MIDDLE DEVONIAN OSTRACODS FROM THE FERRON POINT FORMATION, CHEBOYGAN AND PRESQUE ISLE COUNTIES, MICHIGAN

Thesis for the Degree of M. S.
MICHIGAN STATE UNIVERSITY

Gholam Sorrwar

1961

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By

Gholam Sorrwar

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Geology

1961

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Ostracods from five outcrop localities of the Ferron Point formation of the Middle Devonian Traverse group of Cheboygan and Presque Isle Counties, Michigan, are studied in this work. Fifty-one species distributed among thirty-one genera belonging to 12 families and four superfamilies are identified. One genus and two species are new.

The most numerous of all Ferron Point ostracod families are the Quasillitidae and next to those in abundance are the Kloedenellidae. Other forms are fairly abundant or common and some are quite rare.

ACKNOWLEDGMENTS

The writer is deeply indebted to Dr. Jane E. Smith of the Department of Geology, Michigan State University, for suggesting this project, for helping in preparing the manuscript, for donating the materials, for guiding in the study of the specimens and for supplying the writer with necessary printed materials and useful information to work on the project. Dr. Smith gave freely of her time and knowledge to the writer all through the work in preparing this paper.

To Dr. Chilton E. Prouty, Head of the Department of Geology, Professor Dr. William A. Kelly, retired, and Dr. James H. Fisher, Department of Geology, Michigan State University, the writer expresses his gratitude for helping him with valuable suggestions, important information, and encouragement as members of his guidance committee and teachers. Life-long indebtedness is owed to Dr. Prouty, Dr. Smith and all other teachers of the Geology Department for their high standard of quality taught with unparalleled patience and constancy and for their assistance, sympathy, affection and friendliness that the writer always encountered in them.

The writer is thankful to Mr. David V. Lemone, a Ph.D. student of Geology, Michigan State University, for helping him in various ways in this work.

Finally, to Mr. Arthur S. Craner, a former Geology

student of this institution, and his wife, the writer expresses his thanks for assisting him to visit and check the fossil localities of the present study and to collect more materials.

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INTRODUCTION

The Ferron Point formation belongs to the Middle Devonian Traverse group. The type locality of the formation is the Rockport quarry of Kelley's Island Lime and Transport Company at Rockport, Alpena County, Michigan, and the type section is exposed on the west walls of the quarry.

The Middle Devonian limestones and shales of the Traverse group in Michigan, as a whole, have furnished the paleontologists with a diverse series of large fossils, but comparatively little is known of the abundant and well-preserved microscopic forms. Because of their use in identifying strata encountered in drilling wells for oil these small fossils are of particular importance at the present time. Among the microscopic species those of ostracods are well-adapted for this work because of their relatively short time ranges.

The Ferron Point formation is one of the most richly fossiliferous beds of the Traverse group and it contains numerous ostracod fossils. But the ostracods of this formation have not been thoroughly studied. With the purpose of completing this unfinished work, the present study was undertaken as a project suggested by Dr. Jane E. Smith, Department of Geology, Michigan State University.

PREVIOUS WORK

The state geologists have been attracted by the outcrops of limestones and shales in the northern and the northeastern counties of the Southern Peninsula of Michigan since the early decades of the nineteenth century, shortly after 1837 when the Geological Survey of Michigan was established. Geological studies have been carried on in this region since that time and in almost every decade some worker has contributed something to build up the present geological knowledge of the area. It was only in 1935 that A. S. Warthin, Jr., and G. A. Cooper first defined and described the Ferron Point formation. Before that time many of the geologists, who studied the Middle Devonian Traverse group of Michigan, described the lithologic characters of the Ferron Point beds as a part of the Long Lake Series. None of them gave these beds a formational status.

H. M. Martin (1937), B. F. Hake and J. B. Maebius (1937), W. A. Kelly and G. W. Smith (1947), and G. V. Cohee (1947) described the Ferron Point formation in their papers but none of these authors described any microfossils from this formation. They were confined mostly to lithologic descriptions and/or megafossils of the beds. No papers had been written exclusively on the ostracods of the Ferron Point formation before 1952, when R. V. Kesling published

his article on ostracods of the Family Hollinidae from the Ferron Point formation of Michigan. In 1954, R. V. Kesling, in his second paper on the Ferron Point ostracods, described a new species of Phlictiscapha. In 1934, however, A. S. Warthin, Jr., used samples from the Ferron Point formation, which was then included in the Long Lake Series, in his article, "The Ostracods of the Traverse group."

