE 130.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, posterior junction of dorsal margin: *a*, stereoscopic pair, $\times 1525$; *b*, oblique view, $\times 1000$; *c*, oblique view, from Plate 129*b*, $\times 1550$. (Micrographs reduced to 80%.)

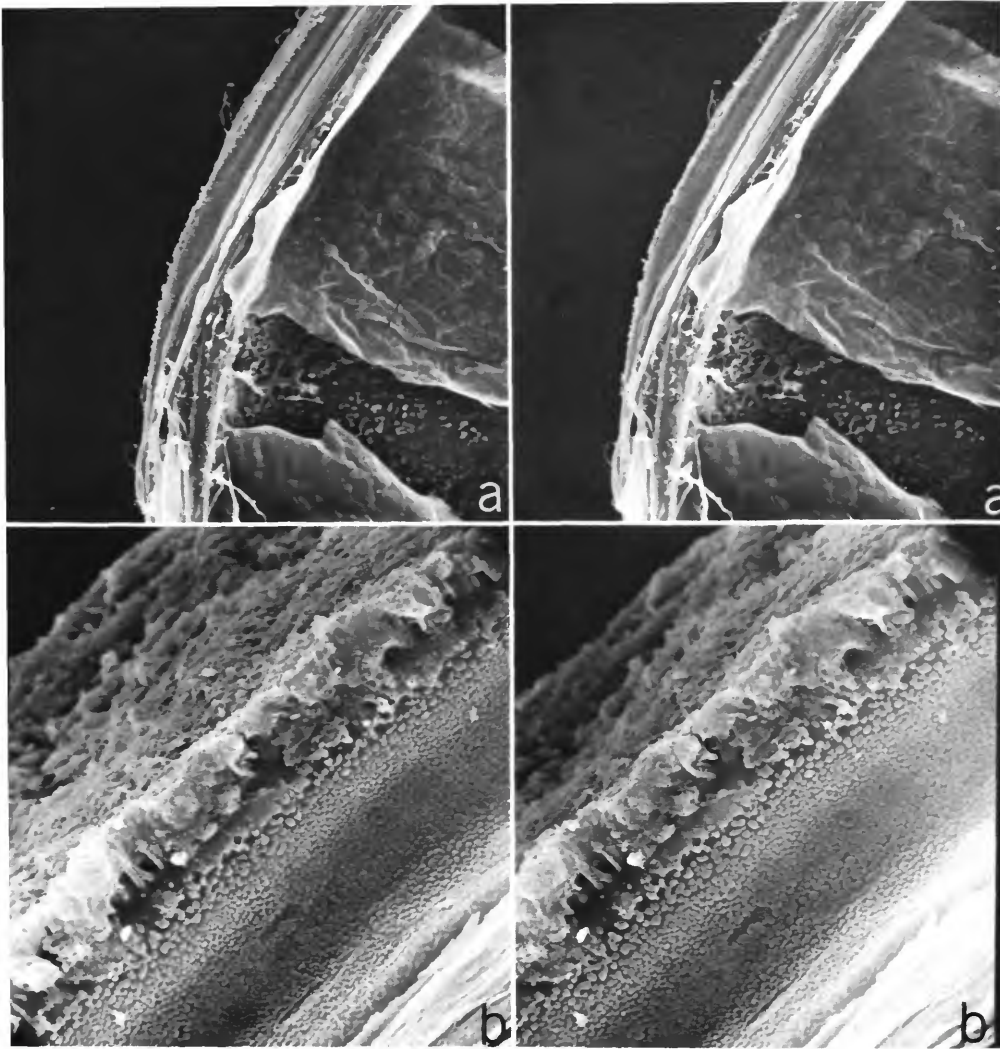


PLATE 131.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, stereoscopic pairs: *a*, anterior end of hingement, anterior juncture, hinge groove, ligament, from Plate 124*b*, $\times 160$; *b*, dorsal edge of valve showing hinge groove with pore, from Plate 127*a*, $\times 1600$. (Micrographs reduced to 79%.)

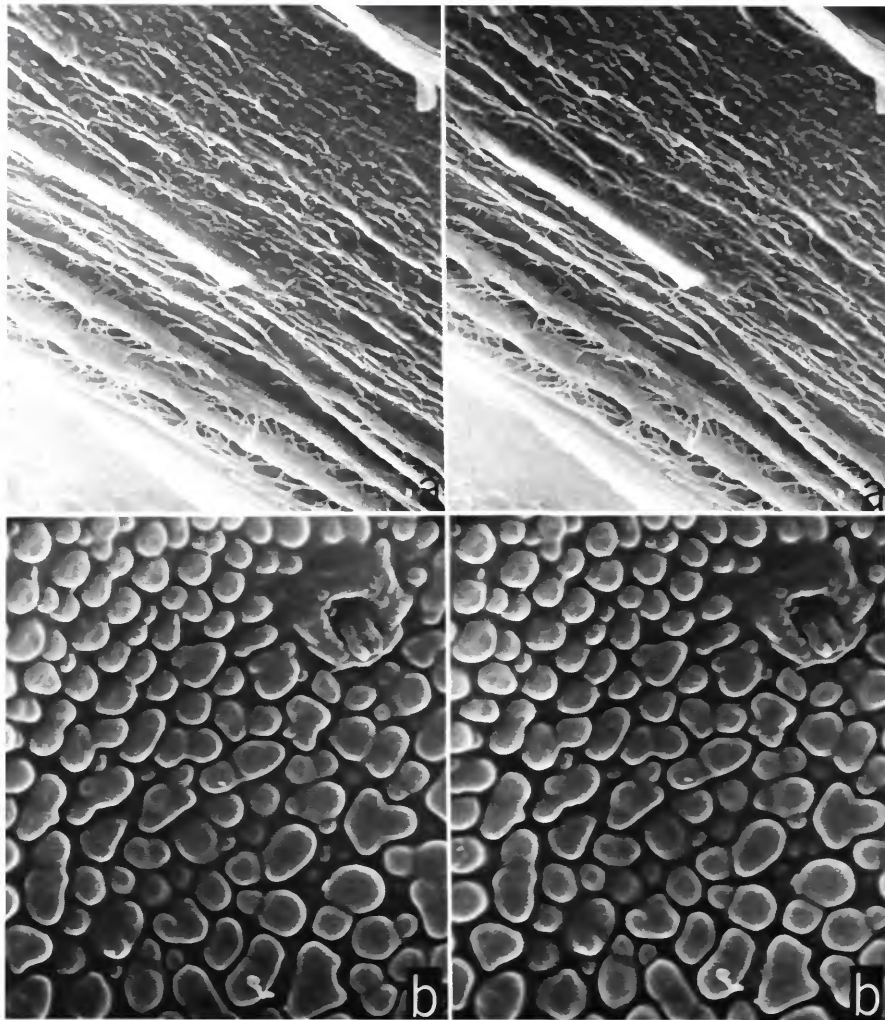


PLATE 132.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views, stereoscopic pairs: *a*, detail of ligament, from near Plate 129*a*, $\times 15,000$; *b*, detail of surface of hinge groove, note pore, from Plate 131*b*, $\times 10,000$. (Micrographs reduced to 79%.)

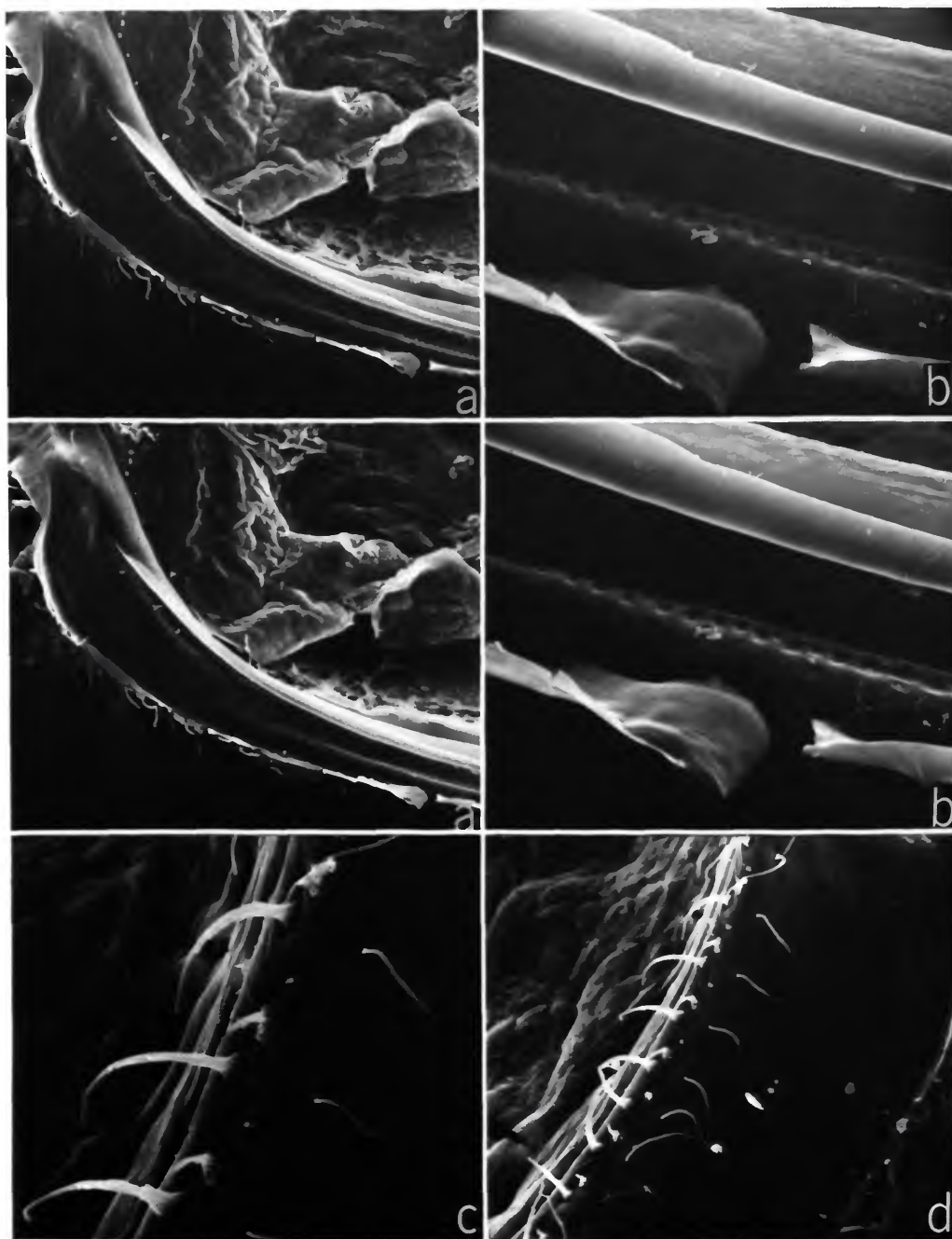


PLATE 133.—*Asteropterygion oculitristis* (Darby), adult male, USNM 157302, right valve, inside views: *a*, anteroventral margin (note lamellar prolongation of list), stereoscopic pair, $\times 160$; *b*, detail from right end of ventral margin of valve in *a*, stereoscopic pair, $\times 800$; *c*, bristles on posteroventral infold, from *d*, $\times 1000$; *d*, posteroventral edge of valve, $\times 400$. (Micrographs reduced to 77%.)

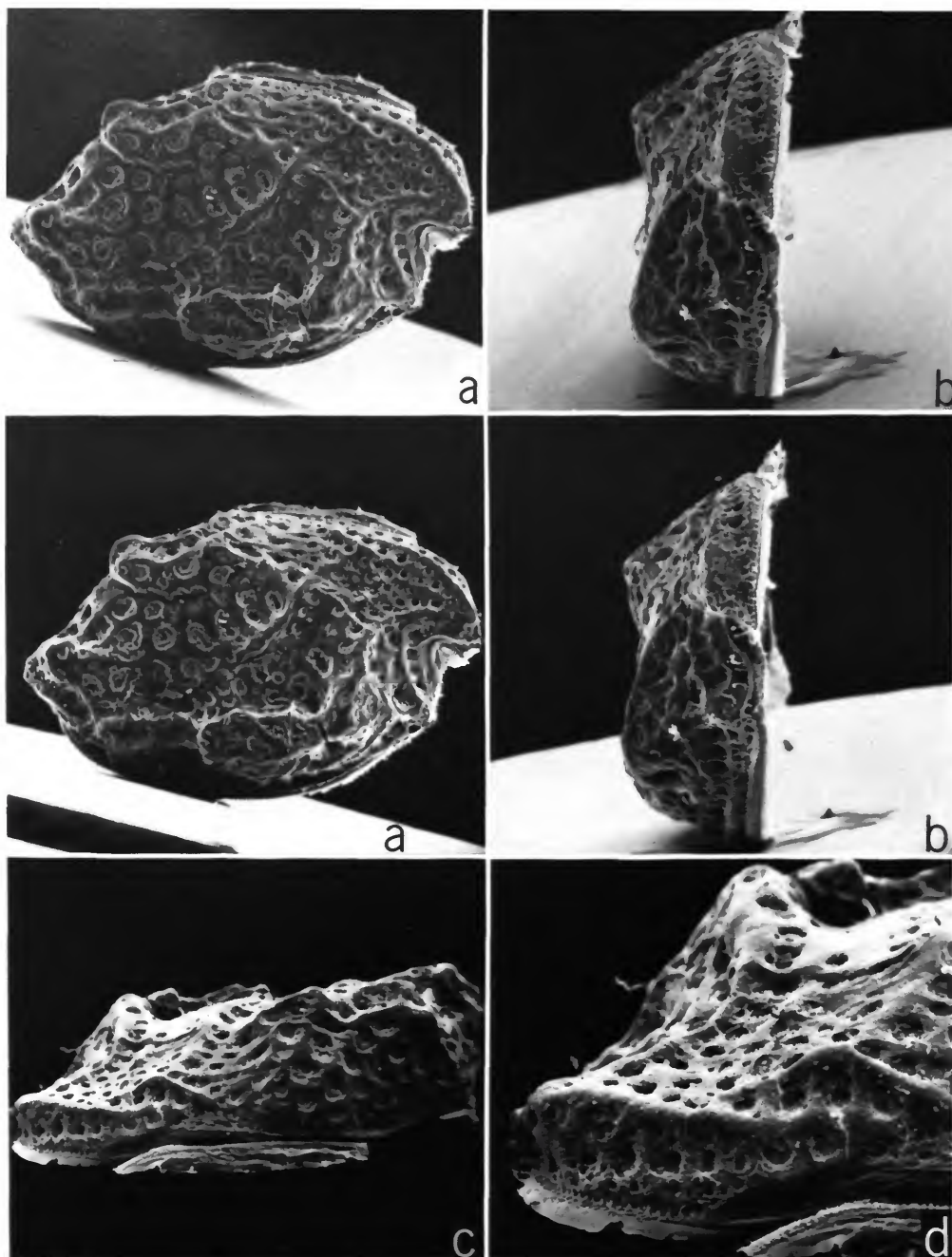


PLATE 134.—*Asteropterygion oculitristis* (Darby), adult female, USNM 151162, right valve, outside views: a, lateral view, stereoscopic pair, $\times 28$; b, anterior view, stereoscopic pair, $\times 40$; c, dorsal view, anterior to left, $\times 38$; d, dorsal view of anterior end, from c, $\times 82$. (Micrographs reduced to 76%.)

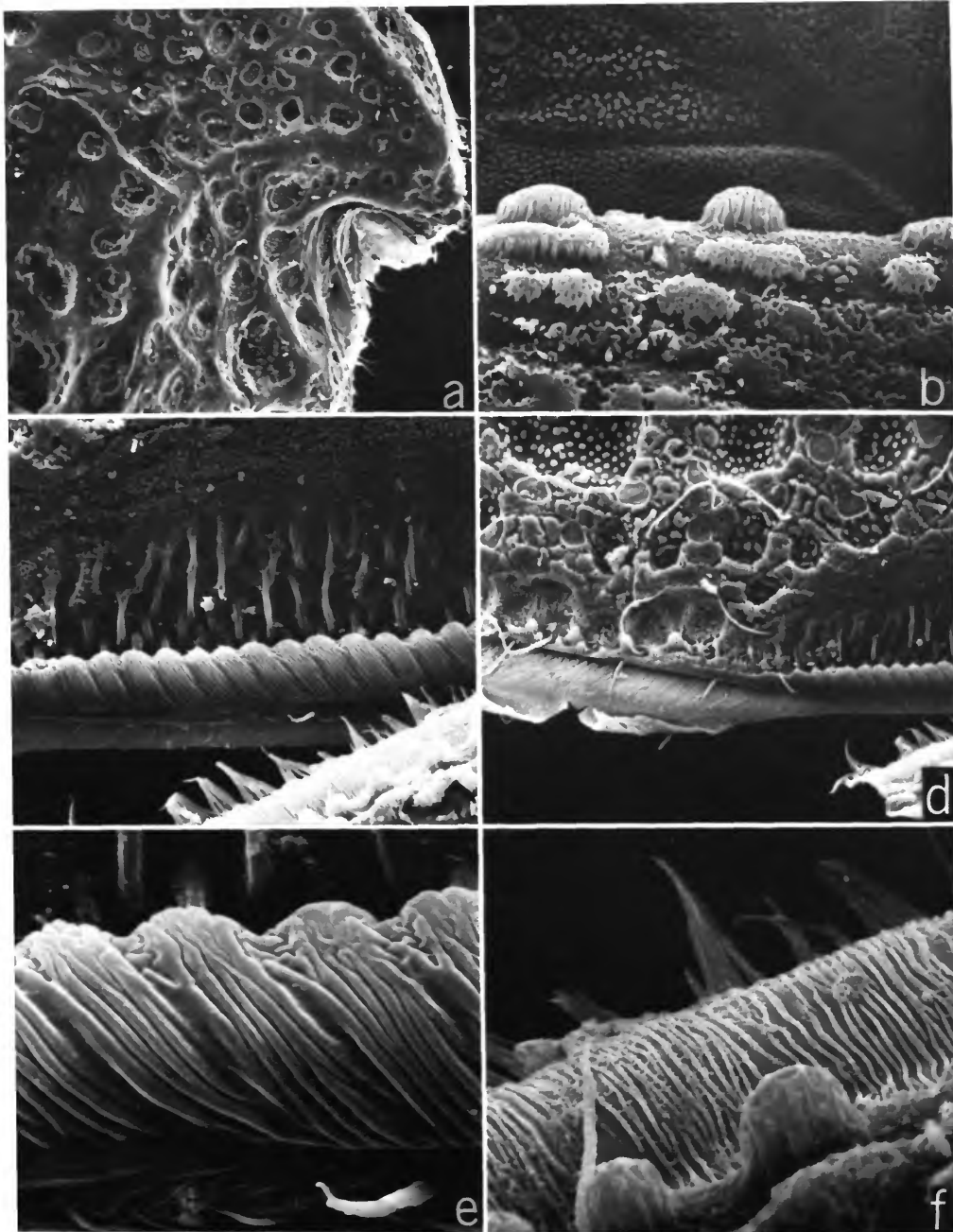


PLATE 135.—*Asteropterygion oculitristis* (Darby), adult female, USNM 151162, outside views: *a*, anterior of right valve, from Plate 134*a*, $\times 70$; *b*, detail of dorsal margin of left and right valves, from Plate 134*c*, $\times 1200$; *c*, dorsal view of left and right valves anterior to anterior juncture, from Plate 134*c*, $\times 600$; *d*, dorsal view of right valve anterior to juncture, from Plate 134*c*, $\times 330$; *e*, detail of right valve from *c*, $\times 2400$; *f*, detail of left valve from *c*, $\times 2400$. (Micrographs reduced to 76%.)

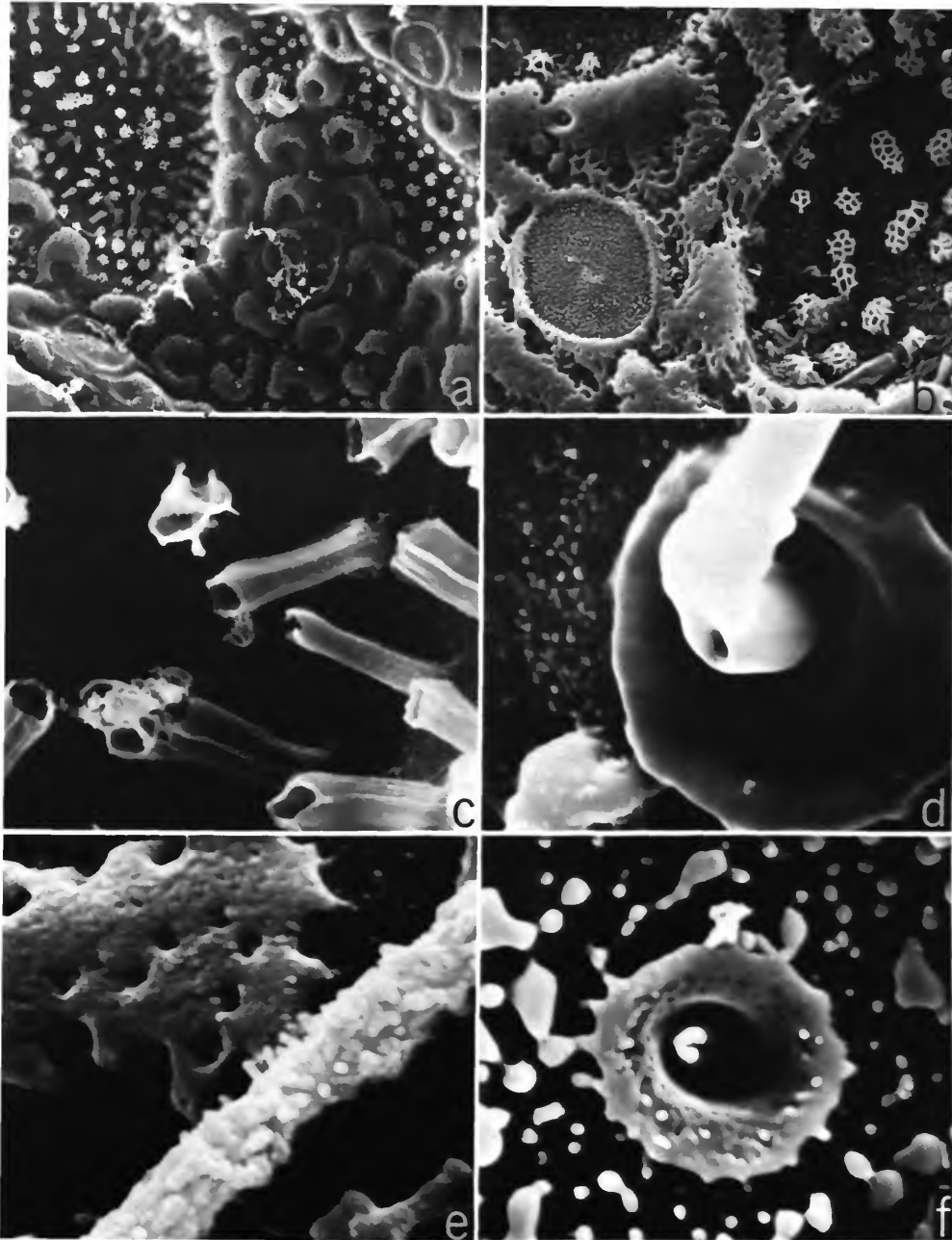


PLATE 136.—*Asteropterygion oculitristis* (Darby), adult female, USNM 151162, right valve, outside views: *a*, detail of surface structures in lower left of Plate 135*a*, $\times 575$; *b*, detail of surface structures in upper right of Plate 135*d*, $\times 1640$; *c*, tubular structures in fossa shown in *a*, $\times 4600$; *d*, base of bristle and pore, from Plate 135*d*, $\times 9500$; *e*, detail of same bristle shown in *d*, $\times 9500$; *f*, pore shown in upper left of Plate 135*b*, $\times 9500$. (Micrographs reduced to 76%.)

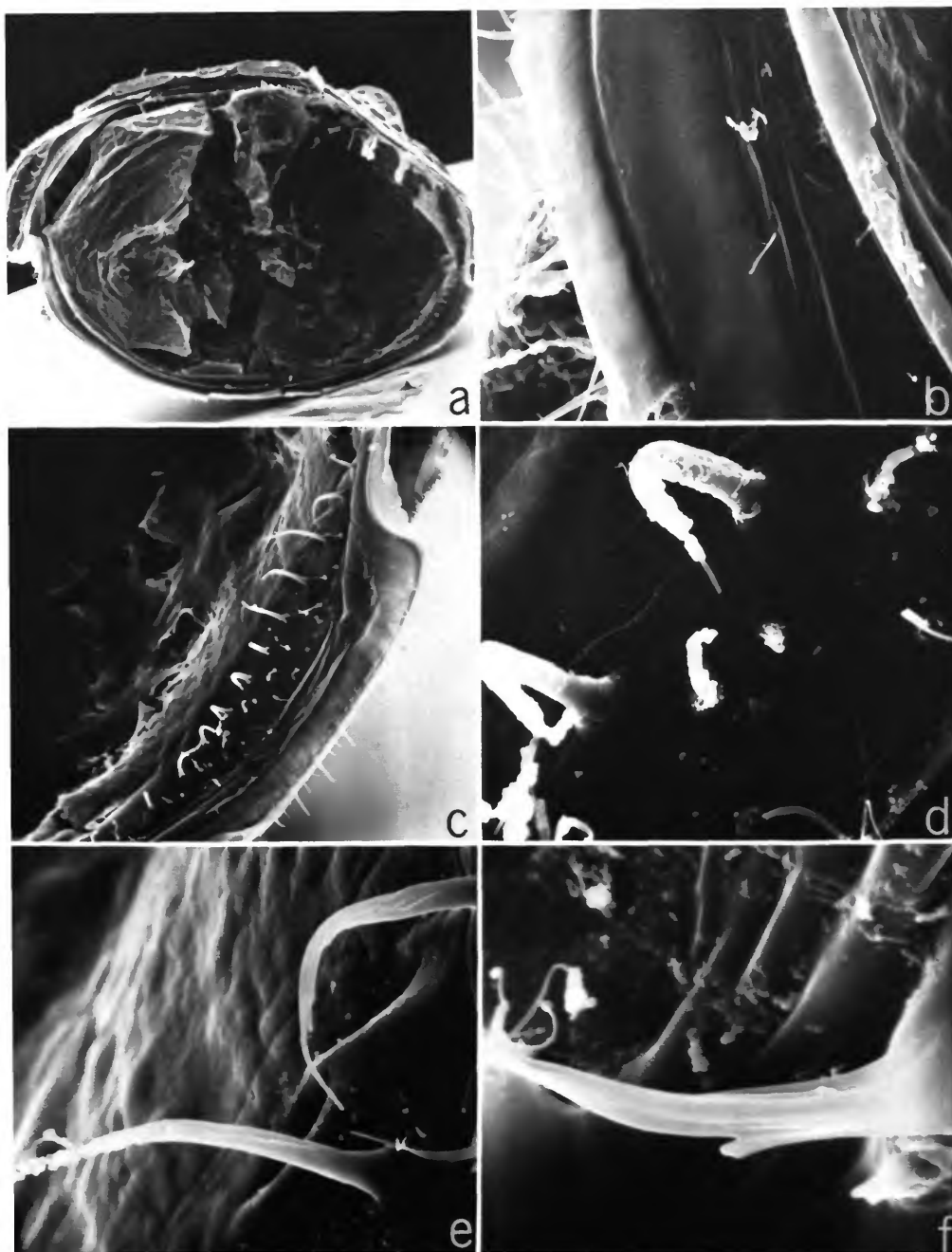


PLATE 137.—*Asteropterygion oculitristis* (Darby), adult female, USNM 151162, right valve, inside views: *a*, complete valve, $\times 38$; *b*, anteroventral margin, from *a*, $\times 490$; *c*, posteroventral margin, from *a*, $\times 170$; *d*, bristles on infold shown near middle of *c*, note proximal part of setose bristle in lower right, $\times 1100$; *e*, bristle on list near top of *c*, $\times 1100$; *f*, detail of bristle in lower right of *e*, $\times 5000$. (Micrographs reduced to 77%.)

