Myodocopid Ostracoda from the Late Permian of Greece and a Basic Classification for Paleozoic and Mesozoic Myodocopida

LOUIS S. KORNICKER
and
J.G. SOHN
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Myodocopid Ostracoda from the Late Permian of Greece and a Basic Classification for Paleozoic and Mesozoic Myodocopida

Louis S. Kornicker
and I.G. Sohn

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ABSTRACT

Komicker, Louis S., and I.G. Sohn. Myodocopid Ostracoda from the Late Permian of Greece and a Basic Classification for Paleozoic and Mesozoic Myodocopida. Smithsonian Contributions to Paleobiology, number 91, 33 pages, 22 figures, 2000.—Four new genera and six new species are described from the top of the Episkopi Formation (Dorashamian) on the island of Hydra, Greece: Cypridinelliforma rex (new species), Nodophilomedes phoenix (new genus, new species), Swainella bex (new genus, new species), Triadocypris pax (new species), Siveterella pax (new genus, new species), Siveterella flex (new species), and Sylvesterella (new genus), based on specimens in the collection from Greece. Supplementary descriptions are presented of Philomedes rankiniana (Jones and Kirkby, 1867) and Eocypridina radiata (Jones and Kirkby, 1874).

A basic classification proposed for Paleozoic and Mesozoic Myodocopida includes a new suborder, three new superfamilies, and three new families.
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Myodocopid Ostracoda from the Late Permian of Greece and a Basic Classification for Paleozoic and Mesozoic Myodocopida

Louis S. Kornicker and I.G. Sohn

Introduction

Fossils of Permian myodocopid ostracodes are sparse in the geologic record (Kellett, 1935:132). The Permian ostracodes described herein are from the top of the Episkopi Formation (Dorashamian) (USNM localities 9260, 9262) on the island of Hydra, Greece (Sohn and Kornicker, 1998). This formation contains an excellent record of Late Permian life in the western Tethys Sea that may have lived in a calm, low-energy environment behind protecting algal reefs (Grant et al., 1991:493).

Carapaces of some of the Permian myodocopids in the collection appear to be morphologically more similar to those of Holocene taxa than do the carapaces of previously described Silurian to Carboniferous myodocopids. Because of this, we expanded our study of the Permian myodocopids from Greece to include a basic classification for some Paleozoic and Mesozoic myodocopids.

METHODS.—Discussions of methods, carapace measurements, samples, stratigraphy and paleoecology were described in Sohn and Kornicker (1998:1-2) and are not repeated herein. Length, height, or width measurements followed by an asterisk (*) indicate the measurement was based on the illustration; otherwise these measurements were taken using an optical micrometer and were based on the specimen.

Central adductor muscle scar patterns legitimately are used to discriminate taxa. Fossil myodocopids, however, rarely have preserved muscle scars; this presents a problem when attempting to relate specimens having preserved scars with those not having scars. Therefore, in taxonomic keys presented herein, we do not use muscle scar patterns. In order to make our classification of greater use to taxonomists attempting to identify unknowns, some taxa that we were unable to separate even broadly in a key have been synonymized.

DISPOSITION OF SPECIMENS.—Permian specimens have been deposited in the Department of Paleobiology, National Museum of Natural History (NMNH), Smithsonian Institution (under the acronym USNM for the former United States National Museum, which collections are now housed in the NMNH).

ABBREVIATIONS.—The following abbreviations are used in legends and text.

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>av</td>
<td>anterior view</td>
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<tr>
<td>dv</td>
<td>dorsal view</td>
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<tr>
<td>H</td>
<td>height</td>
</tr>
<tr>
<td>iv</td>
<td>inside view</td>
</tr>
<tr>
<td>L</td>
<td>length</td>
</tr>
<tr>
<td>LV</td>
<td>left valve</td>
</tr>
<tr>
<td>lv</td>
<td>lateral view</td>
</tr>
<tr>
<td>pv</td>
<td>posterior view</td>
</tr>
<tr>
<td>RV</td>
<td>right valve</td>
</tr>
<tr>
<td>vv</td>
<td>ventral view</td>
</tr>
<tr>
<td>W</td>
<td>width</td>
</tr>
<tr>
<td>*</td>
<td>shell measurement based on micrograph</td>
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ACKNOWLEDGMENTS.—The samples were collected by Richard E. Grant (NMNH, deceased) and Rex A. Doescher (NMNH). The process of leaching was headed by Doescher. The scanning electron micrographs are by W.R. Brown (NMNH). We thank Elizabeth Harrison-Nelson (NMNH) for general assistance, Molly Ryan (NMNH) for lettering plates, and Jack Korytowski (Smithsonian Institution Press) for final editing and preparation of the manuscript for publication.
Classification

The new suborder Paleomyodocopina is proposed herein for taxa having a subcentral node on each valve. The known range of the Paleomyodocopina is Devonian to Permian, whereas the known range of the Myodocopina is Silurian to Recent. The suborders are assumed to have a common ancestry. The absence of post-Paleozoic Paleomyodocopina is interpreted herein as indicating that the suborder became extinct at the end of the Permian.

In an attempt to relate the extant and fossil Myodocopina, fossil Myodocopina are subdivided herein into the same three superfamilies comprising the Holocene Myodocopina: Cypridinacea, Sarsiellacea, and Cylindroleberidacea (Kornicker, 1986a, fig. 113). We have attempted herein to discriminate fossil superfamilies by selecting characters on the carapaces of the fossils that hold for most species in extant superfamilies. The fossil Myodocopina are referred to a particular Holocene superfamily on the basis of similarities in their carapace morphology. Unfortunately, within extant Myodocopina, which are classified mainly on the basis of appendage morphology, the carapaces of species within each superfamily have a wide range of shapes, ornamentation, and adductor muscle attachment scar patterns, which to some extent overlap between the superfamilies. Because of this, many fossils cannot be placed with certainty into a particular superfamily simply on the basis of carapace morphology, yet, with rare exceptions, this is all that is available. Errors in classification caused by the overlap of characters is a common problem in discriminating taxa.

Except for the presence of a subcentral node, the carapaces of many taxa referred to the Paleomyodocopina resemble those of fossil Myodocopina; we interpret the similarities to be parallelism. Nevertheless, in an attempt to relate fossil Myodocopina and Paleomyodocopina, we have assumed that carapace similarities between the taxa of each suborder are meaningful, possibly due to similarities in behavior and/or ecological requirements. The Paleomyodocopina are subdivided herein into three superfamilies, each having similarities with a superfamily in the Myodocopina (Table 1).

Our proposed classification includes mainly fossils whose similarity with extant taxa permitted the assumption that they are related. Many Paleozoic taxa that, in our opinion, do not closely resemble extant forms, have been previously referred to the Myodocopina (Siveter et al., 1987; Siveter and Vannier, 1990, fig. 16). Examples of such taxa include Rhombina Jones and Kirkby, 1874 (R. hibernica Jones and Kirkby, 1874, and R. belgica Jones and Kirkby, 1874), Bolbozoe Barrande, 1872, and Entomozoe Pribyl, 1950. Our omission of such taxa from the proposed classification is not intended to infer that they are not Myodocopina, rather, the consideration of those taxa is outside the scope of the present effort. We offer the present classification as a base to which other taxa may be added.

Superorder MYODOCOPA Sars, 1866

Composition.—The superorder Myodocopa includes the orders Myodocopida and Halocyprida (Kornicker and Sohn, 1976:3, fig. 2). The Halocyprida includes the suborders Cladocopina and Halocypridina. Whatley et al. (1993:350) included in the order Myodocopa the suborders Myodocopina, Halocyprina, and Cladocopina. We herein include within the Myodocopa the new suborder Paleomyodocopina. Only the Myodocopa (sensu Kornicker and Sohn, 1976:3) and the equivalent Myodocopia (sensu Whatley et al., 1993:350) are treated herein.

Diagnosis.—Carapace extremely variable: rostrum and incisor developed or undeveloped; dorsal margin either arched or straight; valves strongly or weakly calcified, either smooth or ornamented with diverse processes. Appendages: with either 5 or 7 appendages (excluding copulatory organs); 2nd antennae adapted for swimming, and with exopod larger and with many more segments than endopod; 7th limb short, worm-like, or absent; paired furca flat, plate-like, sclerotized with rows of claws, and located posterior to anus. Male copulatory appendage single or double. Paired lateral compound eyes present or absent.

