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NEW UPPER DEVONIAN CYPRIDINACEAN OSTRACOD FROM SOUTHERN INDIANA

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VOLUME XV

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CONTENTS

INTRODUCTION

OSTRACODS from the Upper Devonian Blackiston shale in southern Indiana are classified as a new genus and species of the order Myodocopida, suborder Myodocopina, superfamily Cypridinacea, and family Cypridinidae. They were collected and presented to the Museum of Paleontology, University of Michigan, by Guy Campbell, for whom we have named the species.

Fossil cypridinacean ostracods are relatively rare. They are never concentrated in normal marine strata. Only in dark shales, evidently deposited in foul waters, are they significant elements of the ostracod fauna. Those from Paleozoic rocks differ markedly from most of their contemporaries in having relatively thin-walled carapaces. Apparently, extinct species, like their living descendants, were free-swimmers in the open seas. For this reason, they may yet prove to be more significant than the common benthonic ostracods in correlating rocks of one continent with those of another. At present, however, the known occurrences of cypridinacean ostracods are too few to be useful. Careful collecting, particularly from black shales which are barren of most other fossils, is needed.

Ecology of living cypridinid ostracods may provide clues to the presence and, commonly, the local concentration of fossil members of the family in Paleozoic black shales. Living ostracods of the subgenus *Doloria* of the genus *Cypridina,* in their outline and shape of beaks, closely resemble the Upper Devonian forms described here. *Cypridina (Doloria) levis* Skogsberg has been caught at depths of 252–310 meters and *C. (D.) pectinata* Skogsberg at 270 meters (Skogsberg, 1920, pp. 237, 245). Another living ostracod of the family Cypridinidae, *Gigantocypris mülleri* Skogsberg, was obtained in closing-type wire nets at depths of 2700 to 3600 meters (Skogsberg, 1920, p. 218). As one might expect, these actively swimming forms have wide geographic ranges. For example, the species *Gigantocypris mülleri* has been found in the Atlantic and Antarctic Oceans from about 60° N. lat. to 60° S. lat. (Skogsberg, 1920, p. 218). It seems unusual that these deep-sea ostracods could establish and maintain such an extensive range.

Although the mating habits of many cypridinids have not been studied, those of one species have been investigated in detail by several workers. At certain times in the year, great numbers of *Philomedes globosa* (Lilljeborg) ascend to the surface of the ocean. At the time of this nuptial swarming, the females have strong natatory setae, but after mating they settle to the bottom and break off (or, more probably, saw off with setiferous claws) these setae and thereafter must remain benthonic for the rest of their existence. Males of the species molt into maturity with weak mouth parts and apparently are unable to feed; presumably, they continue to swim for a time but soon starve. As reported by Skogsberg (1920, pp. 348–68), this interesting life history, involving planktonic copulation and subsequent self-mutilation by the females, was worked out independently for *Philomedes globosa* by three investigators. He further suggested (pp. 365–68) that other species of *Philomedes* have similar mating procedures.

We may characterize living cypridinid ostracods thus: they live at moderate to great depths, they swim rapidly, a species maintains itself over a great area, and at least one species, probably others, has a nuptial swarming to the surface, where both adult males and females are subject to surface currents for a brief time.

The Blackiston shale, which yielded our specimens, was probably accumulated in foul waters that were not affected by deep currents. Although the water near the bottom was too toxic to support an endemic fauna, it did favor preservation of any planktonic or nektonic animals that fell into it, since it discouraged or prohibited scavengers. It seems very doubtful that the region of stagnation and toxicity extended to the surface or spread over all the sea bottom. Probably, above the foul region the water was aerated by wave action, and in other areas circulation extended to the bottom.

The occurrence of cypridinids and the absence of other ostracods in the Blackiston shale appears clearly related to their ecology. Cypridinid ostracods were swimmers, whereas their thick-shelled contemporaries, particularly the paleocopids, may be presumed to have been benthonic. How the cypridinids came into the deposit is less certain. Perhaps ageing individuals, too feeble to maintain their positions in the upper aerated zone, settled into the foul water below and were killed; or they may have swum into the stagnant region and were unable to escape. Another possibility is that adults that rose to upper levels during the mating period may have been carried over the foul region by surface currents, whereupon the males that were returning to their normal depth and the females that were settling to the bottom to take up brood care died in the poisonous water. The concentration of specimens in a layer indicates a sudden influx of ostracods, but the cause remains conjectural.

Nearly all the ostracods described in this paper are complete carapaces, but a few isolated valves were found. Most are well-preserved, crushed in only small areas. More than half have parts of the thin shell exfoliated from one or both valves, revealing details of the muscle scars.