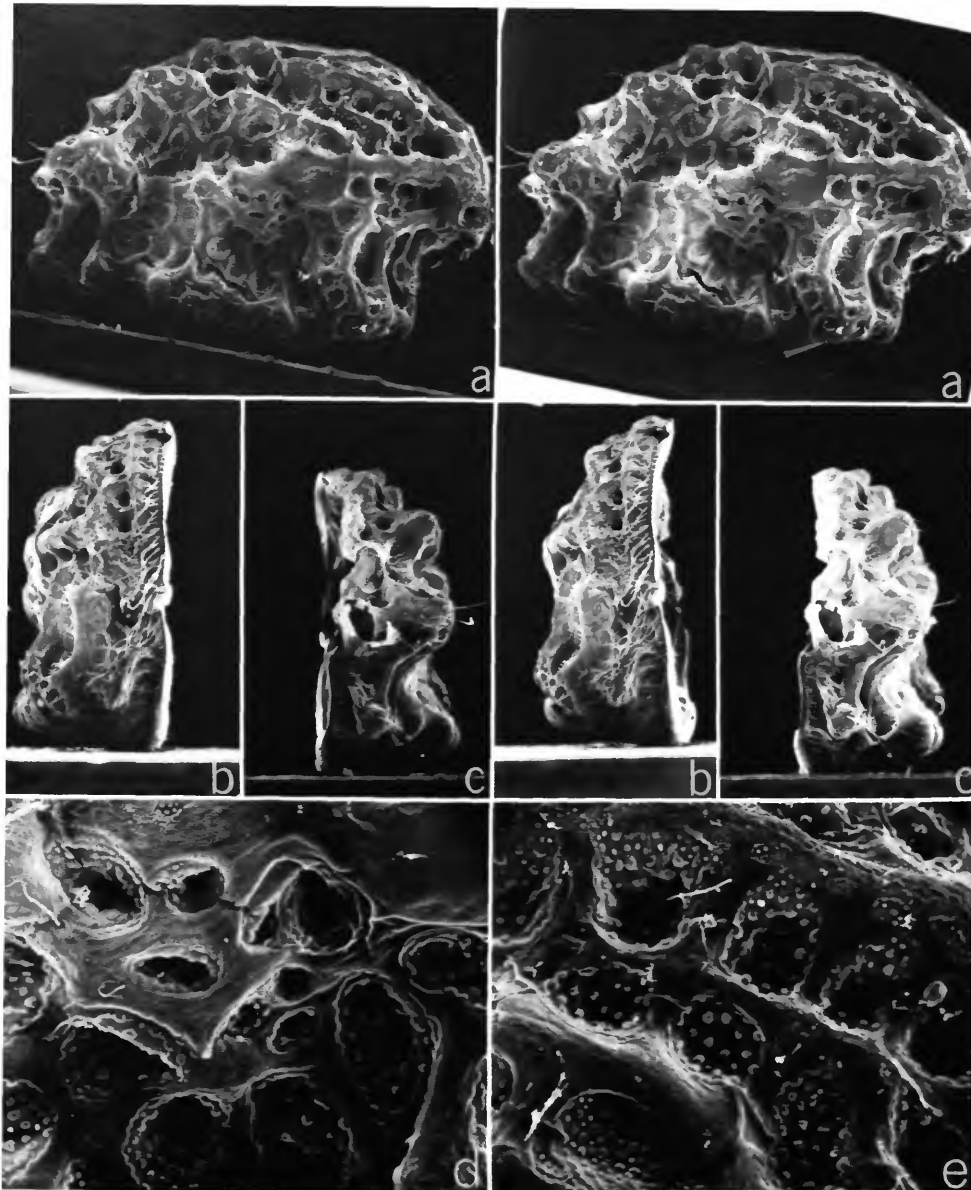


PLATE 138.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, right valve, outside views: *a*, lateral view, stereoscopic pair, $\times 42$; *b*, anterior view, stereoscopic pair, $\times 42$; *c*, posterior view, stereoscopic pair, $\times 42$; *d*, area of adductor muscle attachments, from *a*, $\times 200$; *e*, anterodorsal part of valve, from *a*, $\times 200$. (Micrographs reduced to 68%.)

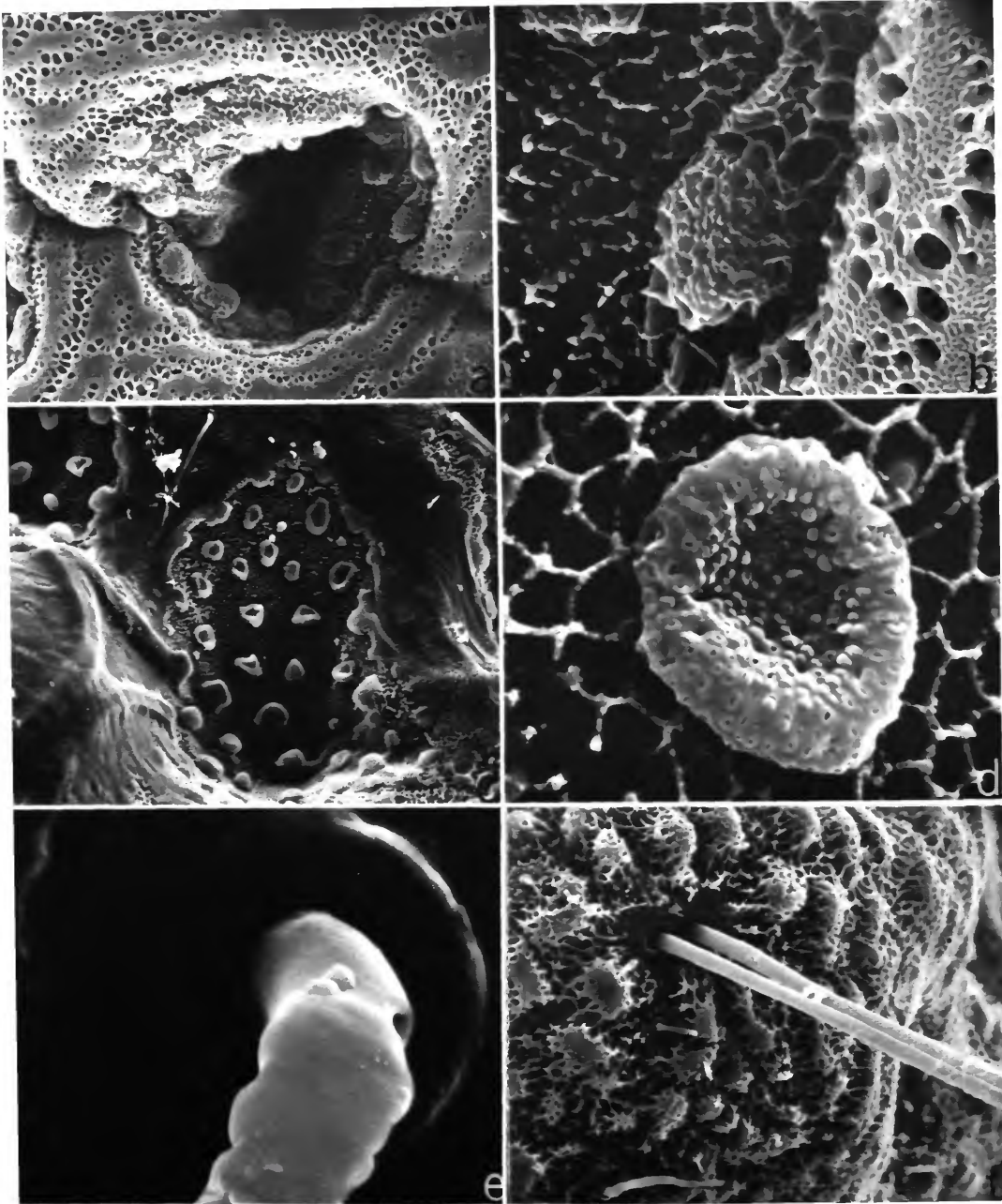


PLATE 139.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, right valve, outside views: *a*, detail of fossa in vicinity of adductor muscle attachments, from Plate 138*d*, $\times 1000$; *b*, detail of edge of fossa in *a*, $\times 5000$; *c*, detail of fossa in anterodorsal part of valve, from Plate 138*e*, $\times 500$; *d*, pustules at bottom of fossa in *c*, $\times 7500$; *e*, detail of pore and bristle, from top of *c*, $\times 15,000$; *f*, bristles and detail of surface, from Plate 138*e*, $\times 1000$. (Micrographs reduced to 74%.)

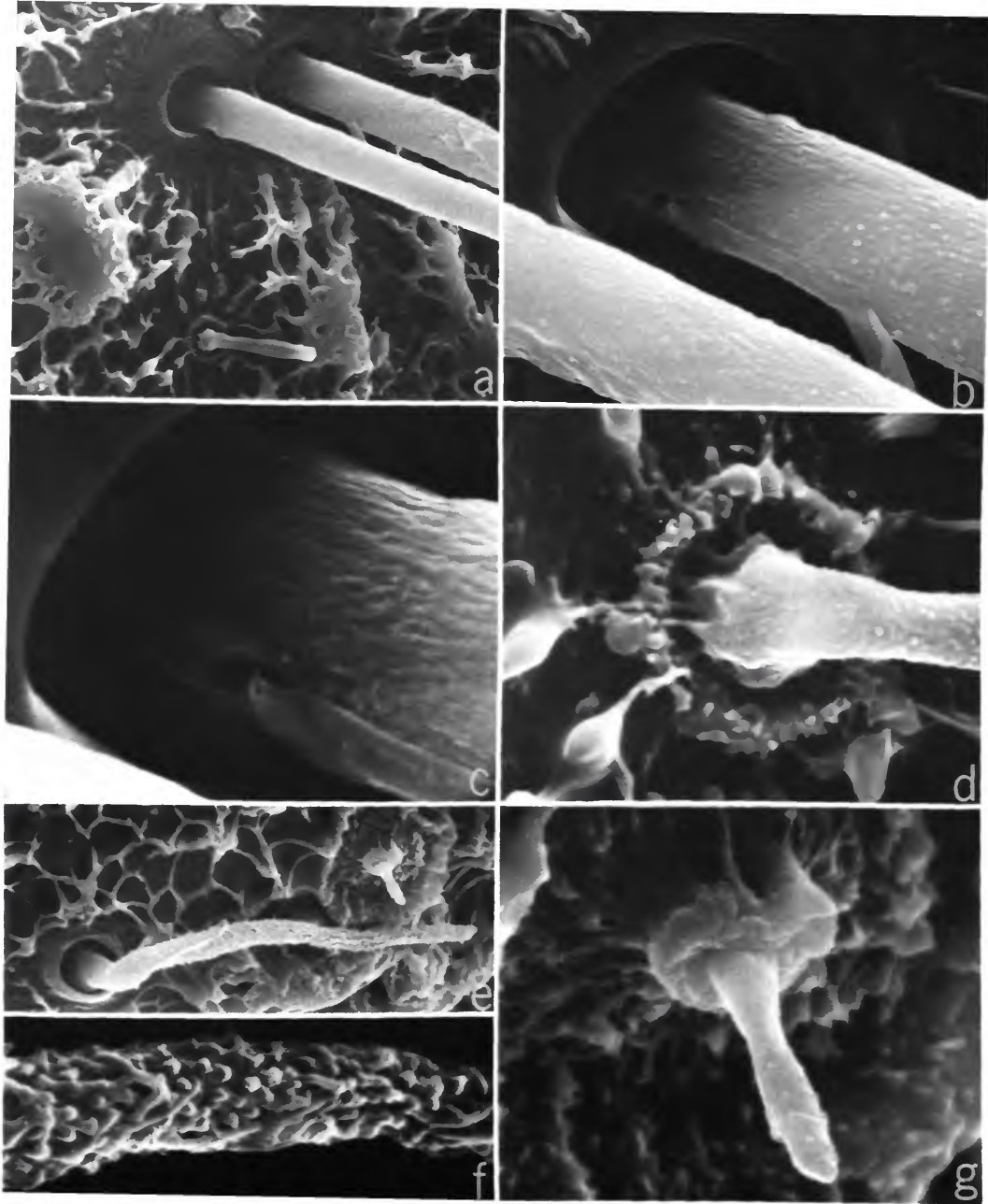


PLATE 140.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, right valve, outside views: *a*, detail of pores and bristles shown in Plate 139*f*, $\times 2750$; *b*, *c*, details of upper bristle in *a* (note pore in bristle), $\times 8650$, $17,300$; *d*, pore and bristle near bottom of *a*, $\times 17,300$; *e*, detail of bristles at lower edge of Plate 139*f*, $\times 3150$; *f*, detail of lower bristle in *e*, $\times 15,750$; *g*, detail of upper bristle in *e*, $\times 15,250$. (Micrographs reduced to 74%.)

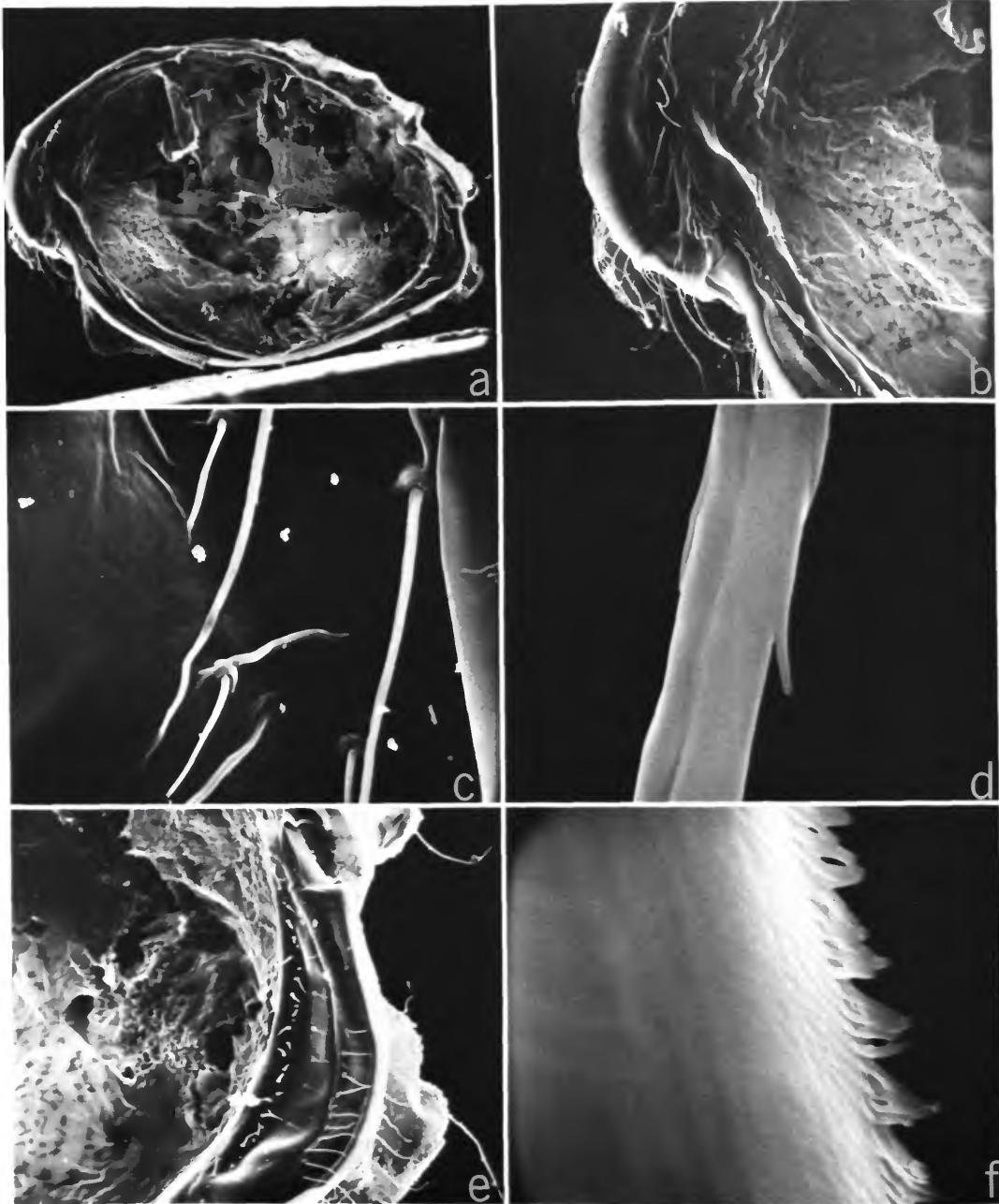


PLATE 141.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, right valve, inside views: *a*, complete valve, $\times 44$; *b*, anterior part, from *a*, $\times 100$; *c*, bristles on infold of rostrum, from *a*, $\times 1000$; *d*, detail of bristle in *c*, showing marginal spines, $\times 10,000$; *e*, posteroventral edge of valve showing bristles of infold and lamellar prolongation of selvage, from *a*, $\times 158$; *f*, serrated margin of lamellar prolongation of selvage, from *e*, $\times 10,000$. (Micrographs reduced to 74%.)

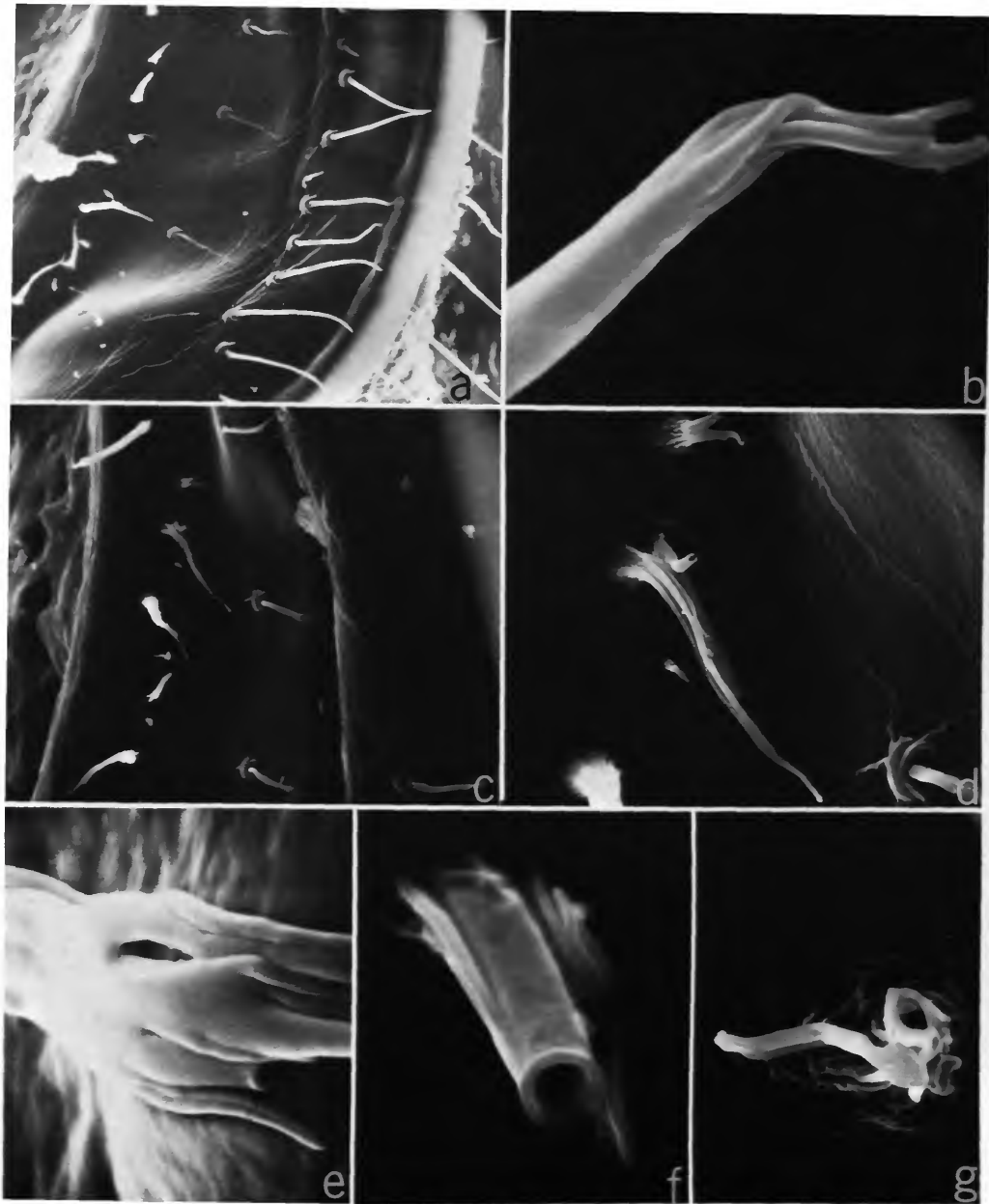


PLATE 142.—*Asteropterygion thomassini*, new species, adult male, holotype, USNM 151161, right valve, posteroventral infold: *a*, part of infold, from Plate 141*e*, $\times 500$; *b*, tip of middle bristle in posterior row, from *a*, $\times 19,000$; *c*, bristles near dorsal end of posteroventral infold, from Plate 141*e*, $\times 750$; *d*, detail of bristles in *c*, $\times 2100$; *e*, detail of middle section of bristle near middle of *c*, $\times 19,000$; *f*, detail of minute process between lower most two bristles on list shown in *c*, $\times 20,000$; *g*, detail of minute process between 2nd and 3rd bristle (counting from bottom) on list shown in *c*, $\times 20,000$. (Micrographs reduced to 72%.)

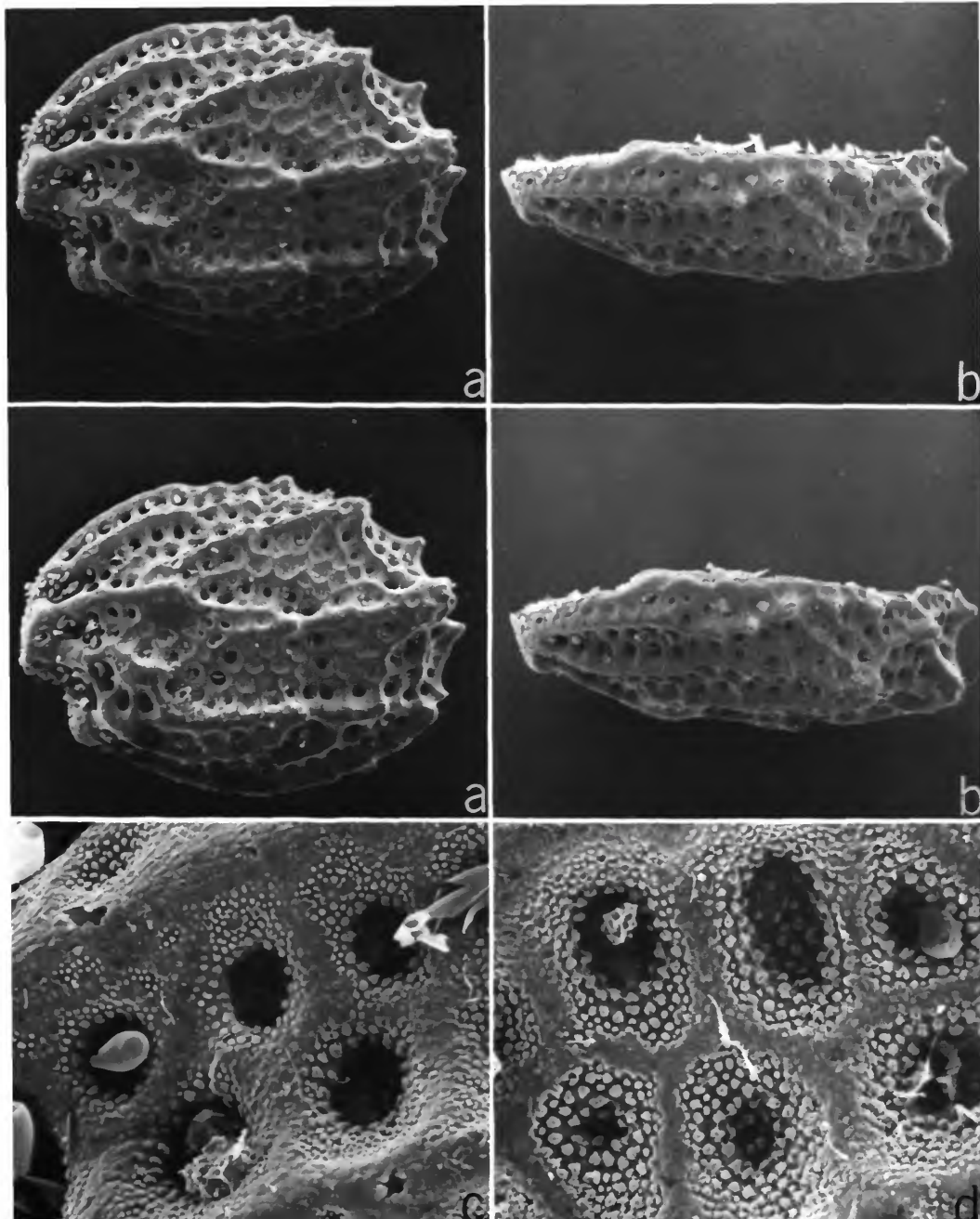


PLATE 143.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157224, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 22$; *b*, dorsal view, stereoscopic pair, $\times 24$; *c*, fossae along anterodorsal margin, $\times 150$; *d*, fossae from rows just ventral to those in *c*, $\times 170$. (Micrographs reduced to 80%.)

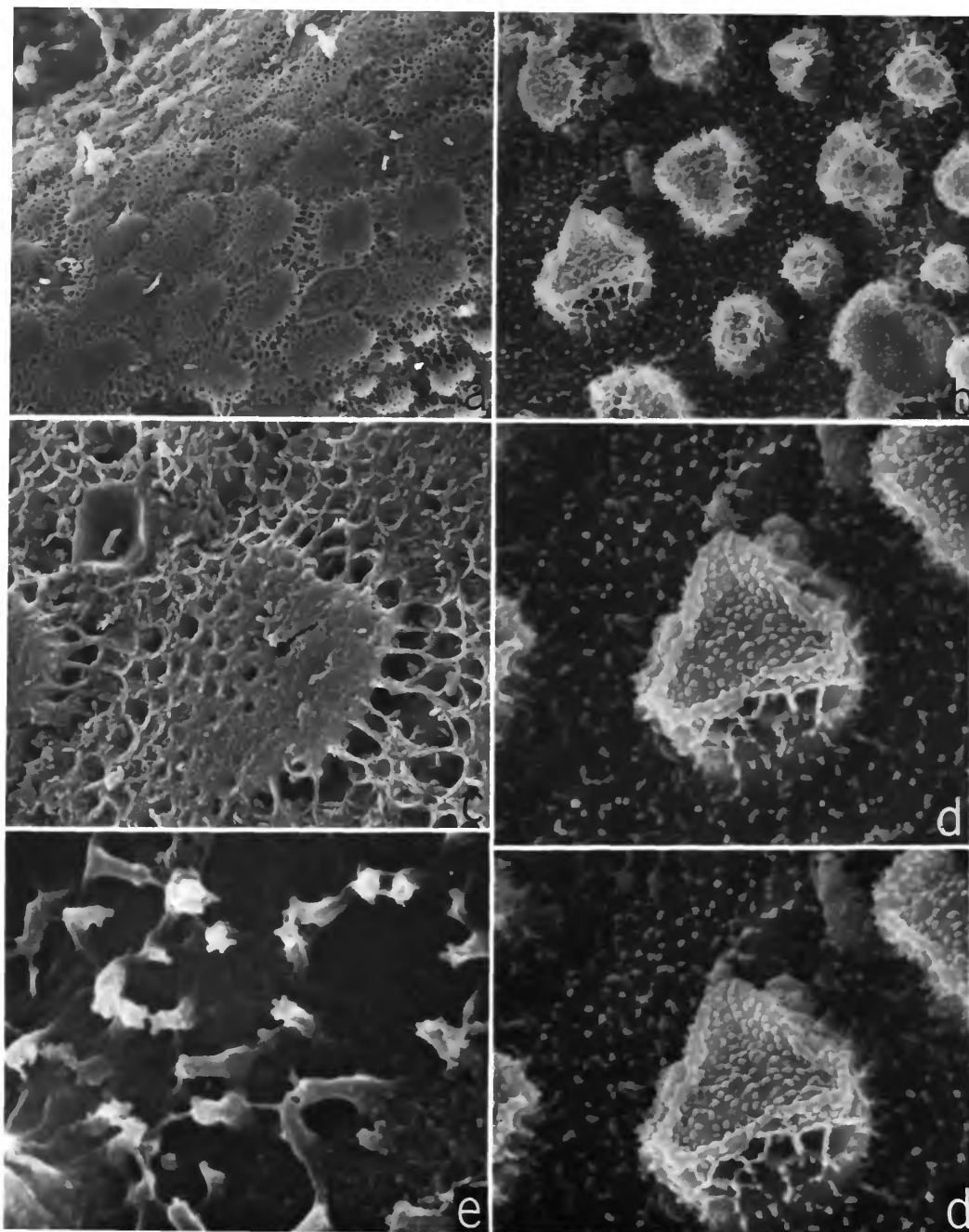


PLATE 144.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157224, left valve, outside views: *a*, detail of surface in bottom right of Plate 143c, $\times 750$; *b*, processes at bottom of fossa shown in Plate 143d, $\times 1700$; *c*, detail of surface in *a*, $\times 3000$; *d*, process in *b*, stereoscopic pair, $\times 3450$; *e*, detail of surface in vicinity of process in *d*, $\times 12,000$. (Micrographs reduced to 80%.)