Most synapomorphies defining extant members are not shell characters, but the fossil shells included in the Myodocopa have shell characters like those of the extant Myodocopa.

Range.—Silurian to Holocene.

Order MYODOCOPIDA Sars, 1866

Composition.—The Myodocopida includes the suborders Myodocopina and Paleomyodocopina, new suborder.

Diagnosis.—Carapaces generally larger and not as ovate as those of the Cladocopina; carapaces generally more strongly calcified and with more arcuate dorsal margins than those of the Halocypridina. Myodocopida differing from Cladocopina in having 7 rather than 5 limbs (excluding copulatory organ),

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Table 1.—Equivalent1 superfamilies2 and families in the Paleomyodocopina and the Myodocopina.

<table>
<thead>
<tr>
<th>PALEMYODOCOPINA</th>
<th>MYODOCOPINA</th>
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<tr>
<td>CYPRIDINELLIFORMACEA</td>
<td>CYPRIDINACEA</td>
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<tr>
<td>Cypridinelliformidae</td>
<td>Cypridinidae</td>
</tr>
<tr>
<td>NODOPHILOMEDACEA</td>
<td>SARSIELLACEA</td>
</tr>
<tr>
<td>Nodophilomedidae</td>
<td>Philomedidae</td>
</tr>
<tr>
<td>SWAINELLACEA</td>
<td>CYLINDROLEBERIDACEA</td>
</tr>
<tr>
<td>Swainellidae</td>
<td>Cylindroleberididae</td>
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1. The nontaxonomic term equivalent as used herein identifies taxa within the two suborders having similarities in carapace morphology.
2. The ending "-oidea" is usually preferred for superfamilies by Zoologists, and the ending "-acea" by Paleontologists (Sohn, 1984). Recommendation 29A in the International Code of Zoological Nomenclature (1985:55) recommended "that the suffix -OIDEA be added to the stem for the name of a superfamily." We have used "acea" in the present paleontological paper to conform with other similar papers.
from Halocypridina in having a worm-like 7th limb, and from both taxa in the male having paired copulatory organs. Lateral eyes possibly present in Myodocopa but absent in Cladocopa and Halocypridina.

**Key to Suborders of the Myodocopida**

Carapace with subcentral node [node replaced by a backward-directed dorsal protuberance in the genus *Sulcuna*] ............................................ **PALEOMYODOCOPINA**, new suborder

Carapace without subcentral node ............................................. **MYODOCOPINA**

**PALEOMYODOCOPINA**, new suborder

**Composition.**—The Paleomyodocopina includes the superfamilies Cypridinelliformacea, Nodophilomedacea, and Swainellacea.

**Diagnosis.**—Carapace with subcentral node replaced by backward-directed dorsal protuberance in genus *Sulcuna*. Nuchal furrow and rostrum either present or absent. Appendages unknown, but herein presumed similar to those of the Myodocopina.

**Range.**—Devonian to Permian.

**Key to Superfamilies of the Paleomyodocopina**

(Key includes characters of most members of each superfamily)

1. Tip of rostrum generally truncate ........... **NODOPHILOMEDACEA**, new superfamily
   
2. Tip of rostrum generally rounded or pointed ............................................. 2

2. Carapace circular in lateral view .............. **SWAINELLACEA**, new superfamily
   
Carapace elliptical in lateral view ...... **CYPRIDINELLIFORMACEA**, new superfamily

**CYPRIDINELLIFORMACEA**, new superfamily

**Composition.**—The superfamily Cypridinelliformacea includes the families Cypridelliformidae and Cyprellidae.

**Diagnosis.**—Carapace elliptical in lateral view, with smooth or irregular margin: posterior half of dorsal margin straight or convex; posterior of valve acuminate, terminating in acute or rounded caudal process; rostrum with rounded tip, and either down-curved, or with horizontal ventral margin; anterior edge of margin ventral to incisur either extending past tip of rostrum forming prow, or not extending past tip of rostrum; node present near dorsal margin anterior to midlength (node replaced by backward-directed dorsal protuberance in genus *Sulcuna*); nuchal furrow (median sulcus [Moore, 1961:Q53]) either present or absent. Carapace smooth or with either vertical or horizontal ribs. In inside medial view, posterior half of dorsal margin generally with straight oblique hinge line.

**Range.**—Carboniferous and Permian.

**Key to Families of the Cypridinelliformacea**

Carapace with vertical ribs ..................................................... ***CYPRELLIDAE***

Carapace without vertical ribs ............................. ***CYPRIDINELLIFORMIDAE**, new family

**CYPRIDINELLIFORMIDAE**, new family

**Composition.**—The family Cypridinelliformidai includes the genera Cypridellina, Cypridella, *Sulcuna*, and *Cypridinelliforma*. *Cypriscusella* Sanchez de Posada and Bless, 1971:203, which is close to *Cypridella*, also may be included in the Cypridinelliformidae, but this requires further study.

**Diagnosis.**—In outside lateral view: posterior half of dorsal margin straight or convex; posterior of valve acuminate, terminating in acute or rounded caudal process; tip of rostrum rounded and with horizontal ventral margin; anterior edge of margin ventral to incisur either extending past tip of rostrum forming prow, or not extending past tip of rostrum (Cypridella, *Cypridinelliforma*); node present near dorsal margin anterior to midlength; node either projecting perpendicular from valve, or projecting posteriorly (node replaced by backward-directed dorsal protuberance in the genus *Sulcuna*). Nuchal furrow either present (*Cypridella, Sulcuna*) or absent (*Cypridellina, Cypridinelliforma*). In inside medial view, posterior half of dorsal margin with straight oblique hinge line. In anterior view, ventral edge of rostrum either horizontal or close to horizontal.

**Range.**—Devonian to Permian.
Key to Genera of the Cypridinellformidae

1. Carapace with nuchal furrow ........................................ 2
   Carapace without nuchal furrow .................................... 3

2. Anteroventral prow extending past tip of rostrum .......... Sulcuna
   Anteroventral prow not extending past tip of rostrum ....... Cypridella

3. Anteroventral prow extending past tip of rostrum .......... Cypridellina
   Anteroventral prow not extending past tip of rostrum ...... Cypridinelliforma

Cypridella Koninck, 1841

Type Species.—Cypridella cruciata Koninck, 1841. (The type species, C. cruciata, illustrated by Koninck (1841, fig. 11a–d) differs considerably from the illustration of Cypridella sp. by Sylvestre-Bradley (1961, fig. 325:2a–d). The former is without a siphon, and the tubercles do not project backward.)

Diagnosis.—Carapace with anteroventral margin generally not extending past tip of rostrum, with subcentral tubercle (backwardly directed on some species), and with curved nuchal furrow just posterior to tubercle; caudal siphon well developed or absent; other tubercles possibly present. Diagnosis in part from Sylvestre-Bradley (1961:Q403, fig. 325:2a–d).

Range.—Upper Devonian to Lower Permian (Whatley et al., 1993:350).

Sulcuna Jones and Kirkby, 1874

Type Species.—Sulcuna lepus Jones, Kirkby, and Brady, 1874, subsequent designation by Bassler and Kellett, 1934.

Diagnosis.—Subcentral node replaced by backward-directed dorsal protuberance and defined posteriorly by shallow nuchal furrow; anteroventral margin projecting slightly past tip of rostrum (from Sylvestre-Bradley, 1961:Q403–Q404, fig. 325:4).

Range.—Carboniferous, Europe (Sylvestre-Bradley, 1961: Q403).

Discussion.—Siveter and Vannier (1990:48) included the genus Sulcuna in the family Bolbozoidea. Because of the prominent rostrum of Sulcuna lepus, the type species, we prefer to include the genus in the Cypridinelliformidae.

Cypridellina Jones and Kirkby, 1874

Type Species.—Cypridellina clausa Jones and Kirkby, 1874, subsequent designation by Bassler and Kellett, 1934.

Diagnosis.—Subcentral node slightly above center of each valve; anteroventral margin extending well past tip of rostrum; without nuchal furrow (from Sylvestre-Bradley, 1961:Q403–Q404, fig. 325:3).

Range.—Carboniferous, Europe (Sylvestre-Bradley, 1961: Q403).

Cypridinelliforma Bless, 1971

Type Species.—Cypridinelliforma emmaensis Bless, 1971.

