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OSTRACODS FROM THE
MIDDLE DEVONIAN DUNDEE LIMESTONE
IN NORTHWESTERN OHIO

BY
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INTRODUCTION

THE ostracods described in this paper are from the Middle Devonian Dundee limestone in northwestern Ohio. They comprise six genera and five species. Two of the genera and all of the species are new. A single valve of a species of *Octonaria* apparently differs from members of that genus, but is here given only as *nomenclatura aperta*. Additional specimens would be necessary for a specific assignment. The Dundee fauna contains some unusual barychilinid ostracods which have been placed in the new genera. No ostracods have been described previously from the Dundee limestone, although Ehlers and others (1951, p. 18; 1952, p. 18) mention their occurrence in chert nodules of the formation near Silica, Ohio.

All the specimens are from weathered irregular lenses and nodules of chert. They are incompletely silicified. When placed in concentrated hydrochloric acid, they effervesce a little and fine details of their ornamentation become obscure or disappear. The ostracods can be separated from the chert matrix only if the rock has been extensively weathered. Careful work with small metal picks is necessary to isolate them from the matrix and to clean their surfaces of adhering granular material. Many specimens are complete carapaces with the fine details of ornamentation preserved. The two valves can be pried from the carapace to expose the siliceous steinkern. The steinkerns form excellent molds of the interior surfaces of the valves and by comparing them with the exterior surfaces of the valves the relative thickness of various parts of the shell can be determined.

The author is very grateful to Dr. C. A. Arnold, Dr. G. M. Ehlers, and Dr. L. B. Kellum for their helpful criticism of this paper.

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

REGISTER OF LOCALITY

All specimens are from the same locality.

LOCALITY

Middle Devonian Dundee limestone, exposed in northwestern Ohio about $\frac{1}{4}$ mile north of Sylvania Avenue and 200 feet west of Centennial Road; about $\frac{3}{4}$ mile north of Silica and 3 miles south-southwest of Sylvania, Lucas County. Ehlers and others show a geographic map (1952, Map 1), an areal geologic map (1951, Map 1), and a drawing based on an oblique aerial photograph (1951, Fig. 1) for this area. Devonian rocks in this region are folded in the Lucas County monocline and dip 6° S. 80° W. Sample taken from chert in Dundee limestone about 28 feet above the base of the formation. Bed containing the chert was uncovered when a few inches of soil and glacial gravels were bulldozed off so that the rocks below could be quarried as part of the west quarry of the France Stone Company. This bed was described as Unit 4 of the Dundee limestone by Ehlers and others (1951, p. 18). Bed with the chert now exposed for almost $\frac{1}{2}$ mile along the N. 10° W. strike, immediately north of Sylvania Avenue. Chert, white to light buff, occurs as irregular lenses (at most 8 inches thick) and as nodules; lenses and nodules contained in dolomitic, buff-gray limestone bed 1 foot 3 inches thick. Chert at some places deeply weathered and at others dense and hard; degree of weathering apparently inversely proportional to the depth of glacial gravels and soil which were recently removed. Fossils occur throughout the chert but can be removed from the matrix only if chert has been extensively weathered. Chert contains, in addition to ostracods, numerous trochilisks, *Tentaculites scalariformis* Hall, *Brevispirifer lucasensis* (Stauffer), *Glyptodesma erectum* (Conrad), and many crinoid columnals. Sample obtained by G. M. Ehlers, E. C. Stumm, C. A. Arnold, and R. V. Kesling in 1952.

SYSTEMATIC DESCRIPTIONS

Phylum ARTHROPODA

Class CRUSTACEA

Order OSTRACODA

Superfamily Beyrichiacea

Family Kloedenellidae Ulrich and Bassler

Genus *Dizygopleura* Ulrich and Bassler

Genotype.—By original designation, *Dizygopleura swartzii* Ulrich and Bassler, 1923, pp. 313–14, 681–82, 693; Pl. LXII, Figs. 1–8.

Dizygopleura compsa, sp. nov.

(Pl. I, Figs. 1–26; Pl. II, Figs. 13–24)

Description of female.—Carapace subelliptical to subrhomboidal in lateral view, nearly kite-shaped in dorsal view, and subelliptical in end view.

Left valve overlapping right around free border. Greatest height in the anterior one-third of the carapace, through the toothlike projection of the left valve. Greatest width in the posterior one-fourth of the carapace, through the middle of L4. Axis from posterodorsal to anteroventral parts of carapace. Dorsal border of right valve slightly higher than that of left. Dorsal border of each valve distally convex, extending above the hinge line. Anterodorsal border nearly straight, set at an angle of about 135 degrees to the dorsal border; anteroventral border curved evenly with a radius of curvature equal to about one-half the height; ventral border very slightly convex distally, set at an angle of about 10 degrees to the dorsal border; posteroventral border gently curved with radius of curvature equal to the height; posterior border slightly convex distally, set at an angle of about 60 degrees to the dorsal border; and posterodorsal border sharply curved with radius of curvature equal to about one-third the height. In lateral view, a distinct indentation in the anterior corner of the right valve, fitting around the lower edge of a large toothlike projection of the left valve. In dorsal view, the hinge line terminating in a large, broad knurling at the anterior end and in a small, distinct flexure at the posterior end. The knurling forms the border between the large toothlike projection of the left valve and the corresponding indentation of the right valve at the anterior corner. Hinge line from the knurling to the flexure straight.

