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OSTRACODS OF THE FAMILY HOLLINIDAE  
FROM THE ARKONA SHALE OF ONTARIO

BY  
ROBERT V. KESLING



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CONTENTS

Introduction ..... 203  
 Register of localities ..... 204  
 Systematic descriptions ..... 204  
 Literature cited ..... 213  
 Plates ..... (after) 215

INTRODUCTION

THE ostracods from the Middle Devonian Arkona shale of Ontario described in this paper include six genera and ten species. All genera have been previously described, but five of the species are new.

Although ostracods have been studied from the Middle Devonian Hungry Hollow and Widder formations, very little has been written about the ostracods from the Arkona shale. Nicholson (1874), Stauffer (1915), Coryell and Malkin (1936), and Turner (1939) described or listed ostracods from the formations above the Arkona. Warthin (1937 and 1945) mentioned the occurrence of Middle Devonian ostracod species in the Hungry Hollow formation in his card indices. Jones (1890, p. 544) described *Ulrichia conradi* Jones from this region. Inasmuch as this species also occurs in the Bell shale of Michigan (Kesling, 1952a, p. 26), which the author regards as equivalent to the lower strata of the Arkona, it is assumed that Jones collected his specimens from an exposure of the Arkona shale.

Some of the hollinid ostracods in the Arkona are the same species as those in the upper part of the Ferron Point formation of Michigan, and the rest are closely related to Ferron Point species.

All specimens are catalogued and deposited in the Museum of Paleontology of the University of Michigan.

## REGISTER OF LOCALITIES

## LOCALITY

1. Shale, light gray, highly fossiliferous. Shale weathers easily to soft clay. Fossils calcareous, beautifully preserved. Sample from layer 22 feet below the Encrinal limestone (see Shimer and Grabau, 1902, pp. 152-60, for description of the stratigraphic section including the Encrinal limestone). Brick and tile yard, about  $\frac{1}{2}$  mile north of Thedford, Lambton County, Bosanquet Township, Ontario, about  $\frac{1}{8}$  mile east of north-south road. Collected by Mr. and Mrs. E. P. Wright in 1952.
2. Shale, light gray. Shale weathers easily to clay. Fossils pyritized, covered by limonite stain. Sample from a layer 14 feet below the Encrinal limestone. This layer about 1 foot above a layer containing numerous brachiopods of the genus *Leptalosia*. Near the junction of Rock Glen and the Ausable River, on the east bank of the river, Middlesex County, West Williams Township, Ontario, about 1 mile northeast of Arkona. Collected by Mr. and Mrs. E. P. Wright in 1952.
3. Shale, light gray. Shale weathers easily to soft clay. Fossils pyritized, covered by limonite stain. Sample from a layer 16 feet below the Encrinal limestone. This layer about 1 foot below a layer containing numerous brachiopods of the genus *Leptalosia*. Near the junction of Rock Glen and the Ausable River, on the east bank of the river, Middlesex County, West Williams Township, Ontario, about 1 mile northeast of Arkona. Collected by Mr. and Mrs. E. P. Wright in 1952.

## SYSTEMATIC DESCRIPTIONS

## Phylum ARTHROPODA

## Class CRUSTACEA

## Order OSTRACODA

## Superfamily Beyrichiacea

## Family Hollinidae Swartz 1936

Genus *Ctenoloculina* Bassler 1941

*Genotype*.—*Tetradella cicatricosa* Warthin, 1934, p. 209, Pl. I, Figs. 4-6, by subsequent designation of Bassler, 1941, p. 22.

***Ctenoloculina thliberilobota*, sp. nov.**

(Pl. I, Figs. 4-13; Pl. II, Figs. 14-16)

*Description of female*.—Carapace subelliptical in lateral view; subquadrate, posteriorly acuminate in ventral view; and subquadrate in end view. Left valve overlapping right; overlap greatest in posterior and posteroventral parts of carapace. Each valve with slight swing. Hinge line straight. Anterior border round, ventral and posteroventral borders evenly curved, and posterodorsal border subround.

Each valve distinctly quadrilobate. Lobes either flat-topped, ornamented, and surrounded by small ridge, unornamented and without ridge, or combinations of the two. All lobes extending from dorsal to ventral border. L1, L2, and L3 narrow, inclined downward and slightly forward, extending a little above the hinge line. L4 large, D-shaped, widest in the dorsal part. L1 slightly acuminate dorsally, distinctly acuminate ventrally, the ventral tip posteriorly recurved. L2 extremely variable, particularly with regard to the ornamented area, but always widest at the ventral border. Ornamented areas of L2 occurring as elongate areas with nearly parallel sides (Pl. II, Fig. 15), elongate panduriform areas (Pl. II, Fig. 14), separate small dorsal and ventral areas (Pl. I, Figs. 7, 13), or small triangular areas at the ventral border (Pl. I, Fig. 12). L3 slightly S-shaped, the dorsal convex part directed posteriorly and the ventral convex part directed anteriorly. Ornamented areas of L3 occurring as elongate panduriform areas (Pl. II, Fig. 14), separate dorsal and ventral areas with the dorsal area sharply acuminate ventrally and the ventral area sharply acuminate dorsally (Pl. I, Figs. 7, 12), or dorsal and ventral areas connected at their tips (Pl. II, Fig. 15). In several hundred specimens studied, all possible combinations of ornamented areas of L2 and L3 found. Sulci deep, with smooth, rounded bottoms. S1 nearly straight in some specimens (Pl. I, Fig. 13), distinctly curved, convex posteriorly in others (Pl. II, Fig. 15). S2 sinuous. S3 slightly sinuous. All sulci extending from dorsal to ventral border.

Frill not well defined in lateral view, with L1, L2, and L3 extending onto it. Six loculi in each valve, all with round openings. Ventral surface nearly flat, sloping slightly upward and inward from the distal edge. Distinct submarginal ridge around free edge of each valve (that this ridge is not marginal is shown in Pl. I, Fig. 8) with unbroken fragments of delicate margin of valve appearing distal to the ridge.