Diagnosis.—From Bless (1971:22): Carapace elongate with projecting rostrum forming an acute angle in lateral view; ventral edge of rostrum horizontal and fairly straight in well-preserved specimens. Complete carapace slightly narrower than high. Dorsal margin viewed laterally with anterior % evenly rounded and posterior % rounded, or almost straight except for slight concavity near posterior end. Concavity coincides with a round hole (siphon) with posteroventral orientation. Ventral edge of carapace in lateral view slightly convex in anterior %, and more convex and upsweeping in posterior %. Anteroventral margin not reaching tip of rostrum in some specimens, and just reaching tip of rostrum in others. Each valve with rounded or tapering node just dorsal to valve midheight and anterior to valve midlength. Lateral surface with ridges on well-preserved specimens. Straight, slightly indented, oblique hinge present along posterior half of dorsal margin. Posterior end of hinge terminating in siphon. Siphon not evident on all specimens. Hinge teeth and nuchal furrow absent. Broad triangular infold present in posterior end of valve ventral to siphon. Adductor muscle attachment scars unknown. Known length range 1.45–2.29 mm.

Range.—Upper Carboniferous (Bless, 1971); Permian (herein).

Comparisons.—The carapace of Cypridinelliforma differs from Cypridellina and Sulcuna in that the anteroventral prow does not extend past the tip of the rostrum; it differs from Cypridella and Sulcuna in not having a nuchal furrow.

Cypridinelliforma rex, new species

Figures 1–7

Etymology.—From the Latin rex (king).

Holotype.—USNM 496703, complete carapace.

Type Locality.—USNM 496703 locality 9260: Greece 1, 21 Aug 1968, uppermost brachiopod zone in Episkopi section B, Episkopi Formation, Barmari Group, Late Permian (Dorashamian), Hydra, Greece (Grant et al., 1991:482, 495).

Paratypes.—USNM locality 9260, Hydra, Greece 2, 4 Jul 1974: USNM 496717, LV; USNM 496718, RV; USNM
FIGURE 1.—Cypridinelliforma rex, new species, holotype, USNM 496703, complete carapace, length 1.78 mm: a, lv, x 56; b, dv, x 50; c, oblique view, x 63; d, detail of siphon in b, x 280; e, av, x 65. (Original magnifications of micrographs reduced to 88% for publication.)
FIGURE 2.—Cypridinelliforma rex, new species. Paratype, USNM 496727, LV, length 1.50* mm: a, lv, x 46; b, av?, x 42; c, iv, x 75; d, av. USNM 496704, RV, length 1.85* mm: e, lv, x 41. USNM 496705, LV, length 1.45 mm: f, lv, x 41.

DESCRIPTION (Figures 1–7).—Carapace elongate with projecting rostrum forming an acute angle in lateral view (Figures

DISTRIBUTION.—Permian: USNM localities 9260 and 9262, Hydra, Greece.

496719, LV; USNM 496720, LV. USNM locality 9262, Hydra, Greece 2, 23 Aug 1968: USNM 496704 (broken after SEM), RV; USNM 496705, LV; USNM 496706, RV; USNM 496707 (broken), RV; USNM 496727 (lost), LV.
FIGURE 3.—Cypridinelliforma rex, new species, paratype, USNM 498706, RV, length 1.47 mm: a, iv, x 43; b, iv, x 65; c, dv, anterior to right, x 40; d, view of siphon in c, x 175. (Original magnifications of micrographs reduced to 99% for publication.)

1a, 2af, 4a, 5a, 6a,b, 7a); ventral edge of rostrum horizontal and fairly straight in well-preserved specimens (Figures 1a,e, 2a,d,f, 4, 5a,d, 7). (The hook-like rostrum on one specimen (Figure 6a,b) tentatively is interpreted as an artifact caused by abrasion.) Complete carapace slightly narrower than high (Figure 1e). Dorsal margin viewed laterally with anterior % evenly rounded and posterior % almost straight, except for slight concavity near posterior end (Figure 1a). Concavity coinciding with a round hole (siphon) with posterodorsal orientation (Figures 1b–d, 2c, 3b–d). Siphon not observed on all specimens (Figures 4–7) and possibly lacking. Ventral edge of carapace in lateral view slightly convex in anterior %, and more convex and upsweeping in posterior % (Figures 1a, 2ac,ef). Anteroventral margin not reaching tip of rostrum in some specimens (Figure 1a), and just reaching tip of rostrum in others (Figure 2f).

Ornamentation: Each valve with rounded or tapered node just dorsal to valve midheight and anterior to valve midlength (Figures 1a–c, 2a,b, 3a, 4, 5, 6c, 7). Node reflected by concavity on inner side of valve (Figures 2c, 3b, 6a,b, 7a). Node worn off on some specimens (Figure 2e,f), and when broken off appearing as a hole (Figure 7a). Anterior surface ventral to rostrum with concentric ridges (seen best in anterior view, Figures 1e, 2d). Three or 4 ribs extending from anterior end of rostrum around periphery of valve and terminating in anteroventral part of valve in vicinity of anterior concentric ridges (Figures 1a–c, 2a,b,d–f); 10 or 11 straight or slightly convex longitudinal ribs present within area of peripheral ribs (Figure 1a); 2 ribs just dorsal to round node follow contour of dorsal edge of process
Figure 4.—Cypridinelliforma rex, new species, paratype, USNM 496717, LV, length 1.69 mm: a, lv, x 35; b, dv, anterior to left, x 35; c, vv, anterior to left, x 35; d, vv of rostrum, x 89.5; e, av, x 35.2.

Cross riblets connect ribs near posterior end of valves to form reticules (Figure 1a,c). Weakly developed reticules also present on rostrum near tip (Figure 1e). Ribs interpreted to be worn off on many specimens (Figures 3a,c,d, 4, 5, 6c).

Hinge: Straight, slightly indented, oblique hinge present along posterior half of dorsal margin (Figures 2c, 3b, 6a). Posterior end of hinge terminating in siphon (Figures 1b–d, 2c, 3b–d). Hinge teeth absent.

Infold: Broad triangular infold present in posterior end of valve ventral to siphon (Figures 2c, 6a,d).

Central Adductor Muscle Scars: Unknown.

Carapace Size (in mm): Holotype, USNM 496703, complete carapace, L=1.78, H=1.23, W=1.04. Paratypes: USNM 496704 (broken), RV, L=1.85*, H=1.22*; USNM 496705, LV, L=1.45, H=1.15; USNM 496706, RV, L=1.47, H=1.00; USNM 496717, LV, L=1.69, H=1.26; USNM 496718, RV, L=1.90, H=1.43; USNM 496719, LV, L=1.74, H=1.26; USNM 496720, LV, L=1.64, H=1.32; USNM 496727 (lost), LV, L=1.50*, H=0.86*. Length range: 1.45–1.90.

Variability: Ribs are well developed in the holotype (Figure 1a) but are less well developed (Figure 2a) or absent (Figure 3a) in most specimens. We interpret this to be the result of
differential preservation. Cross riblets forming reticulations in the posterior end of the carapace are visible only on the holotype (Figure 1a,c). We interpret this to be either the result of differential preservation or intraspecific variability. We do not exclude, however, the possibility that the differences in ornamentation among the specimens studied are the result of more than one species being present.

COMPARISONS.—The new species differs from Cypridinelliforma emmaensis in having a straighter posterodorsal margin.
FIGURE 6.—Cypridinelliforma rex, new species, paratype, USNM 496719, LV, length 1.74 mm: a, iv, \( \times 35 \); b, detail of anterior, from \( a, \times 70 \); c, dv, anterior to right, \( \times 33.4 \); d, detail of posterior, from \( a, \times 70 \). (Original magnifications of micrographs reduced to 89\% for publication.)
CYPRELLIDAE Sylvester-Bradley, 1961

COMPOSITION.—The family includes only the genus Cyprella.

DIAGNOSIS.—“Carapace annulate; rostrum down-curved; incisure horizontal; posterior produced into caudal siphon” (Sylvester-Bradley, 1961:402). Narrow nuchal furrow behind tubercle.

RANGE.—Lower Carboniferous (Whatley et al., 1993:350).

NODOPHILOMEDACEA, new superfamily

COMPOSITION.—The Nodophilomedacea includes the new family Nodophilomedidae.

DIAGNOSIS.—Carapace oval in lateral view, with deep incisur and square-tipped rostrum at valve midheight. Posterior margin of valve extending posteriorly to form distinct angle at midheight (Nodophilomedidae). Surface smooth or faintly reticulate. Node better developed in some specimens than in others, and possibly absent (node absence presumed herein to be the result of wear, but possibly node never present).