Each valve distinctly trisulcate. S1 of left valve narrow, U-shaped in cross section, terminating abruptly in the ventral one-third of the valve; its dorsal one-fourth shallow and sharply curved backward, reaching the dorsal border behind the toothlike projection of the valve. S1 of right valve with the same cross section and shape as that of left valve, except the dorsal part curved backward only slightly and reached the dorsal border at anterodorsal indentation of the valve. S2 of each valve subtriangular, widest in its dorsal part, curved slightly forward in its acuminate ventral part; terminating abruptly at both ends, ventrally a little below the middle of the valve and dorsally below the dorsal border by a distance equal to about one-fifth the height. S3 of each valve narrow, about the same width and depth as S1. S3 of left valve sloping downward and slightly backward, a little longer than one-half the height, terminating rather abruptly at both ends, dorsally terminating below the dorsal border by a distance equal to about one-sixth the height. S3 of right valve set more nearly at right angles to the dorsal border, about the same length as that of the left valve but located in the middle of the valve and, hence, terminating dorsally below the dorsal border by a distance equal to about one-fourth the height.

All lobes confluent with the ventral part of each valve. L1 regarded as that part of valve between S1 and the anterior border; D-shaped, sepa-

rated from the dorsal part of the valve by the shallow upper part of S1 and confluent with the ventral part of the valve below S1. L2 regarded as that part of the valve between S1 and S2; vertically elongate with nearly parallel sides, slightly wider in the middle part, dorsally confluent with the dorsal part of the valve and ventrally confluent with the ventral part of the valve. L3 regarded as that part of the valve between S2 and S3; subtrapezoidal, widest at the bottom, dorsally confluent with the dorsal part of the valve and ventrally confluent with the ventral part. L4 regarded as that part of the valve behind S3; it is more or less D-shaped, widest in dorsal half. In dorsal view anterior half of L4 is in about the same plane as L3, but the posterior half, which is nearly straight, slopes toward the juncture of the two valves of a carapace at an angle of about 55 degrees, the anterior and posterior halves of the lobe joined by a smooth curved surface with radius of curvature equal to about one-third the width of a valve. In lateral view L4 is joined dorsally with the dorsal part of the valve and ventrally with the ventral part. Dorsal part of the valve as seen in lateral view narrow, confluent with L2, L3, and L4; in end view, curved evenly and extending a little above the hinge line. Ventral part of each valve as seen in end view curved gently and evenly from its confluence with the lobes to the ventral border.

Surface smooth.

Description of male.—Carapace with the same outline in lateral view and with overlap, sulcation, hinge, and ornamentation as in female. In dorsal view, the posterior two-thirds of the carapace narrower and the sides of the two L3's more nearly parallel than those of the female; also, the anterior and posterior halves of L4 joined sharply at about 100 degrees. Posterior half of L4 concave; the concavity sharpest near the juncture with the anterior half of the lobe. Middle part of L2 slightly wider than in the female.

Description of ultimate immature (third) instar.—Carapace the same shape as that of adult male except in L2 and L4. L2 proportionately a little wider and, as seen in lateral view, L4 proportionately much narrower than in male. In dorsal view, the anterior and posterior halves of L4 joined sharply at a little less than 90 degrees. Posterior half of L4 concave with a sharp indentation near the juncture with the anterior half of the lobe.

Description of penultimate immature (second) instar.—Carapace the same shape as that of third instar except in L4. In dorsal view, the indentation in the posterior half of L4 deeper than in the third instar.

Description of antepenultimate immature (first) instar.—Carapace the same shape as that of the second instar except in L4 and posteroventral border. In dorsal view, indentation in posterior half of L4 very deep; rear

one-fourth of L4 forming a 45 degree angle with the hinge line. In lateral view, the posteroventral border sloping steeper than in the second instar. Each valve, therefore, is more acuminate posteriorly, more plicate anteriorly, and with greater swing than in the second instar.

Description of steinkern of female carapace.—Subelliptical to sub-rhomboidal in lateral view; sharply acuminate anteriorly and somewhat kite-shaped in dorsal view. Greatest width in the rear one-fourth. The two halves of the steinkern with a broad ridge around their junction; this ridge sharply delineated from the rest of the steinkern. In lateral view, a deep indentation in the anterodorsal part of the ridge marks the position of the toothlike projection of the left valve. Ridge with small projections above the sides of the indentation. In dorsal view, ridge offset to the right at the position of the toothlike projection. Exclusive of the ridge, each half of the steinkern elliptical with round ends in lateral view. S1 and S3 represented by shallow grooves extending to the ventral border. S2 represented by a distinct broad groove terminating bluntly a little below the middle of the steinkern. L2 and L3 joined below S2 by the ventral part of the steinkern.

Remarks.—*Dizygopleura compsa* closely resembles *Dizygopleura euglyphea* Warthin (Warthin, 1934, pp. 210–11, Pl. I, Fig. 7) in size, overlap, and general lobation. It is distinguished from that species by its narrower and more sharply defined sulci, straighter anterodorsal border, rounder posterior corner, smaller L1, and somewhat straighter dorsal border. All species of *Dizygopleura* are very similar in sulcation and overlap. Those from the Middle Devonian are much like those from the Silurian. Only small differences in the shape of the carapace and in the dimensions of lobes and sulci differentiate one species from others of the genus. Comparison of a complete carapace with a steinkern of a carapace shows that the valves are thinnest in the sulci.