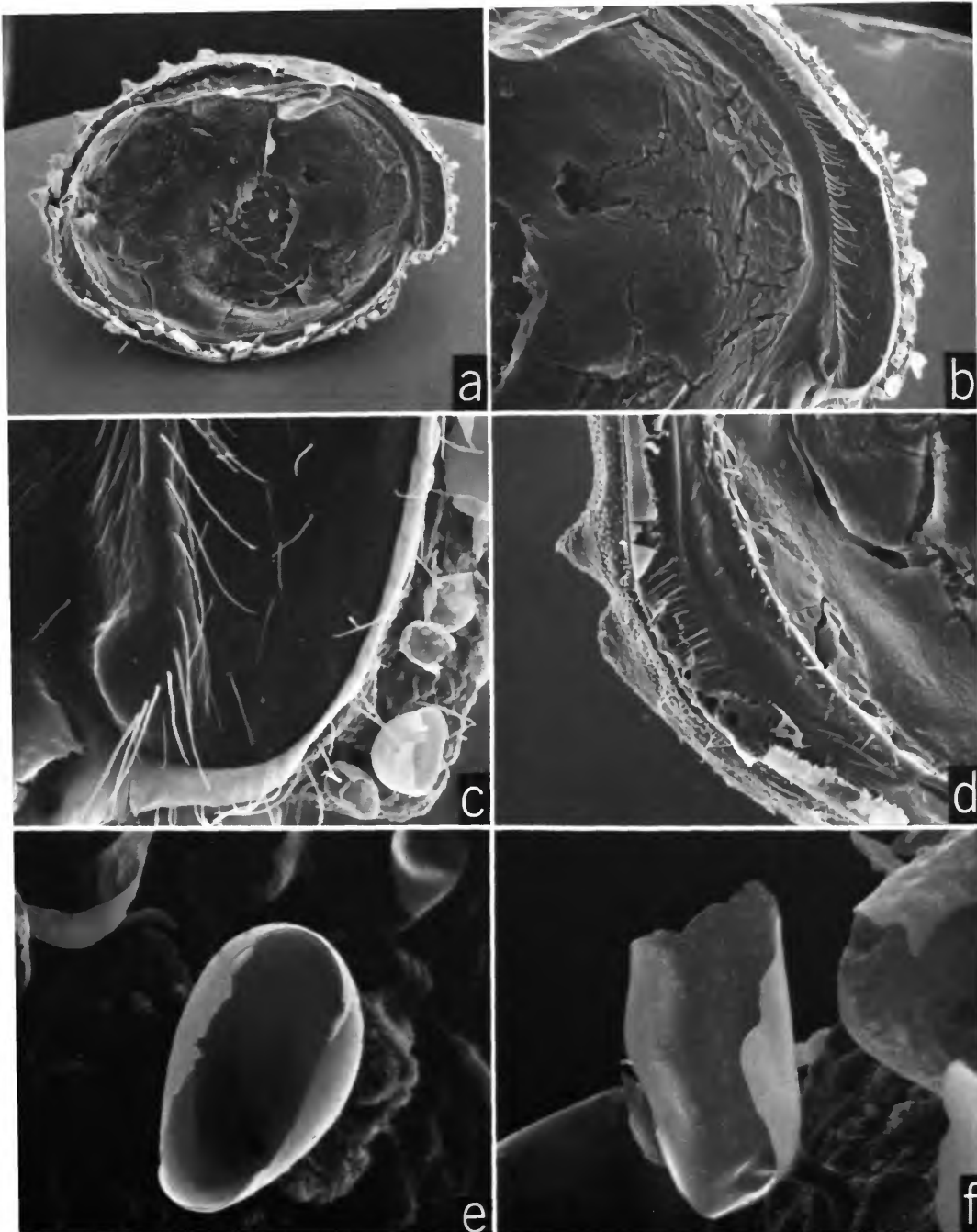


PLATE 145.—*Astropterygion thomassini*, new species, ovigerous female, paratype, USNM 157224, left valve, inside views: *a*, complete valve, $\times 20$; *b*, rostrum, from *a*, $\times 50$; *c*, detail from *b*, $\times 225$; *d*, posteroventral margin showing bristles of infold, $\times 100$; *e, f*, protists along anterior margin, $\times 775$, 1100 . (Micrographs reduced to 81%.)

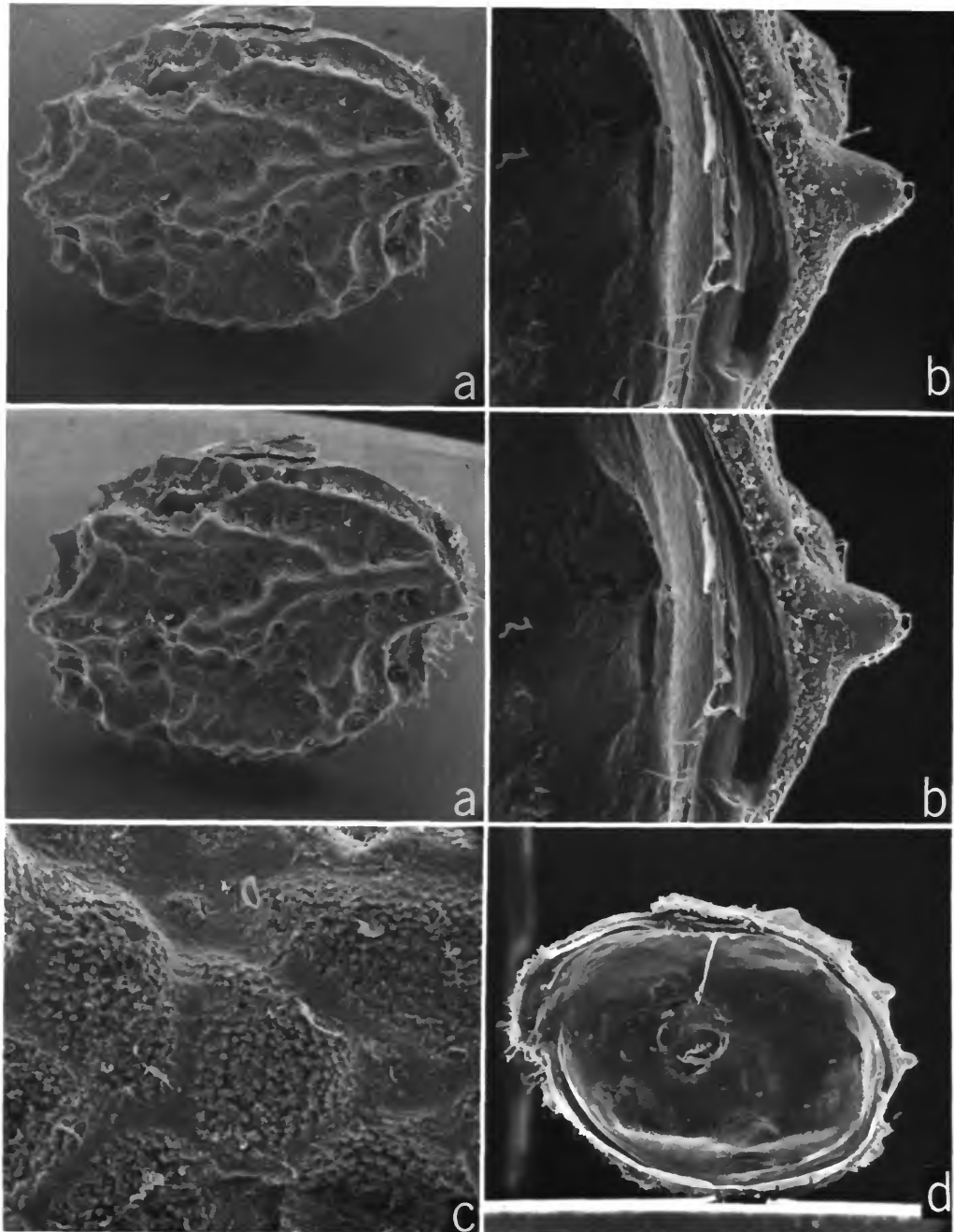


PLATE 146.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157232, right valve: *a*, lateral view, stereoscopic pair, $\times 34$; *b*, inside view of posterior margin, stereoscopic pair, $\times 150$; *c*, fossae from near posterior margin, from *a*, $\times 170$; *d*, inside view of valve, $\times 30$. (Micrographs reduced to 77%.)

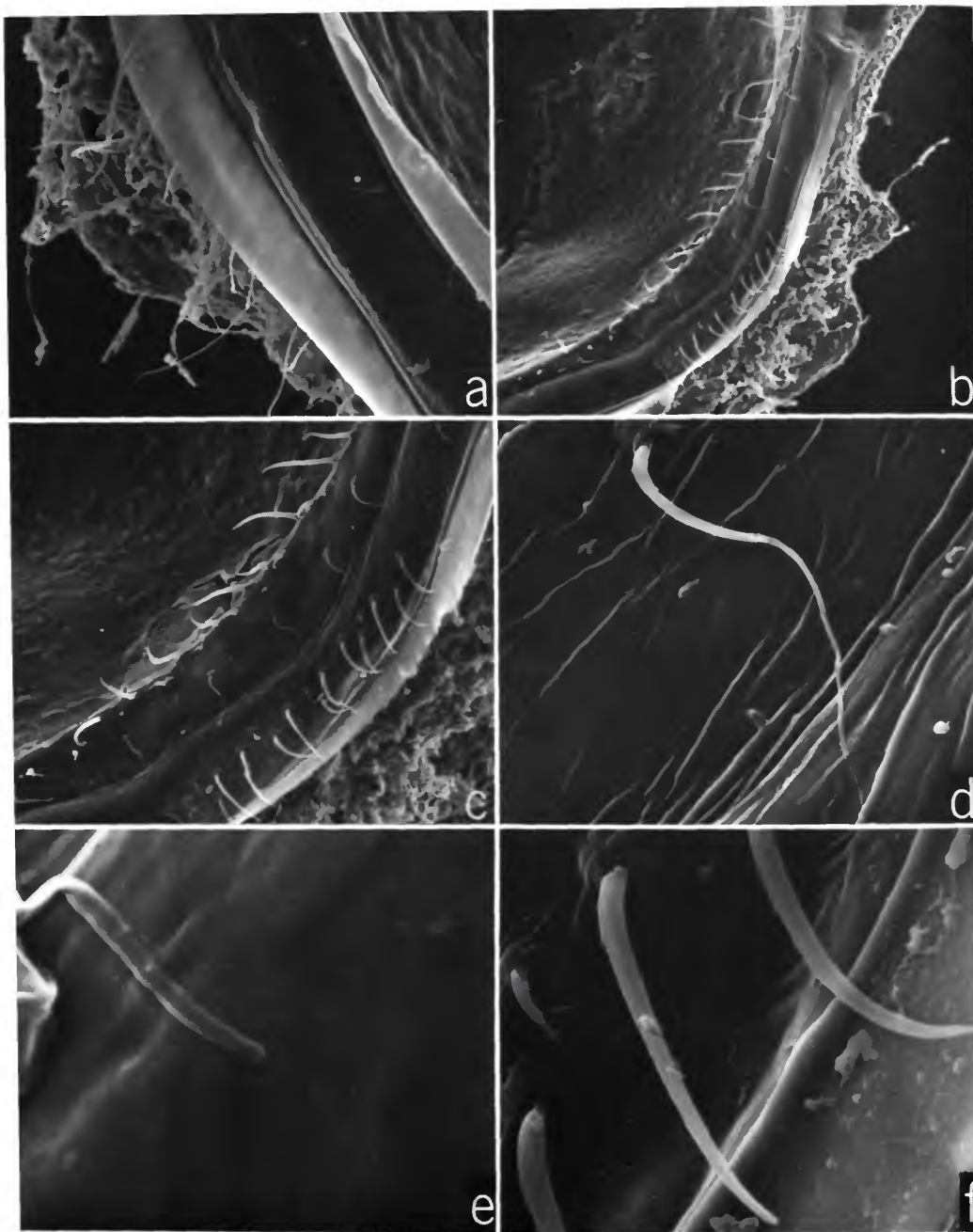


PLATE 147.—*Astropterygion thomassini*, new species, ovigerous female, paratype, USNM 157232, right valve inside views: *a*, anteroventral margin showing lamellar prolongations on selvage and list, from Plate 146*d*, $\times 300$; *b*, posteroventral margin, from Plate 146*d*, $\times 150$; *c*, posteroventral infold showing selvage bristles, from *b*, $\times 300$; *d*, bristle posterior to list, from *c*, $\times 8000$; *e*, tip of bristle shown in *d*, $\times 20,000$; *f*, bristles near posterior margin of infold, from *c*, $\times 1900$. (Micrographs reduced to 78%.)

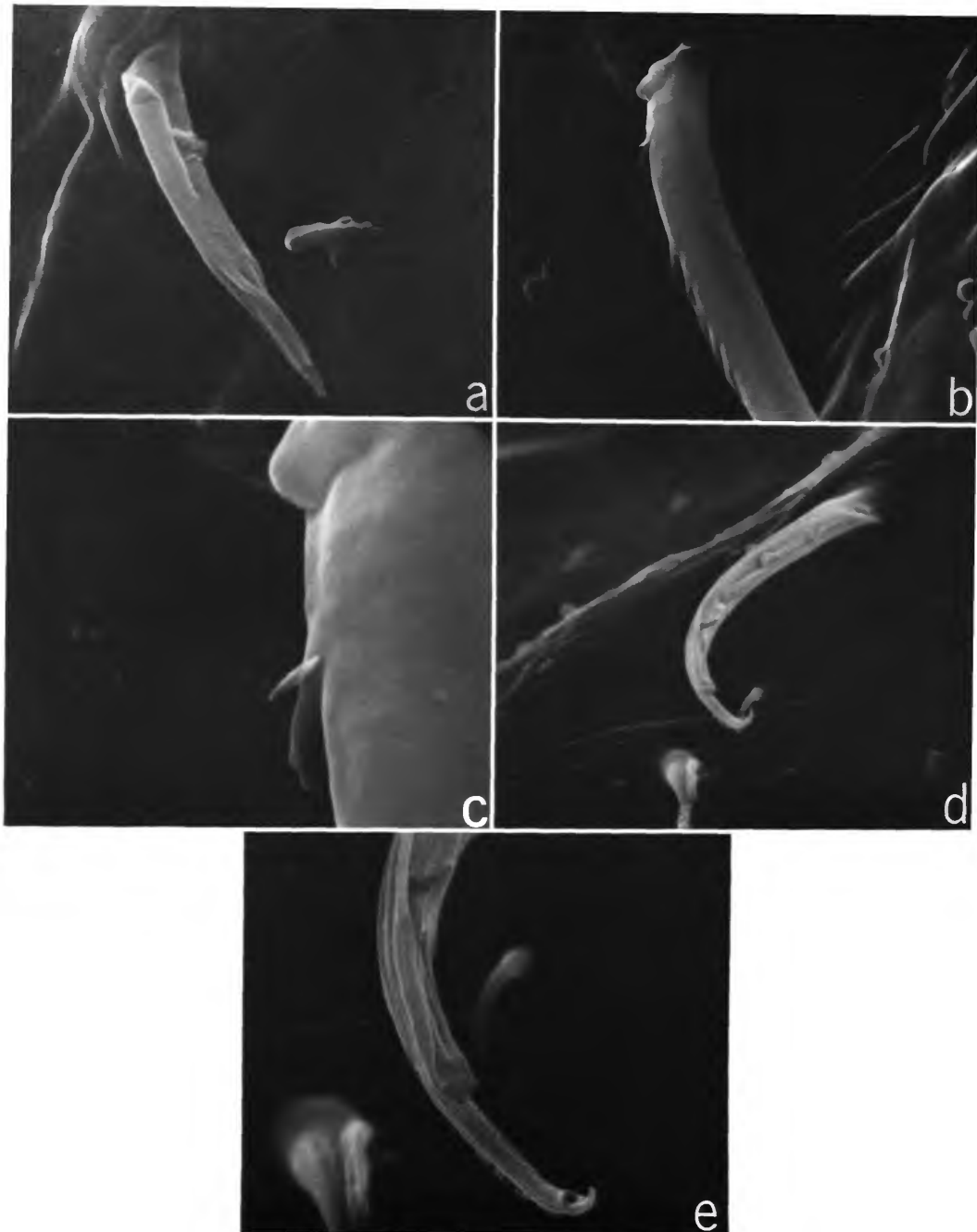


PLATE 148.—*Asteropterygion thomassini*, new species, ovigerous female, paratype, USNM 157232, right valve, bristles of posteroventral infold: *a*, small bristle shown on left of Plate 147*f*, $\times 8000$; *b*, detail of long bristle in Plate 147*f*, $\times 1900$; *c*, proximal part of bristle in *b*, $\times 20,000$; *d*, bristles on list in lower left of Plate 147*c*, $\times 2330$; *e*, detail of stout bristle in *d*, $\times 5600$. (Micrographs reduced to 80%.)

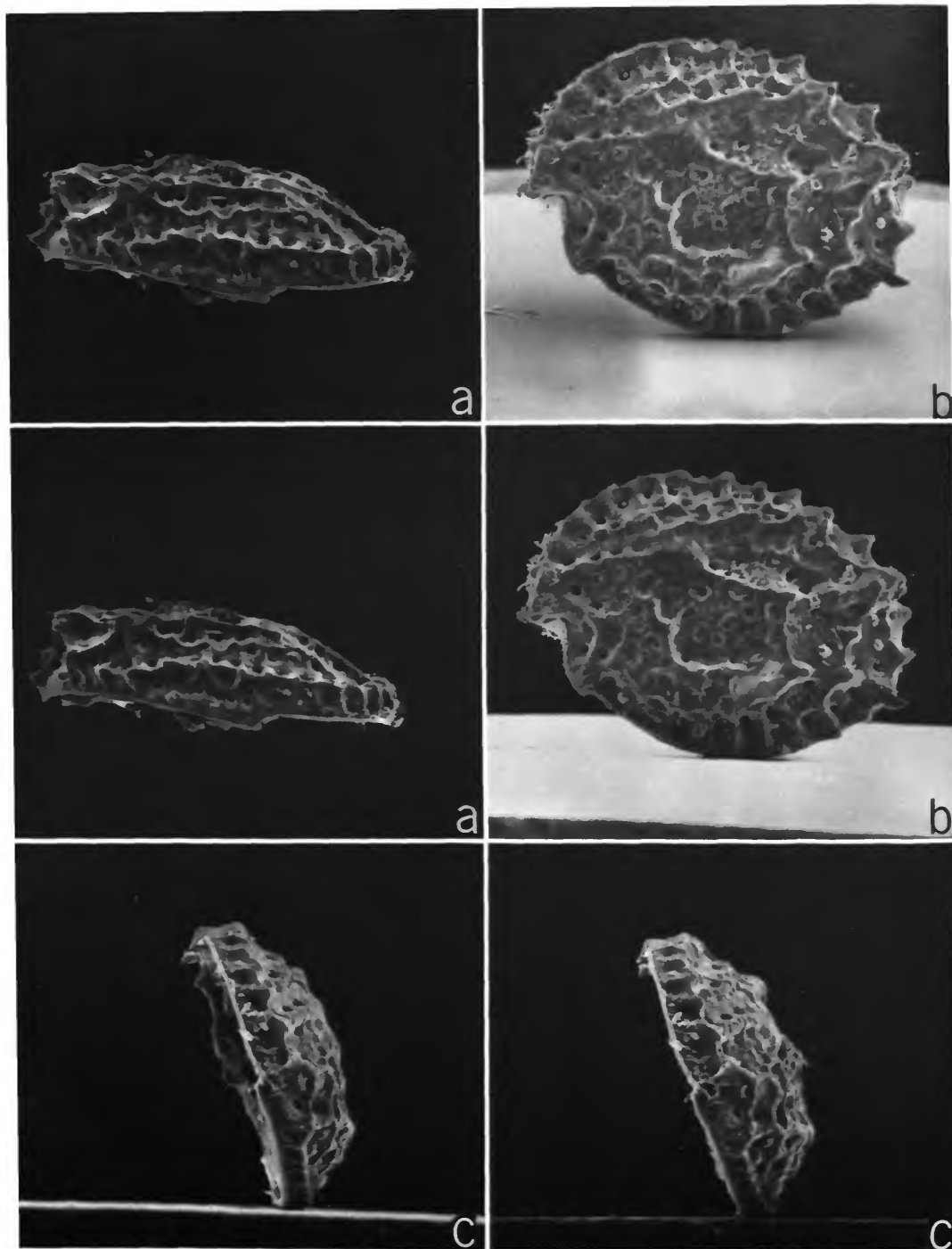


PLATE 149.—*Asteropterygion romei*, new species, female (A-1? instar), USNM 157413, left valve, stereoscopic pairs, $\times 35$: *a*, dorsal view, anterior to right; *b*, lateral view; *c*, anterior view. (Micrographs reduced to 81%.)

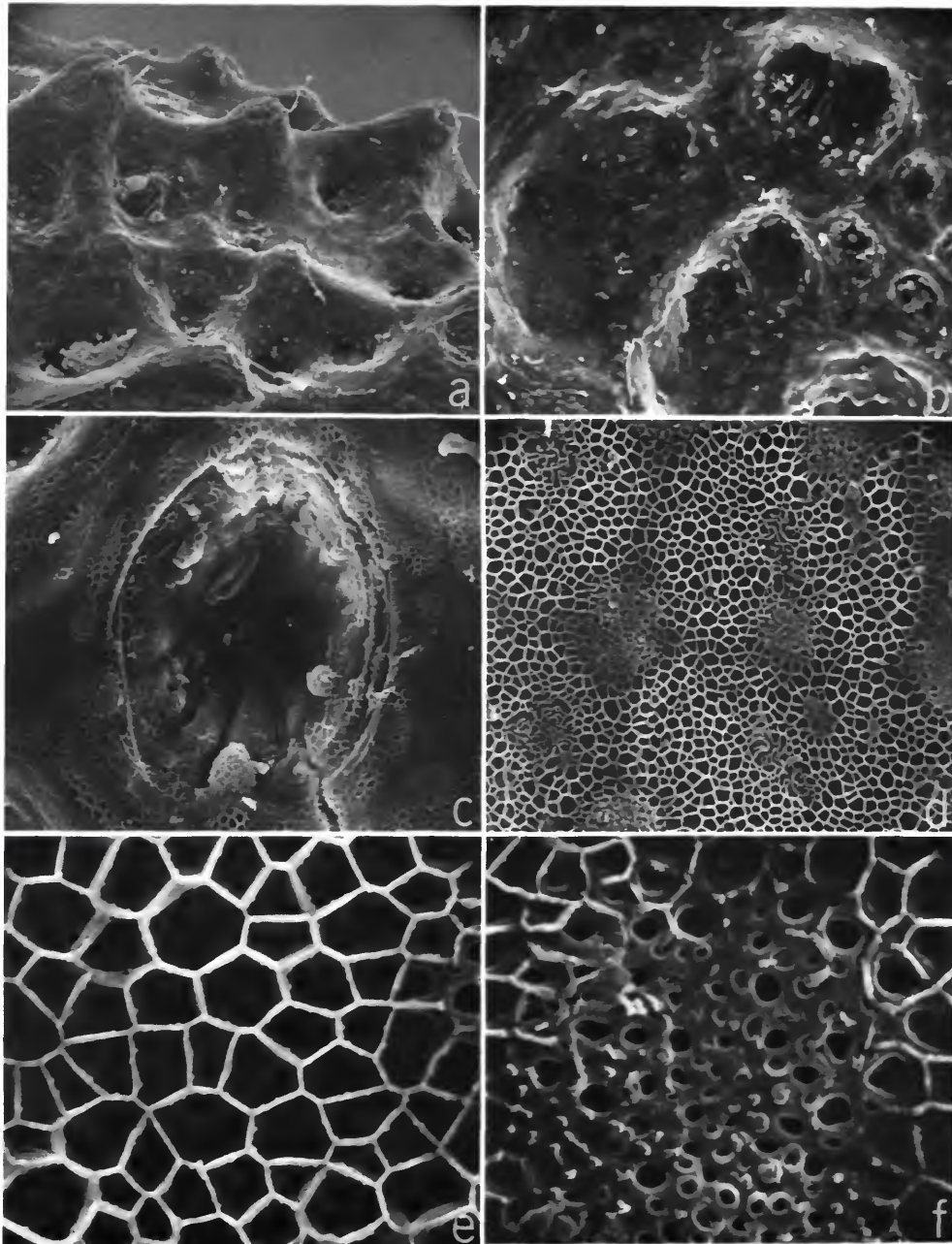


PLATE 150.—*Asteropterygion romei*, new species, female (A-1? instar), USNM 157413, left valve, outside views: *a*, posterdorsal edge of valve, from Plate 149*b*, $\times 150$; *b*, fossae in vicinity of central adductor muscle attachments, from middle of Plate 149*b*, $\times 260$; *c*, detail of fossa on upper right of *b*, $\times 400$; *d*, detail of surface on upper right corner of *b*, $\times 2000$; *e*, detail on right edge of *d*, $\times 10,000$; *f*, detail from *d*, $\times 10,000$. (Micrographs reduced to 75%.)

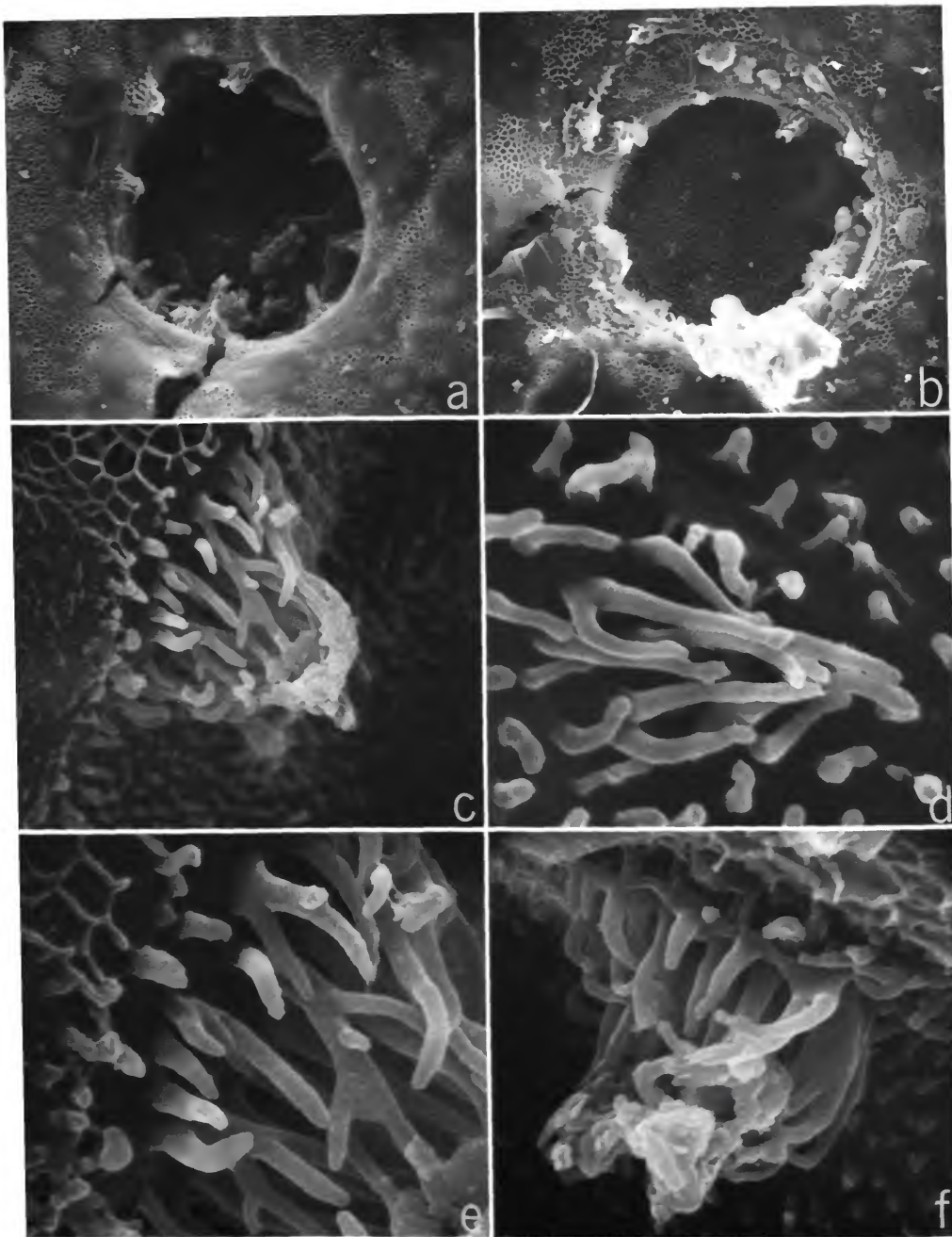


PLATE 151.—*Asteropterygion romei*, new species, female (A-1? instar), USNM 157413, left valve, fossae: *a*, fossa near anteroventral margin of valve, note diatoms, from Plate 149*b*, $\times 750$; *b*, fossa just dorsal to valve middle, from Plate 149*b*, $\times 750$; *c*, branching papillae on upper left edge of fossa in *a*, $\times 5000$; *d*, papillae at bottom of fossa shown in *a*, $\times 13,000$; *e*, detail of papillae in *c*, $\times 10,000$; *f*, branching papillae on upper right edge of *b*, $\times 7500$. (Micrographs reduced to 76%.)