RANGE.—Permian.

NODOPHILOMEDIDAE, new family

COMPOSITION.—The Nodophilomedidae includes the new genus Nodophilomedes.

DIAGNOSIS.—Carapace oval in lateral view with deep incisur and square-tipped rostrum at valve midheight. Posterior margin of valve extending posteriorly to form distinct angle at midheight. Posteroventral margin more oblique than antero-ventral margin; posterodorsal margin either straight or less rounded than anterodorsal margin. Each valve rounded in dorsal view and with width about ½ length; anterior half in dorsal view more acuminate than posterior half on some specimens, but similar in other specimens. In anterior view valve broader in ventral half. Surface smooth except for rounded node near midlength dorsal to midheight. Node better developed in some specimens than in others, and possibly absent (the latter presumed to be the result of wear, but possibly never present). Straight posterodorsal margin on some specimens suggesting hinge located there.

RANGE.—Permian.

Nodophilomedes, new genus

ETYMOLOGY.—From the Latin nodus (swelling) plus Philomedes.

TYPE SPECIES.—Nodophilomedes phoenix.

DIAGNOSIS.—Same as for family.

RANGE.—Permian.

Nodophilomedes phoenix, new species

FIGURES 8, 9

ETYMOLOGY.—From the Latin phoenix (purple-red).

HOLOTYPE.—USNM 496708, LV.

TYPE LOCALITY.—USNM locality 9262, Hydra, Greece, 23 Aug 1968, about 1 km nearly due E of the village of Episkopi (E side of island), down steep trail to about 25 m elevation near shrine called Aya Hohannis, relatively flat area where Permian beds make terraces. Collected from 4 ft. (1.2 m) bed. R.E. Grant, collector, 23 Aug 1968.
FIGURE 8.—Nodophilomedes phoenix, new species. Paratype, USNM 496709, LV, length 2.51 mm: a, lv, x 38; b, dv, x 37; c, iv, x 32. Holotype, USNM 496708, LV, length 2.83 mm: d, iv, x 30. Paratype, USNM 496735, LV, length ~2.65 mm: e, iv, x 30, f, iv, posterior tip, from e, x 150. (Original magnification reduced to 84% for publication.)
FIGURE 9.—*Nadophilomedes phoenix* new species, paratype, USNM 496726, LV, length 3.8 mm: a, lv, x 20.6; b, av, x 24.6; c, dv, x 21; d, detail of rounded process, from a, x 36; e, detail of rostrum, from a, x 60. (Original magnifications of micrographs reduced to 86% for publication.)

**PARATYPES.**—USNM locality 9262: USNM 496709 (lost), LV; USNM 496726, LV; USNM 496735 (lost), LV.

**DESCRIPTION** (Figures 8, 9).—Carapace oval in lateral view, with deep incisur and square-tipped rostrum at valve midheight (Figures 8a,c, 9a,e). Posterior margin of valve extending posteriorly to form distinct angle at midheight. Posteroventral mar-
gin more oblique than anteroventral margin; posterodorsal mar-
gin either straight or less rounded than anterodorsal margin
(Figures 8a–c–e, 9a). Dorsal outline rounded; width approxi-
mately ½ length (Figure 9c,b); anterior half in dorsal view
more acuminate than posterior half on some specimens (Figure
9c), but similar in other specimens (Figure 8b). In anterior
view, valve broader in ventral half (Figure 9b). Notch on
anteroventral margin just ventral to incisur visible in Figure
9a,e is interpreted to be an artifact.

Ornamentation: Surface smooth except for rounded node
near midlength dorsal to midheight. Node better developed in
some specimens (Figure 9a–d) than in others, and possibly
absent (the latter presumed to be the result of wear (Figure
8a,b), but possibly never present (Figure 8e is an inside view of
valve without depression that would indicate presence of outer
node)).

Hinge: Straight posterodorsal margin on some specimens
suggests hinge located there (Figure 8d,e).

Infold: Small infold evident in and ventral to posterior
angle (Figure 8d–f). Small siphon possibly present immedi-
ately dorsal to posterior angle (Figure 8f).

Central Adductor Muscle Scars: None observed.


Swainellaceae, new superfamily

Composition.—The Swainellaceae includes the family Swain-
ellidae, new family.

Diagnosis.—Carapace circular in lateral view with tapered
rostrum and broad incisur. Valve width about ⅓ valve length.
Central part of valve fairly flat. Each valve with anterodorsal,
large, rounded node just dorsal to midheight, node appearing
as depression on inside of valve. Outer surface of valve with
round pits. Surface of valves with several low nodes.

Range.—Permian.

Remarks.—According to Siveter et al. (1987:793), “Cypridinid” gen. et sp. nov. A (Siveter et al., 1987),” which resem-
bles Swainella bex, new species, lacks an anterodorsal node.
The lack of the node places that genus in the Myodocopina,
rather than in the Paleomyodocopina.

Swainellidae, new family

Type Species.—Swainella bex, new species.

Composition.—The Swainellidae includes the genus Swain-
ella.

Diagnosis.—Same as for superfamily.

Range.—Permian.

Swainella, new genus

Etymology.—Named in honor of Frederick M. Swain,
Ostracodologist.

Type Species.—Swainella bex, new species.

Diagnosis.—Same as for family. Known length range, 1.27–
1.59 mm.

Range.—Permian.

Swainella bex, new species

Figures 10–13

Etymology.—From the Greek bex (cough).

Holotype.—USNM 496725, RV.

Type Locality.—USNM locality 9260, Hydra, Greece 2, 4

Paratypes.—USNM locality 9260, Hydra, Greece 2, 4 Jul
1974: USNM 496712, LV; USNM 496713, RV; USNM
496724, LV; USNM 496723, RV.

Distribution.—Permian: USNM locality 9260, Hydra,
Greece.

Description.—Carapace oval in lateral view with tapered
rostrum and broad incisur (Figures 10a–c, 11b,c, 12a,b). Valve
width about ⅓ valve length (Figures 10b,d,e, 11b,c, 12b). Cen-
tral part of valve fairly flat (Figures 10b,d,e, 11a,b, 12b,c).

Ornamentation: Each valve with anterodorsal, large,
rounded node just dorsal to midheight (Figures 10a,b, 11, 12a,
13a,c); node appearing as depression on inside of valve (Fig-
ures 10c, 13d (faint)). Outer surface of valve with round pits
(Figures 12a,c, 13a–c,ef). Pits less well developed on some
valves (Figures 10a, 11a). Surface of valves with low nodes
(Figures 10a,b,d,e, 11b,c, 12a,c, 13a,c).

Hinge: None evident (Figures 10c, 13d).

Infold: Not preserved (Figures 10c, 13d).

Carapace Size (in mm): Holotype, USNM 496725, RV, L=
1.59, H=1.37. Paratypes: USNM 496713, RV, L=1.33, H=1.16;
USNM 496712, LV, L=1.39, H=1.18; USNM 496723, RV,
L=1.27, H=1.08; USNM 496724, LV, L=1.41, H=1.13. Length
range 1.27–1.59.
FIGURE 10.—Swainella box, new species, paratype, USNM 496723, RV, length 1.27 mm: a, lv, x 75; b, av, x 75; c, iv, x 75; d, e, dv and vv, respectively, x 75. (Original magnifications of micrographs reduced to 98% for publication.)
**Figure 11.** — *Swainella bex*, new species, paratype, USNM 496724, LV, length 1.41 mm: a, av, ×47.8; b, dv, ×34.6; c, lv, ×34.8.

**Figure 12.** — *Swainella bex*, new species, holotype, USNM 496725, RV, length 1.59 mm: a, lv, ×35.2; b, av, ×35; c, oblique vv, ×28.4.
**Suborder MYODOCOPINA Sars, 1866**

**COMPOSITION.**—The Myodocopina includes the superfamilies Cypridinacea, Sarsiellacea, and Cylindroleberidacea.

**DIAGNOSIS.**—*Carapace:* Carapace without subcentral node, smooth or ornamented; dorsal border straight or arched. Adult males generally more elongate than females. Rostrum well developed or absent, generally differing in adult males and females; tip of rostrum truncate, rounded, or pointed. Caudal process well developed or absent. *Appendages:* Coxal endite (usually present) of mandible spiny or serrate lobe; 5th limb (2nd maxilla) compacted (not leg-like) (reduced in some males); 6th limb short and flat; male copulatory limbs paired; 7th limb (present in almost all adults) long, worm-like, unsegmented but with many annulations.