Dr. Jane E. Smith in 1959 studied ostracods from the Traverse group of northwestern Lower Peninsula of Michigan in preparation of her Ph.D. dissertation entitled "Ostracods from the Middle Devonian Traverse group of Emmet and Charlevoix Counties of Michigan."

STRATIGRAPHY AND CORRELATIONS

As a formation of the Middle Devonian Traverse group the Ferron Point occupies about the middle part of the Lower Traverse group in the stratigraphic column.

The Ferron Point formation was first defined and described by A. S. Warthin, Jr., and G. A. Cooper in 1935. Their original description of the formation is:

> Green to bluish clays, interbedded with argillaceous limestones, all carrying an abundance of fossils. Overlain directly by the calcareous shale of the Genshaw formation and underlain by the Rockport limestone.* Thickness approximately thirty-five feet. Type locality, Rockport quarry, Rockport, Alpena County, Michigan. (Warthin and Cooper, 1935, p. 526).

The name of the formation is taken from Ferron Point situated on Lake Huron in Presque Isle County but the type locality and the type section are in Alpena County, Michigan. Type locality is the Rockport quarry which is an abandoned quarry of Kelley's Island Lime and Transport Company (Great Lakes Stone and Lime Company) at Rockport, Sec. 6, T.32 N., R.9 E., Alpena County, Michigan. The type section is exposed on the western walls of the quarry about half a mile west of the crusher. This is locality 38 of the Geological Survey of Michigan. Here the top of the section is covered

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*The name was later changed to "Rockport Quarry limestone" by the same authors (G. A. Cooper and A. S. Warthin: Jour. Wash. Acad. Sci., Vol. 31, p. 261, 1941.)

and so the contact between Ferron Point formation and the overlying Genshaw formation is not determined.

In the abandoned shale quarry of the Alpena Portland Cement Company, locality 51 of the Geological Survey of Michigan, which is about 1 mile east and one-eighth mile north of Genshaw School and 8 miles northeast of Alpena, Alpena County, SE¼, Sec. 18, T.32 N., R.9 E., some beds are exposed at higher level than the Ferron Point beds in the Rockport quarry. These beds are referred to the Ferron Point formation and are considered upper beds of the formation. Here the base of the formation is not exposed.

The stratigraphic position of the Ferron Point formation in the Traverse section in Thunder Bay region of Michigan was described by A. S. Warthin, Jr., and G. A. Cooper (1943, p. 579) as follows (Fig. 1):

Squaw Bay limestone
Thunder Bay limestone
Potter Farm formation
Norway Point formation
Four Mile Dam formation
Alpena limestone
    Dock Street Clay member
Newton Creek limestone
Genshaw formation
    Killians member
Ferron Point formation
Rockport Quarry limestone
Bell Shale

W. A. Kelly and G. W. Smith (1947, p. 50) showed the stratigraphic position of the Ferron Point formation of the Traverse rocks in Afton-Onaway area as follows (Fig. 1):

CORRELATION OF NAMED GEOLOGIC UNITS IN TRAVERSE GROUP IN CHARLEVOIX, CHEBOYGAN, PRESQUE ISLE, AND ALPENA COUNTIES, MICHIGAN

<table>
<tr><th>EMMET & CHARLEVOIX COUNTIES</th><th colspan="2">CHEBOYGAN & WESTERN PRESQUE ISLE COUNTIES</th><th colspan="2">ALPENA & EASTERN PRESQUE ISLE COUNTIES</th></tr>
<tr><td>POHL
1930</td><td colspan="2">KELLY-1944
G. W. SMITH-1944</td><td colspan="2">WARTHIN & COOPER-1943
COOPER & WARTHIN-1941</td></tr>
<tr><td rowspan="2">PETOSKEY
FORMATION</td><td colspan="2" rowspan="4">BEEBE SCHOOL
FORMATION</td><td colspan="2">SQUAW BAY
LIMESTONE</td></tr>
<tr><td colspan="2">THUNDER BAY
LIMESTONE</td></tr>
<tr><td rowspan="2">CHARLEVOIX
STAGE</td><td colspan="2">POTTER FARM
FORMATION</td></tr>
<tr><td colspan="2">NORWAY POINT
FORMATION</td></tr>
<tr><td>GRAVEL POINT STAGE</td><td colspan="2">GRAVEL POINT FORMATION
GORBUT MEMBER</td><td colspan="2">FOUR-MILE DAM
LIMESTONE</td></tr>
<tr><td rowspan="6">UNEXPOSED</td><td colspan="2">KOEHLER
LIMESTONE</td><td colspan="2">DOCK ST. CLAY
ALPENA LIMESTONE</td></tr>
<tr><td colspan="2">NEWTON CREEK
LIMESTONE</td></tr>
<tr><td rowspan="2">GENSHAW FORMATION</td><td>KILLIANS MEMBER</td><td rowspan="2">GENSHAW FORMATION</td><td>KILLIANS MEMBER</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">FERRON POINT FORMATION</td><td colspan="2">FERRON POINT FORMATION</td></tr>
<tr><td colspan="2">ROCKPORT QUARRY LS.</td><td colspan="2">ROCKPORT QUARRY LS.</td></tr>
<tr><td colspan="2">UNEXPOSED</td><td colspan="2">BELL SHALE</td></tr>
</table>

