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PHYLLOCARID CRUSTACEANS FROM THE
MIDDLE DEVONIAN SILICA SHALE OF
NORTHWESTERN OHIO AND SOUTHEASTERN MICHIGAN

By

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MUSEUM OF PALEONTOLOGY
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VOLUME 23

1. The Rodents from the Hagerman Local Fauna, Upper Pliocene of Idaho, by Richard J. Zakrzewski. Pages 1-36, with 13 text-figures.
2. A new brittle-star from the Middle Devonian Arkona Shale of Ontario, by Robert V. Kesling. Pages 37-51, with 6 plates and 2 text-figures.

PHYLLOCARID CRUSTACEANS FROM THE MIDDLE DEVONIAN SILICA SHALE OF NORTHWESTERN OHIO AND SOUTHEASTERN MICHIGAN

ERWIN C. STUMM¹ and RUTH B. CHILMAN

ABSTRACT—The Silica Shale of Middle Devonian age, exposed in northwestern Ohio and southeastern Michigan, contains a relatively rich fauna of phyllocarid crustaceans. One of these, *Rhinocaris ehlersi*, was described on the basis of one right valve of the carapace by Stewart (1933). Recent extensive collecting has revealed the other hard parts of this species, many specimens of *Echinocaris punctata* (Hall), specimens of a species of *Dithyrocaris* allied to *D. neptuni* Hall, and specimens of a new genus and species, *Hebertocaris wideneri*, which may be among the largest phyllocarids known.

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INTRODUCTION

A FAUNA of rare, extinct phyllocarid crustaceans similar to that described by Hall & Clarke (1888) from the Hamilton Group of New York State has been found in the Silica Shale of northwestern Ohio and southeastern Michigan (Ehlers, Stumm, & Kesling, 1951). At least four genera of these strange creatures lived in the mud of the shallow Middle Devonian seas that once covered this area.

As early as 1933, Dr. Grace Stewart described the brilliantly iridescent carapace of *Rhinocaris ehlersi*, which she named for Dr. G. M. Ehlers of the University of Michigan. He collected the single plate on which the species is based from the quarry of what was then the Sandusky Cement Company, in Lucas County, Ohio. *Rhinocaris* and specimens belonging to at least three other genera have been collected recently from the present quarry of the Medusa

Portland Cement Company, now extended northward beyond Brint Road. *Rhinocaris* fragments have also been found in the shale dump of the now closed Martin-Marietta Co. near Milan, Michigan.

Echinocaris punctata Whitfield, a small ceratiocarid crustacean, is found abundantly in the same beds as *Rhinocaris*. The larger *Dithyrocaris* is much rarer, and occurs only in small fragments. The beautiful *Rhinocaris* is more noticeable against the light gray shale. Often occurring in groups, clusters of 20 or 30 carapaces are sometimes found in one rock, flashing blue, green, and red. It is the only one of the phyllocarids to show color; this has never been reported before.

The newest and largest member of this family is *Hebertocaris wideneri*. It has been known only in the past few months, when three dedicated amateur collectors presented us with

¹ Deceased April 24, 1969.

the specimens much larger than any previously known phyllocarid. The genus is named for Mr. William Hebert and his son, John, who presented us with the holotype and axial plate. The species is named for Mr. Millard Widener, who contributed not only an important part of the telson but also many of the other specimens described in this paper, as well as other fine phyllocarid specimens, to the Museum of Paleontology.

The many black mandibles which have been found in the same beds were first described as the jaws of a fish, *Pseudodontichthys whitei* Skeels (1962), but these have since been identified as the mandibles of phyllocarids by Dunkle (1965) and Rolfe & Denison (1966). Although not found in direct association with the carapace, they undoubtedly were from *Dithyrocaris* and *Hebertocaris*, the only genera large enough to contain them in their gastric mill. Similar smaller ones have been found with the carapaces of *Rhinocaris*, and a ceratiocarid form with the carapaces of *Echinocaris*.

With one exception (pl. 2, fig. 6), all the specimens collected are from the quarries of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio. The exception, which shows gnathal lobes of *Echinocaris*, is from the Windom Shale of western New York.

All illustrated specimens are in the collections of the Museum of Paleontology, The University of Michigan.

ACKNOWLEDGMENTS

Many professional paleontologists and amateur collectors have aided this study immeasurably by donating rare, even unique, specimens to the museum.

May we express thanks to Dr. G. M. Ehlers who collected the first specimens in the early days of the operation of the quarry; to Dr. Richard Hoare of Bowling Green State University for the rostra of *Hebertocaris wideneri*; to Mr. William Hebert and his son John for the holotype and two paratypes of *H. wideneri*; Mr. Millard Widener of Toledo, Ohio, for a telson of *H. wideneri* and many specimens of *Rhinocaris ehlersi* and *Echinocaris punctata*; to Mrs. Robert Rutkowski of Taylor, Michigan, for the complete specimen of *Echinocaris punctata*; to Mr. Stephen Mitchell of Detroit for the specimen of *E. punctata* from New York; to Mr. Larry Magrum of Toledo for specimens of *Echinocaris*; and to Mr. and Mrs. F. E. Mitchell of Dayton, Ohio, for the nearly entire carapace of *Rhinocaris ehlersi*.

The authors wish to thank Drs. R. V. Kessler and C. A. Arnold for critically reviewing the manuscript.

In addition, the authors are indebted to Mr. Karoly Kutasi for his excellent photography of specimens which are very difficult to portray; to Mrs. Gladys Newton for the arduous task of typing the manuscript; and to Mr. William A. Chilman for drafting the text-figures.

SYSTEMATIC DESCRIPTIONS

Phylum ARTHROPODA

Class CRUSTACEA

Order PHYLLOCARIDA

Family RHINOCARIDAE

Genus RHINOCARIS Clarke

Rhinocaris, Clarke in Hall & Clarke, 1888, p. 195; Clarke, 1893, p. 793; Stewart, 1933, p. 363.

Type species. — *Rhinocaris columbina* Clarke in Hall & Clarke, by designation of

EXPLANATION OF PLATE 1

FIGS 1-15—*Echinocaris punctata* (Hall). 1, dorsal view of carapace showing posterodorsal lobes; hypotype UMMP 56839, × 1. 2, dorsal carapace showing eye lobes and pits on ventral marginal ridge; hypotype UMMP 55316, × 1. 3, dorsal carapace offset along hinge line; hypotype UMMP 56836, × 1. 4, enlargement of figure 2 showing misplaced mandible with broken posterior denticle, × 2. 5 peripheral part of right valve of carapace showing sigmoid ridge; hypotype UMMP 55341, × 1. 6, three abdominal somites showing posterior spines on each; hypotype UMMP 55335, × 1. 7, axial and periaxial parts of carapace with well-developed anterior lobes, optic lobes, lateral lobes and posterodorsal lobes; hypotype UMMP 56835, × 1. 8, ventral view of carapace with well-developed posterior sulcus; hypotype UMMP 56837, × 1. 9, complete, somewhat crushed specimen showing all major dorsal features; hypotype UMMP 56838, × 1; gift of Mrs. Robert Rutkowski. 10, specimen with closed carapace and well-preserved telson; hypotype UMMP 56831, × 1. 11, specimen with posterior part of carapace well developed and a perfect gnathal lobe out of position on the left anterior; hypotype UMMP 56832, × 1. 12, dorsal carapace with epifauna of small inarticulate brachiopods; hypotype UMMP 55344, × 1. 13, enlargement of part of surface of carapace of original of figure 12 showing brachiopods and finely tuberculate ornamentation on carapace, × 10. 14, anterior part of a well-preserved carapace showing anterior margin; hypotype UMMP 56834, × 2. 15, complete uncrushed carapace of same specimen showing all lobes, medial sulcus and sigmoid ridge, × 1.

