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BULLETIN 127

**ORDOVICIAN OSTRACODA
FROM LAKE TIMISKAMING, ONTARIO**

M. J. Copeland

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PREFACE

Many outliers of Lower Palaeozoic rocks occur within the boundaries of the Precambrian Canadian Shield. One of the largest of these, situated around Lake Timiskaming near the headwaters of the Ottawa River, has yielded many finely preserved ostracods of Middle Ordovician age. This report describes this ostracod faunule and continues the study of Canadian fossil arthropods begun with publication of Bulletins 60 and 91 of this series.

Y. O. FORTIER

Director, Geological Survey of Canada

OTTAWA, June 19, 1964

Bulletin 127 — Ordovizische Ostracoda
vom Temiskaming-See in Ontario
Von M. J. Copeland

Eine Beschreibung der Muschelkrebse des mittleren Ordoviziums aus zwei Gesteinsgruppen am Temiskaming-See in Ontario.

Бюллетень 127 — Ордовикские остракоды озера Темискаминг, Онтарио
М. Дж. Копланд

Описывается средне-ордовикские остракоды двух горных пород озера Темискаминг, Онтарио.

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ORDOVICIAN OSTRACODA FROM LAKE TIMISKAMING, ONTARIO

Abstract

More than seventy species of ostracods were obtained from the Middle Ordovician Liskeard Formation at Lake Timiskaming, Ontario. Lithologically and palaeontologically, exposed strata of this formation may be subdivided into an upper and a lower unit, respectively of Trenton and Wilderness age.

Résumé

Plus de soixante-dix espèces d'ostracodes ont été trouvées dans la formation Liskeard de l'Ordovicien moyen, près du lac Témiscamingue, en Ontario. Les lits à découvert de cette formation peuvent être subdivisés lithologiquement et paléontologiquement en deux unités l'une supérieure et datant du Trenton, et l'autre inférieure, et contemporaine du Wilderness.

INTRODUCTION

The ostracods discussed in this report, with the exception of two species (*Tallinnella panda* n. sp. and *Norochilina foerstei* n. sp.), occur in Middle Ordovician strata exposed near the northwest shore of Lake Timiskaming and in samples from a bore-hole (Lake Timiskaming No. 1) drilled near Wabi Point at the northern end of the lake. Seventy-four species (28 new) of 45 genera (3 new) are described.

Few Palaeozoic ostracods have been reported from this area. Most are Silurian (i.e., *Mastigobolbina lata?* (Hall), *Bolbineossia punctata* (Ulrich and Bassler), *Zygobolba williamsi* Ulrich and Bassler, *Isochilina* sp., *Leperditia* sp., *L. arctica* (Jones), *L. hisingeri* Schmidt, and *L. fabulina* Jones), but some (*Beyrichia* sp., *Isochilina* sp., *Leperditia* sp., and *Leperditia balthica primaeva* Jones) were reported by Hume (1925, pp. 19, 22) from strata of the Middle Ordovician Liskeard Formation.

GEOLOGY¹

Recent stratigraphic studies (G. W. Sinclair, pers. com.) have shown that exposed rocks of the Liskeard Formation may be subdivided into two units—an upper, predominantly thick-bedded limestone and dolomite sequence (Upper Limestone Member, or *Maclurea* Zone, and *Streptelasma corniculum*-bearing beds of the Upper grey and green shale member of Hume, 1925) and a lower, grey, green, and red shale sequence underlying the *Streptelasma* beds. These lithological subdivisions are exposed in part in the Farr (lot 11, con. III, Bucke tp.) and Shipyards (lot 10, con. V, Bucke tp.) quarries respectively. They are nowhere exposed in their entirety but the upper unit is 60 feet thick, and the lower one consists of most or all of the underlying 180 feet of strata cut in a diamond-drill hole described by Hume (1925, p. 16). Recently, a bore-hole (Lake Timiskaming No. 1) intersected a much thicker and more complete section of Ordovician strata than had been previously known from this area. A complete description of strata encountered in this bore-hole has been published by the Ontario Department of Mines (Thomson, 1965).

Strata of the upper unit exposed in lot 4, con. I, Dymond tp., Farr quarry, and along the road between lots 10 and 11, cons. II and III, Bucke tp., have yielded

¹See GSC Paper 65-34 for new stratigraphic terminology.

Ordovician Ostracoda, Lake Timiskaming, Ontario

the following ostracods: *Aparchites fimbriatus?* (Ulrich), *Aparchites?* sp. cf. *A.? labellosus* (Jones), *Dicranella marginata* Ulrich, *Diplopsis* sp. cf. *D. frequens* (Steusloff), *Ectoprimitia?* sp., *Laccochilina* (*Laccochilina*) sp., *Oepikella* sp., *Oepikium* sp., and "Primitia" sp. Three of these (*Dicranella marginata* Ulrich, *Laccochilina* (*Laccochilina*) sp., and *Oepikium* sp.) are not known to occur in the underlying unit. This Middle Ordovician faunule cannot be more precisely dated but, based on stratigraphic and other palaeontologic evidence, is of late Trenton age.

Many well-preserved ostracods were obtained from grey, black, and green shale beds of the lower unit exposed in the abandoned Shipyards (Moore's Cove or Match Factory) quarry. This quarry is situated in rocks of the Liskeard Formation 50 feet southwest of the Ontario Northland Railway tracks, on a small hill, 1,250 feet southeast of the Wabi Iron Works, Lakeshore Plant, approximately 150 feet above Lake Timiskaming. The following section was measured (in descending order) in this quarry; that of the upper unit is taken in part from Hume (1925, p. 16) and Goudge (1938, p. 346):

Bed	<i>Liskeard Formation</i>	feet	inches
<i>Upper unit</i>			
21	Limestone and dolomite, mottled	+ 5	0
20	Limestone, coarse, massive, grey, in beds up to 2 feet thick	10	0
19	Limestone and clay-shale, interbedded, in beds up to 4 inches thick ----- disconformity? -----	± 15	0
<i>Lower unit</i>			
18	Shale and clay, grey, with abundant subround, frosted, quartz grains; limestone, rubbly, grey, lensing	0	7
17	Limestone, grey, crystalline	0	6
16	Shale, and clay, varicoloured	0	10
15	Limestone, fine-grained, grey	0	7
14	Shale, grey-black; limestone, grey, rubbly, in 2-inch bands	0	8
13	Limestone, fine-grained, grey	0	3
12	Shale, grey-black; clay, grey	0	5
11	Limestone, fine-grained, grey	0	2
10	Shale, grey-black	0	1
9	Limestone, fine-grained, grey and brown	0	5
8	Shale, grey-black	0	5
7	Limestone, fine-grained, grey	0	5
6	Shale, grey-black; limestone, fine-grained, grey; interbedded	0	7
5	Limestone, fine-grained, grey	0	4
4	Shale, grey-black; limestone, rubbly, grey	1	6
3	Shale and clay, grey-black and yellow-brown; limestone, rubbly, in lenses up to 4 inches thick	1	7
2	Covered interval	6	0
1	Clay, green-grey, with abundant fine, subround, quartz grains and pyrite in small cubes	0	6

The Lake Timiskaming No. 1 bore-hole, drilled during the winter of 1963 from the ice of Lake Timiskaming, approximately 4,420 feet south, 1,700 feet west of the northeast corner of lot 2, con. A, Harris tp., Ontario, intersected strata of the lower unit similar in lithology to those described above. These strata underlie thick-bedded limestone and dolomite of the upper unit of the Liskeard Formation and contain ostracods similar to those from the lower unit of the Shipyards quarry.

Ostracods from the lower unit are:

- Aechmina* sp.
Aparchites fimbriatus? (Ulrich)
Aparchites? labellosus (Jones)
Aparchites sp. cf. *A. millepunctatus* (Ulrich)
Aparchites? sp.
Bollia persulcata (Ulrich)
Byrsolopsina planilateralis (Kay)
Bythocypris? cylindrica (Hall)
Bythocypris granti Ulrich
Conchoprimites sp.
Ctenobolbina lucifer n. sp.
Diplopsis sp. cf. *D. frequens* (Steusloff)
Ectoprimitia sp.
Eohollina depressa (Kay)
Eoleperditia? sp. cf. *E.? obscura* (Jones)
Eridococoncha bifurcata n. sp.
Euprimitia labiosa (Ulrich)
Euprimitia linepunctata (Kay)
Eurychilina sp. cf. *E. reticulata* Ulrich
Eurychilina subradiata Ulrich
Eurychilina ventrosa Ulrich
Glymmatobolbina? magna n. sp.
Hallatia sp. cf. *H. particylindrica* Kay
Hallatia? dubia n. sp.
Hyperchilarina bella n. sp.
Hyperchilarina obscura n. sp.
Isochilina aspera n. sp.
Kayina? sp.
Krausella sp. cf. *K. arcuata* Ulrich
Krausella brevicornis (Keenan)
Krausella calvini (Kay)
Laccochilina (Prochilina) granulosa n. sp.
Laccochilina (Prochilina) irrasa n. sp.
Leperditella aequilatera? (Ulrich)
Leperditella rex (Coryell and Schenck)
Levisulculus michiganensis Kesling
Levisulculus planus n. sp.
Levisulculus undatus n. sp.
Levisulculus sp.
?Longiscula emaciata n. sp.
Macrocypoides trentonensis (Ulrich)
Macronotella sp.
Milleratia longisulcata n. sp.
Milleratia mica n. sp.
Monoceratella spicata n. sp.
Norochilina nora n. sp.
Oepikella labrosa n. sp.
Pleurodella costata n. sp.
"Primitia" harrisensis n. sp.
"Primitia" sp.
Primitiella sp. cf. *P. constricta* Ulrich
Primitiella limbata Ulrich
Primitiella sp.
Pseudulrichia sp. cf. *P. bivertex* (Ulrich)
Pseudulrichia simplex (Ulrich)
Pullvillites? wabiensis n. sp.
Sacclatia angularis (Ulrich)
Sacclatia buckensis n. sp.
Tallinnella sp.
Tetradella sp. cf. *T. ellipsilira* Kay
Tetradella kayi n. sp.

Ordovician Ostracoda, Lake Timiskaming, Ontario

Tetradella ulrichi Kay
Thomasatia falcicosta Kay
Tvaerenella tersa n. sp.
Wabiella sella n. sp.
Winchellatia longispina Kay
Winchellatia? magna n. sp.
Winchellatia? parva n. sp.
Ostracod indet.

Most of these ostracod species occur all through the lower unit, but *Hallatia? dubia* n. sp., *Hallatia* sp. cf. *H. particylindrica* Kay, and *Norochilina nora* n. sp. have been found only in the lower part, and the leperditiids (*Eoleperditia? sp. cf. E.? obscura* (Jones) and *Isochilina aspera* n. sp.) occur only in Bed 1 of the Shipyards quarry section.

This ostracod faunule is similar to those of the 'lower Hull Formation' (Kay, 1934) at Healey Falls, Ontario, the Guttenberg and/or Ion beds of the Decorah Formation, Iowa and Minnesota, and, possibly, the Bromide Formation of the Simpson Group of Oklahoma. These relationships are shown on Table I. Recent work substantiates the observation by Kay (1934, p. 331) that the Healey Falls ostracods, in general, are similar to those from the Ion beds of Minnesota. Numerous ostracods from the shaly beds at Healey Falls have been figured previously (Kay, 1934; Copeland, in Sinclair, 1964, *Am. Assoc. Petrol. Geol.*, field guidebook, Pl. III), and a revised list (other than those indicated on Table I) includes:

Anisocyamus sp.
Bassleratia typa Kay
Balticella sp.
Bellornatia tricollis Kay
Bollia subaequata Ulrich
Byrsolopsina ovata (Kay)
Ceratopsis quadrifida (Jones)
Cryptophyllus oboloides (Ulrich and Bassler)
Drepanella sp. cf. *D. crassinoda* (Ulrich)
Hallatia healeyensis Kay
Halliella magnapuncta Kay
Parenthatia cf. *P. punctata* (Ulrich)
Punctaparchites rugosus (Jones)
Raymondatia goniglypta Kay
Sacclatia arrecta (Ulrich)
Schmidtella cf. *S. incompta* Ulrich
Schmidtella umbonata Ulrich
Scofieldia bilateralis (Ulrich)

Thirty-two species are presently known to occur in the shaly beds at Healey Falls, more than two-thirds of which are also present in beds of the Decorah Formation and nearly one-half in the lower unit of the Liskeard Formation. The Lake Timiskaming ostracod faunule, unlike that from Healey Falls, contains some northern (Scandinavian) elements, possibly indicating the mingling of North American and European genera. This may be further substantiated by examination of lists of similarly aged Middle Ordovician ostracods from Baffin Island in the Canadian Arctic.

Based on similarity of the ostracod faunule from the lower unit of the Liskeard Formation with those from the Decorah Formation and Healey Falls, a Late Wilderness age appears to be indicated.

Table I
 Other Occurrences of Ordovician Ostracoda species from Lake Timiskaming
 (after various authors)

	Decorah Formation (Iowa and Minnesota)		Lincolnshire and Edinburg Fms. (Virginia)	Healey Falls (Ontario)	Bony Falls Limestone (Michigan)	Silliman's Fossil Mount (Baffin Island)	Simpson Group		
	Spechts Ferry	Gutten- berg					Ion	Tulip Creek	Bro- mide
<i>Eoleperditia? obscura</i> (Jones)									
<i>Bollia persulcata</i> (Ulrich)									
<i>Pseudulrichia</i> sp. cf. <i>P. bivertex</i> (Ulrich)						X			
<i>Pseudulrichia simplex</i> (Ulrich)		X	X	X				X	
<i>Eohollina depressa</i> (Kay)		X	X	X				X	
<i>Euprimitia labiosa</i> (Ulrich)		X	X	X				X	
<i>Euprimitia lineopunctata</i> (Kay)		X	X	X				X	
<i>Eurychilina</i> sp. cf. <i>E. reticulata</i> Ulrich	X			X	X				
<i>Eurychilina ventrosa</i> Ulrich	X			X	X				
<i>Eurychilina subradiata</i> Ulrich	X			X	X				
<i>Thomasatia falcicosta</i> Kay		X	X	X				X	
<i>Winchellatia longispina</i> Kay		X	X	X					
<i>Tetradella</i> sp. cf. <i>T. ellipsilira</i> Kay		X	X	X					
<i>Tetradella ulrichi</i> Kay						X			
<i>Levisulculus michiganensis</i> Kesling									
<i>Diplopsis</i> sp. cf. <i>D. frequens</i> (Steusloff)						X			
<i>Aparchites fimbriatus?</i> (Ulrich)	X					X			
<i>Aparchites? labellosus</i> (Jones)						X			
<i>Aparchites</i> sp. cf. <i>A. millepunctatus</i> (Ulrich)	X					X			
<i>Saccolatia angularis</i> (Ulrich)									
<i>Leperditella rex</i> (Coryell and Schenck)								X	
<i>Leperditella aequalitara?</i> (Ulrich)				X					X
<i>Primitella constricta</i> Ulrich	X			X					
<i>Primitella limbata</i> Ulrich	X								
<i>Hallatia?</i> sp. cf. <i>H. parvicylindrica</i> Kay									
<i>Byrsotopsina planilateralis</i> (Kay)		X	X	X					
<i>Bythocypris? cylindrica</i> (Hall)		X	X	X					
<i>Bythocypris granti</i> Ulrich	X							X	
<i>Krausella cavini</i> (Kay)									
<i>Krausella brevicornis</i> (Keenan)								X	
<i>Krausella</i> sp. cf. <i>K. arcuata</i> Ulrich	X			X				X	
<i>Macrocypoides tremtonensis</i> (Ulrich)	X			X				X	
<i>Dicranella marginata</i> Ulrich		X							

SYSTEMATIC PALAEOONTOLOGY

Family LEPERDITIIDAE Jones, 1856

Genus *Eoleperditia* Swartz, 1949

Type species. *Cytherina fabulites* Conrad, 1843

Eoleperditia? sp. cf. *E.?* *obscura* (Jones)

Plate VII, figure 17

Leperditia(?) obscura Jones, 1891, Contrib. Can. Micro-Pal., pt. III, p. 71, pl. 10, figs. 15a-c.
Leperditella? obscura (Jones), Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 637.

Remarks. One specimen, 3.05 mm long and 1.8 mm high, apparently shows the characteristics reported for *L.(?) obscura* Jones. The hingeline is long in proportion to the total length of the valve and both extremities are smoothly curved, the anterior more broadly than the posterior. An inconspicuous 'eye' tubercle is located in the antero-dorsal quarter. The small adductor scar is only faintly visible. There does not appear to be any evidence of a chevron scar ventral to the 'eye' tubercle. Assignment of this species to *Eoleperditia* Swartz is questioned because the type specimen of *L.(?) obscura* Jones is not available for study.

Occurrence. Green calcareous shale 6 feet below lowest exposure of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp., Ontario; Lorette Falls, Quebec.

Type. Hypotype, GSC No. 17061.

Family ISOCHILINIDAE Swartz, 1949

Genus *Isochilina* Jones, 1858

Type species. *Isochilina ottawa* Jones, 1858

Isochilina aspera n. sp.

Plate VII, figures 25-27

?*Leperditia* sp. Hume, 1925, Geol. Surv. Can., Mem. 145, p. 19

Description. Valves large, 10 to 15 mm in greatest length. Dorsal margin straight, about two-thirds greatest length. Cardinal angles abrupt, obtuse. Free margins evenly convex, posterior more broadly rounded than anterior. Marginal rim entire, more pronounced anteriorly and posteriorly, extending from antero-dorsal corner along the free margins to mid-dorsum. Marginal rim of right valve with an anterior and posterior ventral pit.

Surface finely tuberculate, smooth in rim groove. Distal edge of rim tuberculate. 'Eye' spot prominent, conical, situated antero-dorsally, one-fourth the distance from the anterior margin and one-fifth the distance below the dorsal margin. Adductor scar large, ovate, postero-ventral of the 'eye' spot, consisting of numerous (more than 75?) rectangular to polygonal impressions forming a reticulate pattern (fig. 27). Several (four to seven) vertical, elongate scars present ventral to the 'eye' tubercle, forming an indistinct triangular grouping. Surface of valve slightly depressed behind the 'eye' tubercle forming a shallow, undefined furrow anterior to the slightly elevated adductor swelling.

Measurements (in mm) of the type specimens: holotype, GSC No. 17059, length 15.0, height 8.0; paratype, GSC No. 17060, length 12.8, height 7.0; paratype, GSC No. 17060a, length 10.0, height 5.3.

Remarks. This species is somewhat similar to *Isochilina ottawa* Jones but is proportionately longer and finely tuberculate, not smooth or minutely punctate as reported for *I. ottawa* by Swartz (1949, p. 323).

Occurrence. Green calcareous shale 6 feet below lowest exposure of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Family AECHMINIDAE Bouček, 1936

Genus *Aechmina* Jones and Holl, 1869

Type species. *Aechmina cuspidata* Jones and Holl, 1869

Aechmina sp.

Plate V, figures 10-12

Remarks. Several incomplete specimens were obtained during the present study. One valve (fig. 11) bears a nearly complete, distally curved, dorsal spine situated near the dorsal margin. In most specimens this spine has a very strong base (fig. 12) which extends about half the length of the spine proper. About mid-length the spine base tapers abruptly, giving rise to the fine, posteriorly curving, acicular, distal spine. The contact margin of the valve appears to be plain but may be very finely and irregularly denticulate.

The length, shape, and dorsally directed spine appears to differentiate these specimens from *Aechmina richmondensis* Ulrich and Bassler and *Aechmina ionensis* Kay, closely related species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Figured specimens, GSC Nos. 17028, a, b.

Ordovician Ostracoda, Lake Timiskaming, Ontario

Family BOLLIIDAE Bouček, 1936

Genus *Bollia* Jones and Holl, 1886

Type species. *Bollia uniflexa* Jones and Holl, 1886

Bollia persulcata (Ulrich)

Plate XI, figures 9, 11

Beyrichia persulcata Ulrich, 1879, J. Cincinnati Soc. Nat. Hist., vol. 2, No. 1, p. 12, pl. 7, fig. 6.

Bollia persulcata (Ulrich), Ulrich, 1890, J. Cincinnati Soc. Nat. Hist., vol. 13, p. 116, figs. 3a-d.