Anterior cardinal angle about 115 degrees; posterior cardinal angle about 125 degrees.

Lobes or parts of lobes ornamented with a thin surface layer of fine pebbly texture (see L4 in Pl. II, Fig. 16). Thin surface layer partly exfoliated from some lobes (see L4 in Pl. II, Fig. 15), revealing underlying small discrete round papillae. Thin surface layer of many lobes completely broken off (see L2 in Pl. II, Fig. 14). Ornamented parts of lobes bordered by low smooth ridge. Rest of valve smooth.

Dimensions of holotype, No. 28929, a complete carapace: length, 1.62 mm.; height, .90 mm.; and width (through L3's), .77 mm.

*Description of male.*—Outline in lateral view, overlap, lobation, and

ornamentation as in female. In dorsal view, carapace constricted at positions of the three sulci. L1, L2, and L3 extending a little below the rest of the ventral border. L2 and L3 with small posteriorly directed spurs. Ventral end of L3 flat. Variations in ornamental areas of L2 and L3 about the same as those of female, except area of L2 larger in most specimens. Low, smooth, complete ridges around each lobe.

Dimensions of allotype, No. 28926, a male right valve: length, 1.39 mm.; height, .78 mm.; and width, .32 mm.

*Remarks.*—This species is closely related to *Ctenolocolina myurilobota* Kesling (Kesling, 1952*b*, p. 48, Pl. I, Figs. 10–15), from which it differs in having larger size, greater constrictions of L2 and L3, and L2 wider at the ventral border.

The name of this species is derived from Greek θλιβερός (“squeezed”) and λοβός, m. (“a lobe”) and refers to the constricted L2 and L3.

*Occurrence.*—Localities 1 and 2. This species represented by many specimens at Locality 2. In number of specimens it makes up about two-thirds of all ostracods at this place. About five hundred specimens were present in ten pounds of shale.

*Types.*—Holotype, a complete female carapace, No. 28929; allotype, a male right valve, No. 28926; paratypes, one male right valve, No. 28927, three male left valves, Nos. 28930–28932, three female right valves, Nos. 28928, 28948–28949, and three female left valves, Nos. 28933–28934, 28947.

### *Ctenolocolina acanthina*, sp. nov.

(Pl. II, Figs. 1–13)

*Description of female.*—Carapace subelliptical in lateral view; subquadrate, posteriorly acuminate in ventral view; and subtriangular in end view. Left valve overlapping right; overlap greatest in posterior parts of carapace. Each valve with slight swing. Hinge line straight. Free border curved evenly, most sharply rounded in posterodorsal part.

Each valve distinctly quadrilobate. Lobes flat-topped, ornamented. L1 with nearly parallel sides, slightly acuminate dorsally, ventrally confluent with the frill. L2 short, with parallel sides, extending from dorsal border to the wide frill. L3 panduriform, extending from dorsal border to the frill. L4 large, subtriangular, its posterodorsal corner subrounded. Low, indistinct, smooth rim around lobes in some specimens, absent in others.

Frill well defined in lateral view, anteriorly confluent with L1 and posteriorly reaching nearly to L4, wide, flaring outward and downward to the broad ventral surface. Distal lateral part of frill with narrow orna-

mented surface. Six loculi in each valve. Marginal papillae from anterior corner to posteroventral part of free edge, and narrow marginal ridge from posteroventral part of free edge to posterior corner.

Anterior cardinal angle about 115 degrees; posterior cardinal angle about 125 degrees.

Ornamentation of two distinct sizes. Lobes and distal lateral margin of frill covered by low, fine reticulation. Lobes further ornamented by large papillae widely spaced around the edges of the flat reticulate areas and a few large papillae on the posteroventral part of L4 and the anteroventral part of L3. No papillae on the anteroventral edge of L3. Loculi rimmed by partly fused papillae. Rest of valve smooth.

Dimensions of holotype, No. 28940, a complete female carapace: length, 1.00 mm.; height, .52 mm.; and width, .55 mm.

*Description of male.*—Outline in lateral view, overlap, lobation, and ornamentation about the same as in female. Carapace subelliptical in ventral view, constricted at the positions of the three sulci. No frill. L1, L2, and L3 extending beyond the rest of the free border as large spurs. Spurs of L2 and L3 unusually large and flat, extending well beyond the rest of the valve ventrally and laterally (Pl. II, Figs. 6–7). Rims around ventral parts of L1, L2, and L3 higher than those around rest of lobes.

Dimensions of allotype, No. 28942, a complete male carapace: length, .90 mm.; height, .55 mm.; and width, .52 mm.

*Remarks.*—This species resembles *Ctenolocolina eurybathrota* Kesling (Kesling, 1952*b*, p. 46, Pl. I, Figs. 1–9) and *C. platyzanclota*, sp. nov. (see below) in size and general shape, but differs distinctly from both in its ornamentation.

The name of this species is derived from Greek ακανθινοσ ("thorny") and refers to the widely spaced large papillae around and on the lobes.

*Occurrence.*—Localities 1 and 2. This species is very common in samples from Locality 2.

*Types.*—Holotype, a complete female carapace, No. 28940; allotype, a complete male carapace, No. 28942; paratypes, a complete female carapace, No. 28941; two male carapaces, Nos. 28945–28946; and two male right valves, Nos. 28943–28944.

*Ctenolocolina eurybathrota* Kesling

(Pl. II, Figs. 17–19)

*Ctenolocolina eurybathrota* Kesling, 1952*b*, p. 46, Pl. I, Figs. 1–9.

*Ctenolocolina eurybathrota* Kesling and Tabor, 1952, p. 94, Pl. I, Figs. 1–2.

*Remarks.*—The specimens from the Arkona formation can not be dis-

tinguished from those in the upper part of the Ferron Point formation of Michigan in any way.

*Occurrence.*—Locality 1. Common.

*Types.*—Hypotypes, two female right valves, Nos. 28950–28951; and one female left valve, No. 28952.