After Kelly and Smith, 1947, p. 450, Fig. 2.

Fig. 1

Beebe School formation
Gravel Point formation - Gorbut member
Koehler limestone
Genshaw formation - Killians member
Ferron Point formation
Rockport Quarry limestone

The lithology and sequence of beds of the Ferron Point formation exposed in Rockport quarry (type locality) and in the shale quarry of Alpena Portland Cement Company are produced in tabular form by A. S. Warthin, Jr., and G. A. Cooper (1943, pp. 581-582), and in the Guide Book of Seventh Annual Field Excursion of the Michigan Academy of Science, Arts, and Letters, Section of Geology and Mineralogy (May 29-30, 1937). The generalized forms of the tables are as follows:

Type locality and type section, locality 38 of the Geological Survey of Michigan:

Ferron Point formation:

7. Shale, gray, calcareous -- 6 inches thick
6. Limestone, gray -- 2 feet 8 inches thick
   Characteristic megafossils: Prismatophyllum, many cup corals, crinoid columnals
5. Shale, gray, calcareous -- 1 foot 1 inch thick
   Characteristic megafossils: Prismatophyllum, Schizophoria
4. Limestone, a gray, massive, argillaceous bed weathering yellow -- 1 foot 10 inches thick
   Characteristic megafossils: Atrypa cf. reticularis, Prismatophyllum, cup corals, massive Bryozoa
3. Claystone, bluish gray -- 1 foot 10 inches thick
   Characteristic megafossils: Spirifer cf. mucronatus, Camarotoechia, fenestellids
2. Limestone, blue-gray, argillaceous -- 1 foot 8 inches thick
   Characteristic megafossils: Prismatophyllum
1. Claystone, bluish gray; limestone lenses -- 9 feet thick
   Characteristic megafossils: ABUNDANT- Atrypa, Athyris, Cyrtina alpenensis, Stropheodonta cf.

demissa, Spirifer cf. mucronatus, large Ceratopora, Pholidostrophia; COMMON- Prismatophyllum, cup corals, dumose Favosites, Aulopora conferta, Hederella, massive and fenestellid bryozoans, Cyrtina cf. hamiltonensis, large Pentameralla, Schizophoria, Stropheodonta cf. erratica; RARE- Chonetes cf. fragilis, Camarotoechia (Bell shale type), Schuchertella, Productella.

Total thickness of Ferron Point formation here is 18 feet 7 inches.

Locality 51 of the Geological Survey of Michigan:

Ferron Point formation-

2. Greenish gray clay shale with lenses of Chonetes coquina -- 16 feet thick
   Characteristic megafossils: Hederella sp., Arthoclama sp., Helopora inexpectata McNair, Stictoporina granulifera Stewart, Stropheodonta cf. demissa, Spirifer mucronatus, Chonetes cf. fragilis Stewart, Cyrtina cf. hamiltonensis, Orthoceras sp., Hemicystites devonicus Bassler, Lepidodiscus alpenensis Bassler, Lophonychia cf. cordata Stewart.
1. Shale, gray, calcareous, fossiliferous; to bottom of drainage ditch -- 3 feet thick

Total thickness of Ferron Point formation here is 19 feet.

According to Warthin and Cooper (1943) the basal bed (bed 1) of the section at the locality 51 of the Geological Survey of Michigan contains essentially the same fossil assemblage as the top bed (bed 7) of the Rockport quarry section. Though the two sections do not overlap enough to give positive assurance of the identity of these two beds, measurements on two sets of outcrops fail to indicate any covered interval.