Dimensions of specimens of *Dizygopleura compsa* are listed in Table I. The specimens group distinctly into instars. The ostracods approximately double their volume from one instar to the next. It is not known whether the smallest specimens really belong to the youngest instar of the species. It seems more probable that *Dizygopleura compsa*, like other species whose ontogeny has been investigated, had even younger instars than those found. The dimorphism of *Dizygopleura*, like that of other kloedenellids, consists of posterior tumidity in the dimorph designated as female; the female dimorph of this species has about one-sixth greater volume than the male.

The name of this species is derived from Greek κομψος (“elegant”) and refers to the delineation of the lobes and sulci, which is unusually sharp and clear for a species of this genus.

Types.—Holotype, a female carapace, No. 30443. Allotype, a male cara-

pace, No. 30447. Paratypes: five female carapaces, Nos. 30441–30442, 30444–30446; three male carapaces, Nos. 30448–30450; six third instar

TABLE I
MEASUREMENTS OF SPECIMENS OF *Dizygopleura compsa*, SP. NOV.

Stage	Catalogue Number	Length (mm.)	Height (mm.)	Width (mm.)	Length x Height x Width (cu. mm.)
Adult female	30441	1.30	.75	.75	.731
	30442	1.30	.73	.77	.731
	30443	1.27	.73	.73	.673
	30444	1.26	.70	.77	.679
	30445	1.24	.67	.75	.623
	30446	1.23	.69	.71	.602
Mean		1.27	.71	.75	.673
Adult male	30447	1.19	.67	.70	.558
	30448	1.18	.62	.66	.483
	30449	1.14	.64	.64	.467
	30450	1.11	.61	.65	.440
Mean		1.16	.64	.66	.587
Third instar	30451	.99	.58	.54	.310
	30452	.96	.55	.55	.291
	30453	.95	.54	.51	.262
	30454	.94	.55	.52	.269
	30455	.94	.54	.51	.259
	30456	.93	.54	.52	.261
Mean		.95	.55	.53	.275
Second instar	30457	.74	.45	.40	.133
	30458	.73	.45	.40	.131
	30459	.71	.44	.41	.128
Mean		.73	.45	.40	.131
First instar	30460	.61	.39	.35	.083
	30461	.61	.38	.36	.083
Mean		.61	.39	.36	.083

carapaces, Nos. 30451–30456; three second instar carapaces, Nos. 30457–30459; two first instar carapaces, Nos. 30460–30461. Steinkerns of two carapaces, Nos. 30462–30463.

Family Barychilinidae Ulrich

Genus *Barychilina* Ulrich

Genotype.—By original designation, *Barychilina punctostriata* Ulrich, 1891, p. 199; Pl. 13, Figs. 1a-e, 2a-c.

***Barychilina periptyches*, sp. nov.**

(Pl. II, Figs. 5-6)

Description.—Carapace distinctly inequivalved. In dorsal view, carapace elongate oval to subpyriform, acuminate in the front half; front end subround with radius of curvature about one-third the width. Greatest width posterior. Right valve larger than left, strongly overlapping left valve around the free edge. Overlap wide in anterodorsal and posterodorsal parts of carapace. Hinge line short and straight, depressed below dorsal border. Right valve subrhomboidal with well-rounded corners; the dorsal border gently curved; anterior border subround, curved most strongly in anteroventral part; ventral border gently curved; posteroventral border more strongly curved than ventral or posterior; posterior border gently and evenly curved; and posterodorsal border subround with radius of curvature about one-third the height. Left valve suboval, smaller end anterior, the axis of the valve inclined about 15 degrees to the dorsal border of the right valve. Highest part of left valve slightly posterior in the area of no overlap; valve sloping away from highest part toward front and rear in areas of strong overlap; anterior end subround, connected to the highest part of the valve by the slightly curved anterodorsal border; ventral border slightly curved, nearly straight; and posterior border subround, slightly acuminate in its middle part.

Distinct pit located about one-third the length behind the front and about one-third the height below the top of the valve.

Surface of each valve ornamented with 15 to 20 small inosculating ridges more or less parallel to the axis of the left valve. Ridges in the posterior one-fifth of each valve nearly parallel to the free border. Ridges in the anterodorsal part of each valve bifurcating around the pit. Distal one or two ridges in the anteroventral part of each valve parallel to the free border. A row of shallow punctae between adjacent ridges.

Dimensions of holotype, a complete carapace: length, 1.15 mm.; height, .80 mm.; and width, .75 mm.