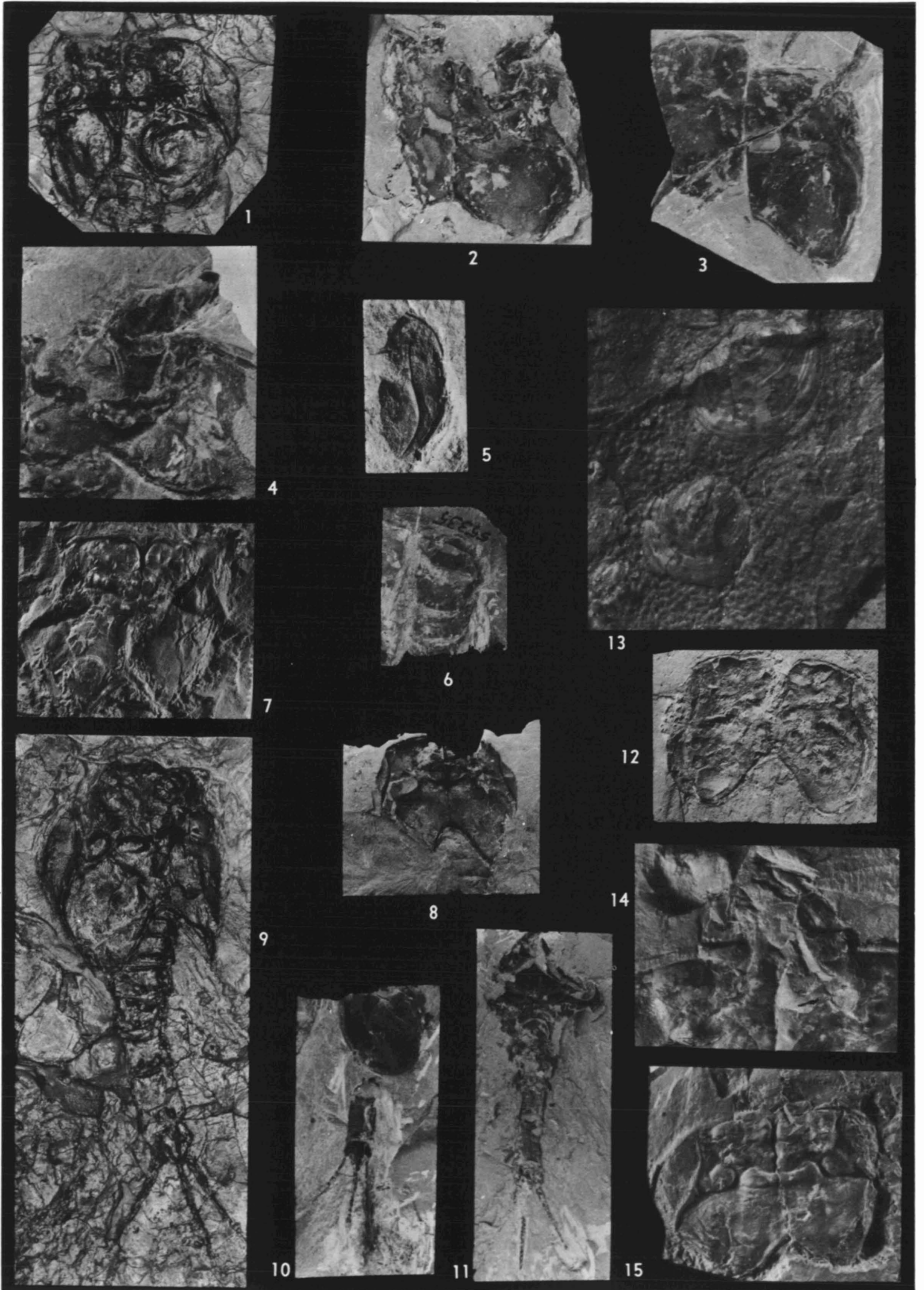


PLATE 1

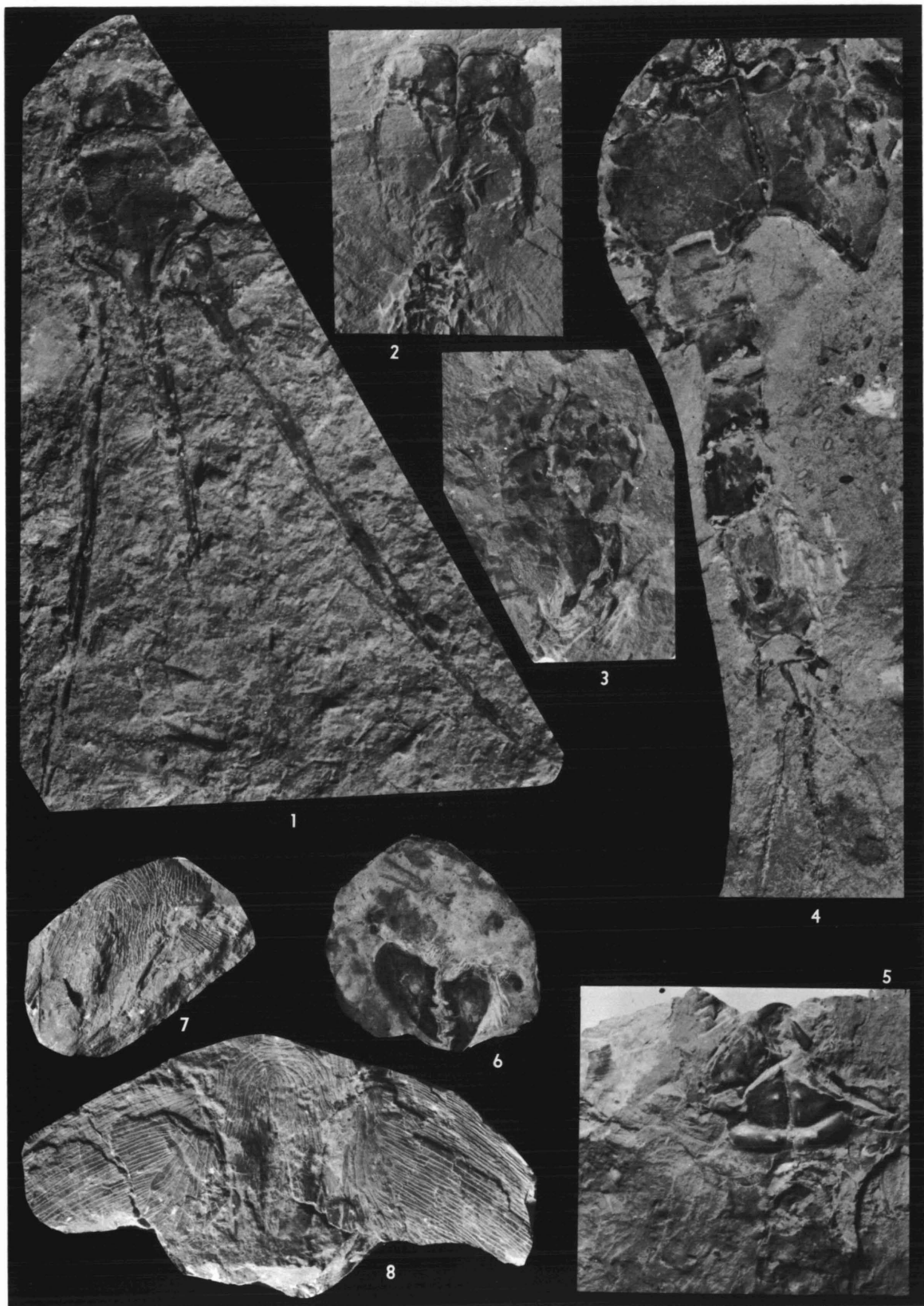


PLATE 2

Clarke (1893, p. 793), Middle Devonian, Hamilton Group, several localities in western New York.

Diagnosis.—Carapace in four parts: rostrum, narrow axial valve, and two winglike lateral valves. Abdomen consisting of two visible somites and three-pronged telson.

RHINOCARIS EHLERSI Stewart

Pl. 3, figs. 1-8; pl. 4, figs. 1-12; text-fig. 1

Rhinocaris ehlersi Stewart, 1933, p. 363-366, pl. 10, figs. 1-3, 1 text-fig. (reproduction of Clarke's *R. columbina*).

Description.—Carapace composed of 4 parts, 2 semi-oval lateral valves with relatively straight axial margins, apparently attached by a membrane. Anterior one-fourth of axial region occupied by an elongate rostrum, widest about one-fourth distance above base, rounded posteriorly, tapering anteriorly into a long, narrow spinose process (pl. 3, figs. 6-7). Basal part of rostrum with faint vertical lines. Posterior three-fourths occupied by a narrow axial plate parallel sided except for tapering ends. Posterior part of axial plate with medial ridge increasing in height posteriorly. Anterior axial part of lateral valves extended into a small process called the prora. Posteriors of lateral valves pointed at peripheral and axial ends, concave between; peripheral points more prominent. Lateral valves with fine parallel grooves in peripheral part, extending about one-third the distance to the axis. Anterior ends of lateral valves with closely set horizontal grooves turning abruptly to extend up the prora. Axial part of lateral valves and entire axial valve covered with fine, anteriorly convex lines interspersed with minute punctae. Where outer layer of carapace is preserved an original opalescent series of colors is present.

Abdomen composed of 2 visible somites, sub-rectangular in shape. Both somites provided with anteriorly convex chevron-shaped lines.

Telson composed of a caudal plate terminating in an axial spine and 2 lateral spines whose anterior ends are covered by the caudal plate. Caudal plate with same lines as appear on abdominal somites. Axial spine relatively smooth with a row of elongate apertures along each margin. Lateral spines with chevron-shaped lines on anterior part; posterior part with faint lines parallel to margins.