### ***Ctenoloculina platyzanclota*, sp. nov.**

(Pl. II, Figs. 20–24)

*Description of female.*—Carapace subelliptical in lateral view; subquadrate, posteriorly acuminate in ventral view; and subtriangular in end view. Left valve overlapping right. Each valve with slight swing. Hinge line straight. Anterior border round, ventral border very evenly curved, and posterior border subround.

Each valve distinctly quadrilobate. Lobes flat-topped, ornamented. L1 small, extending above hinge line, slightly acuminate posterodorsally, ventrally confluent with frill, constricted posteroventrally at its junction with the frill. L2 short, subelliptical, ventrally acuminate, separated from frill by a wide, deep groove. L3 subpanduriform, extending above hinge line, acuminate anteroventrally, its ventral border straight but sloping, separated from the frill by a deep groove. L4 large, subtriangular but with a notch in the posterodorsal corner; its anterior side nearly vertical, its dorsal side short and straight, and its posterior side subround. Smooth rims around L2, L3, and L4; a single, continuous rim around L1 and the frill.

Frill broad, sickle-shaped, anteriorly confluent with L1. Six loculi in each valve. Wide ventral surface between the frills.

Anterior cardinal angle about 125 degrees; posterior cardinal angle about 115 degrees.

Lobes ornamented by reticulation of papillae. Frill ornamented by low, fused papillae, forming a pebbly texture.

Dimensions of holotype, No. 28953, a female right valve: length 1.05 mm.; height, .65 mm.; and width, .27 mm.

*Remarks.*—No males that could be definitely assigned to this species have been found. The males may resemble those of *Ctenoloculina eurybathrota* Kesling (Kesling, 1952*b*, p. 46, Pl. I, Figs. 1–9) very closely. Females of this species can be readily distinguished from those of *C. eurybathrota* Kesling, which they closely resemble in size and general shape, in two ways: the ventral end of L2 of *C. platyzanclota* is acuminate, whereas that of *C. eurybathrota* is blunt and straight; and the frill of the former is wide and ornamented with low fused papillae, whereas that of



the latter is narrow and ornamented with papillae of the same size as those on the lobes.

The name of this species is derived from Greek πλατύς ("broad") and ζαγκλή, f. ("a sickle") and refers to the shape of the frill.

*Occurrence*.—Locality 1.

*Types*.—Holotype, a female right valve, No. 28953; paratypes, a female right valve, No. 28954; and three female left valves, Nos. 28955–28957.

Genus *Hollina* Ulrich and Bassler 1908

*Genotype*.—*Ctenobolbina insolens* Ulrich, 1900, p. 182, Pl. 8, Figs. 10–11, by subsequent designation of Ulrich and Bassler, 1908, p. 315.

*Hollina pyxidata* Kesling

(Pl. I, Figs. 1–3)

*Hollina pyxidata* Kesling, 1952b, p. 49, Pl. I, Figs. 24–31.

*Remarks*.—The specimens from the Arkona formation appear to be conspecific with those from the Ferron Point formation. The shell is evidently fragile, because all specimens found in the Arkona were broken. The specimens also appear to have suffered more from abrasion and from crushing than those of other species in the same shale bed. L3 is a bulb, L1 is a knob, L2 is a node, and the ventral lobes are large. These features together with the size and surface ornamentation agree with those of the Ferron Point specimens.

*Occurrence*.—Locality 1. Rare.

*Types*.—Hypotypes, one broken female right valve, No. 28924; a broken male right valve, No. 28923; and a broken male left valve, No. 28925.

Genus *Subligaculum* Kesling and McMillan 1951

*Genotype*.—By original designation, *Subligaculum scrobiculatum* Kesling and McMillan, 1951, pp. 65–66, Pl. II, Figs. 1–4; Pl. VII, Figs. 1–8.

*Subligaculum calcaratum*, sp. nov.

(Pl. I, Figs. 14–20; Pl. IV, Figs. 30–31, 34–35)

*Description of female*.—Carapace suboval in lateral view, subquadrate in ventral view, and subquadrate in end view. Left valve overlapping right slightly. Hinge line straight. Free border evenly round.

Lobation largely determined by deep S2 extending from the dorsal border to about the middle of the valve, there bifurcating sharply with short anterior and posterior extensions. L2 and L3 raised a little above the rest of the surface, but ill defined.

Frill narrow, with four curved indentations as seen in lateral view and with four semicircular segments, convex outward, as seen in ventral view. Each semicircular segment forming a half of one of the four "extraneous chambers" in a complete closed carapace. These "extraneous chambers" open completely on their distal side. The ends of the semicircular segments projecting as sharp tips, particularly those of the two anterior segments. A short backwardly directed spur on the posteroventral border of each valve, separated from the frill by about the diameter of one segment. Marginal structure formed around free edge of each valve by very small closely spaced papillae.

Anterior cardinal angle about 120 degrees; posterior cardinal angle somewhat less.

Small discrete papillae covering entire surface except frill and spur. Frill and spur smooth.

Dimensions of holotype, No. 28935, a complete female carapace: length, .72 mm.; height, .43 mm.; and width, .33 mm.

*Description of male.*—Outline in lateral view, overlap, lobation, and ornamentation as in female. No frill. A short spur on the posteroventral border, and a larger spur on the anteroventral border. The anteroventral spur about twice the width of the posteroventral spur.

Dimensions of allotype, No. 28975, a complete male carapace: length, .73 mm.; height, .43 mm.; and width, .31 mm.

*Remarks.*—The anteroventral velate structure of the male is very close to that of *Parabolbina* and very much smaller than that of the genotype of *Subligaculum*. The sulcation and velate structures of the female are typical of the latter genus and the species is here assigned to it. This species is very close to *Subligaculum lacinosum* Kesling (Kesling, 1952*b*, p. 54, Pl. II, Figs. 16–18), from which it differs in the position of the spur in the female valve.

The name of this species is derived from Latin *calcar*, n. ("a spur") and refers to the spur on the female valve.

*Occurrence.*—Localities 1, 2, and 3. Rare at all localities.

*Types.*—Holotype, a complete female carapace, No. 28935; allotype, a complete male carapace, No. 28975; paratypes, one female carapace, No. 28937; two female left valves, Nos. 28936 and 28939; one female right valve, No. 28938; and a male carapace, No. 28973.