Remarks.—*Barychilina periptyches*, sp. nov., resembles certain other species of the genus from the older Onondaga limestone and from the younger Genshaw formation of the Traverse group. It is like *B. punctostriata* Ulrich (Ulrich, 1891, p. 199, Pl. 13, Figs. 1a-e, 2a-c), from the

Jeffersonville limestone, in having a row of punctae between adjacent ridges of the ornamentation, but differs from *punctostriata* in having fewer and coarser ridges, a posterior border somewhat acuminate dorsally instead of subround, posterior ridges parallel to the border, and an oval instead of narrow pit. *B. periptyches* is also much smaller than the largest specimen of *punctostriata*, but only one specimen of *periptyches* is known and that may be immature. *B. periptyches* is similar to *B. pulchella* Ulrich (Ulrich, 1891, pp. 199–200, Pl. 13, Figs. 4a-d), from the Jeffersonville limestone, in lateral outline, size and number of ridges, and in shape of pit, but differs from *pulchella* in having punctae between the ridges, strong overlap in the anterodorsal and posterodorsal parts, and the posterior ridges parallel to the border. *B. periptyches* is like *B. embrithes* Kesling and Kilgore (Kesling and Kilgore, 1952, p. 12, Pl. II, Figs. 36–44), from the Genshaw formation, in size and number of ridges, outline in lateral view, and dimensions, but can be distinguished from *embrithes* by its larger pit, bifurcating ridges around the pit, ridges in the anteroventral part of each valve, and larger and fewer punctae between the ridges. Although *B. walcotti* (Jones) (Jones, 1890, p. 543, Fig. 1), from the Hamilton group in the Thedford, Ontario, region, is not represented by a completely exposed valve (part of the only described and illustrated specimen is embedded in the matrix), the pattern of the ridges, insofar as can be seen, is different from that of *B. periptyches*.

The name of this species is derived from Greek περιπτυχης (“folded around, embracing”) and refers to the overlap, which is well developed, particularly in the anterodorsal and posterodorsal parts of the carapace.

Types.—Holotype, a complete carapace, No. 30464.

Endolophia, gen. nov.

Genotype.—*Endolophia chariessa*, sp. nov.

Description.—Carapace inequivalved. Right valve larger than left, overlapping left valve around free edge. Hinge line short and straight. Right valve subrhomboidal to suboval in lateral view; dorsal border gently curved. Left valve oval in lateral view; its axis from posterodorsal to anterodorsal parts of the valve. Complete carapace subpyriform in dorsal view and oval in end view. As seen in dorsal view, right valve overlapping left in broad flexures at the ends of the short straight hinge. No sulci on either valve.

Hinge of right valve consisting of hinge flange, hinge-flange groove, and hinge selvage; hinge-flange groove straight in its middle part, its ends curved downward around the ends of the hinge selvage. Hinge of left valve consisting of hinge flange fitting into hinge-flange groove of the right valve.

Interior of each valve with a vertical ridge extending downward from the dorsal part of the valve in the anterior half of the valve.

Remarks.—*Endolophia* is assigned to the family Barychilinidae because of its strong resemblance to *Barychilina*. It exhibits, however, certain features that occur in other genera which raise some question as to its exact familial relationship. *Endolophia* can be compared not only to *Barychilina* but to *Pachydomella* and *Cavellina*. *Endolophia* strongly resembles *Barychilina* in the shape of each valve, the hinge line, and overlap, but differs from it in lacking a pit. In the anterodorsal part of each valve *Endolophia* has an internal ridge; in the corresponding part of each valve *Barychilina* has a short internal ridge and an external pit. Because the carapaces in these two genera are so nearly alike in shape and overlap, it was thought at first that the absence of a pit in specimens of *Endolophia* might be attributed to unusual preservation. The original shell material has been replaced by silica and the specimens are all natural casts. If the two pits of a carapace of *Barychilina* had filled with calcium carbonate before burial, the shell material and the pit fillings might have silicified to form a natural cast in which no external trace of the pits would be preserved; in that case the fossil would resemble *Endolophia*. To test this hypothesis transverse sections of valves of *Endolophia* were made through the internal ridge. The material was uniform throughout these sections and showed no divisions that can be interpreted as traces of an original pit. It is concluded that *Endolophia* never had a pit.

Endolophia can be compared also with *Pachydomella* (Ulrich, 1891, pp. 197–98, which was described as:

Carapace exceedingly ventricose; valves thick and strong, the left much the largest, its thick edges overlapping the right valve at all sides. Dorsal side strongly arched, ventral edge more nearly straight, ends subequal. A faintly impressed, subcentral umbilical pit.

The only known species resembles *Xestoleberis*, but the thick valves forbid placing it with that genus. *Bythocypris*, and other genera of that type, also have thin valves, and are never so ventricose. It might perhaps have gone with *Barychilina* were it not for the fact that it has the left valve largest instead of the right.

If the illustration of *Pachydomella tumida* Ulrich, the genotype (Ulrich, 1891, Pl. 13, Figs. 5a-c), was inverted, it would then resemble the genus *Endolophia* in outline and in direction of overlap. It would differ, however, in having complete overlap. Dr. Ulrich was a very careful worker and did not confuse dorsal and ventral borders of ostracods.

In his recent study of Devonian ostracods, Swain (1953, p. 280) classified *Pachydomella* as of uncertain family and listed *Tubulibairdia* Swartz as a junior synonym of *Pachydomella*. Of his three species of *Pachydomella*, Swain described (p. 282) only one, *P. multitubulis* (Swartz and Swain), as

having an internal ridge. Inasmuch as Swain noted (p. 281) the muscle scars in the other two species, he must have seen the interiors of the valves but, presumably, he found no internal ridges. Swain states (p. 280):

The holotype of *Pachydomella tumida* Ulrich was kindly examined by I. G. Sohn of the U.S. Geological Survey, and found to contain normal canals. *Tubulibairdia* Swartz is a synonym as it is similar in shape and overlap and likewise possesses deep normal canals.