Throughout the eastern half of the Southern Peninsula

of Michigan and some parts of the western half, the shale encountered at this approximate stratigraphic horizon in oil wells is at least in part of Ferron Point formation age. G. V. Cohee (1947) included in Ferron Point formation the calcareous shale and shaly limestone beds that are encountered in oil wells drilled in eastern, northern, and central parts of the Southern Peninsula of Michigan and he states that the Traverse rocks exposed along the Ten Mile Creek near Silica, in Lucas County, Ohio, are believed to represent the same time interval as the formations above the Rockport Quarry limestone in the outcrop area in Alpena and Presque Isle Counties of Michigan. Warthin, Jr., and Cooper (1943) think that the Silica Shale of northwestern Ohio may represent the southern end of this shale mass.

A correlation of the Ferron Point formation outside of Michigan is possible because of the work of Cooper and Warthin, Jr. (1935, pp. 376-377; 1941, pp. 259-260). These authors believe that the Ferron Point formation is to be correlated with the Skaneateles formation of the Hamilton group of New York.

The upper limit of the Ferron Point formation is marked by the appearance of more calcareous shale containing fossils of the Genshaw formation. Sedimentation was probably uninterrupted.

MATERIAL

All the samples were collected by Dr. Jane E. Smith in October, 1956, from the outcrops at the localities shown on the map (Figure 2). The total amount of washed sample was about 3660 grams from all the localities ranging from 60 grams to over 2000 grams from each locality. About 60% of the material was collected from locality 1, 30% from locality 4, 4% from each of localities 2 and 5 and 2% from locality 3.

The beds of Ferron Point formation of the area consist of very soft, light gray calcareous shale interbedded with thin lenses of argillaceous limestone. Because of the easily weathered character the Ferron Point beds are exposed generally in artificial openings, ditches or pits. It is very easy to free the fossils from the rocks.

The materials for the present study were mainly dry clay. To free the fossils the materials were soaked in water for 3 to 4 hours which loosened most of the fossils from clay and sand. Clay particles were removed by pouring out the muddy water. This decantation process was repeated several times until most of the clay particles were removed. The fossils mixed with sand grains and a few small fragments of limestone rocks enclosing fossils were boiled in water containing sal-soda (Na_2CO_3). This

FOSSIL LOCALITIES OF THE FERRON POINT FORMATION, CHEBOYGAN AND PRESQUE ISLE COUNTIES, MICHIGAN

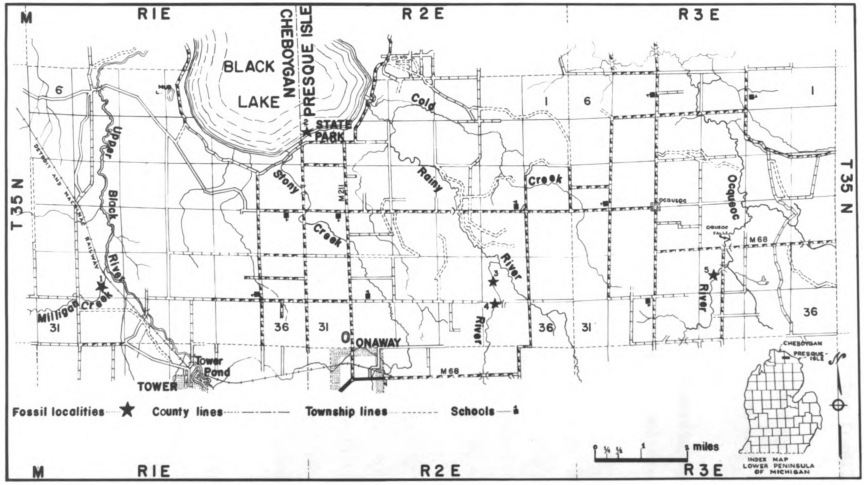

Fig. 2

process broke the limestone fragments and freed the fossils from them as well as cleaned the samples.

After drying the samples fossils were picked up from the sand grains with a wet, pointed, fine brush and mounted with tragacanth on the card board slides.

All the specimens are deposited in the Paleontological Museum, Department of Geology, Michigan State University, East Lansing, Michigan.

REGISTER OF LOCALITIES

The localities of fossil collection for the present work are numbered independently without following the previous authors. For localities coincident to those of the previous works references of numbers are made in descriptions of the localities (Fig. 2).