**RANGE.**—Silurian to Holocene.
Key to Superfamilies of the Myodocopina

(Key includes characters of most members of each superfamily and applies only to taxa reported from the Paleozoic and/or Mesozoic)

1. Tip of rostrum truncate .................................................. Sarsiellacea
   Tip of rostrum rounded or pointed ................................. 2
2. Rostrum and incisur well developed .................................. Cypridinacea
   Rostrum and incisur poorly developed ......................... Cylindroleberidacea

Sarsiellacea Brady and Norman, 1896

Composition.—The Sarsiellacea includes the families Sar- siiellidae, Rutidermatidae, and Philomediidae. None of these has been reported from the Mesozoic, and only the Philomediidae has been reported from the Paleozoic.

Diagnosis.—Carapace with minute rostrum in adult female and prolonged in adult male; caudal process usually present in adult females, longer in adult males; dorsal margin of carapace convex; surface smooth or ornamented. Adult males usually more elongate than adult females.

Range.—Carboniferous to Holocene.

Philomediidae Müller, 1912

Composition.—The Philomediidae includes two subfamilies: Philomedinae and Pseudophilomedinae. The former has been reported in the Paleozoic.

Diagnosis.—Rostrum and caudal process usually well developed; surface smooth or ornamented; dorsal margin of carapace straight or arched; rostrum truncate, rounded, or pointed; carapace usually with small caudal process. Adult males usually more elongate than adult females, and with more open incisur.

Range.—Carboniferous to Holocene. Holocene taxa are cosmopolitan, with a known depth range of intertidal to 3382 m.

Philomedes Liljeborg, 1853

Philomedes Liljeborg, 1853:175.

Type Species.—Philomedes longicornis Liljeborg, 1853:176 (= Cypridina Brenda Baird, 1850).

Diagnosis.—Same as for subfamily.

Range.—Same as for subfamily.

Philomedes rankiniana (Jones and Kirkby, 1867), new combination

Figure 14

Cypridina rankiniana Jones and Kirkby, 1867:218; 1871:27.
Bradycinetus rankiniana (Jones and Kirkby, 1867).—Jones and Kirkby, 1874: 42, pl. II: figs. 21, 22a–c; pl. V: fig. 5.

H holotype.—Philomedes rankiniana (Jones and Kirkby, 1867).

Type locality.—Carboniferous, Scotland.

Material.—Permian: USNM locality 9260, Hydra, Greece, USNM 496710, complete carapace (at present fragmented).
DISTRIBUTION.—Carboniferous of Scotland, Ireland?, and Great Britain?; Permian of Hydra, Greece.

DESCRIPTION OF HYDRA SPECIMEN.—Carapace oval in lateral view, with rounded incisur and square-tipped rostrum (Figure 14a). Dorsal end of square-tipped rostrum forming most anterior projection of valve. Posterior margin slightly less rounded in dorsal half (Figure 14a). Left valve overlapping right along margins (Figure 14a, b). In ventral view, posterior half of valve more acuminate than anterior half (Figure 14b). Width of carapace less than \( \frac{3}{4} \) of length.

Ornamentation: Surface with many minute papillae (Figure 14). Lateral nodes absent.

Hinge: Not observed.

Infold: Not observed.

Carapace Size (in mm): USNM 496710, complete carapace, L=1.00.

CYPRIDINACEA Baird, 1850

COMPOSITION.—The Cypridinacea includes the family Cypridinidae.

DIAGNOSIS.—For fossil taxa, diagnosis same as for the Cypridinidae below.

RANGE.—Silurian to Holocene.

CYPRIDINIDAE Baird, 1850

COMPOSITION.—This family includes two subfamilies: Cypridininae Baird, 1850, and Azygocypridininae Komicker, 1970. The latter is known only from the Holocene. The Cypridininae as interpreted herein is present in both the Holocene and the Paleozoic.

DIAGNOSIS.—Carapace usually smooth; dorsal border arched. Rostrum well developed, evenly curved or sinuous. Caudal process either small or well developed.

RANGE.—Silurian to Holocene. Holocene taxa are circumglobal, with a depth range of intertidal to abyssal.

Cypridininae Baird, 1850

COMPOSITION.—This subfamily includes two tribes: Cypridinini Baird, 1850, and Gigantocypridinini Hartmann, 1974. The latter is known only from the Holocene. The Cypridinini as interpreted herein is present in both the Holocene and the Paleozoic.

DIAGNOSIS.—Same as for family. Carapaces of the Gigantocypridinini longer than 4 mm.

RANGE.—Silurian to Holocene.

Cypridinini Baird, 1850

COMPOSITION.—This tribe includes approximately 21 Holocene genera and three genera known only as fossils.

DIAGNOSIS AND RANGE.—Same as for family.

REMARKS.—It is possible that the Carboniferous Eocypridina Kesling and Ploch, 1960, which is referred herein to the superfamily Cylindroleberidacea, could be a member of the Cypridinini.

Key to Genera of the Cypridinini

(Key applies only to taxa reported from the Paleozoic and Mesozoic)

1. Carapace with nuchal furrow. ........................................... Palaeophilomedes
   Carapace without nuchal furrow ........................................... 2

2. Anteroventral prow produced ........................................... Cypridinella
   Anteroventral prow not produced ......................................... Silvesterella, new genus

Cypridina Milne-Edwards, 1840


COMPOSITION.—Komicker (1991:27) recognized 21 Holocene Cypridina species sensu Poulsen (1962:255). Because many Paleozoic species have been incorrectly referred to Cypridina (e.g., Jones and Kirkby, 1874), a discussion of the genus is included.

DIAGNOSIS.—The description of the shell of the genus by Skogsberg (1920:313) included the following: “Shell rather elongated; rostrum always with a distinct ventral corner; rostral incisur comparatively narrow and moderately deep, sometimes even shallow; posterior of shell with well-developed beak-shaped process [caudal process].” Poulsen (1962:255), in a diagnosis of the genus, was essentially in agreement with Skogsberg’s description above, but added: “The antero-superior corner of the rostrum is protruding over the front margin; the ‘corner’ is as a rule rounded, in a single species pointed. The incisur is rather short and broad. The posterior shell process [caudal process] is always well developed, varying somewhat in size and form.”

RANGE.—Holocene.

REMARKS.—Holocene species are present in the Indian and Pacific oceans between latitudes of about 35°N and 30°S, planktonic and demersal.

DISCUSSION.—A basic problem with this genus is the inadequate description of the type species. The illustrations of the type species by Milne-Edwards (1840, pl. 36: figs. 5, 5a) is of a shell without an anterior incisur. Skogsberg (1920:316) attrib-
uted the absence of the incisur to mistakes in observation by Milne-Edwards. His conclusion is supported by a statement in a prior publication of Jones and Kirkby (1874:11): “In a courteous reply to an inquiry with which I troubled M. Milne-Edwards, he kindly informed me that the Cypridina described in the ‘Hist. Nat. des Crust’ has really the antero-ventral notch so characteristic of the genus.”

Müller (1912:52) referred the type species to “Cypridinarum genera dubia et species dubiae.” On the other hand, Skogsberg (1920:316) concluded that “as no other forms either—except those belonging to Pyrocypris—are known so far, which can with any great probability be considered as closely related to the species described by Milne-Edwards, it seems to me justifiable and convenient to use the name Cypridina for the last mentioned group of forms.” (Pyrocypris is a genus proposed by Müller (1906:16) that has been correctly referred to Cypridina). Skogsberg (1920:313), in a synonymy of the subgenus Cypridina, listed as “Non Cypridina” fossil ostracodes identified by Bosquet (1847) and other authors.

Sylvester-Bradley (1951:209) stated that “it is probable that all Paleozoic specimens referred to Bradycinetcs and also to Cypridina, should more correctly be assigned to new genera, most of which would belong to families other than Rhombinidae.” Sylvester-Bradley (1961:Q399) confined the range of Cypridina to the Recent.

Poulsen (1962:255) mentioned the difficulty of referring species to the genus Cypridina because of the very incomplete description of C. renaudii, but he did recognize the genus. We conclude that fossil species without a caudal process, as well as fossils with lateral nodes, should not be referred to Cypridina Milne-Edwards, 1840.

**Palaeophilocedodes Sylvester-Bradley, 1951**

*Type Species.*—Philomedes bairdiana Jones and Kirkby, 1874.