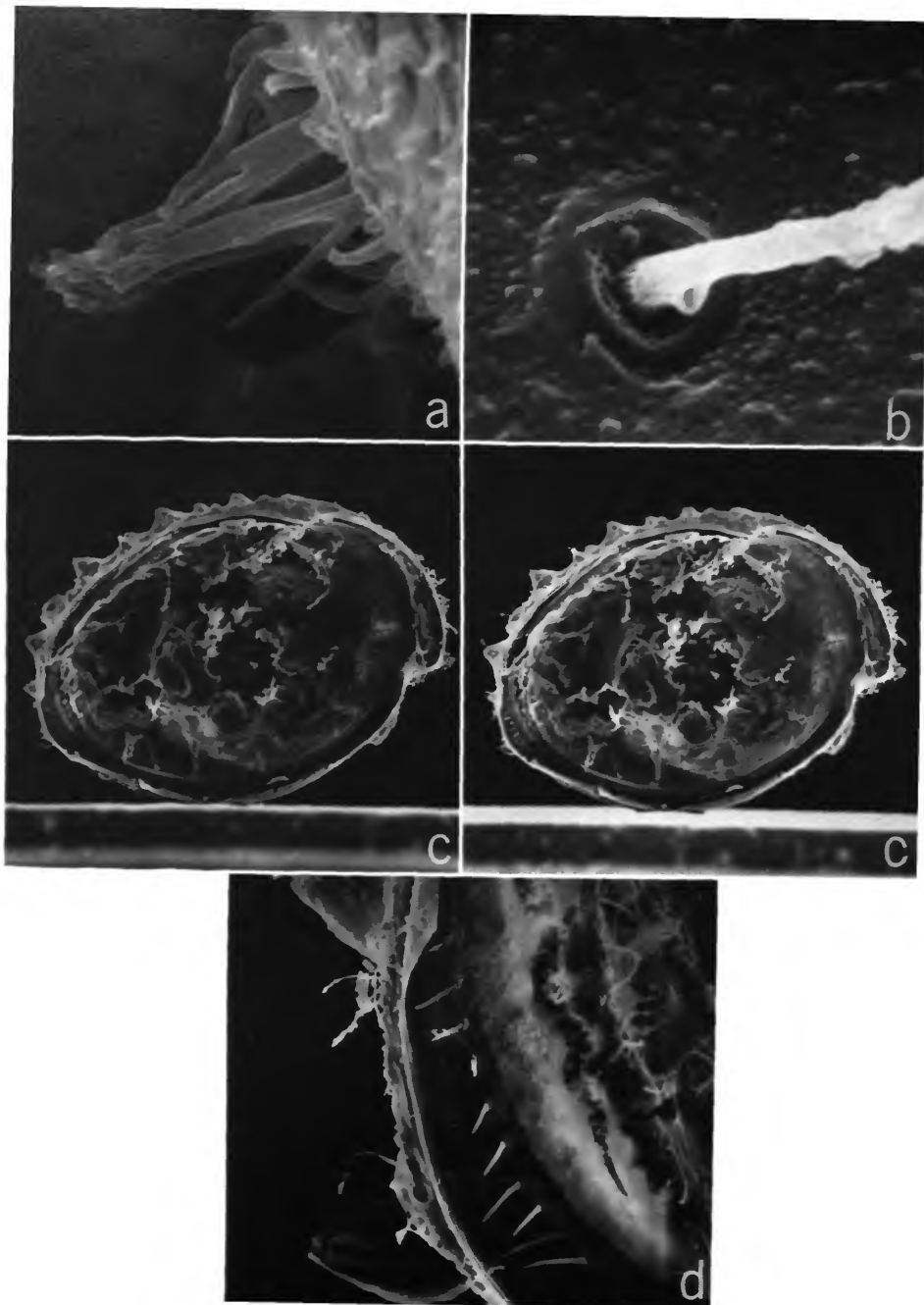


PLATE 152.—*Asteropterygion romei*, new species, female (A-1? instar), USNM 157413, left valve outside views: *a*, branching on upper right of fossa shown in Plate 151*a*, $\times 7500$; *b*, base of bristle shown in lower left of Plate 151*b*, $\times 14,000$. Inside views: *c*, complete valve (tilted forward about 15°), stereoscopic pair, $\times 35$; *d*, posteroventral edge of valve showing bristles of infold, $\times 265$; (Micrographs reduced to 77%.)

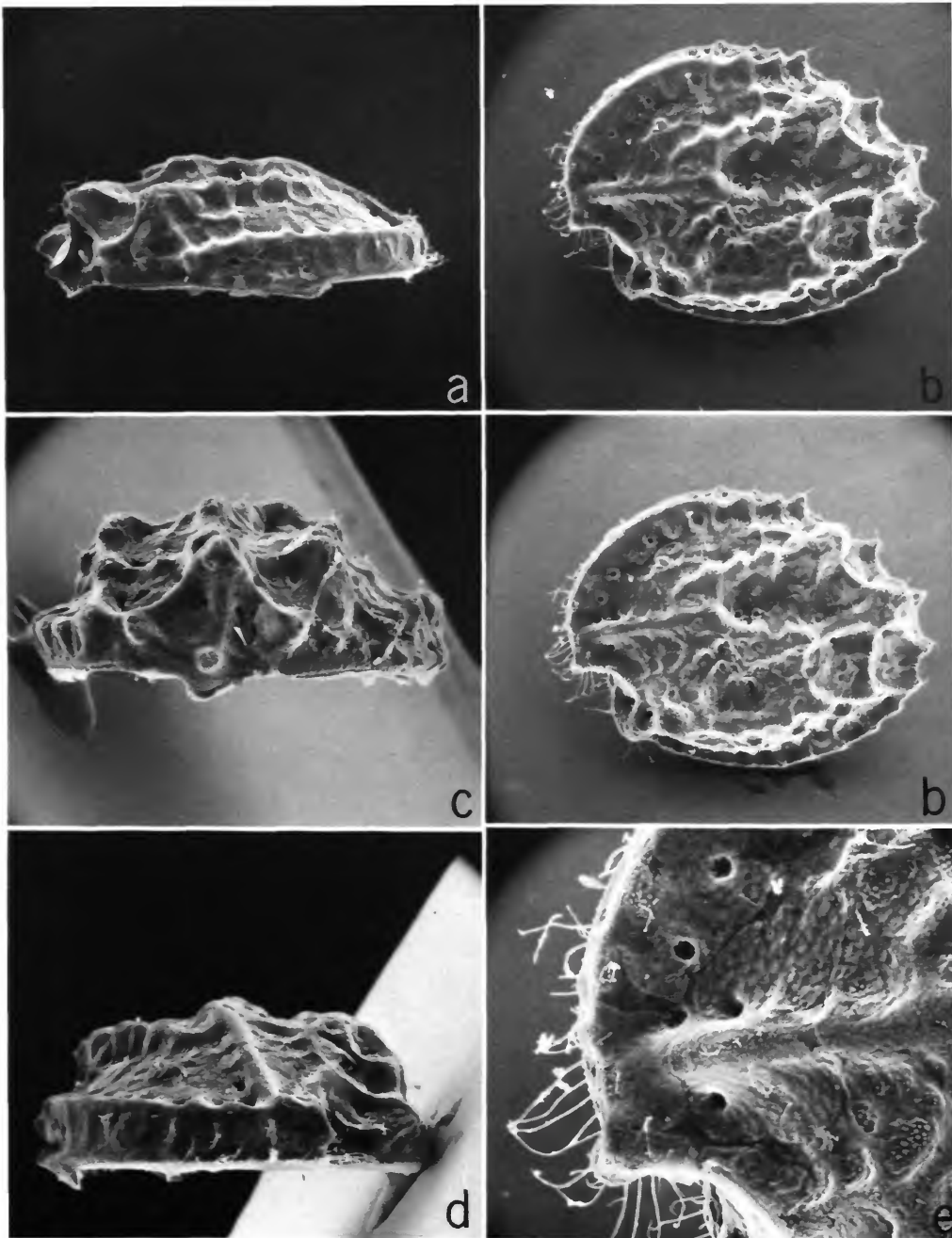


PLATE 153.—*Asteropterygion romei*, new species, male (A-1 instar), paratype, USNM 157705, left valve, outside views: *a*, dorsal view, anterior to right, $\times 34$; *b*, lateral view, stereoscopic pair, $\times 32$; *c*, posterior view, ventral margin of left, $\times 50$; *d*, anterior view, ventral margin to right, $\times 50$; *e*, lateral view of rostrum, from *b*, $\times 100$. (Micrographs reduced to 76%.)

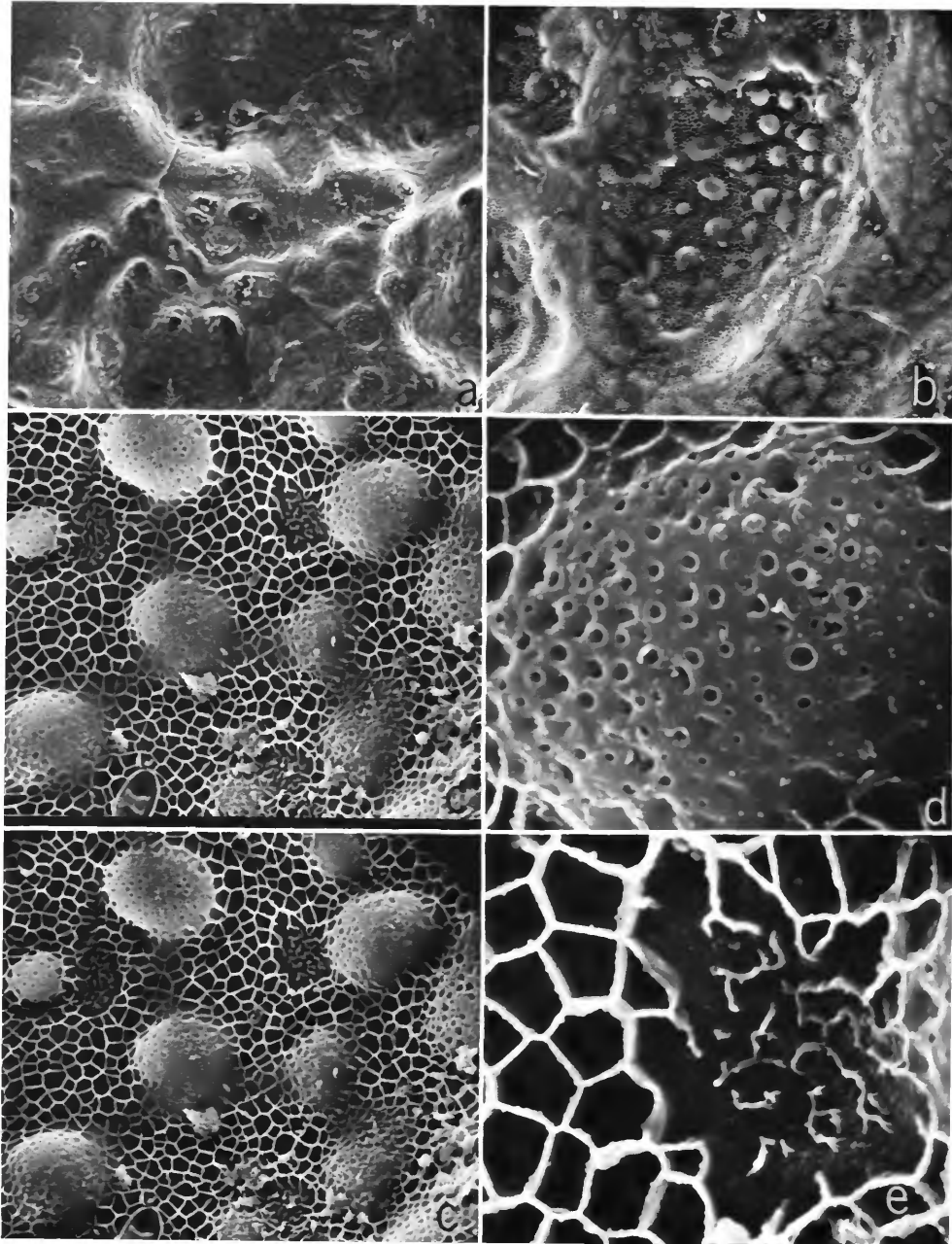


PLATE 154.—*Asteropterygion romei*, new species, male (A-1 instar), paratype, USNM 157705, left valve, outside views: *a*, fossae in middle of valve in area of central adductor muscle attachments, from Plate 153*b*, $\times 100$; *b*, detail of fossae in lower right of Plate 153*e*, $\times 500$; *c*, detail of surface at bottom of fossa in middle of *b*, stereoscopic pair, $\times 2000$; *d*, surface of pustule on upper right of *c*, $\times 10,000$; *e*, detail of structures in upper right of *c*, just left of pustule, $\times 10,000$. (Micrographs reduced to 74%.)

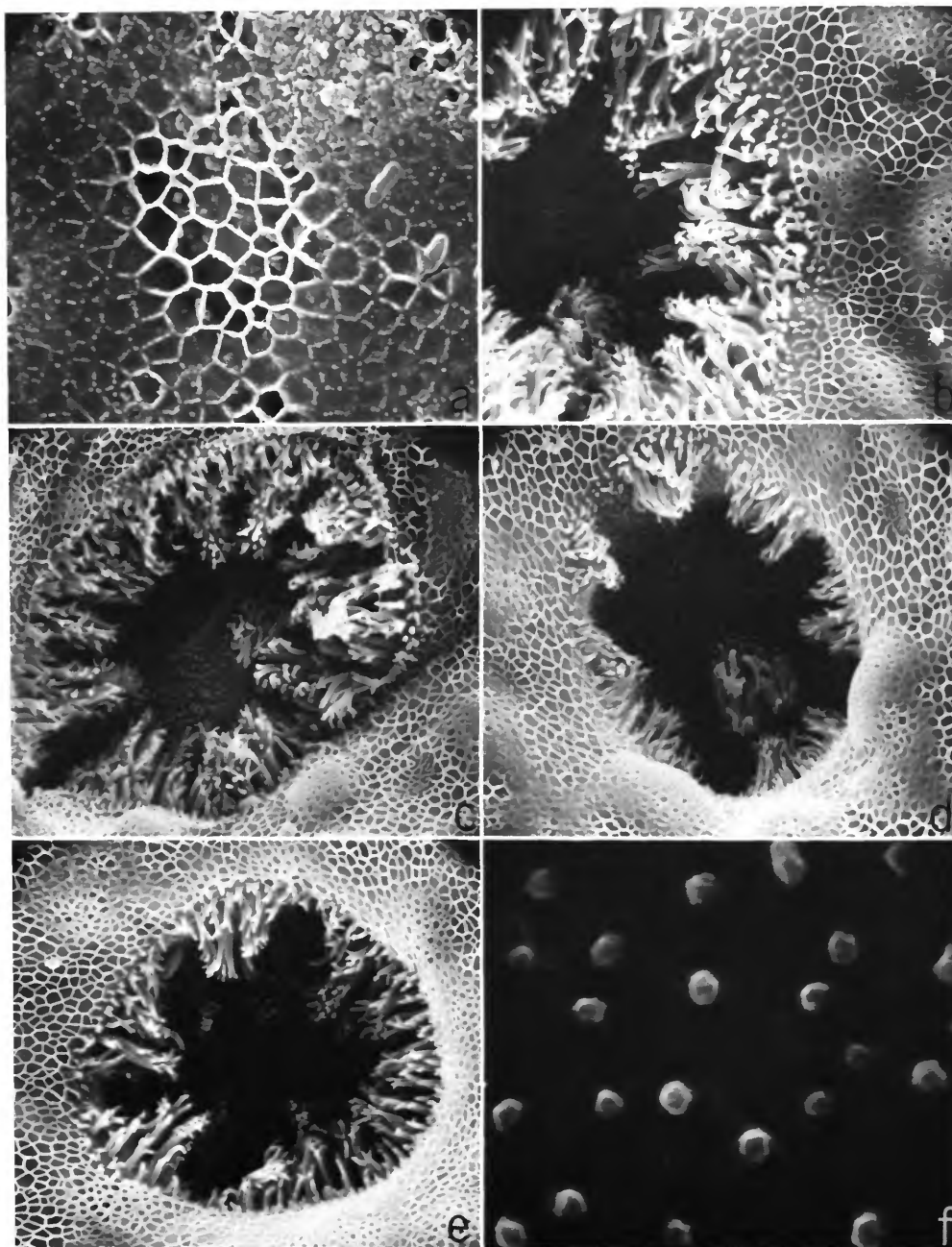


PLATE 155.—*Asteroptyrigion romei*, new species male (A-1 instar), paratype, USNM 157705, left valve, outside views: *a*, detail of surface reticulations near *e*, $\times 5000$; *b*, fossa near right edge of Plate 154*a*, $\times 2000$; *c*, fossa to upper left of middle of Plate 154*a*, $\times 1500$; *d*, top fossa in row of fossae along anterodorsal margin of valve, from Plate 153*b*, $\times 1600$; *e*, fossa in same row as *d*, from Plate 153*e*, $\times 1500$; *f*, papillae on bottom of fossa in *d*, $\times 20,000$. (Micrographs reduced to 75%.)

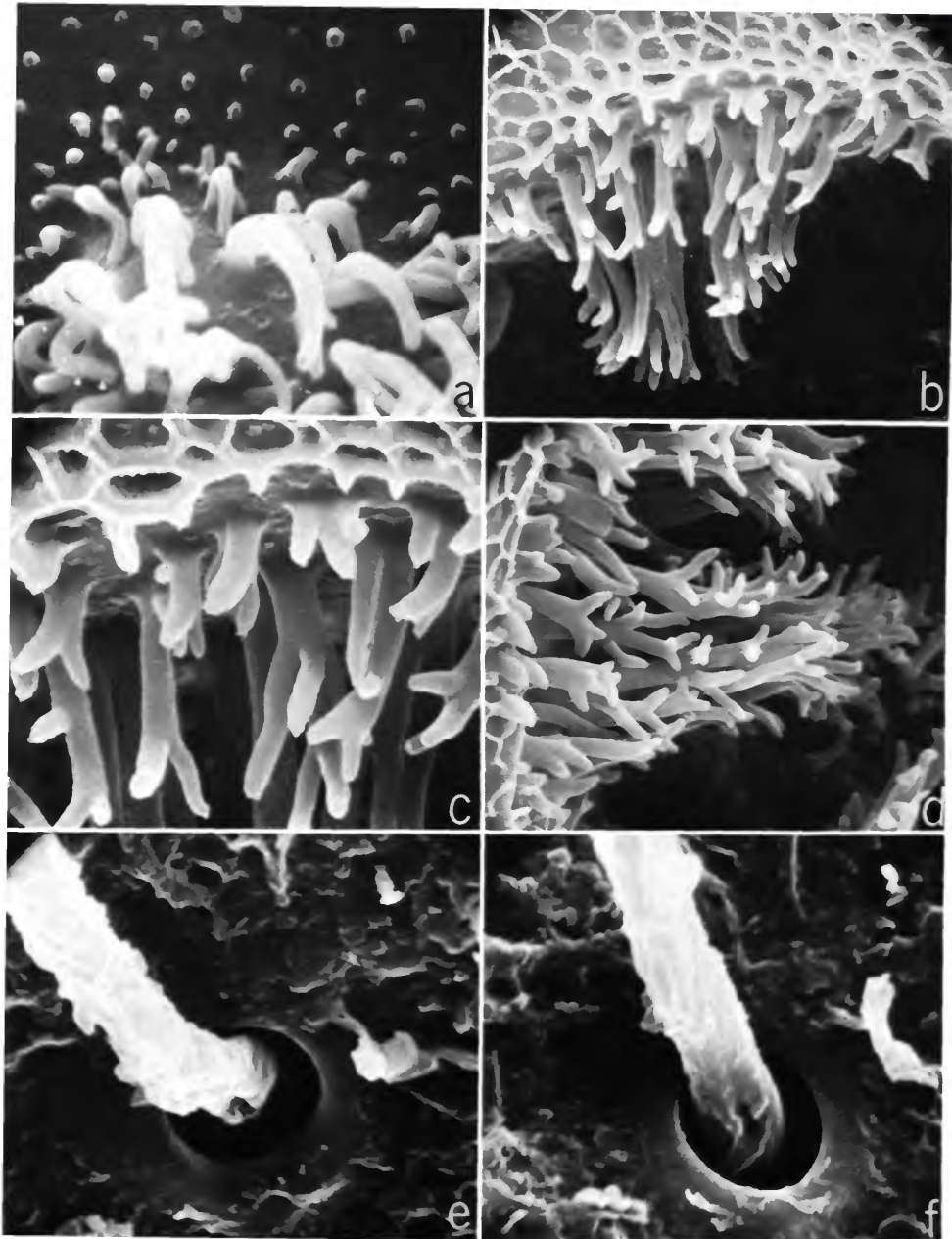


PLATE 156.—*Asteropterygion romei*, new species, male (A-1 instar), paratype, USNM 157705, left valve, outside views: *a*, detail of pustules and branching papillae on bottom of fossa in Plate 155*d*, $\times 10,000$; *b*, branching papillae along top of fossa in Plate 155*e*, $\times 5000$; *c*, detail of structures in *b*, $\times 10,000$; *d*, branching papillae along left side of fossa in Plate 155*c*, $\times 5000$; *e*, base of bristle near middle of Plate 154*a*, $\times 10,000$; *f*, base of bristle, from Plate 153*b* (note pore in bristle near base), $\times 10,000$. (Micrographs reduced to 73%.)

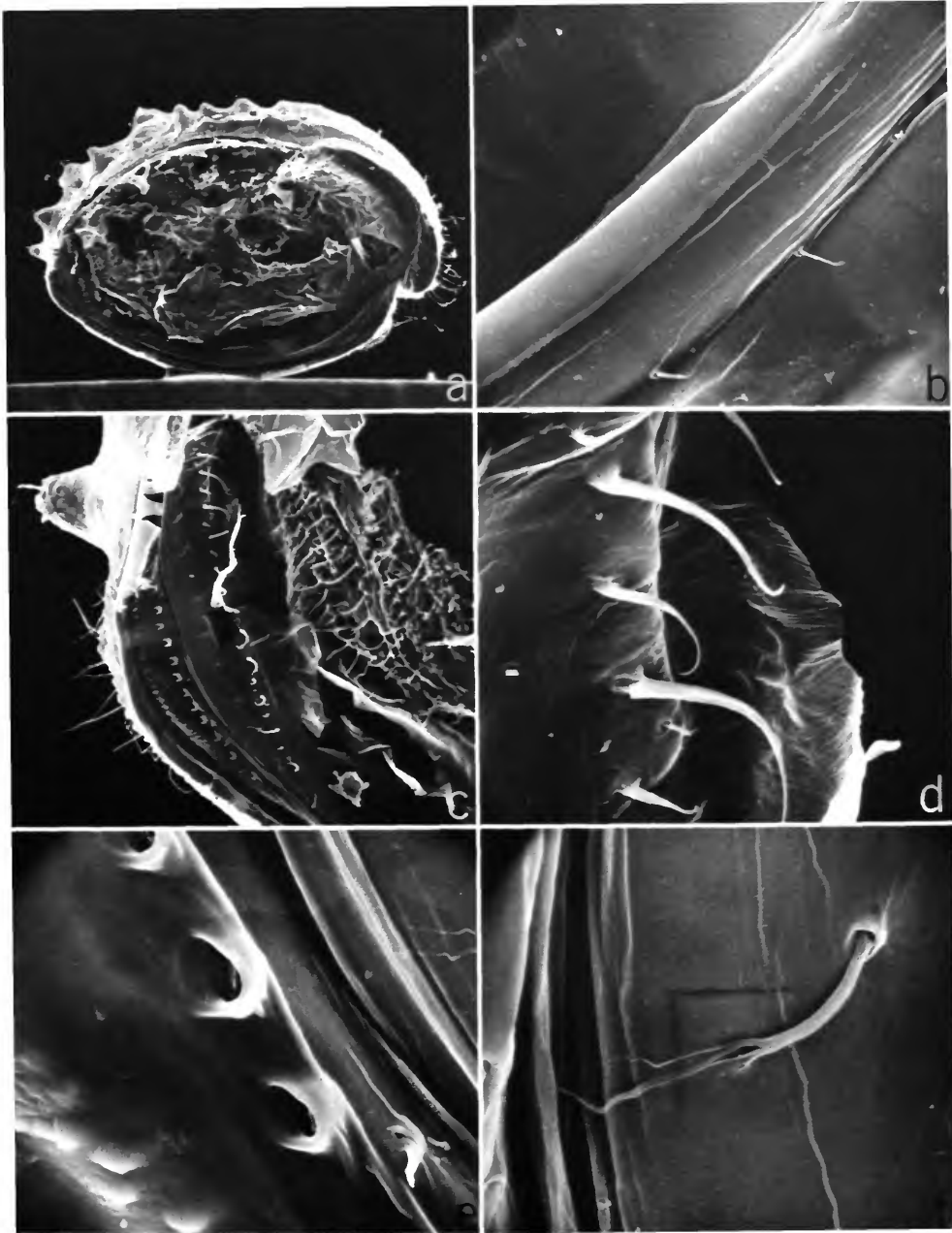


PLATE 157.—*Asteropterygion romei*, new species, male (A-1 instar), paratype, USNM 157705, left valve, inside views: *a*, complete specimen tilted forward, $\times 34$; *b*, anteroventral infold showing bristles and lamellar prolongation of list, from *a*, $\times 550$; *c*, posteroventral margin showing bristles of infold, from *a*, $\times 150$; *d*, bristles on list of posteroventral infold, from *c*, $\times 1000$; *e*, pores on posteroventral infold from which bristles are missing, from *c*, $\times 1500$; *f*, branching bristle posterior to list, from *c*, $\times 2000$. (Micrographs reduced to 74%.)

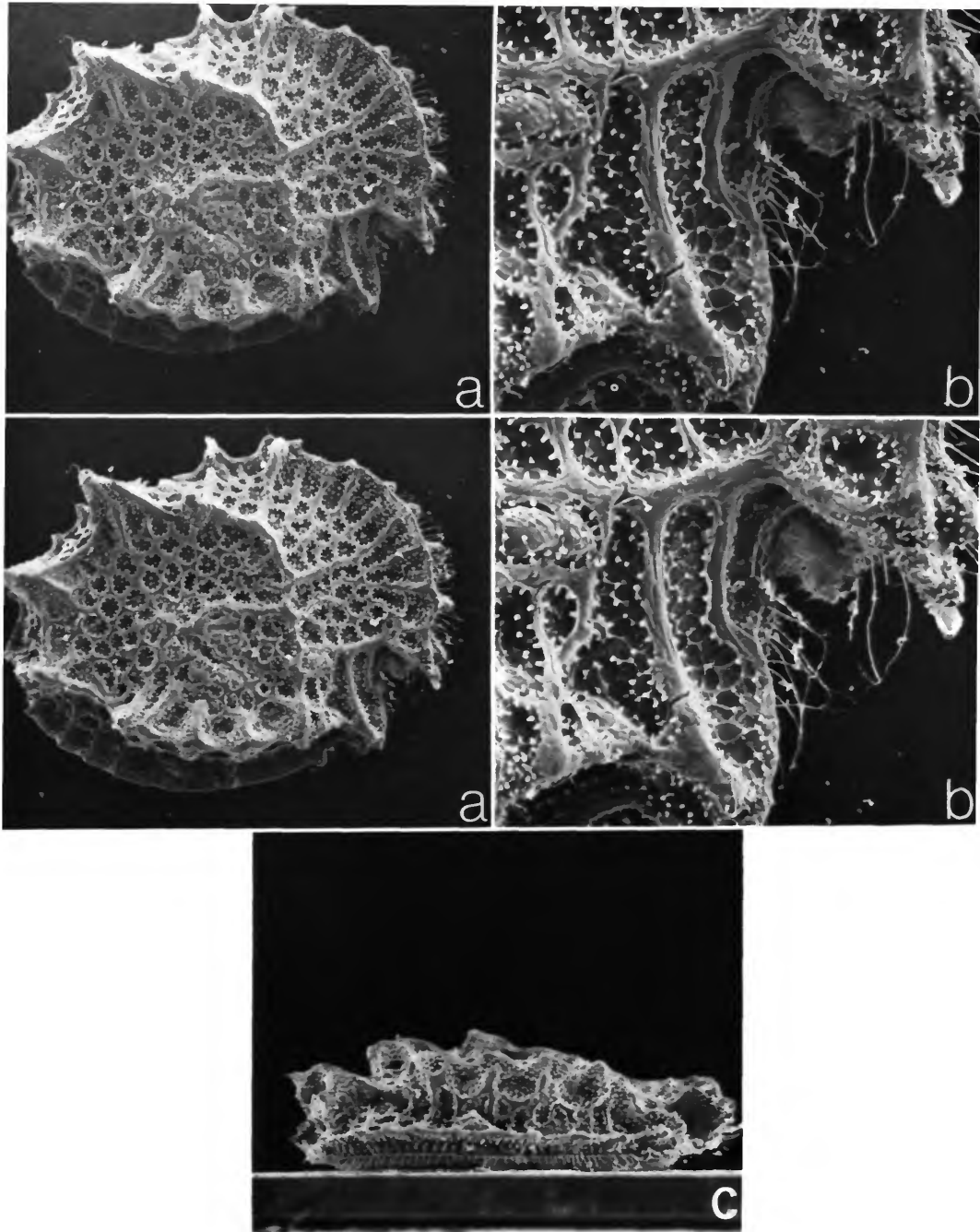


PLATE 158.—*Asteropterygion magnum* (Poulsen), female (probably A-1 instar), USNM 157762, right valve outside views, stereoscopic pairs: *a*, lateral view, $\times 30$; *b*, rostrum and incisur, from *a*, $\times 100$; *c*, ventral view, anterior to right, $\times 30$. (Micrographs reduced to 81%.)