Locality 1. It is near locality 17 of Kelly and Smith (1947), on Milligan Creek about 2¼ miles northwest of Tower city and about 450 yards south of Detroit-Mackinac Railway bridge over Milligan Creek in NW¼, SW¼, SE¼, Sec. 29, T.35 N., R.1 E., Cheboygan County, Michigan.

Locality 2. This is locality 29 of the Geological Survey of Michigan and locality 34 of Kelly and Smith (1947). Abandoned quarry of Onaway Limestone Company on the south shore of Black Lake and western end of the State Park at about center of W½ of NW¼, Sec. 7, T.35 N., R.2 E., Presque Isle County; about 200 yards east of the county line between Cheboygan and Presque Isle.

Locality 3. Anticline on the western branch of the Rainy River about 1000 yards down stream (towards north) from the waterfalls on the river in NE¼, NW¼, SW¼, Sec. 26, T.35 N., R.2 E.,

Presque Isle County and about 3 miles north-east of Onaway, Michigan.

Locality 4. Just below falls on western branch of the Rainy River, about 120 yards south of the north section line in N½ of NW¼, Sec. 35, T.35 N., R.2 E., Presque Isle County, and about 2¼ miles east-north-east of Onaway and half a mile directly south of locality 3.

Locality 5. On the Ocqueoc River about 0.8 mile south-southwest of Ocqueoc falls and about 350 yards southwest of the bridge at the center of the section in W½ of NE¼, Sec. 27, T.35 N., R.2 E., Presque Isle County, Michigan.

SYSTEMATIC DESCRIPTIONS

Phylum ARTHROPODA

Class Crustacea

Order Ostracoda

Superfamily Leperditacea

Family Leperditellidae Ulrich and Bassler 1906

Genus Macronotella Ulrich 1894

Type species.--By original designation, Macronotella scofieldi Ulrich, 1894, pp. 683-84; Pl. 43, Figs. 30-34.

Macronotella hypercala Kesling and Kilgore

Macronotella hypercala Kesling and Kilgore, 1952, p. 2; Pl. I, Figs. 25-36.

Smith, 1959, p. 24; Pl. IX, Fig. 14.

Occurrence.--Rare at locality 5.

Types.--Hypotype, one complete carapace, No. 5u, from locality 5.

Genus Dictyogramma Smith 1959

Type species.--By original designation, Dictyogramma scabratum Smith, 1959, pp. 25-26; Pl. I, Figs. 1-11.

Dictyogramma scabratum Smith

Dictyogramma scabratum Smith, 1959, pp. 25-26; Pl. I, Figs. 1-11.

Remarks.--Only one right and one left valve are available for study. On the left valve, No. 2e(i), there

is a distinct vertically elongate pit in the anterocentral part. Right valve, No. 2e(ii), has its anterocentral part covered with some foreign materials and does not reveal clearly whether or not there is a similar anterocentral pit on it like that of the left valve. It is not possible to be sure if this anterocentral pit is a characteristic of surface ornamentation of the species since only one right valve was available for study. Except for this anterocentral pit the specimens have all other characteristics of Dictyogramma scabratum Smith. This pit may be the result of injury or distortion.

Occurrence.--Common at locality 2.

Types.--Hypotypes, an adult left valve, No. 2e(i), and an adult right valve, No. 2e(ii), from locality 2.

Genus Schmidtella Ulrich 1892

Type species.--By original designation, Schmidtella crassimarginata Ulrich, 1892, p. 269; Pl. 9, Figs. 27-30.

Schmidtella fabiformis Kesling and Kilgore

Schmidtella fabiformis Kesling and Kilgore, 1952, pp. 2-3; Pl. II, Figs. 1-7.

Smith, 1959, pp. 28-29; Pl. IX, Figs. 15-17; Pl. X, Figs. 2-6.

Occurrence.--Rare at locality 5.

Types.--Hypotype, one complete carapace, No. 5v, from locality 5.

Superfamily Beyrichiacea

Family Hollinidae Swartz 1936

Genus Adelphobolbina Stover 1956

Type species.--Ctenobolbina papillosa Ulrich, 1891, p. 186; Pl. 15, Figs. 8a-e., by subsequent designation of Stover, 1956, pp. 1103-04.

Adelphobolbina megalia (Kesling and Tabor)

Ctenobolbina megalia Kesling and Tabor, 1952, pp. 761-62; Pl. 111, Figs. 15-19.

