

*ROSALIE F. MADDOCKS*

*Recent Ostracodes  
of the Family  
Pontocyprididae  
Chiefly from the  
Indian Ocean*



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## ABSTRACT

Maddocks, Rosalie F. Recent Ostracodes of the Family Pontocyprididae Chiefly from the Indian Ocean. *Smithsonian Contributions to Zoology*, 7: 1-56. 1969.—Recent ostracodes of the marine family Pontocyprididae may be identified as easily by the carapace as by appendage characteristics, especially by the five discrete central muscle scars. The five genera and three subgenera are each distinguished by a diagnostic arrangement of the muscle scars, as well as by carapace shape and characters of the appendages and genitalia.

From collections of the International Indian Ocean Expedition, from other collections at the Smithsonian Institution, and from the type "Challenger" material of Brady (1880), 48 species and 2 subspecies (12 new, 8 pre-existing, 30 in open nomenclature) are described here and assigned to four genera. Two new subgenera, *Ekpontocypris* and *Schedopontocypris*, are established within the genus *Propontocypris*.

The following species and subspecies are new: *Propontocypris* (*Propontocypris*) *crocata*, *P.* (*P.*) *quasicrocata*, *P.* (*P.*) *paradispar*, *P.* (*P.?*) *lobodonta*, *Propontocypris* (*Ekpontocypris*) *litoricola*, *P.* (*E.*) *l. litoricola*, *P.* (*E.*) *l. admirantensis*, *P.* (*E.*) *mcmurdoensis*, *P.* (*E.?*) *epicyrta*, *Propontocypris* (*Schedopontocypris*) *bengalensis*, *Australoecia mckenziei*, *A. abyssophilia*.

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## Introduction

The Superfamily Cypridacea comprises a very large and heterogeneous group of ostracodes united by a distinctive and consistent plan of body structure. Although this group is commonly identified with freshwater faunas, which are almost entirely composed of cypridacean forms, the Cypridacea have adapted to a wider range of habitats than any other ostracode group, ranging from marine through brackish to freshwater and even terrestrial conditions. Swimming, crawling, and burrowing modes of life are all represented, and at least one partially commensal marine species is known.

The marine Cypridacea are presented by three very distinct taxa: the Macrocyprididae, which show some affinity with the exclusively marine and very ancient Bairdiacea and may represent a rather primitive structure; the subfamily Paracypridinae of the Cyprididae, whose internal morphology is almost identical to that of the freshwater Candoninae and may represent a reinvasion of the marine environments by this family; and the Pontocyprididae, which, although entirely cyprid in aspect, show close affinities to no other group of living ostracodes. Although the latter is perhaps the most abundantly represented and diversified of the

three families in modern marine assemblages, it is also the least documented and most misunderstood. Like such cytheracean families as the Paradoxostomatidae and the Xestoleberididae, species of the Pontocyprididae have a very simple carapace structure that seems capable of assuming a myriad of subtly and bewilderingly variable outlines, so that the accepted classification has been based mainly on appendage structures.

To show that a carapace-based classification can be equally orderly and distinctive is one purpose of this report. Further, it seems desirable to present an orderly documentation of the entire variety of forms encountered in collections from this region of the world, even though most of this material is not sufficiently abundant or well preserved to permit formal nomenclatural identification. It is hoped that from these collated data may emerge some clarification of the direction and range of variability that is characteristic at the infra- and interspecific levels of this group.

**MATERIAL.**—The core of the material on which this report is based is from the International Indian Ocean Expedition, which includes several distinct types of collections: (1) littoral and inner sublittoral collections by the author at Nosy Bé, Madagascar, which are an especially prolific source of living specimens for which the soft-part anatomy can be described; (2) the currently available (1966-1967) faunas, mostly subfossil

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(empty carapaces), contained in sediment samples dredged on Cruises 1, 4B, 7, 8, and 9 of the *R. V. Anton Bruun* in the Bay of Bengal, Arabian Sea, and Mozambique Channel; and (3) miscellaneous shallow-water collections from islands visited by participants in these cruises.

South African shallow shelf faunas were obtained from the collecting program of the South African Ecological Survey. Additional coverage is provided by single samples, mostly from the littoral zone, from Iran, Mauritius, South Australia, Tasmania, and New Zealand, collected independently by many individuals. Five abyssal stations of the *Albatross* in the western hemisphere and a single station of the *Eltanin* are also included. All of this material was made available by R. H. Benson from collections in the Smithsonian Institution.

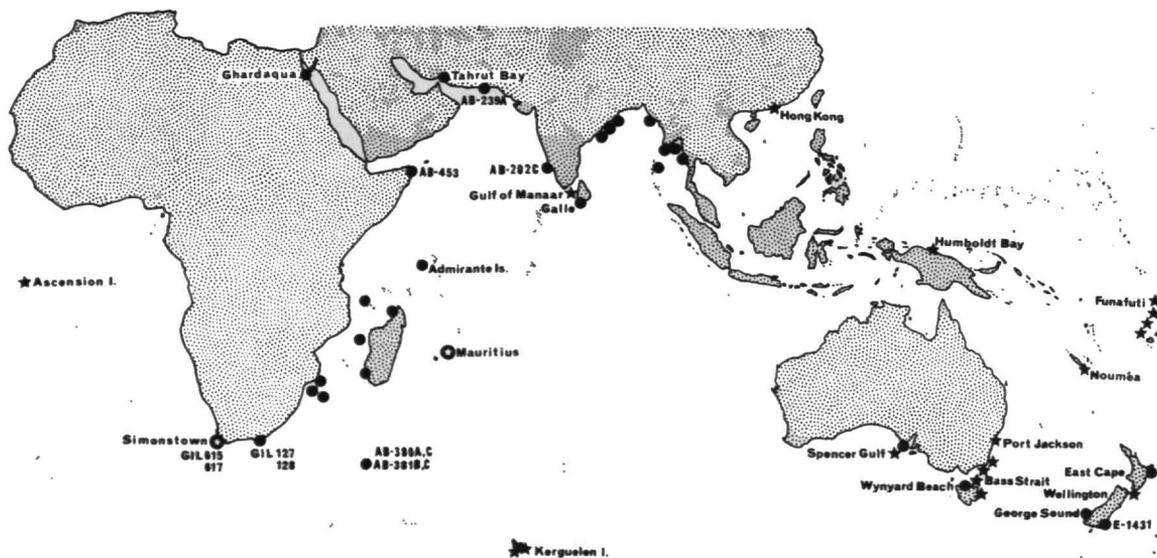
Also considered here are the "Challenger" (Brady, 1880) types belonging to this family. Most of these specimens were collected at anchorage stations in New Zealand, Australia, Kerguelen Islands, and South Africa.

**COLLECTING LOCALITIES.**—Tables 1–5 summarize the locality data for new collections discussed in this

report. For the locations of these stations and those of previous studies see Figures 1–4.

**ACKNOWLEDGMENTS.**—The project "Ostracodes of the Indian Ocean," of which this study forms a part, is based mainly on collections of the United States Program in Biology of the International Indian Ocean Expedition (1963–1964). My participation in this expedition and subsequent involvement in the project as research associate at the Smithsonian Institution (1965–1967) was financed by grants from the National Science Foundation and the Smithsonian Research Foundation to Richard H. Benson of the Division of Invertebrate Paleontology, Smithsonian Institution, who also provided laboratory facilities and collections for this investigation.

Many other individuals have contributed faunas for this study; particularly helpful were those of John H. Day, Department of Zoology, University of Cape Town, and Louis S. Kornicker, Division of Crustacea, Smithsonian Institution. I was privileged to study the "Challenger" ostracode type-specimens of G. S. Brady (1880) while they were on loan to Harbans S. Puri, Florida State Geological Survey, from the British Museum (Natural History). The Mauritius types of



**FIGURE 1.**—The Indian Ocean and adjacent areas, showing locations of collecting stations where pontocyprid ostracodes have been identified. (Star=locality corresponding to published citation; dot=location of collections described in this report; circled star=locality of published citation and described in this report.)

TABLE 1.—*International Indian Ocean Expedition, 1963–1964. Cruises 1, 4B 7, 8, and 9 of the R.V. Anton Bruun in the Bay of Bengal, Arabian Sea, and Mozambique Channel (chiefly by R. H. Benson)*

Station	Latitude	Longitude	Depth (m)	Locality
28A	11°52' N	92°49' E	66	Andaman Sea
28B	12°01' N	92°55' E	64–50	Andaman Sea
36A	13°00' N	97°41' E	68	Andaman Sea
40	15°20' N	96°24' E	18–20	Andaman Sea
41	15°04' N	95°51' E	44–46	Andaman Sea
42	15°08' N	94°54' E	35	Andaman Sea
43	15°08' N	94°04' E	55	Andaman Sea
46	21°00' N	91°59' E	23–25	Bay of Bengal
47	20°27' N	92°20' E	19–20	Bay of Bengal
87F	19°44' N	86°32' E	120	Bay of Bengal
87I	19°47' N	86°02' E	20	Bay of Bengal
87K	19°35' N	85°41' E	37	Bay of Bengal
87M	18°36' N	84°41' E	72	Bay of Bengal
87N	18°21' N	84°10' E	50	Bay of Bengal
88	17°41' N	83°19' E	20	Bay of Bengal
202C	18°27' N	71°13' E	84–97	Arabian Sea
239A	25°09' N	64°54' E	18	Arabian Sea
361B	26°34' S	35°59' E	1829	near Mozambique
363G	23°38' S	43°24' E	1350	near Tulear, Madagascar
363K	23°43' S	43°25' E	1190	near Tulear, Madagascar
363L	23°17' S	43°20' E	841	near Tulear, Madagascar
364A	23°20' S	43°46' E	51	near Tulear, Madagascar
365D	23°20' S	43°32' E	695–475	near Tulear, Madagascar
370B	24°25' S	35°47' E	910	near Mozambique
371F	24°46' S	35°18' E	110	near Mozambique
371G	24°49' S	35°13' E	73	near Mozambique
372M	25°03' S	34°31' E	55	near Mozambique
373J	26°58' S	33°53' E	380	near Mozambique
380A	32°58' S	43°37' E	935	Walterson Shoal
380C	32°58' S	43°41' E	950	Walterson Shoal
381B	33°13' S	43°51' E	38	Walterson Shoal
381C	33°13' S	43°53' E	40	Walterson Shoal
397D	26°14' S	34°04' E	665	near Mozambique
207A	18°24' S	42°11' E	2125	Mozambique Channel
412C	12°47' S	47°42' E	23	near Nosy Bé, Madagascar
453	11°11' N	51°14' E	47–49	Cape Guardafui, Somali Republic

TABLE 2.—*Shallow-water collections from islands visited by participants during cruises*

Station	Latitude	Longitude	Depth (m)	Locality
412L			30	Banque de Cinq Mètres near Nosy Bé, Madagascar (by R. H. Benson)
LK-12			0–1	Galle Harbor, Ceylon. <i>Thalassia</i> sand flats (by L. S. Kornicker)
LK-49	5°24' S	53°18' E	1	Resource I. near St. Joseph's I., Admirante Islands. Sea grass near reefs (by L. S. Kornicker)
HA-33	27°16' N	33°47' E	0–1	Ghardaqua, Egypt. Washings of algae from low tide level (by H. A. Fehlmann)
Grand Comoro I.			20	Grand Comoro I., Comores Islands, coral reef sand (by Bruce Rodgers)
Tulear			10	Tulear, Madagascar. Reef sand in tide pocket (by R. H. Benson)
Nosy Bé			0–40	Nosy Bé, Madagascar. Various littoral and inner sublittoral collections around Nosy Bé and nearby mainland (by R. F. Maddocks)

TABLE 3.—Collections of the South African Ecological Survey (from J. H. Day).

Station	Latitude	Longitude	Depth (m)	Locality
GIL 341	34°02.5' S	23°27' E	42	Cape Seal, South Africa
GIL 348	34°39' S	23°41' E	120	Cape Seal, South Africa
GIL 615	34°17' S	18°29' E	10	False Bay, South Africa
GIL 617	34°09' S	18°27' E	6	False Bay, South Africa

TABLE 4.—Collections made by the U.S. Fish Commission Steamer Albatross

Station	Latitude	Longitude	Depth (m)	Locality
2381	28°05'N	87°56'15''W	2433	Gulf of Mexico
2751	16°54'N	63°12'W	1257	Caribbean Sea
2763	24°17'S	42°48'30''W	1127	Atlantic Ocean near Brazil
3360	06°17'N	82°05'W	3050	Pacific Ocean near Panama
4693	26°30'S	105°45'W	2069	southeast Pacific Ocean

TABLE 5.—Miscellaneous collections

Station	Latitude	Longitude	Depth (m)	Locality
AB-714C	25°07'S	70°42'W	165	Anton Bruun cruise 18, coast of Chile (by R. Menzies)
E1431	45°45'S	17°58'E	51	station of the <i>Eltanin</i> , northeast of Dunedin Harbor, South I., New Zealand
RM1001				near East Cape, New Zealand
RM1004				George Sound, New Zealand
1148			0	Recent sand, Wynyard Beach, Tasmania (by N. G. Lane)
Mauritius 1 and 3			0	Mauritius I. Mudflat surface near low tide level (by W. G. McIntire)
McMurdo Sound			57	McMurdo Sound, Antarctica. U.S. Antarctic Research Program, Station "P," "south of Hut Point at entrance to Winter Quarters Bay" (by J. H. Dearborn)
Spencer Gulf			0	Beach sand, Whaler's Bay, Thistle I., Spencer Gulf, South Australia (by M. Wade)
Tahrut Bay				Persian Gulf

Brady (1868b) were made available for brief inspection by Kenneth G. McKenzie, Monash University, Victoria, to whom they were on loan from the Hancock Museum, Newcastle-upon-Tyne. I wish especially to thank R. H. Benson, Joseph E. Hazel of the U.S. Geological Survey, and Vladimir Pokorný, Visiting Research Associate, Smithsonian Institution, for their critical reading of the manuscript.

#### Morphology and Classification

**NOMENCLATURE HISTORY.**—Sars (1866) established the genus *Pontocypris* with three new species: *P. serrulata*, *P. hispida*, and *P. trigonella*. Müller (1894) established the genus *Erythrocypris* for seven new

species, among them *E. serrata*. Later, in 1912, Müller recognized *E. serrata* as a junior synonym of *P. serrulata* Sars and removed *P. hispida* Sars to *Erythrocypris*. Now *P. serrulata* Sars [= *E. serrata* Müller] had already been shown by Brady (1868a) to be equivalent to *Cythere (Bairdia) mytiloides* Norman, 1862. In 1889 Brady and Norman had designated *P. mytiloides* (Norman) as the type of *Pontocypris*. Sars (1923), overlooking this designation, named *P. trigonella* Sars as the type-species of *Pontocypris* and *E. mytiloides* (Norman) as the type of *Erythrocypris*. Having the same type-species as *Pontocypris*, *Erythrocypris* ceased to exist as an available name, although it was generally used for the next 25 years. Meanwhile, for the concept typified by *P. trigonella* no valid name existed.

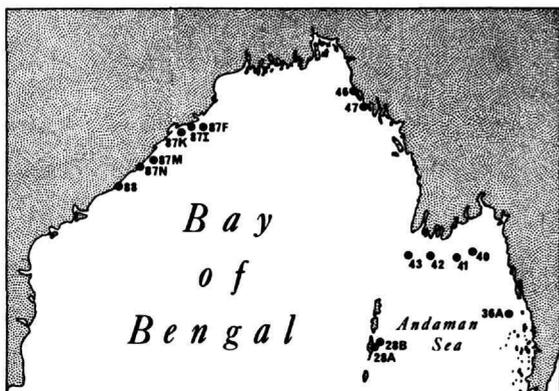


FIGURE 2.—Bay of Bengal, showing locations of collecting stations of Cruise 1 of the "Anton Bruun" (International Indian Ocean Expedition) from which pontocyprid ostracodes have been identified.

Sylvester-Bradley (1947) recognized and corrected this discrepancy, citing *Pontocypris* as the valid name for the forms commonly called *Erythrocypris* and proposing the new name *Propontocypris* for the genus based on *P. trigonella*. Because the confusion has been purely nomenclatural, the contents and diagnostic characters of the two genera being generally recognized as discrete and distinctive, Puri (1964) suggested that the International Commission on Zoological Nomenclature should be petitioned to restore the

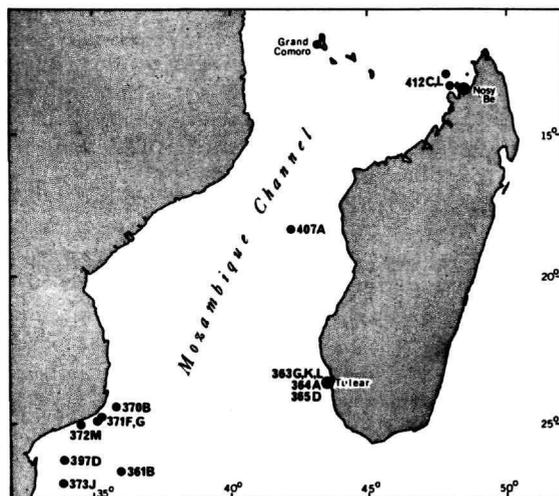


FIGURE 3.—Mozambique Channel, showing locations of collecting stations of cruises 7 and 8 of the "Anton Bruun" and other collections of the International Indian Ocean Expedition from which pontocyprid ostracodes have been identified.

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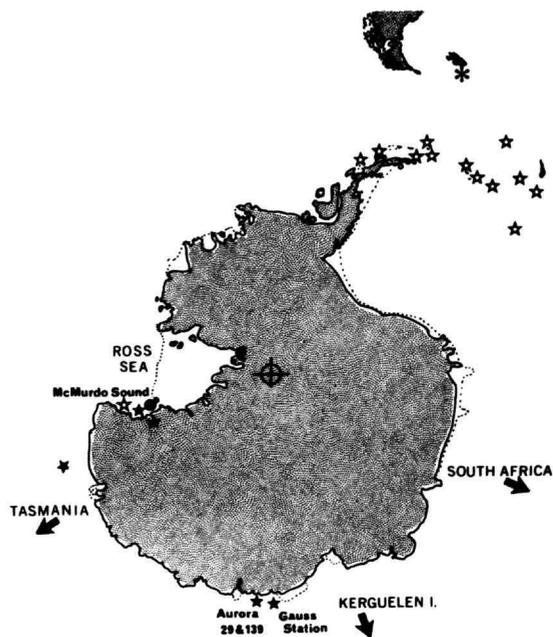


FIGURE 4.—Antarctic region, showing localities where Pontocyprididae have been described. (Black star=station corresponding to published citation; white star=known distribution of *Pontocypris helenae* Maddocks; asterisk=known distribution of *Pontocypris meridionalis* (Brady); black dot=station locality corresponding to species described in this report.)

names *Erythrocypris* and *Pontocypris* to their previously (1894–1947) understood definitions. As it is now twenty years, however, since the correction of this misunderstanding, which has been accepted in modern revisionary treatments (Swain, 1961; Hartmann, 1963; Van Morkhoven, 1962, 1963), it seems both unnecessary and unwise to petition for such an arbitrary solution. The synonymies of individual species remain relatively uncomplicated.

Sars (1866) described the genus *Argilloecia* for a single species *A. cylindrica* Sars, which is thus the type. Many other species have been added since to this genus. Müller (1894) described the genus *Pontocypris* for the single species *P. spinosa*; Maddocks (1968) added two new species and removed *Aglaia meridionalis* Brady to this genus. Several anomalous species formerly assigned to *Argilloecia* now belong to the genus *Australoecia* McKenzie. *Bacunella* Schneider, 1959 (Plio-Pleistocene); *Clinocypris* Mandelstam, 1956 (Triassic-Early Cretaceous); and *Subulacypris*

Schneider, 1957 (in Mandelstam, 1957) (Pliocene) are also generally assigned to the Pontocyprididae; they are not considered further here, as no material is available for study.

**CARAPACE MORPHOLOGY.**—In the older literature the names *Macrocypris*, *Paracypris*, *Pontocypris*, *Aglaia*, *Bythocypris*, and *Argilloecia* have been used almost interchangeably to designate smooth, more or less elongate, cyprid-appearing carapaces. With modern attention to details of carapace structure this confusion can be shown to be unnecessary; each of the marine cyprid families and genera can be identified as readily on diagnostic carapace structures as on appendage anatomy. Structures that may be diagnostic include carapace lateral and dorsal outlines, valve overlap, hinge, normal pore canals, and especially muscle-scar patterns. Characters of the marginal area, particularly radial pore canals, vestibules, and width of zone of concrescence, are less reliable; Hartmann (1963) has shown convincingly that the often conspicuous similarities in these structures among species and genera from different families are the result of convergence due to adaptation to similar habitat and mode of life.

Carapace curvatures, although difficult to describe objectively, are in practice easily differentiable by inspection. Maximum carapace dimensions and proportions, however, such as are often presented in length/height scatter diagrams, are not distinctive and do not provide useful discriminator indices at the generic, specific, or infraspecific levels of classification (see Figures 5, 6).

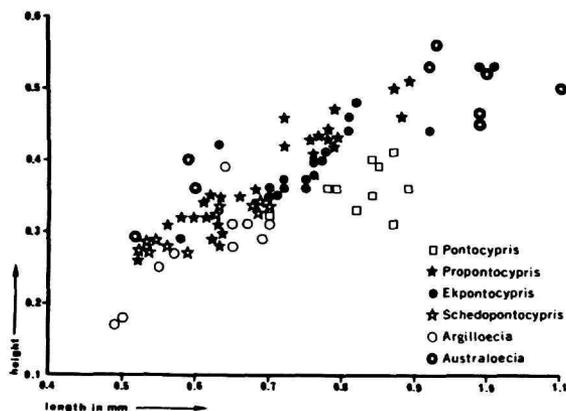


FIGURE 5.—Scatter diagram of length/height measurements plotted for representative specimens of the 7 genera and subgenera of Pontocyprididae; measurements are those listed under "Dimensions" in the systematic treatment.

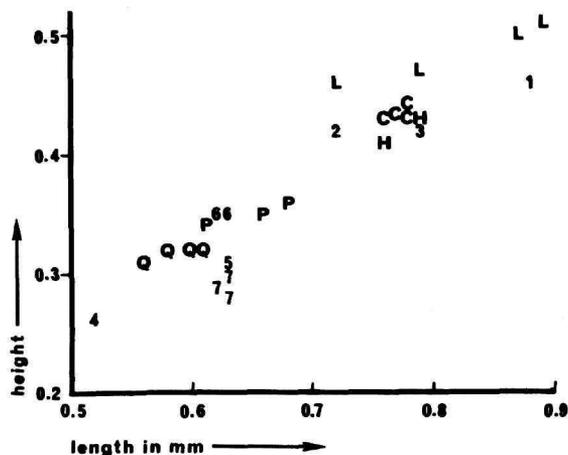


FIGURE 6.—Scatter diagram of length/height measurements plotted for 11 species of *Propontocypris* (*Propontocypris*), some species represented by specimens from two or more geographic localities. Each species is represented by the initial letter of its trivial name or by its number in open nomenclature. Figures 5 and 6 illustrate the relative uselessness of maximum dimensions as taxonomic discriminators.

Muscle-scar patterns are very stable and apparently conservative features at the familial, generic, and even specific levels, as they are elsewhere in the Cypridacea (Benson 1967). The subgeneric classification of the genus *Propontocypris* into *Propontocypris* Sylvester-Bradley, *Ekpontocypris*, new subgenus, and *Schedopontocypris*, new subgenus, proposed in the systematic portion below, is based primarily on muscle-scar patterns and carapace curvature.