Swartz (1936, p. 581) described *Tubulibairdia* and assigned it to the family Bairdiidae. Many of the specimens of the genotype, *Tubulibairdia tubulifera* Swartz (p. 581, Pl. 89, Figs. 2a-r), were steinkerns with numerous long spines thought to be fillings of deep normal pore canals. There were no furrows on the steinkerns which would correspond to internal ridges of the two valves. Although there were no complete carapaces, Swartz believed the overlap to be L/R.

The specimens of *Endolophia* do not show large pore canals like those reported for *Pachydomella* and *Tubulibairdia*. Furthermore, the R/L overlap of *Endolophia* is the reverse of that known in *Pachydomella* and presumed in *Tubulibairdia*.

Endolophia resembles *Cavellina* Coryell in direction of overlap and in having an internal ridge. It differs from that genus in having no overlap in the dorsal border and in having thicker shell material. *Endolophia* is oval in lateral view like *Barychilina* and not elongate elliptical like *Cavellina*. It is not known to what degree the development of an internal ridge reflects familial relationships. Triebel (1950, p. 116) removed the genus *Cavellina* from the family Cytherellidae, to which it had been previously assigned, and placed it in the family Healdiidae on the basis of the muscle-scar pattern. The genus *Endolophia* seems closer allied to the Barychilinidae than to either the Cytherellidae or the Healdiidae.

The name of this genus is derived from Greek εἰςδο- ("internal") and λοφία, f. ("ridge") and refers to the ridge in the internal part of each valve.

***Endolophia chariessa*, sp. nov.**

(Pl. II, Figs. 1-4; Pl. III, Figs. 1-14)

Description.—Carapace inequivalved. Right valve larger than left, strongly overlapping left valve around the free edge. Hinge line short and straight. Dorsal border of each valve extending above the hinge line. Right valve subrhomboidal in lateral view; its dorsal border gently curved with radius of curvature greater than the height of the valve; anterodorsal and anterior borders curved with radius of curvature about equal to the height, set at about 120 degrees to the dorsal border, and separated from dorsal border by rounded anterior corner; anteroventral border round with radius

of curvature equal to slightly less than one-half the height; ventral border gently curved; posteroventral and posterior borders curved evenly with radius of curvature equal to the height, set at about 60 degrees to the dorsal border; and posterodorsal border and posterior corner curved evenly with radius of curvature equal to about one-third the height.

Left valve oval; border of the posterior half nearly round, slightly acuminate in the posterior part; ventral border gently curved; border of the anterior one-third of the valve round, with radius of curvature equal to about one-third the height of the valve; and anterodorsal border nearly straight, slightly indented. In a complete carapace, the axis of the left valve set at about 25 degrees to the dorsal border of the right valve. Complete carapace subpyriform in dorsal view, oval in end view. Hinge line short and straight as seen in dorsal view, terminated at each end by a broad flexure. Flexures at ends of hinge formed by overlapping edges of the right valve.

Each valve ornamented by inosculating, distinct, low ridges in its posterior half, but with smooth margin between ornamented area and the borders of the valve. Ridges oriented more or less parallel to the axis of the valve. Grooves between ridges with small punctae set in one line (rarely two lines) along the bottom of the groove and spaced at intervals equal to the width of the groove. Rest of each valve nearly smooth, ornamented with faint widely spaced punctae.

Hinge of right valve (Pl. III, Figs. 4, 6) consisting of hinge flange, hinge-flange groove, and hinge selvage. Hinge flange continuous with flange of contact margin. Hinge-flange groove straight and narrow in its middle part, its ends wide and curved downward around the hinge selvage. Hinge selvage consisting of a short bar terminated at each end by the downwardly curved ends of the hinge-flange groove. Hinge of left valve (Pl. III, Figs. 10, 12) consisting of a narrow hinge flange, flexed proximally at its ends and continuous with the flange of the contact margin. Hinge flange fitting into the hinge-flange groove of the right valve, the proximal flexures fitting into the downwardly curved ends of hinge-flange groove of the right valve. Flange of right valve overlapping that of left valve. Proximal part of the contact margin of right valve rabbeted to fit the flange of the left valve; the rabbeted part widest in the anterior part of the valve.

Interior of each valve with a distinct vertical ridge extending downward from the front half of the central dorsal part of the valve to about the middle. This ridge without a counterpart on the exterior of the valve.

Steinkern of a carapace (Pl. II, Figs. 3-4) showing a distinct sulcus in the anterodorsal part of each half corresponding to the anterodorsal interior ridge of each valve. Each sulcus of a steinkern of a carapace extending to the dorsal border.

Remarks.—The name of this species is derived from Greek *χαριεσσα* (“neat, elegant”) and refers to the appearance of the carapace.

Types.—Holotype, a carapace, No. 30468. Paratypes: three carapaces, Nos. 30465–30467; two left valves, Nos. 30469–30470; two right valves, Nos. 30471–30472. Steinkern of a carapace, No. 30473.

Trypetera, gen. nov.