*Composition.*—In addition to the type species, we include in the genus Philomedes elongata Jones, Kirkby, and Brady, 1884, and Palaeophilocedodes neuvillensis Casier, 1988.

*Diagnosis.*—Posterior margin triangular; each valve with short nuchal furrow pointing toward posteroventral corner.

*Range.*—Upper Devonian (Casier, 1988:90); Carboniferous (Sylvester-Bradley, 1961:Q403).

**Cypridinella Jones and Kirkby, 1874**

*Type Species.*—Cypridinella cummingii Jones, Kirkby, and Brady in Jones and Kirkby, 1874, subsequent designation by Bassler and Kellett, 1934:44. Howe (1955:47, 1962:59) stated that “the genotype is therefore Cypridinella monitor Jones, 1873a, not C. cummingii as designated by Bassler and Kellett, 1934, p. 44.” Howe’s conclusion apparently was based on the statement by Jones (1873b:410) that the carapace of C. monitor is typical of the genus. We do not concur with Howe because Article 67, International Code of Zoological Nomenclature (1985), states otherwise.

Sylvester-Bradley (1961:Q402) proposed the family Cypridinellidae for the genera Cypridinella, Cypridella, Cypridellina, and Sulcuna. The last three genera are referred herein to the family Cypridinellinae.

*Diagnosis.*—Sylvester-Bradley (1961:Q402): “Anteroventral margin extending past tip of rostrum; incisur narrow and horizontal; carapace length 2 to 10 mm.”

*Range.*—Carboniferous.

**Sylvesterella, new genus**

*Etymology.*—The genus is named in honor of P.C. Sylvester-Bradley.

*Type Species.*—Cypridina oblonga Jones and Kirkby, 1874.

*Diagnosis.*—Posterior margin evenly curved; carapace without nuchal furrow.

*Range.*—Carboniferous.

**Sylvesterella oblonga (Jones and Kirkby, 1874), new combination**

Cypridina oblonga Jones and Kirkby, 1874:20, pl. V: fig. 12a–c.—Jones, Kirkby, and Brady, 1884:90.

*Rhombina oblonga* (Jones and Kirkby, 1874)—Sylvester-Bradley, 1951:210, pl. XI: figs. 1–4; 1961:Q403, Q405, fig. 326:2a).

*Holotype.*—Sylvester-Bradley (1951:210–211): “Imperfect right valve (rostrum missing). Figured upside down by Jones and Kirkby, 1874 (pl. 5: fig. 12a), and interpreted by them as left valve. The so-called beak of their figure is an irregular crack. British Museum No. I. 6267.”

*Description.*—Sylvester-Bradley (1951:210): “Rostrum large, down-curved. Dorsal margin curved. Anteroventral margin receding. Posterior tumid, with a large, ill-defined, oval protuberance, sloping steeply to posterior margin. A slight furrow parallel to the venter delineates a marginal rim. Surface covered with faint papillae. Muscle-scar pattern consisting of an approximate triangular group of irregular, elongated scars, presenting certain points of resemblance to the muscle-scar patterns of recent Myodocopace. Length: 6 to 7½ mm.”

*Range.*—Carboniferous.

**"Cypridinid" sensu Siveter et al., 1987**

Siveter et al. (1987:794, 800) referred one Silurian species to “Cypridinid” gen. et sp. nov. A, a second to “Cypridinid” gen. et sp. nov. B, and a third to “Cypridinid” sp.

*Diagnosis.*—Siveter et al. (1987:793): “Oval, dome-like shells that differ considerably from bolbozoids in muscle scar pattern, in being relatively shorter and higher, and in lacking sulci or an anterodorsal bulb (see pl. 84: fig. 1; pl. 85: figs. 1, 2). The general designation 'cypridinid' is employed herein for
these forms. Their shape and outline is comparable with Devonian and Carboniferous cypridinids (Bless, 1973; Sohn, 1977), Mesozoic myodocopids such as *Triadocypris* (Weitschat, 1983b), and particularly with the Recent cypridinacean families Cypridinidae, Philomedidae, and Cylindroleberididae (see pl. 88; Kornicker, 1975, 1981; Kornicker and Caraion, 1978)."

**Range.**—Silurian.

**Remarks.**—Until the unnamed genera and species are described, we provisionally refer the myodocopids listed by Siveter et al. (1987) to the Cypridinidae, subfamily Cypridininae, tribe Cypridinini. (As of September, 1997, the taxa had not been formally described (in litt., Siveter, 1997).)

**“Cypridinid” Genus A, Siveter et al., 1987**

**Review.**—Siveter et al. (1987) considered the genus to be new.

**Range.**—Silurian.

**Genus A, Species A, Siveter et al., 1987**

**Review.**—Siveter et al. (1987) considered the species to be new. Whatley et al. (1993:350) referred this taxon to the Cypridinidae Baird, 1850.

**Diagnosis.**—Siveter et al. (1987:799–800): “A regular pattern of shallow, elliptical to polygonal fossae (each 100–300 μm across) covers the posterior half of the valve (pl. 84: figs. 1, 3). In many cases both the smaller, granule-like elements and the perforated polygonal platelets (combined range: 10–150 μm diameter) occur as a gradational, intermingled pattern on individual valve (e.g., pl. 87: fig. 4). The perforated polygonal platelets should not be considered as true external ornament. Radiate microstructures (pl. 87: figs. 2–4) also should not be considered as true external ornament.”

**Range.**—Silurian.

**“Cypridinid” Genus B, Siveter et al., 1987**

**Review.**—Siveter et al. (1987:794) considered this to be a new species.

**Diagnosis.**—Siveter et al. (1987:799–800): “In many cases both the smaller, granule-like elements and the perforated polygonal platelets (combined range: 10–150 μm diameter) occur as a gradational, intermingled pattern on individual valve (e.g., pl. 87: fig. 4). The perforated polygonal platelets should not be considered as true external ornament. Radiate microstructures (pl. 87: figs. 2–4) also should not be considered as true external ornament.”

**Range.**—Silurian.

**Cylindroleberidacea Müller, 1906**

**Composition.**—The Cylindroleberidacea includes the family Cylindroleberididae.

**Diagnosis.**—Carapace shape and ornamentation extremely variable; carapaces of Cylindroleberidinae and Cyclasteropinae generally appearing smooth, whereas those of Asteropteroniinae generally with ribs and processes; incisur slit-like in Cylindroleberidinae and Cyclasteropinae, and forming a right or acute angle in Asteropteroniinae.

**Range.**—Permian to Holocene.

**Cylindroleberididae Müller, 1906**

**Composition.**—The Cylindroleberididae includes three subfamilies: Cylindroleberidinae Müller, 1906; Cyclasteropinae Poulsen, 1965; and Asteropteroniinae Kornicker, 1981. The Asteropteroniinae is represented in the Permian, and the Cyclasteropinae is represented in the Triassic.

**Diagnosis.**—Same as for family.

**Range.**—Permian to Holocene. Holocene taxa are circumglobal, with depth range of intertidal to abyssal.

**Key to Paleozoic and Mesozoic Subfamilies of the Cylindroleberididae**

(Key includes characters of most members of each superfamily)

- **Incisur long slit-like.**
  - **Cyclasteropinae**
  - **Incisur short, forming right angle between ventral edge of rostrum and anterior edge of valve ventral to rostrum.**
  - **Asteropteroniinae**

**Asteropteroniinae Kornicker, 1981**

**Composition.**—The Asteropteroniinae includes three genera in the Paleozoic and/or Mesozoic: *Triadocypris*, *Triadogigantocypris*, and *Siveterella*, new genus.

**Diagnosis.**—Carapace generally oval in lateral view, but some with posterodorsal projections; incisur generally forming right angle between ventral margin of rostrum and anterior margin of valve below rostrum; surface generally with ribs and large processes.

**Range.**—Permian to Holocene. Holocene taxa from about 42°S to 42°N, with depth range mostly shallower than 100 m, but maximum known depth range 1100 m (Kornicker, 1981:189).
DISCUSSION.—We consider the referral of *Triadogigantocypris* to the Asteropteroninae to be tentative.

REMARKS.—The surface ridges of many genera of “fingerprint” ostracodes included in the ?Entomozoaacea by Sylvester-Bradley (1961:Q388) resemble those of *Asteropella kalkei* Kornicker, 1986b (fig. 56). These genera are *Bertillonella* Stewart and Hendrix, 1945; *Entomoprimitia* Kummerow, 1954; and *Volkina* Rabien, 1954. Whatley et al. (1993:350) referred the families, within which those genera are usually placed, to either the Halocypridina and Cladocopina. We have similar reservations about referring those genera to the Myodocopina, and they are not considered further herein.