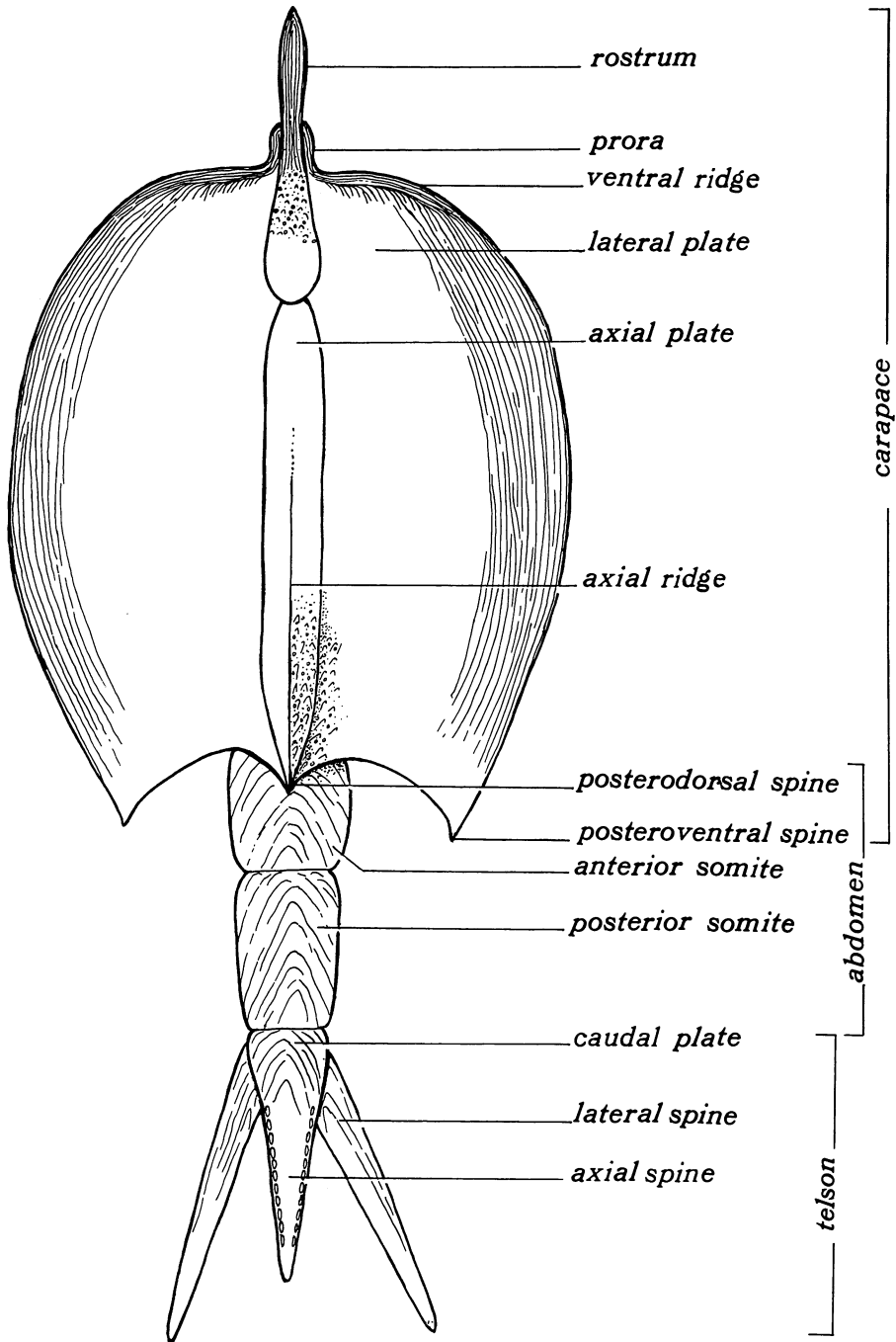
Mandibles or gastric teeth located under anterior one-third of lateral valves, composed of left and right gnathal lobes. Crown composed of about 5 denticles, low and cusplike anteriorly, high and pointed posteriorly. Corpus mandibula attached to crown, irregularly shaped but typically terminating in a long, blade-like shaft. Gnathal lobes convex distally. Posterior denticle of right gnathal lobe with single point; of left gnathal lobe with double point.

Measurements of some specimens are as follows: Length of five lateral valves (excluding proras) ranges from 5.9 cm to 9.7 cm. Maximum width of five lateral valves from 2.3 cm to 3.8 cm. Width of two axial plates 4 mm and 5 mm. One, nearly complete, with a length of 4 cm. Length of anterior somite 1.1 cm. Length of posterior somite 1.7 cm. Average width of somites 1.1 cm. Length of telson spines extremely variable.

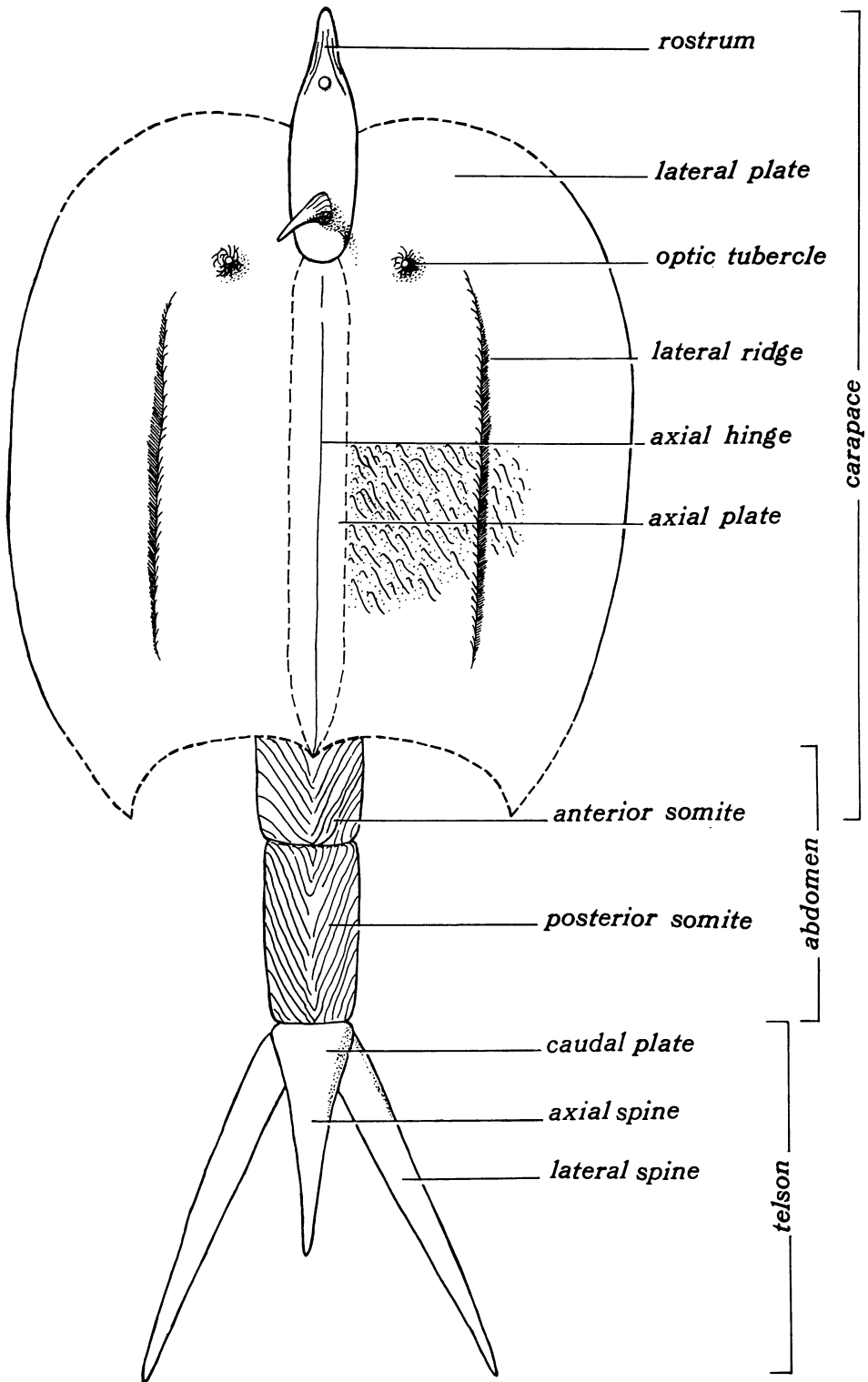
Remarks.—The remarkable iridescence of the carapace makes the species easy to identify. In most cases the mandibles are not in their original position but can be found in almost any position under the carapace, revealing themselves by lumps where the thin carapace has been crushed down upon them. The paired

EXPLANATION OF PLATE 2

- FIGS. 1-6—*Echinocaris punctata* (Hall). 1, telson enlarged to show two rows of rounded pores on axial spine; hypotype UMMP 57465, $\times 4$. 2, ventral view of carapace showing posterior denticle of gnathal lobe on right side; hypotype UMMP 57463, $\times 2$. 3, another ventral view showing almost complete gnathal lobe with prominent posterior denticle; hypotype UMMP 56833, $\times 2$. 4, ventral view of relatively complete specimen showing row of pores near the axis of the carapace; hypotype UMMP 57392, $\times 2$. 5, incomplete dorsal carapace with complete left and partial right gnathal lobes out of position at anterior margin of carapace; hypotype UMMP 56832, $\times 2$. 6, ventral view of carapace showing complete gnathal lobe in position; hypotype UMMP 57470; Windom Shale, Little Beard's Creek, east side of Leicester, New York, $\times 1$; gift of Steven Mitchell.
- 7-8—*Hebertocaris wideneri* n. sp. 7, dorsal view of caudal plate. 8, counterpart showing caudal plate and axial parts of lateral caudal process; paratype UMMP 57464; both figures $\times 1$; gift of Millard Widener.