The muscle-scar pattern of the Pontocyprididae is unlike that of any other ostracode family (Figure 7). The five freshwater subfamilies of the Cyprididae and the marine subfamily Paracypridinae all display some variant of the basic cyprid scar: adductor scars arranged in a compact group of five surmounted by a larger cap scar, single or double frontal scars, and two mandibular scars. The adductor scars may be arranged in a compact rosette, as in the Candoninae and some Paracypridinae, or in a more dispersed en echelon fashion, as in the Cypridinae; certain scars may on occasion be divided, but the basic pattern is always recognizable.

The Pontocyprididae, on the other hand, have as their basic scar pattern an exceedingly simple triangular arrangement of five tiny scars, presumably adductors, whose homologies with individual scars of the basic cyprid pattern are obscure. Frontal and mandib-

ular scars are entirely absent. The trends of differentiation within the adductor pattern do not at all correspond to those of other cyprid families. The basic scar seems to be that of Figure 7c, which is expressed in about half the species of *Pontocypris*, *Propontocypris* (*Propontocypris*), and *P. (Schedopontocypris)*. Other species of these groups show horizontal stretching and slight anterior tilting of the whole scar (Figure 7E), to such an extent that Müller illustrated most scars for *Pontocypris* [= *Erythrocypris*] as only three very elongate diagonal bars. Less acuminate forms of *Propontocypris* (*Propontocypris*) and *P. (Schedopontocypris)* have a somewhat disorganized version of the basic scar (Figure 7D, F, G) with the three anterior scars arranged in a vertical arc. This trend proceeds to the aggregate rosette pattern characteristic of *P. (Ekpontocypris)* (Figure 7H) and culminates in the extraordinary patterns of *Australoecia* and *Pontocyprina*. None of these scars show any consistent trend toward subdivision, except the dorsal scar under stress of extreme elongation in *P. (Pontocypris)*. An entirely different trend is represented by the scar of *Argilloecia* (Figure 7A), with three large vertically stacked anterior scars and two smaller posterior scars displaced dorsally.

The pontocyprid scar pattern shows some affinity with those of the Macrocyprididae and especially of *Bythocypris* (Bairdiidae, Bairdiacea), although here again the homologies cannot be reliably established, and the basic plan of organization and evolutionary trends are clearly independent. Thus the muscle scars corroborate internal evidence for the antiquity and independence of the Pontocyprididae. In my opinion, there is strong justification for reviving the classification of the Cypridacea according to the scheme proposed by Alm (1916) and followed (except for the inclusion of the Bairdiidae) by Sars (1923, 1925):

- Superfamily Cypridacea
  - Family Macrocyprididae
  - Family Pontocyprididae
  - Family Cyprididae
    - Subfamily Cypridinae
    - Subfamily Candoninae
    - ? Subfamily Paracypridinae
    - Subfamily Cyclocypridinae
    - Subfamily Cypridopsinae
    - Subfamily Ilyocypridinae

The general aspect of the carapace is also distinctive for many members of the Pontocyprididae, being thickly chitinous but weakly calcified. The carapace of a typical living animal is yellow to light brown in color

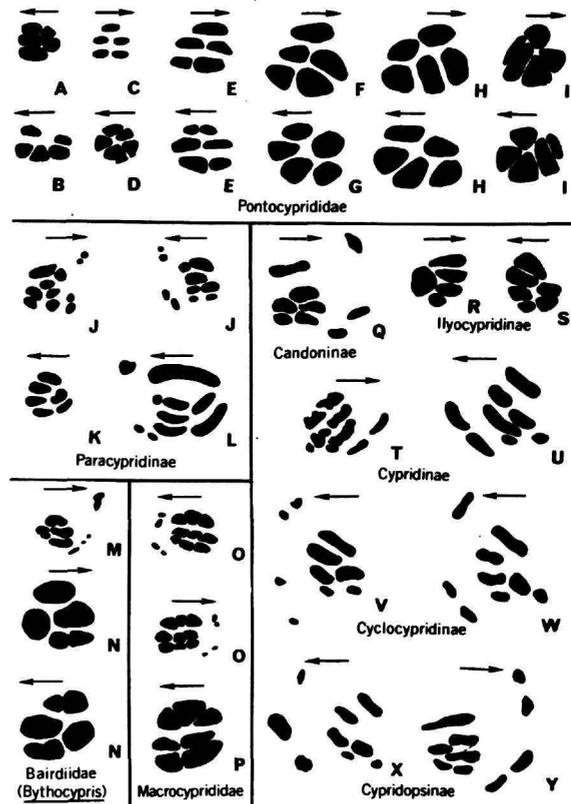


FIGURE 7.—Representative muscle-scar patterns of the eight major families and subfamilies of Cypridacea plus *Bythocypris* (Bairdiacea): A, *Argilloecia* species 7, "Challenger" specimen; B, *Pontocyprina meridionalis* (Brady), lectotype; C, *Pontocypris* species 3; D, *Propontocypris (Schedopontocypris?) simplex* (Brady), "Challenger" specimen; E, *Propontocypris (Propontocypris) species 7*; F, *Propontocypris (Propontocypris) paradyspar*, new species; G, *Propontocypris (Schedopontocypris?) species 3*; H, *Propontocypris (Ekpontocypris) species 2*; I, *Australoecia abyssophilia*, new species; J, *Ghardagliaia species*, Nosy Bé; K, *Paracypris polita* Sars (Sars, 1923); L, *Phlyctenophora species*, Spencer Gulf, South Australia; M, *Bythocypris species* (near Nosy Bé); N, *Bythocypris species* (west of Chile); O, *Macrocyprina species* (Nosy Bé); P, *Macrocyprina species* (False Bay); Q, *Candona acuta* Hoff (Benson, 1967); R, *Ilyocypris gibba* (Ramdohr) (Wagner, 1957); S, *Ilyocypris biplicata* (Koch) (Sars, 1923); T, *Cypris pubera* O. F. Müller (Van Morkhoven, 1963); U, *Cyprinotus salinus* (Jordan, Bernstorff and Gründel, 1962); V, *Cypris ophthalmica* (Jurine) (Van Morkhoven, 1963); W, *Cyclocypris cinesea* (Brady) (Van Morkhoven, 1963); X, *Cypridopsis vidua* (O. F. Müller) (Benson, 1967); Y, *Potamocypris vanoyei* De Vos (Van Morkhoven, 1963).

with dark brown margins; this color is retained in subfossil specimens. Normal pore canals are extremely numerous and often quite large and conspicuous, each occupied by a short brown seta in the living animal. The central part of the carapace may be occupied by a suboval semiopaque area just behind the muscle-scar pattern. The free portion of the inner lamella is entirely uncalcified in *Pontocypris*, weakly calcified and visible only in adults in the other genera.

*Argilloecia*, *Australoecia*, and *Propontocypris* (*Ekpontocypris*) may differ from this description in several respects, having often a colorless or white carapace with fewer and more distinct normal pore canals, and an irregularly widened fuse zone with conspicuous and often complexly branching radial pore canals.

Valve overlap is uniformly right over left (in contrast to the Paracypridinae), except in certain species of *Australoecia*. Conspicuous sexual dimorphism is present but unpredictable; males may be larger than, smaller than, or same size as females.

**INTERNAL ANATOMY.**—The appendages and genitalia of the Pontocyprididae are entirely distinctive. Unlike all other freshwater and marine Cypridacea, males of the Pontocyprididae have an extremely simple ejaculatory organ, consisting of a simple tube slightly expanded at the two ends, only moderately chitinized, and entirely lacking the chitinous spikes that radiate from the typical cypridacean Zenckers organ.

Almost all Pontocyprididae have very long "swimming setae" on the antennules and antenna, corresponding to the strong swimming ability characteristic of this group. The feeding structures of mandible and maxilla are very weakly designed. The first thoracic leg lacks the respiratory plate characteristic of the Bairdiacea, which is present in reduced or vestigial aspect in both the Macrocyprididae and Cyprididae. The third thoracic leg ("cleaning limb") carries one strong conspicuously pectinate seta and at least two other long setae, none of which are ever reflexed. The well-developed furca bears two stout claws and four slender setae.

### Ecology and Distribution

**ECOLOGY.**—The family Pontocyprididae is exclusively marine and restricted to normal marine salinity. *Propontocypris* has some tolerance for the higher salinity and temperature fluctuations encountered periodically in the lower littoral zone, as may be seen from its common occurrence at Nosy Bé, Madagascar,

and other island shore localities. It is never found, however, in the upper littoral zone or in other extreme conditions at Nosy Bé, and it is completely absent from even slightly brackish environments. Cyprids found under these conditions are always of the Paracypridinae.

*Propontocypris* and *Pontocypris* are characteristic of shallow-water nearshore environments, especially those offering abundant phytal and coralline microhabitats, and are never found at bathyal or abyssal depths and only rarely in offshore shelf sediments. *Argilloecia* is most typical of deeper water, infraneritic through bathyal depths. *Argilloecia* and *Australoecia* are sparsely represented in the abyssal biofacies.

Hartmann (1963) has suggested that the development of an irregularly widened fused zone with many long, often branching, radial pore canals is correlated with strengthening of the ventral margin for adaptation to a benthic habitat and loss of swimming power, arising independently in such unrelated forms as *Macrocyprissa*, *Paracypris*, and *Argilloecia*. It is worth noting, in this regard, that the only species of *Propontocypris* with a wide marginal zone and long branching radial pore canals, *P. (Ekpontocypris) epicyrta*, new species, was collected living in Nosy Bé as epifauna on corals and on alga-encrusted shells of *Tridacna* from the coral reefs but never as sediment benthos. This species is laterally very compressed, which heightens its superficial resemblance to the Paradoxostomatidae (which also typically inhabit the microphytal jungle encrusting coralline surfaces). The so-called "swimming setae" of the antennules and antennae of *P. (E.) epicyrta* are fully developed, and there is no evidence for loss of swimming ability.

Almost all species of *Pontocypris*, *Propontocypris*, and *Pontocypris* are extremely quick swimmers, though they rarely move very far in one saltation. A few species of *Propontocypris* (*Schedopontocypris*) show reduction in the "swimming setae" of the antenna; it is not known whether this affects their swimming ability. The burrowing form *Argilloecia* has long "swimming setae" on the antenna, but the antennules bear only a few long setae among the many shorter ones, and even these are present only in the males.

**INDIAN OCEAN DISTRIBUTION.**—Published citations of Indian Ocean and Antarctic Pontocyprididae are almost entirely confined to the works of Brady (1868b, Mauritius; 1886, Ceylon; 1880, south temperate region "Challenger" stations), A. Scott (1905, Ceylon), Müller (1908, South Africa, Antarctica), Chapman

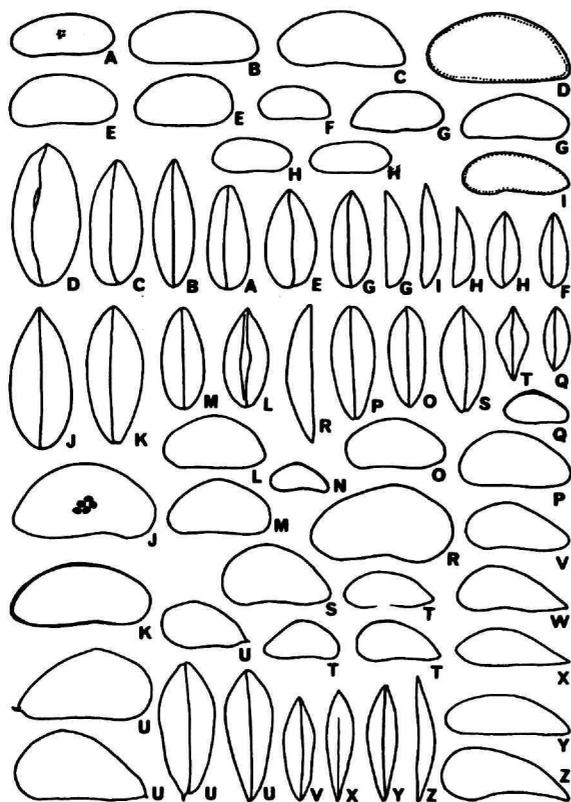


FIGURE 8.—Twenty-six species of Pontocyprididae previously described from Indian Ocean localities. Dorsal and lateral outlines are taken from published illustrations in the following references: Brady, 1868b, 1869, 1880, 1886, 1890; A. Scott, 1905; Chapman, 1902, 1910, 1915, 1916a, 1916b, 1919, 1941. A, *Argilloecia clavata* (Brady), 1880; B, *Pontocypris meridionalis* (Brady), 1869; C, *Argilloecia eburnea* Brady, 1880; D, *Argilloecia tumida* (Brady), 1880; E, *Argilloecia obtusata* (Brady), 1880; F, *Argilloecia badia* Brady, 1880; G, *Argilloecia affinis* Chapman, 1902; H, *Argilloecia pusilla* (Brady), 1880; I, *Argilloecia gracilior* Chapman, 1910; J, *Propontocypris* (*Ekpontocypris*) *robusta* (A. Scott), 1905; K, *Propontocypris* (*Ekpontocypris*) *tumida* (A. Scott), 1905; L, *Propontocypris* (*Ekpontocypris*) *davisoni* (Brady), 1868b; M, *Pontocypris subtriangularis* Brady, 1880 [nomen nudum]; N, *Pontocypris subreniformis* Brady of Chapman, 1916a; O, *Propontocypris* (*Schedopontocypris*?) *simplex* (Brady), 1880; P, *Propontocypris* (*Propontocypris*) *subreniformis* (Brady), 1880; Q, *Propontocypris* (*Propontocypris*) *nitida* (Brady), 1886; R, *Pontocypris simplex* Brady of Chapman, 1919; S, *Pontocypris faba* (Reuss) of Brady, 1880 ("female"); T, *Pontocypris bradyi* Chapman, 1941 [= *P. faba* (Reuss) of Brady, 1880 ("male"), and Chapman, 1916b]; U, *Propontocypris* (*Propontocypris*) *herdmani* (A. Scott), 1905 [= *Pontocypris attenuata* Brady of Brady, 1890, and Chapman, 1941]; V, *Propontocypris* (*Propontocypris*) *attenuata* (Brady), 1868b; W, *Pontocypris attenuata* Brady of Chapman, 1915; X, *Pontocypris sicula* Brady, 1890; Y, *Pontocypris gracilis* Brady, 1890; Z, *Pontocypris davidiana* Chapman, 1910.

(1902, 1910, Funafuti; 1915, 1941, Australia, Tasmania; 1916a, 1916b, 1919, Antarctica), and Maddocks (1966, 1968, Madagascar). The "Gazelle" collections described by Egger (1902) contained many species of Pontocyprididae, but the illustrations and identifications of this report are in general so inaccurate that no use can be made of them for either taxonomic or biogeographic purposes. Egger's report has been entirely ignored in the present study.

Twenty-six nomenclatural and at least 30 morphologic species of Pontocyprididae, mostly belonging to *Propontocypris* and *Argilloecia*, are represented in the faunas described by the authors cited above. For seven of these species the types have been examined and re-assigned in this report; another species has been identified from the collections at hand. The lateral and dorsal outlines illustrated elsewhere for most of these species have been assembled from the literature into Figure 8 for quick reference and to provide a convenient visual synonymy; the caption provides the probable generic assignments in the modern classification. Figure 8 also summarizes the difficulty and frus-

tration of attempting to define and distinguish with outline drawings alone the subtle multiplicity of geometric shapes represented by species of this group.

The most striking aspect of pontocyprid distribution in the Indian Ocean is the extreme rarity of specimens in subfossil faunas. Even in nearshore shallow-water sands, representing favorable environments for these epiphytal dwellers, they are frequently absent and never abundant in most subfossil assemblages. Nevertheless, intensive sampling in shallow water, such as in the Nosy Bé area, shows that species of *Propontocypris* are a consistent and abundant element of the shallow-water fauna in living assemblages. Their rarity in subfossil assemblages of high energy environments is presumably due to their small size and fragile carapaces. Under exceptional conditions they may be abundantly preserved; in the Nosy Bé region, certain offshore clays with an otherwise typical shelf fauna contain numerous specimens of a fragile species transported from the littoral zone. In general, the "Anton Bruun" collections were made in water too deep for most forms except *Argilloecia*. The localities listed

above represent only a small part of the material that was searched, mostly unsuccessfully, for specimens of Pontocyprididae.

The sparseness of representation compounds the difficulty of making species-level identifications of this material. Wherever specimens are sufficiently abundant and well preserved, and invariably where appendages are available for study, evidence is accumulating for an extremely rigid and narrowly defined morphologic species concept in this group. Similarly, most species are more narrowly restricted in their geographic range than statements in existing literature would imply. Very few species could be identified from two or more samples of the Indian Ocean collections. Geographically distant assemblages, however, often contain parallel species, easily distinguished but obviously closely related. Such species-level parallelism is especially characteristic of the southern latitudes, as among New Zealand, Kerguelen Islands, and South Africa.

The absence of reliably identified *Pontocypris* in these collections is interesting, as species of this genus are well represented in northern European and Mediterranean assemblages.

#### Family Pontocyprididae Müller, 1894

Subfamily PONTOCYPRINAE Müller, 1894, p. 246; 1912, p. 109.—Sars, 1923, p. 46.

Subfamily PONTOCYPRIDINAE.—Kaufmann, 1900, p. 108.—Pokorný, 1958, p. 228.—Hartmann, 1963, p. 126.—Van Morkhoven, 1962, p. 107.

Gruppe PONTOCYPRIDAE.—Alm, 1916, p. 27.

Family PONTOCYPRIDAE.—Swain, 1961, p. Q247.

TYPE-GENUS.—*Pontocypris* Sars, 1866.

DIAGNOSIS.—Carapace varying from subtriangular to nearly oval in lateral view, surface smooth; muscle-scar pattern a cluster of five discrete scars, normal pore canals numerous and tiny, hinge simple.

Masticatory process of mandible with simple claw-like teeth, those of maxilla much reduced. First thoracic leg without respiratory plate, three-segmented and subpediform in female, transformed into nearly symmetrical hook-shape grasping organs in male. Terminal podomere of third thoracic leg with three unequal setae, one of which is pectinated, none ever recurved; dorsal margin of podomere with two or three cusped projections. Furca well developed, with two terminal claws and four slender setae. Testes and ovaries located between valve lamellae. Ejaculatory ducts very simple tubular structures with swollen ends,

without whorls of chitinous spikes. Efferent ducts not convoluted.

INCLUDED GENERA.—The following genera have Recent representatives: *Pontocypris*, *Propontocypris*, *Pontocyprina*, *Australoecia*, and *Argilloecia*.

#### Genus *Propontocypris* Sylvester-Bradley, 1947

*Propontocypris* Sylvester-Bradley, 1947, p. 193.—Van Morkhoven, 1963, p. 74.

*Pontocypris* Sars [part], 1866, p. 13.—Brady, 1868a, p. 384.—Brady, Crosskey, and Robertson, 1874, p. 136.—Brady, 1878, p. 381; 1880, p. 35.—Cushman, 1906, p. 367.

*Pontocypris* Sars.—Müller, 1894, p. 246; 1912, p. 109.—Sars, 1923, p. 47.

TYPE-SPECIES.—*Pontocypris trigonella* Sars, 1866 (by Sylvester-Bradley, 1947).

DIAGNOSIS.—Carapace suboval to subtriangular in lateral view, dorsal margin broadly arched with greatest height located slightly before midlength, posteroventral angle narrowly rounded or acutely angled; posteroventral margin of right valve not serrate; posterior setae dense and short. Muscle-scar pattern composed of five discrete scars arranged in three horizontal rows.

Eyes always present. Antennules rather elongate, eight-segmented, most setae of last four podomeres very long. Mandibular palp with three setae on ventral margin of basal segment. Palps of first thoracic legs in male of moderate size and nearly symmetrical. Last podomere of third thoracic leg with thick pectinate seta and three slender setae, one of which is much longer than petinate seta, others much shorter. Furca with two stout subterminal claws, proximal one usually somewhat longer, tiny apical seta, one slender seta of variable size near claws, and two slender setae of variable length at midpoint of dorsal margin. Testes are located between posterior lamellae of carapace, extend ventrally forward, and may form dense coil in anterior vestibule. Ovaries form thick irregular sigmoid curve in posterior vestibule.

INCLUDED SPECIES.—Recent species for which soft parts have been described, listed by original binomen:

*Propontocypris calderensis* Hartmann, 1962

*Pontocypris declivis* Müller, 1894

*P. dispar* Müller, 1894

*P. edwardsi* Cushman, 1906

*P. flava* Müller, 1908

*P. gaussi* Müller, 1908

*Bythocypris howei* Puri (by Hulings, 1966)

*Pontocypris inflata* Müller, 1908

*P. intermedia* Brady, 1868c

*Propontocypris iquiquensis* Hartmann, 1962  
*Pontocypris levis* Müller, 1894  
*P. maculosa* Müller, 1894  
*P. mediterranea* Müller, 1894  
*P. monstrosa* Müller, 1894  
*P. pellucida* Müller, 1894  
*P. pirifera* Müller, 1894  
*P. setosa* Müller, 1894  
*P. subfusca* Müller, 1894  
*P. succinea* Müller, 1894  
*P. trigonella* Sars, 1866

Many other species have been described on carapace only, including the following species from the Indian Ocean region which are listed by original binomen.

*Pontocypris attenuata* Brady, 1868b  
*P. bradyi* Chapman, 1941  
*P. davidiana* Chapman, 1910  
*P. davisoni* Brady, 1868b  
*P. gracilis* Brady, 1890  
*Erythrocypris herdmanni* A. Scott, 1905  
*Pontocypris nitida* Brady, 1886  
*P. robusta* A. Scott, 1905  
*P. sicula* Brady, 1890  
*P. simplex* Brady, 1880  
*P. subreniformis* Brady, 1880  
*P. tumida* A. Scott, 1905

Seven new species of *Propontocypris* are named and described below:

*P. (Propontocypris) crocata*, new species  
*P. (Propontocypris) quasicrocata*, new species  
*P. (Propontocypris) paradispar*, new species  
*P. (Propontocypris?) lobodonta*, new species  
*P. (Ektopontocypris?) epicyrta*, new species  
*P. (Ektopontocypris) litoricola*, new species  
*P. (Ektopontocypris) mcmurdoensis*, new species  
*P. (Schedopontocypris) bengalensis*, new species

#### Subgenus *Propontocypris* Sylvester-Bradley, 1947

TYPE-SPECIES.—*Pontocypris trigonella* Sars, 1866.

DIAGNOSIS.—Carapace compressed, rounded subtriangular in lateral outline, location of greatest height a distinct angle. Greatest thickness located anterior to midlength at obscure angle in dorsal outline, sides converging linearly to narrowly rounded anterior and posterior ends. Muscle-scar pattern composed of five discrete scars in three horizontal or slightly tilted rows; dorsal scar may be divided.

Ejaculatory organ of male tubular dumbbell-shape, with swollen globular ends; vas deferens long and narrow. Copulatory organ of variable shape but usually somewhat elongate, with straight venter, broadly and

bluntly terminated, with long spirally coiled, distally thickened copulatory tube. Testes may or may not form anterior coil.

AFFINITIES.—This subgenus corresponds closely to Müller's group 3 (1894, p. 247). The subgenus comprises a large group of rather closely related species whose compressed subtriangular carapace and appendage anatomy have represented the normative standard for the concept of the genus. In carapace morphology and especially in muscle-scar pattern it shares many attributes with *Pontocypris*. The narrowly defined morphologic limits of species of this group combine with the difficulties of interpreting illustrations of smooth carapaces to encourage the apparent proliferation of nomenclatural species. In fact, these are mostly valid "biologic species" as well; it seems that more sophisticated statistical methods will be necessary to diagnose accurately the geometric parameters of these shapes.