Key to Genera of the Asteropteroninae
(Key applies only to taxa reported from the Paleozoic and/or Mesozoic)

1. Surface with nodes ............................................. *Siveterella*, new genus
   Surface without nodes ............................................. 2
2. With caudal process ............................................. *Triadogigantocypris*
   Without caudal process ............................................. *Triadocypris*

*Triadocypris Weitschat, 1983*

**Type Species.**—*Triadocypris spitzbergensis* Weitschat, 1983a.

**Composition.**—This genus includes *Triadocypris spitzbergensis* Weitschat, 1983a, from the Triassic of Spitzbergen, and a new species from the Permian.

**Diagnosis.**—Carapace oval in lateral outline, rostrum small with minute incisur; inner lamella narrow and calcified; with numerous radial pore canals. Adductor muscle scar pattern consisting of two diagonal rows of scars (based on carapace diagnosis in Weitschat, 1983a:314).

Weitschat (1983b:127) added to the diagnosis of the carapace, “Myodocopid with carapace 2.9–3.1 mm long. With small rostrum and narrow rostral incisur. Posterior margin forming angle at midpoint. Left valve overlaps right. With delicate dentition along dorsal margin of each valve. Ornamentation composed of small, closely spaced pits.”

**Range.**—Permian to Triassic.

**Discussion.**—The shape of the carapace, the small rostrum, the lack of a deep incisur, and the convex dorsal margin of left valve visible in dorsal view (Figure 15b) of *T. pax* closely resemble carapaces of species of the extant species *Actinoseta jonesi* (Kornicker, 1981, pls. 62a, 63a.e); this suggests that the genus *Triadocypris* should be referred to the Asteropteroninae. It is not known if the fossil specimens of *Triadocypris* have the postero-dorsal tooth-and-socket structures present on Recent species of *Actinoseta* (see Kornicker 1981, pls. 57e.f, 58a,b). Weitschat (1983b:127) mentioned “delicate dentition along dorsal margin of each valve.”

**Remarks.**—The legend to pl. 10: figs. 1, 2 of *Triadocypris spitzbergensis* in Weitschat (1983b:127) stated that both illustrations are of specimen number GPIHM 2559. Actually, figs. 1 and 2 are from different specimens (in litt., Weitschat, 1997). Cohen et al. (1998) referred this species to a new family, Triadocypriidae, but because it is based on soft parts of the unique fossil, we do not think it practical to use the new family when identifying fossils.

*Triadocypris pax, new species*

**Figure 15**

**Etymology.**—From the Latin *pax* (peace).

**Holotype.**—USNM 496722, complete carapace (broken in half after micrography).

**Type Locality.**—USNM locality 9260, Hydra, Greece 2, 4 Jul 1974.

**Paratype.**—USNM locality 9260, USNM 496728 (lost), complete specimen with valves askew.

**Distribution.**—USNM locality 9260, Hydra, Greece.

**Description.**—Carapace oval in lateral view with slightly projecting rostrum and with minute incisur just ventral to valve midheight (Figure 15a,d). In dorsal and ventral view, carapace broadest at ½ valve length measured from anterior end of valve; carapace acuminate anterior to broadest part.

**Ornamentation:** Surface with abundant minute pits (Figure 15).

**Hinge:** Not observed in detail but located in posterior half of dorsal margin.

**Infold:** Unknown.

**Central Adductor Muscle Scars:** Unknown.

**Carapace Size (in mm):** Holotype, USNM 496722, *L*= ~1.6, *H*=~1.2.

**Comparisons.**—Rostrum and incisur much larger in *T. spitzbergensis*.

*Siveterella, new genus*

**Etymology.**—Named in honor of David Siveter, prominent ostracodologist.

**Type Species.**—*Siveterella pax*.

**Diagnosis.**—Carapace oval in lateral view, with short rostrum and rounded posterior without caudal process.

**Range.**—Permian.

**Discussion.**—The resemblance of the many nodes on the carapaces of *S. pax* and *S. flex* compared to those of *Actinoseta*
Figure 15.—Triadocypris pax, new species. Holotype, USNM 496722, complete specimen broken after micrography, length ~1.6 mm: a, lv, x 50; b, dv, anterior to right, x 50; c, vv, anterior to right, x 50. Paratype, USNM 496728, complete specimen (valves askew), length unknown: d, lv; e, dv, anterior to right; f, vv, anterior to right.

*chelisparsa* Kornicker, 1958 (see Kornicker, 1981, fig. 52a-c) and *Actinoseta nodosa* Kornicker, 1981 (see figs. 66a,b,d, 67a) suggested that the genus be referred to the Asteropteroninae. The carapaces of known species of *Siveterella* do not have the posterodorsal tooth-and socket structures present on Recent species of *Actinoseta* (Figures 17a, 20a,c).

*Siveterella pax,* new species

*Figu*res 16, 17

**ETYMOLOGY.**—From the Latin *pax* (peace, tranquility).

**HOLOTYPE.**—USNM 496730, RV.

**TYPE LOCALITY.**—USNM locality 9260, Hydra, Greece 2, 4 Jul 1968.
Figure 16 (opposite).—Siveterella pax, new species. Holotype, USNM 496730, RV, length 2.15 mm: a, lv, x37.4; b, detail of anterior, from a, x78; c, av, x40.2; d, anteroventral view of rostrum and incisur, x146. Paratype, USNM 496731, LV, length 2.41 mm: e, lv, x33.2; f, detail of anterior, from e, x88. (Original magnifications of micrographs reduced to 82% for publication.)

Figure 17 (above).—Siveterella pax, new species. Paratype, USNM 496733, LV?, length of fragment 2.00 mm: a, iv, x 40; b, dv?, x40; c, lv, x24. USNM 496734, valve broken into 2 pieces, length of assembled pieces 1.96* mm: d, lv, x28; e, dv?, x28. USNM 496732, broken valve, length of small fragment (more than about ½ total length), 1.19 mm: f, lv, x50; g, end view, from f, x75; h, detail from g, x740. (Original magnifications of micrographs reduced to 87% for publication.)

**Distribution.**—USNM localities 9260 and 9262, Hydra, Greece.

**Description** (Figures 16, 17).—Carapace oval in lateral view with deep incisur (Figure 16a,c,d).

**Ornamentation:** Surface of valves with numerous rounded nodes (Figures 16a,b,e, 17b-g).

**Hinge:** None evident.

**Infold:** None preserved (Figure 17a).

**Central Adductor Muscle Scars:** Unknown.

**Carapace Size** (in mm): Holotype, USNM 496730, L=2.15, H=1.66. Paratypes: USNM 496731, LV, L=2.41, H=1.55; USNM 496732, length of small fragment (more than about ¼ total length)=1.19; USNM 496733, LV?, L=2.00, H=1.73; USNM 496734 (broken), L=1.96.

*Siverterella flex,* new species

**Figures 18, 19**

**Etymology.**—An arbitrary combination of letters.

**Holotype.**—USNM 496729 (lost), LV.

**Type Locality.**—USNM locality 9260, Hydra, Greece 2, 4 Jul 1968.

**Paratypes.**—None.

**Distribution.**—USNM locality 9260, Hydra, Greece.
Figure 19.—Siveterella flex, new species, holotype, USNM 496729, LV, length 4.43 mm: a, lv, x 31.8; b, dv, x 35.2; c, av, x 25.6; d, pv, x 25.8; e, detail of anterior, from a, x 59.
DESCRIPTION (Figures 18, 19).—Carapace oval in lateral view (Figures 18a, 19a) with short rostrum (Figures 18a,b, 19a,e) and small caudal process (Figures 18a,d, 19a). Outer surface with large nodes reflected on inside surface by depressions.

Ornamentation: Surface with 8 or 9 large round tapered processes (3 just inward from ventral margin); 1 inward from posterior margin at midheight; 1 anterior and 1 posterior to valve midlength along dorsal margin; 2 near midlength inward from dorsal margin; and 1 at valve middle in vicinity of central adductor muscle attachment) (Figures 18, 19). In inside view of valve, processes appear as round depressions (Figure 18). Rounded process also at tip of rostrum (Figure 19a,e). Surface of valve between large processes with small nodes (Figure 19a,e).