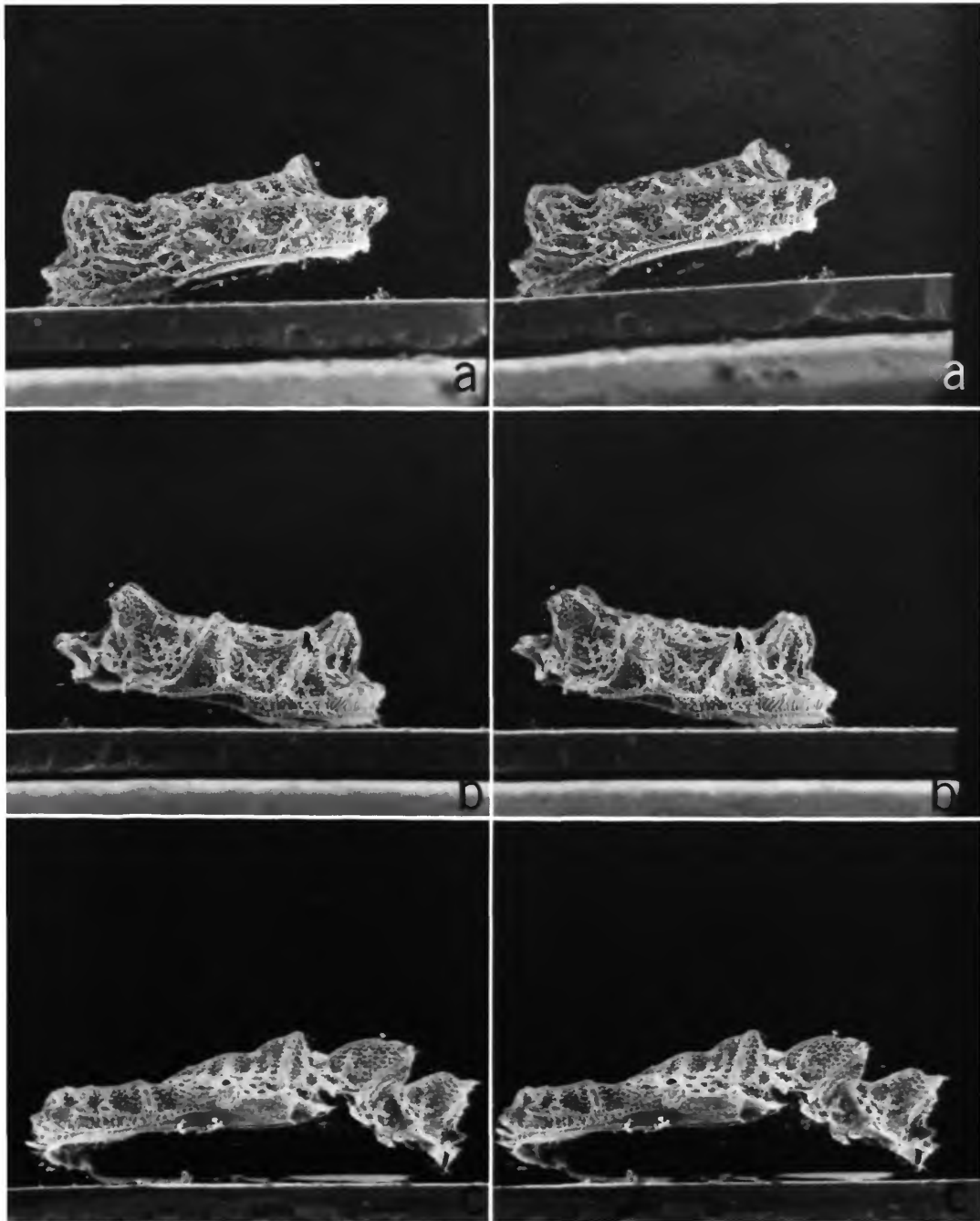


PLATE 159.—*Asteropterygion magnum* (Poulsen), female (probably A-1 instar), USNM 157762, right valve, outside views, stereoscopic pairs, X 30: *a*, anterior view, ventral margin to left, *b*, posterior view, ventral margin to right; *c*, dorsal view, anterior to left. (Micrographs reduced to 81%.)

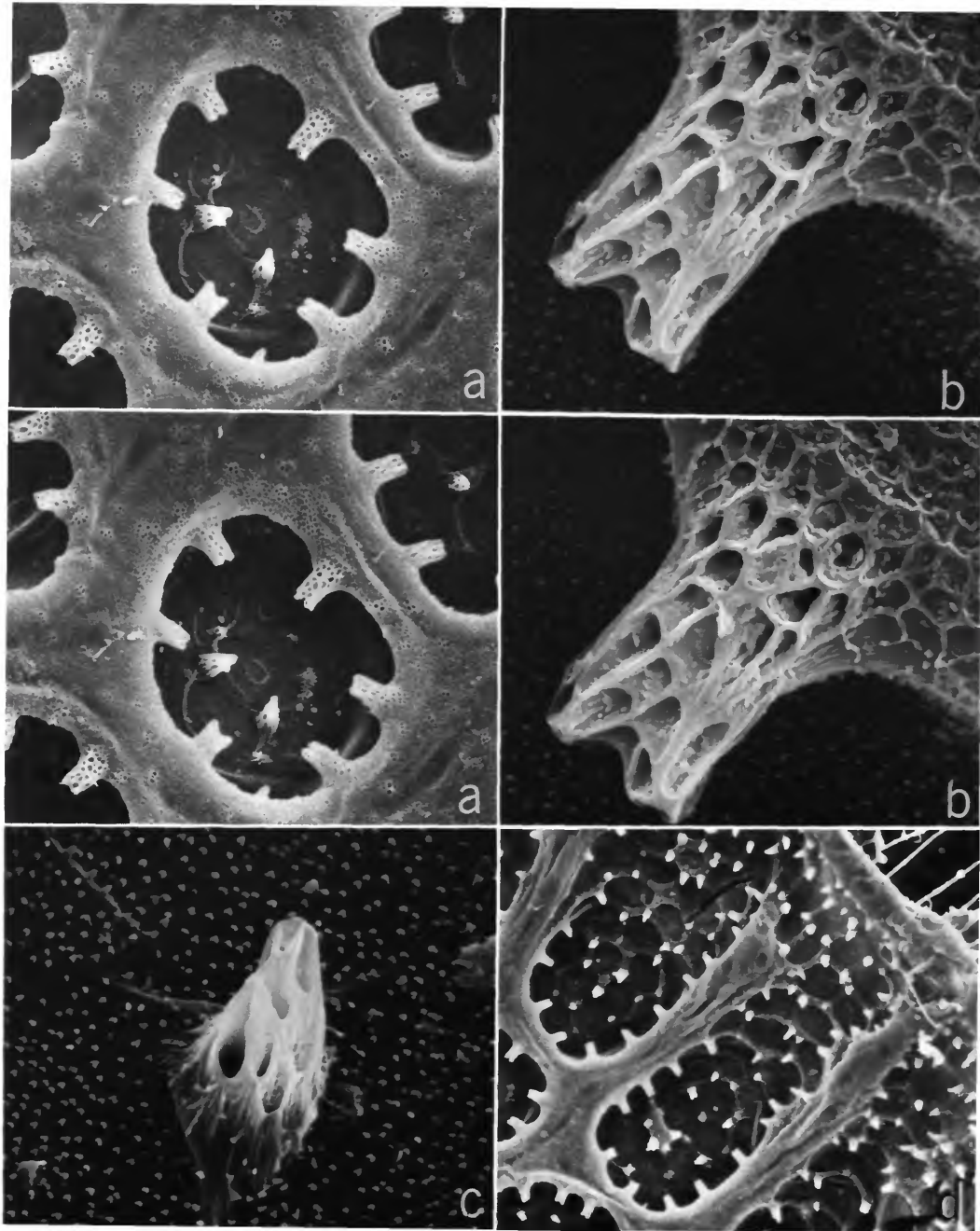


PLATE 160.—*Astropterygion magnum* (Poulsen), female (probably A-1 instar), USNM 157762, right valve, outside views: *a*, fossae on anterodorsal part of valve, from Plate 158a, stereoscopic pair, $\times 500$; *b*, process on margin of middle fossa in *a*, stereoscopic pair, $\times 3500$; *c*, process in middle of fossa in *a*, $\times 3500$; *d*, elongate fossae along anterodorsal margin, from Plate 158a, $\times 200$. (Micrographs reduced to 80%.)

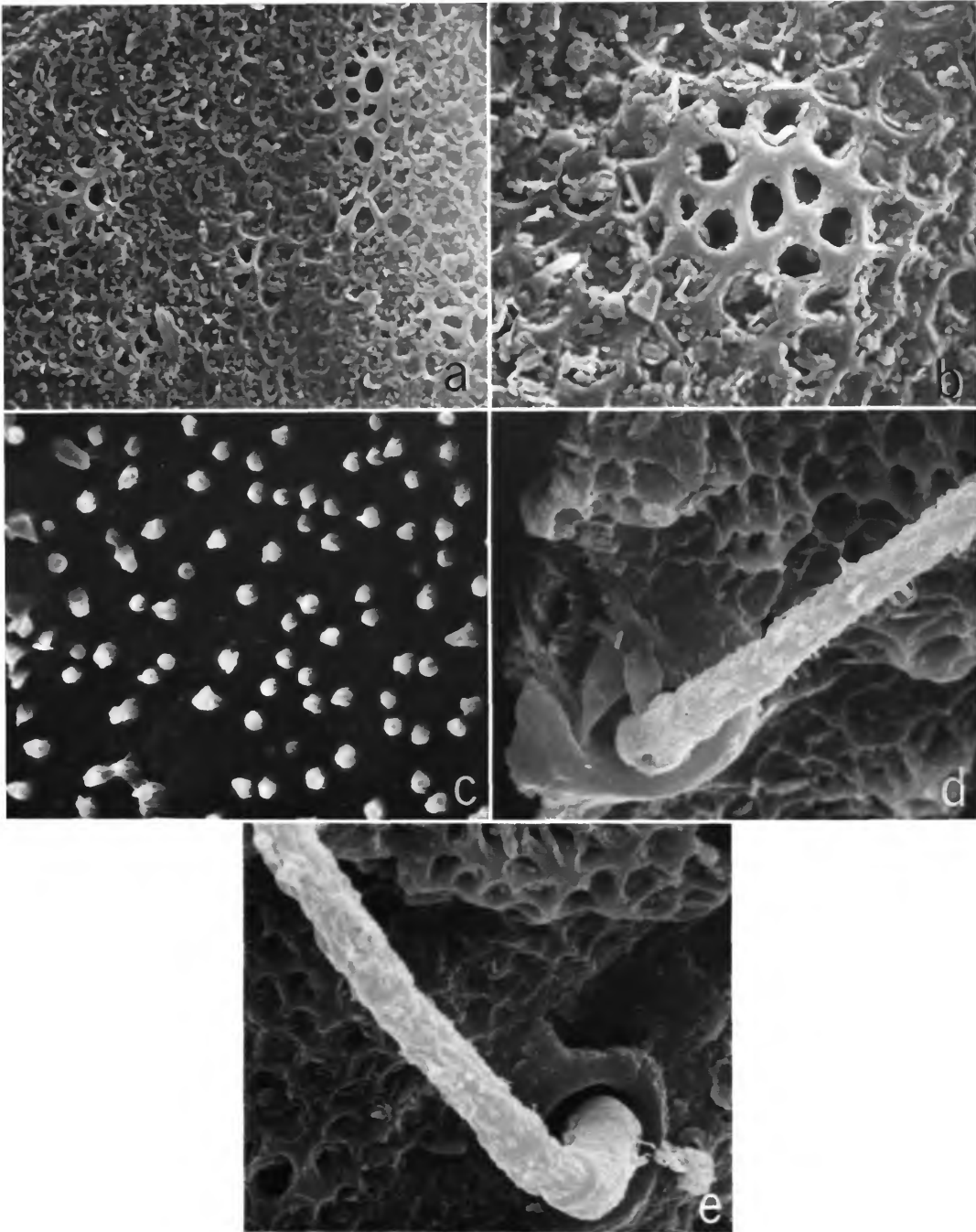


PLATE 161.—*Asteropterygion magnum* (Poulsen), female (probably A-1 instar), USNM 157762, right valve, outside views: *a*, detail of valve surface between fossae, from Plate 160*a*, $\times 3000$; *b*, detail of pores in *a*, $\times 7500$; *c*, surface of bottom of middle fossa in Plate 160*a*, $\times 10,000$; *d*, *e*, bristles emerging from open pores, $\times 5000$. (Micrographs reduced to 81%.)

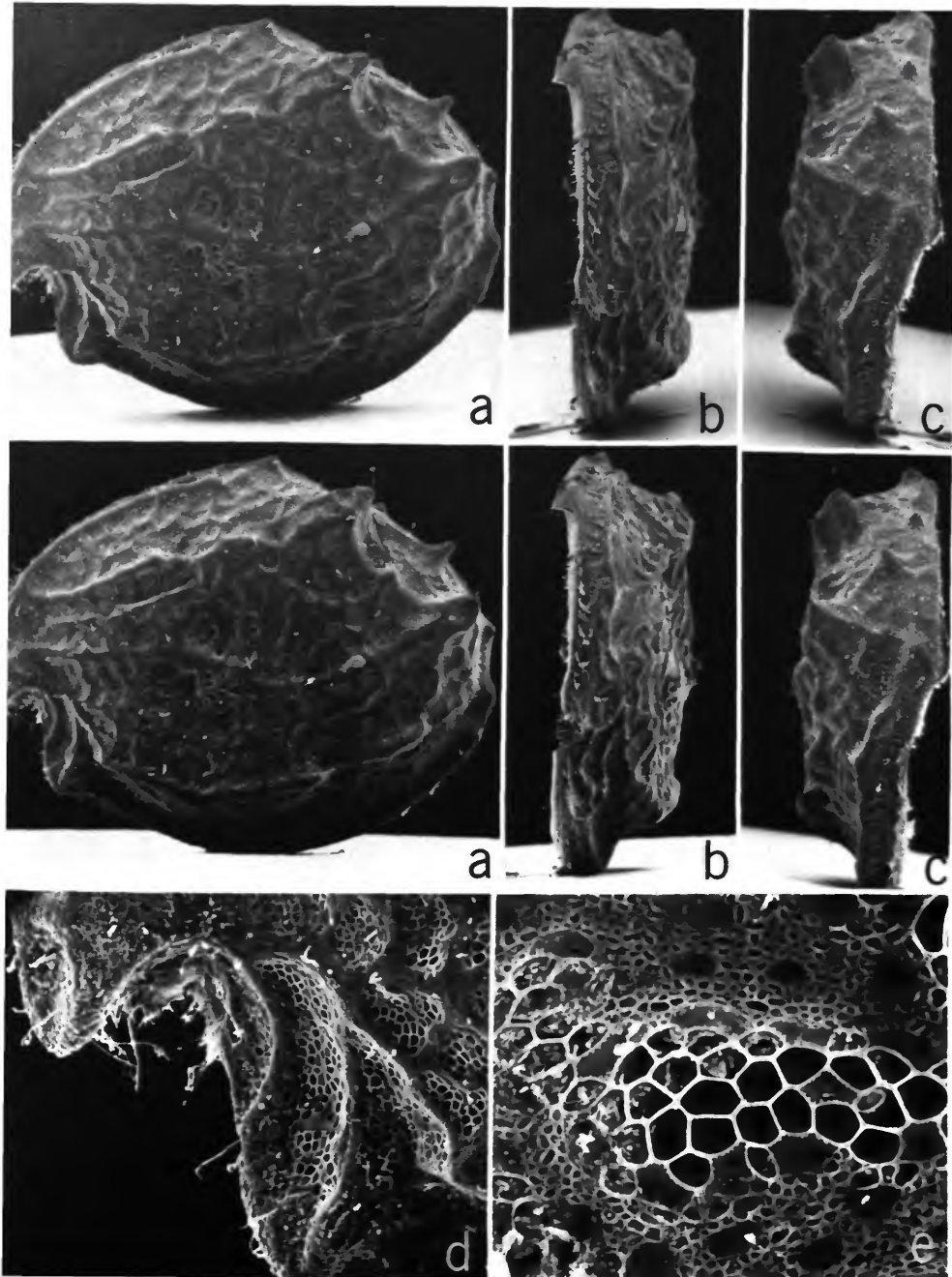


PLATE 162.—*Asteroptygion dayi*, new species, ovigerous female, holotype, USNM 151923, left valve, outside views: *a*, lateral view, stereoscopic pair, $\times 28$; *b*, anterior view, stereoscopic pair, $\times 33$; *c*, posterior view, stereoscopic pair, $\times 31$; *d*, anterior, from *a*, $\times 100$; *e*, surface reticulations, from *a*, $\times 360$. (Micrographs reduced to 78%.)

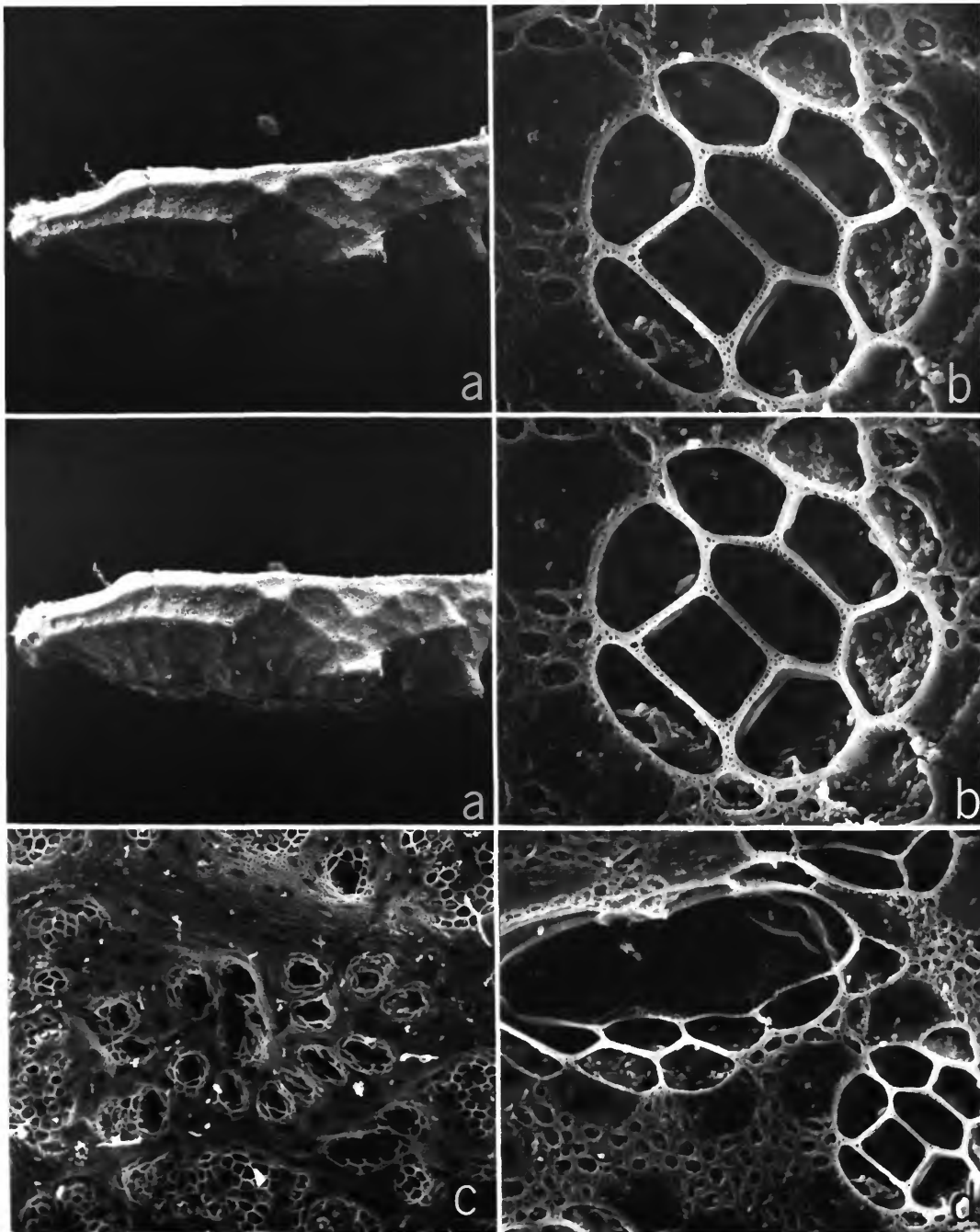


PLATE 163.—*Asteroptyrigion dayi*, new species, ovigerous female, holotype USNM 151923, left valve, outside views: *a*, dorsal view, stereoscopic pair, $\times 30$; *b*, reticulated fossa, from *d*, stereoscopic pair, $\times 1260$; *c*, fossae in area of central muscle attachments, from Plate 162*a*, $\times 125$; *d*, fossae on lower right of *c*, $\times 630$. (Micrographs reduced to 80%.)

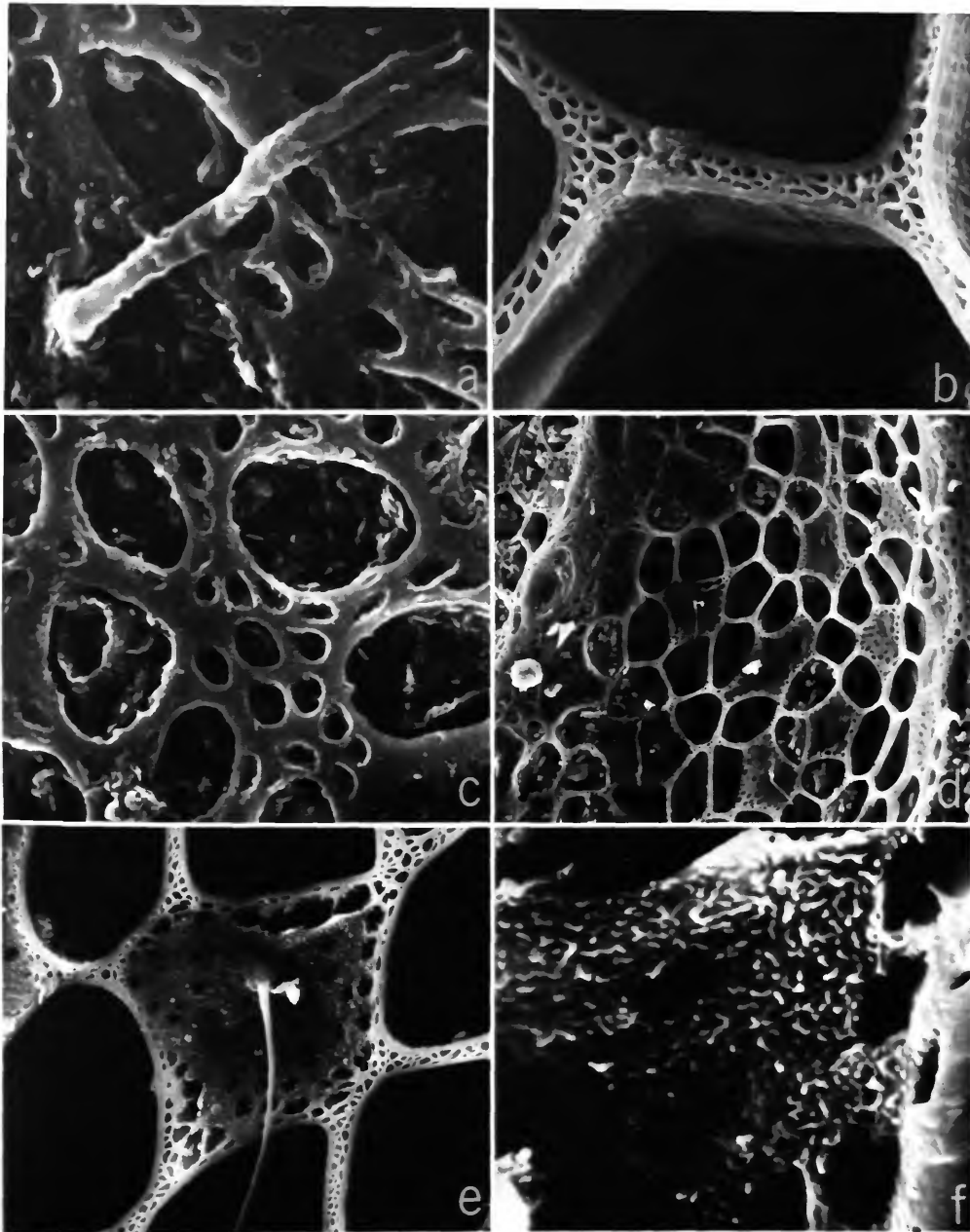


PLATE 164.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923, left valve, outside views: *a*, bristle on oval area lowered by "skin," from near surface shown in Plate 163*d*, $\times 10,000$; *b*, detail of structure in walls forming reticulations over fossa in Plate 163*b*, $\times 6300$; *c*, surface structures on left of fossa in Plate 163*b*, $\times 6300$; *d*, surface structure near anterior margin below incisur, from Plate 162*d*, $\times 500$; *e*, detail of reticulations and bristle in *d*, $\times 2000$; *f*, detail of surface of membrane on middle reticulation in *e*, $\times 10,000$. (Micrographs reduced to 76%.)