Beyrichia buchiana(?) Jones, Jones, 1890, Geol. Soc. London, Quart. J., vol. 46, p. 16, pl. 3, fig. 25.

Remarks. Specimens in the present collection are identical with those described from the Upper Ordovician Cincinnatian beds at Covington, Kentucky. They are 0.52 mm long and 0.3 mm high. As in the figure by Ulrich (1890, figure 3a) L2 is slightly constricted above mid-valve and the large dorsal node of L3 is broadly separated from the ventral part of the lobe.

Occurrence. Grey shale, 1963 bore-hole near southwest shore of Wabi Point, Harris tp., Ontario; depth 660-663 feet.

Types. Hypotypes, GSC Nos. 17084, a.

Family RICHINIDAE Scott, 1961

Genus *Pseudulrichia* Schmidt, 1941

Type species. *Leperditia bivertex* Ulrich, 1879

Pseudulrichia sp. cf. *P. bivertex* (Ulrich)

Plate VII, figure 8

Leperditia bivertex Ulrich, 1879, J. Cincinnati Soc. Nat. Hist., vol. 2, p. 11, pl. 7, figs. 5, 5a.

Ulrichia? bivertex (Ulrich), Ruedemann, 1912, New York State Mus., Bull. 162, p. 120, pl. 9, figs. 11, 12; Bassler, 1919, Maryland Geol. Surv., Cambrian and Ordovician, p. 370, pl. LV, fig. 32.

Dicranella bivertex (Ulrich), Bassler and Kellett, 1934, Geol. Soc. Amer., Spec. Paper 1, p. 286.

Pseudulrichia bivertex (Ulrich), Schmidt, 1941, Senck. Naturf. Ges. Abh., No. 454, p. 59, pl. 4, fig. 33.

?*Primitia cincinnatiensis* (Miller), Roy, 1941, Field Mus. Mem. Geol. 2, p. 172, figs. 139a, b.

Remarks. The figured specimen is broken postero-ventrally. It is 0.8 mm long and 0.6 mm high. The posterior node is directed slightly posteriorly, highly elevated and bluntly rounded. The anterior node is lowly rounded, knoblike, and confluent with the valve surface. An intermediate sulcus is present between the nodes but is only slightly depressed below the general lateral valve surface.

This species is somewhat similar to *Pseudulrichia simplex* (Ulrich) as described by Kay, 1940. That species has a curved dorsal margin and smoothly rounded dorsal angles. *Parapyxion subovatum* (Thorslund) is somewhat similar to

P. bivertex (Ulrich) in lateral view but has nodes situated lower on the lateral surface and more anterior of the middle of the valve, and is distinctly postplete whereas *P. bivertex* is apparently amplete to slightly preplete.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Trenton Group of eastern North America.

Type. Hypotype, GSC No. 14576.

Pseudulrichia simplex (Ulrich)

Plate XI, figures 13, 14, 17

Dicranella simplex Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 666, pl. 44, figs. 24, 25; pl. 46, fig. 42.

Bollia simplex (Ulrich), Kay, 1940, J. Pal., vol. 14, No. 3, p. 258, pl. 32, figs. 33, 34.

Remarks. On well-preserved specimens, L3 bears a short, blunt, posteriorly directed spine. L2 is lowly rounded, and S2 is short and shallow, not reaching mid-height of the valve. Less well-preserved or abraded specimens do not possess a spinose L3 but instead this lobe has a rounded outline only slightly more elevated than L2.

Occurrence. Grey shale, 1963 bore-hole near southwest shore of Wabi Point, Harris tp., Ontario; depth 635-663 feet. Decorah Formation, Iowa.

Types. Hypotypes, GSC Nos. 17081, a, b.

Family HOLLINIDAE Swartz, 1936

Genus *Eohollina* Harris, 1957

Type species. *Beyrichia irregularis* Spivey, 1939

Eohollina depressa (Kay)

Plate VIII, figures 14-16, 21-23

Bromidella depressa Kay, 1940, J. Pal., vol. 14, No. 3, p. 263, pl. 34, figs. 12-15; Kraft, 1962, Geol. Soc. Amer., Mem. 86, p. 43, pl. 15, figs. 8-17, text-figs. 14g, h.

Eohollina depressa (Kay), Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 208, pl. 7, figs. 1a, b, 2a-d.

Remarks. A complete description of this species has been presented by Kraft, 1962. Numerous dimorphic specimens of *E. depressa* (Kay) have been obtained during the present study. These agree in all respects with previously described specimens, averaging approximately 0.7 mm in length and 0.5 mm in height.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-663 feet. Decorah Formation, Iowa, etc.; Lincolnshire and Edinburg Formations, Virginia (*see* Kraft, 1962, p. 43).

Types. Hypotypes, GSC Nos. 14577, a-f.

Genus *Ctenobolbina* Ulrich, 1890

Type species. *Beyrichia ciliata* Emmons, 1855

Ctenobolbina lucifer n. sp.

Plate IX, figures 7, 8

Description. Carapace subquadrate in lateral view, slightly preplete. Hinge long, straight. Anterior and posterior extremities rounded; ventral margin straight, inclined posteriorly. Right valve slightly overlapping left antero-ventrally; marginal ridge denticulate. Surface densely punctate. Lobate area abruptly elevated ventrally and laterally, sloping dorsally, separated from the free edge by an interrupted channel. Edge of lobate area parallel with free margin, marked by a disrupted frill along the antero-ventral edge of L1, ventral edge of L3, and posterior edge of L4.

Two major oblique sulci, concave anteriorly, not extending to dorsal margin, ventrally confluent with marginal channel. S2 prominent, geniculate, anterior of median, inclined antero-ventrally, broader dorsally, separating broad, confluent L1-L2 and somewhat drop-shaped L3. L2 a small, dorsally situated, slightly elevated node on the posterior flank of L1, partly separated anteriorly from L1 by an indistinct semisulcus. S3 mainly situated in ventral half of valve, broader dorsally, limiting the anterior side of the indistinct, slightly ovate, and node-like L4. Dimorphism unknown.

Measurements: length 0.5 mm, height 0.3 mm, width of carapace 0.2 mm.

Remarks. This species fundamentally agrees with *Ctenobolbina ciliata* (Emmons) as figured by Jones (1890, pl. 3, fig. 12a) in having the sulci extending nearly to the ventral margin. The posterior sulcus of that specimen of *C. ciliata* is, however, much longer than the S3 of *C. lucifer* n. sp. and L3 bears a spine base ventrally. This is also true of *C. ciliata parva* Kirk which, like *C. lucifer*, *C. subcrassa* Ulrich, and the specimen of *C. ciliata* figured by Ruedemann (1901, pl. 2, figs. 8, 9), has L2 developed as a small node on the postero-dorsal flank of L1. *C. lucifer* differs from these last mentioned species, however, in having an interrupted frill (velate ridge) along the ventral margin of the lobate area and in being smaller and coarsely punctate.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 660-663 feet.

Types. Holotype, GSC No. 14580; paratypes, GSC Nos. 14581, a.

Family EURYCHILINIDAE Ulrich and Bassler, 1923

Genus *Euprimitia* Ulrich and Bassler, 1923

Type species. *Primitia sancti pauli* Ulrich, 1894

Euprimitia labiosa (Ulrich)

Plate XI, figures 6, 8

Halliella labiosa Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 656, pl. 46, figs. 43-46; Kay, 1934, J. Pal., vol. 8, No. 3, p. 332, pl. 44, figs. 17, 18; Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 200, pl. 6, figs. 16a, b.

Euprimitia labiosa (Ulrich), Kay, 1940, J. Pal., vol. 14, No. 3, p. 252, pl. 31, figs. 16-18; Swain, 1957, J. Pal., vol. 31, No. 3, p. 568, pl. 62, fig. 24; Kraft, 1962, Geol. Soc. Amer., Mem. 86, p. 26, pl. 7, figs. 6-13, text-figs. 13a-c.

Remarks. Well-preserved, typical specimens from cores from the Wabi Point bore-hole are figured here. Only one small, broken specimen was found at the Shipyards quarry, within a left valve of *Bythocypris? cylindrica* (Hall). Complete valves are 0.85 to 0.95 mm long and 0.6 to 0.7 mm high. Both dimorphs occur, females being slightly larger than presumed male specimens.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. and 1963 bore-hole near southwest shore of Wabi Point, Harris tp., depth 624-663 feet. Decorah Formation, Minnesota and Iowa; Bromide Formation, Oklahoma; Lincolnshire and Edinburg Formations, Virginia; Chazyan, Lake Champlain, New York; Wilderness Stage, Healey Falls, Ontario.

Types. Hypotypes, GSC Nos. 17019, a, b.

Euprimitia linepunctata (Kay)

Plate XI, figure 12

Halliella linepunctata Kay, 1934, J. Pal., vol. 8, p. 333, pl. 44, figs. 19-21.

Euprimitia linepunctata (Kay), Kay, 1940, J. Pal., vol. 14, p. 252, pl. 31, fig. 19.

Remarks. Specimens of *Euprimitia* with somewhat regular linear arrangement of surface ornamentation are considered as distinct from *Euprimitia labiosa* (Ulrich). The figured specimen bears rows of pits aligned in a somewhat radiate pattern originating from a point near the mid-posterior margin and curving parallel with the antero-ventral margin. Anteriorly this pattern is discontinuous and disrupted, with more random placement of the pits as is typical of *E. labiosa*.

Occurrence. Grey shale, 1963 bore-hole near the southwest shore of Wabi Point, Harris tp., Ontario; depth 635-645 feet. Decorah Formation, Iowa.

Type. Hypotype, GSC No. 17082.

Genus *Eurychilina* Ulrich, 1889

Type species. *Eurychilina reticulata* Ulrich, 1889

Eurychilina sp. cf. *E. reticulata* Ulrich

Plate III, figures 18, 19

Eurychilina reticulata Ulrich, 1889, Geol. Nat. Hist. Surv., Canada, Contrib. Micro-Palaeontology, pt. II, p. 52, pl. 9, figs. 9, 9a; Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 660, pl. 44,

Ordovician Ostracoda, Lake Timiskaming, Ontario

fig. 1; Ruedemann, 1901, New York State Mus. Bull. vol. 49, p. 76, pl. 5, fig. 3; Kesling, 1960, Contrib. Mus. Pal., Univ. Michigan, vol. XV, No. 15, p. 355, pl. II, figs. 1-3, pl. III, figs. 1-6, pl. IV, figs. 1, 2.
Eurychilina reticulata var. *incurva* Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 661, pl. 44, fig. 2.

Remarks. Two elongate, abraded male left valves somewhat resembling *E. reticulata* Ulrich were obtained during the present study. They are slightly acuminate posteriorly and have a striate frill inclined at a sharp angle to the domicilium. Both specimens have a prominent pre-sulcal node and confluent sub-sulcal ridge. The lateral surface of the domicilium is variously, but coarsely, pitted over much of its area but is bounded by a smooth band adjacent to the frill. Neither of the specimens figured here is as coarsely reticulate as is typical for the species (i.e., Kesling, 1960).

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah Formation, Iowa and Minnesota; Bony Falls Limestone, Michigan; Upper Black River Group, West Virginia; Wilderness Stage, Healey Falls, Ontario.

Types. Hypotypes, GSC Nos. 17038, a.

Eurychilina ventrosa Ulrich

Plate III, figures 16, 17

Eurychilina ventrosa Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 662, pl. 45, figs. 1-3; Kay, 1940, J. Pal., vol. 14, No. 3, p. 250, pl. 31, fig. 2; Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 234, pl. 7, figs. 15a-c.

Remarks. According to Kay (1940), this species is very similar to *E. reticulata incurva* Ulrich (= *E. reticulata* Ulrich) but is smooth surfaced. The specimens from Haileybury are similar to the male specimens of *E. reticulata* Ulrich recently figured by Kesling (1960, pls. 2-4) but are less posteriorly acuminate and smooth or only slightly punctate. One specimen (fig. 17) shows the distal part of the male frill "bordered by a fringe of long (about 0.12 mm) discrete cylindrical denticles" (Kesling, *ibid.*, p. 356) identical with that of *E. reticulata*. As with *E. reticulata*, the subdistal surface of the domicilium bears a smooth concentric band nearly devoid of ornamentation. Unlike *E. reticulata*, however, this band is limited dorsally by a fine groove similar in position to the inferred lines of molt retention preserved on such genera as *Conchoprimitia* and *Conchoprimites*. The reason for this groove cannot be explained satisfactorily at present but could represent a line of molt retention or possible weakness along which the valve is flexed or slightly cracked.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 650-660 feet. Decorah Formation, Iowa and Minnesota; Bromide Formation, Oklahoma.

Types. Hypotypes, GSC Nos. 17037, a, b.

Eurychilina subradiata Ulrich

Plate IV, figures 6-13; Plate X, figures 15-17

Eurychilina subradiata Ulrich, 1890, J. Cincinnati Soc. Nat. Hist., vol. XIII, p. 126, pl. 9, figs. 1a-c, 2a-c; Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 661, pl. 44, figs. 3, 4, a; Ulrich and Bassler, 1908, Proc. U.S. Nat. Mus., vol. 35, p. 299, fig. 49; Ruedemann, 1912, N.Y. State Mus. Bull., vol. 49, pl. 9, fig. 16; Butts, 1926, Ala. Geol. Surv., Spec. Rept., No. 14, p. 124, pl. 30, fig. 5; Bassler, 1932, Tenn. State Dept. Educ., Div. Geol., Bull. 38, pl. 10, fig. 14; Kesling, 1960, Contrib. Mus. Pal., Univ. Michigan, vol. 15, No. 15, p. 356, pl. 4, fig. 3.

Remarks. Female specimens of this species have been figured and described by numerous authors (Ulrich, 1894, p. 661; Ruedemann, 1912, p. 121; Kesling, 1960, p. 356; etc.); no redescription is necessary. Distinctive features of these female valves are the variable surface pitting of the domicilium (not reticulate as in *Eurychilina reticulata* Ulrich), the marked proximal ridge-like geniculation of the frill bordering the distal margin of the domicilium, and the pronounced plica or ridge extending along the dorsal domicilial margin. The specimens figured here (Pl. IV, figs. 9-13; Pl. X, figs. 15-17) are typical of those previously described but have coarser, more consistently overall pitting than previously reported.

Kesling (1960, p. 357) pointed out the lack of knowledge concerning dimorphism within this species. Harris (1957, p. 233), however, briefly described both male and female specimens. Three broken specimens figured here (Pl. IV, figs. 6-8) in the opinion of the present author, may represent male and immature specimens of *Eurychilina subradiata* Ulrich. These specimens have domicilial ornamentation similar to female valves but their striate frills are concave similar to the non-convex parts of the female frill. The frill of one specimen (Pl. IV, fig. 6) bears a faintly discernible proximal ridge-like undulation bordering the anterior and anteroventral edges of the domicilium in the position of the prominent ridge-like geniculation of the female frill. This was not reported by Harris and appears to indicate a more probable male characteristic for this species. Two of the figured broken individuals appear to be similar in size to the previously mentioned adult female valves and are considered to be adult male valves; the third specimen (Pl. IV, fig. 8) is slightly smaller and may be immature.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-663 feet. Decorah Formation, Iowa and Minnesota; Black River Group, Tennessee; Glen Falls Formation, New York; Bony Falls Limestone, Michigan; Bromide Formation, Oklahoma.

Types. Hypotypes, GSC Nos. 17035, a-g; 17036, a, b.

Genus *Laccochilina* Hessland, 1949

Type species. *Eurychilina estonula* Öpik, 1935

Diagnosis. "Unisulcate, with a well-defined adductorial pit. Tecnomorphs with a moderately broad concave velar frill of more or less uniform width along its whole extension; heteromorphs with the anteroventral and ventral parts of the frill inflated forming a well-defined, strongly convex dolon. The velar structure may be entire or represented posteriorly by a row of spines." (Jaanusson, 1957, p. 241).

Subgenus *Laccochilina* (*Prochilina*) Jaanusson, 1957

Type species. *Primitia decumana* Bonnema, 1909

Diagnosis. "Dorsal plica faint, obsolete in the middle. The posterior part of the velar structure developed as a row of spines." (Jaanusson, 1957, p. 250).

Laccochilina (*Prochilina*) *granulosa* n. sp.

Plate II, figures 14-20

Description. Valves moderately convex, domicilium broadly subovate to semi-circular in lateral view, truncated dorsally by long, straight dorsal margin. Greatest length, height, and width, near median. Dorsal plica poorly developed when present. S2 slit-like, slightly curved, concave anteriorly, near mid-valve. L2 an indistinct, low, rounded node anterior to S2. Surface moderately to coarsely granular. Narrow velar frill extending from antero-dorsal corner to postero-ventral margin. Velar structure developed posteriorly as a row of small, granule-like spines. Subvelar field shallow, concave. Both valves with a row of indistinct marginal tubercles. Average measurements of several adult valves: length 1.30 mm, height 0.90 mm.

Remarks. The frills of the typical specimens of this species are concave, possibly indicating the presence of male dimorphs and immature specimens only. Dimorphism has not been established for this species. *Laccochilina* (*Prochilina*) *granulosa* differs from other species of the subgenus in having only poorly developed posterior velar spines, lacking a well-defined dorsal plica on the domicilium and in being more coarsely granular.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 17051; paratypes, GSC Nos. 17052, a-f.

Laccochilina (*Prochilina*) *irrasa* n. sp.

Plate IX, figures 1, 2; Plate X, figures 2-5; Plate XI, figure 5

Description. Valves convex, domicilium subovate in lateral view, truncated dorsally by long, straight dorsal margin. Greatest length, height, and width near median. Dorsal plica present, but not well developed. S2 slit-like, deepest ventrally, curved, concave anteriorly, slightly anterior of mid-valve. L2 a low, circular node anterior to S2. Surface finely papillose, papillae angular in cross-section giving the surface a finely reticulate appearance.

Male specimens with a narrow velar frill extending from antero-dorsal corner to postero-ventral margin. Velar structure developed posteriorly as minute granular spines. Subvelar field shallow, concave. Both valves with a row of discrete marginal tubercles, those of the right valve larger.

Female specimens with a narrow velar frill similar to that of the male specimens and extending uniformly along the ventral edge of the dolon. Dolonate area

extending along the entire ventral free margin, well defined in both lateral and ventral views and strongly convex. Lateral and ventral surfaces of the dolon faintly, but uniformly, striate. Marginal structure of the right valve finely tuberculate. Right valve overlapping left ventrally. Average measurements of several adult valves: length 1.3-1.5 mm, height 0.9-1.05 mm, width (carapace) 0.7 mm.

Remarks. This species is similar in size to *L. (Prochilina) granulosa* n. sp. but is papillose rather than granulose in surface ornamentation. As in *L. (Prochilina) granulosa* the posterior velar spines of this species are minute. Apparently unlike other species of this subgenus, female specimens of *L. (Prochilina) irrasa* bear a complete velar ridge extending along the strongly convex dolon.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 17071; paratypes, GSC Nos. 17072, a-f.

Subgenus *Laccochilina (Laccochilina)* Hessland, 1949

Type species. *Eurychilina estonula* Öpik, 1935

Diagnosis. "Velar frill reaching posteriorly up to the posterior cardinal corner without any considerable decrease in its width. Preadductorial node comparatively prominent." (Jaanusson, 1957, p. 243).

Laccochilina (Laccochilina) sp.

Plate XI, figure 18

Description. Species known from an incomplete, weathered male left valve. Adductorial pit large, ovate, near mid-valve. Preadductorial node large, hemispherical in outline. Dorsal ridge prominent, slightly undulating near mid-length. Sulcal depression present dorsal of adductorial pit. Velar frill complete, narrow. Length 1.7 mm, height 1.1 mm.

Remarks. The large preadductorial node mentioned above was broken off and lost before the specimen was photographed. This node (L2) was hemispherical in cross-section, equal in size to the adductorial pit (S2), and situated antero-dorsally of S2. Leaching of the specimen precludes description of its surface texture. *L. tarda* Henningsmoen (1954) may be a somewhat similar species.

Occurrence. Farr quarry, half a mile west of Haileybury, Ontario.

Type. Figured specimen, GSC No. 17080.

Genus *Norochilina* n. gen.

Type species. *Norochilina nora* n. sp.