? *Subligaculum* sp.

(Pl. III, Figs. 29–32; Pl. IV, Figs. 22–29, 32–33, 36–45)

*Remarks.*—In the immature specimens the anteroventral and posteroventral spurs are nearly the same size. The posterior extension from the

ventral end of S2 is weakly developed or absent. These immature specimens may all belong to *Subligaculum calcaratum*, sp. nov. or some of them may belong to the genus *Parabolbina*. Inasmuch as no studies have been made of young instars of these two genera, it is not possible to define their limits at this time. Because no adults of *Parabolbina* were found in the Arkona samples, the immature specimens are questionably assigned to *Subligaculum*.

*Occurrence*.—Localities 1, 2, and 3.

*Specimens*.—Immature carapaces, Nos. 28998–28999, 29200–29201, 28969–28972, 28974, and 28976–28980.

#### Genus *Hollinella* Coryell 1928

*Genotype*.—By original designation, *Hollinella dentata* Coryell, 1928, p. 378, Pl. 51, Fig. 1.

#### *Hollinella pumila* Kesling

(Pl. III, Figs. 1–21)

*Hollinella pumila* Kesling, 1952*b*, p. 48, Pl. I, Figs. 16–23.

*Remarks*.—The specimens from the Arkona shale are conspecific with those from the Ferron Point formation. There are also immature specimens from the Arkona (Pl. III, Figs. 7–21) which by their lobation, ornamentation, and general shape are evidently immature instars of this species, and they have anteroventral and posteroventral spurs on each valve instead of frills. The bulblike form of L3 in each valve separates these specimens from those of *Parabolbina*, which they resemble in their velate structures.

*Occurrence*.—Locality 2.

*Types*.—Hypotypes, two male carapaces, Nos. 28981–28982; one female carapace, No. 28983; and nine immature carapaces, Nos. 28984–28991 and 29228.

#### *Hollinella senticosa*, sp. nov.

(Pl. III, Figs. 22–23)

*Description*.—Carapace subpyriform in lateral view; attenuated, subpanduriform in ventral view; and sublanceolate in end view. Left valve overlapping right. Each valve with slight swing. Hinge line straight. Anterior border round, ventral and posteroventral borders gently curved, and posterior border acutely subround.

L1 gently arched, extending from anterior part of dorsal border to very shallow depression separating it from the anteroventral lobe. L2 a small node. L3 a round knob, tangent to the dorsal border, rising laterally to about the same width as the posteroventral lobe. L4 gently arched, from

the posterior part of the dorsal border to its confluence with the posteroventral lobe. Anteroventral lobe gently arched, rising laterally to about the same width as L1. Posteroventral lobe rising to about the same width as L3, confluent with L4, separated from L3 by a furrow, separated from anteroventral lobe by shallow ventral extension of S2. S1 a furrow around the posterior and ventral sides of L1, very shallow ventral to L1, dorsally confluent with S2 above L2. S2 a deep vertical sulcus between L3 and L2 from the dorsal border to the center of the valve, there becoming an anteroventrally slanting furrow to the ventral border, linked to S3 by a furrow around the ventral part of L3. S3 a shallow furrow.

No velate structures present in this immature specimen. Marginal papillae, slightly larger than those of rest of valve, each separated from the adjacent papillae by a distance greater than its own diameter.

Anterior and posterior cardinal angles each about 115 degrees.

Surface ornamented by a reticulation of small partly fused papillae almost obscured by much larger subconical papillae.

Dimensions of holotype, No. 28992, an immature carapace (slightly crushed): length, 1.10 mm.; height, .69 mm.; and width, .39 mm.

*Remarks.*—The ornamentation of the holotype is so markedly different from that of any other *Hollinella* from the Middle Devonian that it is described as a new species, even though it is an immature specimen. The adult of this distinctive species may be discovered later.

The name of this species is derived from Latin *senticosus* ("full of thorns") and refers to the surface ornamentation.

*Occurrence.*—Locality 2.

*Type.*—Holotype, a slightly crushed immature carapace, No. 28992.

#### Genus *Falsipollex* Kesling and McMillan

*Genotype.*—By original designation, *Falsipollex altituberculatus* Kesling and McMillan, 1951, pp. 68–69, Pl. III, Figs. 1–3.

#### *Falsipollex valgus* Kesling

(Pl. III, Figs. 24–28)

*Falsipollex valgus* Kesling, 1952b, p. 52, Pl. II, Figs. 19–26.

*Remarks.*—The females from the Arkona show several variations in the remarkable posteroventral spur. The spur may be a low, smooth, hemispherical protuberance (Pl. III, Fig. 28), a subconical spine, a flat, ornamented, round-tipped projection (Pl. III, Fig. 27), or a large, blunt, ornamented projection constricted at its base (Pl. III, Fig. 25). The breadth of the frill in female valves also varies appreciably. The tips of the spurs on the male right valve (Pl. III, Fig. 26) are broken, but the bases

of the spurs are directed the same as those in the Ferron Point specimens. The specimens are evidently very fragile, inasmuch as many broken pieces but very few complete valves were found.

*Occurrence.*—Locality 1.

*Types.*—Hypotypes, a male right valve, No. 28995; and four female left valves, Nos. 28993–28994 and 28996–28997.

#### Genus *Tetrasacculus* Stewart

*Genotype.*—By original designation, *Tetrasacculus bilobus* Stewart, 1936, pp. 744–45, Pl. 100, Figs. 8–11.

#### *Tetrasacculus magnivelatus* Kesling and McMillan

(Pl. IV, Figs. 1–21)

*Tetrasacculus magnivelatus* Kesling and McMillan, 1951, p. 51, Pl. I, Figs. 6–7.

*Tetrasacculus magnivelatus* Kesling and Tabor, 1952, p. 95, Pl. I, Figs. 5–8.