#### INCLUDED SPECIES OF *P. (Propontocypris)*.

*P. (P.) attenuata* (Brady), 1868b  
*P. (P.) dispar* (Müller), 1894  
*P. (P.) herdmanni* (Scott), 1905  
*P. (P.) intermedia* (Brady), 1868c  
*P. (P.) maculosa* (Müller), 1894  
*P. (P.) mediterranea* (Müller), 1894  
*P. (P.) monstrosa* (Müller), 1894  
*P. (P.) nitida* (Brady), 1886  
*P. (P.) setosa* (Müller), 1894  
*P. (P.) subreniformis* (Brady), 1880  
*P. (P.) trigonella* (Sars), 1866  
*P. (P.) crocata*, new species  
*P. (P.?) lobodonta*, new species  
*P. (P.) paradispar*, new species  
*P. (P.) quasicrocata*, new species

#### *Propontocypris (Propontocypris) crocata*, new species

FIGURES 9; 10; 11B, D-F, I-M

SPECIES DE Maddocks, 1966, p. 50, fig. 17.

*Propontocypris* sp.—Maddocks, 1968, fig. 2.

ETYMOLOGY.—Latin *crocatus*, saffron-yellow.

TYPE-SPECIMENS.—Holotype male USNM 121100, allotype female USNM 121101, paratypes USNM 119804, 119805, 121102, 121103, 121251.

TYPE-LOCALITY.—Nosy Bé, Madagascar, sample no. 290 (washings of alga growing at lowest tide level on the back-reef platform near the village of Antafian-ambitry).

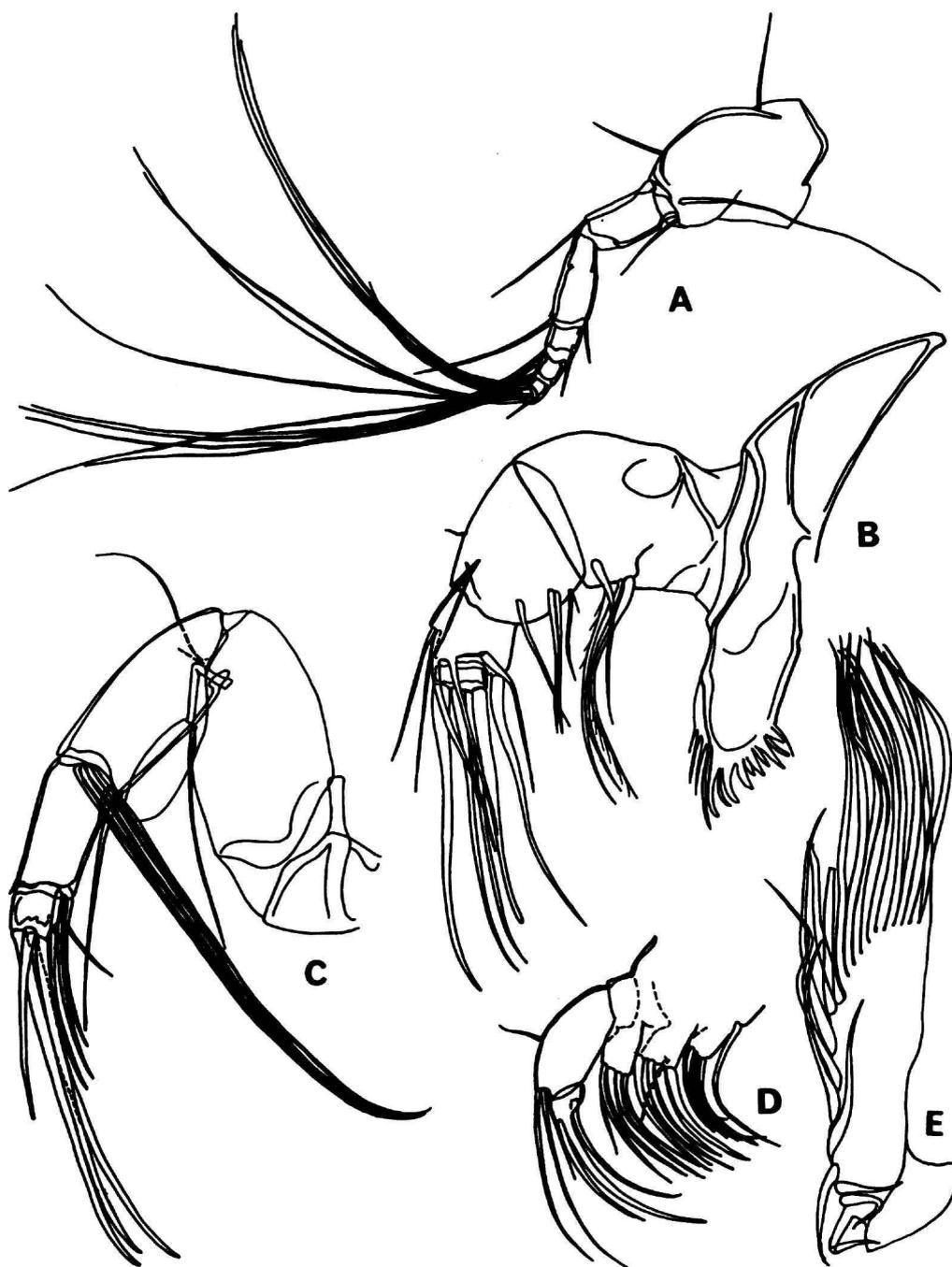


FIGURE 9.—*Propontocypris (Propontocypris) crocata*, new species. A, B, D, adult male USNM 119804; C, E, adult male USNM 121100: A, right antennule; B, right mandible; C, right antenna; D, right maxillar palp and masticatory processes; E, vibratory plate of left maxilla.

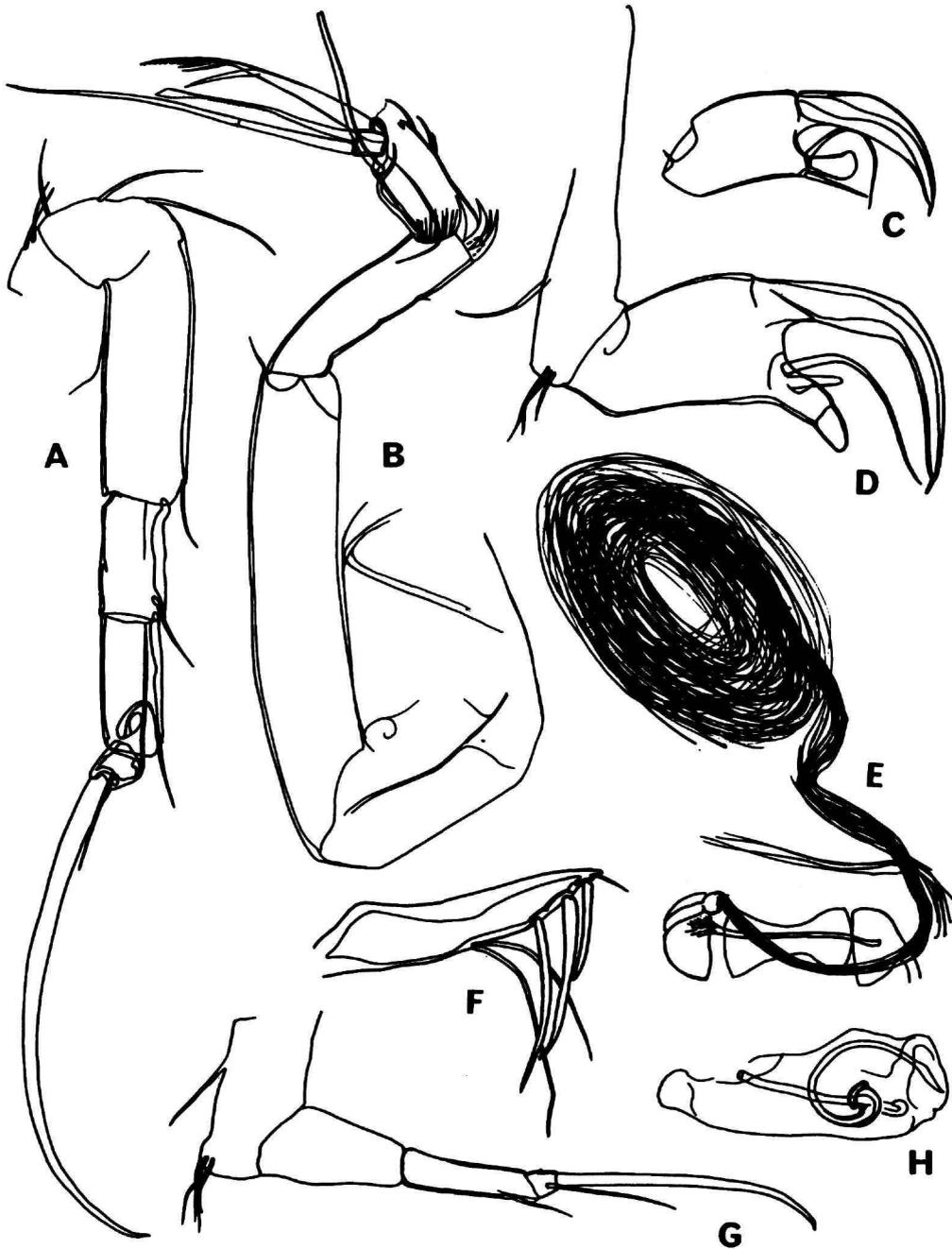
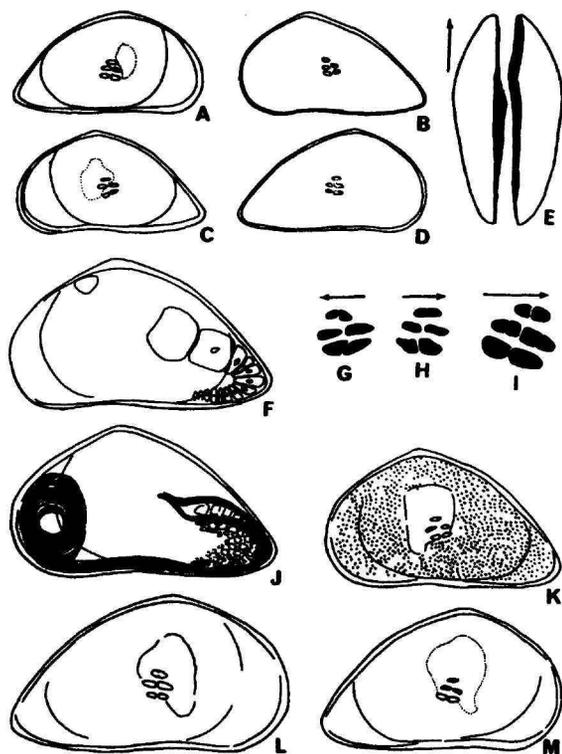


FIGURE 10.—*Propontocypris* (*Propontocypris*) *crocata*, new species. A, B, G, adult female USNM 121102; C, E, F, adult male USNM 119804; D, H, adult male USNM 121100: A, left second thoracic leg; B, right third thoracic leg; C, left first thoracic leg; D, right first thoracic leg; E, testes and ejaculatory organ; F, furca; G, left first thoracic leg; H, copulatory organ.

**DIAGNOSIS.**—Carapace rounded subtriangular in lateral outline with distinct dorsal angle, males and females of equal size and shape. Normal pore canals very small and numerous, each with short thin brown seta, radial pore canals indistinct or not differentiated. Muscle-scar pattern an orderly arrangement of five adductor scars in three widely separated horizontal rows, topmost scar partly divided. Carapace of living specimen transparent and yellowish, body deep yellow with brown patches, appendages yellow. Juveniles relatively more elongate and posteriorly more acuminate than adults.



**FIGURE 11.**—*Proponentocypris (Proponentocypris) quasicrocata* new species, A, C, G, H, USNM 121104. *Proponentocypris (Proponentocypris) crocata*, new species, B, D, juvenile USNM 121103; E, adult male KU 1000038; F, adult female USNM 121102; I, L, adult male USNM 119804; K, M, adult female USNM 121101; J, adult male USNM 121100.

A, right exterior view; B, left exterior view; C, left exterior view; D, right exterior view; E, dorsal view of both valves; F, left exterior view, showing position of eyes and ovaries; G, H, I, muscle-scar patterns seen from exterior view; J, left exterior view showing position of testes; K, left exterior view, L, right exterior view; M, right exterior view.

Palps of first thoracic legs of male slightly asymmetrical, with moderately thick right-angled hooks tapering distally and terminated by a tiny digitiform seta; basal podomere of palp subquadrangular, with swollen lobate peg, slender flagellate seta, and tapered ventral seta slightly longer than peg. Third thoracic leg with stout finely pectinate seta having especially long and thick proximal barb, slender tapered seta half as thick as pectinate seta and half again as long, short tapered seta half as thick but just as long as pectinate seta, and slender distally spatulate sensory seta slightly shorter than pectinate seta. Furca with two smooth slender tapered claws, distal claw half as long and two-thirds as thick as proximal claw; distal seta very thin and one-third as long as distal claw, median seta enlarged to equal distal claw in thickness and proximal claw in length, proximal setae slender and subequal in length, longer than median seta. Copulatory organ of male oblong, bluntly truncate anteriorly, height/length ratio approximately one-third. Vas deferens narrow, copulatory tube spirally coiled clockwise and distally spatulate. Testes arranged in thick posterior loop, extending anteriorly along venter, and forming dense coil in anterior vestibule.

**MATERIAL.**—Nosy Bé: 284 living specimens, 607 subfossil specimens.

**DIMENSIONS.**—Adult male, USNM 119804: left valve, length 0.76 mm, greatest height 0.43 mm, located 0.31 mm from anterior, thickness 0.23 mm; right valve, length 0.78 mm, greatest height 0.43 mm, located 0.30 mm from anterior, thickness 0.17 mm.

Adult female, USNM 121101: left valve, length 0.76 mm, greatest height 0.43 mm, located 0.30 mm from anterior, thickness 0.25 mm; right valve, length 0.78 mm, greatest height 0.44 mm, located 0.30 mm from anterior, thickness 0.19 mm.

**HABITAT.**—Nosy Bé: common on many varieties of calcareous and noncalcareous algae, *Thalassia*, beach-stranded sponges, and dead coral and shell fragment accumulations, at all littoral and sublittoral shore collecting localities.

**SUBFOSSIL DISTRIBUTION.**—Nosy Bé: widely dispersed but never abundant among sediments of all types from the intertidal zone to more than 40 m depth.

**AFFINITIES.**—This species is very similar to *P. (P.) intermedia* (Brady) but the carapace of the latter is not as high, and its copulatory organ has an anterior conical protuberance. *P. (P.) dispar* (Müller) is very similar in appendage and reproductive morphology but

shows extreme dimorphism in carapace outline, the height/length ratio being 0.46 for males, 0.54 for females. *P. (P.) trigonella* (Sars) is not as high, less acuminate posteriorly, conspicuously dimorphic, and has posteriorly confined testes and recurved hooks on the palps of the male first thoracic legs. The lateral outline of *P. (P.) crocata*, new species, somewhat resembles that of *P. (P.) herdmanni* (Scott); the latter is larger and more angulate in lateral outline, and its left valve has a single stout posteroventral spine. *P. (P.) attenuata* (Brady) is larger and more acutely terminated.

*Propontocypris (Propontocypris) quasicrocata*,  
new species

FIGURE 11A, C, G, H

ETYMOLOGY.—Latin, quasi-, simulating, from its resemblance to the Instar I stage of *P. (P.) crocata*, new species.

TYPE-SPECIMENS.—Holotype USNM 121104, paratypes USNM 121105–121108.

TYPE-LOCALITY.—Nosy Bé, Madagascar, sample 497 (grab sample 2 km south of Hellville, depth approximately 20 m).

DIAGNOSIS.—Adult carapace extremely similar in size and shape to the Instar I stage (Figure 1B, D) of *P. (P.) crocata*, new species, but with fully mature inner lamella and slightly less attenuate posterior angle, considerably smaller and with distinctly more attenuate posterior angle when compared with adult stage of *P. (P.) crocata*. Carapace strongly compressed, very fragile.

MATERIAL.—Nosy Bé: 73 specimens, all subfossil. A few specimens contain fragments of appendages, not well enough preserved to yield further information about the affinities of this form. Tulear: two specimens, both subfossil, at station AB-364A. Bay of Bengal: three specimens, all subfossil, slightly smaller than the Madagascar specimens, at AB-28A.

DIMENSIONS.—Nosy Bé adult specimen USNM 121104: left valve, length 0.61 mm, greatest height 0.32 mm, located 0.25 mm from anterior, thickness 0.13 mm; right valve, length 0.60 mm, greatest height 0.32 mm, located 0.26 mm from anterior, thickness 0.12 mm.

Bay of Bengal specimen USNM 121105: right valve, length 0.58 mm, greatest height 0.32 mm, located 0.23 mm from anterior, thickness 0.14 mm.

Tulear specimen USNM 121106: right valve, length

0.56 mm, greatest height 0.31 mm, located 0.24 mm from anterior, thickness 0.13 mm.

HABITAT.—Probably crawling on algae and corals in the coral reef and backreef platform zones near shore.

SUBFOSSIL DISTRIBUTION.—Nosy Bé widely distributed but never abundant in shallow-water and intertidal carbonate sands, especially near coral reefs.

*Propontocypris (Propontocypris) paradyspar*,  
new species

Figures 7r, 12, 13

ETYMOLOGY.—Greek *para-*, near; from its affinity to *P. (P.) dyspar* (Müller).

TYPE-SPECIMENS.—Holotype USNM 121109, paratypes USNM 121110, 121111.

TYPE-LOCALITY.—“Anton Bruun” cruise 9 station 453.

DIAGNOSIS.—Carapace small, fragile, moderately inflated; lateral outline rounded subtriangular without marked dorsal angle, moderately acuminate posterior angle; greatest height located considerably anterior to midlength; sexual dimorphism not pronounced.

Appendage anatomy essentially identical to that of the closely related species *P. (P.) dyspar* (Müller), *P. (P.) intermedia* (Brady), and *P. (P.) maculosa* (Müller), and very similar to that of *P. (P.) crocata*, new species. Barbs of pectinate seta of third thoracic leg enlarged equally and gradually diminishing in size. Copulatory organ with distal end swollen and overhanging dorsally, copulatory tube tapering distally. Median seta of furca enlarged and distally feathered.

MATERIAL.—One male and one female living at station AB-453, one female from station AB-28A, all adults.

DIMENSIONS.—Adult male USNM 121109 from AB-453: left valve, length 0.61 mm, greatest height 0.34 mm, located 0.25 mm from anterior.

Adult female USNM 121111 from AB-453: left valve, length 0.66 mm, greatest height 0.35 mm, located 0.29 mm from anterior, thickness 0.15 mm; right valve, length 0.68 mm, greatest height 0.36 mm, located 0.31 mm from anterior, thickness 0.15 mm.

HABITAT.—Collected in sediment from 66 m in the Andaman Sea and 47–49 m off Cape Guardafui.

AFFINITIES.—This species is one of a complex of forms including *P. (P.) dyspar* (Müller), *P. (P.) intermedia* (Brady), *P. (P.) maculosa* (Müller), and



FIGURE 12.—*Propontocypris (Propontocypris) paradisiar*, new species. A, E, F, H, adult female USNM 121110; B-D, G, adult male USNM 121109: A, mandible; B, antenna; C, second thoracic leg; D, third thoracic leg; E, basal part of maxilla; F, furca; G, antennule; H, first thoracic leg of female.

probably *P. (P.) quasicrocata*, new species, which are distinguishable only on subtleties of carapace curvature and outline and on distal outline of copulatory organ.

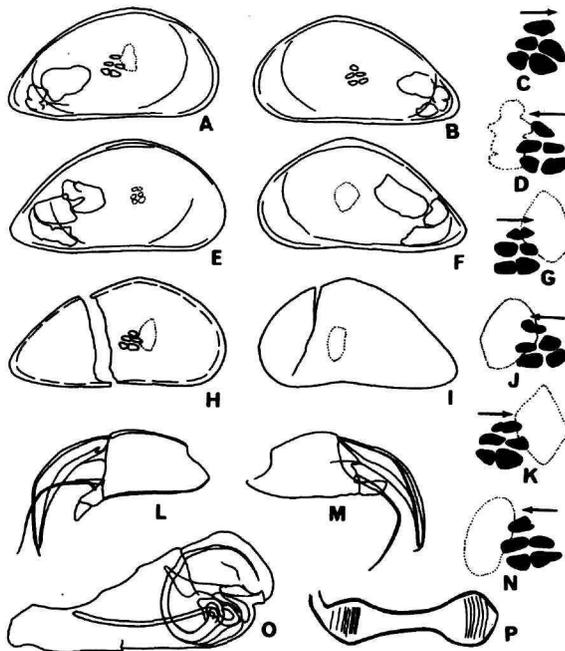


FIGURE 13.—*Propontocypris (Propontocypris) paradyspar*, new species. A–D, adult female USNM 121110; E–F, J, adult female USNM 121111; H, I, K–P, adult male USNM 121109: A, B, E, F, H, I, carapace exteriors with positions of ovaries or testes; C, D, G, J, K, N, muscle-scar patterns with opaque spots, seen from exterior; L, M, first thoracic legs of male; O, male copulatory organ; P, ejaculatory organ.

*Propontocypris (Propontocypris) herdmani*  
(A. Scott), 1905

FIGURES 8U; 14F, G, L, M

*Erythrocypris herdmani* A. Scott, 1905, p. 372, pl. 1: figs. 15, 16.

*Pontocypris attenuata* Brady.—Brady, 1890, p. 491, pl. 1: figs. 3, 4.—Chapman, 1919, p. 17; 1941, p. 194, pl. 9: fig. 8.

**DIAGNOSIS.**—Carapace large, moderately inflated, nearly subtriangular in lateral outline with highly arched, angulate dorsal margin and sharply pointed posterior angle, the right valve terminated by a short hollow spine.

**MATERIAL.**—Nineteen specimens from eight stations

in the Bay of Bengal, all subfossil, USNM 121112–121114, 121122–121127.

**DIMENSIONS.**—Adult specimen USNM 121112 from AB–36A: right valve, length including spine 0.82 mm, length without spine 0.79 mm, greatest height 0.43 mm, located 0.32 mm from anterior, thickness 0.20 mm.

Adult specimen USNM 121113 from AB–87K: left valve, length 0.76 mm, greatest height 0.41 mm, located 0.29 mm from anterior thickness 0.19 mm.

**DISTRIBUTION.**—Recovered from sediments in the Bay of Bengal and Andaman Sea at depths ranging from 19 to 68 m; “Anton Bruun” stations 36A, 42, 46, 47, 87I, 87K, 87N, 88. Recorded from the Gulf of Manaar by A. Scott (1905); from Nouméa, New Caledonia, and Samoa by Brady (1890); from Bass Strait and southeast Australia by Chapman (1941).

**AFFINITIES.**—This species is one expression of a very widely distributed morphologic type within the subgenus *Propontocypris*. Other species with a very similar carapace shape include *P. (P.) crocata*, new species, and *P. (P.) quasicrocata*, new species, *P. (P.)* species 1, 2, 3, and 6, and the forms identified variously as *Pontocypris faba* (Reuss) and *Pontocypris bradyi* Chapman. The presence of the terminal spine on the right valve, while it serves to confirm the identification with the forms described by Brady (1890) and A. Scott (1905), probably cannot be relied upon as an invariant property of a species.

*Propontocypris (Propontocypris) subreniformis*  
(Brady), 1880

FIGURE 8P

*Pontocypris(?) subreniformis* Brady, 1880, p. 38, pl. 7: fig. 5a–d [not pl. 15: fig. 6a–d].

Not *Pontocypris subreniformis* T. Scott, 1894, p. 136, pl. 14: figs. 38, 39.

Not *Pontocypris(?) subtriangularis* Brady, 1880, pl. 15 [nomen nudum].

Not *Pontocypris subreniformis* Brady.—Chapman, 1915, p. 35; 1916a, p. 37; 1941, p. 194.