Diagnosis. Unisulcate, S2 deep, straight, directed transversely, extending half the

height of the lateral surface of the domicilium, with a short oblique antero-dorsal semisulcus (S1?). L1 and L3 with dorsal crests. Velar structure broadest antero-ventrally, extending as a frill from near mid-anterior to mid-posterior margins, reaching antero-dorsal corner as a thin velar ridge, not extending to postero-dorsal corner. Male frill broad, slightly flaring; female frill with an elongate, convex, sausage-shaped, ventral dolon. Surface of frill radially striate. Complete marginal ridge.

Species. *Norochilina nora* n. sp., *Norochilina foerstei* n.sp.

Remarks. *Norochilina* differs from other eurychilinid genera mainly in sulcation and velar development. S2 is typically long and deep, joined dorsally with the short rudimentary semisulcus, S1, which dorsally divides L1 and L2. The female sausage-shaped velar dolon is eurychilinid in nature even though the velar frill is mainly ventral and antero-ventral in position and extends to the antero-dorsal corner only. This type of velar development is similar to that of *Actinochilina* Jaanusson (1957), which genus has the dolon occupying the entire width of the frill rather than being restricted to the proximal part as in *Norochilina* and *Eurychilina*.

Norochilina nora n. sp.

Plate IV, figures 1-5; Plate X, figures 7, 21-23

Description. Valves convex. Domicilium subovate, truncated by straight hinge. Dorsal corners obtuse, limited from the lobate areas by distinct triangular furrows. Greatest height, length, and width of domicilium near mid-point of valve. S2 narrow, deep, straight, near mid-length of valve, extending to mid-valve, open dorsally to hingeline, surrounded ventrally by a low, horseshoe-shaped elevation. S2 joined antero-dorsally with an oblique semisulcus, S1, limiting L1 and L2. L1 plicate, extending above dorsal margin. L2 low, rounded, adjacent and anterior to S2. L3 broad, convex, plicate dorsally and postero-dorsally, extending above dorsal margin. Lobate areas smoothly confluent ventrally.

Lateral surface smooth, except for a short, horizontal, narrow groove ventral to, and extending posterior of, S2. No muscle scar visible.

Velar frill extending from slightly dorsal of mid-anterior margin to postero-ventral margin and as a low velar ridge to the antero-dorsal corner of the valve, not extending to the postero-dorsal corner. Frill striate, broadest antero-ventrally, giving the valve a preplete aspect. Male frill plane to slightly convex, flaring, with occasional longitudinal striations, radial striae broad, bordered distally by a distinct marginal border. Female frill apparently narrower than male frill, of similar extent, with a long ventral 'sausage-shaped', convex dolon situated proximally, not occupying the entire width of the frill. Female frill, except for dolonal part, plane, slightly flaring. Subvelar field low, with a smooth marginal ridge.

Dimensions of holotype: length, including frill, 2.03 mm; length of domicilium 1.70 mm; height, including frill, 1.50 mm; height of domicilium 1.00 mm.

Remarks. Immature specimens appear to bear comparatively narrower, more

convex velar frills than adult male specimens and, in this respect, are more similar to adult female specimens.

Occurrence. Green calcareous shale, 6 feet below lowest occurrence of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 650-687 feet.

Types. Holotype, GSC No. 17055; paratypes, GSC Nos. 17056, a-h.

Norochilina foerstei n. sp.

Eurychilina(?) striatomarginata (Miller), Foerste, 1924, p. 253, pl. 46, fig. 4 (*not* pl. 45, fig. 8).

Description. Valves convex, domicilium elongate, subovate, truncated by straight hinge. Dorsal corners obtuse, limited from the lobate areas by distinct triangular furrows. Greatest height, length, and width of domicilium near mid-point of valve. S2 narrow, deep, straight, near mid-point of valve, open dorsally to hingeline, surrounded ventrally by a low, horseshoe-shaped elevation. S2 joined antero-dorsally with an oblique furrow (semisulcus?) extending towards the mid-anterior margin, delineating an oblique anterior plicate lobe (L1?) and the broad surface of L2. L3 broad, convex, plicate dorsally and postero-dorsally, extending slightly above dorsal margin. Lobate areas smoothly confluent ventrally.

Lateral surface randomly pustulose excepting sulcal depressions and short, horizontal, narrow groove ventral to, and extending posterior of, S2. No muscle scar visible.

Velar frill extending from slightly dorsal of mid-anterior margin to postero-ventral margin, extending as a low ridge to the antero-dorsal corner of the valve, not extending to the postero-dorsal corner. Frill striate, broadest antero-ventrally giving the valve a preplete aspect. Dimorphism unknown on the type specimens. Velar frill plane to slightly convex, flaring. Subvelar field unknown.

Dimensions of type specimens (GSC Nos. 8525a, b): length, including frill, 2.10, 2.00 mm; length of domicilium 1.95, 1.70 mm; height, including frill, 1.50, 1.50 mm; height of domicilium 1.05, 1.00 mm.

Remarks. This species differs from *Norochilina nora* n. sp. in being slightly pustulose, having a more elongate domicilium, and having a more elongate oblique, anterior furrow delineating L1 and L2. The specimens are not well preserved, accounting for Foerste's statement (*ibid.*, pl. 46, fig. 4) that "the upper anterior and upper posterior parts of the marginal rim not preserved". This characteristic is typical of *Norochilina* as previously described.

Occurrence. North and south road, along lot 24, con. VIII, 4 miles northwest of Meaford, Ontario. In the Queenston Formation.

Types. Holotype, GSC No. 8525a; paratype, GSC No. 8525b.

Family BASSLERATIIDAE Schmidt, 1941

Genus *Thomasatia* Kay, 1934

Type species. *Thomasatia falcicosta* Kay, 1934

Thomasatia falcicosta Kay, 1934

Plate VIII, figure 20

Thomasatia falcicosta Kay, 1934, J. Pal., vol. 8, No. 3, p. 337, pl. 46, figs. 13-23; Kay, 1940, J. Pal., vol. 14, No. 3, p. 266, pl. 34, fig. 29.

Remarks. The specimen figured here is representative of those described by Kay. It is 0.8 mm long and 0.5 mm wide. The orientation adopted here is reversed to that used by Kay, the prominent median node (L2) being anterior and the inner ridge extending parallel with the anterior and ventral margins. The posterior lobe (L3) of the figured specimen extends above the dorsal margin and is divided from the inner ridge by a shallow furrow.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; Wilderness Stage, Healey Falls, Ontario. Decorah Formation, Iowa and Minnesota.

Type. Hypotype, GSC No. 14578.

Family PIRETELLIDAE Öpik, 1936

Genus *Oepikium* Agnew, 1942

Type species. *Biflabellum tenerum* Öpik, 1935

Oepikium sp.

Plate XI, figure 20

Description. Species known from one crushed male right valve. Hinge straight, more than three-fourths greatest length of the domicilium. Preserved domicilial surface finely pitted. S2 slit-like, concave anteriorly, near mid-height of valve. L2 low, indistinct. Frill broad, equal to domicilium in greatest height, extending from anterior cardinal angle to mid postero-ventral slope, broken posteriorly. Frill radially striated and faintly ridged horizontally.

Remarks. The specimen is too poorly preserved for exact measurements and more detailed description. It has approximately the same measurements as those given by Öpik (1937, p. 40) for *Biflabellum* (*Oepikium*) *tenerum*, but its reticulate surface ornamentation apparently differentiates the Timiskaming specimen from *O. tenerum*.

Occurrence. Outcrop along the road between con. I and con. II, lot 4, Dymond tp., Ontario.

Type. Figured specimen, GSC No. 17079.

Family QUADRIJUGATORIDAE Kesling and Hussey, 1953

Genus *Tallinnella* Öpik, 1937

Type species. *Tallinnella dimorpha* Öpik, 1937

Diagnosis. "All species known are rather large. Quadrilobate, L2 shorter than the other lobes, united with the connecting lobe or developed as a knob. Ventral part of L1 mostly more or less swollen. Velar structure developed as a thick ridge or a thick, narrow flange, broadest anteriorly forming a raised or flattened border along the free margin around a part of the lateral surface of the valve. The velar ridge ends rather abruptly before reaching the posterior cardinal corner. In the type species a velar dimorphism has been described, the velar flange being broader anteriorly in heteromorpha." (Jaanusson, 1957, p. 340).

Tallinnella panda n. sp.

Plate VIII, figures 28-30

Description. Valves subquadrate, quadrilobate, with anterior swing. Dorsal margin long, straight; anterior cardinal angle obtuse, posterior cardinal angle nearly 90 degrees. Posterior margin broadly rounded; anterior margin more narrowly rounded, slightly extended antero-ventrally; ventral margin straight to slightly convex.

Velate structure forming a strongly raised border along the lateral margin, overhanging the narrow subvelar channel; free margin tuberculate. Lobes prominent, slightly curved, inclined anteriorly in their ventral parts, all but L2 extending to or above the dorsal margin, confluent with a narrow ridge parallel to the ventral margin extending from L1 to L4. L1 broad, rounded, joined to small cudgel-shaped L2 above mid-valve, broader ventrally. L3 prominent, slightly constricted medially, knoblike dorsally, ridged and elevated ventrally. L4 curved parallel with postero-ventral margin, knoblike dorsally, ventrally with three or four nodes. Surface smooth. Dimorphism indicated by broader anterior and antero-dorsal part of velate structure in female valves. Measurements of three valves: length, 2.1-2.2 mm; height, 1.2-1.3 mm.

Remarks. This species agrees in general with the type species, *Tallinnella dimorpha* Öpik and *T. marchica* Krause. *T. panda* n. sp. differs from these species in having smooth, non-punctate lobes and in having the ventral part of L4 nodose. The broader dimorphic velar structure of *T. dimorpha* Öpik is antero-ventral in position whereas it is anterior or antero-dorsal in *T. panda*.

Occurrence. Black shales of the Eastview Formation, St. Laurent Blvd., east side, 200 yards north of Montreal Road, Ottawa, Ontario.

Types. Holotype, GSC No. 14582; paratypes, GSC Nos. 14583, a.

Tallinnella sp.

Plate XI, figure 4

Description. Valves subovate in lateral view; truncated dorsally by long, straight hinge. Quadrilobate, lobes highly elevated above lateral valve surface. L1, L3, and L4 well developed, oriented vertically, joined ventrally; L1 and L3 extending nearly

Ordovician Ostracoda, Lake Timiskaming, Ontario

to dorsal margin, L4 slightly shorter. L2 small, narrow, short, constricted ventrally, joining with L1 below mid-height of valve. Posterior extra-lobate area fairly wide. Surface smooth to somewhat granulose. Velar structure apparently extending from anterior to mid-posterior margin; marginal structure unknown; dimorphism unknown. Dimensions of figured specimen: length 1.5 mm, height 0.8 mm.

Remarks. Two incomplete and several fragmentary specimens were obtained during the present study. The pronounced elevation of the lateral lobation, the small size and position of L2, and the width of the posterior extra-lobate area serve to distinguish this species. Well-preserved specimens are necessary, however, before this species can be described in detail.

Occurrence. Grey shale, 1963 bore-hole near the southwest shore of Wabi Point, Harris tp., Ontario; depth 650-695 feet.

Types. Figured specimens, GSC Nos. 17085, a.

Family SIGMOOPSIDAE Henningsmoen, 1953

Genus *Winchellatia* Kay, 1940

Type species. *Winchellatia longispina* Kay, 1940

Winchellatia longispina Kay, 1940

Plate X, figure 6

Winchellatia longispina Kay, 1940, J. Pal., vol. 14, No. 3, p. 254, pl. 32, figs. 1-5.

Remarks. One poorly preserved specimen exhibiting all the characteristics of *W. longispina* Kay was obtained during the present study. It is broken posteriorly and the two valves are rotated on each other. Distinctive features preserved on the specimen are the deep, anteriorly concave S2, low, indistinct L2, and pronounced ventral extension of L3. Velate structures are obscured by matrix and preservation.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 660-663 feet. Decorah Formation, Iowa.

Type. Hypotype, GSC No. 17073.

Winchellatia? magna n. sp.

Plate V, figures 6-9; Plate X, figures 18, 24

Description. Valves large, smooth to sparsely punctate, subelliptical, truncated dorsally by long, straight hinge four-fifths greatest length of valve. Greatest length in dorsal half, greatest height and width in posterior half. Dorsal margin straight, antero- and postero-dorsal angles abrupt, obtuse. Free margins regularly curved, ends subequal, posterior margin more broadly rounded than anterior. Unisulcate, S2 poorly developed, slightly concave anteriorly, situated in dorsal half of valve;

L2 a small, barely perceptible elevation anterior to S2. Valves convex, subtriangular in end view, abruptly elevated ventrally, sloping gently to dorsal margin. Ventral elevation smoothly rounded, decreasing in height towards anterior margin, swollen posteriorly and curving abruptly inward to merge with the low posterior quarter of the valve surface. Ventral elevation of some specimens may slightly obscure the ventral margin in lateral view. Free margin with denticulate marginal ridge, denticles club-shaped, alternating on opposing valves, interfingering on closed carapaces in a zipper-like arrangement (Pl. X, fig. 18). Measurements (in mm) of several specimens:

Length:	1.68	1.55	1.50	1.37	1.20	1.10
Height:	1.02	0.95	0.90	0.80	0.73	0.70

Remarks. It is not certain that this species should be assigned to the genus *Winchellatia*. The presence of a poorly defined S2 and nearly imperceptible L2 would appear to restrict its inclusion in *Sacclatia*. Similarly, the rather abrupt but smoothly rounded ventral elevation of the valves would appear to prevent its inclusion in the typically sac-shaped genus *Sacclatia*. *Winchellatia? magna* n. sp. differs from other presently known species of the genus in that it is much larger, and the ventral elevation of the valves and L2 and S2 are relatively more indistinct.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 17025; paratypes, GSC Nos. 17026, a-d.

Winchellatia? parva n. sp.

Plate VIII, figures 24, 25

Description. Valves small, smooth, subovate, truncated dorsally by long, straight hingeline. Greatest length in dorsal half, greatest height and width near median. Dorsal margin straight, antero- and postero-dorsal angles abrupt, forming small 'ears'. Free margins regularly curved, ends subequal. Unisulcate, S2 a pronounced, regular depression extending vertically from the dorsal margin to mid-height of valves. L2 a low, indistinct node anterior to S2. Valves subtriangular in end view, abruptly elevated ventrally and sloping gently to dorsal margin. Ventral elevation smoothly rounded, swollen, overhanging free margin of valve. Free margin with tuberculate to somewhat nodose marginal ridge. Measurements (in mm): length 1.1-1.2, height 0.65-0.7.

Remarks. This species is most closely allied to *Winchellatia? magna* n. sp. Both species have smoothly rounded ventral elevations but *Winchellatia? parva* has more pronounced S2 and L2 and is smaller than *Winchellatia? magna*. The marginal denticles of *W.? parva* are discrete and nodulose in character rather than elongate, club-shaped such as those of *W.? magna*.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 17027; paratype, GSC. No. 17027a.

Family TETRADELLIDAE Swartz, 1936

Genus *Tetradella* Ulrich, 1890

Type species. *Beyrichia quadrilirata* Hall and Whitfield, 1875

Tetradella kayi n. sp.

Plate I, figures 5, 7, 8

Description. Valves subelliptical in lateral view. Hingeline straight, free margins broadly curved, slightly preplete. Broad, 'U'-shaped platform along entire free margin. Lobate part of valve sharply elevated within a 'U'-shaped carina which joins anteriorly with L1 and posteriorly with L4. L1 lunate, with two anteriorly convex crests confluent dorsally and extending above the hingeline. L2 club-shaped, not extending to dorsal margin, nearly confluent ventrally with posterior crest of L1. L3 lunate, with two posteriorly convex, variously tuberculate crests joining dorsally with the simply curved L4 and extending slightly above the dorsal margin. Crests of L3 ornamented with five, six, or more, tubercles. Crest of L4 dissected into two to four tubercles above mid-height of valve. Crests of interior lobes (posterior part of L1, L2, and L3) not merging ventrally with carina.

Remarks. This species differs from most other species of *Tetradella* in having tuberculate crests on L3 and the dorsal part of L4, and in having the interior lobate crests separated from the ventral carina.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 624-663 feet.

Types. Holotype, GSC No. 14568; paratypes, GSC Nos. 14569, a, b.

Tetradella sp. cf. *T. ellipsilira* Kay

Plate I, figures 6, 9, 12

Tetradella quadrilirata Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 679, pl. 46, figs. 1-4 (not *Beyrichia quadrilirata* Hall and Whitfield, 1875).

Tetradella ellipsilira Kay, 1934, J. Pal., vol. 8, No. 3, p. 339, pl. 45, figs. 10-15; Kay, 1940, J. Pal., vol. 14, No. 3, p. 265, pl. 34, figs. 18-22; Schmidt, 1941, Senck. Naturf. Ges., vol. 454, p. 41; Kesling, 1953, Contrib. Mus. Pal., Univ. Michigan, vol. 11, No. 4, p. 88.

Remarks. This species is distinguished from *T. ulrichi* Kay, 1934 by the only partial bifurcation of L1 and L3, and the dorsal coalescence of L3 and L4. The dorsal junction of L3 and L4 on the present specimens is visible only in dorsal view.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 660-663 feet; Wilderness Stage, Healey Falls, Ontario. Decorah Formation, Iowa; Chaumont Formation, Ontario.

Types. Hypotypes, GSC Nos. 14570, a,b.

Tetradella ulrichi Kay

Plate I, figures 10, 11

Tetradella lunatifera (Ulrich), 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 680, pl. 46, figs. 12-14, text-figs. 51a, b.

Tetradella ulrichi Kay, 1934, J. Pal., vol. 8, No. 3, p. 339, pl. 45, figs. 16-19; Kay, 1940, J. Pal., vol. 14, No. 3, p. 265, pl. 34, fig. 23.

Remarks. As described and illustrated by Kay (1934, 1940), this species agrees closely with *Tetradella lunatifera* (Ulrich) but has lobes continuous with the ventral carina. L1 bifurcates and is 'D'-shaped, L3 is inverse 'V'-shaped, completely bifurcating.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 660-663 feet; Healey Falls and Game-bridge, Ontario. Decorah Formation, Iowa.

Types. Hypotypes, GSC Nos. 14571, a.

Pleurodella n. gen.

Type species. *Pleurodella costata* n. sp.

Diagnosis. Quardrilobate. L1 feeble, limited posteriorly by a weak semisulcus. L2 prominent, cudgel-shaped, not reaching dorsal margin. L3 and L4 elongate, concave anteriorly, separated by a weak semisulcus, L3 reaching almost to dorsum. Dorsal extensions of L1 and L4 connected by a dorsal plica. Summit of each lobe bearing a sharp crest or rib, united ventrally by a connecting longitudinal crest. Velar flange entire, prominent. Dimorphic, female valves loculate.

Remarks. This genus closely resembles *Rigidella* Öpik, 1937 and *Tallinnellina* Jaanusson, 1957 in lateral and dorsal views, but differs from both genera in dimorphic structures. Both *Rigidella* and *Tallinnellina* are reported to exhibit velar dimorphism of a simple type whereas *Pleurodella* exhibits locular dimorphism. This genus is, therefore, placed within the Tetradellidae rather than the Quadrijugatoridae.

Pleurodella differs from *Tetradella*, a closely related genus, in having S1 and S3 represented by semisulci rather than by well-defined sulci, and in possessing crested or ribbed lobes rather than the typically ridge-like lobes of *Tetradella*.

Pleurodella costata n. sp.

Plate I, figures 1-4; Plate VIII, figures 31-37; Plate X, figure 8

Description. Valves subovate in lateral view, slightly preplete, truncated dorsally by the long, straight hingeline. Greatest length and height near mid-valve; greatest carapace width through L3 in postero-ventral half of the valves. Dorsal angles obtuse, abrupt, posterior one slightly spinose in some specimens. Free margins evenly rounded.

Quadrilobate. L1 feeble, extending to dorsal margin. L2 prominent, club-shaped, not reaching dorsal margin, separated by an indistinct semisulcus from L1. L3 broad, curved, concave anteriorly, posterior to prominent, curved S2. L4 broad, extending to dorsal margin, curved parallel with posterior margin, separated from L3 by a curved semisulcus, may be confluent in ventral half with L3. Lobes confluent ventrally, each with a distinct rib or crest, joined ventrally to a horizontal crest extending from L1 to L4. Rib of L1 nearly vertical, joining ventral rib at about 90 degrees; rib of L2 directed slightly obliquely, meeting ventral rib at or near the juncture with the crest of L1; L3 and L4 with crests curving parallel to each other and the postero-ventral margin. Dorsal crests of L1 and L4 joined with a dorsal plica.