*Remarks.*—The Arkona specimens of this species consist of beautifully preserved adult females, adult males, and immature instars. They show certain features previously undescribed. The adult female left valve (Pl. IV, Fig. 4) has subtriangular pits at the junctions of the contact margin and the hinge into which the two corners of the right valve (Pl. IV, Fig. 2) fit. The adult male valve has two very prominent ventral projections and a velate ridge extending from the anterior part of the anteroventral projection, below the two projections, and curved around the posterior half of the posteroventral projections (Pl. IV, Figs. 15–16). This curious ridge is larger and longer than any previously described for species of *Tetrasacculus*. The immature instars have the same general shape as the adult male, but the velate ridge is absent in the smaller specimens. The ventral projections and the long slanting S2 are easily seen even on very small specimens.

*Occurrence.*—Locality 2.

*Types.*—Hypotypes, three female carapaces, Nos. 28960–28962; a female right valve, No. 28958; a female left valve, No. 28959; a male carapace, No. 28965; and five immature carapaces, Nos. 28963–28964 and 28966–28968.

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**PLATES**

## EXPLANATION OF PLATE I

(All figures  $\times 30$ )

	PAGE
<i>Hollina pyxidata</i> Kesling .....	209
FIG. 1. Lateral view of incomplete male right valve. Hypotype No. 28923. Locality 1.	
FIG. 2. Lateral view of incomplete female right valve. Hypotype No. 28924. Locality 1.	
FIG. 3. Lateral view of incomplete male left valve. Hypotype No. 28925. Locality 1.	
<i>Ctenoloculina thliberilobota</i> , sp. nov. ....	204
FIG. 4. Lateral view of male right valve. Allotype No. 28926. Locality 1.	
FIG. 5. Lateral view of male right valve. Paratype No. 28927. Locality 1.	
FIG. 6. Lateral view of female right valve. Paratype No. 28928. Locality 1.	
FIGS. 7-8. Lateral and ventral view of female carapace. Holotype No. 28929. Locality 2.	
FIG. 9. Lateral view of male left valve. Paratype No. 28930. Locality 1.	
FIG. 10. Lateral view of male left valve. Paratype No. 28931. Locality 1.	
FIG. 11. Lateral view of male left valve. Paratype No. 28932. Locality 1.	
FIG. 12. Lateral view of female left valve. Paratype No. 28933. Locality 1.	
FIG. 13. Lateral view of female left valve. Paratype No. 28934. Locality 1.	
<i>Subligaculum calcaratum</i> , sp. nov. ....	209
FIGS. 14-15. Lateral and ventral views of female carapace. Holotype No. 28935. Locality 3.	
FIG. 16. Lateral view of female left valve. Paratype No. 28936. Locality 2.	
FIGS. 17-18. Lateral and ventral views of female carapace. Paratype No. 28937. Locality 3.	
FIG. 19. Lateral view of female right valve. Paratype No. 28938. Locality 1.	
FIG. 20. Lateral view of female left valve. Paratype No. 28939. Locality 1.	