**MATERIAL.**—A single whole specimen containing dry appendages, in the “Challenger” collection (G. S. Brady, 1880) of the British Museum (Natural History), Catalog No. 81.5, slide no. 11. Its source is labeled as Port Jackson, depth 2–10 fms.

**DISTRIBUTION.**—Port Jackson, Australia, depth 2–10 fms; ?Simon’s Bay, South Africa, depth 15–20 fms (Brady, 1880).

**AFFINITIES.**—This specimen agrees well with that illustrated by Brady (1880) as plate 7: figure 5a–d, and identified as *Pontocypris subreniformis*. In his plate 15: figure 6a–d, Brady illustrated a form with more angulate outline and greater inflation, identified in the caption as *Pontocypris(?) subtriangularis*. As there is no description of this species in the text, subsequent readers, including Müller (1912) and Chapman (1915, 1941) have assumed this to be an alternative illustration of *P. subreniformis* and have cited this illustration indiscriminately with that of Brady's plate 7, a conclusion reinforced by the fact that Brady himself cited only the plate 15 illustration in the text description of *P. subreniformis*. This synonymization of the two forms may well correspond to Brady's own con-

clusions; nevertheless comparison of the two illustrations in the context of the much greater number of species known today shows that they belong to separate species and very possibly even to distinct subgenera.

The "Challenger" specimen under consideration (the lectotype-designate of Puri, 1968) corresponds well to Brady's plate 7: figure 5a–d. Its mild compression and posterior attenuation in dorsal view is compatible with the subgenus *Propontocypris*; its rounded contours in lateral view are reminiscent of *P. (P.?) lobodonta*, new species (see below).

The illustration of *P. subtriangularis* (Brady, 1880, pl. 15: fig. 6a–d) is much more angulate in lateral outline, with the narrowly rounded margin (noted by Brady as anterior depression?) and bluntly truncated posterior; in dorsal view the outline is ovate, the carapace evenly inflated and gently rounded at both ends. Thus this species is probably a member of the subgenus *Ekpontocypris* (p. 27). It is tempting to suppose that this is the specimen Brady recorded from Simonstown, but this cannot be proven. It has not been identified from subsequent collections in this region, unless as *Pontocypris gausi* Müller, 1908, which has a very similar lateral outline but clearly belongs to the subgenus *Schedopontocypris* (p. 37) on the basis of the muscle-scar pattern and soft parts.

Chapman (1915, 1941) did not illustrate the specimens he identified as *Pontocypris subreniformis* Brady from southeast Australia and east of Tasmania; as he cited both of Brady's illustrations, it is probable that he included both forms in his concept of the species. A single specimen from Wynyard Beach, Tasmania, described below as *Propontocypris (P.)* species 4, resembles in lateral but not dorsal outline plate 15: figure 6a–d of Brady (1880).

Chapman's (1916a) suggestion that plate 7: figure 5a–d, may be regarded as an illustration of "*Bythocypris subreniformis* Brady" is clearly erroneous, according to any hypothesis. In any case, *P. subtriangularis* is a nomen nudum, and this form, if ever recovered in recognizable condition, must be treated as a new species.

*Propontocypris (Propontocypris?) lobodonta*, new species

FIGURES 15, 16

Species DE [part] Maddocks, 1966, p. 50.

**ETYMOLOGY.**—Greek: *lobos*, rounded projection; *odous*, tooth.

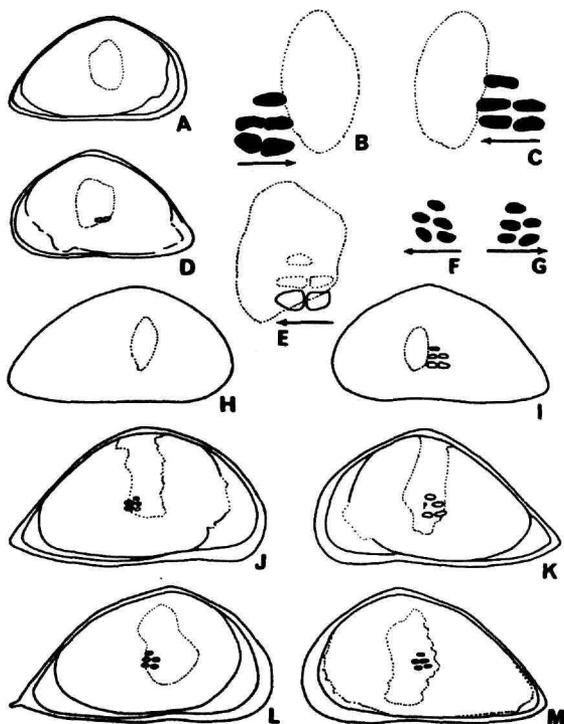


FIGURE 14.—*Propontocypris (Propontocypris)* species 1: B, H, USNM 121129; C, I, USNM 121128. *Propontocypris (Propontocypris)* species 2: A, USNM 121133; D, E, USNM 121132. *Propontocypris (Propontocypris)* species 3: J, USNM 121134; K, USNM 121135. *Propontocypris (Propontocypris) herdmani* (A. Scott): F, M, USNM 121113; G, L, USNM 121112.

A, D, H–M, carapace exteriors; B, C, E–G, muscle-scar patterns with opaque spots, seen from exterior.

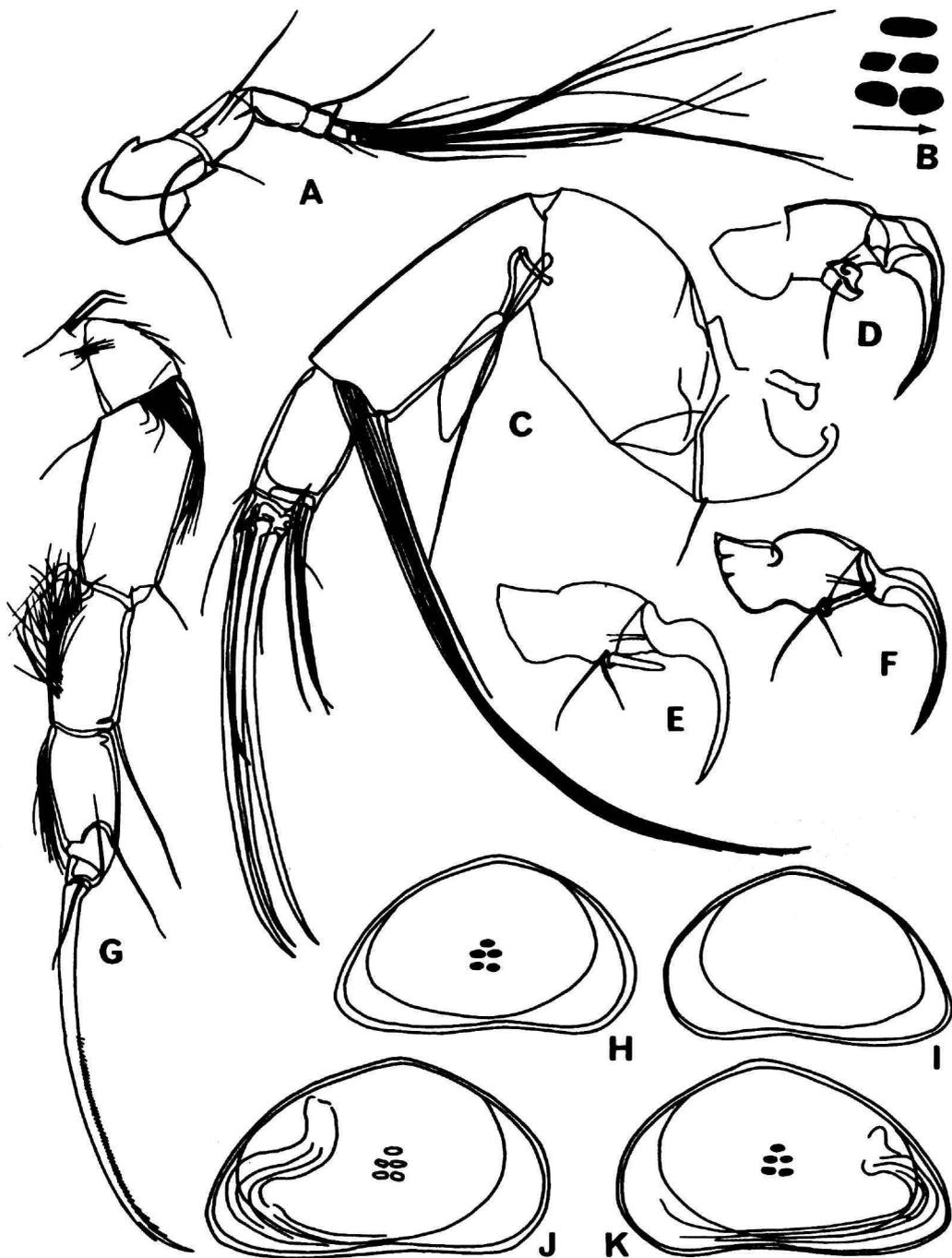


FIGURE 15.—*Propontocypris (Propontocypris?) lobodonta*, new species: A, D-G, J, K, adult male USNM 121115; B, H, I, adult female USNM 121116; C, adult male USNM 121117; all from Nosy Bé. A, antennule; B, right muscle-scar pattern from exterior; C, antenna; D, E, F, first thoracic legs; G, simplified drawing of Figure 15F; G, second thoracic leg; H, I, carapace exteriors; J, K, carapace exteriors with positions of testes.



FIGURE 16.—*Propontocypris* (*Propontocypris* ?) *lobodonta*, new species: A, C–E, adult male USNM 121115; B, F, adult female USNM 121116; G, adult male USNM 121117; all from Nosy Bé. A, mandible; B, first thoracic leg; C, third thoracic leg; D, enlarged view of third thoracic leg; E, basal part of maxilla; F, furca; G, copulatory organ.

**TYPE-SPECIMENS.**—Holotype USNM 121115, allotype USNM 121116, paratypes USNM 121117–121121, 121250.

**TYPE-LOCALITY.**—Nosy Bé, Madagascar, sample 196 (washings of *Enteromorpha*-like alga growing at low tide at Ambariobe).

**DIAGNOSIS.**—Carapace smooth, moderately inflated, greatest height and greatest thickness located slightly anterior to midlength. Dorsal margin in lateral view highly arched and angulate, narrowly rounded posteroventral angle located below one-fifth height, anterior margin very broadly rounded; females much smaller than males. Muscle-scar pattern an orderly arrangement of five scars in three horizontal rows, top-most scar not divided. Carapace of preserved specimen translucent white with short golden setae, body and appendages yellow, thick chitinous structures dark brown.

Mandible with stout multilobed teeth on the basal part, of the structural type found in the Paracyprididae, Macrocyprididae, and Bairdiidae; basal podomere of palp with three long annular feathered setae and one short simple seta, ventrodistal claw of podomere-2 and all distal claws of endopodite of annular and feathered structure. Maxilla with dorsomedian seta of basal podomere of palp pulmose, first and second masticatory processes each with two setae thickened and sparsely feathered, four setae slender and simple; third masticatory process with two setae thickened and abundantly feathered, two thick and simple, one short and simple. Palp of first thoracic legs of male with slender curved terminal hook; asymmetric peg on basal podomere, elongate and digitiform on one leg, short and nodular on the other. Second thoracic leg with dorsolateral mane of about ten fine setae at knee joint; podomeres-3 and -4 each with thick posteromarginal mane of short hairs, suture at their junction unusually distinct and perhaps movable, distal setae of each unusually long; terminal claw finely but distinctly pectinate. Pectinate seta of third thoracic leg very stout with regularly diminishing barbs; simple tapered seta five-fourths as long and one-half as thick as pectinate seta; triangularly spatulate seta four-fifths as long and one-fourth as thick as pectinate seta; slightly shorter and thinner, flexible, distally bladed seta. Furca with proximal claw twice as long and thick as distal claw, both distally barbed; distal seta tiny and half as long as distal claw, median and proximal setae of graduated length, thickly pectinate, median seta twice as thick

as proximal setae. Copulatory organ of male arcuate, oblong, distally blunt and wrinkled in outline; copulatory tube short, straight and horizontal; vas deferens narrow. Testes confined to simple loop in posterior part of carapace.

**MATERIAL.**—Nosy Bé: 24 living specimens, 684 subfossil specimens. Grand Comoro Island: Two living specimens, eight subfossil specimens.

**DIMENSIONS.**—Adult male specimen USNM 121115 from Nosy Bé: left valve, length 0.90 mm, greatest height 0.52 mm, located 0.41 mm from anterior, thickness 0.22 mm; right valve, length 0.92 mm, greatest height 0.52 mm, located 0.41 mm from anterior, thickness 0.23 mm.

Adult female USNM 121116 from Nosy Bé: left valve, length 0.72 mm, greatest height 0.46 mm, located 0.37 mm from anterior, thickness 0.25 mm; right valve, length 0.79 mm, greatest height 0.47 mm, located 0.36 mm from anterior, thickness 0.21 mm.

Adult male specimen USNM 121118 from Grand Comoro Island: left valve, length 0.87 mm, greatest height 0.50 mm, located 0.40 mm from anterior, thickness 0.24 mm; right valve, length 0.89 mm, greatest height 0.51 mm, located 0.41 mm from anterior, thickness 0.24 mm.

**HABITAT.**—Nosy Bé: infrequent in washings of *Enteromorpha*-like algae from low tide level, of corals from the sublittoral zone, and in coralline sand from low tide level to 15 m depth. Grand Comoro Island: carbonate sand near coral reefs at about 70 feet depth.

**SUBFOSSIL DISTRIBUTION.**—Nosy Bé: extremely abundant in fine carbonate mud in the Lac du Cratère and from the front slope of the Sambirano River delta at 10–20 m depth; moderately abundant in shallow-water sands and sandy muds of all types, also present in intertidal beach sands and carbonate reef sands. Abundance appears to be dependent on nearby source of supply in reef or littoral zone and low energy sedimentary environment. Grand Comoro Island: carbonate reef sand.

**AFFINITIES.**—This anomalous species is not closely allied to the normative members of *Propontocypris* (*P.*), from which it differs in structure of copulatory organ as well as mandible. The carapace shape and muscle-scar pattern, however, are closer to this group than to either of the two other subgenera.

This very large and ruggedly developed species displays feathering, pectination, and other hirsute characteristics wherever an appendage structure has this

potential. Presumably this high degree of differentiation is directly related to the increased size. Most of these features are also present in one or more species elsewhere in the genus or family, but their simultaneous and profuse expression here in one species produces a sumptuous impression unparalleled elsewhere.

The stout multilobed mandibular teeth, of the structural type characteristic of the Paracyprididae, Macrocyprididae, and Bairdiidae, are not known from any other form in the Pontocyprididae, nor are any transitional types known between this type and the usual pontocyprid pattern, which consists of very simple slender, curved, tapering denticles. Large size alone is not the causative factor, as many other species of Pontocyprididae reach lengths of more than a millimeter, and all retain the normal structure of mandibular dentition.

#### *Propontocypris (Propontocypris) species 1*

FIGURE 14B, C, H, I

**MATERIAL.**—Four subfossil valves from stations AB-371F, 371G, 372M; USNM 121128–121131.

**DIMENSIONS.**—Specimen USNM 121128: left valve, length 0.87 mm, greatest height 0.46 mm, located 0.38 mm from anterior, thickness 0.20 mm.

Specimen USNM 121129: right valve, length 0.88 mm, greatest height 0.46 mm, located 0.38 mm from anterior, thickness 0.20 mm.

**DISTRIBUTION.**—Collected in sediment from 55, 73, and 110 m depth off Mozambique.

**AFFINITIES.**—Carapace more inflated and more elongate than most other members of the group typified by *P. (P.) crocata*, new species, and lacking any terminal spine.

#### *Propontocypris (Propontocypris) species 2*

FIGURE 14A, D, E

**MATERIAL.**—Two subfossil valves from station AB-364A.

**DIMENSIONS.**—Specimen USNM 121132: left valve, length 0.74 mm, greatest height 0.43 mm, located 0.33 mm from anterior, thickness 0.18 mm.

Specimen USNM 121133: right valve, length 0.72 mm, greatest height 0.42 mm, located 0.30 mm from anterior, thickness 0.17 mm.

**DISTRIBUTION.**—Collected in sediment at 51 m depth off Tulear, Madagascar.

**AFFINITIES.**—Similar to *P. (P.) crocata*, new species, but anterior margin more narrowly rounded, posterior end more acutely pointed.

#### *Propontocypris (Propontocypris) species 3*

FIGURE 14J, K

**MATERIAL.**—Three subfossil valves from station AB-381C; USNM 121134–121136.

**DIMENSIONS.**—Specimen USNM 121134: right valve, length 0.79 mm, greatest height 0.42 mm, located 0.35 mm from anterior.

Specimen USNM 121135: left valve, length 0.76 mm, greatest height 0.42 mm, located 0.35 mm from anterior.

**DISTRIBUTION.**—Collected in sediment at 40 m depth, Walterson Shoal.

**AFFINITIES.**—Carapace outline very similar to that of *P. (P.) herdmani* (A. Scott) but dorsal angle more rounded, posterior margin sloping more steeply, posterior angle more acute and slightly upswung, lacking posterior spine.

#### *Propontocypris (Propontocypris?) species 4*

FIGURE 31

?*Pontocypris*(?) *subreniformis* Brady.—Chapman, 1915, p. 35; 1916a, p. 37; 1941, p. 194.

?*Pontocypris*(?) *subtriangularis* Brady, 1880, pl. 15: fig. 6a–d.

**MATERIAL.**—A single subfossil valve from Wynyard Beach, Tasmania.

**DIMENSIONS.**—Specimen USNM 121137: left valve, length 0.52 mm, greatest height 0.26 mm, located 0.23 mm from anterior, thickness 0.17 mm.

**DISTRIBUTION.**—Beach sand, Wynyard Beach, Tasmania; (?) 777 fms depth, east of Tasmania (Chapman, 1915); (?) Quaternary marine muds, Antarctica (Chapman, 1916a); (?) 65 and 505 fms depth, south-east Australia (Chapman, 1941).

**AFFINITIES.**—This specimen resembles that illustrated by Brady (1880, pl. 15: fig. 6a–d) in lateral outline, but its more attenuate dorsal outline suggests that it should be placed in the subgenus *Propontocypris* rather than *Ekpontocypris*. Its muscle-scar pattern cannot be seen. The excellent development of the radial pore canals corresponds to that found in some members of the subgenus *Schedopontocypris*.

*Propontocypris (Propontocypris?) species 5*

FIGURES 17K, 18

**MATERIAL.**—A single whole adult male, collected living in reef sand at Tulear, Madagascar. This specimen, though fully mature and apparently in excellent condition, is missing one first thoracic leg and both third thoracic legs.

**DIMENSIONS.**—Specimen USNM 121138: left valve, length 0.63 mm, greatest height 0.31 mm, located at 0.24 mm from anterior, thickness 0.17 mm.

**AFFINITIES.**—This specimen, while its carapace shape and muscle-scar pattern are conformable with those of the subgenus *Propontocypris*, displays several extremely anomalous characters of the appendages and genitalia, unparalleled elsewhere in the genus.

Antennule with podomeres-4 and -5 completely fused, retaining short setae at their junction. Antenna with rather short and slender claws, "swimming setae" entirely absent. Copulatory organ sharply and angularly truncated distally, with conical dorsomedian and ventrodistal prominences, copulatory tube long but crooked rather than spiral. Testes arranged in usual posterior loop continuing anteriorly to form a close spiral in anterior vestibule, also forming an unprecedented dorsal coil above ejaculatory organ. Ejaculatory organ of usual dumbbell shape, vas deferens thick and wrapped in a close coil dorsal to the ejaculatory organ before connecting with copulatory organ.

It is unfortunate that no living males could be studied of *P. (P.)* species 7, which this species most closely approaches in carapace shape. The fusion of podomeres 4 and 5 of the antennule is seen also in certain species of the subgenus *Schedopontocypris* and is incipiently expressed in *P. (P.)* species 7 and *P. (P.?) lobodonta*, new species. Certain species of *P. (Schedopontocypris)* have the "swimming setae" of the antenna much shortened. The shape of the copulatory organ is unlike any other presently known. The dorsal coiling of the testes has not been described for any other species. A similar coiling of the vas deferens is diagnostic of the presumably unrelated subgenus *Macrocypris* Brady.

*Propontocypris (Propontocypris) species 6*

FIGURE 17L-N

**MATERIAL.**—A single adult female collected living at station AB-202c in the Arabian Sea.

**DIMENSIONS.**—Specimen USNM 121139: left valve, length 0.62 mm, greatest height 0.35 mm, located 0.26 mm from anterior; right valve, length 0.63 mm, greatest height 0.35 mm, located 0.27 mm from anterior.

**AFFINITIES.**—This specimen represents yet another subtle variant of the *P. (P.) dispar* group. It is slightly more elongate than *P. (P.) quasicrocata*, new species, but otherwise similar in carapace shape. It differs from *P. (P.) paradispar*, new species, in its more pronounced dorsal angle and the vestigial peneproximal barb on the pectinate seta of the third leg. Furca and pectinate seta very similar to those of *P. (P.)* species 8.

*Propontocypris (Propontocypris) species 7*

FIGURES 7E, 17A-G, 19

**MATERIAL.**—Mauritius: three adult valves, from intertidal mud, USNM 121140-121142. Cape Guardafui: one adult female collected living, station AB-453.

**DIMENSIONS.**—Adult specimen USNM 121140 from Mauritius: left valve, length 0.63 mm, greatest height 0.28 mm, located 0.31 mm from anterior, thickness 0.14 mm.

Adult female specimen USNM 121141 from AB-453: left valve, length 0.62 mm, greatest height 0.29 mm, located 0.20 mm from anterior, thickness 0.13 mm; right valve, length 0.63 mm, greatest height 0.30 mm, located 0.12 mm from anterior, thickness 0.12 mm.

**DISTRIBUTION.**—Living at 47-49 m depth off Cape Guardafui, Somali Republic; subfossil in intertidal mud, Mauritius.

**AFFINITIES.**—Carapace small, very compressed, acutely prolonged posteriorly; greatest height located at anterior third, equal to less than half of length, dorsal margin sloping smoothly and steeply behind and before; inner margin coincident with line of concrescence in ventral region; topmost scar of muscle-scar pattern partially divided.

Specimens of this general type are widely distributed in Indopacific assemblages; the traditional name for any such elongate subtriangular species is *Pontocypris attenuata* Brady, 1868b. The lectotype-designate of *P. attenuata*, however, is considerably longer and relatively higher in lateral view, with a more nearly triangular outline.



FIGURE 17.—*Propontocypris* (*Propontocypris*) species 7: A, B, D-G, adult female USNM 121141 from AB-453; C, USNM 121140 from Mauritius. *Propontocypris* (*Propontocypris*) species 8: H, juvenile USNM 121145; I, J, adult USNM 12144. *Propontocypris* (*Propontocypris?*) species 5: K, adult male USNM 121138. *Propontocypris* (*Propontocypris*) species 6: L-N, adult female USNM 21139.

A-C, H, I, M, N, carapace exteriors; D, furca; E, basal part of maxilla; F, G, J, muscle-scar patterns; K, schematic view of whole body resting in left valve, before complete dissection. [Note positions of whorls of testes and coiled efferent ducts. This specimen is lacking both third thoracic legs and one first thoracic leg.] L, distal part of third thoracic leg.