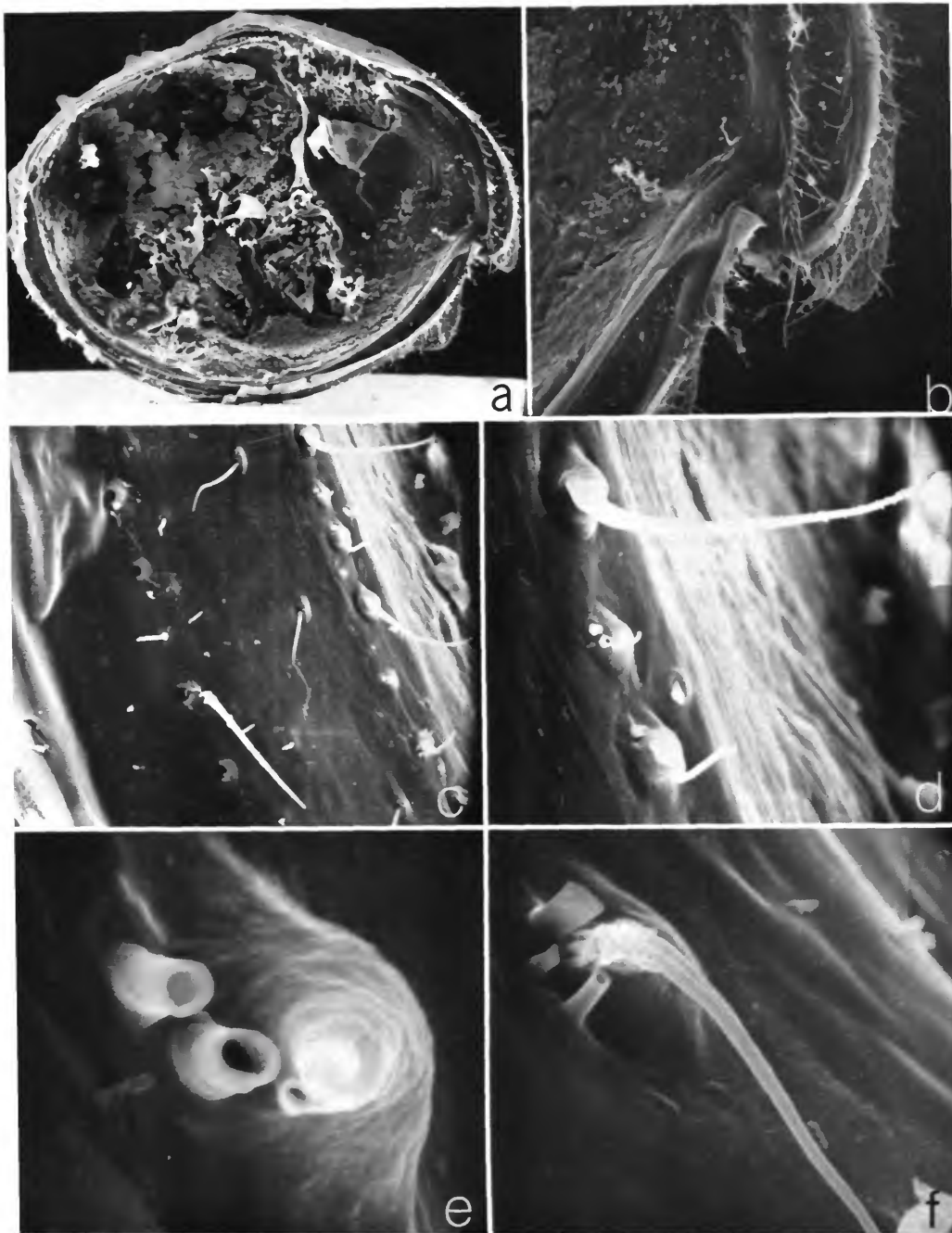


PLATE 165.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923, left valve, inside views: *a*, complete valve, $\times 30$; *b*, rostrum and incisur, from *a*, $\times 100$; *c*, posterior infold, from *a*, $\times 500$; *d*, bristles and tubular processes on list of posterior infold, from *c*, $\times 1400$; *e*, detail from *d*, $\times 10,000$; *f*, bristles and tubular pores on list of posterior infold, from *a*, $\times 5000$. (Micrographs reduced to 77%.)

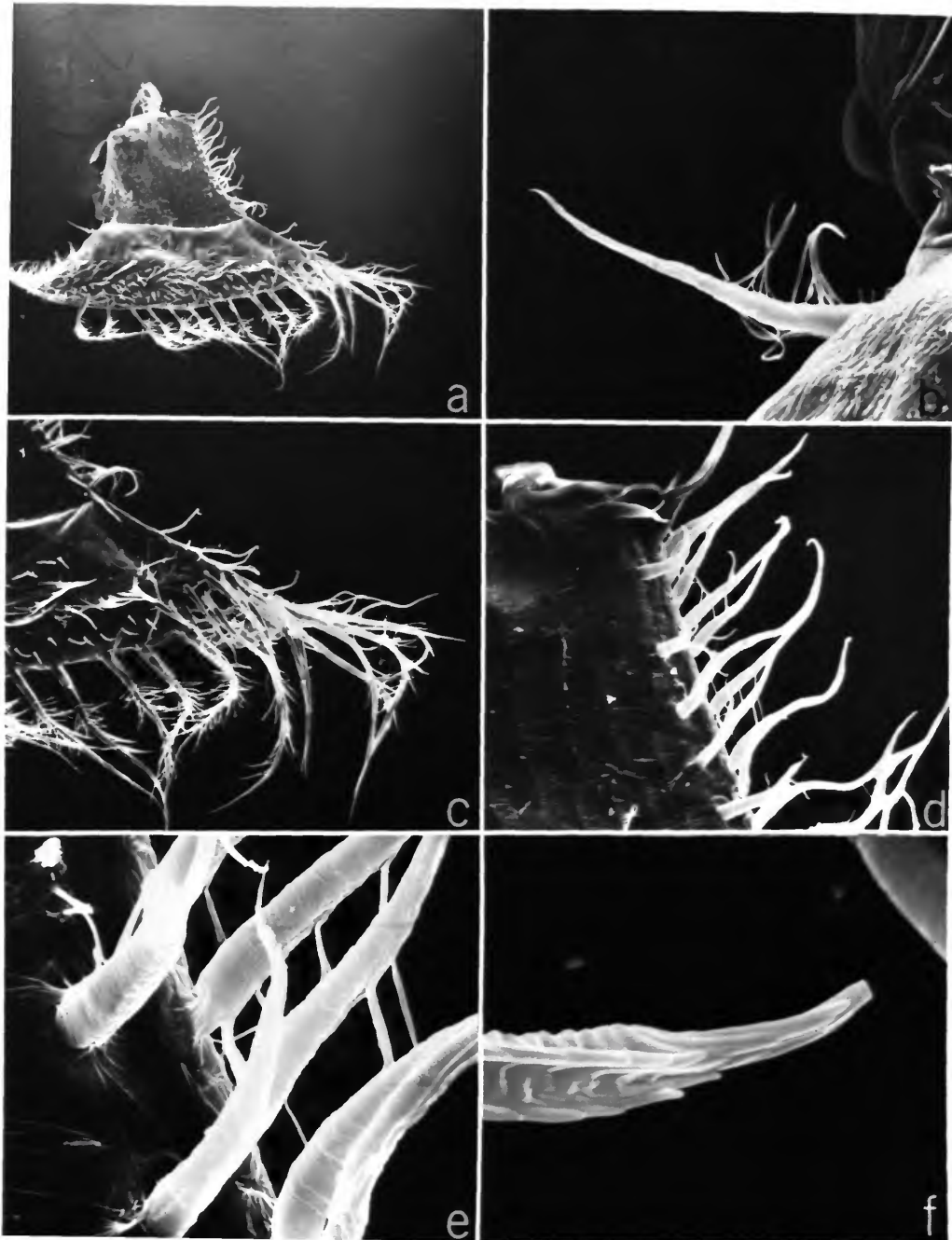


PLATE 166.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923, 6th limb: *a*, complete limb, medial side, $\times 75$; *b*, epipodial bristle, from *a*, $\times 850$; *c*, anterior end of skirt, from *a*, $\times 150$; *d*, bristles along anterior margin of stem, from *a*, $\times 500$; *e*, detail of bristle in *d*, $\times 2000$; *f*, minute medial bristle near ventral margin of skirt, from *c*, $\times 10,000$. (Micrographs reduced to 77%.)

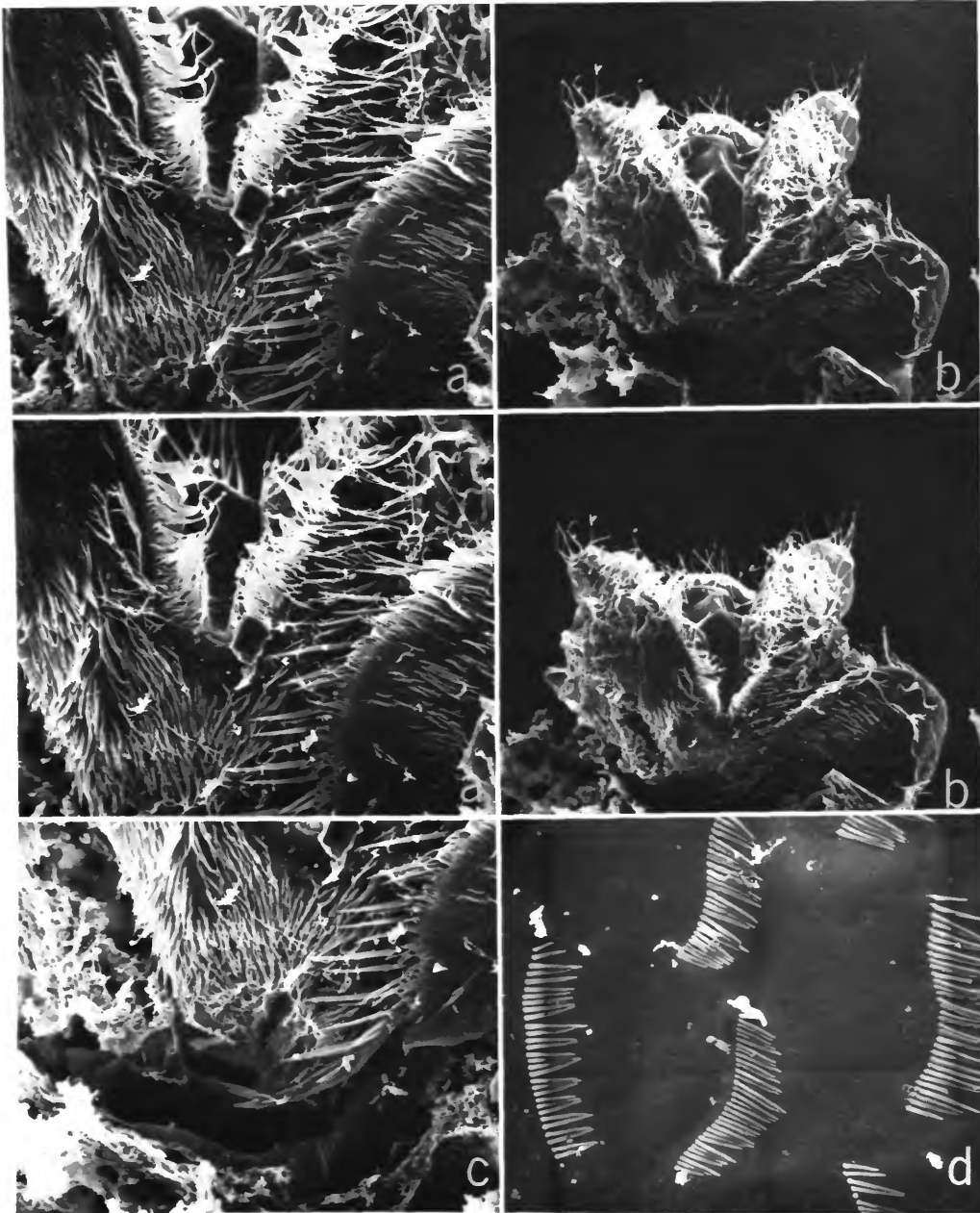


PLATE 167.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923: *a*, ventral view of junction between left and right lobes of upper lip, anterior towards top, from *b*, stereoscopic pair, $\times 500$; *b*, ventral view of complete lip (right lateral flap missing), mouth represented by crescentic slit near bottom, stereoscopic pair, $\times 200$; *c*, ventral view of mouth (note stout bifurcate spine extending from vicinity of left lateral flap to middle of mouth), from *b*, $\times 500$; *d*, medial spines on stem of 6th limb, from Plate 166*a*, $\times 2000$. (Micrographs reduced to 76%.)

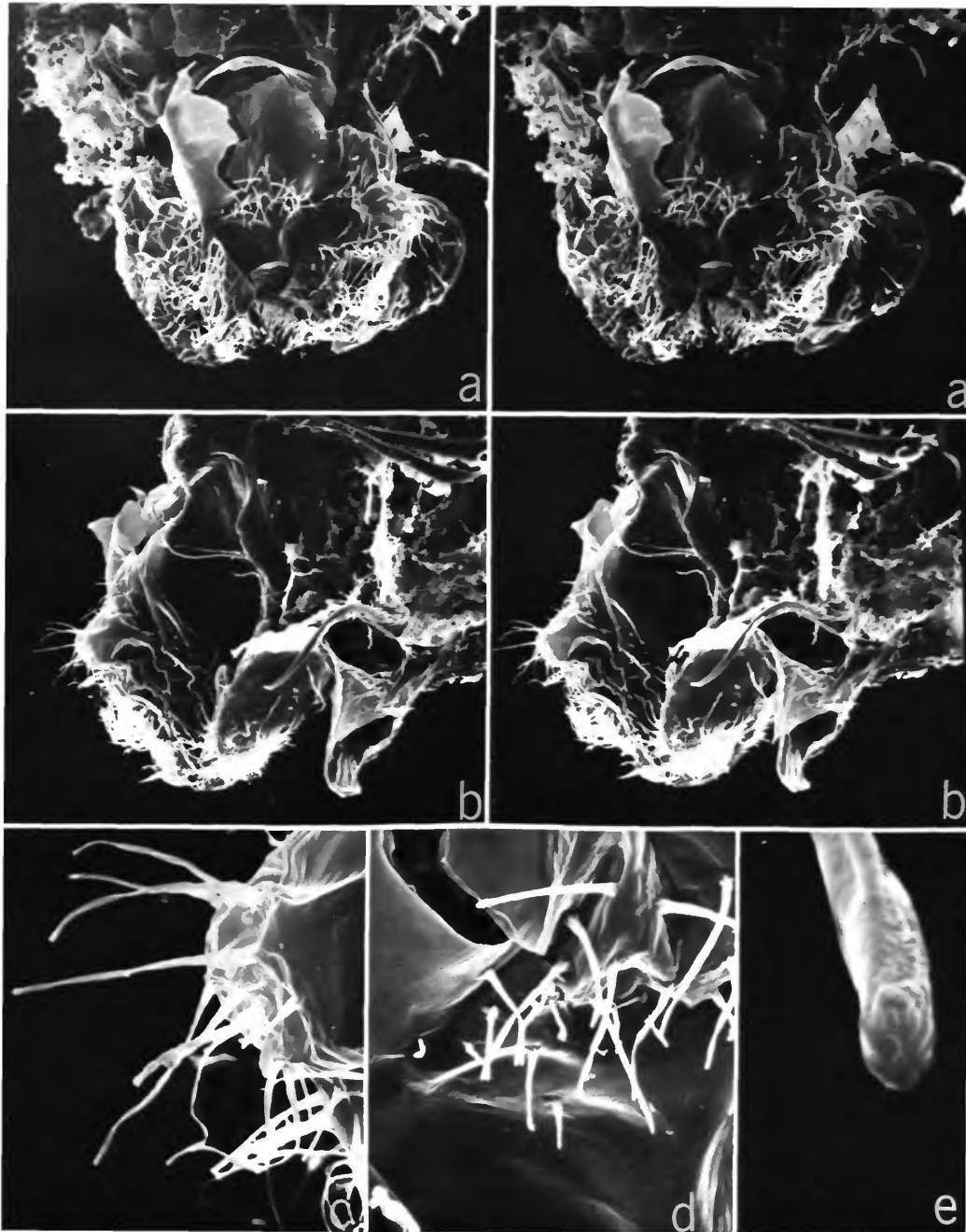


PLATE 168.—*Asteropterygion dayi*, new species, ovigerous female, holotype, USNM 151923, upper lip: *a*, anterior view (right lateral flap missing), stereoscopic pair, $\times 200$; *b*, view from left side, anterior to left, stereoscopic pair, $\times 200$; *c*, bristles of left lobe, from *b*, $\times 1000$; *d*, anterior bristles above saddle, $\times 1000$; *e*, tip of bristle in *d*, $\times 15,000$. (Micrographs reduced to 80%.)

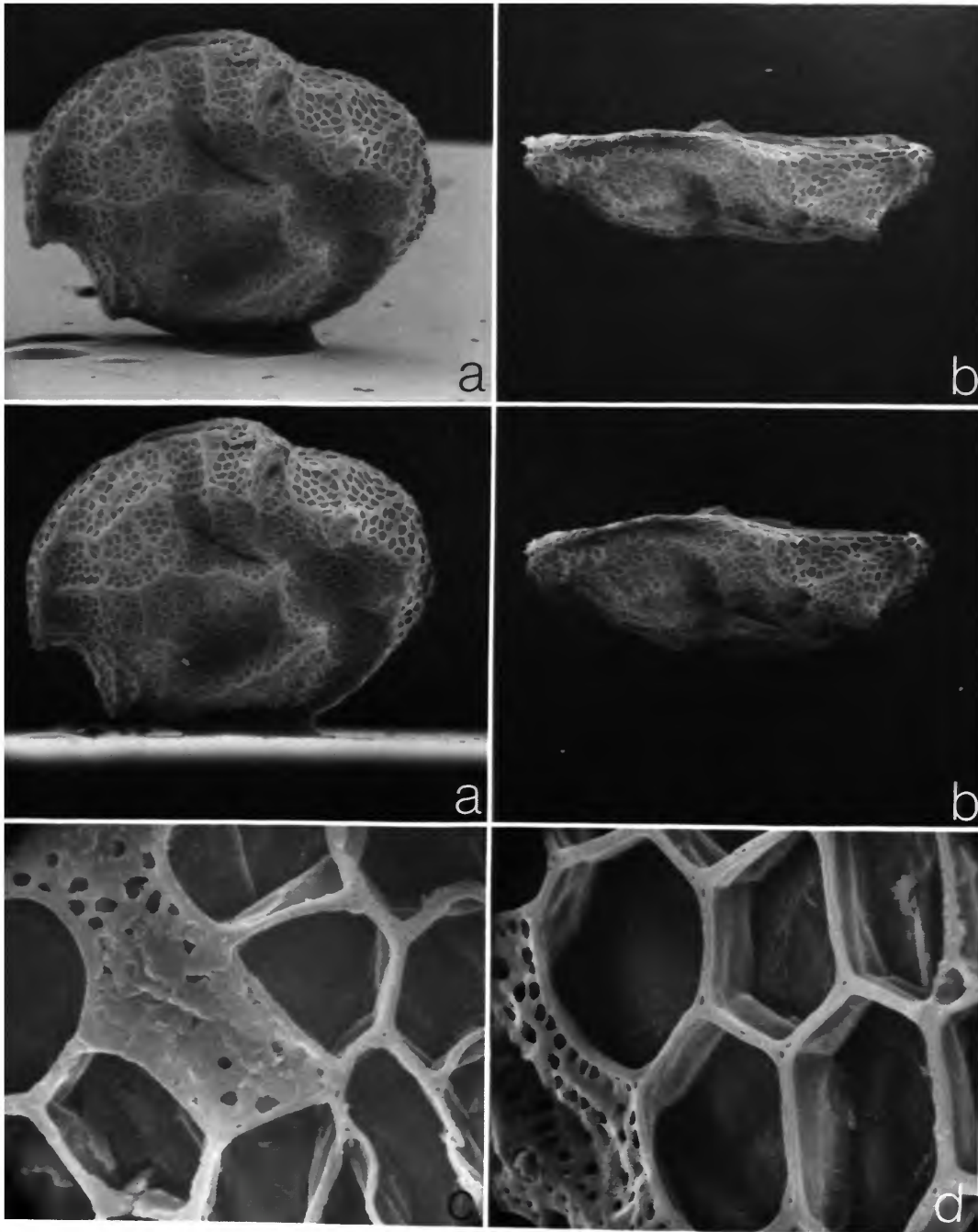


PLATE 169.—*Asteropterygion dayi*, new species, juvenile, Hamburg Zoological Museum K 30025, outside views of left valve: *a*, lateral view, stereoscopic pair, $\times 80$; *b*, dorsal view, stereoscopic pair, $\times 80$; *c*, detail of reticulations, from near middle of Plate 170*b*, $\times 1500$; *d*, detail of reticulations just posterior to rostrum, from Plate 170*a*, $\times 1500$. (Micrographs reduced to 76%.)

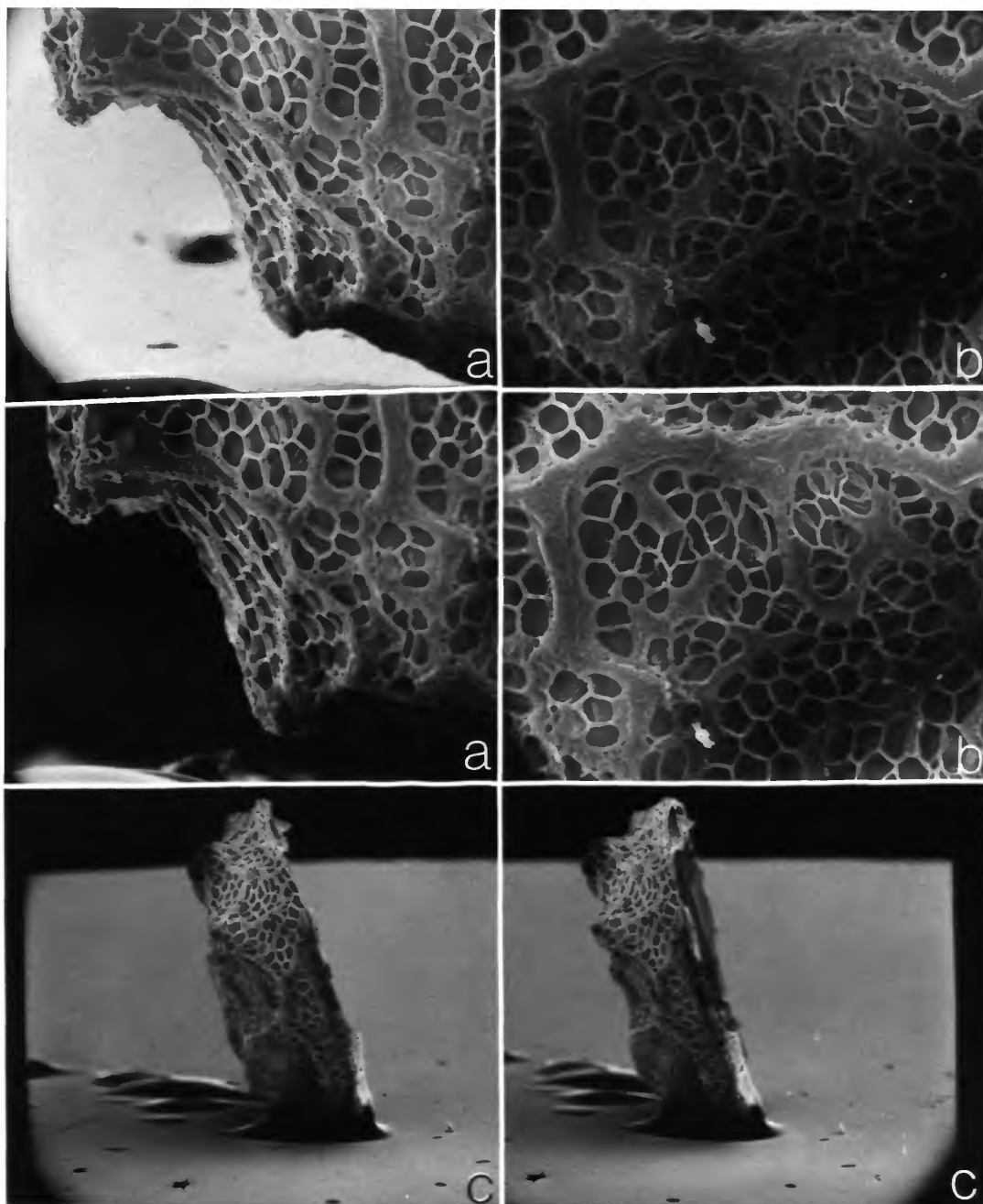


PLATE 170.—*Asteropterygion dayi*, new species, juvenile, Hamburg Zoological Museum K 30025, outside views of left valve: *a*, lateral view of rostrum and incisur, from Plate 169*a*, stereoscopic pair, $\times 240$; *b*, fossae in middle of valve in vicinity of central adductor muscle attachments, from Plate 169*a*, stereoscopic pair, $\times 280$; *c*, posterior view, stereoscopic pair, $\times 80$. (Micrographs reduced to 77%.)

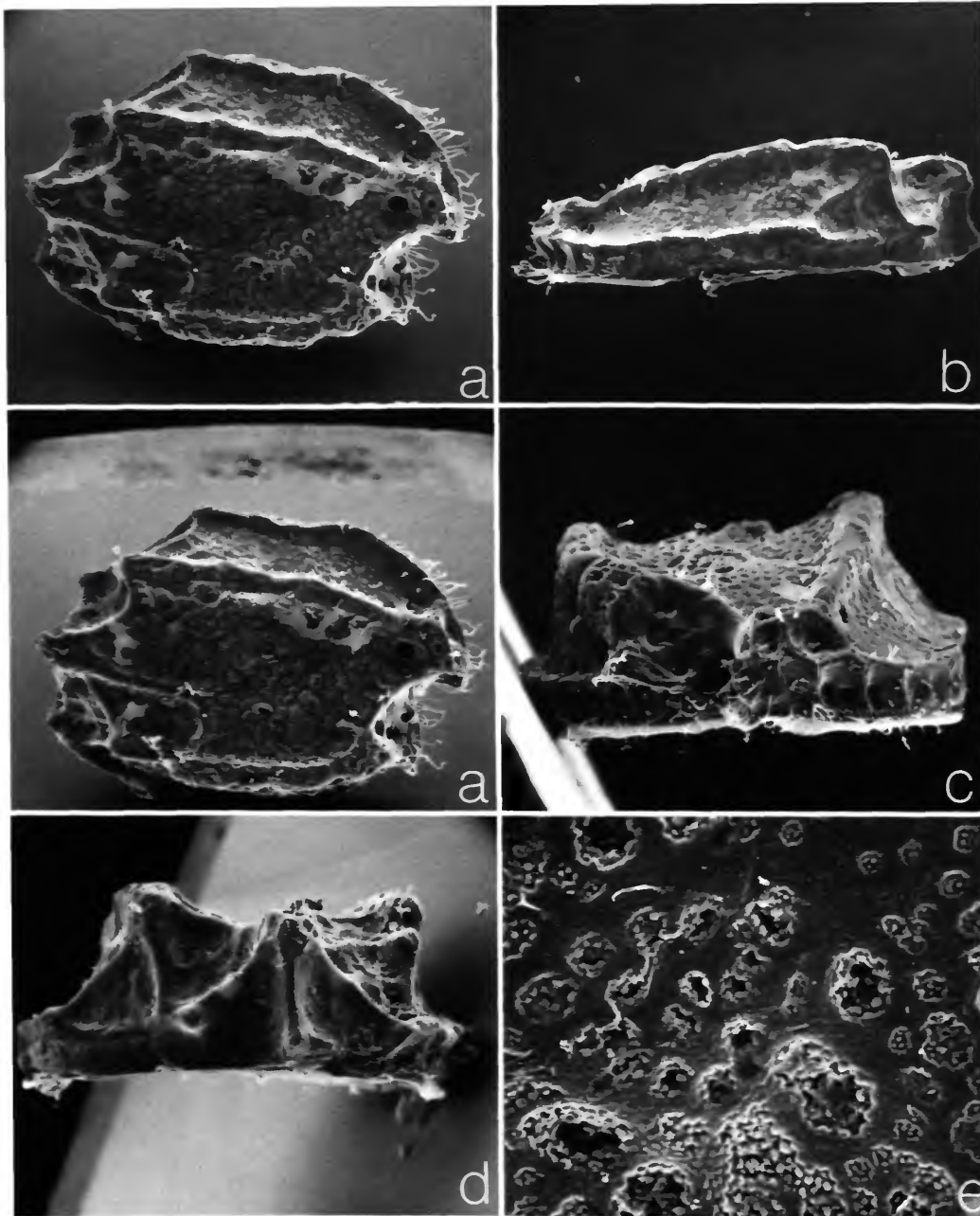


PLATE 171.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701, right valve, outside views: *a*, lateral view of valve, stereoscopic pair, $\times 30$; *b*, dorsal view of valve, anterior to left, $\times 32$; *c*, anterior view of valve, ventral margin to left, $\times 46$; *d*, posterior view of valve, ventral margin to right, $\times 42$; *e*, surface of valve in vicinity of central adductor muscle attachments, from *a*, $\times 150$. (Micrographs reduced to 81%.)