PLATE I

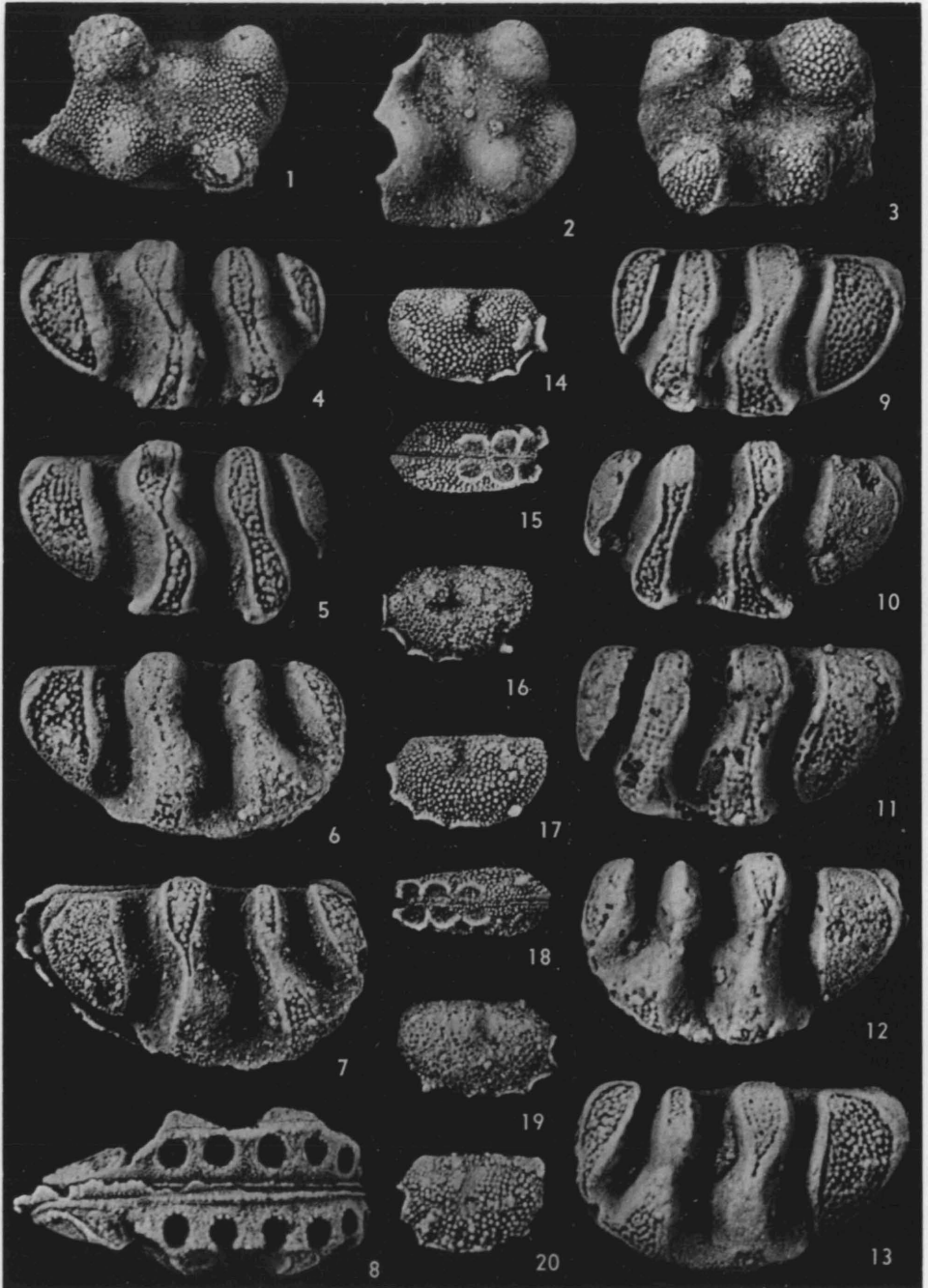
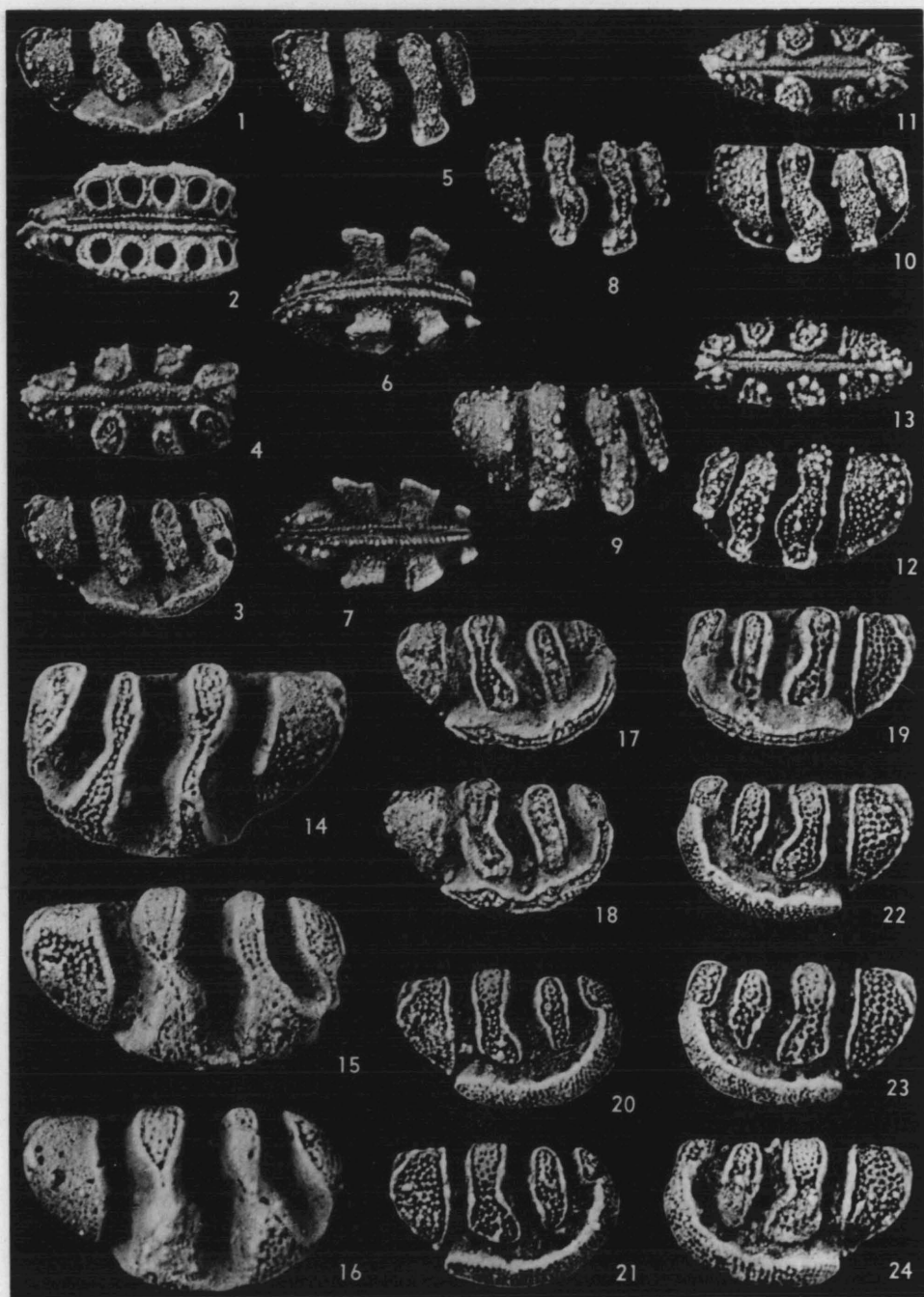


PLATE II



## EXPLANATION OF PLATE II

(All figures  $\times 30$ )

	PAGE
<i>Ctenoloculina acanthina</i> , sp. nov. ....	206
FIGS. 1-2. Right lateral and ventral views of female carapace. Holotype No. 28940. Locality 2.	
FIGS. 3-4. Right lateral and dorsal views of female carapace. Paratype No. 28941. Locality 2.	
FIGS. 5-7. Right lateral, lateroventral, and ventral views of male carapace. Allotype No. 28942. Locality 2.	
FIG. 8. Right lateral view of male right valve. Paratype No. 28943. Locality 1.	
FIG. 9. Right lateral view of male right valve. Paratype No. 28944. Locality 1.	
FIGS. 10-11. Right lateral and dorsal views of male carapace. Paratype No. 28945. Locality 2.	
FIGS. 12-13. Left lateral and dorsal views of male carapace. Paratype No. 28946. Locality 2.	
<i>Ctenoloculina thliberilobota</i> , sp. nov. ....	204
FIG. 14. Lateral view of female left valve. Paratype No. 28947. Locality 1.	
FIG. 15. Lateral view of female right valve. Paratype No. 28948. Locality 1.	
FIG. 16. Lateral view of female right valve. Paratype No. 28949. Locality 1.	
<i>Ctenoloculina eurybathrota</i> Kesling .....	207
FIG. 17. Lateral view of female right valve. Hypotype No. 28950. Locality 1.	
FIG. 18. Lateral view of female right valve. Hypotype No. 28951. Locality 1.	
FIG. 19. Lateral view of female left valve. Hypotype No. 28952. Locality 1.	
<i>Ctenoloculina platyzanclota</i> , sp. nov. ....	208
FIG. 20. Lateral view of female right valve. Holotype No. 28953. Locality 1.	
FIG. 21. Lateral view of female right valve. Paratype No. 28954. Locality 1.	
FIG. 22. Lateral view of female left valve. Paratype No. 28955. Locality 1.	
FIG. 23. Lateral view of female left valve. Paratype No. 28956. Locality 1.	
FIG. 24. Lateral view of female left valve. Paratype No. 28957. Locality 1.	