We are deeply grateful to Guy Campbell for supplying the sample of shale containing the ostracods. We also appreciate the efforts of Dr. K. Barth, of the Stadtische Museum, Naturwissenschaftliche Sammlung, Wiesbaden, Germany, in locating and loaning the type specimens of *Cypridina subglobularis* Sandberger and Sandberger for comparison with our ostracods.

The type specimens are catalogued and deposited in the Museum of Paleontology, University of Michigan.

LOCALITY

North bank of the Ohio River near the mouth of Silver Creek, about ½ mile east of the Kentucky and Indiana Terminal Railroad bridge at New Albany, Indiana. Horizon B1 of Guy Campbell (1946, p. 837), a sandy black shale locally cemented with pyrite and containing fish remains, the lowest 4½ feet of the Blackiston formation of the Upper Devonian New Albany group. Sample consisting of a small chunk, about 4 cubic inches, of black shale, heavy with pyrite and containing the ostracods and fragments of fish bone and scales. Collected by Guy Campbell.

DESCRIPTION

Subclass OSTRACODA
Order MYODOCOPIDA
Suborder MYODOCOPINA
Superfamily Cypridinacea
Family Cypridinidae
Subfamily Cypridininae
Eocypridina, gen nov.

Type species.—*Eocypridina campbelli,* sp. nov.

Description.—Carapace large, ovate, nearly equivalved. Rostrum of each valve sharply acuminate and hooklike (as in *Cypridina* H. Milne Edwards, 1840, p. 409), not bluntly truncate (as in *Philomedes* Lilljeborg, 1853, p. 175). Upper border of rostral notch not folded over lower (as in *Cylindroleberis* Brady, 1868, p. 127). No posteroventral siphon (as in *Gigantocypris* Müller, 1895, p. 164). Adductor-muscle scars arranged in an oval, consisting of a posterior area with nearly horizontal, slightly curved bars, an anterodorsal area with radiating bars, and an anteroventral area with peripheral spots.

Remarks.—Although muscle scars of all living species of ostracods in the suborder Myodocopina have not been described, published illustrations indicate that the general pattern of adductor-muscle scars is distinctive for each genus. We are firmly convinced that the pattern of *Eocypridina* differs so radically from those in other genera assigned to the suborder that it should be separated as a new genus. It has fewer scars than *Cyprosina* and *Entomoconchus* of the Entomoconchaecea (Fig. 1). Compared with other genera in the Cypridinacea, *Eocypridina* has fewer adductor-muscle scars than *Cyclasterope* of the family Cylindroleberididae and slightly more than other genera of the family Cypridinidae. Its scars are arranged in a pattern much more complex than the rosettes of *Cypridina, Philomedes,* and *Codonocera* and very different from the pattern of *Azygocypridina* (Fig. 1). In fact, the pattern of *Eocypridina* resembles that of *Loxoconcha* (see Howe and Laurencich, 1958, p. 32) more closely than those of other myodocopidan ostracods.

From Devonian to Recent, the general outline of the cypridinacean ostracods changed remarkably little. Classification, in our opinion, must be based in part on the muscle-scar pattern. Other Paleozoic species of the superfamily should be examined for details of muscle scars. It seems very likely that careful preparation could uncover the muscle-scar pattern in most, if not all, of the well-preserved cypridinaceans.

Eocypridina campbelli, sp. nov.

(Plates I–III)

Cypridinella n. sp. Campbell, 1946, p. 843.

Male.—Carapace nearly equivalved; left valve slightly larger than right, overlap difficult to discern except at terminations of the hinge. Hinge about $4/5$ as long as carapace; dorsal edge of left valve slightly concave along the hinge line, with gently protuberant terminations overlapping right valve. Carapace in lateral view oval, in dorsal and end views subelliptical to sublanceolate. Greatest length slightly ventral, greatest height and width nearly central. In each valve dorsal border gently and evenly convex, anterodorsal border subround, anterior border with sharply acuminate rostrum, anteroventral border round, ventral border gently convex, and posterior border subround. Rostrum pointed, its sides forming an angle of about 35° (Pl. II, Fig. 2). Rostral notch moderately deep.