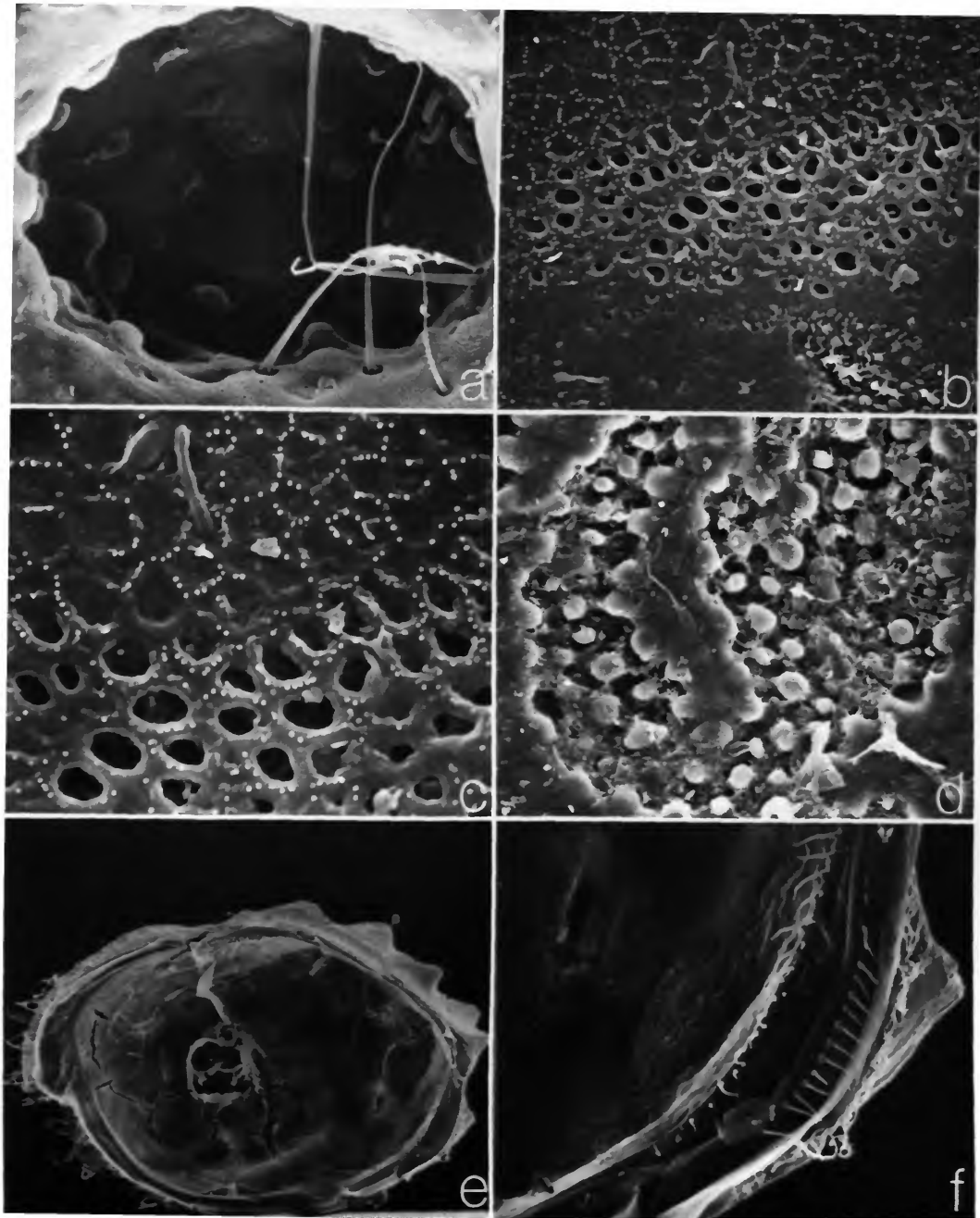


PLATE 172.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701, right valve: *a*, large fossa from anterior end of valve, from Plate 171*a*, $\times 675$; *b*, surface of valve near *a*, $\times 5000$; *c*, detail of *b*, $\times 10,000$; *d*, shallow fossa near middle of valve, from Plate 171*a*, $\times 500$; *e*, inside view of valve, $\times 34$; *f*, posteroventral end of valve, from *e*, $\times 34$. (Micrographs reduced to 83%.)

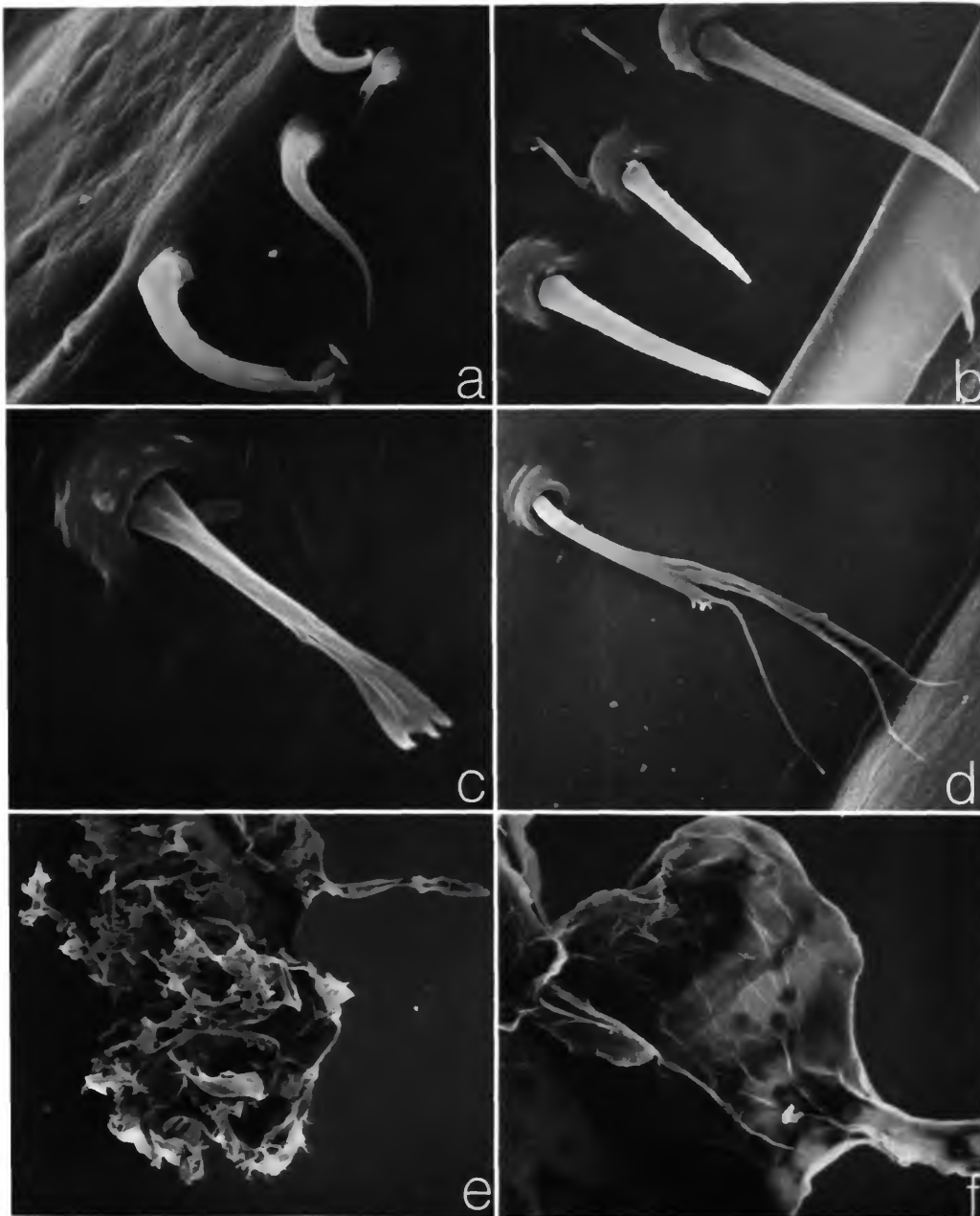


PLATE 173.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701: *a*, bristles on posteroventral list of infold, from Plate 172*f*, $\times 1500$; *b*, bristles on posteroventral infold near selvage, from Plate 172*f*, $\times 1500$; *c*, detail of bristle in *b*, $\times 7200$; *d*, setose bristle on posteroventral infold posterior to list, from Plate 172*f*, $\times 2250$; *e*, lateral view of anterior of body with appendages removed, showing medial eye and rod-shaped organ and upper lip, $\times 100$; *f*, medial eye, from *e*, $\times 500$. (Micrographs reduced to 80%.)

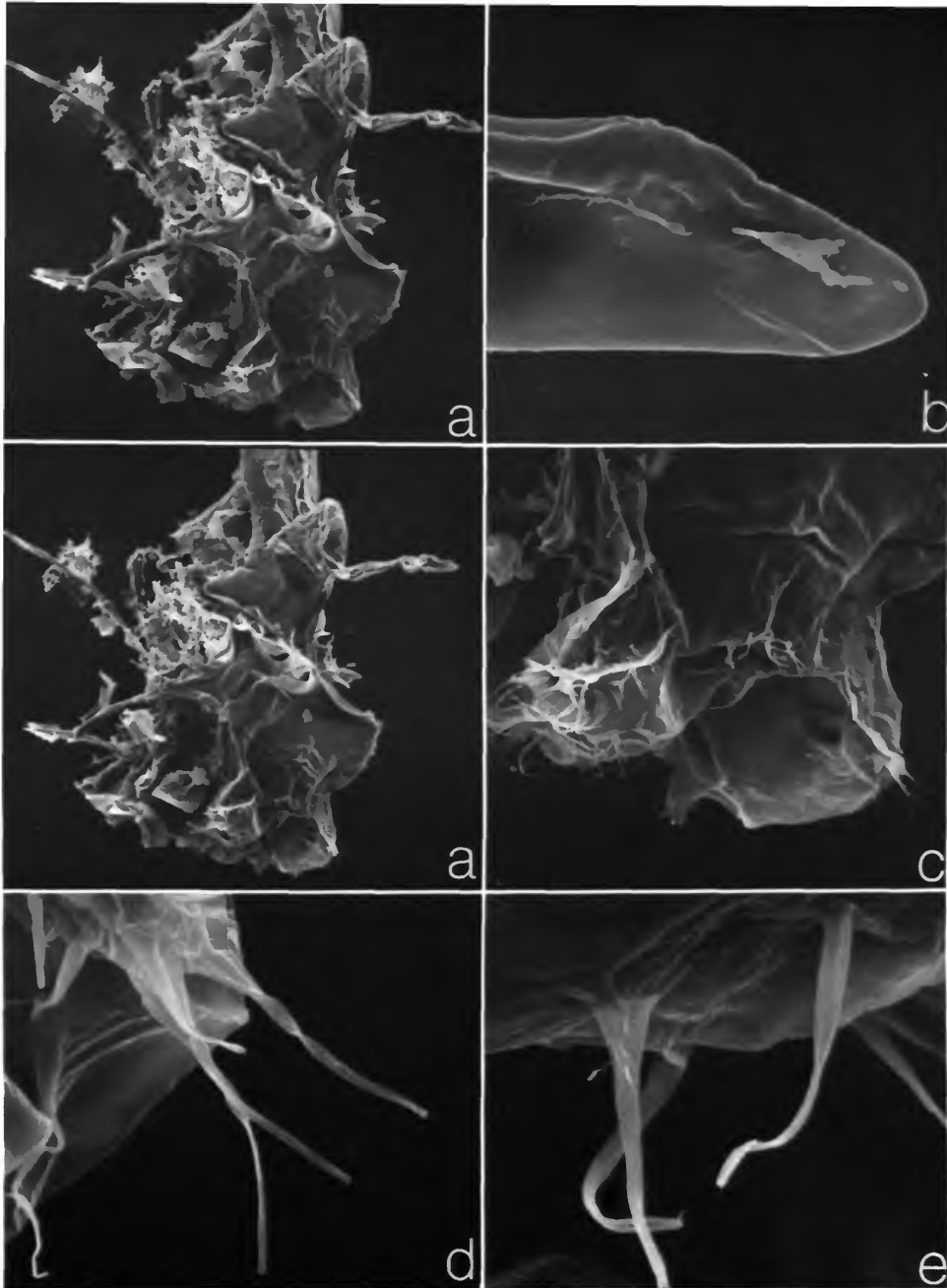


PLATE 174.—*Asteroptyrigion peterseni*, new species, ovigerous female, paratype, USNM 157701: *a*, oblique view of anterior of body with appendages removed showing medial eye and rod-shaped organ, stereoscopic pair, $\times 100$; *b*, tip of rod-shaped organ, from *a*, $\times 200$; *c*, upper lip, from *a*, $\times 300$; *d*, hairs on anterior margin of left lobe of upper lip, from lower right of *c*, $\times 200$; *e*, hairs on anterior margin of saddle between lobes of upper lip, from *c*, $\times 3000$. (Micrographs reduced to 77%.)

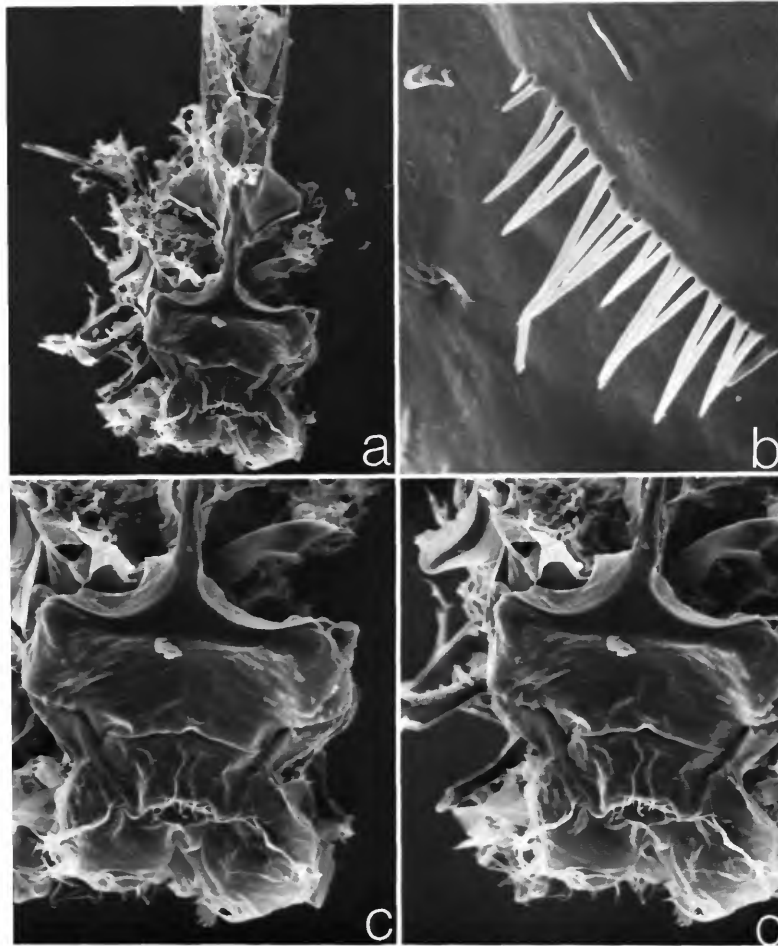


PLATE 175.—*Asteropterygion peterseni*, new species, ovigerous female, paratype, USNM 157701: *a*, anterior view of body with appendages removed, $\times 105$; *b*, spines forming row on anterior of body between saddle of upper lip and openings for 1st antenna, from middle right of *c*, $\times 5200$; *c*, anterior view of upper lip, from *a*, stereoscopic pair $\times 200$. (Micrographs reduced to 76%.)

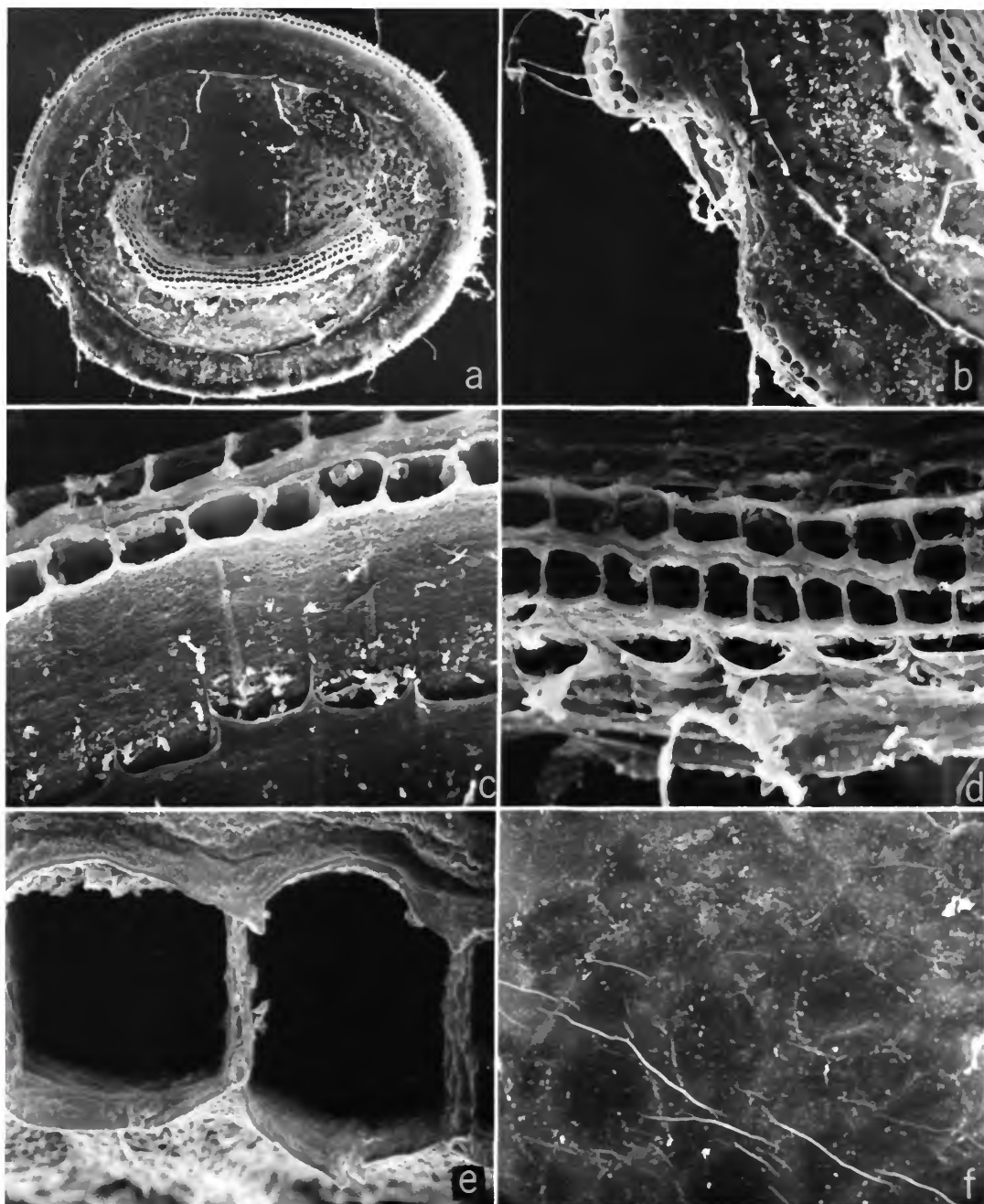


PLATE 176.—*Pteromeniscus intesi*, new species, juvenile female (instar III), paratype, USNM 150287B, left valve, outside views: *a*, lateral view, $\times 60$; *b*, incisur, from *a*, $\times 170$; *c*, dorsal edge of valve, from *a*, $\times 630$; *d*, edge of lateral rib, $\times 600$; *e*, detail from *d*, $\times 2650$; *f*, detail of surface in vicinity of central adductor muscle attachments, from middle of *a*, $\times 600$. (Micrographs reduced to 76%.)

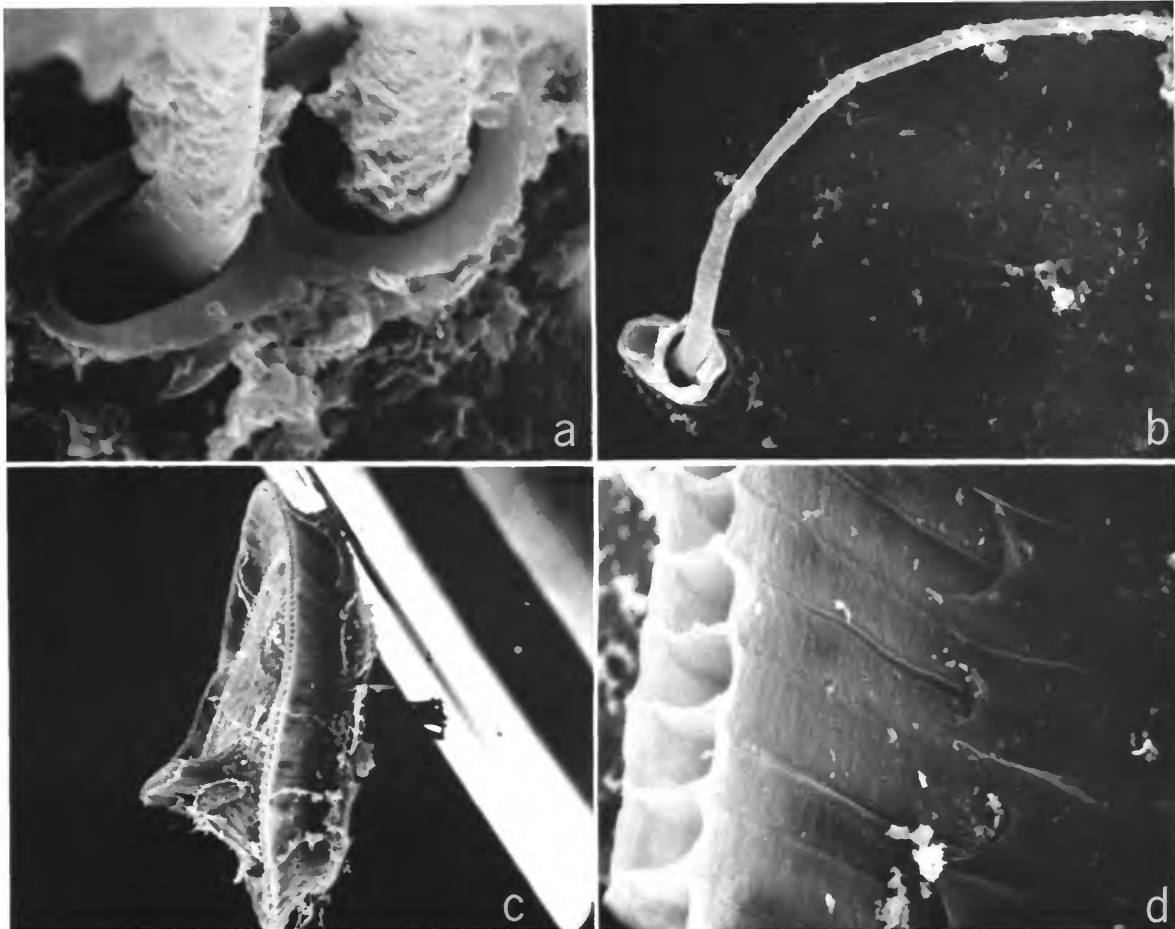


PLATE 177.—*Pteromeniscus intesi*, new species, juvenile female (instar III), paratype, USNM 150287B, left valve, outside views: *a*, paired pores with bristles near posterior end of valve, from Plate 176*a*, $\times 6000$; *b*, single pore and bristle near anterior end of valve, from Plate 176*a*, $\times 2100$; *c*, oblique posterior view, $\times 60$; *d*, detail of edge of peripheral ridge, from *c*, $\times 600$. (Micrographs reduced to 82%.)

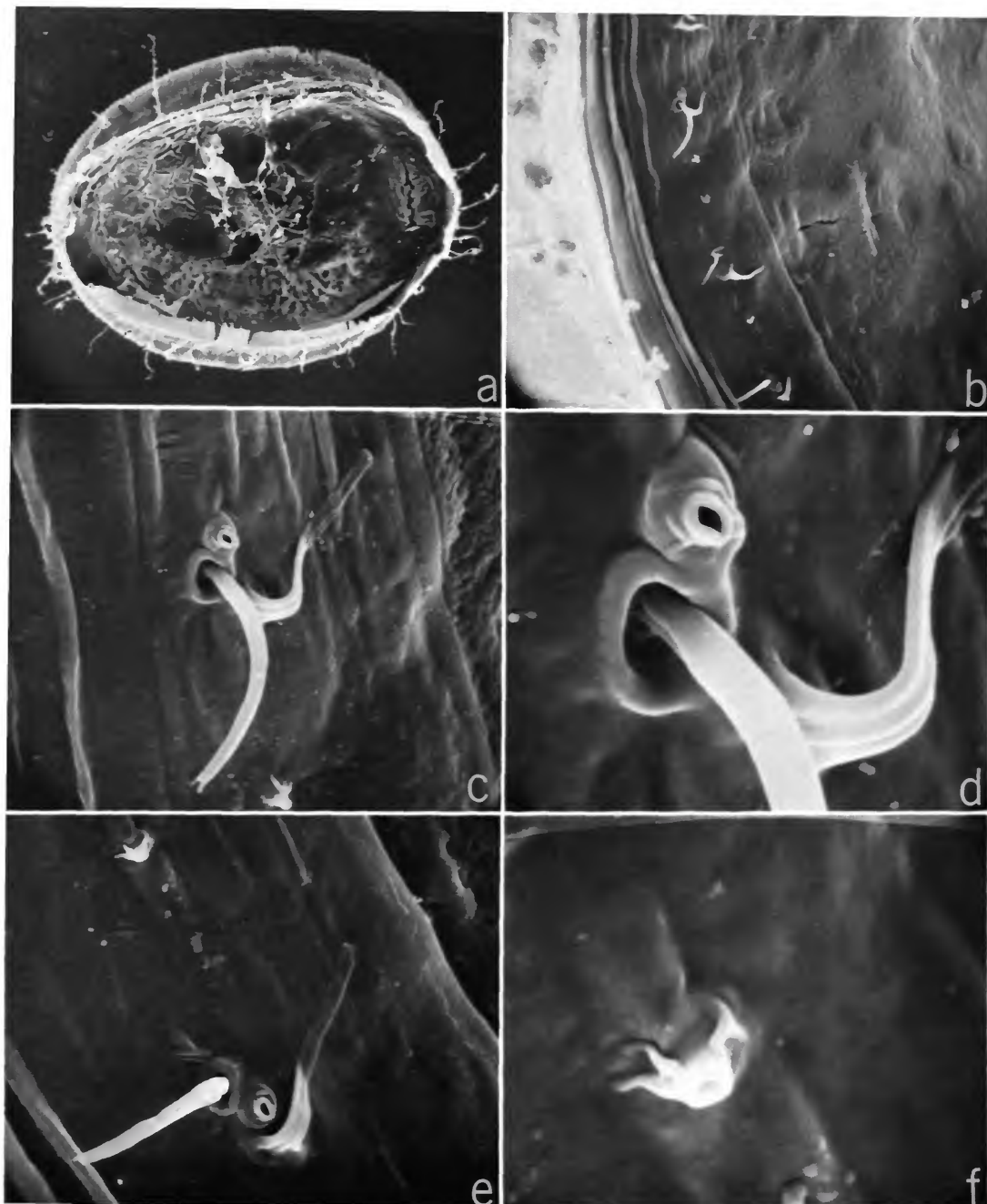


PLATE 178.—*Pteromeniscus intesi*, new species, juvenile female (instar III), paratype, USNM 150287B, left valve, inside views: *a*, medial view, $\times 55$; *b*, posterior infold, from *a*, $\times 2400$; *c*, bristles and tubular pore on list of posterior infold, from *b*, $\times 2400$; *d*, detail from *c*, $\times 7500$; *e*, bristles and pore on list of posterior infold, from bottom of *b*, $\times 2400$; *f*, pore near upper edge of *e*, $\times 7500$. (Micrographs reduced to 77%.)