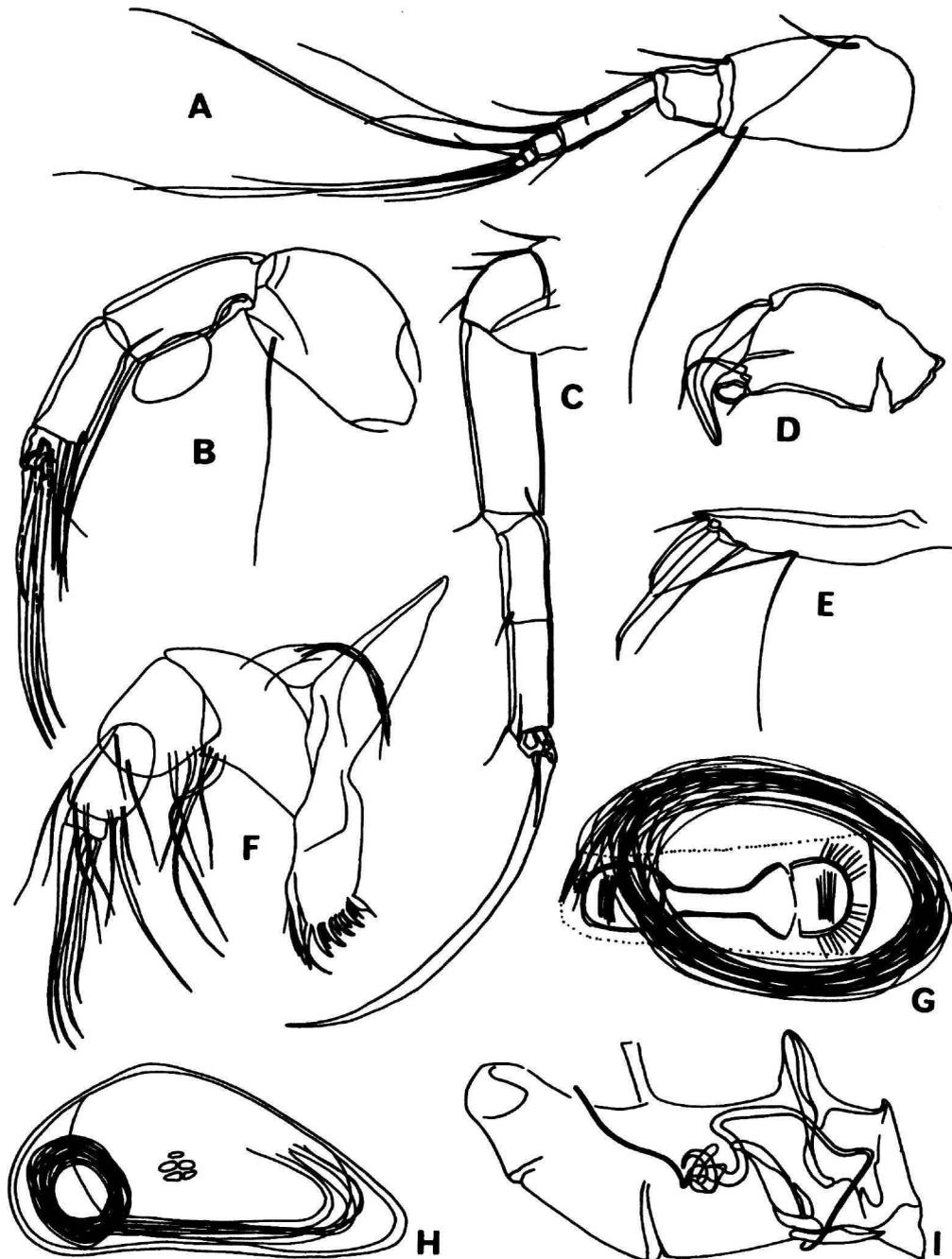


FIGURE 18.—*Profontocypris* (*Profontocypris* ?) species 5, adult male USNM 121138: A, antennule; B, antenna; C, second thoracic leg; D, first thoracic leg; E, furca; F, mandible; G, ejaculatory organ and whorl of testes; H, left exterior of carapace showing anterior whorl of testes; I, copulatory organ.

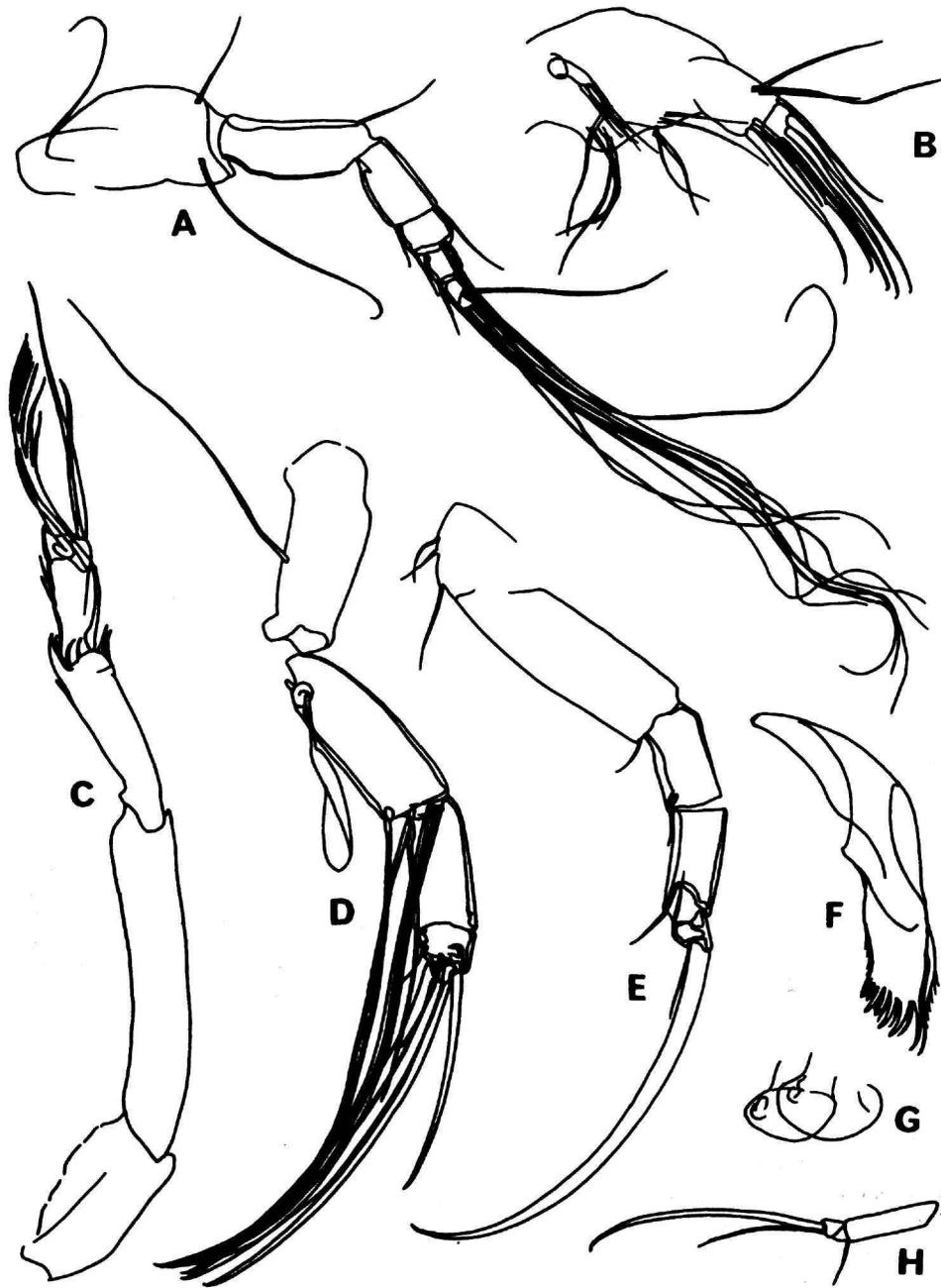


FIGURE 19.—*Propontocypris* (*Propontocypris*) species 7, adult female USNM 121143: A, antennule; B, mandibular palp; C, third thoracic leg; D, antenna; E, second thoracic leg; F, mandibular base; G, genital lobes; H, terminal part of first thoracic leg.

*Propontocypris (Propontocypris) species 8*

FIGURES 17H-J, 20

**MATERIAL.**—A single male specimen collected living at station AB-412L. The carapace of this form is severely damaged and cannot be accurately described or compared. One adult and one juvenile subfossil valve collected at station AB-407.

**DIMENSIONS.**—Specimen USNM 121143: length of right valve 1.08 mm.

Specimen USNM 121144, length of right valve 1.32 mm, greatest height 0.57 mm, located 0.50 mm from anterior.

**AFFINITIES.**—This form represents another member of the *dispar-intermedia-maculosa* complex within *Propontocypris*. It is more elongate and much more acutely terminated than any other species described thus far, except for *P. (P.) sicula* (Brady). The first and third thoracic legs resemble those of *P. (P.) intermedia* (Brady); other appendages and copulatory organ are like those of *P. (P.) dispar* (Müller).

**DISTRIBUTION.**—Living in grassy carbonate sand flat at Banque de Cinq Mètres near Nosy Bé, depth about 30 m; subfossil at 2125 m in the Mozambique Channel.

Subgenus *Ekpontocypris*, new subgenus

**ETYMOLOGY.**—Greek, *ek-*, out of + *Pontocypris*.

**TYPE-SPECIES.**—*Propontocypris (Ekpontocypris) litoricola*, new species

**DIAGNOSIS.**—Carapace of swollen appearance with rounded contours both in lateral and dorsal view; in lateral view anterior margin very broadly rounded, dorsal margin broadly arched without angle at position of greatest height, posteroventral region obscurely angulate. Muscle-scar pattern a compact aggregate of five wedge-shaped scars, arranged in an anterior vertical arc of three scars and a posterior vertical row of two scars. In dorsal view, broadly swollen sides with greatest thickness at midlength not marked by any angle, anterior and posterior ends gently rounded.

Palps of first thoracic legs of male with thick right-angled terminal hook. Pectinate seta of third thoracic leg with proximal barbs thickened and more widely spaced, one or more may be reduced or vestigial. Ejaculatory organ a very thick tube, only obscurely broadened distally; vas deferens very short and extremely thick; copulatory organ oblong with convex ventral margin, distal margin deeply indented to form

jaw-like outline, with overhanging lateral flap, no copulatory tube or other prominence.

## SPECIES INCLUDED.

- P. (E.) davisoni* (Brady), 1868b
- P. (E.) iquiquensis* (Hartmann), 1962
- P. (E.) pirifera* (Müller), 1894
- P. (E.) robusta* (A. Scott), 1905
- ? *P. (E.) tumida* (A. Scott), 1905
- P. (E.) litoricola*, new species
- P. (E.) mcmurdoensis*, new species
- ? *P. (E. ?) epicyrta*, new species

**AFFINITIES.**—The member species of this subgenus form a cohesive and easily recognizable group on the basis of carapace shape, muscle-scar pattern, and male genitalia. One species assigned here, *P. (E. ?) epicyrta*, new species, is transitional between this subgenus and *P. (Schedopontocypris)* but is placed here on the basis of muscle-scar pattern and copulatory organ structure.

The muscle-scar pattern may be regarded as intermediate between that of *Pontocypris*, *Propontocypris (Propontocypris)*, and *P. (Schedopontocypris)* and that of *Pontocypris* and *Australoecia*. The appendages of *Pontocypris* are considerably specialized and not particularly similar to those of *P. (Ekpontocypris)*.

*Propontocypris (Ekpontocypris) litoricola*, new species*P. (E.) litoricola litoricola*, new subspecies

FIGURES 21; 22; 23A-H; 24I, J, M

Species DC Maddocks, 1966, p. 49, fig. 26.

**ETYMOLOGY.**—Latin *litus*, shore + *-cola*, dweller.

**TYPE-SPECIMENS.**—Holotype USNM 121146, allotype USNM 121147, paratypes USNM 121148-121156, 121248.

**TYPE-LOCALITY.**—Nosy Bé, Madagascar, sample 432 (washings of *Enteromorpha*-like alga growing at low tide level on beach near the village of Ankify, east shore of the Massif d'Ankify, Madagascar mainland near Nosy Bé).

**DIAGNOSIS.**—Carapace smooth, moderately inflated, thickest medially, dorsal margin broadly arched, highest at midlength, anterior and posterior sections of dorsal margin convex, ventral margin slightly indented, anterior margin broadly rounded, narrowly rounded posteroventral angle located below one-fifth height. Marginal zone narrow, with numerous short radial pore canals. Normal pore canals numerous, very small.



FIGURE 20.—*Propontocypris* (*Propontocypris*) species 8, adult male USNM 121143: A, furca; B, antenna; C, antennule; D, third thoracic leg; E, first thoracic leg; F, copulatory organ; G, ejaculatory organ.



FIGURE 21.—*Propontocypris* (*Ekpontocypris*) *litoricola litoricola*, new species and new sub-species: A, maxilla of adult female USNM 121151; B, antenna of adult female USNM 121147; C, mandible of adult male USNM 121150; D, antennule of adult male KU1000034.

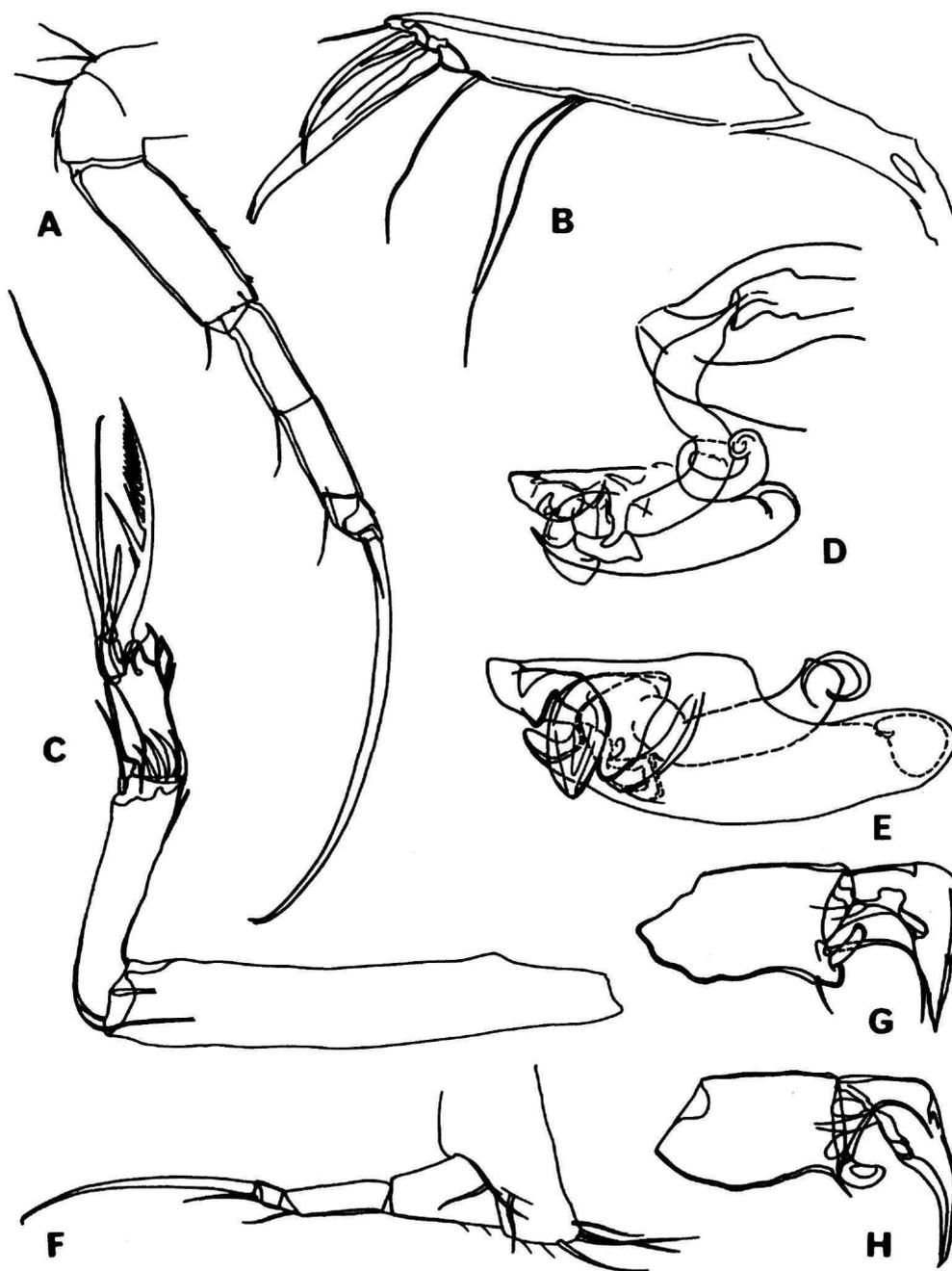


FIGURE 22.—*Propontocypris* (*Ekpontocypris*) *litricola litricola*, new species and new subspecies: A-C, E, G, H, adult male USNM 121146; D, adult male KU1000034; F, adult female USNM 121151; all from Nosy Bé. A, second thoracic leg; B, furca; C, third thoracic leg; D, copulatory organ, vas deferens, and part of ejaculatory duct; E, copulatory organ; F, first thoracic leg; G, right first thoracic leg; H, left first thoracic leg.

Muscle-scar pattern a compact rosette of five subtriangular scars. Living specimen with fairly abundant very short golden setae, carapace translucent white, body pale yellow.

Palps of first thoracic legs in male extremely large, nearly symmetrical, terminal segment thick, right-angled, tapering distally to short finger-like projection, not recurved; basal segment of palp bearing slender tapered median seta, lobate peg, and tiny tapered ventral seta shorter than peg. Third thoracic leg with tapering slender seta half again as long as pectinate seta and about half as thick, second seta only half as long as pectinate seta, third sensory seta slightly spatulate distally and nearly as long as pectinate seta, and coarsely pectinate seta with much enlarged proximal barb separated from other barbs by short gap and followed proximally by very tiny barb. Copulatory organ of male hemiellipsoidal, height/length ratio one-third; dorsal margin straight, ventral margin convex, anterior tip acutely pointed, anteroventral outline deeply notched and retreating beneath tip in beak-like fashion; vas deferens very thick. Testes arranged in thick loop confined to posterior vestibule. Furcal claws of unequal size and shape, distal claw about two-thirds as long as proximal claw and tapering distally, proximal claw more bluntly terminated, both with tiny peripheral barb near tip; distal seta one-third length of distal claw and very thin, proximal and median setae all slender and of graduated length, median seta three-fourths as long as longer proximal seta.

**MATERIAL.**—Mauritius: one adult left valve and two juveniles, all subfossil. Nosy Bé: 95 living specimens, 28 subfossil specimens. Tulear: one adult male living. Ghardaqua: one adult male living, one adult female recently dead.

**DIMENSIONS.**—Adult female (?) specimen USNM 121152 from Mauritius: left valve, length 0.75 mm, height 0.36 mm.

Adult male specimen USNM 121146 from Nosy Bé: left valve, length 0.76 mm, greatest height 0.40 mm, located 0.37 mm from anterior, thickness 0.26 mm; right valve, length 0.78 mm, greatest height 0.41 mm, located 0.38 mm from anterior, thickness 0.24 mm.

Adult female specimen USNM 121147 from Nosy Bé: left valve, length 0.71 mm, greatest height 0.35 mm, located 0.35 mm from anterior, thickness 0.17 mm; right valve, length 0.72 mm, greatest height 0.36 mm, located 0.34 mm from anterior, thickness 0.17 mm.

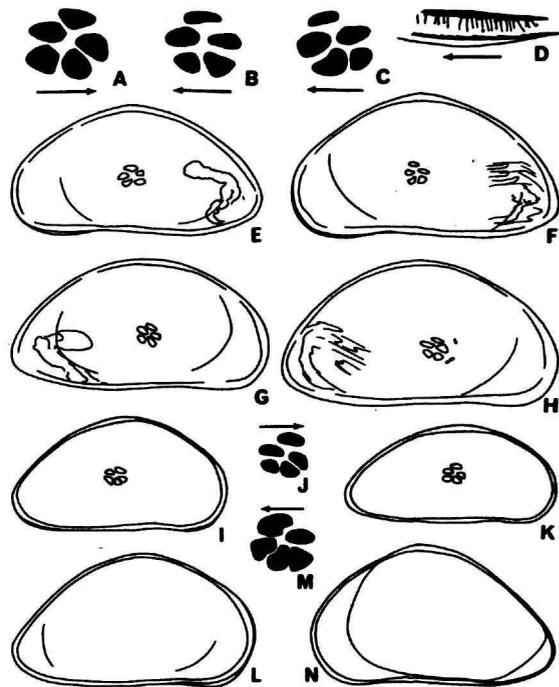


FIGURE 23.—*Propontocypris (Ekpontocypris) littorcola*, new species and *littorcola*, new subspecies: A, C, D, F, H, adult male USNM 121146; B, E, G, adult female USNM 121147; both from Nosy Bé. *Propontocypris (Ekpontocypris) mcMurdoensis*, new species: I, USNM 121161; J, K, USNM 121162; L, USNM 121160; M, USNM 121163; N, USNM 121159.

A-C, J, M, muscle-scar patterns, from exterior; D, left anteroventral marginal area showing radial pore canals; E-I, K, L, N, carapace exteriors.

Adult male specimen USNM 121148 from Tulear: right valve, length 0.63 mm, greatest height 0.42 mm, located 0.23 mm from anterior, thickness 0.21 mm.

Adult male specimen USNM 121149 from Ghardaqua: right valve, length 0.92 mm, greatest height 0.44 mm, located 0.42 mm from anterior, thickness 0.20 mm.

**HABITAT.**—Nosy Bé: abundant in washings of algae and sponges from the intertidal zone at many localities, also in carbonate sand and dead coral fragment accumulations just below low tide level. Tulear: reef sand at 10 m depth. Ghardaqua: washings of algae from low tide level.

**SUBFOSSIL DISTRIBUTION.**—Mauritius: intertidal surface mud. Nosy Bé: infrequent in carbonate and quartz-carbonate reef and intertidal sands, never abundant.

**AFFINITIES.**—The diagnostic characters are based on the Nosy Bé population. The specimens assigned here from Mauritius, Tulear, and Ghardaqua are essentially identical in carapace morphology and, where available, in appendage anatomy.

Two adult male specimens collected from St. Joseph Island, in the Admirante Archipelago, are extremely similar to the Nosy Bé form; however, they are much larger and exhibit several minor differences in ap-

pendage morphology. For these reasons they are assigned to another subspecies.

*Propontocypris (Ekpontocypris) davisoni* (Brady), 1868b, is considerably larger and of less symmetrical outline in lateral view, being slightly higher and more inflated posteriorly.

*Propontocypris (Ekpontocypris) pirifera* (Müller) is very similar in lateral outline but is somewhat larger (length of male=0.86 mm, of female=0.74 mm), differs in oblong outline of male copulatory organ, has brownish color in living male specimens, has thinner terminal hooks and ventral setae exceeding peg in length on palps of first thoracic legs of male, and has sensory seta only two-thirds length of pectinate seta on third thoracic leg.

*Propontocypris (Ekpontocypris) litoricola admirantensis*, new subspecies

FIGURE 24A-H

**ETYMOLOGY.**—For the Admirante Islands.

**TYPE-SPECIMENS.**—Holotype USNM 121157, paratype USNM 121158.

**TYPE-LOCALITY.**—Sample LK-49 (washings of sea grass near reefs), Resource I. near St. Joseph I., Admirante Archipelago.

**MATERIAL.**—Two mature males and one female collected living from station LK-49, Admirante Islands.

**DIMENSIONS.**—Adult male USNM 121157: left valve, length 0.99 mm, greatest height 0.53 mm, located 0.49 mm from anterior, thickness 0.28 mm; right valve, length 1.01 mm, greatest height 0.53 mm, located 0.48 mm from anterior, thickness 0.28 mm.