As seen from the front, outline of rostral incisure heart-shaped, the doubly-arched dorsal part formed by the overhanging rostra and the acuminate ventral part formed by the incisure itself. Edge of each valve with a chamfer or bevel around the edge of the incisure, delineated by a low crest

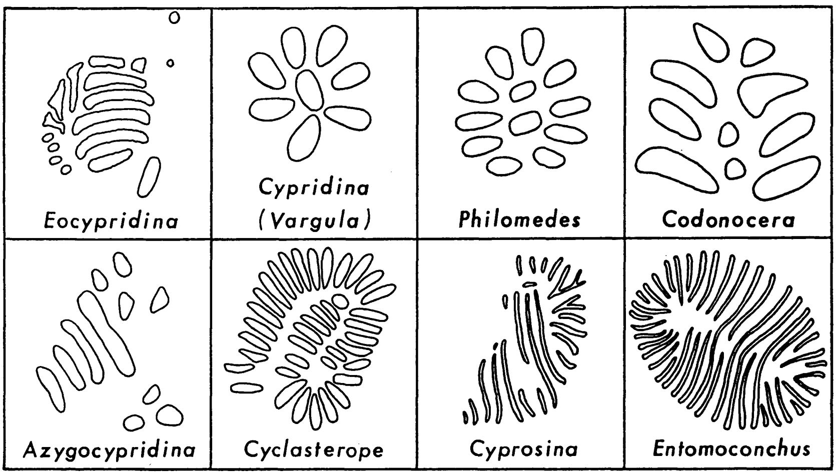

FIG. 1. Muscle scars of some myodocopidan ostracods, oriented with the anterior toward the left. *Eocypridina,* original based on *E. campbelli,* sp. nov., × 58. *Cypridina (Vargula),* after Sars, 1922, Pl. II, × 53. *Philomedes,* after Sars, 1922, Pl. VI, × 120. *Codonocera,* after Sylvester-Bradley, 1953, Fig. 3e, × 142. *Azygocypridina,* after Sylvester-Bradley, 1953, Fig. 3f, × 41. *Cyclasterope,* after Skogsberg, 1920, Fig. CVI, × 27.5. *Cyprosina,* after Sylvester-Bradley, 1953, Pl. VIII, Fig. 6b, × 9.6. *Entomoconchus,* after Sylvester-Bradley, 1953, Fig. 3a, × 14.8.

extending from the tip of the rostrum (Pl. II, Fig. 2) around the chamfer and terminating at the base of the incisure (Pl. I, Figs. 3, 7; Pl. III, Fig. 5).

Carapace smooth. Where shell is exfoliated (Pl. II, Fig. 9), surface, presumably of internal mold, marked by an irregular reticulation of fine dents.

Muscle scars clearly discernible where valves are exfoliated, consisting of grooves and pits in the internal mold and presumed to have been internal counterparts, so that the grooves in the mold represent ridges on the valve interior and the pits in the mold represent tubercles. Adductor-muscle scars arranged in an oval cluster in the center of each valve (Fig. 1; Pl. II, Fig. 9; Pl. III, Figs. 7, 12), consisting of six nearly horizontal, dorsally convex grooves in the rear, three radiating grooves anterodorsally, and four pits along the anteroventral edge of the oval. Considerable individual variation, with the upper horizontal groove in some specimens represented by two or three elongate pits (Pl. II, Fig. 9), the two longer radiating confluent in some valves, and the anteroventral pits in some linked as dorsal and ventral pairs by shallow grooves. Three other scars, presumed not to be of adductor muscles, present: a small pit behind the dorsal edge of the adductor-muscle cluster, a somewhat larger pit above this, and a deep, steeply inclined groove posteroventral to the cluster (Fig. 1).

Measurements of well-preserved carapaces listed in Table I. Average ratio of length to height (8 specimens), 1.25.

TABLE I

MEASUREMENTS OF WELL-PRESERVED CARAPACES OF *Eocypridina campbelli*, SP. NOV.

(in millimeters)

Specimen No.	Sex	Length	Height	Width	Ratio Length/Height
40616	Female	1.90	1.73	....	1.10
40553	Female	1.93	1.73	....	1.12
40612	Male	1.96	1.56	....	1.26
40551	Female	1.97	1.76	....	1.12
40545	Male	2.00	1.70	....	1.18
40547	Male	2.06	1.63	1.10	1.26
40550	Male	2.06	1.66	....	1.24
40548*	Female	2.06	1.83	1.20	1.13
40610†	Male	2.10	1.66	1.11	1.27
40615	Male	2.10	1.70	....	1.24
40611	Female	2.16	2.00	1.23	1.08
40614	Male	2.17	1.83	....	1.19
40613	Male	2.30	1.73	....	1.33

* Holotype
† Allotype

Female.—Carapace similar to that of male with respect to general outline (Pl. I, Fig. 9), dorsal view of hinge line (Pl. I, Fig. 10), rostrum (Pl. II, Fig. 6), chamfer and crest around rostral incisure (Pl. I, Fig. 12; Pl. III, Fig. 16), and muscle scars (Pl. II, Fig. 8; Pl. III, Fig. 1).