Velar dimorphism prominent. Male valves with a complete, broad, velar flange and high subvelar field. Female valves with area between the horizontal ventral crest and velate structure divided by transverse ridges into loculi. Anterior loculus circular, above mid-height of valve; ventral loculi rectangular in outline, increasing in length posteriorly. A spur of the ventral crest extending slightly posteriorly of the ventral end of the crest of L4, dying out part way up the postero-ventral margin of L4. Loculi and extended ventral crest obscuring the velate ridge laterally except along the posterior margin. Velate ridge complete, low, subvelar field slightly grooved.

Immature specimens with S1 and S3 more or less obsolete and lobes with crests indistinct or only partly developed.

Measurements (in mm) of several female carapaces: length 1.0-1.25, height 0.75-0.80, width 0.70-0.75; male carapaces: length 1.10-1.15, height 0.72-0.75, width 0.55-0.62.

Remarks. Specimens of this species are remarkably similar in lateral view to *Rigidella mitis* (Öpik), but adult female specimens are distinctly loculate unlike the velar dimorphism reported by Jaanusson (1957) for *R. mitis*. Species of *Tetradella* also have locular dimorphism but lack the smoothly rounded and crested lobation of *P. costata* and are much more distinctly sulcate.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-663 feet.

Types. Holotype, GSC No. 17057; paratypes, GSC Nos. 17058, a-1.

Family TVAERENELLIDAE Jaanusson, 1957

Genus *Tvaerenella* Jaanusson, 1957

Type species. *Primitiella carinata* Thorslund, 1940

Diagnosis. "No sulcus or merely a faint sulcal depression. A moderately large muscle scar is situated somewhat dorsally of the mid-height of the lateral surface of the domicilium. Technomorphs with a more or less distinct velar ridge, heteromorphs with a usually rather long, slightly convex, flange-like dolon, broadest anteroventrally." (Jaanusson, 1957, p. 296).

Tvaerenella tersa n. sp.

Plate IX, figures 3-6; Plate X, figure 14

Description. Carapace elongate, semioval, slightly preplete. Greatest length and width near median, greatest height in anterior half. Dorsal margin long, straight, with a low dorsal plica; free margins evenly curved, anterior more narrowly rounded than posterior. Velar structure well developed, broken on most specimens, extending from antero-dorsal corner to halfway up the postero-ventral slope. Velar dolon of female dimorph striate, moderately broad, and flange-like. Male velar ridge narrow. Marginal ridge on both valves, stronger on left valve, somewhat tuberculate on right valve.

Surface finely granulose. S2 a small, indistinct depression with a ventral pit, situated anterior of mid-length at or below mid-height of valve near point of greatest thickness. L2 barely discernible on some specimens as a low, rounded node situated antero-dorsally of S2.

Average measurements (in mm): female carapaces, length 1.7-1.9, height 1.05-1.10; male carapaces, length 1.40-1.50, height 0.90-0.95.

Remarks. The ventral pit-like deepening of S2, marking the position of the adductor muscle scar, is somewhat similar to the distinct adductor pit of species of *Chilobolbina*. The dorsal extension (S2) of this pit is, however, faintly discernible on some specimens but is easily obscured by matrix.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 650-663 feet.

Types. Holotype, GSC No. 17053; paratypes, GSC Nos. 17054, a-c.

Genus *Levisulculus* Jaanusson, 1957

Type species. *Levisulculus lineatus* Jaanusson, 1957

Diagnosis. "Almost non-sulcate, with an indistinct, as a rule slightly curved, narrow sulcal depression, mostly with a small preadductor node in front of it. Outline usually rather strongly preplete. Technomorphs with a moderately broad to narrow velar flange, not reaching the posterior cardinal corner. Heteromorphs with a distinct, rather strongly convex dolon which is usually broadest anteriorly. A small, rounded muscle scar is situated at about the mid-height of the lateral surface of the valve or slightly ventrally of it." (Jaanusson, 1957, p. 320).

Levisulculus michiganensis Kesling

Plate VI, figures 2, 4-6

Levisulculus michiganensis Kesling, 1960, p. 352, pl. 1, fig. 2.

Remarks. The specimens figured here agree with the type specimen figured by Kesling but are poorly preserved, lacking the postero-dorsal terminations and com-

plete velar frills. They are distinctly and randomly reticulate with polygonal, mesh-like, ornamentation. Each valve bears a fine subvelar ridge along the free margin. Specimens of both dimorphs occur, males apparently differing from females only in velar development.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-665 feet. Bony Falls Limestone, Michigan.

Types. Hypotypes, GSC Nos. 17041, a-c.

Levisulculus planus n. sp.

Plate VI, figures 7-13

Description. Valves elongate, preplete, with pronounced anterior swing and bluntly projecting postero-dorsal corner. Hingeline straight, nearly equal to greatest length. S2 shallow, nearly obsolete, generally broad. L2 variable, lowly rounded or nearly indistinguishable. Velate frill well developed; in female, broad, faintly striate, convex anteriorly and ventrally, extending from near antero-dorsal corner to mid-posterior slope; in male, narrow, concave, slightly flaring, similar in extent to female frill. Narrow subvelar ridge on male specimens, unknown on female valves.

Surface nearly smooth to slightly granular, some specimens with faintly visible fine reticulations. Average measurements (in mm) of several mature male carapaces; length 1.0-1.1, height 0.6-0.65.

Remarks. In lateral view this species most nearly approximates *Levisulculus* species B and C of Kesling (1960). *L. planus* differs from the former in apparently lacking a recognizable reticulate surface pattern and from the latter in having S2 much less well-defined and lacking the small postero-dorsal hump.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-667 feet.

Types. Holotype, GSC No. 17044; paratypes, GSC Nos. 17045, a-f.

Levisulculus undatus n. sp.

Plate VI, figures 1, 3

Description. Species known from incomplete male and female specimens. Valves elongate, preplete, with definite anterior swing. Dorsum straight, nearly equalling greatest length. S2 shallow, slightly anterior to mid-length, curved, concave anteriorly. L2 low, fairly broad, slightly dorsal of mid-valve. Hinge long. Velate structures incompletely known; in female, broad faintly striate, strongly convex antero-ventrally and ventrally, extending from antero-dorsal angle to mid-posterior slope; in male, only proximal part of velar ridge preserved. Male specimens with fine subvelar ridge, unknown on female valves.

Surface ornamented with polygonal reticulae arranged somewhat linearly.

Anastomosing lineations prominent on anterior and posterior valve surface, non-linear reticulae occurring mid-ventrally and on L2.

Length of figured male carapace 0.78 mm, height 0.42 mm.

Remarks. The combination of reticular and linear ornamentation of this species differentiates it from the linearly ornamented type species, *L. lineatus* Jaanusson, and the reticularly ornamented *L. michiganensis* Kesling. *L. undatus* is also distinguishable from *Levisulculus* species A and B of Kesling (1960) in having much stronger lineations.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 17042; paratype, GSC No. 17043.

Levisulculus sp.

Plate VI, figure 14

Remarks. The figured specimen is a large adult female valve somewhat similar in surface ornamentation to *L. planus* n. sp. Like that species, *Levisulculus* sp. lacks a well-defined L2 and S2 but is larger and more posteriorly attenuate. *Levisulculus* sp. B of Kesling (1960) is similar in lateral outline to *Levisulculus* sp. but is finely reticulate.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17046.

Family OEPIKELLIDAE Jaanusson, 1957

Genus *Oepikella* Thorslund, 1940

Type species. *Öpikella tvaerensis* Thorslund, 1940

Oepikella labrosa n. sp.

Plate VII, figures 16, 22-24; Plate IX, figures 21-25; Plate X, figures 26, 27

Description. Carapace amplete to slightly preplete; large, up to 4 mm long; non-sulcate, with a centrally situated, sometimes slightly elevated, tear-shaped adductor muscle scar. Dorsal margin slightly convex. Hinge three-fifths greatest length of valves, simple, straight, depressed along most of its length. Free margins evenly convex, left valve overlapping right. Dorsal angles rounded, limited proximally by indistinct, curved, oblique furrows. Greatest length and height median, greatest width ventral of mid-height. Surface smooth to finely granulose.

Both dimorphs with velar structures; in males, a thickened, swollen bend along the free margins of both valves, larger on overlapping left valve; in females, a broad, striate velar dolon extending from mid-anterior to postero-ventral margins. Average

measurements of several specimens: adult females, length 3.5-3.85 mm, height 2.6-2.85 mm; adult male, length 3.2-3.25 mm, height 2.50 mm.

Remarks. This species differs from *Oepikella tvaerensis* Thorslund in having less distinct cardinal angles and, on female valves, a velar dolon of greater postero-ventral length. The presence on valves of *Oepikella labrosa* n. sp. of indistinct dorsal furrows adjacent to the cardinal angles and the lack of marginal ridges appears to restrict this species from inclusion in the genus *Diploopsis* Levinson.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-650 feet.

Types. Holotype, GSC No. 17047; paratypes, GSC Nos. 17048, a-e, 17049, a-d.

Genus *Diploopsis* Levinson, 1961

Type species. *Diploopsis socialis* Levinson, 1961

Remarks. Well-preserved specimens of *Diploopsis socialis* Levinson from the Bromide Formation at Rock Crossing, Oklahoma were obtained through the courtesy of Dr. S. A. Levinson. They show the subquadrate lateral outline of the valves, convex dorsal margin, depressed hinge, and velar dimorphism. Female valves possess a convex ventral dolon extending from the mid-anterior to mid-posterior margins and separated by a subvelar groove from the low marginal ridge. Male valves have a smooth, low, velar ridge (bend?) of similar extent as the female dolon and a low, generally smooth but posteriorly and anteriorly spinose, marginal ridge. The lateral outline of the valves and presence of a male velar structure (ridge or bend) serve to distinguish *Diploopsis socialis* from species of *Oepikella*.

The presence of velar and subvelar structures on specimens showing lateral outlines similar to *Diploopsis socialis* has been demonstrated by Henningsmoen (1954, pp. 93, 94) for *Isochilina frequens* Steusloff, 1894, *Primitiella umbilicata* Kummerow, 1924, and, possibly, *Isochilina canaliculata* Krause, 1892. Other species of questionable *Diploopsis* affinity may be *Primitia maccoyi* Jones and Holl, 1868 and *Aparchites carinatus* Kay, 1940.

Diploopsis sp. cf. *D. frequens* (Steusloff)

Plate IX, figures 9-20

Isochilina frequens Steusloff, 1894, Zeit. Deutsch. Geol. Ges., bd. 46, p. 784, pl. 58, fig. 4.

Aparchites(?) frequens (Steusloff), Kummerow, 1924, Jahr. Preuss. Geol. Landes., bd. 44, p. 415, pl. 21, fig. 4.

Oepikella frequens (Steusloff), Henningsmoen, 1954, Norsk. Geol. Tidsskr., Bd. 33, Nos. 1-2, p. 93, pl. 5, figs. 7-9; Kraft, 1962, Geol. Soc. Amer., Mem. 86, p. 32, pl. 3, figs. 15a-c; pl. 4, figs. 1-14; text-figs. 7, 1-o.

Remarks. Kraft (1962) has presented a detailed discussion of this species. Specimens of both dimorphs are common in the present collection. They agree with those discussed and figured by Kraft from the Lincolnshire and Edinburg Formations, Virginia. Some female carapaces show internal partitions within the velar frill (Pl.

IX, fig. 18). These partitions may be similar to the carinate velar(?) frill of *Aparchites carinatus* Kay. *Diplopsis* sp. cf. *D. frequens* differs from *Diplopsis socialis* only in having a smooth marginal ridge on both dimorphs.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-663 feet. *Leptaena*, Algal, and Porkuni Limestones, Baltic regions; Lincolnshire and Edinburg Formations, Virginia; ?Decorah Formation, Iowa; Silliman's Fossil Mount, Baffin Island, Canadian Arctic.

Types. Hypotypes, GSC Nos. 17050, a-i.

Genus *Macronotella* Ulrich, 1894

Type species. *Macronotella scofieldi* Ulrich, 1894

Remarks. Kesling, *et al.* (1960) have demonstrated the dimorphic nature of the type species, *M. scofieldi*, and have included this genus within the Oepikellidae. Their diagnosis of the genus is: "Oepikellin ostracods without furrows delimiting the corner areas. Male with velate structure developed only as a bend at the edge of the lateral surface; female with a well-defined frill, not convex or incurved, restricted to ventral and anteroventral border." No other species of the genus *Macronotella* is known to be dimorphic.

Macronotella sp.

Plate V, figures 2, 3

Remarks. The figured specimen appears to be typical of most species of this genus in having a long, straight hingeline, and punctate shell except for the smooth, circular muscle scar and marginal zone. Its marginal structure is only partly preserved but appears to represent a velar bend. In the light of the information obtained by Kesling, *et al.* (1960) it would appear that this specimen is a male dimorph. No other specimens were obtained during the present study.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17077.

Family APARCHITIDAE Jones, 1901

Genus *Aparchites* Jones, 1889

Type species. *Aparchites whiteavesi* Jones, 1889

Aparchites fimbriatus? (Ulrich)

Plate II, figures 5, 13

Leperditia fimbriata Ulrich, 1892, *Am. Geol.*, vol. X, p. 268.

Aparchites fimbriatus (Ulrich), Ulrich, 1894, *Minn. Geol. Nat. Hist. Surv.*, vol. 3, pt. 2, p. 645, pl. 45, figs. 10-12; authors.

Remarks. The present specimens do not show the highly tuberculate velar ridge typical of this species. Small tubercles are present only on the thin velar or marginal ridge near the mid-posterior and mid-anterior extremities of each valve. Swain (1957, p. 561) and Kraft (1962, p. 29) indicated a dissimilarity between the velar or marginal ridges of juvenile and adult individuals of *A. fimbriatus*. According to these authors the left valve of this species bears "a broad frill in the immature stages which is reduced to a velate ridge in the adult; the right with a weak marginal ridge." (Swain, *ibid.*) If this observation is valid, the present specimens may be adult individuals. Hessland (*in* Treatise on Invertebrate Paleontology, Pt. Q, 1961, p. Q171), presumably basing his observations on the highly tuberculate nature of velar structures on certain species assigned to *Aparchites*, judges that *Aparchites fimbriatus* (Ulrich) actually belongs with oepikellid forms.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah Formation, Minnesota; Lincolnshire and Edinburg Formations, Virginia.

Types. Hypotypes, GSC Nos. 17068, a.

Aparchites? labellosus (Jones)

Plate VII, figures 19-21

Isochilina labellosa Jones, 1891, Geol. Nat. Hist. Surv., Canada, Contrib. Canadian Micro-Pal., pt. 3, p. 69, pl. 10, figs. 16a-c, 17, 19.

?*Leperditia balthica primaeva* Jones, 1891, *ibid.*, p. 70, pl. 10, fig. 18; Hume, 1925, Geol. Surv. Can., Mem. 145, p. 19.

not *Eoleperditia labellosa* (Jones), Swain, 1957, J. Pal., vol. 31, No. 3, p. 546, pl. 59, fig. 4.

Remarks. Specimens equal and intermediate in size between *Isochilina labellosa* Jones and *Leperditia balthica primaeva* Jones are associated in the present collection. They are here included within one species. Typical specimens of *Isochilina labellosa* Jones are similar to those from Haileybury but are generally smaller. The present specimens are questionably included within the genus *Aparchites* due to their straight hingeline, lack of sulcation, and the presence of thickened marginal rims particularly on the overlapping left valve. Inclusion of this species within *Leperditella*, as this genus is broadly envisaged by some authors (*i.e.*, Harris, 1957), is not considered probable due to the absence of a sulcal depression similar to that developed on the type species, *Leperditella rex* (Coryell and Schenck).

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Black River Group, Ottawa, Ontario.

Types. Hypotypes. GSC Nos. 17062, a, b.

Aparchites sp. cf. *A. millepunctatus* (Ulrich)

Plate VII, figure 12

Leperditia millepunctatus Ulrich, 1892, Am. Geol., vol. 10, p. 268, pl. 9, figs. 37-39.

Aparchites millepunctata (Ulrich), Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 645, pl. 45, figs. 16-18; (authors).

?*Leperditella millepunctata* (Ulrich), Swain, 1957, J. Pal., vol. 31, No. 3, p. 563, pl. 62, figs. 19a, b.

Remarks. The figured specimen is small (0.95 mm long) and is probably immature. It is finely punctate and bears indistinct free marginal thickenings. There is no indication of a median dorsal depression as reported by Swain (1957) for specimens of this species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah Formation, Iowa.

Type. Hypotype, GSC No. 17064.

Aparchites? sp.

Plate VIII, figure 41

Description. Carapace subovate to subquadrate in lateral view, highest posteriorly(?). Greatest length (0.8 mm) in dorsal half, greatest height (0.6 mm). Dorsal margin straight, long, with obtuse cardinal angles, posterior(?) angle nearly 90 degrees. Ventral margin strongly convex. Free margins with smooth marginal ridges. Surface finely pitted.

Remarks. This specimen is crushed, but retains sufficient of its shape and features to differentiate it from other aparchitids in the collection. It appears to be most nearly similar to *Aparchites kauffmanensis* Swain, 1957 but lacks the antero-median muscle scar elevation and ventral papillae of that species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17070.

Genus *Saccelatia* Kay, 1940

Type species. *Aparchites arrectus* Ulrich, 1894

Saccelatia angularis (Ulrich)

Plate II, figure 6

Moorea angularis Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 682, pl. 43, fig. 89; pl. 46, figs. 15, 16.

Saccelatia angularis (Ulrich), Kay, 1940, J. Pal., vol. 14, No. 3, p. 243, pl. 29, figs. 17-20.

Remarks. This species has been described in detail by Ulrich and Kay. The specimen figured here is somewhat crushed and apparently lacks part of the antero-dorsal projection as shown by Kay (1940, pl. 29, fig. 18). The specimen is approximately 1.1 mm long and 0.8 mm high.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah Formation, Iowa and Minnesota.

Type. Hypotype, GSC No. 17022.

Saccelatia buckensis n. sp.

Plate V, figures 1, 4, 5, 13, 14; Plate X, figure 1

Description. Valves subquadrate in lateral view, slightly preplete. Greatest length median, greatest width in ventral half. Dorsal margin straight, slightly less than greatest length; cardinal angles distinct, slightly projecting. Free margins evenly convex.

Valves evenly convex, finely but densely reticulate except for an antero-medial, smooth, circular, muscle spot and smooth marginal zone. Free margin of each valve with a low, spinose to denticulate velar(?) ridge. Measurements of several carapaces: length 0.8 mm, height 0.50 mm, width 0.32 mm.

Remarks. This species bears a number of characteristics intermediate between *Saccelatia arrecta* (Ulrich) and *Saccelatia bullata* Kay. *S. arrecta*, the type species, lacks ridges or nodes on the ventral surface of the valves as does *S. buckensis*, but has a seemingly smooth (Kay, 1940, p. 243) valve surface or is "closely set with small punctae" (Swain, Cornell, and Hansen, 1961, p. 356) which differentiates that species from the reticulate *S. buckensis*. *S. bullata*, on the other hand, has pronounced ventral nodes, is densely reticulate, and possesses a smooth, circular muscle spot and a smooth near-marginal zone on each valve.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; Wabi Point bore-hole, Harris tp., depth 635-663 feet.

Types. Holotype, GSC No. 17024; paratypes, GSC Nos. 17024a-d.

Family KLOEDENELLIDAE Ulrich and Bassler, 1908

Genus *Glymmatobolbina* Harris

Type species. *Glymmatobolbina quadrata* Harris, 1957

Diagnosis. "Carapace sub-quadrate in lateral profile, flatly convex; straight-hinged, possibly umbonate; prominent antero-medial sulcus with antero-jacent knob and an additional knob behind antero-cardinal angle, surface smooth, striate, punctate, reticulate, pustulose, or hispid." (Harris, 1957, p. 243).

Remarks. *G. quadrata* Harris is apparently known only from a single left valve (MCZ 4637). Hinge, overlap, or possible dimorphic features are not known. Based on lobation, Harris placed *Glymmatobolbina* within the Kloedenellidae, comparing it with *Kloedenella* Ulrich and Bassler.