TEXT-FIG. 1—*Rhinocaris ehlersi* Stewart. Restoration of dorsal surface showing structural features and ornamentation. Overall length about 15 cm.



TEXT-FIG. 2—*Dithyrocaris* sp. cf. *D. neptuni* (Hall). Showing structural features and ornamentation. Parts indicated by dashes inferred. Overall length about 30 cm.

mandibles (pl. 4, figs. 7-8) are believed to be in place at the axis of the carapace from one-fourth to one-third the distance from the anterior end.

Occurrence.—Middle Devonian, Silica Formation, quarries of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Holotype (an isolated right lateral valve) no. 17802, Department of Geology, Ohio State University; hypotypes nos. 23856, 55310, 55311, 55315, 55319, 55328, 55331, 56826, 56827, 56829, 56846, 57367, 57370, 57389, 55303, and 57401.

Genus DITHYROCARIUS Scouler

Dithyrocarius Scouler in Portlock's Report, 1843, p. 313.

Type species.—By monotypy *Argas testudineus* Scouler, 1835, p. 137, 141, fig. 3, Lower Carboniferous, Scotland.

Diagnosis.—Large phyllocarids with semi-lunate lateral valves bearing medial ridges and posterior spines, a rostrum, and a narrow axial plate. Abdomen of two somites; telson with a caudal plate terminating in an axial spine and two lateral spines arranged similarly to those of *Rhinocaris ehlersi*, but much larger and having a different ornamentation.

Remarks.—Hall & Clarke (1888, p. 187) proposed the name *Mesothyra* for some North American species. The true relationship between *Dithyrocarius* and *Mesothyra* is obscure. We are using the name that has priority. One North American species, *D. oceani* (Hall & Clarke), 1888, p. 187-191, pls. 22-34, from the Upper Devonian Ithaca Shale of New York, shows enough parts to reconstruct a reasonably accurate figure. The Middle Devonian material of *Dithyrocarius* is very fragmentary.

DITHYROCARIUS sp. cf. *D. NEPTUNI* (Hall)

Pl. 5, figs. 1-4; pl. 7, figs. 5-9, 16-17; text-fig. 2

Remarks.—This species is known from one complete telson, (Hall & Clarke, 1888, pl. 33,

fig. 1), and a fragment of a lateral caudal spine (pl. 32, fig. 7), both from a loose block from the Hamilton Group, Plainfield, Otsego County, New York.

In the Silica Shale we have found two telsons, one almost complete, which are very similar to the New York specimens. In addition, we have collected four incomplete lateral valves, a rostrum, and four abdominal segments which may belong to this species. The telsons (pl. 7, figs. 16-17) are very similar to those of *D. neptuni* (Hall). The low ridges on the inner sides of the lateral spines as described by Hall are clearly shown. There are also ridges on the outer sides and faint striae on the anterior ends between them. The impression of the caudal plate (fig. 17) shows the anteriorly convex ridges. The other telson (fig. 16) shows the posterior somite with the proximally convex grooves. In plate 7, both somites are shown in figure 9, a perfect anterior somite in figure 7, and the ventral side of a posterior somite in figure 8.

Three of the four incomplete lateral valves shown on plate 5 have well-developed lateral ridges. Figure 3 (× 1) also shows the axial margin on the left. Figure 2 (× 2) shows a probable eye tubercle, and figures 1 (× 2) and 4 (× 4) show the peculiar ornamentation composed of sinuous, offset ridges and irregularly shaped tubercles. The rostrum which may belong to this species is ovate with a narrow anterior end having a node at the base and a spine near the posterior end.

We have illustrated seven sets of mandibles (pl. 7, figs. 10-15) each composed of a crown of denticles surmounting a corpus mandibula which terminates in a diagonal shaft. If the mandibles are oriented as they are in *Echinocaris* the posterior parts of the crown are composed of single-cusped or bifid denticles, and the anterior of multicusped denticles.

The two mandibles in figure 15 were de-

EXPLANATION OF PLATE 3

FIGS. 1-8—*Rhinocaris ehlersi* Stewart. 1, lateral valves of a relatively complete specimen with proras well developed; axial plate displaced and broken; hypotype UMMP 57389, × 2. 2, complete telson and posterior abdominal segment; hypotype UMMP 56827, × 2. 3, telson showing complete axial spine with subrectangular pores or possibly spine bases along lateral margins; hypotype UMMP 55328, × 4. 4, anterior and posterior abdominal segments of an average sized specimen; hypotype UMMP 56829, × 2. 5, caudal plate of telson showing distinctive ornamentation; hypotype UMMP 57401, × 2. 6, anterior part of rostrum showing long, proboscis-like extension tilted to the right; hypotype UMMP 55331, × 2. 7, posterior part of rostrum showing narrow, pyriform shape; hypotype UMMP 55315, × 2. 8, anterior part of left valve showing prora and transverse ridges; hypotype UMMP 55310, × 2.