## EXPLANATION OF PLATE III

(All figures  $\times 30$ )

	PAGE
<i>Hollinella pumila</i> Kesling .....	211
FIGS. 1-4. Lateral and ventral views of two male carapaces. Hypotypes Nos. 28981-28982. Locality 2.	
FIG. 5-6. Left lateral and ventral views of female carapace. Hypotype No. 28983. Locality 2.	
FIGS. 7-14, 17-20. Right lateral and ventral views of six immature carapaces. Hypotypes Nos. 28984-28987, 28989-28990. Locality 2.	
FIGS. 15-16, 21. Right lateral views of three immature carapaces, Hypotypes Nos. 28988, 29228, and 28991. Locality 2.	
<i>Hollinella senticosa</i> , sp. nov. ....	211
FIGS. 22-23. Right lateral and ventral views of immature carapace. Holotype No. 28992. Locality 2.	
<i>Falsipollex valgus</i> Kesling .....	212
FIGS 24-25. Lateral views of two female left valves. Hypotypes Nos. 28993-28994. Locality 1.	
FIG. 26. Lateral view of male right valve. Hypotype No. 28995. Locality 1.	
FIGS. 27-28. Lateral views of two female left valves. Hypotypes Nos. 28996-28997. Locality 1.	
? <i>Subligaculum</i> sp. ....	210
FIG. 29. Left lateral view of immature carapace. Specimen No. 28998. Locality 2.	
FIGS. 30-32. Left lateral views of three immature carapaces. Specimens Nos. 28999, 29200-29201. Locality 2.	