1953, pp. 87-88; Pl. III, Figs. 18-25.

Occurrence.--Rare at locality 4.

Types.--Hypotypes, two female carapaces, Nos. 4u(i) and 4u(ii), from locality 4.

Adelphobolbina papillata (Tolmachoff), emend.

Warthin, Jr.

Bollia papillata Tolmachoff, 1926, p. 29; Pl. 2, Figs. 4-5.
Bollia protuberata Tolmachoff, 1926, p. 30; Pl. 2, Fig. 6.
Ctenobolbina papillata Warthin, Jr., 1937, Card 67.

Remarks.--The valves of these specimens have a granular surface as well as papillae.

Occurrence.--Common at locality 5, rare at locality 4, shale member.

Types.--Hypotypes, one female right valve, broken at anterodorsal corner, No. 4a, from locality 4; one incomplete male carapace, No. 5b(i), and one female left valve, No. 5b(ii), from locality 5.

Adelphobolbina papillosa (Ulrich)

Ctenobolbina papillosa Ulrich 1891, p. 186; Pl. 15, Figs. 8a-e. Coryell and Malkin, 1936, p. 3, Fig. 8.

Occurrence.--Abundant at locality 5, shale member.

Types.--Hypotype, one female carapace, No. 5c, from locality 5.

Genus Ctenoloculina Bassler 1941

Type species.--By original designation of Bassler, 1941, pp. 22-23, Tetradella cicatricosa Warthin, Jr., 1934, p. 209; Pl. 1, Figs. 4-6.

Ctenoloculina eurybathrota Kesling

Ctenoloculina eurybathrota Kesling, 1952c, pp. 46-48; Pl. I, Figs. 1-9.

Kesling and Tabor, 1953, p. 94; Pl. I, Figs. 1-2.

Occurrence.--Rare at locality 2.

Types.--Hypotype, one eroded male carapace, No. 2a, from locality 2.

Genus Parabolbina Swartz 1936

Type species.--By original designation, Ctenobolbina granosa Ulrich, 1900, p. 183; Pl. 8, Fig. 12, by subsequent designation of Swartz, 1936, p. 570.

Parabolbina oxypages Kesling and Tabor

Parabolbina oxypages Kesling and Tabor, 1953, p. 89; Pl. III, Figs. 8-15.

Remarks.--The hinge line in these specimens is not straight as in the holotype. In lateral view the hinge

line is depressed ventrally probably due to distortion after death because the specimens are broken.

Occurrence.--Common at locality 2.

Types.--Hypotypes, an immature male carapace with posterior end broken, No. 2d(i), and an adult male broken carapace, No. 2d(ii), from locality 2.

Genus Hollinella Coryell 1928

Type species.--By original designation, Hollinella dentata Coryell, 1928, p. 378.

Hollinella cuspibulbata Kesling and Tabor

Hollinella cuspibulbata Kesling and Tabor, 1953, pp. 85-86; Pl. II, Figs. 1-4.

Occurrence.--Common at locality 3.

Types.--Hypotype, one male right valve broken at the posterior end, No. 3a, from locality 3.

Hollinella plauta Kesling and Tabor

Hollinella plauta Kesling and Tabor, 1953, pp. 86-87; Pl. I, Figs. 18-22. Stover, 1956, p. 1102; Pl. 111, Fig. 14.

Occurrence.--Rare at locality 4.

Types.--Hypotype, one right valve of an adult carapace, No. 4b, from locality 4.

Hollinella pumila Kesling

Hollinella pumila Kesling, 1952c, p. 48; Pl. I, Figs. 16-23.

Occurrence.--Abundant at locality 2, rare at locality 4.

Types.--Topotypes, an adult female right valve, No.

2b(i), a right valve of an instar, No. 2b(ii), a complete carapace of an instar, No. 2b(iii), from locality 2. Hypotype, a female broken right valve, No. 4c, from locality 4.

Hollinella rana Weiss

Hollinella rana Weiss, 1954, pp. 59-60; Pl. 20, Figs. 14-20. Smith, 1959, p. 37; Pl. IX, Figs. 28-38.

Occurrence.--Rare at locality 4.

Types.--Hypotype, one complete adult carapace, No. 4d, from locality 4.

Hollinella vegrandis Kesling and Tabor

Hollinella vegrandis Kesling and Tabor, 1953, pp. 84-85; Pl. I, Figs. 23-27.