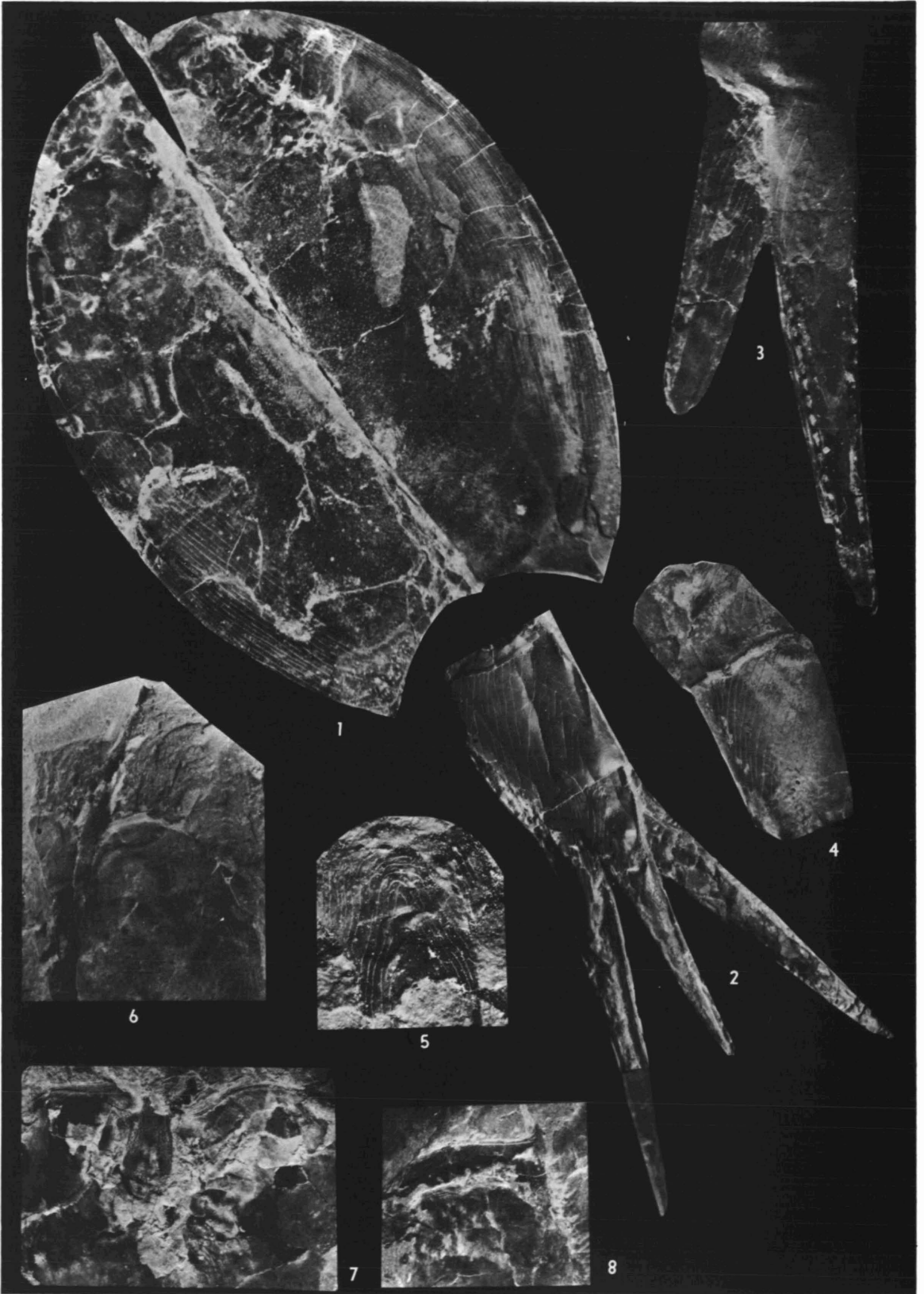


PLATE 3

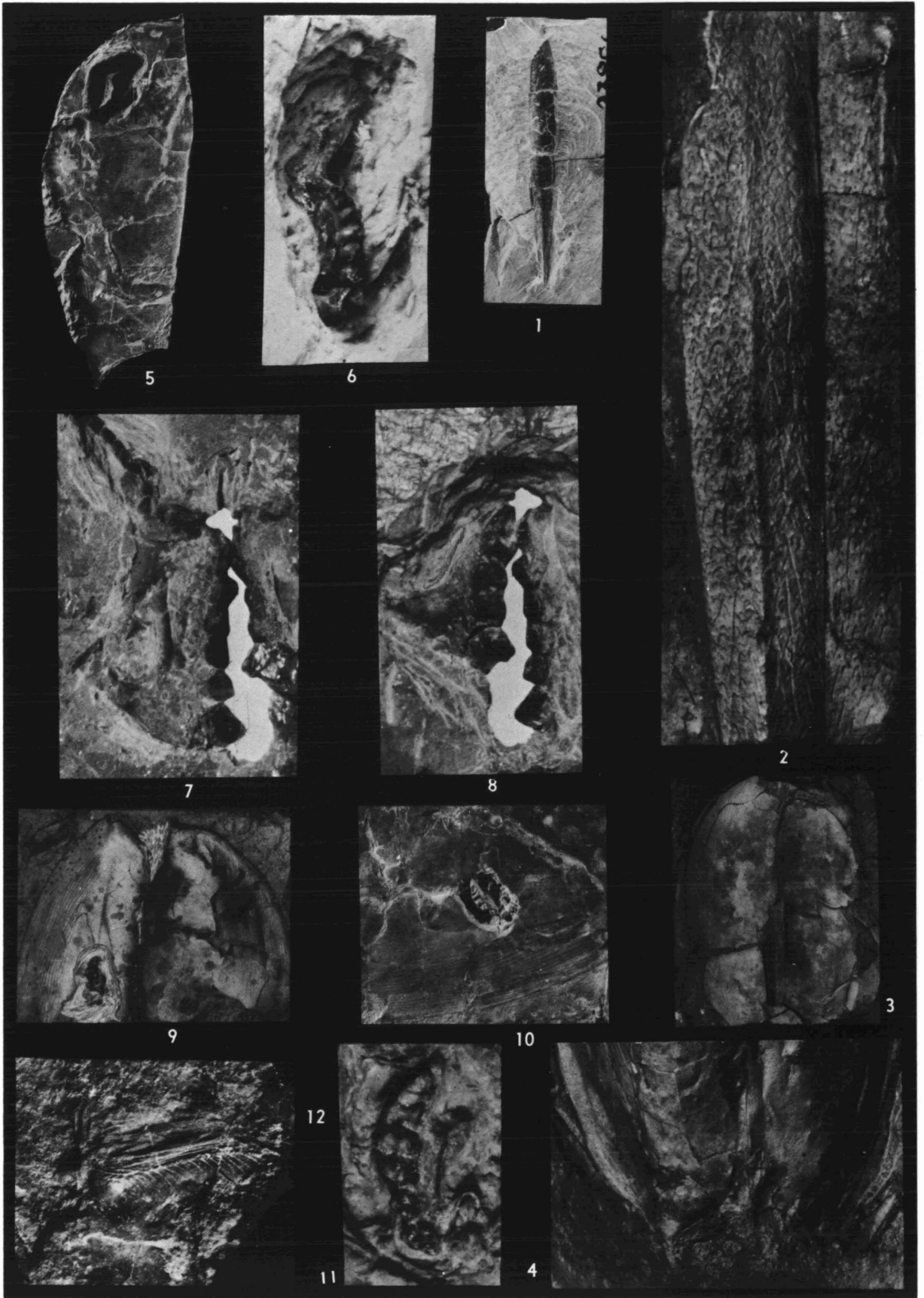


PLATE 4

scribed as fish teeth and named *Pseudodontichthys whitei* (Skeels, 1962, p. 1039–1046, pl. 147, 3 text-figs.). These were considered to be mandibles, or gastric teeth, of *Dithyrocaris* by Dunkle (1965, p. 4) and by Rolfe & Denison (1966, p. 214). Unfortunately, we are unable to determine if the mandibles belong to *Dithyrocaris* or to *Hebertocaris* n. gen. Species of either genus are large enough to have accommodated mandibles that size but we have been unable to find the mandibles in association with any other parts.

Occurrence.—Middle Devonian, Silica Shale, northwestern Ohio.

Types.—Figured specimens nos. 44042, 55313, 56842, 56843, 56844, 56848, 56849, 57368, 57388, 57390, 57393, 57394, 57395 and 57396.

Genus *HEBERTOCARIS* n. gen.

Type species.—*Hebertocaris wideneri* n. sp.
Diagnosis.—As for species.

HEBERTOCARIS WIDENERI n. sp.

Pl. 2, figs. 7–8; pl. 5, fig. 5; pl. 6, figs. 1–4;
pl. 7, figs. 1–4; text-fig. 3

Description.—Species large for a phyllocarid, composed of two semilunate lateral valves, a narrowly pyriform rostrum bearing a posterior spine, an axial valve with long spines, two visible abdominal segments, and a telson with caudal plate terminating in an axial spine and two broad winglike lateral processes.

Right lateral valve (pl. 6, fig. 1) almost complete, lacking only the anterior and posterior marginal areas. It has a straight axial line below the rostrum, a distinct mesolateral ridge and an elevated rimlike marginal ridge. Maximum width of valve 9.3 cm. A smaller right lateral valve (pl. 5, fig. 5) preserves the

axial margin and the mesolateral ridge, but marginal ridge and anterior and posterior extremities missing. Ornamentation of the lateral plate, basal part of the axial plate, and rostrum very distinctive, being composed of oblique offset ridges terminating in anterior hooks (pl. 5, fig. 5; pl. 6, fig. 4) and intervening irregularly shaped pits with elevated margins and short lines producing an anastomosing effect. Axial plate highly convex and surmounted by a uniserial set of posteriorly directed spines, the longest of which is 1.6 cm.

The rostrum is shown by two specimens, one complete (pl. 7, figs. 3–4) showing dorsal surface and a large spine base, the other showing dorsal and side views of the anterior part. The dorsal view shows a very narrowly pyriform or teardrop-shaped figure becoming very narrow and thickened anteriorly and becoming convex with a medial ridge in this area.

Anterior and posterior somites well preserved. Anterior somite 2.5 cm long and about 4 cm wide with ornamentation consisting of low convex grooves which combine at intervals. Posterior somite 3.3 cm long and 4 cm wide, tapering slightly posteriorly, ornamented with grooves in a herringbone pattern, sloping steeply posteriorly to the axis.

Telson with caudal plate shown ventrally and with counterpart on smaller specimen (pl. 2, figs. 7–8). Ornamentation composed of very convex ridges with almost vertical sides. Axial caudal spine incomplete, relatively smooth, with a wide axial and narrow peripheral ridges. Lateral caudal processes winglike, incomplete, largest specimen with a length of 9.2 cm lacking the termination, and a maximum width of 3.1 cm. A raised margin is present on the anterior side. Ornamentation consisting of fine lines in two sets; one, in the axial region almost vertical,