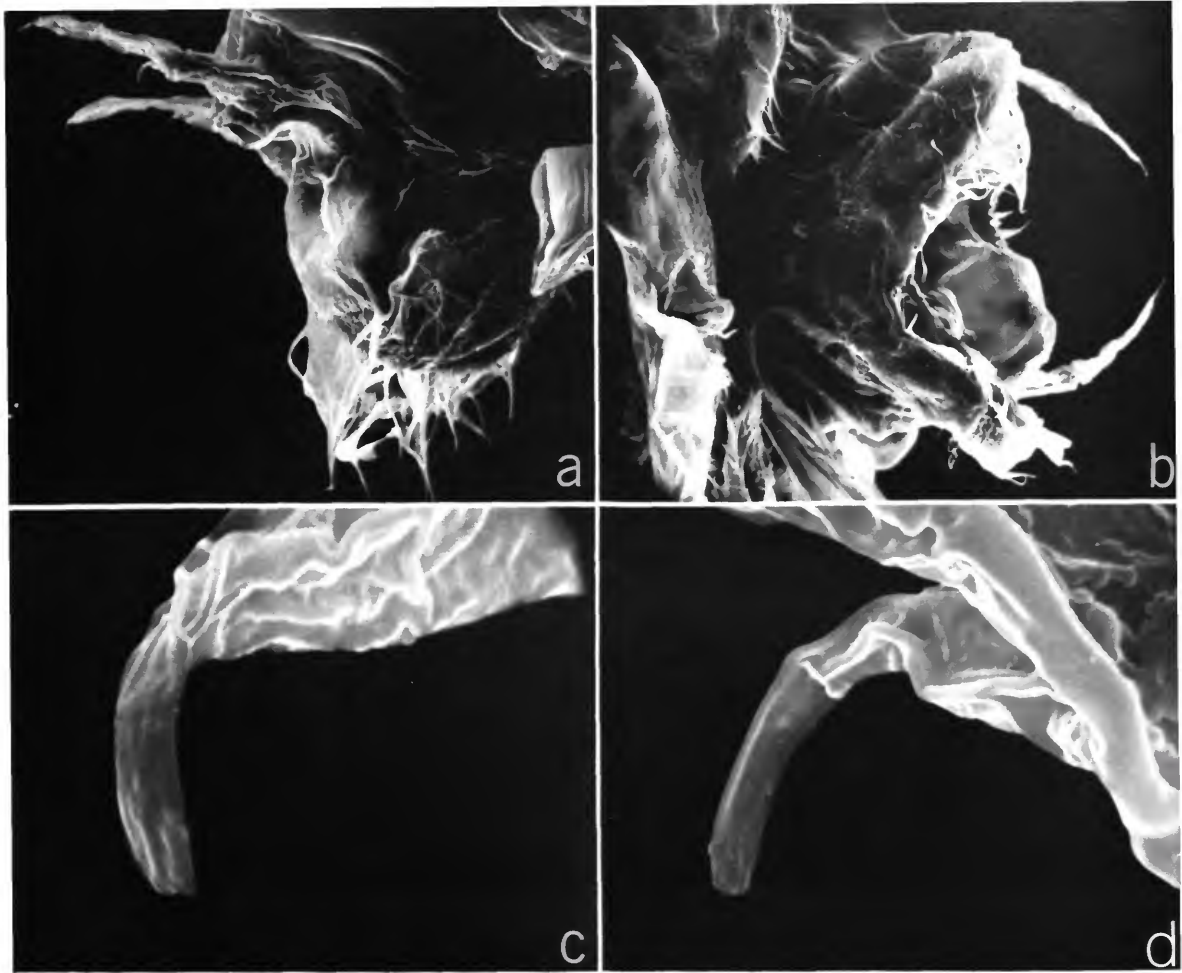


PLATE 179.—*Pteromeniscus intesi*, new species, juvenile female (instar III), paratype, USNM 150287B, upper lip: *a*, lateral view, anterior to left, $\times 440$; *b*, ventral view, anterior to right, $\times 440$; *c*, terminal spine on upper prong in *a*, $\times 10,000$; *d*, proximal spine on lower prong in *a*, $\times 8200$. (Micrographs reduced to 82%.)

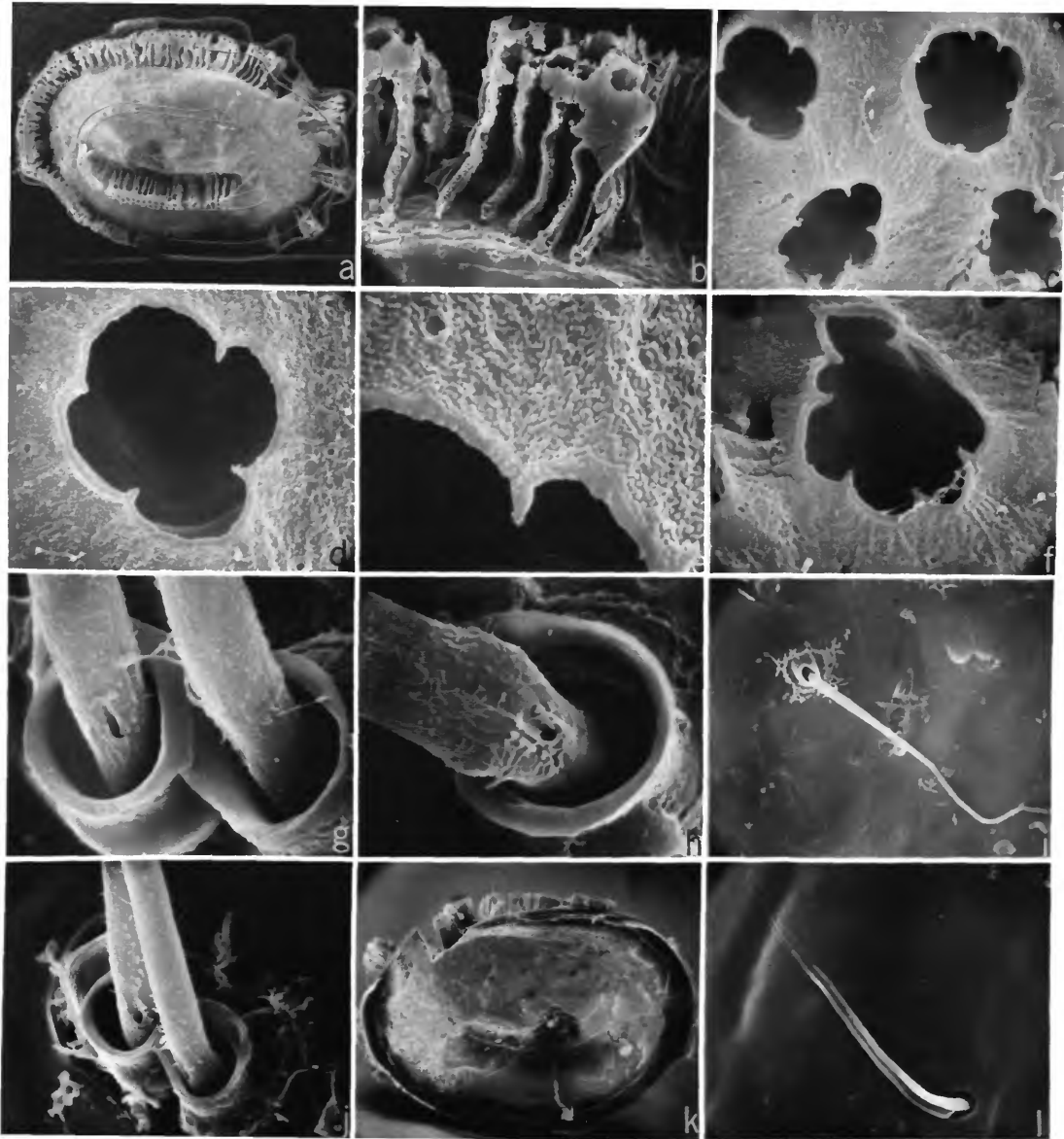


PLATE 180.—*Omegasterope upsilon* (Kornicker and Caraion), adult(?) female, paratype, USNM 142386, left valve with part of ornamentation destroyed by cleaning with vibrator: *a*, lateral view with missing parts outlined with white ink, $\times 70$; *b*, posterodorsal part of peripheral ridge, with surface layer removed, showing grill-like structure of ridge, $\times 400$; *c*, pores along edge of peripheral ridge (from dorsal part of ridge), $\times 2000$; *d*, detail of pore in *c*, $\times 4000$; *e*, spine along edge of pore in *d*, $\times 10,000$; *f*, surface pore along edge of middle ridge, $\times 3300$; *g*, 2 adjacent bristles near anterior end of valve, $\times 10,000$; *h*, single bristle near posterior end of valve, $\times 10,000$; *i*, single bristle near middle of valve, $\times 1600$; *j*, adjacent bristles near dorsal margin, $\times 5000$; *k*, inside view of valve, $\times 70$; *l*, bristle on rostral infold from *k*, $\times 2950$. (Micrographs reduced to 51%.)

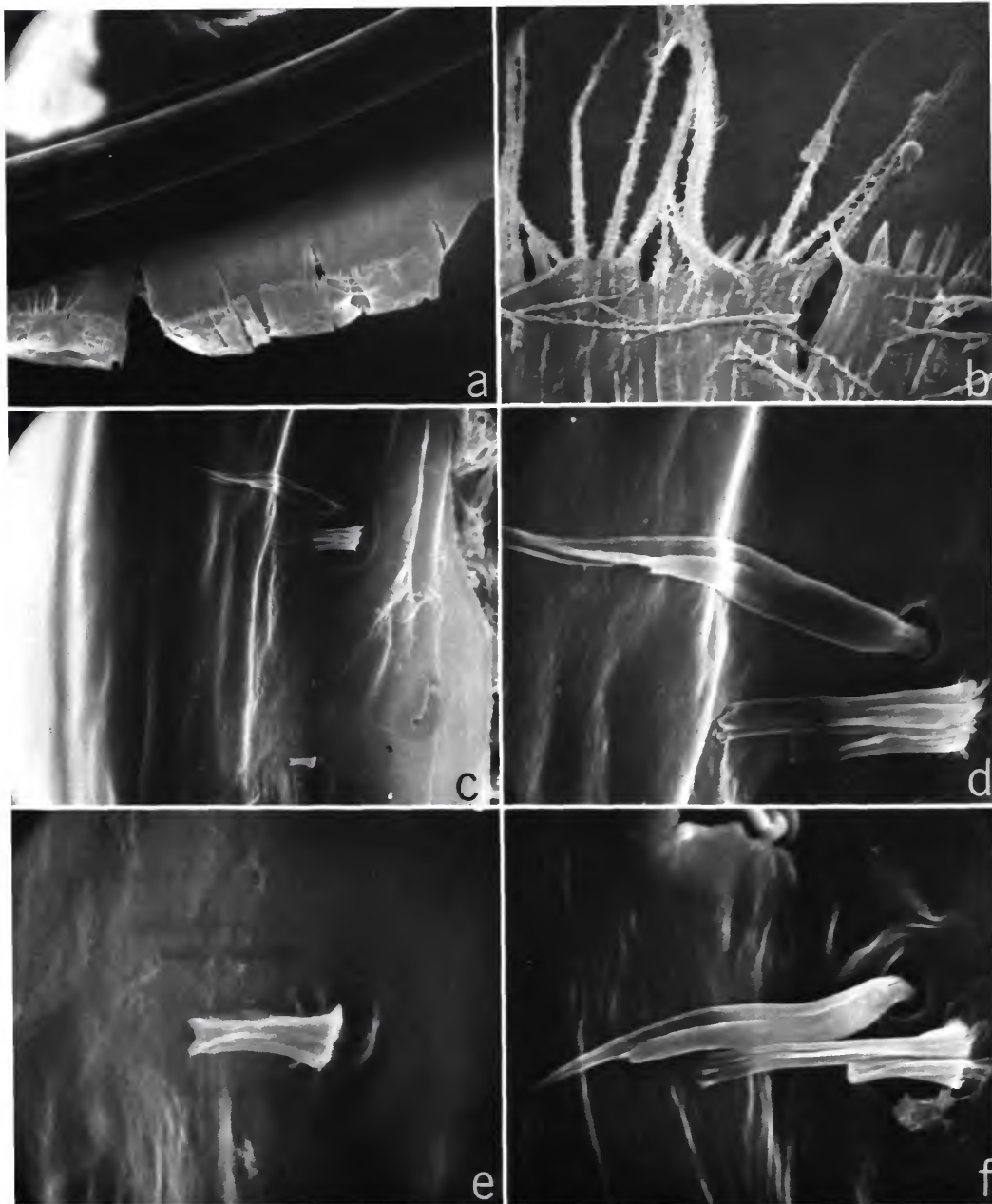


PLATE 181.—*Omegasterope epsilon* (Kornicker and Caraion), adult(?) female, paratype, USNM 142386, left valve, inside views: *a*, medial view of ventral margin just anterior to midlength, from Plate 180*k*, $\times 275$; *b*, fringe along edge of lamellar prolongation of selvage along ventral margin, from *a*, $\times 7250$; *c*, bristles near upper end of posterior infold, from Plate 180*k*, $\times 1800$; *d*, upper 2 bristles in *c*, $\times 5000$; *e*, lower tubular pore in *c*, $\times 10,000$; *f*, bristles near middle of posterior infold just ventral to *c* (about 4 sets of these on posterior infold), $\times 5000$. (Micrographs reduced to 73%.)

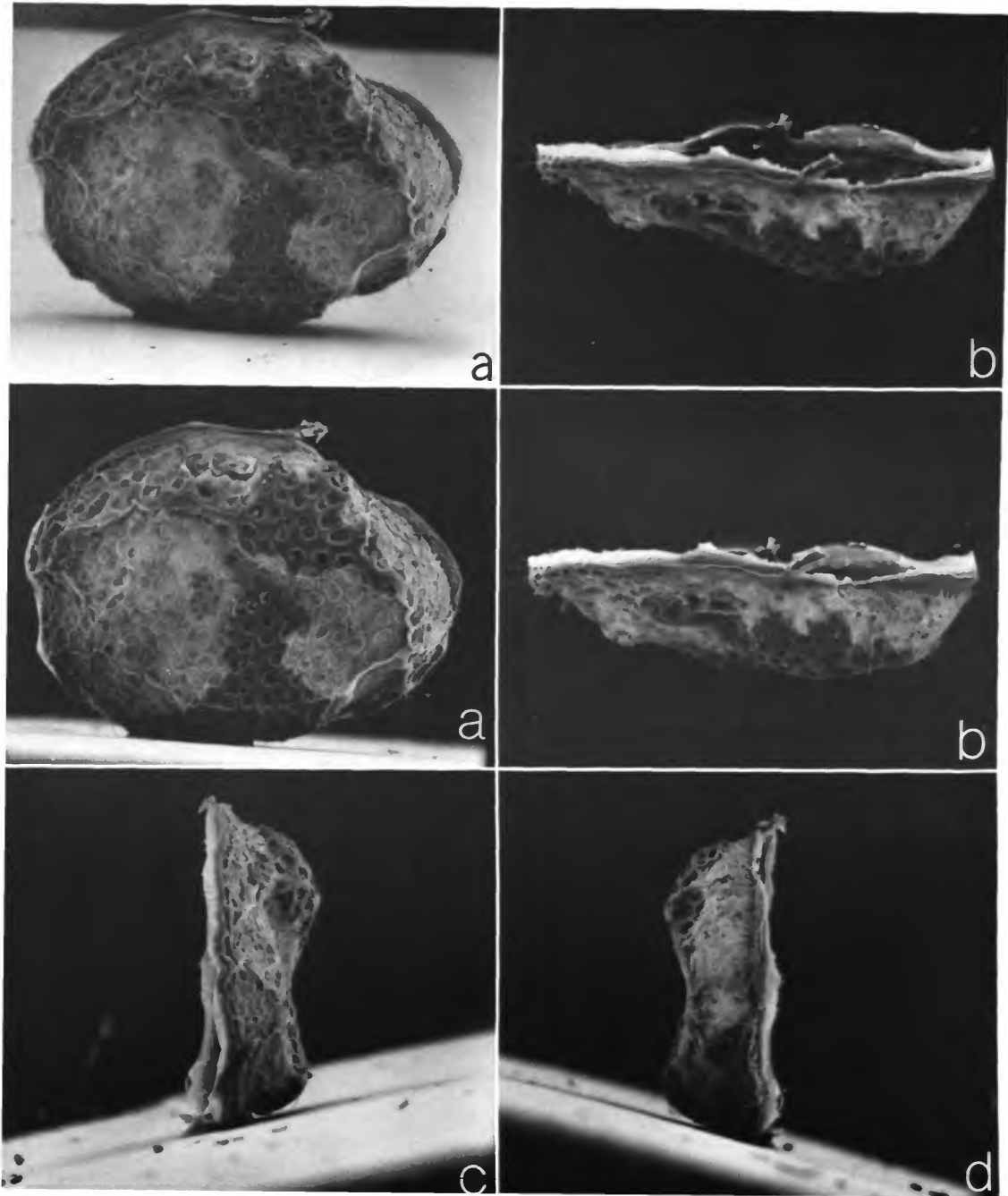


PLATE 182.—*Microasteropteron bacescui*, new species, adult female, paratype, USNM 157773, left valve, outside views of whole valve: *a*, lateral view, anterior to left, stereoscopic pair, $\times 110$; *b*, dorsal view, stereoscopic pair, $\times 110$; *c*, anterior view, $\times 110$; *d*, posterior view, $\times 110$. (Micrographs reduced to 81%.)

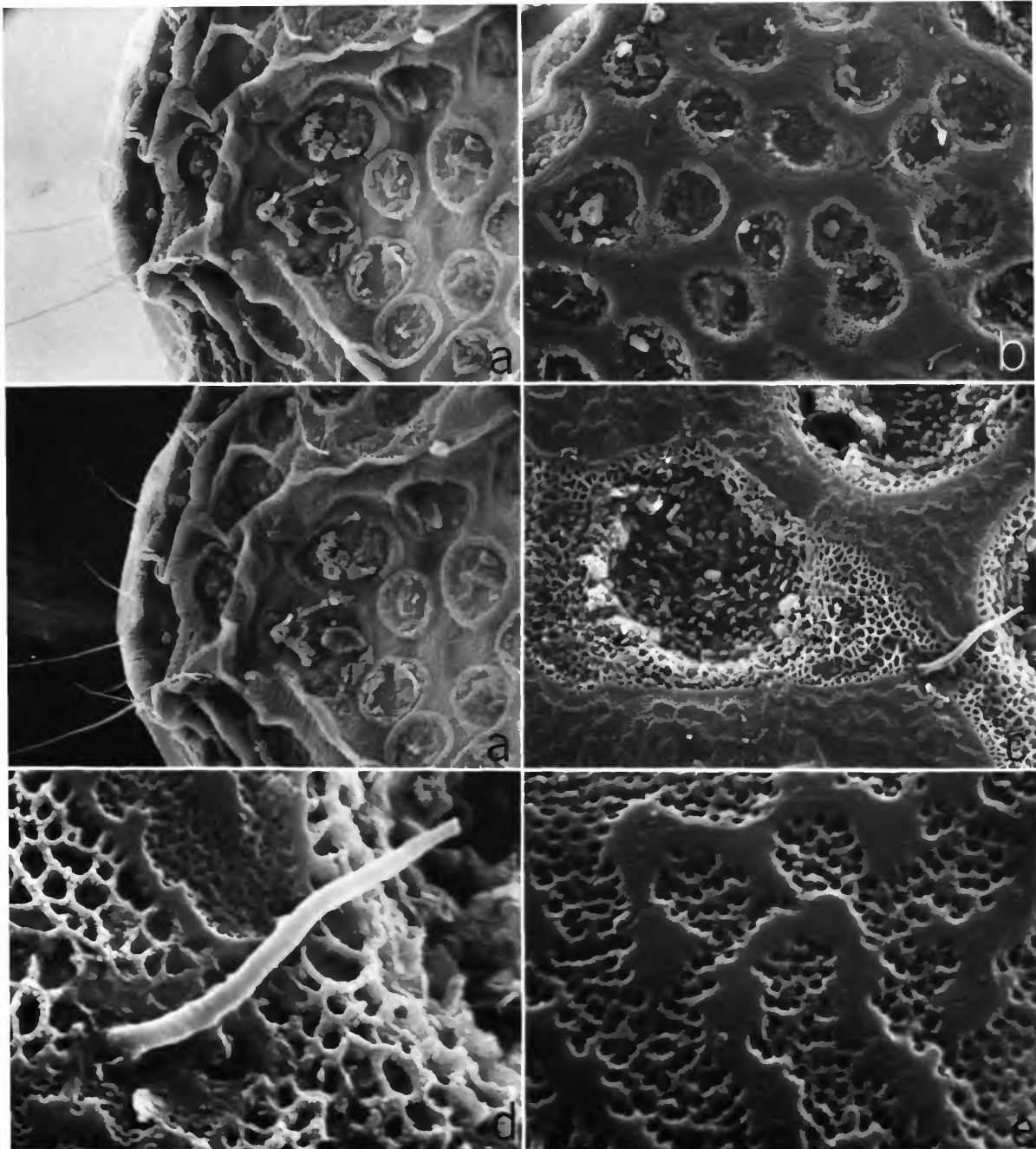


PLATE 183.—*Microasteropteron bacescui*, new species, adult female, paratype, USNM 157773, left valve, outside views: *a*, anterior part of valve, lateral view, stereoscopic pair, $\times 500$; *b*, fossae and bristles in upper part of valve, from Plate 182a, $\times 550$; *c*, detail of fossae and bristle in *b*, $\times 1750$; *d*, detail of bristle and surface structures in *c*, $\times 6250$; *e*, detail of surface above bristle in *c*, $\times 10,000$. (Micrographs reduced to 84%.)

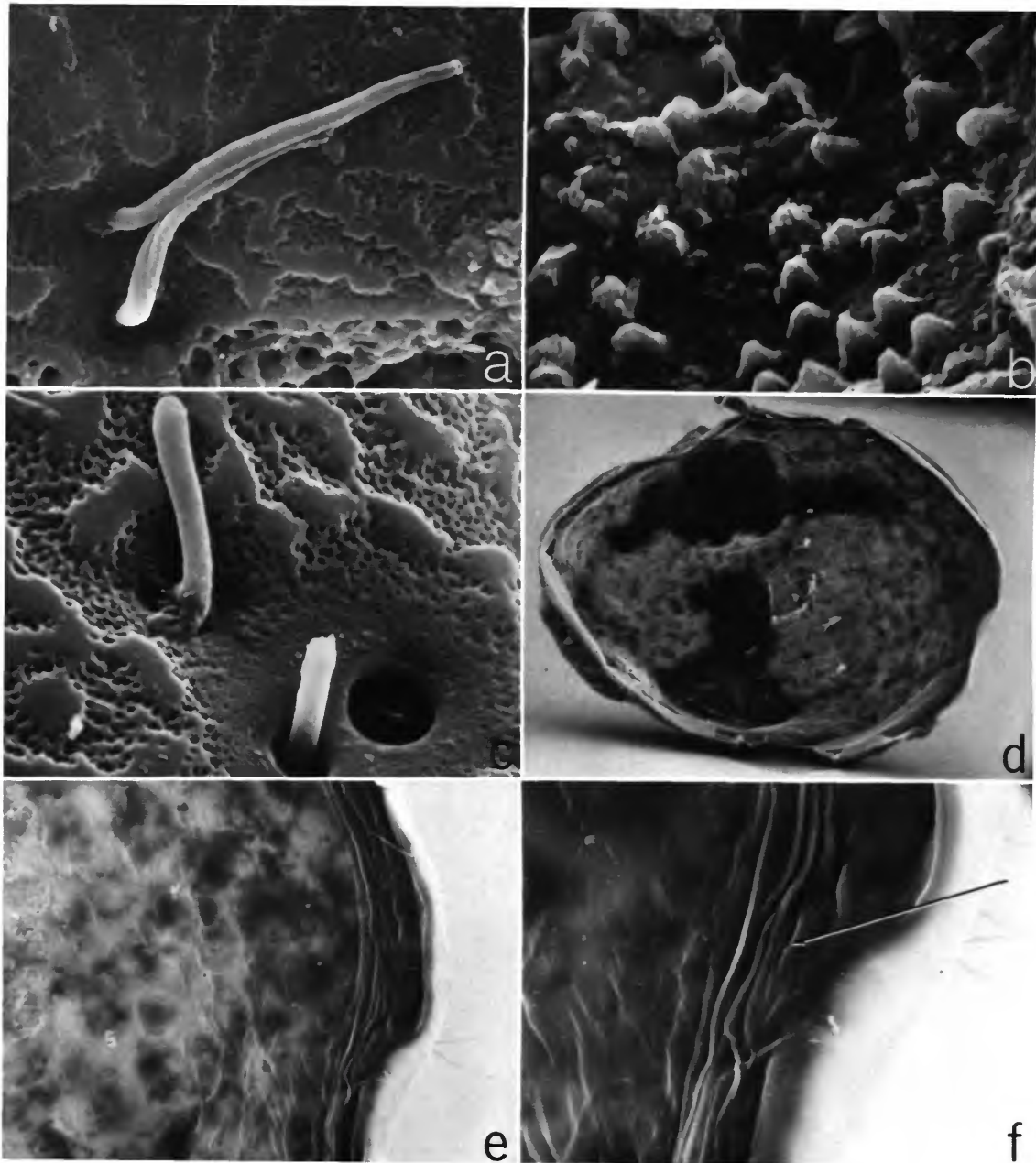


PLATE 184.—*Microasteropteron bacescui*, new species, adult female, paratype, USNM 157773, left valve: *a*, detail of bristles and surface structures in lower right of Plate 183*b*, $\times 6000$; *b*, detail of pustules at bottom of fossa in middle of Plate 183*c*, $\times 10,000$; *c*, detail of bristles and surface structures in upper right of Plate 183*b*, $\times 7500$; *d*, whole valve, inside view, $\times 110$; *e*, anterior of valve showing bristles of infold, from *d*, $\times 360$; *f*, detail from *e* showing short tubular pore (arrow), $\times 1000$. (Micrographs reduced to 81%.)

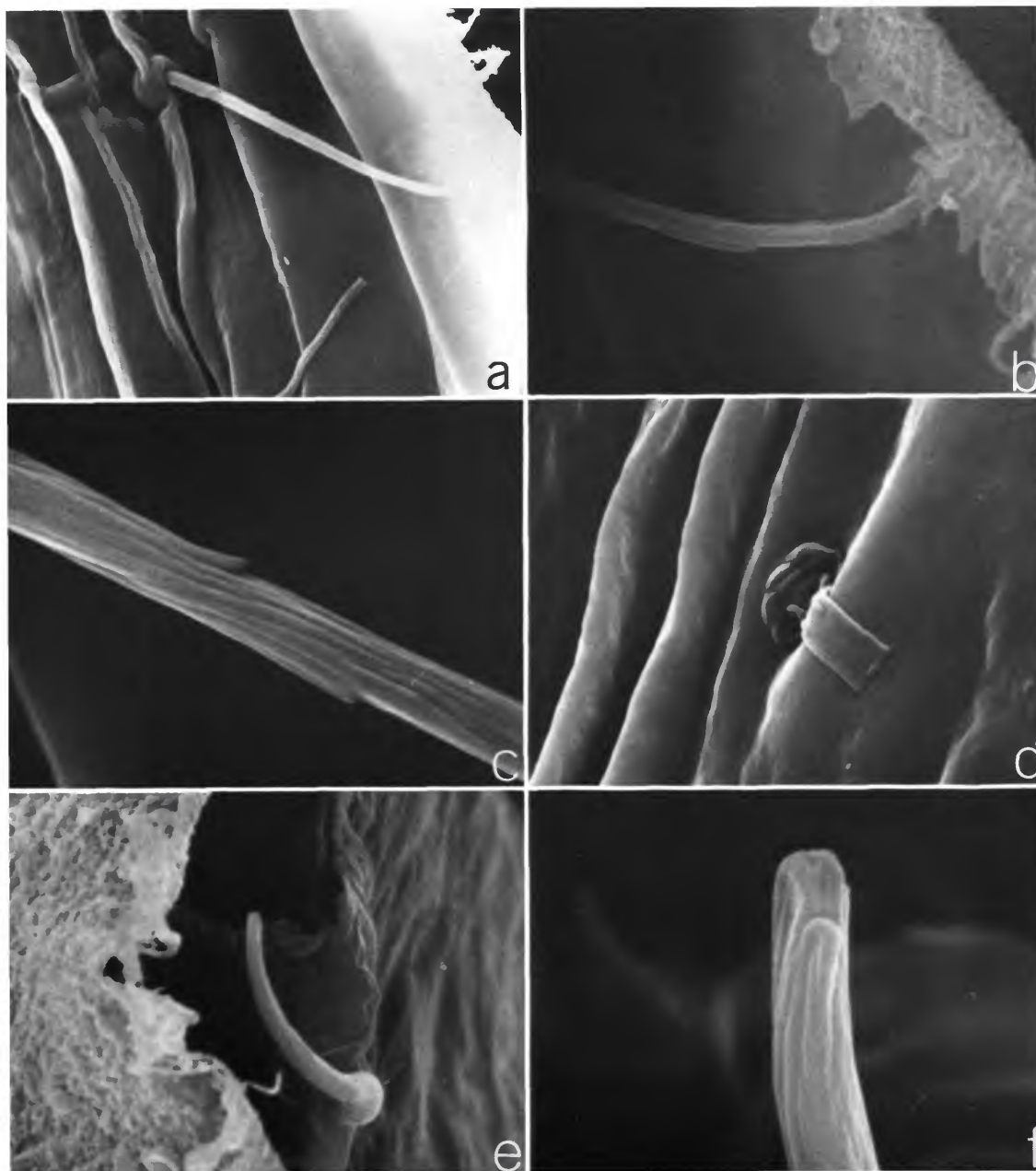


PLATE 185.—*Microasteropteron bacescui*, new species, adult female, paratype, USNM 157773, left valve, inside views: *a*, bristles on anterior infold and lamellar prolongation of selvage, from Plate 184*e*, $\times 2500$; *b*, tip of upper bristle in *a*, going beneath lamellar prolongation of selvage, $\times 7500$; *c*, detail of bristle in *b*, $\times 15,000$; *d*, tubular pore near incisur, from Plate 184*f*, $\times 7500$; *e*, stout bristle on posterior infold, from middle of posterior margin shown in Plate 184*d*, $\times 3000$; *f*, tip of bristle in *e*, $\times 15,000$. (Micrographs reduced to 80%.)

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