**DIAGNOSIS.**—This subspecies is extremely similar in carapace shape and appendage morphology to *P. (E.) litoricola litoricola*, new subspecies from Nosy Bé. It differs from this population in the following characters: larger size; one seta of ventrodistal clump on basal podomere of mandibular palp without visible feathering; proximal barb of pectinate seta of third thoracic leg not preceded by tiny vestigial barb, not quite as enlarged, succeeding gap empty or occupied by a much reduced barb; furca with median seta less than half as long as proximal claw; anterior tip of copulatory organ a swollen subquadrangular lobe, lateral flap not extending beneath ventral outline.

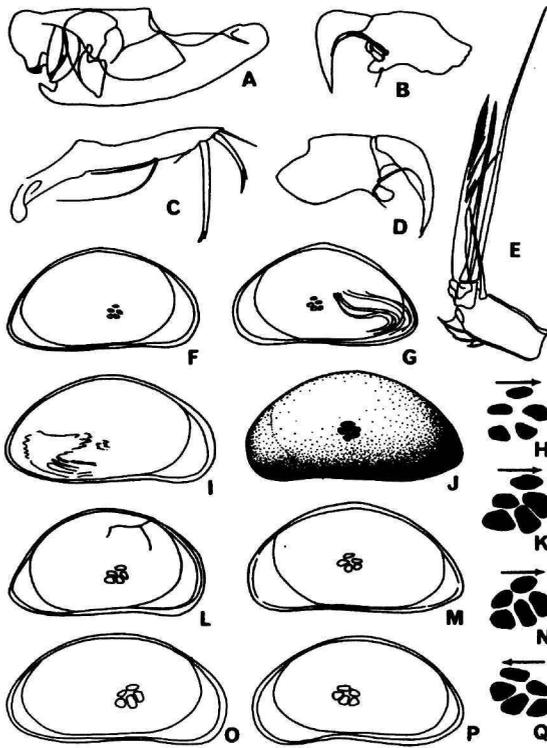


FIGURE 24.—*Propontocypris (Ekpontocypris) litoricola*, *litoricola*, new species and new subspecies: I, adult male USNM 121149 from Ghardaqua; J, M, USNM 121152 from Mauritius. *Propontocypris (Ekpontocypris) litoricola admirantensis*, new species and new subspecies: A-H, adult male USNM 121257 from St. Joseph Island. *Propontocypris (Ekpontocypris)* species 1; K-L, USNM 121172 from AB-412C. *Propontocypris (Ekpontocypris)* species 2; N-Q, USNM 121173 from AB-364A.

A, copulatory organ; B, first thoracic leg; C, furca; D, first thoracic leg; E, distal part of third thoracic leg; F, G, I, J, L, M, O, P, carapace exteriors; H, K, N, Q, muscle-scar patterns, from exterior.

*Propontocypris (Ekpontocypris) mcmurdoensis*,  
new species

FIGURE 23I-N

ETYMOLOGY.—For McMurdo Sound, Antarctica.

TYPE-SPECIMENS.—Holotype USNM 121159, paratypes USNM 121160–121164.

TYPE-LOCALITY.—McMurdo Sound, Antarctica (Station "P," depth 57 m).

DIAGNOSIS.—Carapace very much inflated and highly arched, nearly subtriangular in lateral view, with greatest height located slightly anterior to midlength. Juveniles considerably less high relative to length.

MATERIAL.—Twenty-two subfossil specimens, mostly juveniles, from McMurdo Sound, Antarctica.

DIMENSIONS.—Specimen USNM 121159: left valve, length 0.81 mm, greatest height 0.46 mm, located 0.38 mm from anterior, thickness 0.20 mm.

Specimen USNM 121160: right valve, length 0.81 mm, greatest height 0.44 mm, located 0.37 mm from anterior, thickness 0.20 mm.

AFFINITIES.—This species differs from the only other known Antarctic species, *Propontocypris (Schedopontocypris?) inflata* (Müller), 1908, in the lateral outline of the carapace, the Gauss station species having more broadly rounded anterior and posterior margins. The appendages of *P. (S.) inflata* justify its placement in *Schedopontocypris*, although its carapace curvature is not known; its muscle-scar pattern is apparently of rosette type.

REMARKS.—This completes the roster of ostracode species represented in the McMurdo Sound sample of which the cytheracean species were described by Benson (1964).

*Propontocypris (Ekpontocypris?) epicyrta*,  
new species

FIGURES 25, 26, 27

*Propontocypris(?)* sp. Holden, 1967, p. 18, figs. 11a–b.  
Species DK Maddocks, 1966, p. 51, fig. 30–2.

ETYMOLOGY.—Greek *epikyrtos*, humpbacked.

TYPE-SPECIMENS.—Holotype USNM 121165, paratypes USNM 121166–121171, 121249.

TYPE-LOCALITY.—"Anton Bruun" cruise 7 station 381B, near Walteson Shoal.

DIAGNOSIS.—Carapace smooth, extremely thin,

lacking external setae; dorsal margin highly arched, greatest height located anterior to midlength; ventral margin very deeply indented and sinuous, anterior margin broadly and obliquely rounded, posteroventral margin narrowly rounded; margins compressed, greatest thickness of medial expansion located slightly above midheight. Zone of concrescence very broad, radial pore canals narrow and abundant with many false radial pore canals; line of concrescence irregular; normal pore canals tiny and inconspicuous but abundant. Muscle-scar pattern a compact rosette of five wedge-shaped scars. Carapace yellow and transparent with brown margins, body and appendages yellow, eyes brown.

Palp of maxilla lacking dorsomedian seta on basal podomere, one of distal setae of basal podomere

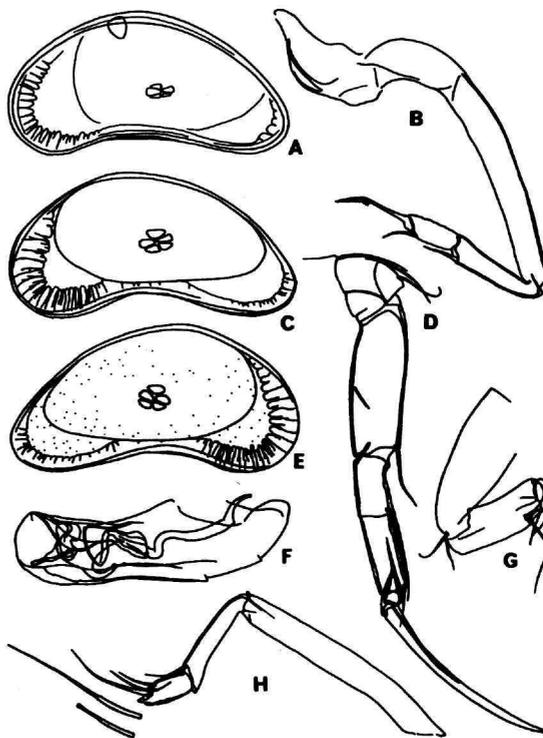


FIGURE 25.—*Propontocypris (Ekpontocypris?) epicyrta*, new species: A, adult male (?) KU 1000047 from Nosy Bé; B–H, adult male USNM 121165 from AB-381B. A, left exterior view of whole specimen showing eye; B, third thoracic leg; C, left exterior view; D, second thoracic leg; E, right exterior view; F, copulatory organ; G, first thoracic leg; H, third thoracic leg.



FIGURE 26.—*Proponotocypris (Ekipontocypris?) epicyrta*, new species, poorly preserved adult male USNM 121165 from AB-381a: A, maxilla and first thoracic leg; B, antennule; C, D, furcae; E, maxilla and base of mandible; F, mandible with palp reversed; G, antenna; H, terminal podomere of antenna showing locations of distal setae.

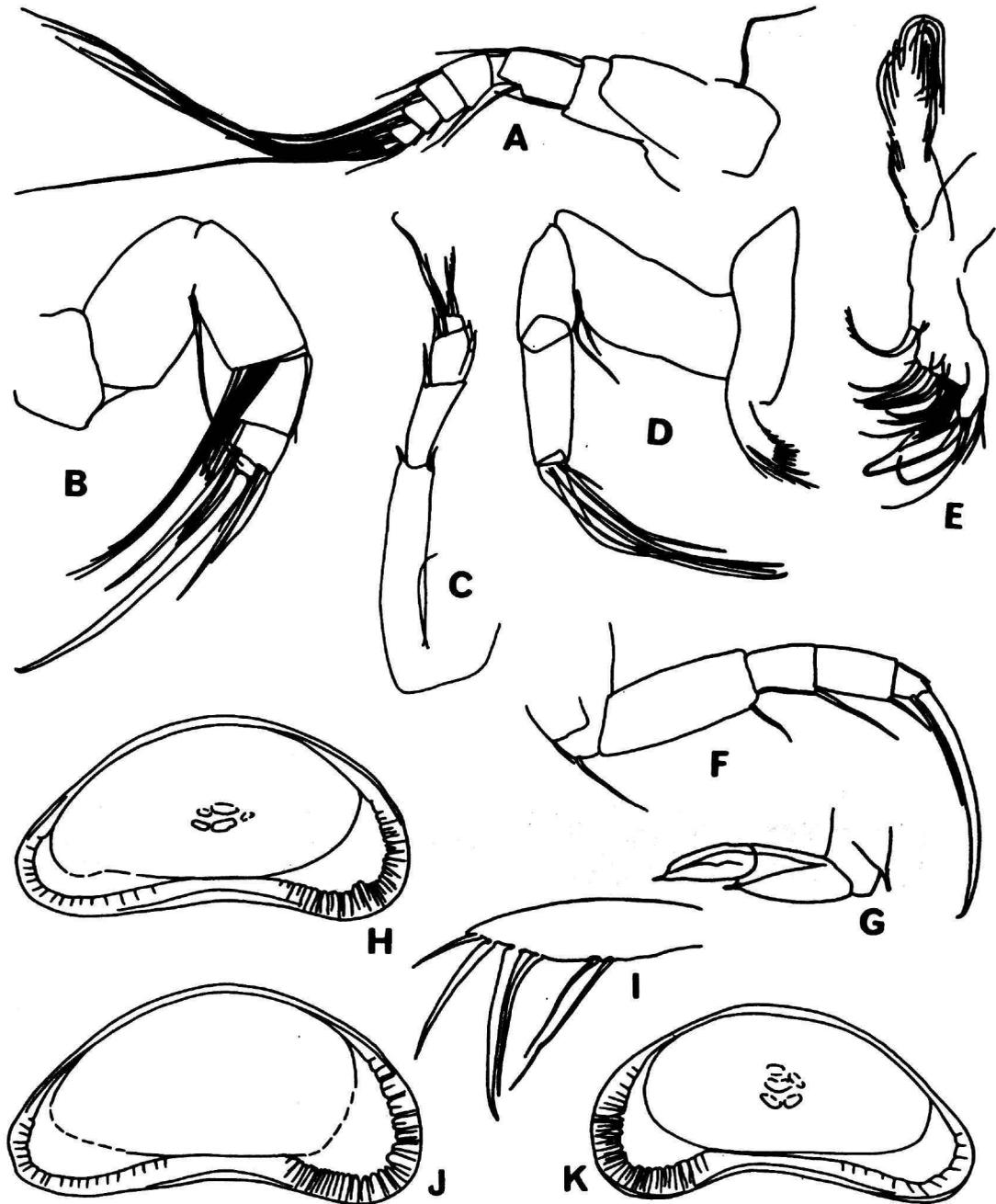


FIGURE 27.—*Propontocypris* (*Ekipontocypris*?) *epicyrta*, new species: A–G, I, juvenile male USNM 121169 from Nosy Bé; H, J, K, subfossil specimens USNM 121168, 121166, 121167, from George Sound, New Zealand. A, antennule; B, antenna; C, third thoracic leg; D, mandible; E, maxilla; F, second thoracic leg; G, first thoracic leg; H, J, K, carapace exteriors; I, furca.

exceptionally long; all setae of palp and masticatory processes long and simple; posterolateral seta of base thick and feathered. Palp of first thoracic leg of male with slender quadrangular basal podomere carrying long thin peg and especially long seta, slender curved hook ending in unusually long digitiform seta. Third thoracic leg with pectinate seta somewhat shorter than usual, finely barbed; lacking lateral cusps on penultimate podomere, lacking spines or setae at knee joint. Copulatory organ of male oblong, bluntly truncated, dorsal and ventral margins slightly concave; lateral flap visible, no copulatory tube seen; vas deferens moderately large.

**MATERIAL.**—Nosy Bé: one adult female (?), one juvenile male, another juvenile living, one subfossil valve. Walteson Shoal, station AB-381B: one adult male with dried remains of appendages. George Sound, New Zealand: one whole carapace and nine valves, all subfossil.

**DIMENSIONS.**—Adult male specimen USNM 121165 from Walteson Shoal: left valve, length 0.75 mm, greatest height 0.37 mm, located 0.29 mm from anterior, thickness 0.13 mm; right valve, length 0.76 mm, greatest height 0.38 mm, located 0.31 mm from anterior, thickness 0.17 mm.

Adult female (?) specimen KU1000047 from Nosy Bé: length 0.57 mm, height 0.29 mm.

Female (?) USNM 121166 from New Zealand: right valve, length 0.76 mm, greatest height 0.40 mm, located 0.34 mm from anterior, thickness 0.17 mm.

Male (?) USNM 121167 from New Zealand: left valve, length 0.70 mm, greatest height 0.36 mm, located 0.28 mm from anterior, thickness 0.14 mm.

Male (?) USNM 121168 from New Zealand: right valve, length 0.72 mm, greatest height 0.37 mm, located 0.32 mm from anterior, thickness 0.14 mm.

**HABITAT.**—Nosy Bé: collected living in washings of two corals and of alga-encrusted valves of the reef-dwelling bivalve *Tridacna*. Walteson Shoal: collected living in sediment at 38 m depth.

**SUBFOSSIL DISTRIBUTION.**—Nosy Bé: known only from a single sample of carbonate beach sand at Antsakoabe. New Zealand: station RM1004, George Sound.

Holden (1967) illustrates a form with identical outline dredged from drowned Neogene terraces in the Hawaiian Islands.

**AFFINITIES.**—This species is conspicuously unlike any other yet named in its reniform outline and well-developed radial pore canals. The aggregate muscle-scar pattern and copulatory organ structure correspond to those of the subgenus *Ekpontocypris*. Several species with comparable shape and visible though shorter radial pore canals are assigned to the subgenus *Schedopontocypris*: *Propontocypris calderensis* Hartmann, 1962; *Pontocypris flava* Müller, 1908; *Pontocypris gausi* Müller, 1908; and *Pontocypris inflata* Müller, 1908. None has these characters in exaggerated condition. *P. (E. ?) epicyrta*, new species, meets none of the requirements for *Schedopontocypris* except the extremely compressed carapace.

The specimens from Nosy Bé and Walteson Shoal are very similar in shape, radial pore canals, and muscle-scar pattern, differing only in the much greater size of the Walteson Shoal specimen. The New Zealand specimens are the same size as the one from Walteson Shoal but differ somewhat in carapace outline, being slightly less elongate and more bluntly rounded posteriorly, and in radial pore canals, these being slightly shorter and with fewer false canals. The muscle-scar pattern of these specimens is obscure but apparently of the same compact rosette type. These differences are not sufficiently pronounced to justify separate names for the geographic variants with so few specimens available.

The characters of appendage morphology noted above are only tentatively established. The appendages figured are those of a juvenile male (USNM 121169) and a mature but dried and fragmentary male (USNM 121165). More precise description and establishment of affinities must await inspection of better preserved material.

#### *Propontocypris (Ekpontocypris) species 1*

FIGURE 24K-L

**MATERIAL.**—A single subfossil right valve from station AB-412c.

**DIMENSIONS.**—Specimen USNM 121172; right valve, length 0.82 mm, greatest height 0.48 mm, located 0.40 mm from anterior, thickness 0.22 mm.

**AFFINITIES.**—Carapace very similar to that of *P. (E.) litoricola*, new subspecies, in size and shape except considerably higher in lateral view.

*Propontocypris (Ektopontocypris) species 2*

FIGURES 7H, 24N-Q

**MATERIAL.**—Three subfossil valves from station AB-364A near Tulear, USNM 121173–121174.

**DIMENSIONS.**—Specimen USNM 121173; right valve, length 0.70 mm, greatest height 0.36 mm, located 0.35 mm from anterior, thickness 0.18 mm.

**AFFINITIES.**—Carapace similar to that of *P. (E.) litoricola*, new subspecies, but smaller overall and relatively not as high, dorsal margin more nearly horizontal.

**Subgenus *Schedopontocypris*, new subgenus**

**ETYMOLOGY.**—Greek *schedon*, almost + *Pontocypris*.

**TYPE-SPECIES.**—*Pontocypris gausi* Müller, 1908, p. 98, pl. 13: figs. 14–18.

**DIAGNOSIS.**—Carapace small, very much compressed, suboval in lateral outline with broadly rounded anterior and posterior margins, broadly arched dorsal margin without distinct angle at highest point; in dorsal outline sizes only slightly curved and not angulate, anterior and posterior ends gently rounded. Muscle-scar pattern intermediate between discrete (as in *Propontocypris*) and compact (as in *Ektopontocypris*); zone of concrescence rather wide with visible and often rather numerous radial pore canals.

Antennule may show some degree of fusion between podomeres-4 and -5. Antenna may have "swimming setae" much shortened. "Peg" of first thoracic leg of male small and slender, set considerably posterior to terminal hook. Barbs of pectinate seta of third thoracic leg numerous and slender, regularly diminishing, none accentuated; longest terminal seta also more or less visibly pectinate; distal seta of podomere-3 much thickened and displaced to a more proximal margin. Distal seta of furca somewhat enlarged, median seta also moderately enlarged. Testes form loop in posterior vestibule and extend anteriorly along venter but do not form anterior spiral. Copulatory organ variably oblong and irregular in outline, with bluntly rounded anterior margin, convex ventral margin; copulatory tube absent or short, other prominences generally absent. Vas deferens narrow, ejaculatory organ tubular with only slightly thickened ends.

**REMARKS.**—This is a less coherent group than *P. (Propontocypris)* or *P. (Ektopontocypris)*. In some

features, muscle-scar pattern for example, it is transitional between these two subgenera; in other respects it is characterized as much by the variability represented as by any consistent trends.

**SPECIES INCLUDED.**—Insofar as their anatomy is known, the following species agree with each other and with the subgeneric diagnosis above:

- P. (S.) calderensis* (Hartmann), 1962
- P. (S.) flava* (Müller), 1908
- P. (S.) gausi* (Müller), 1908
- P. (S.) howei* (Puri), 1953
- P. (S.) inflata* (Müller), 1908

The following species are placed provisionally in this subgenus on the basis of their carapace shape, but they share among themselves several discrepant characters of the third thoracic leg and copulatory organ:

- P. (S.) declivis* (Müller), 1894
- P. (S.) levis* (Müller), 1894
- P. (S.) pellucida* (Müller), 1894
- P. (S.) subfusca* (Müller), 1894
- P. (S.) succinea* (Müller), 1894

The following species are placed here on the basis of carapace shape, the internal anatomy being at present unknown:

- P. (S.?) simplex* (Brady), 1880
- P. (S.) bengalensis*, new species

***Propontocypris (Schedopontocypris?) simplex* (Brady), 1880**

FIGURES 7D, 8O

*Pontocypris simplex* Brady, 1880, p. 37, pl. 1: fig. 5a-d.

Not *Pontocypris simplex* Brady.—Chapman, 1919, p. 18; 1941, p. 194.

Not *Propontocypris simplex* (Brady).—Holden, 1967, p. 17: fig. 10a-b.

**MATERIAL.**—A single whole carapace containing dried appendages, probably a male, in the "Challenger" collection of the British Museum (Natural History), Catalog no. 81.5, slide no. 10, from Ascension Island. It corresponds well with the illustration by Brady (1880, pl. 1: fig. 5a-d).

**AFFINITIES.**—This species has been assigned to *Schedopontocypris* on the basis of its carapace shape. Its anatomical characters are unknown, and the apparently compact-aggregate muscle-scar pattern is difficult to see. The carapace of this species is very similar to those of three other species from Simonstown and New

Zealand (*P. (S.)* species 1, 2, and 3), none of which can be unquestionably identified with it. The form reported from 1300 fms east of Tasmania (Chapman, 1919) and from southeast Australia at 505 fms (Chapman, 1941) has a distinctly different carapace outline and belongs to another species. The Hawaiian form illustrated by Holden (1967) is more acutely terminated but apparently closely related.

*Propontocypris (Schedopontocypris) bengalensis*,  
new species

FIGURE 31A, C, F

ETYMOLOGY.—For the Bay of Bengal.

TYPE-SPECIMENS—Holotype USNM 121175, paratypes USNM 121176–121181.

TYPE-LOCALITY.—“Anton Bruun” cruise 1, station 41.

DIAGNOSIS.—Carapace very small, compressed; sub-oval in lateral outline, with greatest height located anterior to midlength but not marked by any angle; anterior margin very broadly rounded, posterior margin somewhat less broadly rounded, ventral margin straight, dorsal margin gently arched. Muscle-scar pattern not seen, opaque spot a large central elongate oblong. Carapace yellow. Juveniles are very small, milk-white in color or transparent, and relatively more inflated. Some specimens are more elongate than others, showing probable dimorphism.

MATERIAL.—Fifty-one subfossil specimens from “Anton Bruun” stations 40, 41, 47, 87κ, in the Bay of Bengal and LK-12 at Galle, Ceylon.

DIMENSIONS.—USNM 121175 from station AB-41: left valve, length 0.52 mm, greatest height 0.27 mm, located 0.25 mm from anterior, thickness 0.11 mm; right valve, length 0.53 mm, greatest height 0.28 mm, located 0.24 mm from anterior, thickness 0.13 mm.

AFFINITIES.—Of the several species of *Schedopontocypris* represented in these collections, *P. (S.) bengalensis* is the most abundant and widely distributed. It is entirely distinctive in its tiny size and nearly oval shape.

*Propontocypris (Schedopontocypris) species 1*

FIGURES 28; 31P, Q

MATERIAL.—A single adult male specimen collected living at station GIL 615 near Simonstown, South

Africa; a single subfossil valve at station GIL 341, South Africa.

DIMENSIONS.—Specimen USNM 121182: left valve, length 0.68 mm, greatest height 0.33 mm.

Specimen USNM 121183: left valve, length 0.68 mm, greatest height 0.33 mm, located at 0.31 mm from anterior, thickness 0.13 mm.

AFFINITIES.—The soft parts of this species incorporate all the characters which I regard as diagnostic of the subgenus *Schedopontocypris*. It differs from *P. (S.) flava* (Müller, 1908) in having long, slender, gently curved terminal hooks on the palps of the male first thoracic legs, and lacking any dorsodistal conical prominence on the copulatory organ. From *P. (S.) simplex* (Brady) it differs by slightly larger size, less posterior elongation, and location of greatest height more nearly median.

From *P. (S.) gaussi* (Müller) it differs only slightly in the outline of the copulatory organ, which is ventrodistally indented with a small overhanging flap, and in having very tiny “pegs” on the palps of the first thoracic legs of the male. These being very tiny differences, it is possible that examination of better preserved and more abundant material may lead to the identification of this form with *P. (S.) gaussi* (Müller).

*Propontocypris (Schedopontocypris) species 2*

FIGURE 31G, K, L

MATERIAL.—Two subfossil specimens from station GIL 341, four subfossil specimens from station GIL 617, South Africa; USNM 121184–121187.

DIMENSIONS.—Specimen USNM 121184 from GIL 617: left valve, length 0.70 mm, greatest height 0.35 mm, located 0.26 mm from anterior, thickness 0.17 mm; left valve, length 0.70 mm, greatest height 0.35 mm, located 0.27 mm from anterior, thickness 0.17 mm.

AFFINITIES.—Very similar in size and shape to *P. (S.?) simplex* (Brady), but not as high, venter horizontal, posterior more narrowly rounded. These proportions are very like those illustrated for *P. (S.) flava* (Müller), although no radial pore canals are visible.