Measurements of well-preserved carapaces are listed in Table I. Average ratio of length/height (5 specimens), 1.11.

Remarks.—From the original description, we at first thought our ostracods might be *Cypridina subglobularis* Sandberger and Sandberger

(1849, p. 6, Pl. I, Figs. 4, 4a). We wrote to Dr. K. Barth, of the Stadtische Museum, Naturwissenschaftliche Sammlung, Wiesbaden, Germany, who located the type specimens at that museum and loaned them to us for study. The type specimens, from the Posidonomya shales of uppermost Devonian age at Herborn (about 18 miles northwest of Giessen, Hessen, Germany), are embedded on a small slab. Although poorly preserved, they all appear to be ostracods, possibly cypridinaceans. All are much smaller than our specimens, so that we do believe they can be the same species.

Eocypridina campbelli, sp. nov., differs from most previously described species of Paleozoic cypridinids in having a hooklike rostrum. Other species with similar rostra are *Cypridina fallax* Kegel (1926, p. 7, Pl. I, Fig. 3), *C. grossartiana* Jones and Kirkby (1867, p. 218), *C. radiata* Jones, Kirkby, and Brady (1874, p. 14, Pl. 5, Figs. 6a-f), *C. subovata* Ulrich and Bassler (1906, p. 162, Pl. II, Figs. 23–26), and *C. tonkinensis* Patte (1926, p. 128, Pl. 8, Figs. 28–30; Pl. 9, Fig. 1).

Our species differs from *C. radiata* in lacking blebby reticulation and radiate shell structure. It differs from the other species listed above in details of the outline and/or muscle-scar pattern. *C. subovata* has many small elongate muscle scars in a radiate pattern. *C. grossartiana* has a slightly concave anterodorsal border; *C. fallax* is nearly circular; and *C. tonkinensis* is elliptical. According to Patte (1926, p. 128), *C. tonkinensis* has small muscle scars set in the pattern of a Chinese character.

Dimorphism in the new species is rather slight, and it is difficult to determine the sex of crushed specimens. Some badly deformed carapaces cannot be classified as males or females.

Types.—Holotype, a female carapace, No. 40548. Allotype, a male carapace, No. 40610. Paratypes, four female carapaces, Nos. 40551, 40553, 40611, and 40616; seven male carapaces, Nos. 40545, 40547, 40550, 40552, and 40613–40615; one male right valve (attached to matrix), No. 40612; one crushed carapace of undetermined sex, No. 40546; and the anterior part of a right valve of undetermined sex, No. 40549.

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PLATES

EXPLANATION OF PLATE I

(All figures × 15)

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Eocypridina campbelli, sp. nov. 284

FIGS. 1–4. Left lateral, ventral, anterior, and posterior stereograms of male carapace, No. 40545.

FIGS. 5–8. Left lateral, ventral, anterior, and posterior stereograms of crushed carapace of undertermined sex, No. 40546.

FIGS. 9–13. Left lateral, dorsal, ventral, anterior, and posterior stereograms of the holotype, a female carapace, No. 40548.