Glymmatobolbina? magna n. sp.

Plate I, figures 13-18

Description. Valves convex, subovate in lateral view, dorsally truncated by straight hinge four-fifths greatest length. Greatest length near median, greatest

height in posterior third, greatest width near median in male carapaces, in posterior third of female carapaces. Dorsal margin straight in anterior half, posteriorly with pronounced humps of both valves extending above the hingeline. Cardinal angles abrupt, slightly projecting, obtuse, nearly equal. Anterior and posterior margins broadly convex, anterior slightly more narrowly rounded. Ventral margin gently convex, slightly convergent anteriorly with dorsum.

Surface smooth, with a short, deep, vertical sulcus (S2) anterior to median, slightly constricted medially by a presulcal node (L2). L1 low, S1 shallow, both indistinct. Left valve overlapping right ventrally and on antero- and postero-ventral margins. Dimorphic. Female valves with extreme posterior width, male valves evenly convex posteriorly in dorsal view.

Measurements (in mm) of several carapaces: female, length 2.40, height 1.70, width 1.40; male, length 2.20, height 1.50, width 1.05.

Remarks. This species differs from *Glymmatobolbina quadrata* Harris from the Bromide Formation of Oklahoma in lacking a pronounced L1 overhanging the dorsal margin, and in being of much larger size. Specimens of *Glymmatobolbina magna* exhibit well-developed posterior dimorphism typical of most kloedenellids. This type of dimorphism is not known to occur on *G. quadrata* Harris.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-650 feet.

Types. Holotype, GSC No. 17039; paratype, GSC No. 17040.

Genus *Wabiella* n. gen.

Type species. *Wabiella sella* n. sp.

Diagnosis. Bisulcate, well-defined S2 within prominent U-shaped lobes. Dimorphic, females inflated posteriorly, L3 broad; males posteriorly depressed, L3 narrow. Valves unequal, larger overlapping smaller around all or part of free margin. Marginal structure along entire free edge. Hinge depressed posteriorly. Surface of type species smooth.

Remarks. In lateral view, specimens of *Wabiella sella* are somewhat similar to species of the genera *Nanopsis*, *Jonesella*, or *Dilobella*. Species of these genera possess a fused or closely associated L1-L2 and a horseshoe-shaped lobe formed by the junction of L1-L2 and L3 enclosing a prominent S2. The genera *Nanopsis* and *Jonesella*, however, possess no marginal structures and are not known to be dimorphic. *Dilobella*, as demonstrated by Kay (1940) for *D. typa* Ulrich and its synonyms *Ctenobolbina fulcrata* and *Jonesella crassa*, possesses marked locular dimorphism. The male dimorphs of *D. typa* and *Wabiella sella* differ ventrally, *D. typa* possessing a well-defined velate ridge which does not occur on *Wabiella sella*.

The position of this genus is questioned. The anterior U-shaped lobation enclosing S2 is a typical bolliid feature but the posterior dimorphism demonstrated by female carapaces is a kloedenellid characteristic. Male and female valves, however, are not similar; male valves have a narrow, partly isolated L3 and a posterior

extra-lobate area in the position of the broad, swollen L3 of female valves. This male ornamentation greatly resembles that of *Jonesella* as presently known. It may be that *Wabiella* is synonymous with *Jonesella* but species of the latter genus are not known to possess dimorphic characteristics. At present, *Wabiella* is placed questionably within the Kloedenellidae.

Wabiella sella n. sp.

Plate VIII, figures 26, 27; Plate XI, figures 16, 19

Description. Carapace subovate in lateral view, amplete, greatest length and height median, greatest width in posterior third of female carapaces, median in male carapaces. Dorsal margin long, straight, four-fifths greatest length, obscured posteriorly in lateral view of female valve by the dorsal extension of L3. Cardinal angles abrupt, obtuse, posterior angle only slightly more than 90 degrees, anterior angle more obtuse. Free margins smoothly convex, anterior more narrowly curved than posterior margin.

Narrow marginal rim on both valves, more pronounced on left which slightly overlaps entire free margin of right valve except near the cardinal angles. Surface of valves trilobate, convex, with anterior D-shaped extra-lobate area. L1 reduced in size, broadest ventrally, with a vertical anterior margin. L2, a small, cudgel-shaped node situated in dorsal third of valve, joined ventrally to L1 by a weak ridge. L2 bounded anteriorly by a very short, deep S1 and posteriorly by the deeper, vertical S2. S2 extending from dorsal margin to below mid-height of the valve. L1 and L3 strongly connected ventrally of S2, forming a U-shaped lobe. Female with L3 broad, swollen, extending slightly above hinge and occupying posterior half of the valve surface. Male with L3 narrow, node-like, separated near mid-height by a shallow furrow from the curved postero-ventral extension of L1-L2. Male valves with large posterior extra-lobate area. Surface smooth.

Measurements of holotype (female), length 1.15 mm, height 0.7 mm, width of carapace 0.7 mm; paratype (male), length 1.35 mm, height 0.7 mm, width of carapace 0.7 mm.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Grey shale, 1963 bore-hole near the southwest shore of Wabi Point, Harris tp., Ontario; depth 635-650 feet.

Types. Holotype, GSC No. 14579; paratype, GSC No. 14579a.

Family LEPERDITELLIDAE Ulrich and Bassler, 1906

Genus *Leperditella* Ulrich, 1894

Type species. *Leperditia inflata* Ulrich, 1892 (non Murchison, 1839)

Leperditella rex (Coryell and Schenck), 1941

Plate VIII, figures 11-13

Leperditia inflata Ulrich, 1892, Am. Geol., vol. 10, No. 5, p. 265, pl. 9, figs. 12-15.*Leperditella inflata* (Ulrich), Bassler and Kellett, 1934, Geol. Soc. Amer., Spec. Paper 1, p. 374.*Leperditia rex* Coryell and Schenck, 1941, J. Pal., vol. 15, No. 2, p. 176.*Leperditella rex* (Coryell and Schenck), Coryell and Schenck, 1941, J. Pal., vol. 15, No. 2, p. 177, fig. 1 (*see* synonymy).

Remarks. The specimen figured here is 1.05 mm long and 0.65 mm high, somewhat smaller than the specimens figured by Ulrich (1892) and Coryell and Schenck (1941). Despite its smaller size it appears to agree with the previous descriptions of *Leperditella rex* and is included in that species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Black River Group, High Bridge, Kentucky.

Type. Hypotype, GSC No. 17021.

Leperditella aequilatera? (Ulrich)

Plate VII, figure 18

Leperditia aequilatera Ulrich, 1892, Am. Geol., vol. 10, No. 5, p. 265, pl. 9, figs. 9-11.*Leperditella aequilatera* (Ulrich), Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 636, fig. 46i; Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 148, pl. 2, fig. 6; Swain, 1957, J. Pal., vol. 31, No. 3, p. 562, pl. 62, fig. 4; (authors).

Remarks. Specimens referred to this species by several authors vary extensively from those originally described by Ulrich. Variation is also present on the present specimens which show somewhat more truncated postero-ventral outlines but are otherwise fairly similar to *L. aequilatera* as originally defined. A thorough study of the various specimens referred to *L. aequilatera* would probably indicate the occurrence of more than one species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Black River Group, Kentucky.

Type. Hypotype, GSC No. 17066.

Genus *Primitiella* Ulrich, 1894

Type species. *Primitiella constricta* Ulrich, 1894

Primitiella sp. cf. *P. constricta* Ulrich, 1894

Plate VII, figures 9, 13-15; Plate X, figure 10

Primitiella constricta Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 647, pl. 43, figs. 48-52.

Description. Carapace elongate, subovate, preplete; hingeline long, straight, slightly convex posteriorly. Dorsal angles curved, obtuse, posterior angle narrowly

Ordovician Ostracoda, Lake Timiskaming, Ontario

rounded, nearly at right angles to hingeline in some specimens. Anterior margin broadly curved, ventral margin short, straight, inclined posteriorly. Free margins with a low ridge parallel to the contact edge. Surface smooth, with an indistinct median depression in the dorsal half. Measurements (in mm) of several specimens: length 0.75-0.88, height 0.5-0.6.

Remarks. The present specimens are slightly larger and proportionately less elongate than those described by Ulrich from Kentucky and Minnesota. They agree most nearly with *P. constricta* and are, therefore, included provisionally in that species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-667 feet. Black River Group, Kentucky and Tennessee; Decorah Formation, Minnesota.

Types. Hypotypes, GSC Nos. 17065, a-f.

Primitiella limbata Ulrich

Plate III, figure 10

Primitiella limbata Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 648, pl. 43, figs. 53-56.

Remarks. The figured left valve measures 0.92 mm long and 0.53 mm high, somewhat greater than the measurements given by Ulrich for the type carapace. The distinctive characteristic of this species is the dorsal ridge (plica?) continuous with the marginal border. S2 is indistinct, consisting of an ovate adductor scar ventrally with a faint dorsal groove extending to the dorsal ridge.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah and Platteville Formations, Minnesota.

Type. Hypotype, GSC No. 17063.

Primitiella sp.

Plate VIII, figures 17-19

Primitiella constricta (Ulrich), Kay, 1940, J. Pal., vol. 14, No. 3, p. 262, pl. 33, figs. 22-26.

Remarks. The specimens figured here are similar to those figured by Kay (1940) in having reticulate surface ornamentation and finely beaded contact margins. Neither of these features is known to occur on *P. constricta* (Ulrich) to which Kay referred his specimens. No dimorphism such as reported by Kay was observed on the Lake Timiskaming specimens, but only five specimens were observed.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Decorah Formation, Iowa and Minnesota.

Types. Figured specimens, GSC Nos. 17020, a-d.

Genus *Milleratia* Swartz, 1936

Type species. *Beyrichia cincinnatiensis* Miller, 1875

Milleratia mica n. sp.

Plate VII, figures 1-5

Description. Outline subovate, hinge straight, four-fifths valve length. Dorsal region umbonate, extending above hinge. Umbo divided into two dorsal swellings by a prominent, near-vertical sulcus slightly anterior of mid-length. Sulcus extending to mid-valve and dividing ventrally to surround a small, low median, node. Slight angular interruption in valve convexity running parallel to free edge of valve and delimiting a low marginal fold from antero-dorsal to mid-posterior part of the valve. Surface with numerous moderately sized punctae. Dimorphism may be demonstrated by male? specimens being slightly more elongate than females. Average measurements: length 0.6 mm, height 0.4 mm.

Remarks. This species agrees most closely with *Milleratia? elegantula* (Keenan) which also has a median node enclosed by the ventral part of the sulcus. *M.? elegantula* is, however, larger, has a granular or smooth surface, and a more pronounced rounded fold parallel with the free margin. *Eridoconcha? punctata* Keenan is punctate similarly to *M. mica* but lacks a defined marginal fold.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Pt., Harris tp., depth 635-663 feet.

Types. Holotype, GSC No. 14572; paratypes, GSC Nos. 14573, a-c.

Milleratia longisulcata n. sp.

Plate VII, figure 6

Description. Outline subovate; hinge straight, four-fifths greatest valve length. Dorsal region umbonate, extending above hinge. Umbonal area divided by a low, prominent, near-vertical sulcus into two dorsal swellings. Postero-dorsal swelling larger than anterior swelling. Sulcus extending below mid-height of valve. Slight angular interruption in valve convexity running parallel to free edge of valve and delimiting a fairly abrupt ventral marginal fold. Surface smooth or slightly granular. Measurements of type specimen: length 0.6 mm, height 0.45 mm.

Remarks. The extreme length of the sulcus distinguishes this from other species of *Milleratia*. The figured specimen retains part of a previous molt anterior to the ventral end of the sulcus.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Holotype, GSC No. 14574.

Genus *Eridoconcha* Ulrich and Bassler, 1923

Type species. *Eridoconcha rugosa* Ulrich and Bassler, 1923

Eridoconcha bifurcata n. sp.

Plate VII, figure 7

Description. Valve small, ovate, with bilobed umbo extending above hinge. Hinge straight, short. Cardinal angles rounded. Sulcus restricted to a dorsal notch. Wide concentric ridges paralleling the free margins, converging near cardinal angles. Ridges separated from one another by narrow 'U'-shaped grooves. Measurement of holotype: length 0.5 mm, height 0.4 mm.

Remarks. This species is closely allied to *E. multiannulata* Levinson from the Upper Ordovician of Ohio, but *E. multiannulata* is subquadrate in lateral view. The present specimen bears two concentric ridges but, as shown by *E. multiannulata*, uni- or multi-ridged specimens may exist within the same species.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Holotype, GSC No. 14575.

Genus *Kayina* Harris, 1957

Type species. *Kayina hybosa* Harris, 1957

Kayina? sp.

Plate VIII, figure 40

Remarks. One disarticulated left(?) valve, 0.62 mm long and 0.40 mm high bears a lowly rounded postero-dorsal hump somewhat similar in position to the pronounced hump of *K. hybosa* Harris from the Simpson Group of Oklahoma. The valve is markedly postplete and has a relatively straight dorsal margin. Surface smooth.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17029.

Genus *Conchoprimites* Hessland, 1949

Type species. *Conchoprimites reticulifera* Hessland, 1949

Conchoprimites sp.

Plate II, figure 7

Description. Valve subovate, truncated dorsally by straight dorsal margin three-fourths greatest length. Preplete, free margins regularly curved, anterior more

broadly rounded than posterior. Indistinct sulcus slightly anterior to centre in dorsal third of valve. Low presulcal node. Concentric groove parallel with the free margin separating broad marginal border from the elevated central area of the valve. Surface of valve irregularly pitted, in part smooth. Length 1.1 mm, height 0.65 mm.

Remarks. Only the figured right valve was obtained during the present study. It agrees in general shape with *Conchoprimites symmetrica* (Ulrich) as figured by Kay (1940, pl. 30, figs. 28-32) but is smaller and has a better-defined sulcus. *Conchoprimites ovoides* Swain (1957, p. 569) is smaller than the present specimen and is more symmetrical in lateral view.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17030.

Genus *Hyperchilarina* Harris, 1957

Type species. *Hyperchilarina ovata* Harris, 1957

This genus has been considered a synonym of *Conchooides* Hessland = *Conchoprimitia* Öpik. Unlike *Conchoprimitia*, however, species of *Hyperchilarina* possess marked dorsal projection of the left valve above the right valve and a well-defined admarginal ridge on the right valve against which the overlapping left valve abuts during closure. One species described here (*Hyperchilarina bella* n. sp.) is shown to have marginal denticles on the right valve which are accommodated within an internal marginal groove or row of pits on the left valve. These ventral structures have not been reported for species of *Conchoprimitia*. Also, the distinctive concentric grooves characteristic of *Conchoprimitia*, which represent the inferred retention lines of immature molts, have not been observed on species of *Hyperchilarina*. It seems possible, therefore, to distinguish between presently known species of *Hyperchilarina* and *Conchoprimitia*.

Hyperchilarina bella n. sp.

Plate III, figures 1-6, 8

Description. Carapace smooth, ovate in lateral view; valves evenly convex. Some specimens with a round muscular impression near mid-valve. Hinge short, one-half greatest length. Greatest dimensions through mid-valve. Ovate left valve extending well above short straight hingeline of right and widely but imperceptibly overlapping right valve along free margins. Right valve truncated dorsally along short hingeline, otherwise ovate laterally similar to left valve. Right valve with a complete admarginal ridge against which the left valve closes. Admarginal structure a smooth ridge on anterior, ventral, and postero-dorsal margins and finely tuberculate postero-ventrally. Admarginal tubercles largest postero-ventrally, becoming smaller laterally and disappearing before reaching mid-posterior and mid-ventral. Right valve also with a complete row of marginal tubercles, largest ventrally, decreasing

in size and becoming a sharp, finely tuberculate ridge near the dorsal angles. Right marginal tubercles fitting into groove or sockets on interior surface of left valve. Shell of both valves thickened dorsally and ventrally. Measurements (in mm) of 60 carapaces are:

No.	Length	Height	Width	No.	Length	Height	Width
1	2.00	1.50	1.12	31	1.20	0.82	0.56
2	2.07	1.62	1.20	32	1.90	1.31	0.86
3	1.97	1.55	1.10	33	1.20	0.90	0.62
4	2.00	1.52	1.12	34	1.30	0.92	0.61
5	2.10	1.58	1.10	35	1.40	1.00	0.70
6	2.10	1.62	1.20	36	1.42	1.00	0.70
7	2.00	1.50	1.12	37	1.46	1.10	0.73
8	2.15	1.51	1.10	38	1.31	1.06	0.70
9	1.90	1.40	1.01	39	1.48	1.08	0.72
10	1.88	1.50	1.00	40	1.22	0.96	0.60
11	2.00	1.52	1.10	41	1.20	0.98	0.60
12	1.75	1.30	0.90	42	1.27	0.91	0.60
13	1.51	1.25	0.75	43	1.22	0.92	0.61
14	1.57	1.30	0.81	44	1.50	1.12	0.70
15	1.78	1.38	0.90	45	1.41	1.10	0.70
16	1.60	1.22	0.80	46	1.73	1.26	0.82
17	1.90	1.36	0.85	47	1.50	1.14	0.78
18	1.74	1.38	0.90	48	1.18	0.86	0.60
19	1.90	1.46	0.95	49	1.16	0.90	0.58
20	1.80	1.40	0.91	50	2.10	1.50	1.12
21	1.70	1.38	0.90	51	1.48	1.10	0.73
22	1.70	1.26	0.85	52	2.00	1.52	1.10
23	1.60	1.20	0.80	53	1.80	1.30	0.88
24	1.73	1.32	0.86	54	1.72	1.31	0.90
25	1.42	1.10	0.75	55	1.72	1.21	0.72
26	1.32	1.08	0.70	56	1.11	0.90	0.54
27	1.50	1.15	0.80	57	1.55	1.23	0.76
28	1.44	1.10	0.78	58	1.13	0.88	0.60
29	1.50	1.08	0.73	59	1.70	1.33	0.73
30	1.26	0.93	0.64	60	1.60	1.32	0.80

Remarks. Vertical sections cut near mid-length of several carapaces reveal the overlap and closure relationships of this species. Harris (1957, p. 143) pointed out the ventral left/right valve overlap and the closure of the left valve against the "flattened and thickened or beaded" right valve "preventing abnormal overlap of larger left valve." Closure of the valves is strengthened by the marginal tubercles of the right valve and corresponding groove or pits on the interior surface of the left. This groove or pitted structure extends the length of, and parallel with, the free margin of the left valve. On some specimens it is reflected externally as an obscure angulation or colour change within the shell material of the left valve, corresponding in position to the ventral concentric groove or depression present on specimens of *Conchoprimitia*. Whereas the conchoprimitiid groove is an indication of the impression of a previous molt, the corresponding hyperchilarinid structure is the result of reflection of the narrow internal groove or pits of the left valve for

accommodation of the marginal tubercles of the right valve and is, therefore, present only on the left valve.

Hyperchilarina bella n. sp. is most similar to *Hyperchilarina ovata* Harris, 1957 but is more ovate in lateral view, has a much shorter hingeline, is proportionately higher in L/H ratios, and has less noticeable ventral overlap by the left valve. Harris indicated that the admarginal structure of the right valve of *H. ovata* is beaded at the ventral angles—this is true only of the postero-ventral angle of *H. bella*.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-650 feet.

Types. Holotype, GSC No. 17031; paratypes, GSC Nos. 17032, a-f, 17033 (1-60).

Hyperchilarina obscura n. sp.

Plate III, figure 7

Description. Carapace ovate, punctate, punctae widely spaced. Valves evenly convex with a small, round muscular impression slightly anterior of mid-valve. Greatest dimensions through mid-valve. Ovate left valve extending slightly above short, straight hingeline of right, overlapping right valve along the free margins, overlap not visible in lateral view. Right valve truncated dorsally by straight hingeline one-third greatest length. Right valve with a complete admarginal ridge against which the left valve abuts on closing. Admarginal ridge smooth, sharp, apparently not tuberculate, extending evenly with, or slightly beyond the overlapping left valve. Marginal structures of right valve, if present, unknown. Measurement of the holotype, a complete carapace; length 1.90 mm, height 1.55 mm, width 0.92 mm.