Genotype.—*Trypetera barathrota*, sp. nov.

Description.—Carapace small, inequivalved. Right valve larger, overlapping the left around the free edge. Overlap greatest around the anterior part of the dorsal border, the ventral border, and the posterodorsal border. In dorsal view, carapace attenuated oval with the anterior end distinctly smaller. In lateral view, carapace subpyriform with its axis inclined to the dorsal border, the small end anteroventral. Hinge line straight. Dorsal border extending a little above the hinge line. Deep round pit in each valve in the anterodorsal part.

Surface ornamented with large punctae. No crests or ridges on the valves.

Remarks.—This genera is related to other genera of the Barychilinidae by its straight hinge, R/L overlap, and general shape of the valves. Like most barychilid genera, *Trypetera* has a distinct pit in each valve. Unlike other genera of the family, however, *Trypetera* is not ornamented by crests or small ridges. Instead, it has large punctae.

The name of this genus is derived from Greek *τρυπητηρ*, m. (“a colander”) and refers to the large deep punctae in each valve.

Trypetera barathrota, sp. nov.

(Pl. II, Figs. 8–12; Pl. III, Figs. 15–16)

Description.—Carapace small, inequivalved. Right valve larger, overlapping the left around the free edge. Overlap greatest around the anterior part of the dorsal border, ventral border, and posterodorsal border of the left valve. In dorsal view, carapace attenuated oval, its anterior end distinctly smaller. Dorsal border of right valve slightly curved, with a small indentation a little in front of the middle and with convex anterior and posterior parts; anterior border round; ventral border gently curved; posteroventral border gently curved, set at about 60 degrees to the dorsal border; and posterodorsal border rounded evenly from the posteroventral to the dorsal border with radius of curvature about one-third the height. Left valve subpyriform, its axis inclined about 15 degrees to the dorsal border of the right valve; middle of dorsal border coinciding with that of

the right valve, front part of dorsal border straight or slightly concave; anterior border evenly round from dorsal to ventral border; and ventral and posterior borders nearly parallel to those of the opposite valve. Hinge line straight and short, a little below the posterior part of the dorsal border.

Deep round pit in each valve about one-third the height below the dorsal border and about two-fifths the length behind the anterior border. Lateral surface of each valve sloping evenly upward into an elongate low hump in its posterior half. This hump curving forward from the middle of the dorsal border, extending above the pit, diminishing in height in the anterodorsal part of the valve, and becoming tangent to the lateral surface in the anterior part of the valve. A slightly curved, distally convex trough extending from the dorsal border to the anterodorsal part of the valve, above and in front of the hump.

Anterior and posterior corners of both valves round.

Surface ornamented with distinct, deep punctae. Punctae in the middle of the posterior part of the valve larger than other punctae.

Remarks.—The name of this species is derived from Greek βαράθρον, n. ("a pit") and refers to the deep pit in each valve.

Types.—Holotype, a carapace, No. 30476. Paratypes, three carapaces, Nos. 30475 and 30477–30478.

Family Hollinidae Swartz
Genus *Hollinella* Coryell

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

***Hollinella variopapillata*, sp. nov.**

(Pl. III, Figs. 17–19)

Description.—Hinge line straight and long. Anterior border round; ventral and posteroventral borders evenly curved with radius of curvature about $1\frac{1}{2}$ times the height; and posterodorsal curved with radius of curvature about one-fourth the height. Valves elongate subpyriform in lateral view, acuminate posterodorsally. Height less than two-thirds the length. L1 a small node extending a little above the hinge line, its diameter about one-fifth the height, anteroventrally confluent with the rest of the valve. L2 about twice as large as L1, acuminate dorsally, set a little below the dorsal border, anteroventrally confluent with the anterior part of the valve, bordered by S2 posteriorly and ventrally. L3 bulblike, extending above the hinge line by about one-fourth its diameter, bounded anteriorly by S2, ventrally by a deep groove, and posteriorly by S3. The middle of the front

half of the valve arched strongly outward as an anteroventral lobe, confluent with L2. Ventral part of the valve below L3 arched strongly outward as a ventral lobe. Posterior part of the valve sloping evenly to the dorsal and posterior borders.

S1 short, about one-fifth as long as the height, set at an angle of about 45 degrees to the dorsal border, separating L1 and L2. S2 broad and deep, confluent with S1 around the top of L2, extending slightly more than half the distance from the dorsal border to the ventral border, its ventral end curved forward below the rear half of L2. S3 a semisulcus¹ around the posterior and ventral borders of L3. Ventral and anteroventral lobes separated by a shallow depression. Frill very narrow, sharply set off from the rest of the valve by a small, distinct groove, extending from the anterior corner to the posteroventral part of the valve, forming the free border in its anterior two-thirds. Frill terminating posteriorly on an elongate projection of the valve. This projection about one-third the height, rising sharply from the lateral surface at the rear tip of the frill and sloping evenly anteroventrally to become tangent to the lateral surface.

Anterior cardinal angle about 120 degrees; posterior cardinal angle about 110 degrees.