EXPLANATION OF PLATE 4

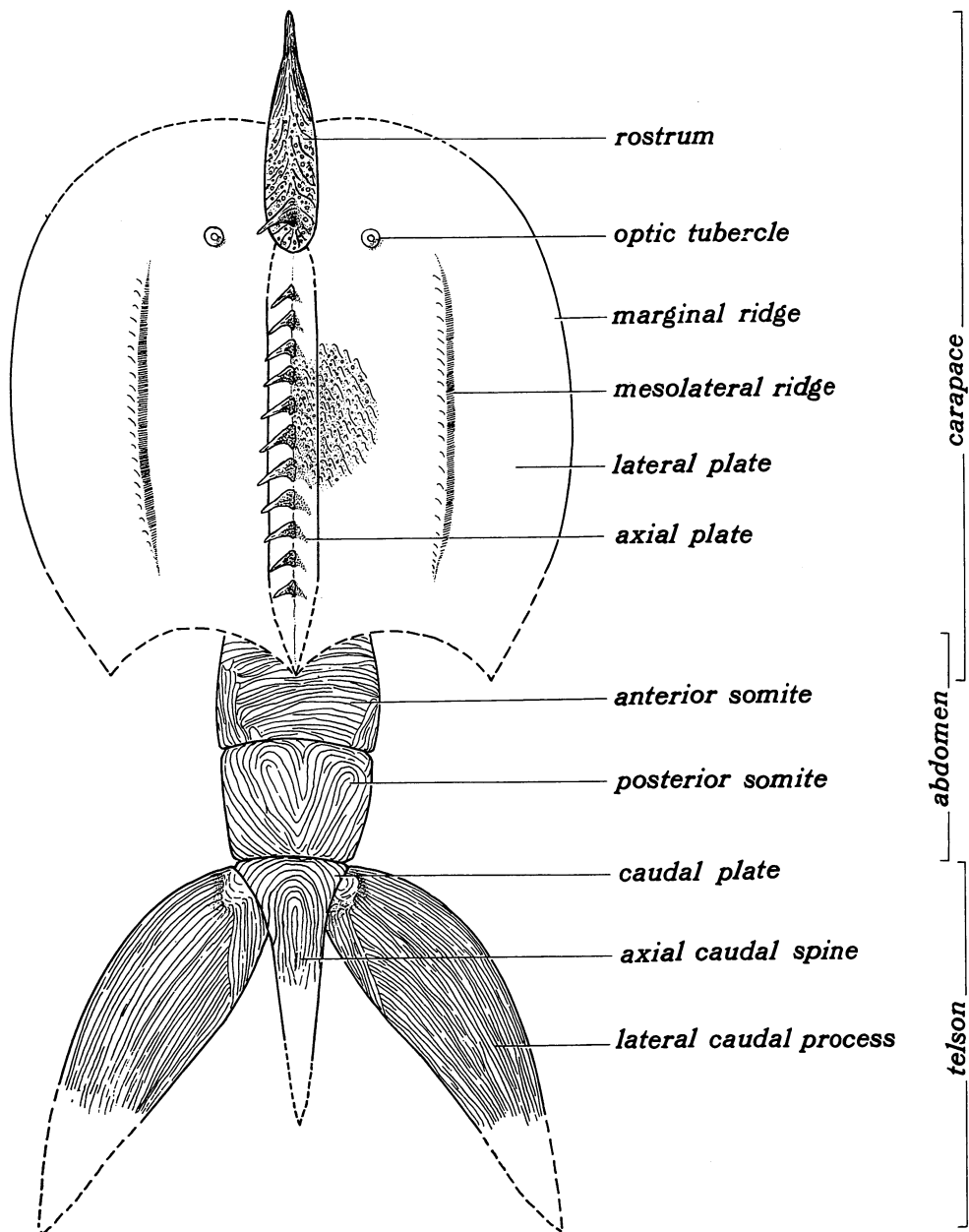
FIGS. 1–12—*Rhinocaris ehlersi* Stewart. 1, axial plate lacking anterior termination; hypotype UMMP 23856, × 1. 2, carapace showing middle part of axial plate between lateral valves; hypotype UMMP 55311, × 1. 3, enlargement of same specimen showing characteristic ornamentation on axial plate and lateral valves and prominent ridge, × 8. 4, view of posterior part of carapace showing spinose posterior termination of axial plate; hypotype UMMP 57367, × 2. 5, left lateral valve showing prora and posterior spines; gnathal lobe excavated from beneath left anterior part of valve; hypotype UMMP 56826, × 1. 6, enlargement of gnathal lobe of same specimen; × 4. 7–8, ventral and dorsal lateral views of paired gnathal lobes, apparently in original position; hypotype UMMP 56846, × 4. 9, left valve (upside down) with gnathal lobe out of position, right valve with prora; hypotype UMMP 55303, × 1. 10–11, dorsal view of gnathal lobe showing denticles; UMMP 57370, 10, × 1; 11, × 4. 12, anterior view of right valve showing prora and transverse ridges across anterior margin of valve; hypotype UMMP 55319, × 2.

another set running parallel to the outline of the process.

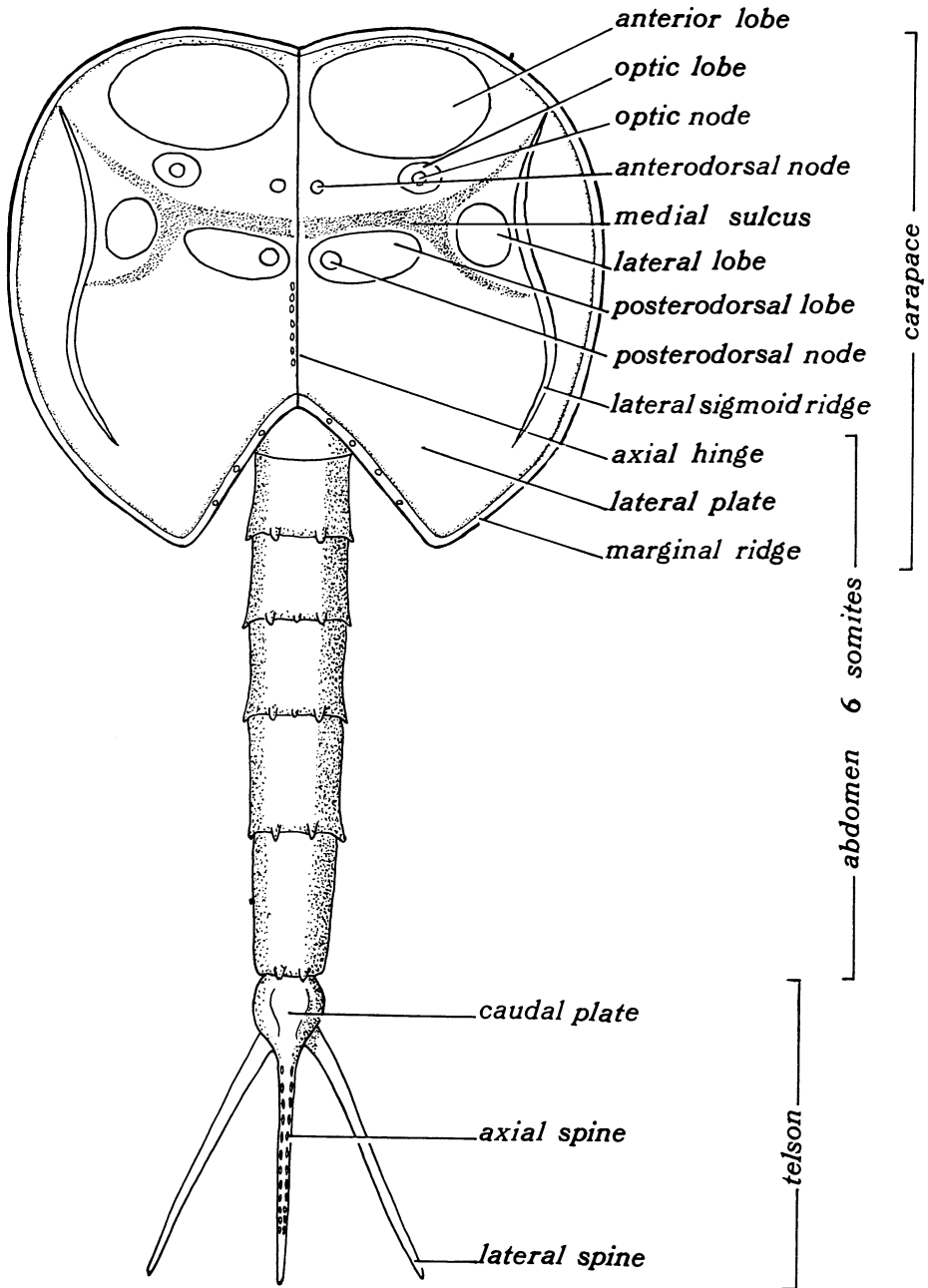
Remarks.—This unusual species has an axial plate and a winged telson quite distinct from other genera of phyllocarids that we have studied. It is the largest phyllocarid, to our knowledge, having reached a length of about 40 cm.

Occurrence.—Middle Devonian, Silica Shale, base of Unit 9, North Quarry of the Medusa Portland Cement Co., at Silica, 1½ miles southwest of Sylvania, Ohio.

Types.—Holotype no. 57461; paratype no. 57461a (both on same slab); other paratypes nos. 56841, 57462, 57464, 57391, and 57398.



TEXT-FIG. 3—*Hebertocaris wideneri* n. sp. Restoration showing major structural features and types of ornamentation. Parts indicated by dashes inferred. Overall length about 40 cm.



TEXT-FIG. 4—*Echinocaris punctata* (Hall). Restoration of dorsal surface. Surface ornamentation not shown. Overall length about $8\frac{1}{2}$ cm.

Family CERATIOCARIDAE
Genus ECHINOCARIS Whitfield

Echinocaris Whitfield 1880, p. 34–36; Beecher, 1884, p. 3–10; Clarke, in Hall & Clarke, 1888, p. 166–171; Whitfield, 1893, p. 455–456; Sturgeon, Hlavin & Kesling, 1964, p. 48–49.

Diagnosis.—Carapace formed of two sub-rounded valves, joined by a straight, flexible axial hinge line. Abdomen composed of five or six typically smooth somites, but with spines along the posterior margins in some species; and a telson composed of a caudal plate term-

inating in an axial spine and bearing two lateral spines.

Type species.—By original designation *Echinocaris sublaevis* Whitfield, 1880, p. 36–37, pl., figs. 4–6; Upper Devonian, Erie [Chagrin] Shale, Leroy, Lake County, Ohio (for synonymy see Sturgeon, Hlavin, & Kesling, 1964, p. 52).