Remarks. This species most nearly agrees with *H. bella* n. sp. but has a shorter hingeline than that species, is sparsely punctate and the right valve apparently has a smooth admarginal ridge completely obscuring the ventral overlap of the left valve in right lateral view. *Paraparchites? circulantis* Harris from the Simpson Group of Oklahoma is somewhat similar to *H. obscura* in valve shape and overlap relationships but is much smaller.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Holotype, GSC No. 17034.

Genus *Ectoprimitia* Bouček, 1936

Type species. *Primitia corrugata* Krause, 1892

Ectoprimitia sp.

Plate III, figure 9

Description. Carapace elongate, subovate in lateral view. Hingeline long, straight,

somewhat convex posteriorly; hinge slightly sunken in posterior half. Cardinal angles obtuse, posterior more angular than anterior. Anterior and posterior margins curved, posterior more broadly than anterior. Ventral margin straight to slightly concave. Both valves apparently with a fine marginal ridge. Right valve extending beyond left valve along free margins. Surface smooth to very finely punctate. S2 anterior of mid-valve, in dorsal half, deeper ventrally, extending to dorsum as a very shallow depression. L2 small, situated anterior to ventral end of S2. Length 1.92 mm, height 1.10 mm.

Remarks. This specimen is somewhat similar to *Ectoprimitia pustulosa* Swain, 1957 but is much larger. The present specimen appears to show a pronounced marginal ridge similar to that reported by Swain for *E. pustulosa*. This appearance may be heightened by the apparent right/left valve overlap or be the result of preservation but cannot be proved due to the presence of matrix along the free margin.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Type. Figured specimen, GSC No. 17067.

Genus *Primitia* Jones and Holl, 1865

Type species. *Beyrichia mundula* Jones, 1885 (ICZN, pending)

"Primitia" harrisensis n. sp.

Plate XI, figures 1-3

Description. Valves subovate, usually amplete. Dorsum epicline posteriorly; cardinal angles subround, obtuse; free margins evenly convex. Hingeline slightly sunken posteriorly, hingement simple. S2 anterior of mid-valve, short, not reaching dorsum, deep, concave anteriorly, with anterior margin steeply inclined, posterior margin sloping. Presulcal node (L2) low, at mid-anterior margin of S2. Surface of valves evenly granulose. Some specimens with smooth areas surrounding L2, S2, and along dorsum; fine longitudinal striae along mid-ventral margins of both valves. Left valve with thickened margin, overlapping right valve ventrally. No marginal or velate structures present. Average measurements: length 0.82 mm, height 0.5 mm.

Remarks. This species is only questionably included within the genus "*Primitia*" because of its surface ornamentation. Inclusion of the species within *Leperditella* or *Conchoprimitia* seems unlikely due to the prominence of S2. *L. rex*, the type species of *Leperditella*, and "*P. harrisensis*" have epicline postero-dorsal margins, a feature distinguishing *Leperditella* and *Conchoprimitia* (Jaanusson, 1957, p. 418). Also, specimens of *Conchoprimitia* are "never granulose or tuberculate" (Jaanusson, 1957, p. 416). Other previously described granulose or pustulose primitiid species (i.e., *P. mundula* [*cincinnatiensis*] *jonesi* Ruedemann 1901 and *P. everesti* Reed 1912) bear marginal or velate structures and thus differ from the present species.

Occurrence. Grey shale, 1963 bore-hole near the southwest shore of Wabi Point, Harris tp., Ontario; depth 650-660 feet.

Types. Holotype, GSC No. 17086; paratypes, GSC Nos. 17086a, b.

"Primitia" sp. indet.

Plate X, figures 19, 20, 25

Description. Valves smooth, ovate to subcircular in lateral view. Greatest length near median, greatest height and width in posterior half. Hinge straight, nearly three-fourths greatest length, sunken in posterior half beneath dorsal elevation of L3. Free margins smooth not ridged. S2 prominent, deep, extending vertically from hingeline to mid-height of valve, slightly enlarged ventrally into a deeper pit, constricted anteriorly near mid-length by a small node (L2). Measurements of largest specimens: length 1.8-1.9 mm, height 1.4-1.5 mm.

Remarks. This species appears to agree most nearly with specimens of *P. mundula* Jones (i.e., Jones, 1893, p. 291, pl. XII, figs. 2, 3) from the 'Pusgill' of Great Britain. *P. lativia* Ulrich, 1889 from the Stony Mountain beds near Winnipeg, Manitoba, is also a closely related species.

Occurrence. Green calcareous shale, 6 feet below lowest occurrence of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Figured specimens, GSC Nos. 17074, a, b.

Genus *Hallatia* Kay, 1934

Type species. *Hallatia healeyensis* Kay, 1934

Hallatia sp. cf. *H. particylindrica* Kay

Plate X, figure 13

Hallatia particylindrica Kay, 1934, J. Pal., vol. 8, No. 3, p. 336, pl. 45, figs. 3, 4; Kay, 1940, J. Pal., vol. 14, No. 3, p. 253, pl. 31, figs. 24, 25.

Remarks. Small specimens, somewhat resembling *H. particylindrica* occur rarely in the Lake Timiskaming collection. The figured specimen apparently lacks the postero-dorsal angle and the posterior lobe is much larger than on figured specimens of *H. particylindrica*.

Occurrence. Green calcareous shale, 6 feet below lowest occurrence of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Pt., Harris tp., depth 650-667 feet. Decorah Formation, Iowa.

Type. Hypotype, GSC No. 17075.

Hallatia? dubia n. sp.

Plate X, figures 9, 11, 12

Description. Valves small, outline elliptical in lateral view, slightly truncated dorsally by moderately long hingeline. Hinge straight, two-thirds greatest length, sunken posteriorly beneath dorsal elevation of L3. Free margins regularly curved, posterior more broadly rounded than anterior. Valve surface rising fairly abruptly from all sides except the dorsum, separated from the free margin by a pronounced groove which, posteriorly, delimits a flat, extra-lobate area. S2 deep, pit-like, not reaching dorsal margin, situated in dorsal half of valve. L2 very poorly developed, lying anterior of, and limiting, S2 near its mid point. Surface of valves finely reticulate to reticulo-lineate parallel with the free margins. Average measurements of several specimens: length 0.92-1.10 mm, height 0.58-0.70 mm.

Remarks. This species differs considerably from other previously described species of *Hallatia*. It bears a surface reticulation, has a pit-like rather than groove-like S2, and shows faint indication of L2. In these respects it is reminiscent of *Euprimites* Hessland but lacks the velar ridge and dolon of species of that genus. The abrupt elevation of the valve surface, the pronounced postero and postero-dorsal extra-lobate area, and the admarginal groove are, however, typical of species of *Hallatia* to which genus this species is questionably assigned.

Occurrence. Green calcareous shale, 6 feet below lowest occurrence of grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 665-687 feet.

Types. Holotype, GSC No. 17076; paratypes, GSC Nos. 17076, a, b.

Genus *Byrsolopsina* Swain and Cornell

Type species. *Paraschmidtella planilateralis* Kay, 1940

Byrsolopsina planilateralis (Kay)

Plate XI, figures 7, 10

Paraschmidtella planilateralis Kay, 1940, J. Pal., vol. 14, p. 246, pl. 30, figs. 8-13.

Byrsolopsina planilateralis (Kay), Swain, Cornell and Hansen, 1961, J. Pal., vol. 35, p. 363, pl. 49, figs. 1a-i, 2a-f; text-figs. 2j, k.

Remarks. The sparse, coarse pits covering the lateral surface, and the smooth marginal area of the valve distinguish this species. Swain, *et al.* (p. 364) mention that "posteriorly in some specimens a low ridgelike elevation runs parallel to margin". This also occurs on some specimens from Lake Timiskaming.

Occurrence. Grey shale, 1963 bore-hole near the southwest shore of Wabi Point, Harris tp., Ontario; depth 635-687 feet. Decorah Formation, Iowa, Minnesota, Wisconsin.

Types. Hypotypes, GSC Nos. 17083, a.

Family BAIRDIIDAE Sars, 1885

Genus *Bythocypris* Brady, 1880

Type species. *Bairdia bosquetiana* Brady, 1866

Bythocypris? cylindrica (Hall), 1871

Plate II, figures 2-4

Leperditia cylindrica Hall, 1871, Description of new species of Fossils, from the Hudson River Group, etc., p. 7, pl. 4, fig. 12; (authors).

Bythocypris cylindrica (Hall), Ulrich, 1889, Geol. Nat. Hist. Surv. Canada, Contrib. to the Micro-palaeontology of the Cambro-Silurian Rocks of Canada, part II, p. 48, pl. IX, fig. 6; (authors).

Remarks. This species has been adequately described by numerous authors. Variation apparently exists within the generally accepted concept of this species which, if carefully studied, would probably indicate the presence of specific differences.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-687 feet. Trentonian and Richmondian of eastern North America.

Types. Hypotypes, GSC Nos. 14591, a, b.

Bythocypris granti Ulrich

Plate III, figures 14, 15

Bythocypris granti Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 689, pl. 44, figs. 39-42; (authors).

Remarks. The Lake Timiskaming specimens are somewhat larger than the typical specimens, measuring 1.75-1.85 mm long and 0.75-0.8 mm high. The valve extremities are nearly equally rounded, the left valve strongly overlapping the right along the ventral margin.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-665 feet. Decorah Formation, Minnesota.

Types. Hypotypes, GSC Nos. 17018, a, b.

Family BAIRDIOCYPRIDIDAE Shaver, 1961

Genus *Longiscula* Neckaja, 1958

Type species. *Longiscula arcuaris* Neckaja, 1958

?*Longiscula emaciata* n. sp.

Plate VIII, figures 1-4

Description. Carapace long, subtriangular, of 'bairdian' aspect in lateral view. Greatest length ventral; greatest height in posterior third; greatest width median.

Hinge short, straight, anterior of greatest height. Dorsal margin arched, sloping steeply and slightly concave in posterior third, somewhat convex and gently sloping in anterior two-thirds. Anterior margin narrowly rounded ventrally; posterior margin slightly concave above, strongly convex below, bluntly acuminate in 'bairdian' fashion. Ventral margin somewhat concave medially, convex in anterior and posterior thirds.

Left valve overlapping right moderately along mid-venter and slightly on dorso-anterior and posterior slopes. Right valve slightly overreaching left valve on mid-dorsum. Surface smooth. Muscular scar unknown. Average measurements of several specimens: length 1.3-1.4 mm, height 0.6-0.62 mm, width 0.42-0.45 mm.

Remarks. This species differs from other members of the genus in its extreme length and somewhat 'bairdian' aspect. A ventral L/R overlap and dorsal R/L overreach such as is present on this species is common to species of the genera *Longiscula* Neckaja, 1958, *Silenis* Neckaja, 1958, and *Arcuaria* Neckaja, 1959. The two latter genera apparently differ from *Longiscula* in having greater L/R overlap of the free margins.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 14584; paratypes, GSC Nos. 14585, a, b.

Family KRAUSELLIDAE Berdan, 1961

Genus *Krausella* Ulrich, 1894

Type species. *Krausella inaequalis* Ulrich, 1894

Krausella calvini (Kay)

Plate II, figures 8, 9

Rayella calvini Kay, 1940, J. Pal., vol. 14, No. 3, p. 268, pl. 34, figs. 32-34; Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 254, pl. 10, figs. 6a-c.

Remarks. The presence of a short posterior elongation of the left valve and a blunt, rounded, posterior spine on the right valve serve to distinguish this species. It is somewhat similar to *K. arcuata* Ulrich in the ventral position of the posterior spine of the right valve but has a more convex, rather than sloping, antero-dorsal shoulder.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-663 feet. Decorah Formation, Iowa and Minnesota; Bromide Formation, Oklahoma.

Types. Hypotypes, GSC Nos. 14589, a.

Krausella brevicornis (Keenan)

Plate II, figures 10-12

Rayella brevicornis Keenan, 1951, J. Pal., vol. 25, No. 5, p. 567, pl. 79, figs. 40, 41.
Bythocypris? spinosa Harris, 1957, Okla. Geol. Surv., Bull. 75, p. 260, pl. 10, figs. 14a-c.
Bythocypris (Rayella) brevicornis (Keenan), Harris, 1957, *ibid.*, p. 261.

Remarks. The Lake Timiskaming specimens measure approximately 1.05-1.20 mm long, 0.5 mm high, and 0.55-0.60 mm wide. They agree with the specimens figured by Keenan from the Maquoketa Shale in lateral outline and in possession of a minute, fragile spine on the posterior margin of the right valve. Specimens of *Rayella calvini parva* Harris and *Rayella minuta* Harris from the Simpson Group of Oklahoma and some specimens of *Krausella variata* Kraft (in Swain, 1962; Kraft, 1962) from the Crown Point Formation of New York and Edinburg Formation, Virginia appear to be somewhat similar to *K. brevicornis* in lateral view and may be conspecific.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp. Simpson Group, Oklahoma; Maquoketa Shale, Iowa.

Types. Hypotypes, GSC Nos. 14588, a, b.

Krausella sp. cf. *K. arcuata* Ulrich

Plate III, figures 11-13

Krausella arcuata Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 692, pl. 44, figs. 47-53; (authors).

Remarks. The specimens figured here are similar in size to *K. arcuata* and show the development of the strong postero-ventral spine typical of that species. The straight ventral and arched dorsal margins are also similar to *K. arcuata* but the antero-dorsal slope of the present specimens is apparently more convex than indicated by other figured specimens of *K. arcuata*.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-663 feet. Black River and Trenton Groups, central and eastern North America.

Types. Hypotypes, GSC Nos. 14590, a, b.

Family indeterminate

Genus *Monoceratella* Teichert, 1937

Type species. *Monoceratella teres* Teichert, 1937

Monoceratella spicata n. sp.

Plate VIII, figures 5-10

Description. Carapace semiovate, dorsally truncated, preplete. Hingeline straight, long, nearly equal to greatest length. Greatest length in dorsal half, greatest height in anterior third, greatest width near median. Anterior cardinal angle nearly 90 degrees, slightly obtuse, with a prominent antero-dorsally directed spine. Posterior cardinal angle obtuse, rounded. Posterior margin narrowly rounded, ventral margin slightly convex, anterior margin broadly rounded, extended ventrally.

Ordovician Ostracoda, Lake Timiskaming, Ontario

Surface smooth, slightly depressed in mid-dorsal half. Near marginal, posteriorly directed spine on postero-ventral slope. Free edge finely denticulate. Measurements: length 1.05-1.1 mm, height 0.65 mm.

Remarks. This species is similar to *Monoceratella teres* Teichert (?=*Monoceratella obliqua* Teichert) in lateral outline and valve obliquity, but is smaller. *M. spicata* has the lateral, near-marginal spine on the postero-ventral slope of the valve, not medio-ventrally as on *M. teres*. The antero-dorsal and postero-ventral spines of *M. spicata* are not preserved on the figured specimens but are interpreted from the preserved spine bases.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Holotype, GSC No. 14586; paratypes, GSC Nos. 14587, a.

Genus *Macrocyproides* Spivey, 1939

Type species. *Macrocyproides clermontensis* Spivey, 1939

Macrocyproides trentonensis (Ulrich)

Plate II, figure 1

Aparchites minutissimus trentonensis Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 646, pl. 43, figs. 18-20; (authors).

Aparchites trentonensis Ulrich, Kay, 1940, J. Pal., vol. 14, No. 3, p. 244, pl. 29, fig. 33.

Macrocyproides trentonensis (Ulrich), Swain, Cornell, and Hansen, 1961, J. Pal., vol. 35, No. 2, p. 371, pl. 48, fig. 11, pl. 50, figs. 5a-d, text-figs. 2-1; Swain, 1962, J. Pal., vol. 36, No. 4, p. 740, pl. 111, figs. 2a-c.

Remarks. Swain (1962, p. 740) has given an abbreviated description of this species based on specimens obtained from Valcour Island, New York. No additional description of the Lake Timiskaming specimens is necessary.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 645-650 feet.

Type. Hypotype, GSC No. 17017.

Genus *Pullvillites* Öpik, 1937

Type species. *Pullvillites triangulum* Öpik, 1937

Pullvillites? wabiensis n. sp.

Plate VII, figures 10, 11

Description. Specimens small, subtriangular in lateral view, with pronounced right(?) valve ventral overlap of the left. Anterior(?) margin more acute and extended than the posterior margin. Dorsal umbo situated centrally on both valves, extending beyond the depressed hingeline. Valve surface smooth, with an indistinct,

umbonal, sulcal impression observable from the exterior as a translucent area within the valve well. Approximate measurements of the figured specimens: length 0.6 mm, height 0.5 mm.

Remarks. The subtriangular lateral outline of *P.?* *wabiensis* is typical of species of this genus. *P.?* *wabiensis* differs from the genotype, *P. triangulum* Öpik, in being dorsally umbonate with a depressed hingeline similar to many species of *Schmidtella* Ulrich (i.e., *Schmidtella umbonata* Ulrich). *P. rostrata* (Krause) bears a short ventral spine on the larger valve and has a nearly straight to slightly depressed dorsal margin. Both of these previously described species show slight dorsal overreach by the larger (right?) valve.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.; 1963 bore-hole, Wabi Point, Harris tp., depth 635-667 feet.

Types. Holotype, GSC No. 17023; paratype, GSC No. 17023a.

Ostracod indet.

Plate VIII, figures 38, 39

Remarks. Several poorly preserved ostracods were obtained which show canoe-shaped outlines in lateral view, a faint marginal ridge on the larger valve, and are smooth to finely pitted. The central part of the hingeline is sunken beneath the protruding cardinal angles, whether by preservation or natural growth is unknown.

Occurrence. Grey-black shale, Shipyards quarry, lot 10, con. V, Bucke tp.

Types. Figured specimens, GSC Nos. 17069, a.

Genus *Dicranella* Ulrich, 1894

Type species. *Dicranella bicornis* Ulrich, 1894

Dicranella marginata Ulrich

Plate XI, figure 15

Dicranella marginata Ulrich, 1894, Minn. Geol. Nat. Hist. Surv., vol. 3, pt. 2, p. 666, pl. 44, figs. 27, 28; Kay, 1940, J. Pal., vol. 14, No. 3, p. 260, pl. 33, fig. 4.

Remarks. The reverse of the descriptions published by Ulrich and Kay is used here. The specimen has a decided anterior swing, the doubled velate ridge is anterior and antero-ventral in position, L2 is small, node-like not reaching the long, straight dorsal margin, L3 is larger than L2 and bluntly acuminate. S2 is very deep and slit-like, ventrally becoming a small, circular pit. The posterior third of the valve is much more attenuated than indicated by Ulrich (1894), probably due to fracturing of the type specimen as shown by Kesling (1951, pl. IV, figs. 9a, b). This attenuation is well shown by the present specimen, that figured by

Ordovician Ostracoda, Lake Timiskaming, Ontario

Kay (1940, pl. 33, figure 4), and figures of *D. bicornis*(?) Ulrich in Moore *et al.* (1961, fig. 136A, Nos. 16a, c).

Occurrence. Abandoned quarry, 2 miles west of New Liskeard, Dymond tp., near top of hill east of South Wabi Creek. Decorah Formation, Iowa and Minnesota.

Type. Hypotype, GSC No. 17078.

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PLATES I to XI

PLATE I

(All figures, except 13-18, magnified approximately X30)

- Figures 1-4. *Pleurodella costata* n. sp. (Page 23)
Left lateral, dorsal, right lateral, and ventral views of four male carapaces. Holotype, GSC No. 17057; paratypes, GSC Nos. 17058, a, b.
- Figures 5, 7, 8. *Tetradella kayi* n. sp. (Page 22)
Left lateral views of three valves. Paratypes, GSC Nos. 14569, a; holotype, GSC No. 14568.
- Figures 6, 9, 12. *Tetradella* sp. cf. *T. ellipsilira* Kay (Page 22)
Left and two right lateral views of three valves. Hypotypes, GSC Nos. 14570, a, b.
- Figures 10, 11. *Tetradella ulrichi* Kay (Page 23)
Left and right lateral views of two valves. Hypotypes, GSC Nos. 14571, a.
- Figures 13-18. *Glymmatobolbina? magna* n. sp. (Page 32)
13-15. Ventral, dorsal, and right lateral views of a female carapace; X20. Holotype, GSC No. 17039.
16-18. Ventral, dorsal, and left lateral views of a male carapace; X20. Paratype, GSC No. 17040.