Frill smooth. The rest of the lateral surface ornamented by closely spaced papillae of various sizes. Papillae large on L1, L2, the anteroventral lobe, L3, and the ventral lobe; papillae very small around the free border, on the posterior part of the valve, and in the shallow depression between the ventral and anteroventral lobes; papillae grading evenly in size from the large to the very small. A line of very narrow, long, partly fused submarginal denticles parallel to the free edge; submarginal denticles longer in the ventral and anteroventral parts of the valve than in the posterior and anterodorsal. Hinge of right valve rabbeted.

The interior of a valve showing four deep pitlike depressions: one vertically elongate corresponding to L1 and the anteroventral lobe, two oval corresponding to L2 and L3, and one horizontally elongate corresponding to the ventral lobe.

Remarks.—This distinctive species can readily be recognized by its elongate valves, the small node-shaped L1, the large L2, and the variation in the size of the papillae.

The name of this species is derived from Latin *varius* ("diverse, various, variegated") and *papillatus* ("having papillae") and refers to the various sizes of papillae on the valves.

Type.—Holotype, a right valve, No. 30479.

¹"Semisulcus" is used as defined and illustrated by Henningsmoen (1953, p. 188, Fig. 1), who stated: "Whereas a sulcus lies between two inflations, the semisulcus is only bordered on one side by an inflation."

Family Thlipsuridae Ulrich

Genus *Octonaria* Jones

Genotype.—By original designation, *Octonaria octoformis* Jones, 1887, p. 404, Pl. 12, Figs. 2a-b.

Octonaria sp.

(Pl. II, Fig. 7)

Remarks.—This species is represented only by a right valve. A complete carapace or a left valve would be necessary to complete the description and determine the specific assignment. The right valve is more than twice as long as high. The dorsal border has a round apex a little behind the middle, the radius of curvature of the apex about one-half the height; anterior and posterior borders round; and ventral border slightly concave. Drop-shaped pit, posteriorly acuminate, in the central dorsal part of the valve a little below the dorsal border. Two long, steep-sided, horizontal furrows in the posterior part of the valve, approximately trisecting that part of the valve, posteriorly terminating about one-sixth the length from the posterior border, their rear tips directed toward the middle of the posterior part of the valve. A narrow U-shaped, steep-sided groove in the anterior part of the valve, its axis of symmetry directed anteroventrally. The upper horizontal furrow surrounded by a low crest, and separated from the pit by the anterior part of this crest. The lower horizontal furrow slightly longer than the upper, separated from the ventral part of the U-shaped groove by a narrow crest. A low crest along the ventral borders of the lower horizontal furrow and the U-shaped groove. Posterior part of the valve with a sharp, low ridge parallel to and near the posterior border.

The shape and the pattern of pit, furrows, and groove are different from those of known species.

Specimen.—A right valve, No. 30474.