*Propontocypris (Schedopontocypris?) species 3*

FIGURES 7G, 29, 30

?*Propontocypris* species McKenzie, 1967, p. 67, fig. 2g.

MATERIAL.—A single adult male collected living at Eltanin 1431, New Zealand.



FIGURE 28.—*Profontocypris* (*Schedopontocypris*) species 1, adult male USNM 121182: A, C, first thoracic leg; B, left exterior of damaged carapace; D, furca; E, copulatory organ; F, antennule; G, antenna; H, second thoracic leg; I, J, third thoracic leg.

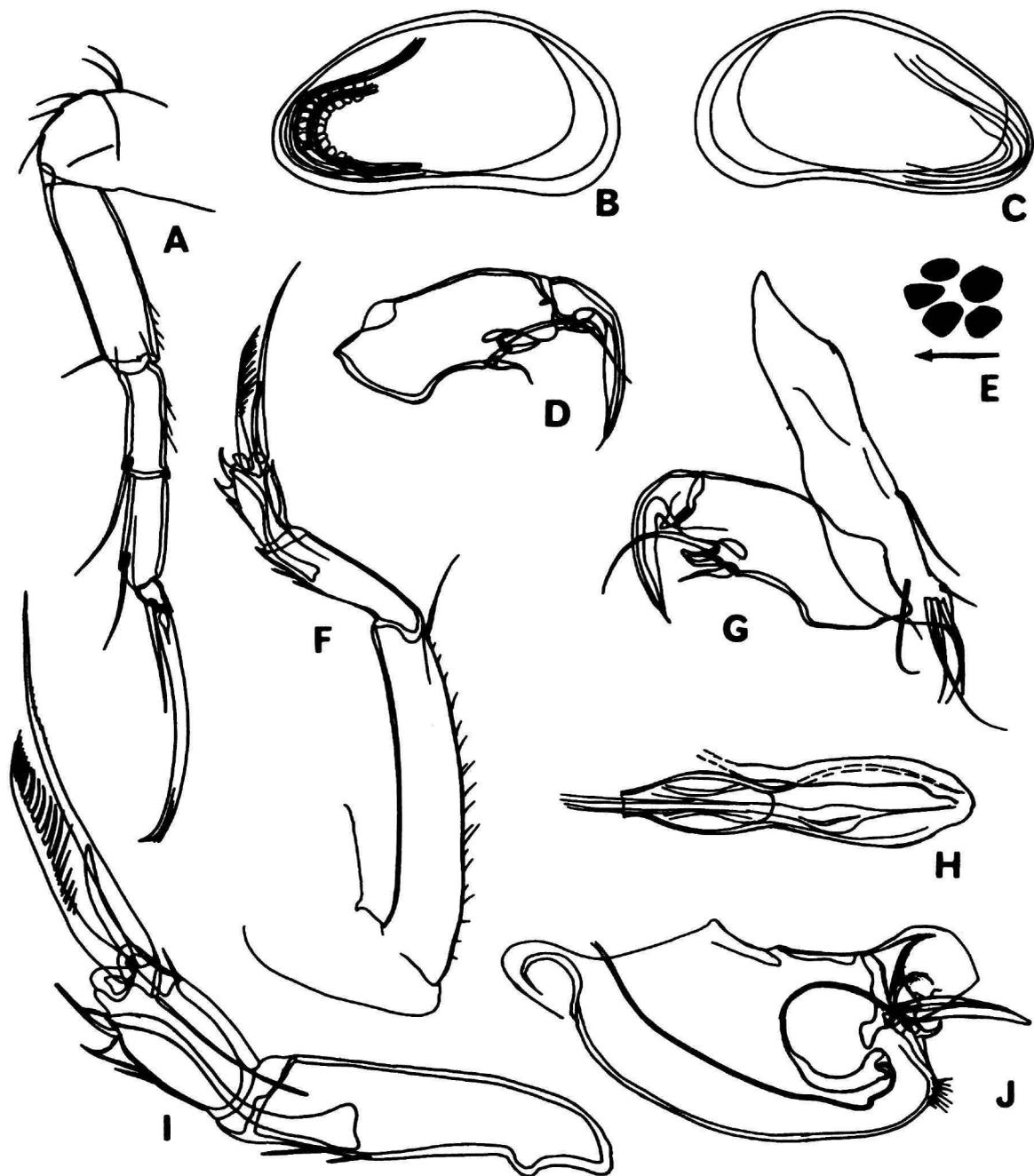


FIGURE 29.—*Propontocypris* (*Schedopontocypris*?) species 3, adult male USNM 12118: A, second thoracic leg; B, C, carapace exterior views showing position of testes; D, G, first thoracic leg; E, left exterior muscle-scar pattern; F, I, third thoracic leg; H, ejaculatory organ; J, copulatory organ.

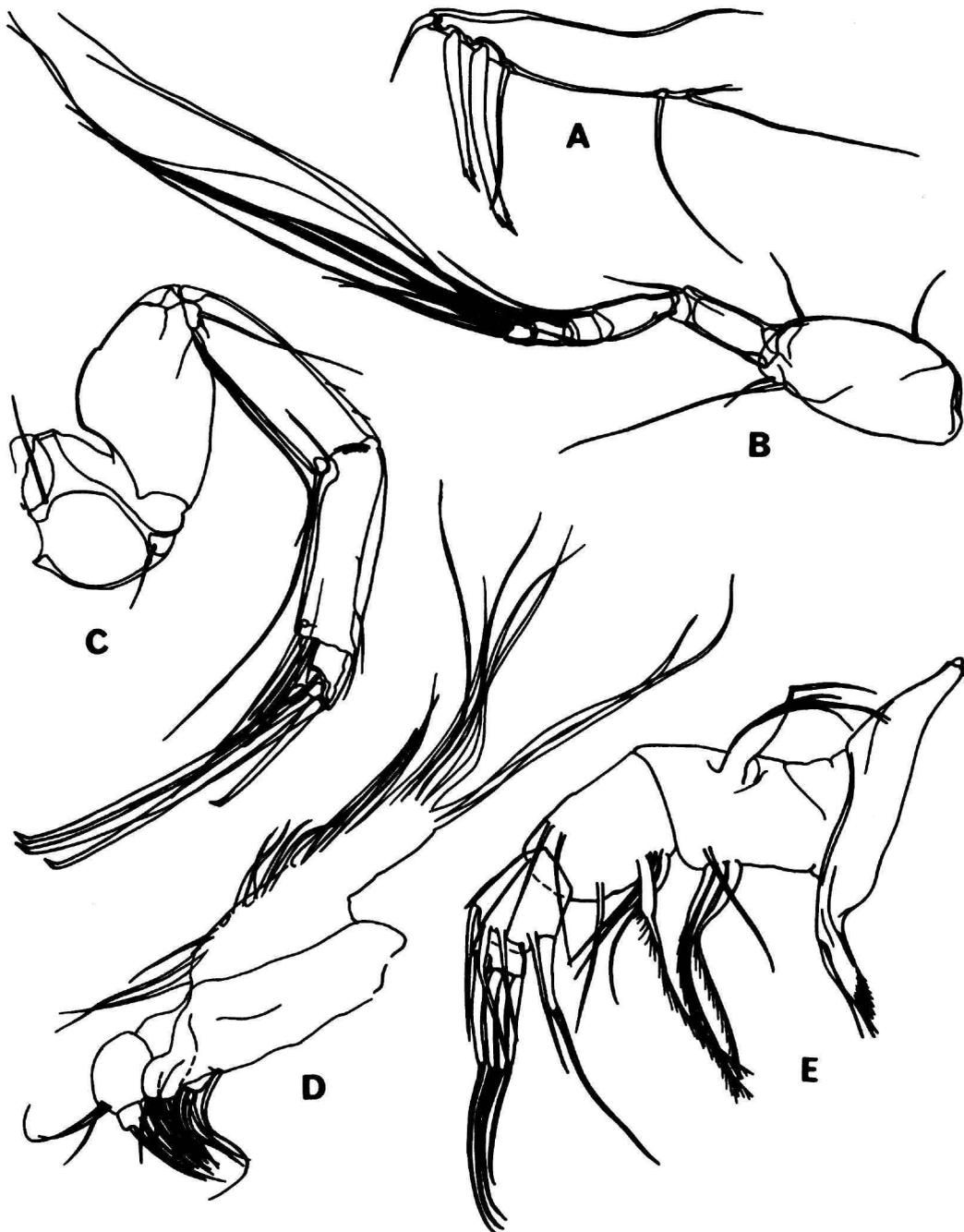


FIGURE 30.—*Propontocypris* (*Schedopontocypris* ?) species 3, adult male USNM 121188: A, furca; B, antennule; C, antenna, long swimming setae not drawn but origins indicated; D, maxilla; E, mandible.

**DIMENSIONS.**—Adult male USNM 121188: left valve, length 0.62 mm, greatest height 0.32 mm, located 0.27 mm from anterior, thickness 0.15 mm; right valve, length 0.63 mm, greatest height 0.33 mm, located 0.26 mm from anterior, thickness 0.15 mm.

**AFFINITIES.**—Carapace very similar to that of *P. (S.)* species 1 but slightly smaller overall and with greatest height distinctly anterior to midlength, anterior margin broadly rounded.

Soft-part structures very different from those of *P. (S.)* species 1: podomeres 4 and 5 of antennule not fused; "swimming setae" of antenna fully developed and longer than claws; first thoracic leg of male with medium-sized pegs and small ventral seta; copulatory organ of male with dorsodistal quadrangular protuberance, short coiled copulatory tube, median distal blade-like projection, and ventrodistal clump of about three tiny setae.

Carapace slightly larger and relatively higher than that of *P. (S.?) simplex* (Brady), posterior end somewhat more broadly rounded.

Carapace and third thoracic leg of female very similar to those illustrated for *P. (S.) calderensis* (Hartmann), for which only the female is known; furcal claws of the latter are of equal size and evenly tapering, anterior setae short and thick, median seta ringed.

The species from Ricketts Point, Port Phillip Bay, Australia, illustrated by McKenzie (1967), is extremely similar in shape but somewhat smaller (length 0.54 mm). Although identified as a juvenile, the illustrated specimen has the full inner lamella and thus is probably mature.

#### *Propontocypris (Schedopontocypris?)* species 4

FIGURE 31E, H, M, N

**MATERIAL.**—Two subfossil specimens from station AB-87I in the Bay of Bengal, USNM 121189–121190.

**DIMENSIONS.**—Specimen USNM 121189: left valve, length 0.53 mm, greatest height 0.28 mm, located 0.26 mm from anterior; right valve, length 0.54 mm, greatest height 0.29 mm, located 0.24 mm from anterior.

**AFFINITIES.**—Although equal to *P. (S.) bengalensis* in size, color, and compression of carapace, this form has a subtriangular lateral outline that corresponds better to the subgenus *Propontocypris*.

#### *Propontocypris (Schedopontocypris?)* species 5

FIGURE 31I, J

**MATERIAL.**—Nine subfossil specimens from "Anton Bruun" stations 36A, 41, 87F, 87K, 87N, 88 in the Bay of Bengal; USNM 121191–121196.

**DIMENSIONS.**—Specimen USNM 121191, from station AB-87K: right valve, length 0.59 mm, greatest height 0.27 mm, located 0.20 mm from anterior.

**AFFINITIES.**—Except for its small size, the carapace of this form is very like that illustrated by Sars (1925) for the female of *P. (Propontocypris) trigonella* (Sars).

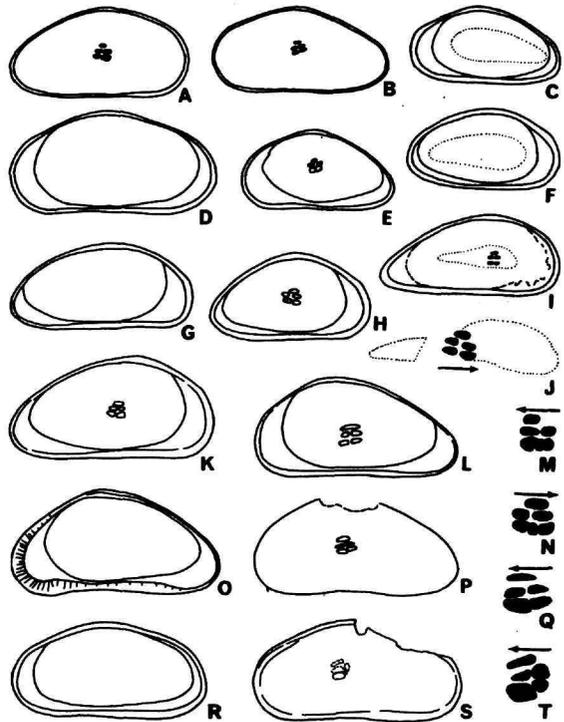


FIGURE 31.—*Propontocypris (Schedopontocypris) bengalensis*, new species: A, B, juvenile USNM 121176; C, F, adult USNM 121183. *Propontocypris (Schedopontocypris)* species 2: D, USNM 121185; E, L, USNM 121184. *Propontocypris (Schedopontocypris?)* species 4: G, H, M, N, USNM 121189. *Propontocypris (Schedopontocypris?)* species 5: I, J, USNM 121191. *Propontocypris (Schedopontocypris?)* species 6: O, USNM 121197. *Argilloecia?* species 5: R, USNM 121230; S, T, USNM 121231. *Propontocypris (Propontocypris?)* species 4: O, USNM 121137. All exterior views.

*Proponocypris* (*Schedopontocypris*?) species 6

FIGURE 31D

**MATERIAL.**—Seven subfossil specimens from “Anton Bruun” stations 40 and 87I in the Bay of Bengal; USNM 121197–121199.

**DIMENSIONS.**—Specimen USNM 121197 from station AB-40: left valve, length 0.56 mm, greatest height 0.28 mm, located 0.28 mm from anterior, thickness 0.12 mm.

**AFFINITIES.**—Carapace larger than *P. (S.) bengalensis* and more fragile, oblong and symmetrical in lateral outline, with greatest height almost exactly at midpoint, dorsal margin very gently arched, anterior and posterior margins extremely broadly and almost equally curved; muscle-scar pattern five scars in three discrete rows.

Genus *Pontocypris* Sars, 1866

*Pontocypris* Sars, 1866 [part], p. 13.—Brady and Norman, 1889, p. 107 [part].—Sylvester-Bradley, 1947, p. 193.—Van Morkhoven, 1963, p. 72.

*Erythrocypris* Müller, 1894, p. 256; 1912, p. 114.—Sars, 1923, p. 50.—Sylvester-Bradley, 1947, p. 193.

**TYPE-SPECIES.**—*Cythere (Bairdia) mytiloides* Norman, 1862, p. 43 [= *Cythere avena* Norman, 1865; *Pontocypris serrulata* Sars, 1866; *Erythrocypris serrata* Müller, 1894]; by Brady and Norman, 1889.

**DIAGNOSIS.**—Carapace equivalved, subtriangular in lateral view, strongly compressed in dorsal view; posterior end drawn out and acutely pointed, dorsal margin angulate, greatest height and thickness located considerably anterior to midlength; posteroventral margin of right valve serrate; posterior course of inner margin diverging from parallelism with outer margin and rising steeply to posterodorsal corner. Muscle-scar pattern with five small scars arranged in three widely separated nearly horizontal rows.

First antenna may be 7-segmented by fusion of podomeres-4 and -5. First podomere of endopodite of mandible with two setae on ventral margin. Palps of first thoracic legs in male very large and distinctly asymmetrical. Pectinate seta of third thoracic leg longer than two subequal smaller setae. Furca with two subequal claws, tiny apical seta, three short and slender posterior setae. Testes forming a spiral in each posterior cavity; connecting tube makes a loop crossing spiral in right valve. Ovaries arranged in simple arc. Ejaculatory organ slender, S-shaped. Eyes lacking.

**REMARKS.**—The diagnostic characters listed above are those visible in the drawings of Sars (1923) and Müller (1894). No reliably identifiable species belonging to this genus are present in the Indian Ocean collections studied. The seven species referred below to this genus are few in number, poorly preserved, and lacking soft parts; they are tentatively assigned to *Pontocypris* chiefly on the basis of lateral outline.

**INCLUDED SPECIES.**—By original binomen.

*Erythrocypris acuminata* Müller, 1894  
*Erythrocypris discrepans* Müller, 1894  
*Erythrocypris frequens* Müller, 1894  
*Pontocypris hispida* Sars, 1866  
*Cythere (Bairdia) mytiloides* Norman, 1862  
*Erythrocypris obtusa* Müller, 1894  
*Erythrocypris pallida* Müller, 1894  
*Erythrocypris rara* Müller, 1894

*Pontocypris* species 1

FIGURE 32F-H

**MATERIAL.**—A single subfossil left valve from station GIL 615, South Africa; a single subfossil right valve, very tentatively identified with the former, from station AB-412c.

**DIMENSIONS.**—Specimen USNM 121200 from South Africa: left valve, length 0.78 mm, greatest height 0.36 mm, located 0.26 mm from anterior, thickness 0.15 mm.

Specimen USNM 121201 from Madagascar: right valve, length 0.70 mm, greatest height 0.33 mm, located 0.23 mm from anterior.

**AFFINITIES.**—The lateral outline of the left valve, with its pronounced posterodorsal angle, nearly horizontal dorsal margin, and upswing posteroventral portion, is very similar to that of *P. discrepans* (Müller), with which it also agrees in the rather compact muscle-scar pattern. The right valve agrees in general size and shape with the left but is not sufficiently distinctive to be identified with either this or any other species of *Pontocypris*.

*Pontocypris* species 2

FIGURE 32A, B

**MATERIAL.**—Four subfossil specimens from station GIL 615, South Africa; USNM 121202–121203.

**DIMENSIONS.**—Specimen USNM 121202: left valve, length 0.84 mm, greatest height 0.35 mm, located 0.24 mm from anterior.

**AFFINITIES.**—The shape of this form is very like that illustrated for *P. acuminata* (Müller) from the Bay of Naples.

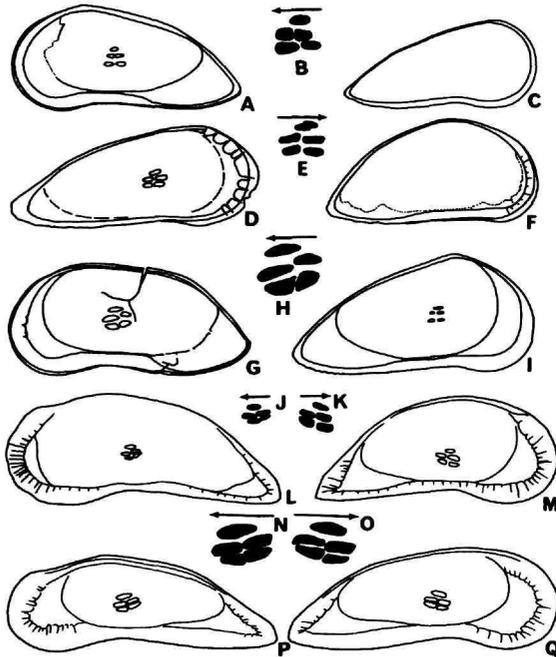


FIGURE 32.—*Pontocypris* species 1: F, USNM 121201; G, H, USNM 121200. *Pontocypris* species 2: A, B, USNM 121202. *Pontocypris* species 3: C, USNM 121204. *Pontocypris* species 4: USNM 121206. *Pontocypris* species 5: D, E, USNM 121208. *Pontocypris* species 6: J, L, USNM 121211 from AB-361A; K, M, USNM 121212 from AB-407; N-Q, USNM 121213 from AB-380A. All exterior views.

### *Pontocypris* species 3

FIGURES 7C, 32C

**MATERIAL.**—Three subfossil juvenile specimens from station AB-363L near Tulear, Madagascar; USNM 121204–121205.

**DIMENSIONS.**—Specimen USNM 121204: left valve, length 0.85 mm, greatest height 0.39 mm, located 0.15 mm from anterior; right valve, length 0.87 mm, greatest height 0.41 mm, located 0.16 mm from anterior.

**AFFINITIES.**—Specimens assigned to this category are all juveniles with extremely high and broadly rounded anterior margin and steeply sloping and angulate dorsal margin.

### *Pontocypris* species 4

FIGURE 32I

**MATERIAL.**—Three subfossil specimens from station GIL 348, South Africa; USNM 121206–121207.

**DIMENSIONS.**—Specimen USNM 121206: right valve, length 0.84 mm, greatest height 0.40 mm, located 0.26 mm from anterior, thickness 0.12 mm.

**AFFINITIES.**—These specimens are somewhat larger, more elongate, and much more angulate in outline than those of *P. species* 2, which occurs nearby in False Bay, South Africa.

### *Pontocypris* species 5

FIGURE 32D, E

**MATERIAL.**—Two subfossil specimens from stations AB-43 and AB-87M in the Bay of Bengal, one subfossil specimen from station AB-407 in the Mozambique Channel; USNM 121208–121210.

**DIMENSIONS.**—Specimen USNM 121208, from station AB-43: right valve, length 0.82 mm, greatest height 0.33 mm, located 0.20 mm from anterior.

**AFFINITIES.**—The extremely acuminate outline without distinct posterodorsal angle and with greatest height located very near anterior end is equally characteristic of *Pontocypris* and of certain species of *Propontocypris*, such as *P. (P.) attenuata* (Brady). The long and very much thickened radial pore canals have not been described for any other species of *Pontocypris*.

### *Pontocypris?* species 6

FIGURE 32J-Q

**MATERIAL.**—Eight subfossil specimens from “Anton Bruun” stations 361B, 380A, and 407A in the Mozambique Channel; USNM 121211–121216.

**DIMENSIONS.**—Specimen USNM 121213: left valve, length 0.87 mm, greatest height 0.32 mm, located 0.31 mm from anterior; right valve, length 0.89 mm, greatest height 0.34 mm, located 0.29 mm from anterior.

Specimen USNM 121212: right valve, length 0.79 mm, greatest height 0.36 mm, located 0.30 mm from anterior.

Specimen USNM 121211: left valve, length 0.89 mm, greatest height 0.36 mm, located 0.34 mm from anterior.

**AFFINITIES.**—Carapace rather sturdier than preceding species, transparent; outline, widened marginal

zone with numerous radial pore canals, caudate posterior, and general aspect all conformable to *Paracypridinae* but the conspicuous muscle-scar pattern is of the basic pontocyprid type. Posteroventral margin of the right valve not serrate. Two distinct outlines are represented among these specimens, a highly arched (female?) form with rounded dorsal contours and a lower (male?) form with more angular dorsal margin. This species probably does not belong to *Pontocypris*.

### Genus *Argilloecia* Sars, 1866

*Argilloecia* Sars, 1866, p. 17.—Brady, 1880, p. 29.—Brady and Norman, 1889, p. 111.—Müller, 1894, p. 260; 1912, p. 117.—Sars, 1923, p. 53.—Van Morkhoven, 1963, p. 76.

TYPE-SPECIES.—*Argilloecia cylindrica* Sars, 1866, p. 18.

DIAGNOSIS.—Carapace usually fairly small, smooth, moderately inflated, oblong; greatest height less than half length, located either before or behind midlength; posteroventral angle often rather distinctly right-angled, may carry a very long seta. Inner margin typically very irregular, zone of concrescence irregularly broad and traversed by moderately abundant radial pore canals, those along the ventral margin curved and of variable length, anterior and posterior vestibules very deep. Muscle-scar pattern consists of the usual five pontocyprid scars arranged in a distinctive compact grouping of three long scars in an anterior vertical row, adjoined closely behind by two subquadrate scars in a much shorter vertical row. Right valve overlaps left, often very conspicuously larger; ridge just below dorsal margin of left valve inserts into strong hinge groove of right valve.