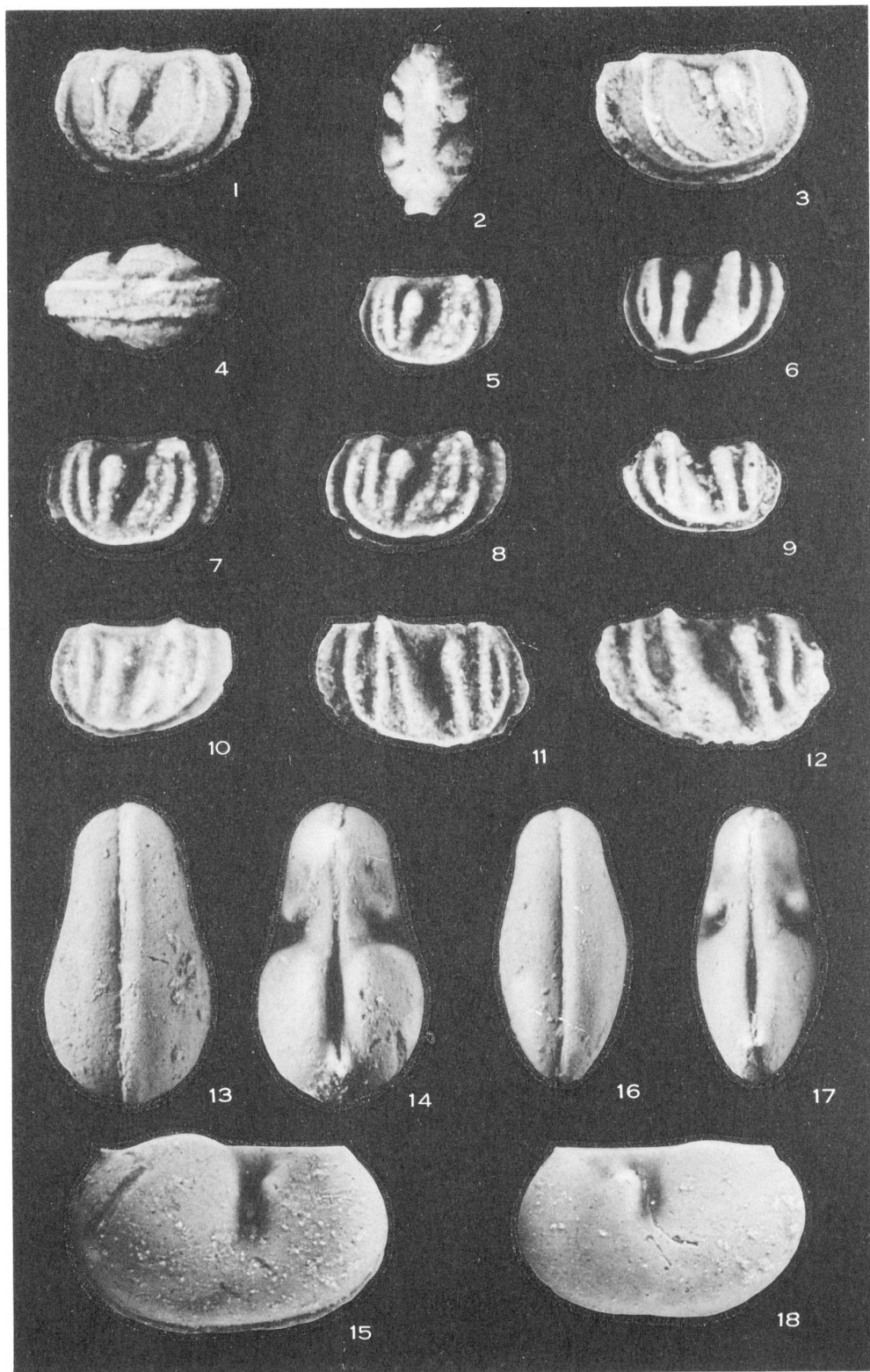


PLATE II

(All figures magnified approximately X30)

- Figure 1. *Macrocyproides trentonensis* (Ulrich) (Page 48)
Left? lateral view of a carapace. Hypotype, GSC No. 17017.
- Figures 2-4. *Bythocypris? cylindrica* (Hall) (Page 45)
Left lateral, right lateral, and ventral views of three carapaces. Hypotypes, GSC Nos. 14591, a, b.
- Figures 5, 13. *Aparchites fimbriatus?* (Ulrich) (Page 29)
Lateral views of two carapaces. Hypotypes, GSC Nos. 17068, a.
- Figure 6. *Sacclatia angularis* (Ulrich) (Page 31)
Left lateral view of a broken valve. Hypotype, GSC No. 17022.
- Figure 7. *Conchoprimites* sp. (Page 38)
Right lateral view of a valve. Figured specimen, GSC No. 17030.
- Figures 8, 9. *Krausella calvini* (Kay) (Page 46)
Dorsal and right lateral views of two carapaces. Hypotypes, GSC Nos. 14589, a.
- Figures 10-12. *Krausella brevicornis* (Keenan) (Page 46)
Right lateral, left lateral, and dorsal views of three carapaces. Hypotypes, GSC Nos. 14588, a, b.
- Figures 14-20. *Laccochilina (Prochilina) granulosa* n. sp. (Page 14)
14-19. Four left lateral and two right lateral views of six valves. Paratypes, GSC Nos. 17052, a-e.
20. Right lateral view of a valve. Holotype, GSC No. 17051.

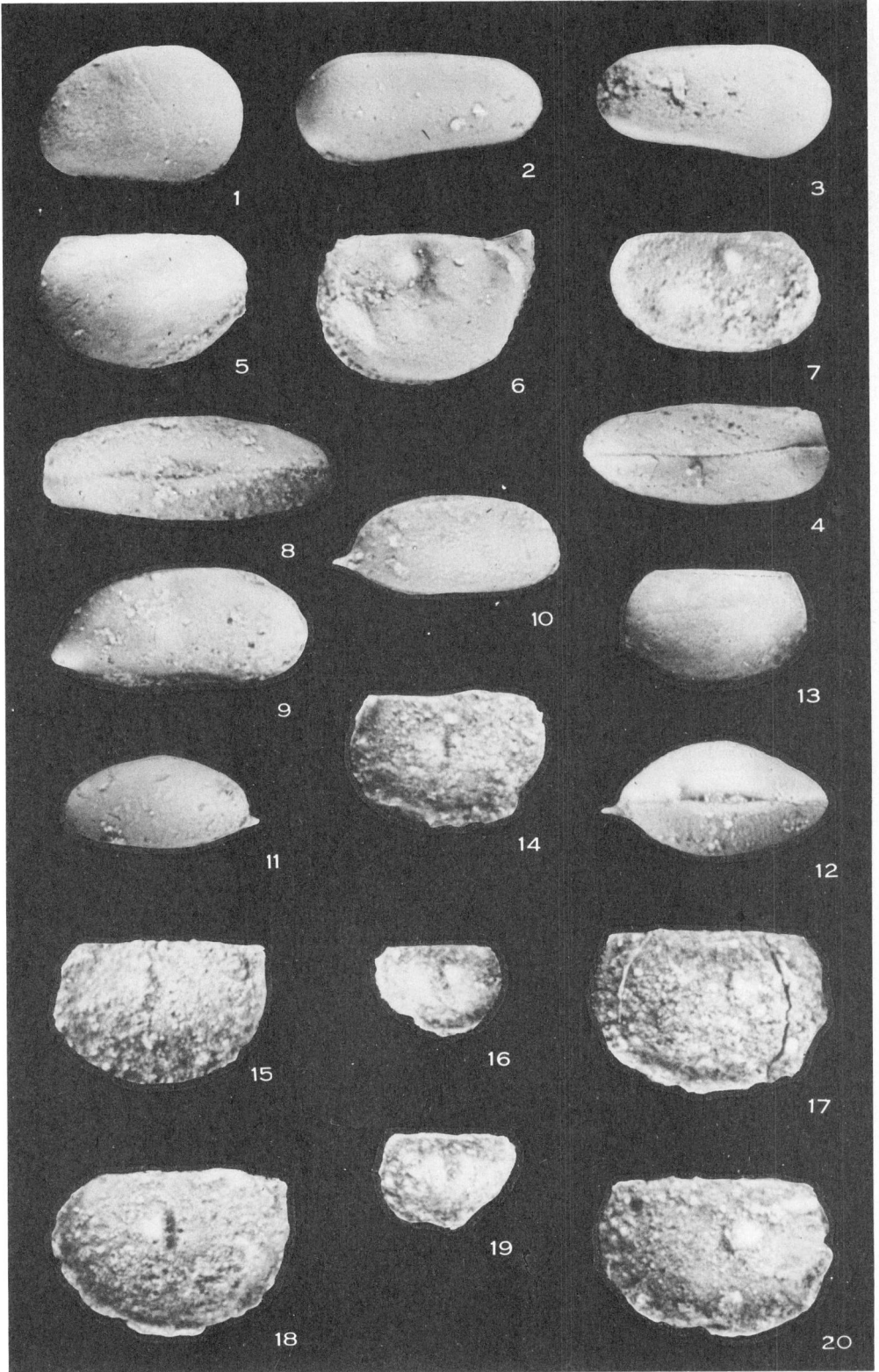


PLATE III

(All figures magnified approximately X20)

- Figures 1-6, 8. *Hyperchilarina bella* n. sp. (Page 39)
1. Left lateral view of a carapace. Holotype, GSC No. 17031.
2-5. Two right lateral, dorsal, and ventral views of four carapaces. Paratypes, GSC Nos. 17032, a-c.
6. Ventral view of a right valve. Paratype, GSC No. 17032d.
8. Right lateral view of a crushed carapace showing greater anterior curvature. Paratype, GSC No. 17032f.
- Figure 7. *Hyperchilarina obscura* n. sp. (Page 41)
Right lateral view of a carapace. Holotype, GSC No. 17034.
- Figure 9. *Ectoprimitia* sp. (Page 41)
Left lateral view of a carapace. Figured specimen, GSC No. 17067.
- Figure 10. *Primitiella limbata* Ulrich (Page 36)
Left lateral view of a carapace. Hypotype, GSC No. 17063.
- Figures 11-13. *Krausella* sp. cf. *K. arcuata* Ulrich (Page 47)
Two right lateral and one left lateral views of three specimens. Hypotypes, GSC Nos. 14590, a, b.
- Figures 14, 15. *Bythocypris granti* Ulrich (Page 45)
Right and left lateral views of two carapaces. Hypotypes, GSC Nos. 17018, a.
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Right and left lateral views of two valves. Hypotypes, GSC Nos. 17037, a.
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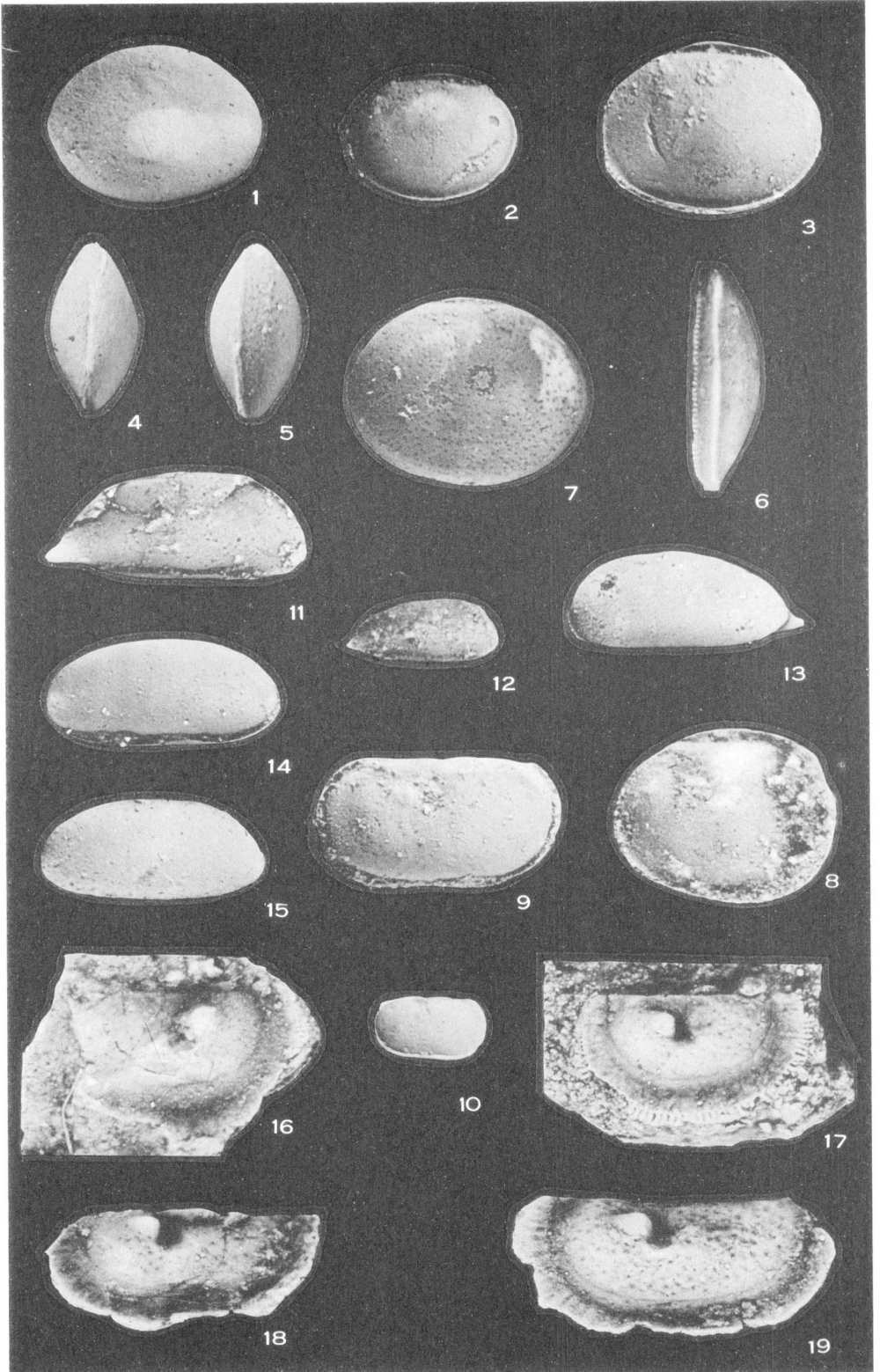


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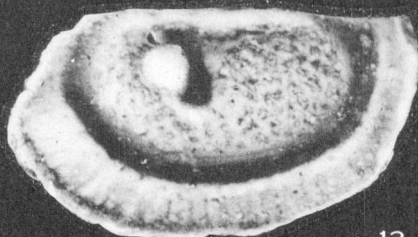
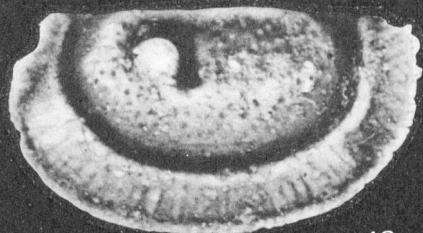
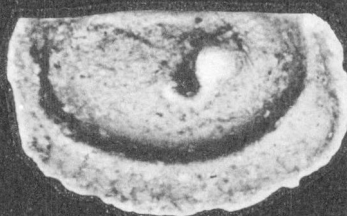
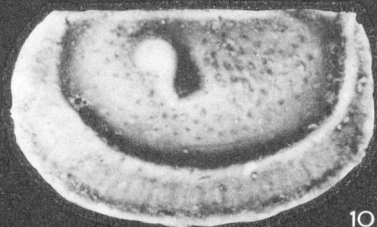
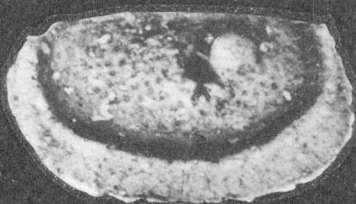
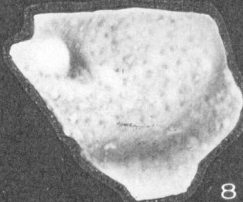
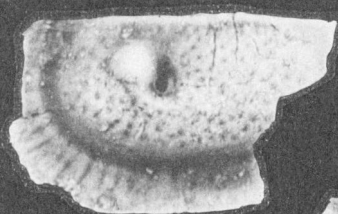
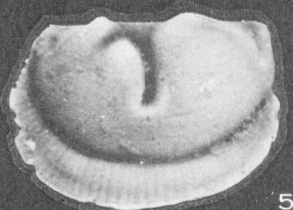
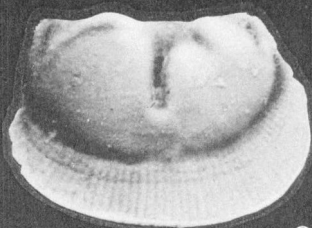
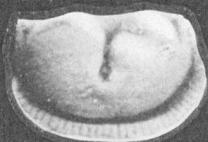
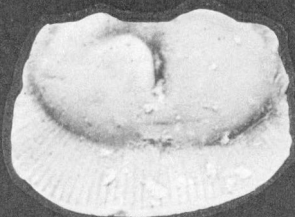


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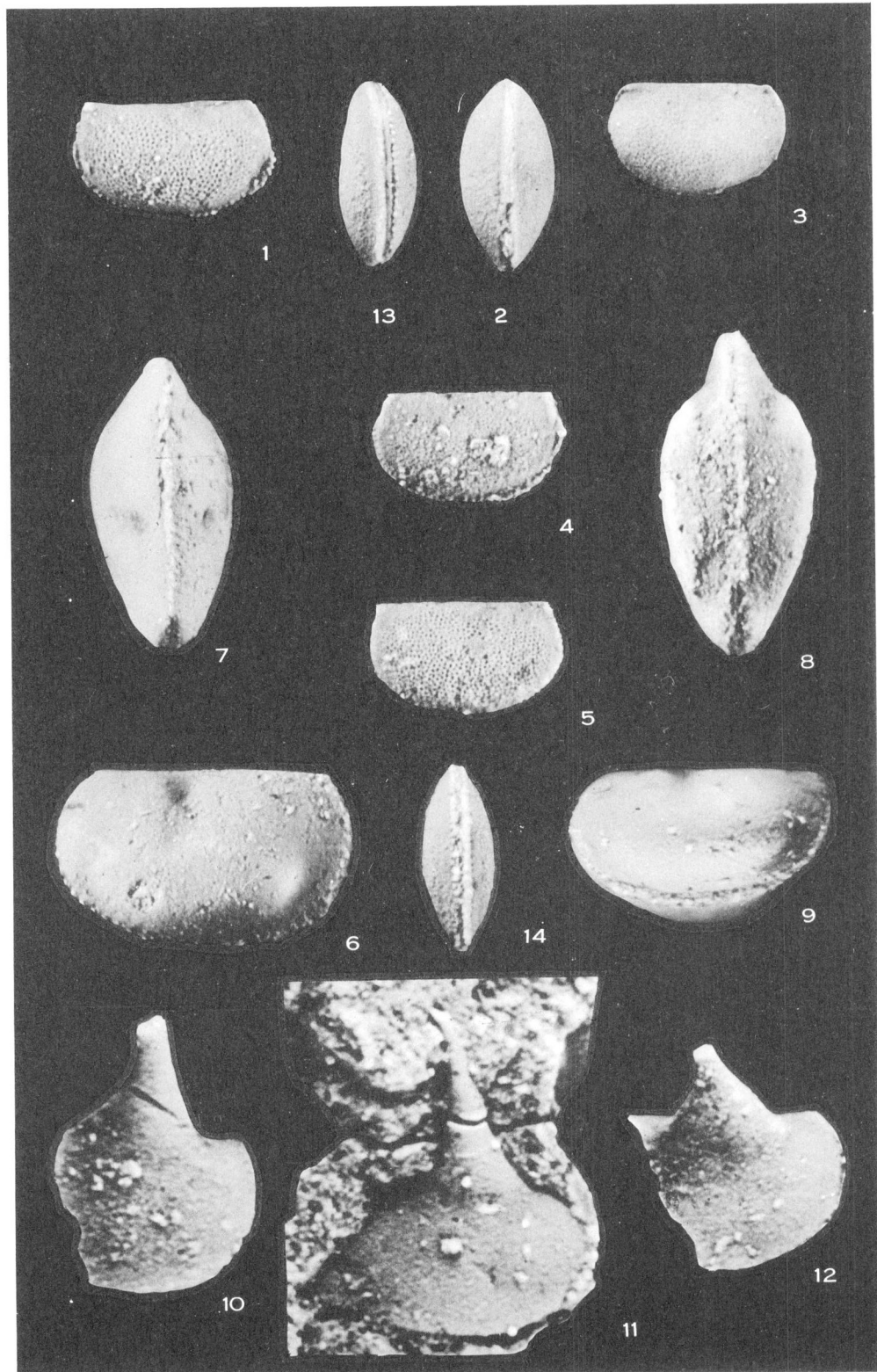