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PLATES

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PLATE I

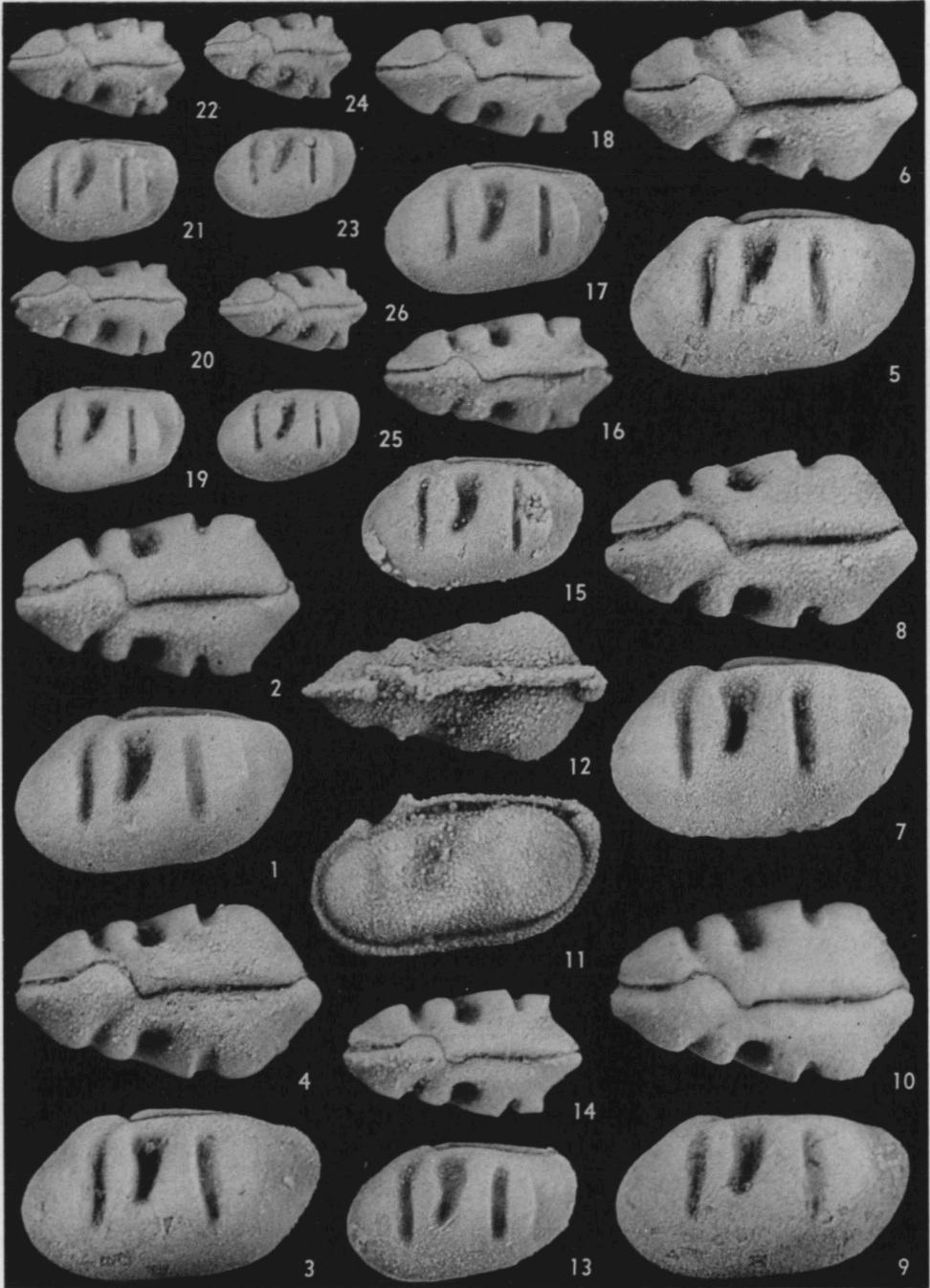
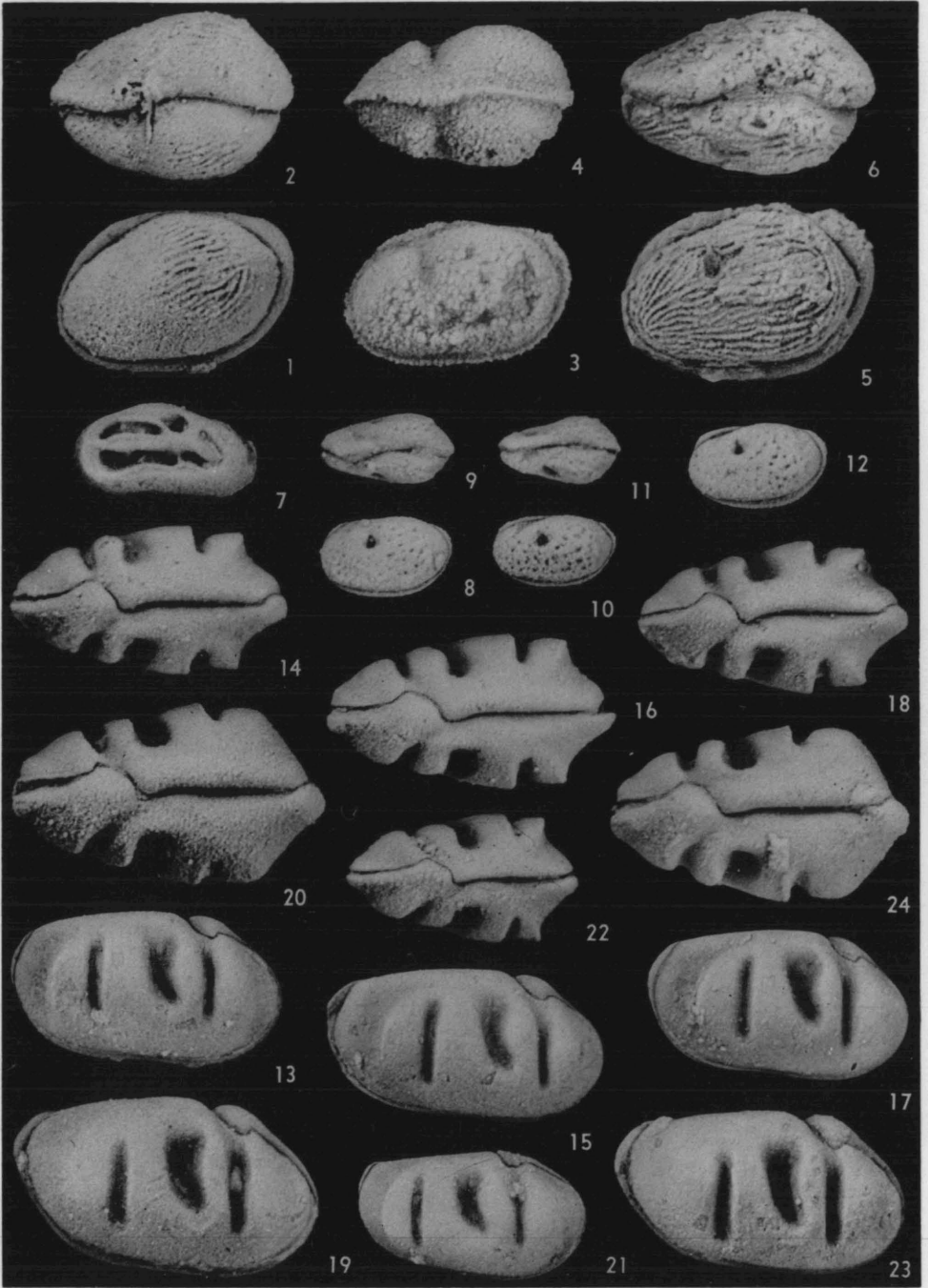


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EXPLANATION OF PLATE II

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