ECHINOCARIS PUNCTATA (Hall)

Pl. 1, figs. 1–15; pl. 2, figs. 1–6; text-fig. 4

Ceratiocaris ? punctata Hall, 1863, p. 74, pl. 1, fig. 8 (for synonymy see Hall & Carke, 1888, p. 166).

Description.—Specimens composed of a bivalved carapace, six visible abdominal somites, and a telson composed of a caudal plate and three spines.

Valves of carapace ovate, with a raised marginal ridge, a straight axial hinge, and a deep posterior sulcus from which the abdominal somites protrude.

Carapace divided transversely by a pronounced medial sulcus which bifurcates laterally. Two large, laterally ovate lobes anterior to the medial sulcus; just behind them, two smaller optic lobes, each bearing a central optic node. Slightly posterior to these, two small anterodorsal nodes situated close to the hinge. Two subrounded lateral lobes present within the bifurcated peripheral parts of the medial sulcus. Just posterior to medial sulcus and close to axial hinge, two laterally elongate posterodorsal lobes, each surmounted with a small posterodorsal node near its axial end. On each valve, between the lobes and the periphery, coinciding with the lateral terminations of the medial sulcus, an elongate lateral sigmoid ridge, convex axially in anterior region and convex peripherally in posterior region.

Row of small pores on the left side of axial hinge, probably spine bases, extending anteriorly as far as posterodorsal lobes. Three or four small nodes present on that part of the marginal ridge that borders the posterior sulcus.

Abdomen composed of six visible somites,

excluding the telson. Somites as wide as long anteriorly, becoming longer and narrower posteriorly. All somites smooth, anterior one with smooth posterior margin, others with two or three spines on the posterior margins.

Telson composed of a globose, pyriform caudal plate, terminating in a slender axial spine bearing two rows of very small pores which may represent spine bases. Two narrow, smooth, lateral spines protruding from beneath caudal plate, typically but not always as long as the axial spine. Lateral spines probably movable.

Mandibles large, terminating in long claw-like denticles oriented posteriorly; corpus mandibulæ irregularly oval, surmounted by a row of small sharp denticles.

Two complete specimens 8.8 cm and 8.5 cm long. Seven carapaces ranging in width from 2.3 to 4.2 cm and four carapaces ranging in length from 2 cm to 3.5 cm. Three abdomens excluding telsons from 2.4 cm to 3.5 cm in length. Four telsons from 1.9 to 2.8 cm in length.

Surface of carapace finely tuberculate, becoming reticulate between sigmoid ridges and marginal ridge. Surface of carapaces of some specimens carrying an epifauna of small inarticulate brachiopods.

Remarks.—The specimens are remarkably similar to those illustrated by Clarke (*in* Hall & Clarke, 1888, pl. 28, figs. 1–7; pl. 29, figs. 1–8), except that his figures do not show the pores in the axial spine of the telson.

Occurrence.—Middle Devonian, Hamilton Group, western New York; Silica Shale, northwestern Ohio.

Types.—Syntypes and hypotypes from western New York in the New York State Museum. Hypotypes from the Silica Shale nos. 55316, 55335, 55341, 55344, 56831, 56832, 56833, 56834, 56835, 56836, 56837, 56838, 56839, 57392, 57463, 57465, and 57470, Museum of Paleontology, University of Michigan.

EXPLANATION OF PLATE 5

Figs. 1–4—*Dithyrocaris* sp. cf. *D. neptuni* (Hall). 1, incomplete left lateral plate showing lateral ridge; figured specimen UMMP 56843, $\times 2$. 2, fragment of a lateral plate showing eye tubercle; figured specimen UMMP 57368, $\times 2$. 3, almost complete right valve showing axial hinge; figured specimen UMMP 55313, $\times 1$. 4, enlargement of part of right lateral plate showing distinctive ornamentation; figured specimen UMMP 56842, $\times 4$.

5—*Hebertocaris wideneri* n. sp. Right lateral valve showing difference in ornamentation when compared with plate 6, figure 4; paratype UMMP 56841, $\times 2$.