PLATE I

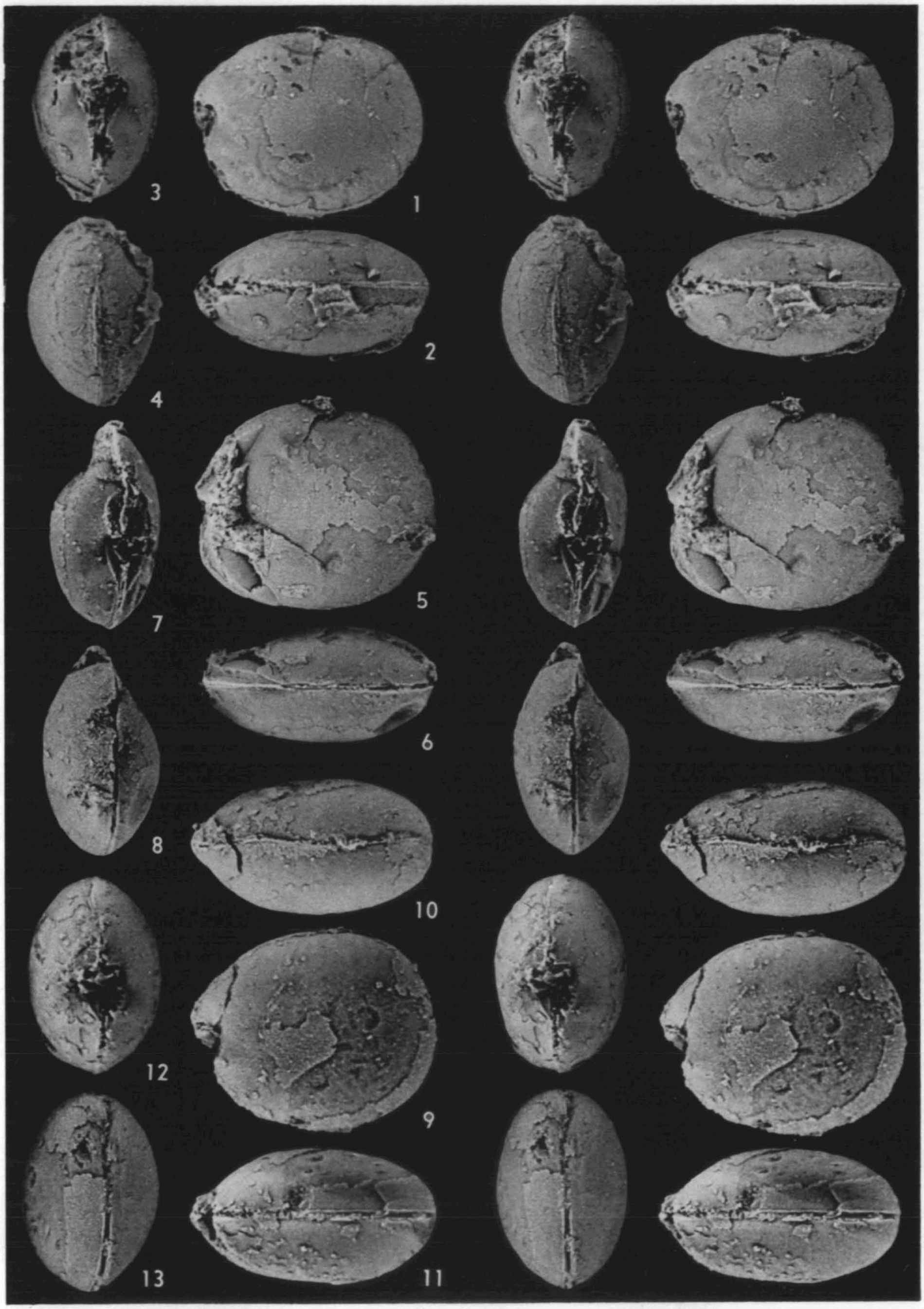

PLATE II

EXPLANATION OF PLATE II

(All figures × 15, except as noted)

PAGE

Eocypridina campbelli, sp. nov. 284

FIG. 1. Right lateral stereogram of female carapace, No. 40551. An enlargement of the muscle scar is shown in Pl. III, Fig. 1.

FIG. 2. Lateral stereogram of anterior part of right valve of undetermined sex, No. 40549.

FIGS. 3–4. Left lateral and ventral stereograms of male carapace, No. 40547.

FIG. 5. Left lateral view of male carapace, No. 40550.

FIGS. 6, 8. Left lateral views of female carapace, No. 40553. Figure 8 an enlargement (× 40) of the carapace illuminated to emphasize the muscle scars of the left valve.

FIGS. 7, 9. Left lateral view of male carapace, No. 40552, and an enlargement (× 40) of the muscle scars of the left valve.

EXPLANATION OF PLATE III

(All figures × 15, except as noted)

PAGE

Eocypridina campbelli, sp. nov. 284

FIG. 1. Muscle scars (× 40) of right valve of female carapace, No. 40551. A right lateral stereogram of this carapace is shown in Pl. II, Fig. 1.

FIGS. 2–7. Dorsal, right lateral, ventral, anterior, and left lateral views of the allotype, a male carapace, No. 40610, and an enlargement (× 40) of the muscle scars of the right valve.

FIG. 8. Right lateral view of male carapace, No. 40613.

FIG. 9. Left lateral view of female carapace, No. 40616.

FIG. 10. Lateral view of male right valve, No. 40612.

FIGS. 11–12. Right lateral view of male carapace, No. 40615, and an enlargement (× 40) of the muscle scars of the right valve.

FIGS. 13–14. Right lateral and left lateral views of male carapace, No. 40614.

FIGS. 15–16. Left lateral and anterior views of female carapace, No. 40611.

PLATE III