PLATE III

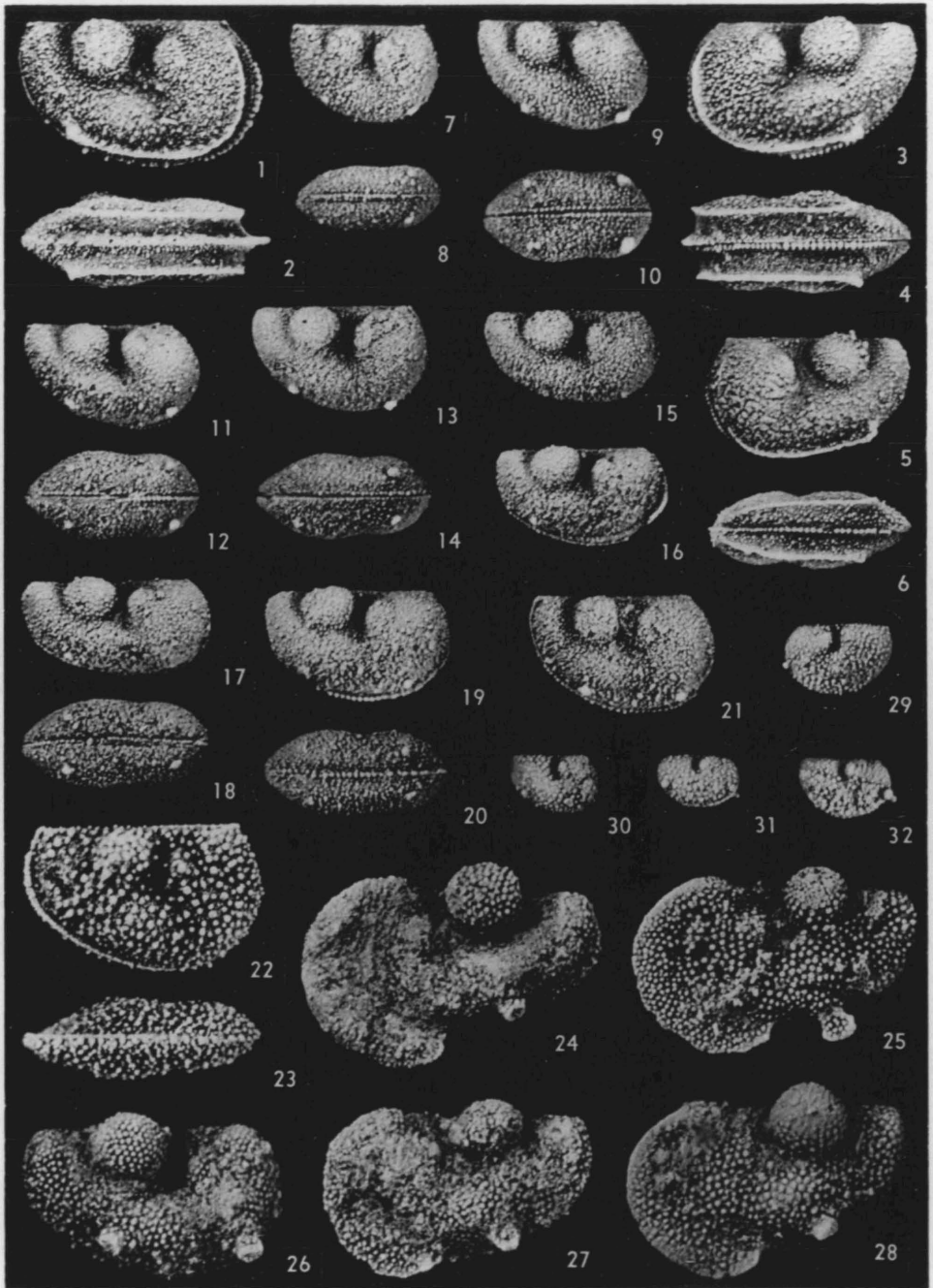
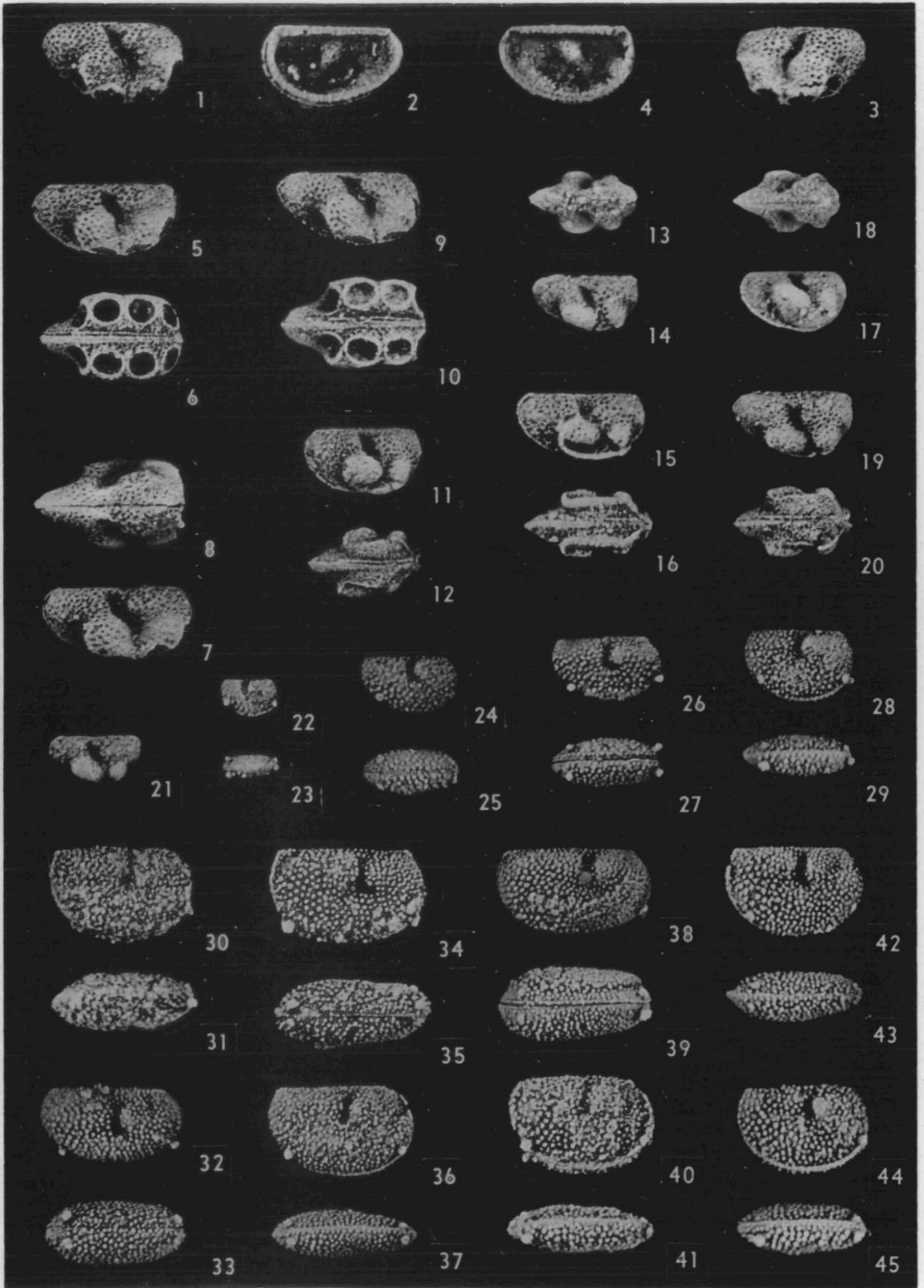


PLATE IV



## EXPLANATION OF PLATE IV

(All figures  $\times 30$ )

	PAGE
<i>Tetrasacculus magnivelatus</i> Kesling and McMillan .....	213
FIGS. 1-2. Lateral and interior views of female right valve. Hypotype No. 28958. Locality 2.	
FIGS. 3-4. Lateral and interior views of female left valve. Hypotype No. 28959. Locality 2.	
FIGS. 5-6, 9-10. Right lateral and ventral views of two female carapaces. Hypotypes Nos. 28960 and 28962. Locality 2.	
FIGS. 7-8. Right lateral and dorsal views of female carapace. Hypotype No. 28961. Locality 2.	
FIGS. 13-14, 17-18. Right lateral and dorsal views of two immature male carapaces. Hypotypes Nos. 28964 and 28966. Locality 2.	
FIG. 15-16. Right lateral and ventral views of male carapace. Hypotype No. 28965. Locality 2.	
FIGS. 11-12, 19-20. Right lateral and ventral views of two immature carapaces. Hypotypes Nos. 28963 and 28967. Locality 2.	
FIG. 21. Right lateral view of immature carapace. Hypotype No. 28968. Locality 2.	
<i>Subligaculum calcaratum</i> , sp. nov. ....	209
FIGS. 30-31. Right lateral and ventral views of male carapace. Paratype No. 28973. Locality 1.	
FIGS. 34-35. Right lateral and ventral views of male carapace. Allotype No. 28975. Locality 2.	
? <i>Subligaculum</i> sp. ....	210
FIGS. 22-29, 32-33, 36-45. Right lateral and ventral views of ten immature carapaces. Specimens Nos. 28969-28972, 28974, and 28976-28980. Nos. 28969-28972, 28974, 28977, and 28979-28980 from locality 2; Nos. 28976 and 28978 from locality 3.	









## VOLUME X

1. Ostracods of the Families Leperditellidae, Drepanellidae, Glyptopleuridae, Kloedenellidae, Bairdiidae, Barychilinidae, and Thlipsuridae from the Genshaw Formation of Michigan, by Robert V. Kesling and John E. Kilgore. Pages 1-19, with 4 plates. Price \$.60.
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