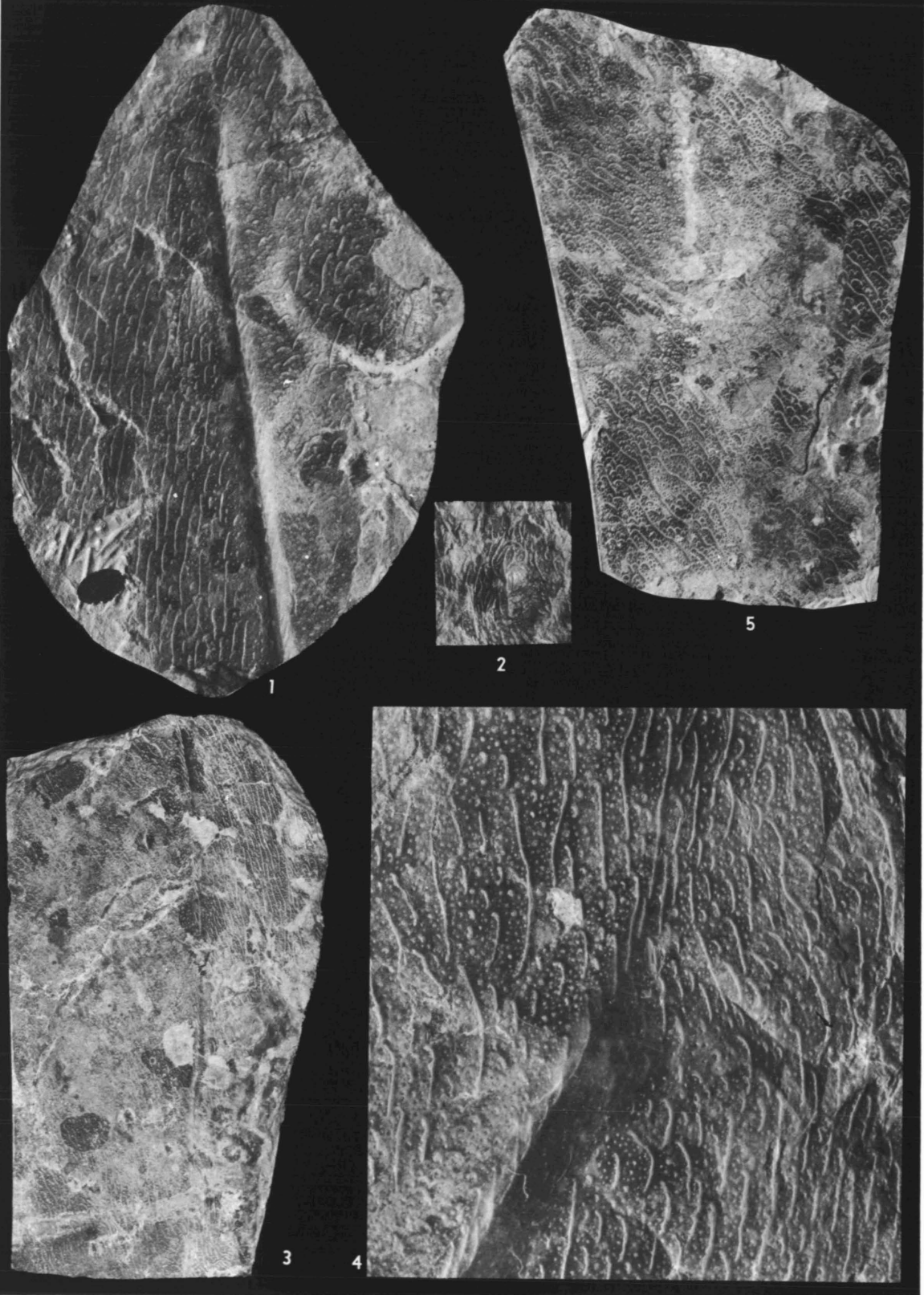


PLATE 5

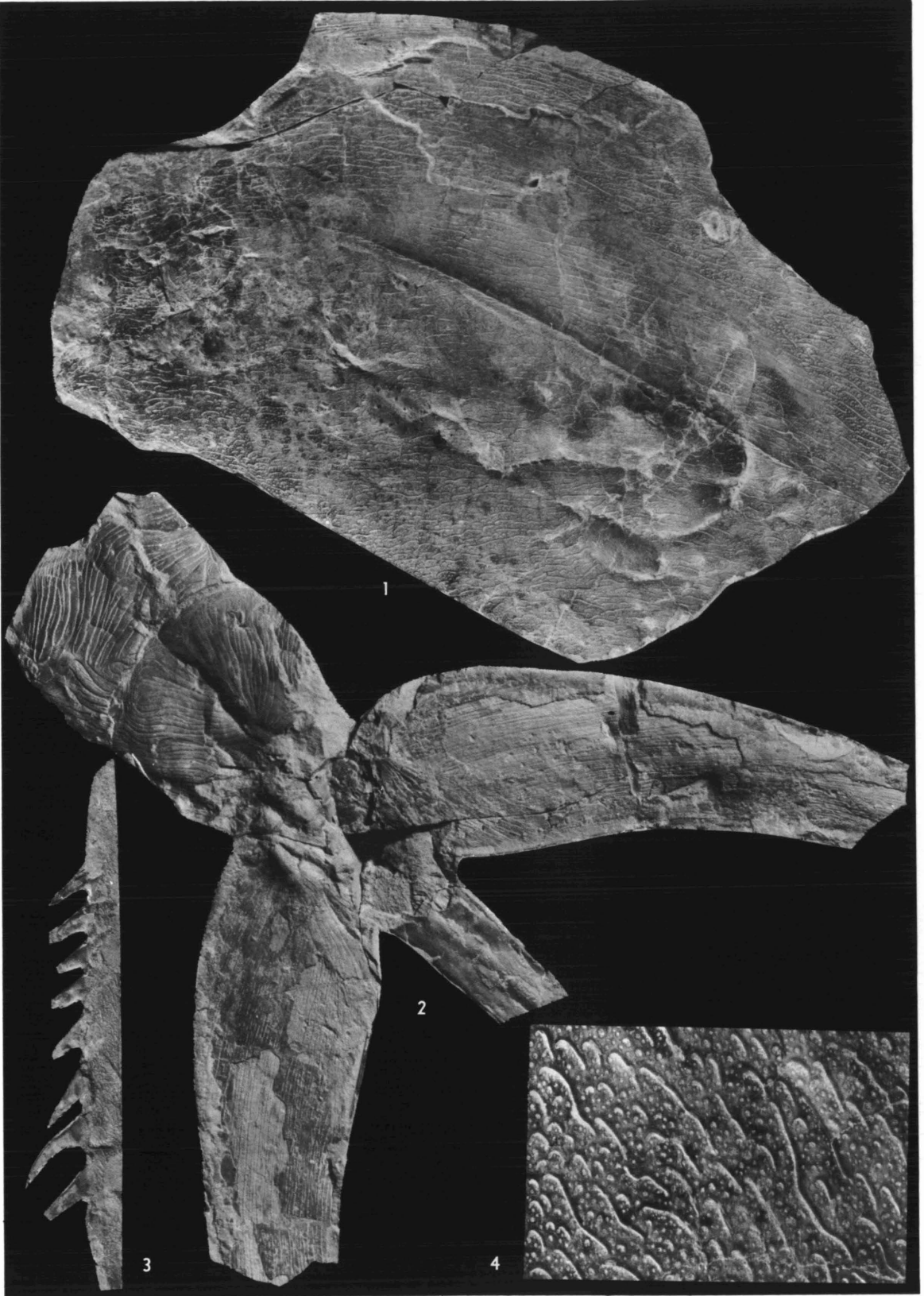


PLATE 6

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EXPLANATION OF PLATE 6

FIGS. 1-4—*Hebertocaris wideneri* n. sp. All specimens a gift of William Hebert and son, John. 1, almost complete right lateral valve with anterior and posterior ends missing; on same slab as holotype; paratype UMMP 57461a, $\times 1$. 2, abdominal somites and telson with median spine and winglike lateral processes; holotype UMMP 57461, $\times 1$. 3, right side of axial plate showing posteriorly recurved spines; paratype UMMP 57462, $\times 1$. 4, enlargement of part of figure 1 to show characteristic ornamentation; $\times 4$.

EXPLANATION OF PLATE 7

- FIGS. 1-4—*Hebertocaris wideneri* n. sp. Both specimens gift of Dr. R. D. Hoare. 1-2, dorsal and lateral views of anterior part of rostrum; paratype UMMP 57398, $\times 2$. 3-4, cast of external mold of rostrum and exterior surface of same specimen showing posterior spine base; ornamentation identical with carapace of *H. wideneri*; paratype UMMP 57391, $\times 2$.
- 5-9, 16-17—*Dithyrocaris* sp. cf. *D. neptuni* (Hall). 5-6, ventral and dorsal counterparts of rostrum tentatively assigned to this species; anterior node and posterior spine well shown; figured specimen UMMP 57390, $\times 1$. 7-9, abdominal somites or segments; 7, dorsal view of anterior somite showing ornamentation; figured specimen UMMP 56849; 8, ventral view of somites; figured specimen UMMP 57388; 9, dorsal view of anterior and posterior somites; figured specimen UMMP 56848; all figures $\times 1$. 16-17, telsons associated with somites; 16, abdominal segments and two spines of telson; figured specimen UMMP 57394; 17, axial and lateral spines of telson; figured specimen UMMP 57393; both figures $\times 1$.
- 10-15—Mandibles belonging either to *Dithyrocaris* or *Hebertocaris*. All figures $\times 1$. 10-11, dorsal and lateral views of left gnathal lobe; figured specimen UMMP 57395. 12-13, lateral and dorsal views of right gnathal lobe; figured specimen UMMP 56844. 14, lateral view of right gnathal lobe showing darker crown and lighter colored corpus mandibulae; figured specimen UMMP 57396. 15, holotype of *Pseudodontichthys whitei* Skeels, incorrectly described as the jaws of a fish; crowns of left and right gnathal lobes; holotype UMMP 44042.

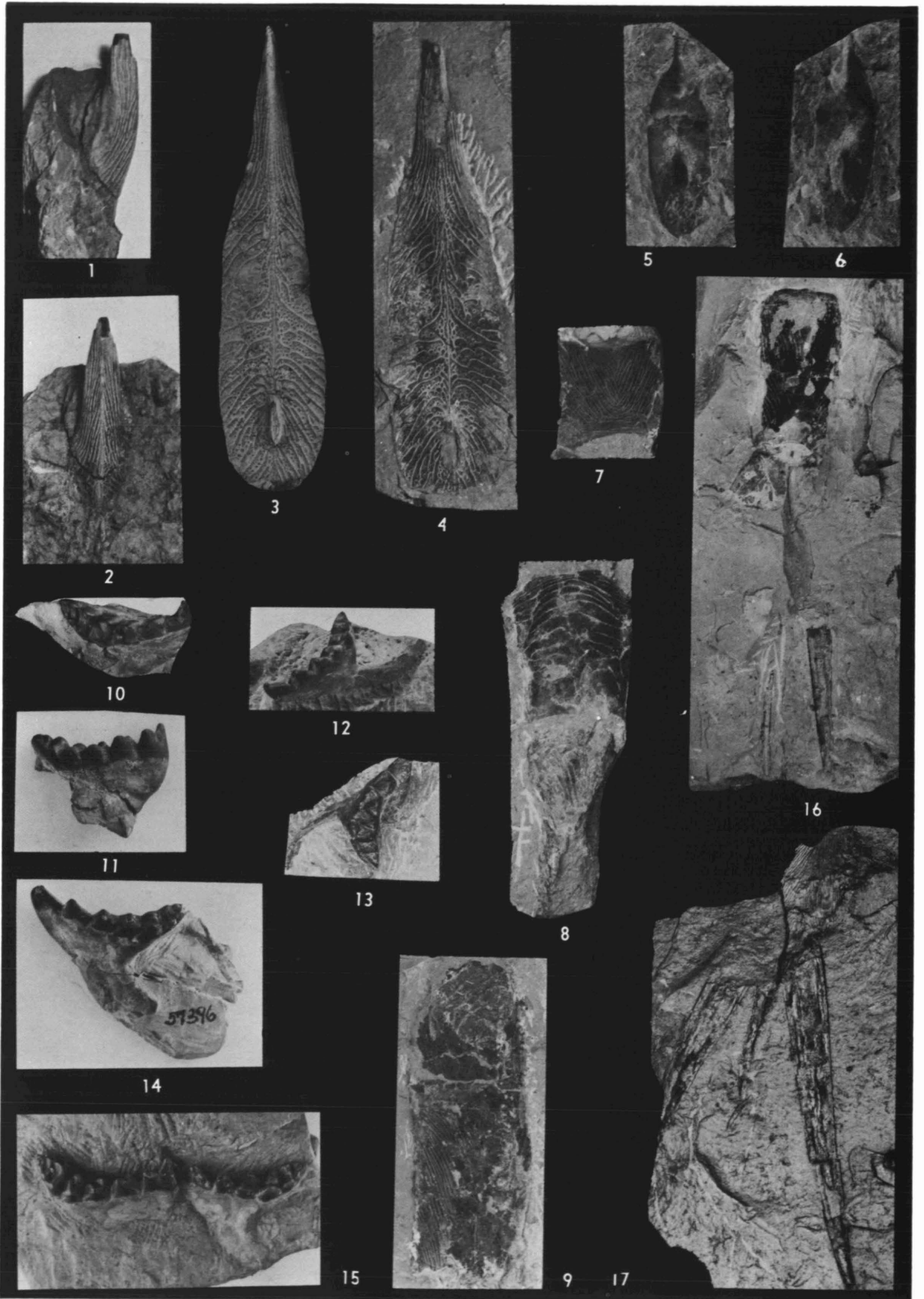


PLATE 7