Central Adductor Muscle Scars: None evident.

Hinge: Straight posterodorsal margin suggests hinge present in that section (Figure 18a,e).

Infold: None preserved (Figure 18).

Carapace Size (in mm): L=4.43, H=2.79.

COMPARISONS.—Differs from Siveterella pax in having a more pronounced projecting posteroventral caudal process and larger surface nodes.

Triadogigantocypris Monostori, 1991


Although Monostori (1991:92) referred the only species he considered (T. balatonica) to the Cypridinidae, he stated (1991:95) that “the arcuate arrangement of some muscle scars resembles the spirally arranged scars of the family Cylindroleberidae G.W. Müller, 1906.”

DIAGNOSIS.—Large oval carapace with rostrum; anteroventral margin not reaching tip of rostrum. Muscle scars consisting of 4 or 5 oblique scars anteroventral to fan of straight to arcuate scars.

RANGE.—Triassic to Cretaceous.

DISCUSSION.—The three tribes are separated mainly by appendages. Fossils, at present, cannot be identified to tribe; therefore, all are included herein in the tribe Cycloleberidini because it is the more common tribe in the Holocene.

Triadogigantocypris balatonica Monostori, 1991

Triadogigantocypris balatonica Monostori, 1991:94–95, fig. 2.

HOLOTYPE.—Steinkern deposited in Paleontological Department of the Hungarian Natural History Museum, catalog number M. 90.1.

DIAGNOSIS.—Adductor muscle scar pattern consisting of 5 oblique scars anteroventral and posterior to fan of about 10 arcuate scars; a third set of about 5 smaller scars dorsal to scar fan (Monostori, 1991:92, fig. 2).

RANGE.—Lower Ladinian, Middle Triassic, Hungary.

Triadogigantocypris donzei (Neale, 1976), new combination


HOLOTYPE.—University of Hull collection number HU.152.C.1, carapace.

DIAGNOSIS.—Carapace thick shelled; tip of rostrum rounded; male carapace more elongate than that of female. Muscle scars consisting of 4 oblique scars anteroventral to fan of 5 straight scars and also anterior to 2 short vertical scars (Neale, 1976, text-fig. 1).

RANGE.—Basal Valanginian, Lower Cretaceous, France.

Cyclostirinae Poulsen, 1965

COMPOSITION.—The Cyclostirinae includes three tribes: Cycloleberidini Hartmann, 1974; Cyclostirini Poulsen, 1965; and Tetraleberidini Kornicker, 1981.

DIAGNOSIS.—Carapace usually oval in adult females and juveniles, elongate in adult males; fairly deep incisur present below rostrum; carapace of adult males usually about same size as adult females; adductor muscle attachment scars elongate, oval, and often appearing as spiral.

RANGE.—Upper Devonian to Holocene. Holocene taxa have been reported from about 46°S (in the vicinity of New Zealand) to about 42°N (in the Mediterranean); depth range shallow to 290 m (rarely 1100 m) (Kornicker, 1981:72).

DISCUSSION.—The three tribes are separated mainly by appendages. Fossils, at present, cannot be identified to tribe; therefore, all are included herein in the tribe Cycloleberidini because it is the more common tribe in the Holocene.

Cycloleberidini Hartmann, 1974

COMPOSITION.—The Cycloleberidini includes four genera: Cycloleberis Skogsberg, 1920; Leuroleberis Kornicker, 1981; Alphaeleberis Kornicker, 1981; and Eocypridina Kesling and Ploch, 1960. Only the latter is interpreted to be present in the Paleozoic and Mesozoic.

DIAGNOSIS.—Same as for family.

RANGE.—Upper Devonian to Holocene.

DISCUSSION.—Because of insufficient details available in fossils, we have included Paleozoic and Mesozoic species in the genus Eocypridina. The three remaining genera in the tribe are recognized only in the Holocene.

Eocypridina Kesling and Ploch, 1960


DIAGNOSIS.—Same as for subfamily.

RANGE.—Upper Devonian to Upper Jurassic. Questionably from Devonian of Russian Platform (Samoilova, 1976:150).
Eocypridina radiata (Jones and Kirkby, 1874)

FIGURES 20–22

Cypridina radiata Jones and Kirkby, 1874:14, pl. 5: fig. 6a–f.
Radiocypridina radiata (Jones and Kirkby, 1874).—Bless, 1973:250, fig. 1.
Eocypridina radiata (Jones and Kirkby, 1874).—Sohn, 1977:129.
Eocypridina aciculata (Scott and Summerson, 1943).—Sohn, 1977:132, figs. 1b,c,g,h, 2c,d,g-r.

Holotype. — Cypridina radiata (Jones and Kirkby, 1874).
Type Locality. — Glasgow, Scotland.
Material. — USNM locality 9260?, Hydra, Greece 1, 21 Aug 1968?: USNM 496711, RV; USNM 496714, RV. USNM locality 9260, Hydra, Greece 1, 21 Aug 1968: USNM 496715, RV. USNM locality 9260, Greece 3, 21 Jun 1975: USNM 496716, complete carapace; USNM 496721, LV.

Description. — Carapace ovoid in lateral view with slit-like or rounded oblique incisur (Figures 20a,b, 21a, 22a,b). Rostrum sharply acuminate and hook-like (Kesling and Ploch, 1960:284). In lateral view, posterior evenly rounded (Figures 20a,b, 22a) or with slight posterodorsal angle (Figure 22a,d), and without siphon. In dorsal and ventral views, carapace broadest near midlength (Figures 20c, 21c), and anterior half possibly more acuminate than posterior half (Figures 20c, 21c). In end view, carapace evenly rounded (Figures 21b, 22e). Valves almost equivalved (Eocypridina campelli (Kesling and Ploch, 1960)), or left valve overlaps right on complete carapaces (Figure 22c–e).

Ornamentation: Ridge along ventral edge of rostrum of USNM 496714 (Figure 21a,b), but not on other specimens (Figures 20a, 22a,b). Carapace fairly smooth (Figures 20a,c, 21a,b, 22). (A low swelling in anterodorsal quadrant of USNM 496714 (Figure 21a,b) is tentatively interpreted as not being a node similar to those in the Paleomyodocopina.)

Hinge: None evident (Figure 21e).
Infold: Not preserved (Figure 21e,f).
Central Adductor Muscle Scars: Consisting of numerous long slender straight or slightly curved elongate scars located near valve middle (Figure 21a,d).

Carapace Size (in mm): USNM 496711, RV, L=2.45, H=1.87; USNM 496714, RV, L=1.86, H=1.44; USNM 496715, RV, L=2.12, H=1.57; USNM 496716, complete carapace, L=1.28, H=1.00; USNM 496721, LV, L=2.42, H=2.02.

Range. — Upper Devonian to Permian.
Remarks. — Differences in the width and curvature of the rostrum of the Permian specimens indicate that several species may have been included in this taxon. The differences are not of sufficient distinction to separate them at this time.
The muscle scars of Eocypridina radiata are radiate. Shells of Permian specimens having a shape similar to that of E. radiata, but without evidence for having a radiate muscle scar, are tentatively referred to E. radiata herein.

Eocypridina sp. (Dzik, 1978), new combination

Cycloleberis sp. Dzik, 1978:393, figs. 1–3.

Diagnosis. —Same as for genus.
Range. — Upper Jurassic, Volga Region, USSR.
Remarks. — The unique specimen has some of its appendages preserved.

Figure 20.—Eocypridina radiata (Jones and Kirkby, 1874), USNM 496711, RV, length 2.45 mm: a, iv, × 45; b, iv, × 37; c, dv, × 40. (Original magnifications of micrographs reduced to 81% for publication.)
Figure 21.—Eocypridina radiata (Jones and Kirkby, 1974), USNM 496721, LV, length 2.42 mm: a, lv, x 26.8; b, av, x 26.8; c, vv, x 26.8; d, detail of central adductor muscle scars, from a, x 75; e, iv, x 31.8; f, detail of anterior, from e, iv, x 80. (Original magnifications of micrographs reduced to 95% for publication.)
FIGURE 22.—Locypridina radiata (Jones and Kirkby, 1974). USNM 496714, RV, length 1.86 mm: a, lv, × 52. USNM 496715, RV, length 2.12 mm: b, lv, × 37. USNM 496716, complete carapace, length 1.28 mm: c, lv, × 50; d, dv, × 50; e, av, × 50. (Original magnifications of micrographs reduced to 99% for publication.)
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