Eye lacking. Antennule very robust, with podomeres-4 and -5 fused, all setae in female and most setae in male very short, male with a pair of longer setae on each of podomeres-6 and -7. Antennae of most species with very much reduced "swimming setae"; a few species have extremely long swimming setae present in the male only. Mandible with three ventrodistal setae on podomere-1 of palp. First thoracic legs of male nearly symmetrical. Second thoracic legs often with setae of terminal podomere much enlarged to resemble a second claw in shape and size. Furca without distal seta. Copulatory organ oblong in outline, bluntly terminated distally, vas deferens medium-sized, may have coiled copulatory tube (diagnosis based on illustrations of Müller, 1894).

SPECIES INCLUDED.—Recent species for which soft parts have been described.

*Argilloecia acuminata* Müller, 1894  
*Argilloecia anceps* Rome, 1942  
*Argilloecia bulbifera* Müller, 1894  
*Argilloecia caudata* Müller, 1894  
*Argilloecia conoidea* Sars, 1923  
*Argilloecia cylindrica* Sars, 1866  
*Argilloecia eburnea* Brady, 1880  
*Argilloecia levis* Müller, 1894  
*Argilloecia minor* Müller, 1894

AFFINITIES.—At least two general morphologic types are represented among species assigned to this genus, and they probably deserve to be distinguished as subgenera (Van Morkhoven, 1963). The typical form is a delicate elongate carapace with very narrow zone of concrescence, wide continuous vestibule, and short simple radial pore canals. (*A. cylindrica* Sars, *A. species 2*, probably also *A. eburnea* Brady. More abundant are slightly more robust forms of sinuous outline with irregularly widened ventral fused marginal zone, restricted vestibules, and long curving radial pore canals.

### *Argilloecia eburnea* Brady, 1880

FIGURES 8c, 33r

*Argilloecia eburnea* Brady, 1880, p. 40, pl. 4: figs. 1–15.—Chapman, 1910, p. 428; 1919, p. 20.

MATERIAL.—One left valve, designated lectotype by Puri (1968); in slide 113 of the "Challenger" collection (Brady, 1880) of the British Museum (Natural History), labeled *Argilloecia eburnea* Brady, n[epth] 20–50 [fms], Balfour Bay [Kerguelen Island], catalog no. 80.38.9.

Two valves, probably of the same specimen, tentatively assigned to this species, in slide 158 of the "Challenger" collection of the British Museum (Natural History), labeled *Macrocypris tumida* "young" Brady, Challenger no. 149, Royal Sound [Kerguelen Island].

AFFINITIES.—The gently arched dorsal margin and rounded contours of the carapace are very similar to those of *Macrocypris*, as is the circular opaque spot in the anteriomedial region of the Royal Sound specimens, but the muscle-scar pattern is clearly that of *Argilloecia*. The inner lamella is broad with wide and open vestibules and narrow marginal fused zone. *A. tumida* Brady is smaller and relatively more elongate, with irregularly widened ventral fused zone.

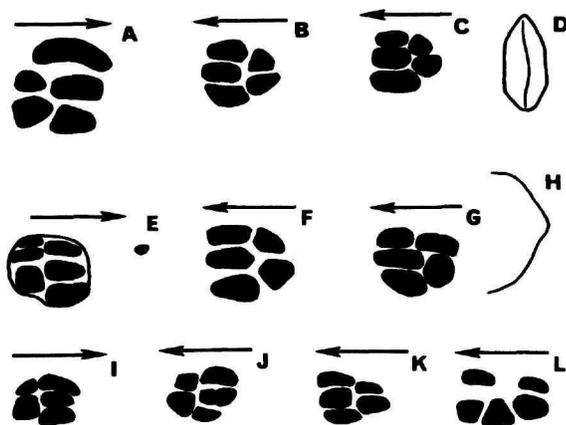


FIGURE 33.—Muscle-scar patterns of eight "Challenger" species assigned to *Argilloecia* and *Pontocypris*: A, *Argilloecia obtusata* (Brady), 1880, lectotype; B, *Argilloecia* species 4; C, D, *Argilloecia* species 7, from Royal Sound; E, *Argilloecia clavata* (Brady), 1880, USNM 121227 from East Cape; F, *Argilloecia clavata* (Brady), 1880, lectotype; G, H, *Argilloecia pusilla* (Brady), 1880, muscle-scar pattern and posterior lateral outline of "Challenger" lectotype; I, *Argilloecia eburnea* (Brady), 1880, from Royal Sound; J, *Argilloecia clavata* (Brady), 1880, from Royal Sound; K, *Argilloecia tumida* (Brady), lectotype; L, *Pontocypris meridionalis* (Brady), 1880, lectotype.

### *Argilloecia clavata* (Brady), 1880

FIGURES 8A; 33E, F, J

*Aglaia clavata* Brady, 1880, p. 34.—Chapman, 1910, p. 426.

**MATERIAL.**—A single whole carapace in slide 4 of the "Challenger" collection (Brady, 1880) of the British Museum (Natural History), labeled *Aglaia clavata* Brady, Wellington Harbor, New Zealand; designated lectotype by Puri (1968). The specimen is intact and opaque; no normal pore canals, radial pore canals, or other internal structures are visible.

Two valves, apparently belonging to the same specimen, included in "Challenger" slide 158, labeled *Macrocypris tumida* "young" Brady, but not conspecific with any of the other specimens in this slide; from Royal Sound, Kerguelen Island.

A single right valve (USNM 121227) from station RM1001 near East Cape, New Zealand.

**DISTRIBUTION.**—Wellington Harbor, and near East Cape, New Zealand; Royal Sound, at 28 fms depth, Kerguelen Islands; at 1050 fms in dredgings near Funafuti (Chapman, 1910).

**AFFINITIES.**—The East Cape specimen has the usual

scar of *Argilloecia* preserved as distinctly as on the lectotype; to it are added a third posterodorsal scar and an apparent frontal scar, which are somewhat differently expressed and less conspicuously marked than the other scars.

### *Argilloecia pusilla* (Brady), 1880

FIGURES 8H; 33G, H

*Aglaia*(?) *pusilla* Brady, 1880, p. 34.—(?) Chapman, 1919, p. 17.

**MATERIAL.**—A single disarticulated specimen from slide 7 of the "Challenger" collection (Brady, 1880) of the British Museum (Natural History), labeled *Aglaia pusilla* Brady, D[epth] 38 [fms], off E. Moncoeur Is., Bass Strait; designated lectotype by Puri (1968).

**DISTRIBUTION.**—Depth 38–40 fms off East Moncoeur Island, Bass Strait; (?) southeast of Tasmania in 1300 fms (Chapman, 1919); (?) at "Aurora" stations 29 and 139, Antarctica, at 125 and 328 fms depth (Chapman, 1919).

**REMARKS.**—The published illustrations of Brady (1880, pl. 30: fig. 6a–d) are curiously inaccurate: the conspicuous overlap of right valve over left is not mentioned by him in the text, and the overlap illustrated is left over right; in the right lateral view (mis-labeled as left) the rather straight dorsal margin is illustrated with considerable anterior slope.

### *Argilloecia obtusata* (Brady), 1880

FIGURES 8E, 33A

*Aglaia*(?) *obtusata* Brady, 1880, p. 35.—Chapman, 1910, p. 426; (?) Chapman, 1915, p. 34; 1916b, p. 71.

**MATERIAL.**—A single intact carapace in slide 6 of the "Challenger" collection (Brady, 1880) of the British Museum (Natural History) labeled *Aglaia obtusata* Brady, D[epth] 20–50 [fms], Balfour Bay [Kerguelen Island]; designated lectotype by Puri (1968). It is opaque, no internal structures are visible.

**DISTRIBUTION.**—Depth 20–50 fms in Balfour Bay, Kerguelen Island; 1050 fms near Funafuti (Chapman, 1910); 121 fms in the Ross Sea (Chapman, 1916b).

**AFFINITIES.**—It seems likely that the form reported by Chapman (1915) as "common and typical" at 100 fms depth, south of Spencer Gulf, Australia, and identified as *Aglaia obtusata* Brady is identifiable either with *Australoecia mckenziei*, new species (p. 49), or with an undescribed species of *Aglaiocypris* with simi-

lar outlines, both of which are abundant constituents of the beach sand subfossil assemblage at nearby Thistle Island.

REMARKS.—The illustrations by Brady (1880, pl. 30: fig. 8a-d) are curiously reversed and exaggerated. The conspicuous overlap of right valve over left is mentioned by Brady in the text description, but the illustrated overlap is clearly left over right. The left lateral outline lacks the seam resulting from this overlap. In dorsal view the tapering of the anterior end is much exaggerated.

### *Argilloecia tumida* (Brady), 1880

FIGURES 8, 33k

*Macrocypris tumida* Brady, 1880, p. 43, pl. 6: fig. 2a-d.

MATERIAL.—One whole carapace in slide 114 of the "Challenger" collection, British Museum (Natural History) catalog no. 80.38.17, labeled no. 149, Royal Sound [Kerguelen Island]; designated lectotype by Puri (1968).

AFFINITIES.—The muscle-scar pattern of this specimen is clearly that of *Argilloecia*; the deep anterior vestibule and the irregularly widened ventral portion of the fused marginal zone with scattered curved radial pore canals show that this belongs to the second group within *Argilloecia* for which a second generic name should probably be established.

### *Argilloecia* species 1

FIGURE 34i-m

MATERIAL.—A single whole carapace from station AB-363L, near Tulear, Madagascar; a single valve from AB-714c off the coast of Chile; USNM 121226, 121228.

DIMENSIONS.—Specimen USNM 121228 from AB-363L: left valve, length 0.65 mm, greatest height 0.28 mm, located 0.30 mm from anterior; right valve, length 0.67 mm, greatest height 0.31 mm, located 0.20 mm from anterior.

DESCRIPTION.—Carapace small but moderately robust, lateral outline and inner margin very sinuous, posteroventral angle prolonged to a slight peak in right valve; fused marginal zone very wide ventrally, anterior and posterior vestibules very deep, anterior radial pore canals numerous and straight, anterior margin denticulate.

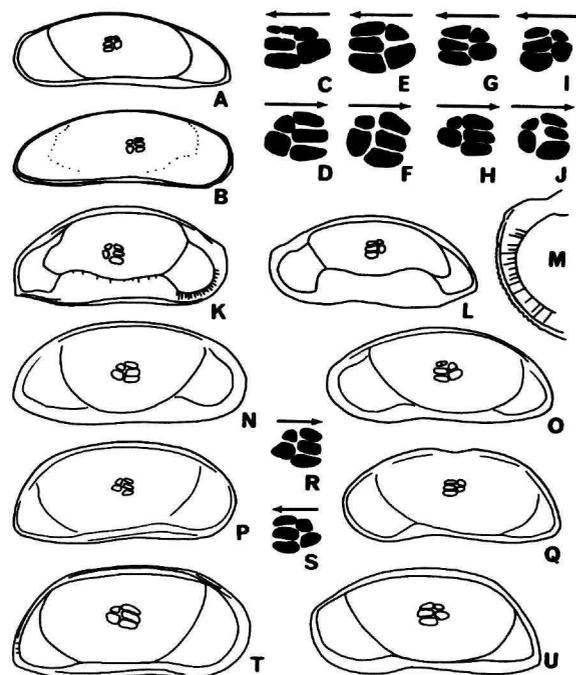


FIGURE 34.—*Argilloecia* species 1: i-m, USNM 121228. *Argilloecia* species 2: A, B, E, F, USNM 121229. *Argilloecia* species 3: P, R, USNM 121219; Q, S, USNM 121220. *Argilloecia* species 6: C, D, N, O, USNM 121218. *Argilloecia* species 7: G, H, T, U, USNM 121217. All exterior views.

AFFINITIES.—*A. acuminata* Müller has a similarly sinuous outline but is very much more elongate.

### *Argilloecia* species 2

FIGURE 34A, B, E, F

MATERIAL.—A single whole specimen with dried appendage fragments from station AB-87k in the Bay of Bengal. Its inner lamella is extremely delicate, but it is apparently mature.

DIMENSIONS.—Specimen USNM 121229: left valve, length 0.49 mm, greatest height 0.17 mm, located 0.23 mm from anterior; right valve, length 0.50 mm, greatest height 0.18 mm, located 0.16 mm from anterior.

DESCRIPTION.—Carapace tiny and fragile, extremely elongate, somewhat inflated; anterior margin broadly rounded, dorsal and ventral margins gently arched and subparallel, narrowly rounded posterior end. Fused

marginal zone very narrow and regular, vestibule not constricted. Muscle scars arranged rather discretely but in the generic pattern.

**AFFINITIES.**—Few other species of *Argilloecia* possess such a narrow and regular zone of concrescence; however, the carapace outlines, the overlap, and the muscle-scar pattern are those typical of *Argilloecia*.

### *Argilloecia* species 3

FIGURE 34P-S

**MATERIAL.**—Four subfossil specimens from “Albatross” stations 3360 and 4693 in the southeast Pacific; USNM 121219, 121220, 121225.

**DIMENSIONS.**—Specimen USNM 121220; left valve, length 0.65 mm.

Specimen USNM 121219: right valve, length 0.65 mm, greatest height 0.31 mm, located 0.34 mm from anterior.

**AFFINITIES.**—Distinguished from similarly oblong species by larger size, relatively higher subquadrate carapace, simple marginal zone, and very slightly up-turned simple posterior angle; a member of the typical group within *Argilloecia*.

### *Argilloecia* species 4

FIGURE 33B

**MATERIAL.**—A single intact carapace included in slide 160 of the “Challenger” collection of the British Museum (Natural History), labeled *Argilloecia eburnea* Brady, depth 120 [fms] off Xmas Harbor [Kerguelen Island]. It is an intact male containing dried soft parts, not conspecific with other specimens (see *A. species 7*) on this slide.

**AFFINITIES.**—Its elongate subcylindrical shape distinguishes it easily from *A. eburnea* Brady. The distinct muscle-scar pattern is that of *Argilloecia*.

### *Argilloecia* ? species 5

FIGURE 31R, S, T

**MATERIAL.**—Two subfossil specimens from AB-239A and Tahrut Bay in the Persian Gulf region; USNM 121230–121231.

**DIMENSIONS.**—Specimen USNM 121230 from Tahrut Bay: left valve, length 0.64 mm, greatest height 0.39 mm, located 0.33 mm from anterior, thickness 0.13 mm.

**AFFINITIES.**—Carapace extremely similar to that of *Propontocypris* (*Schedopontocypris*?) species 6 but very slightly more elongate and somewhat more robust. Muscle-scar pattern obscure but apparently more similar to that of *Argilloecia* than any other, consisting of an anterior vertical row of three scars and a posterior row of two scars, compactly grouped.

### *Argilloecia* species 6

FIGURE 34C, D, N, O

**MATERIAL.**—Three subfossil specimens at “Anton Bruun” stations 380A, c; USNM 121218, 121221, 121224.

**DIMENSIONS.**—Specimen USNM 121218, from AB-380A: left valve, length 0.70 mm, greatest height 0.31 mm, located 0.34 mm from anterior; right valve, length 0.69 mm, greatest height 0.29 mm, located 0.34 mm from anterior.

**AFFINITIES.**—The elongate-oblong lateral outline with rounded posterior and rather compressed carapace in dorsal outline separate this species both from *A. eburnea* Brady and from *Argilloecia* species 1 and 7 of the Mozambique Channel.

### *Argilloecia* species 7

FIGURES 7A; 33C, D; 34G, H, T, U

**MATERIAL.**—Nine subfossil specimens from “Anton Bruun” stations 361B, 363L; USNM 121217, 121222, 121223.

Two valves, probably of the same specimen, and one whole carapace, in slide 160 of the “Challenger” collection (Brady, 1880) of the British Museum (Natural History), labeled *Argilloecia eburnea* Brady, depth 120 [fms] off Xmas Harbor [Kerguelen Island]. Another specimen also included in this slide belongs to a separate species, identified as *Argilloecia* species 4.

**DIMENSIONS.**—Specimen USNM 121217 from AB-363L, right valve, length 0.57 mm, greatest height 0.27 mm, located 0.24 mm from anterior, thickness 0.11 mm; left valve, length 0.55 mm, greatest height 0.25 mm, located 0.26 mm from anterior, thickness 0.14 mm.

**AFFINITIES.**—The lateral outline of this form is somewhat like that of *Argilloecia* species 1, which occurs in the same sample near Tulear; it is distinguished by its nearly straight dorsal margin, even marginal

zone, and simple rounded posterodorsal angle. The specimen from Tular (USNM 121217) is somewhat smaller and more acutely terminated than the "Challenger" specimens. The lectotype of *A. eburnea* has a broadly arched dorsal margin and lateral outline generally reminiscent of *Macrocyprina*.

### Genus *Australoecia* McKenzie, 1967

*Australoecia* McKenzie, 1967, p. 67.

**TYPE-SPECIES.**—*Australoecia victoriensis* McKenzie, 1967, p. 68, figs. 2f, 7j-m.

**DIAGNOSIS.**—Carapace variable in size but always grossly inflated and very robust; shape varies from perfect ovoid to elongate-subcylindrical. Exterior smooth, valve overlap conspicuous and inconsistent, either left or right valve may be the larger. Muscle-scar pattern a radiate rosette of five wedge-shaped scars, pattern intermediate between those of *Proponotocypris* (*Ekpnotocypris*) and *Pontocypris*.

**SPECIES INCLUDED.**—The following Recent species may be assigned to *Australoecia* at present.

*Australoecia victoriensis* McKenzie, 1967

*Australoecia abyssophilia*, new species

*Australoecia mckenziei*, new species

### *Australoecia mckenziei*, new species

FIGURE 35K-P

**ETYMOLOGY.**—For K. G. McKenzie, who first recognized this paradoxical genus.

**TYPE-SPECIMENS.**—Holotype USNM 121232, paratypes USNM 121233-121236.

**TYPE-LOCALITY.**—Whaler's Bay, Thistle Island, Spencer Gulf, South Australia.

**DIAGNOSIS.**—Carapace very large and exceedingly robust, egg-shaped, of variable sizes and proportions best explained by sexual dimorphism; left valve conspicuously larger than and overlapping right valve; approximately oval in lateral and dorsal outlines but with posterior portion somewhat more swollen; anterior vestibule very small, marginal zone very broad with many radial pore canals; muscle-scar pattern a loose aggregate of five scars in roughly radial arrangement.

**DIMENSIONS.**—Specimen USNM 121232: left valve, length 0.99 mm, greatest height 0.45 mm, located 0.48 mm from anterior, thickness 0.26 mm.

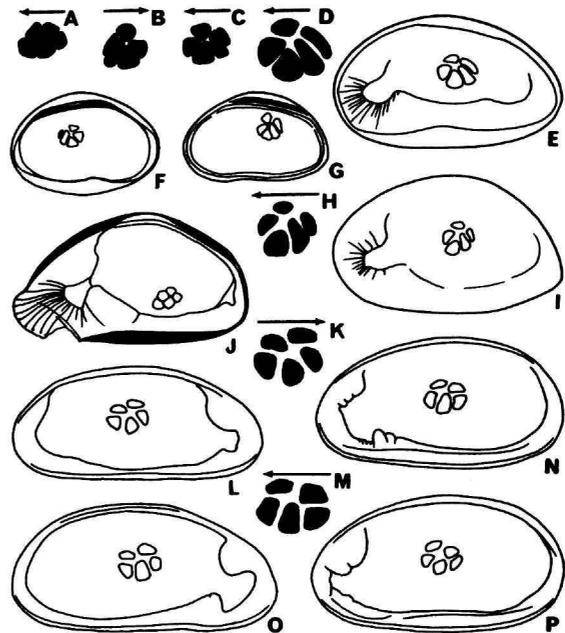


FIGURE 35.—*Australoecia mckenziei*, new species: K, L, USNM 121235; M, N, USNM 121232; O, USNM 121234; P, USNM 121233. *Australoecia abyssophilia*, new species: B, G, USNM 121238; C, F, USNM 121239; D, E, 121237; H, I, USNM 121240. *Australoecia* species 1: A, J, USNM 121247. A, F, G, J, interior views; B-E, H, I, K-P, exterior views.

Specimen USNM 121233: left valve, length 1.00 mm, greatest height 0.53 mm, located 0.43 mm from anterior, thickness 0.24 mm.

Specimen USNM 121234: right valve, length 1.10 mm, greatest height 0.50 mm, located 0.49 mm from anterior, thickness 0.25 mm.

Specimen USNM 121235: right valve, length 0.99 mm, greatest height 0.45 mm, located 0.40 mm from anterior, thickness 0.21 mm.

**MATERIAL.**—More than 40 subfossil specimens in beach sand.

**AFFINITIES.**—*Australoecia victoriensis* McKenzie is much smaller (0.65, 0.59 mm length), rather more elongate in lateral view, has right valve larger than and overlapping left, and has no known sexual dimorphism. The overlap of left valve over right that is possible in this genus is well displayed in *A. mckenziei* but not to as exaggerated an extent as in some other species.

It is possible that this species was recorded by Chapman (1915) from south of Cape Wiles, Australia, as *?Aglaila obtusata* Brady.

*Australoecia abyssophilia*, new species

FIGURES 7i, 35B-I

ETYMOLOGY.—Greek *abyssos*, the deep sea + *philios*, loving.

TYPE-SPECIMENS.—Holotype USNM 121237, paratypes USNM 121238–121245.

TYPE-LOCALITY.—“Anton Bruun” cruise 7 station 363G.

DIAGNOSIS.—Carapace extremely robust, yellowish white color; shape ovoid with varying proportions, left valve much larger than and overlapping right valve and of rounder outlines. Well-developed hinge consisting in right valve of straight bar with overlying “accommodation groove,” in left valve of deep straight groove with overlying incised shelf. Larger forms with widened marginal zone and deep restricted anterior vestibule; more abundant smaller forms (juveniles?) with narrow regular marginal zone and no vestibules. Muscle-scar pattern very large, located dorsomedially, consisting of a very compact arrangement of five triangular scars.

MATERIAL.—Forty subfossil specimens from “Anton Bruun” stations 363 G, K, 356D, 380A, 397D, and 407 in the Mozambique Channel and “Albatross” 2763 in the western Atlantic.

DIMENSIONS.—Specimen USNM 121237: left valve, length 0.92 mm, greatest height 0.53 mm, located 0.40 mm from anterior.

Specimen USNM 121240: left valve, length 0.93 mm, greatest height 0.56 mm, located 0.47 mm from anterior.

Specimen USNM 121239: left valve, length 0.59 mm, greatest height 0.40 mm, located 0.34 mm from anterior.

Specimen USNM 121238; right valve, length 0.60 mm, greatest height 0.36 mm, located 0.31 mm from anterior.

*Australoecia* species 1

FIGURE 35A, J

MATERIAL.—One subfossil specimen from “Albatross” station 4693 in the southeast Pacific.

DIMENSIONS.—Specimen USNM 121247: right valve, length 0.52 mm, greatest height 0.29 mm, located 0.22 mm from anterior.

AFFINITIES.—The flange-like projection of the compressed anteroventral region is a unique feature, as are

the ventral position and honeycomb-texture arrangement of the muscle scars.

Genus *Pontocypria* Müller, 1894

*Pontocypria* Müller, 1894, p. 255; 1912, p. 117.—Maddocks 1968, p. 123.

TYPE-SPECIES.—*Pontocypria spinosa* Müller, 1894.

AFFINITIES.—This genus has been described at some length elsewhere (Maddocks, 1968) and little more need be said here. Its distinctive muscle-scar pattern (Figures 6D, 32L) and suboval outline, as well as peculiar internal characters, distinguish this group easily from other pontocyprids.

INCLUDED SPECIES.—The following Recent species are known:

- Pontocypria spinosa* Müller, 1894 (Bay of Naples)  
*Pontocypria helenae* Maddocks (commensal on asteroids, Antarctica)  
*Pontocypria humesi* Maddocks (Nosy Bé, Madagascar)  
*Pontocypria meridionalis* (Brady), 1869 (Falkland Islands)

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