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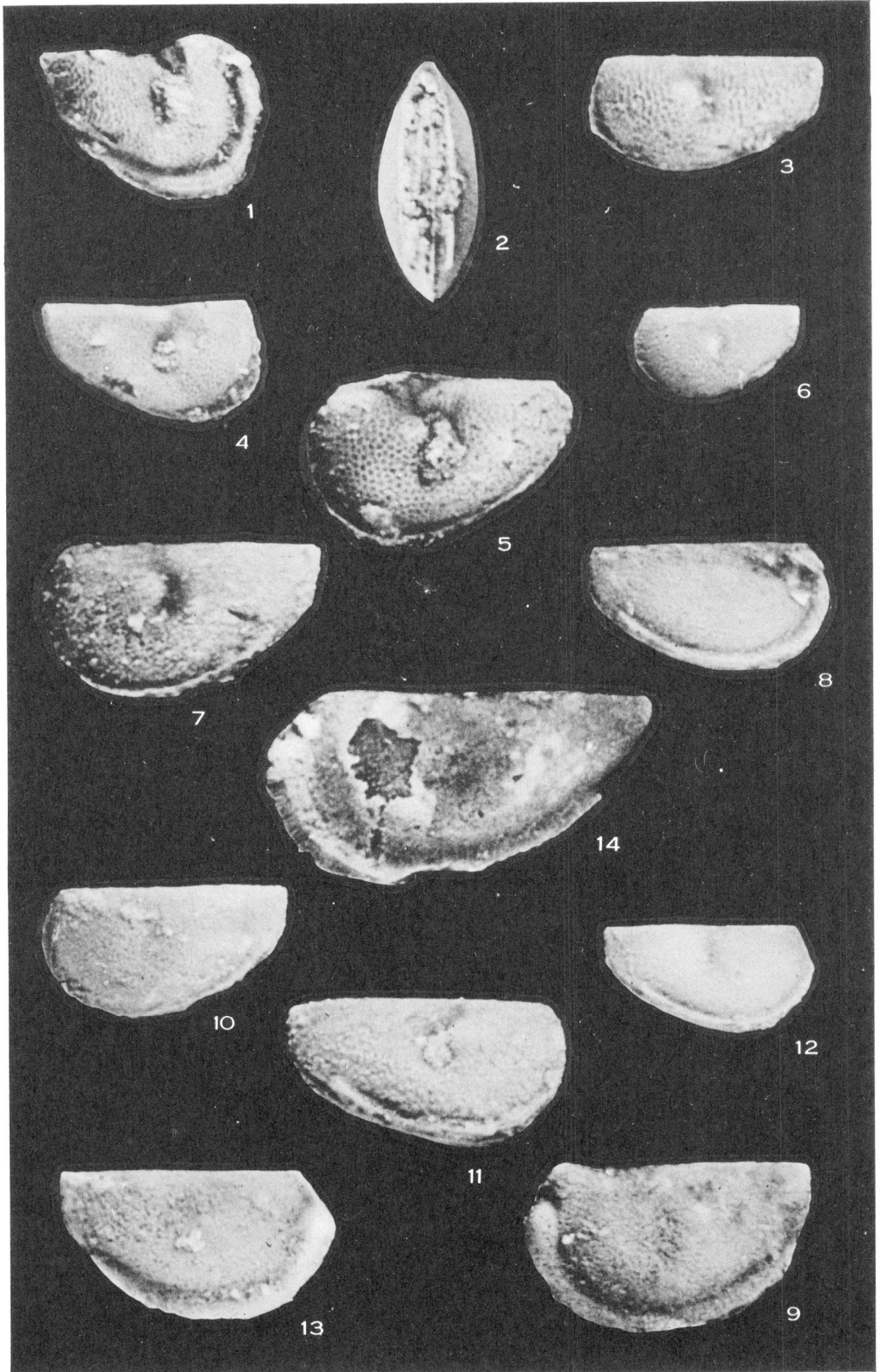


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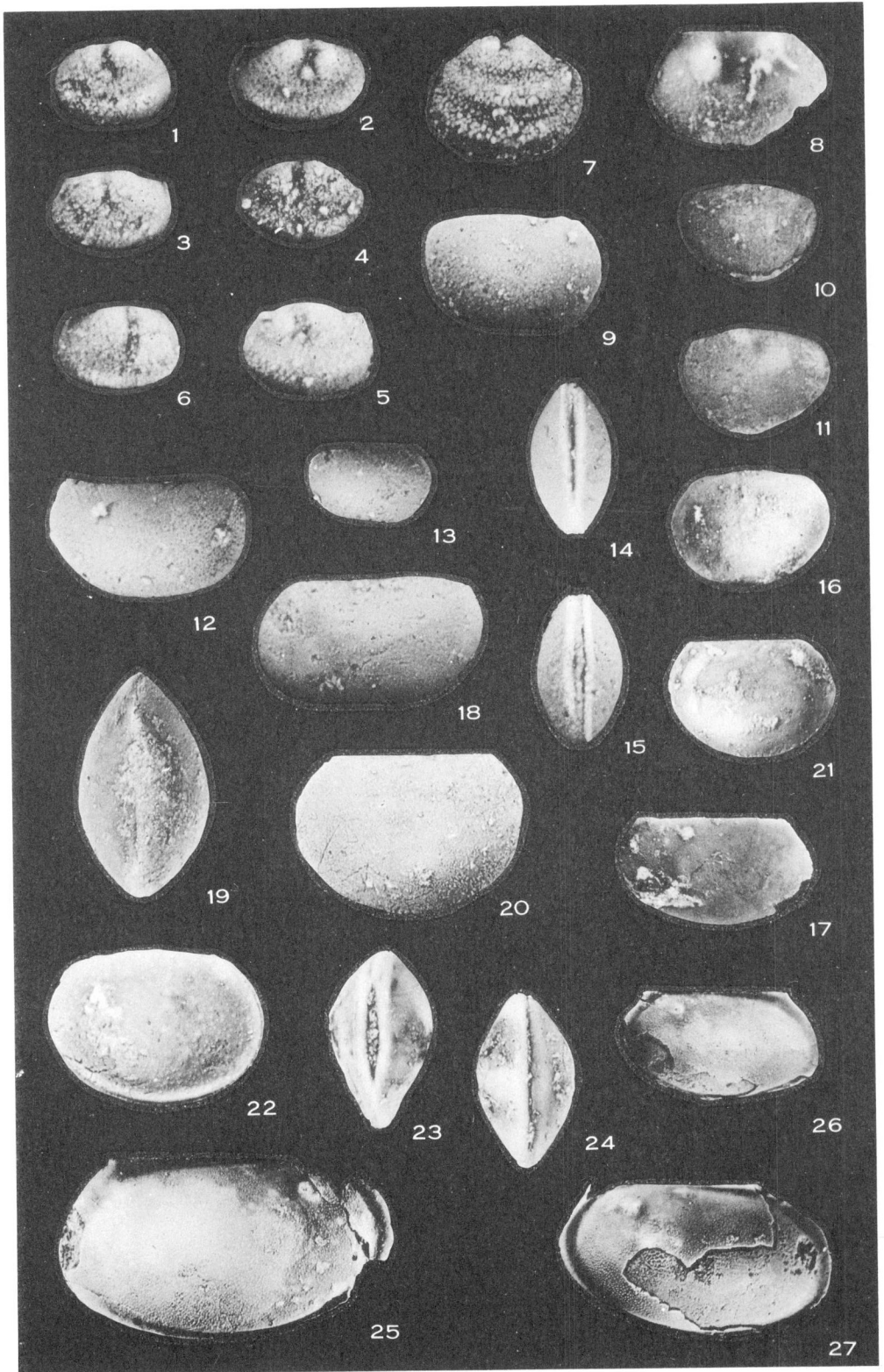


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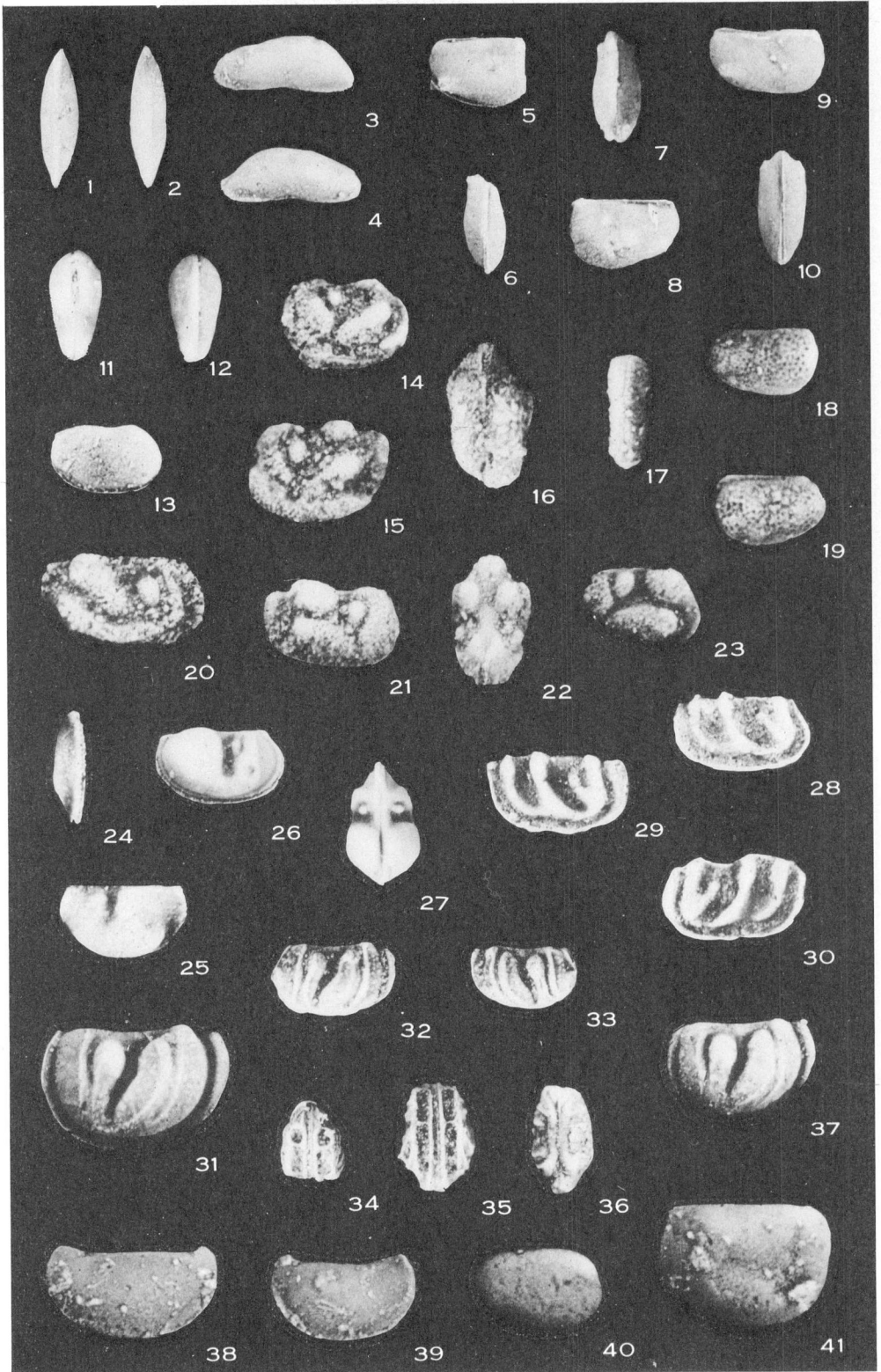


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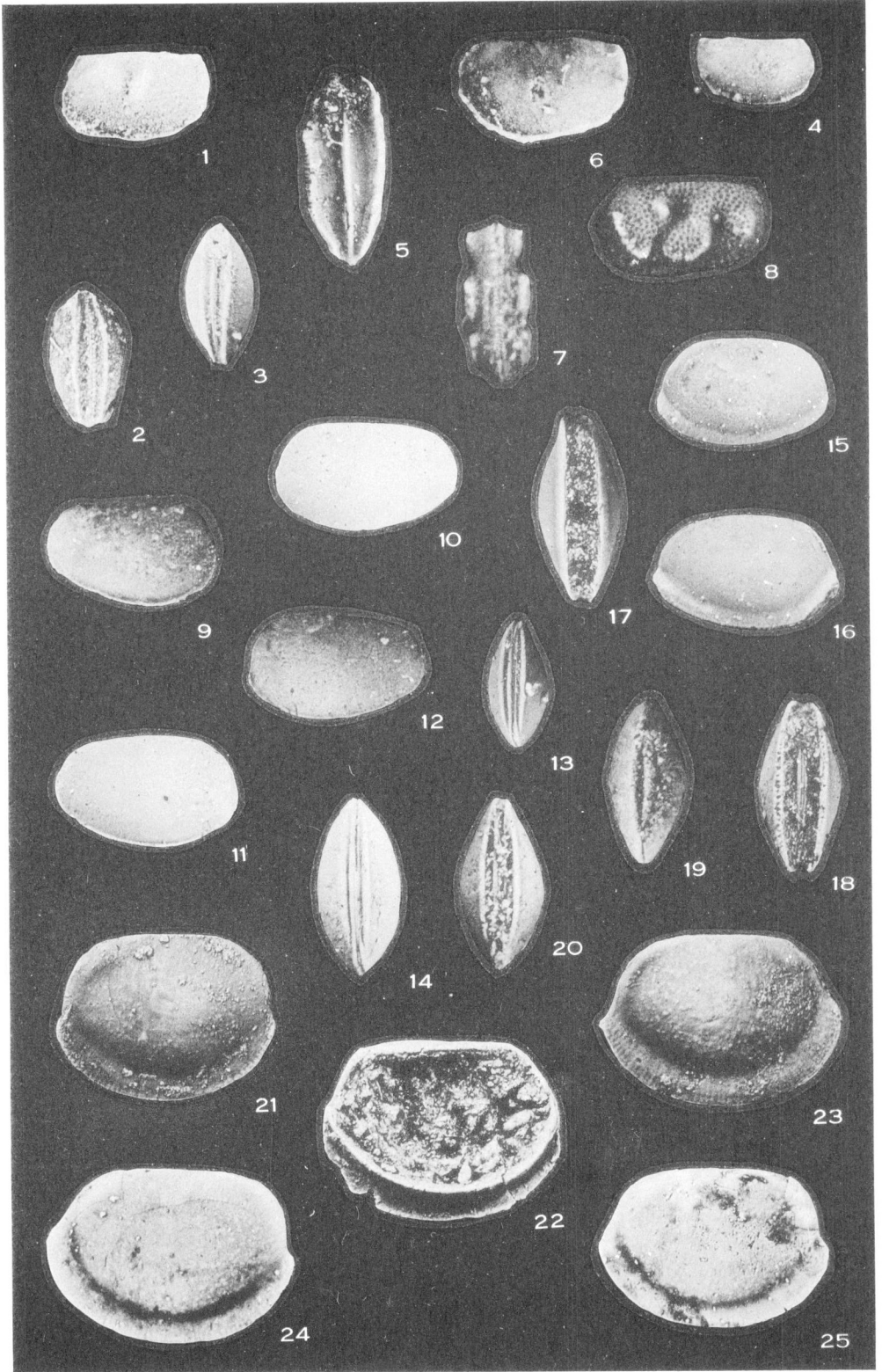


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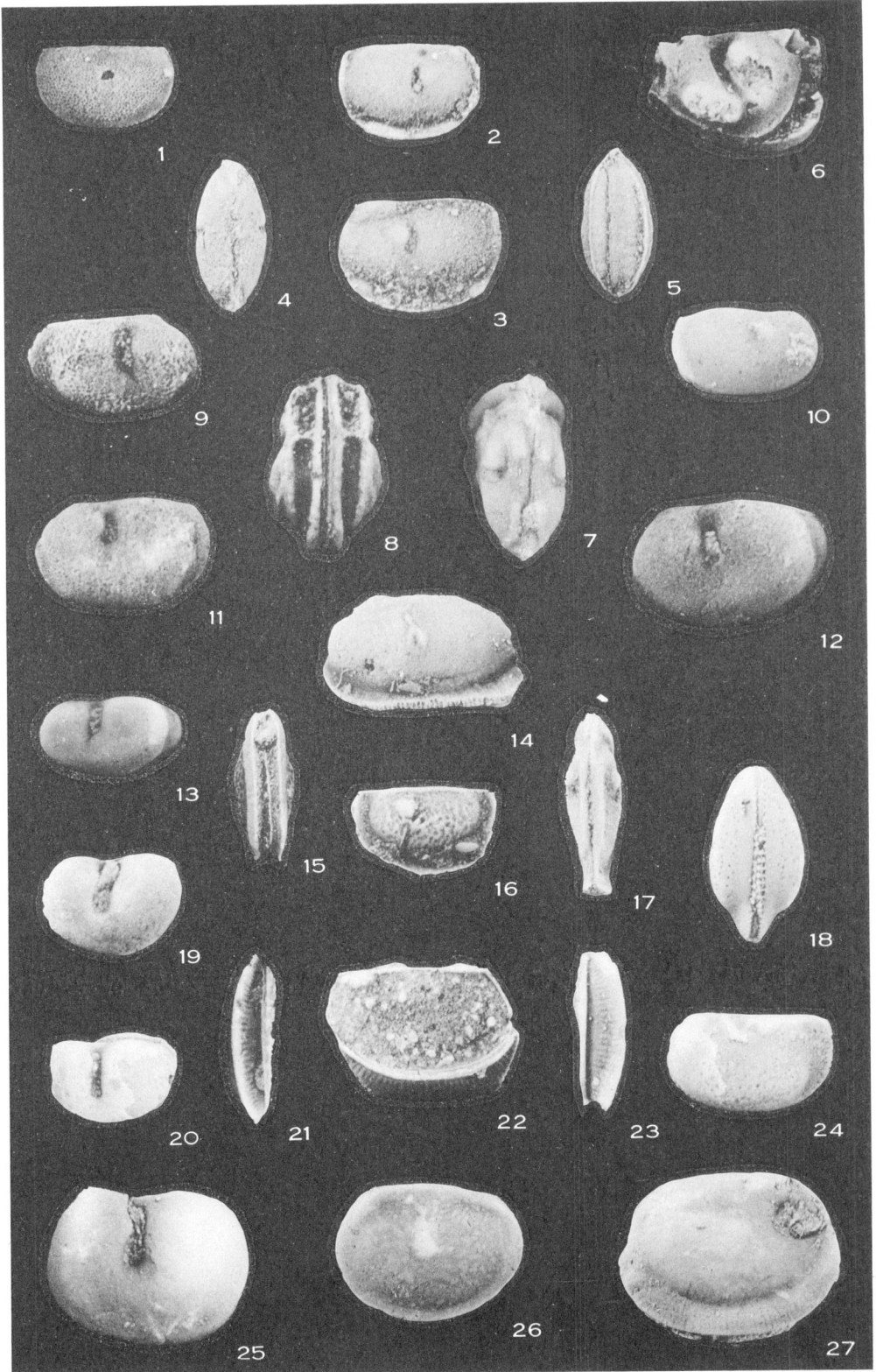
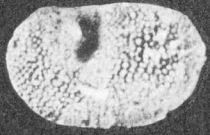


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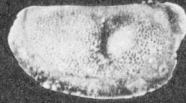
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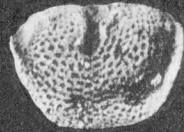
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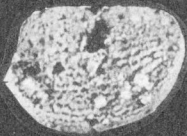
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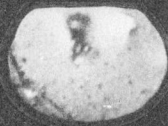
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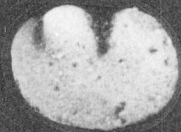
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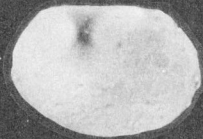
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