Smith, 1959, pp. 36-37; Pl. IX, Figs. 39-41; Pl. X, Fig. 1.

Occurrence.--Abundant at locality 5, common at locality 3, rare at localities 2 and 4.

Types.--Hypotypes, an adult left valve, No. 3c, from locality 3; two adult left valves, Nos. 4e(i), 4e(ii), and two adult right valves, Nos. 4e(iii), 4e(iv), from locality 4; a complete carapace of an instar, No. 5e(i), a left valve, No. 5e(ii), and two adult right valves, Nos. 5e(iii), 5e(iv), from locality 5.

Family Drepanellidae Swartz 1936

Genus Bollia Jones and Holl 1886

Type species.--Bollia uniflexa Jones and Holl, 1886, by subsequent designation of Miller, 1892, p. 706.

Bollia disjuncta Kesling and Kilgore

Bollia disjuncta Kesling and Kilgore, 1952, p. 7; Pl. II, Figs. 8-13. Smith, 1959, pp. 40-41; Pl. XI, Fig. 12.

Remarks.--These specimens are more finely punctate on surface and ridges than the holotype and the puncta are arranged in faint radiating rows.

Occurrence.--Rare at locality 5.

Types.--Hypotypes, one right and one left valve, Nos. 5a(i) and 5a(ii) respectively, from locality 5.

Family Kloedenellidae Ulrich and Bassler 1923a

Genus Dizygopleura Ulrich and Bassler 1923b

Type species.--By original designation, Dizygopleura swartzi, Ulrich and Bassler, 1923b, p. 693; Pl. 62, Figs. 1-8.

Dizygopleura euglyphea Warthin, Jr.

Dizygopleura euglyphea Warthin, Jr., 1934, p. 210; Pl. I, Fig. 7; 1937, Card 57. Stewart and Hendrix, 1945, p. 90; Pl. 10, Figs. 6-8. Kesling and Weiss, 1953, p. 54; Pl. III, Figs. 30-31. Smith, 1959, pp. 54-55; Pl. XII, Figs. 7-26.

Occurrence.--Abundant at localities 2, 3, and 5, rare at locality 4.

Types.--Hypotypes, one adult male carapace, No. 2f(i), two adult female carapaces, Nos. 2f(ii), 2f(iii), and one complete carapace of an instar, No. 2f(iv), from locality 2; one male carapace, No. 3d(i), and one female carapace, No. 3d(ii), from locality 3; one male and one female adult

carapace, Nos. 4f(i) and 4f(ii) respectively, from locality 4; an adult male carapace, No. 5f(i), a mature female carapace, No. 5f(ii), and two complete instars, Nos. 5f(iii), 5f(iv), from locality 5.

Dizygopleura trisinuata Van Pelt

Dizygopleura trisinuata Van Pelt, 1933, p. 328; Pl. 39, Fig. 61. Stewart, 1950, p. 661; Pl. 86, Figs. 4-6. Coley, 1954, pp. 455 and 457. Smith, 1959, p. 55; Pl. XIII, Figs. 1-5.

Dizygopleura oblonga Warthin, Jr., 1934, p. 211; Pl. I, Fig. 8. Stewart, 1936, p. 750; Pl. 101, Figs. 1-4.

Occurrence.--Abundant at localities 2 and 3.

Types.--Hypotypes, two adult male carapaces, Nos. 2g(i) and 2g(ii), from locality 2; two adult female carapaces, Nos. 3e(i) and 3e(ii), from locality 3.

Genus Kloedenella Ulrich and Bassler 1908

Type species.--Kloedenia pennsylvanica Jones, 1889, p. 341; Figs. 5a-d, 6 (not 7a-b, 8, or 9), by subsequent designation of Ulrich and Bassler, 1908, p. 304, Fig. 54; pp. 318, 340; Pl. 43, Figs. 1-3.

Kloedenella trisulca Smith

Kloedenella trisulca Smith, 1959, pp. 58-60; Pl. III, Figs. 1-15.

Occurrence.--Abundant at localities 2 and 3, rare at locality 5.

Types.--Hypotypes, two mature female carapaces, Nos.

2c(i), 2c(ii), two mature male carapaces, Nos. 2c(iii), 2c(iv), and two complete instars, Nos. 2c(v), 2c(vi) from locality 2; two complete instars, Nos. 3f(i), 3f(ii), two mature female carapaces, Nos. 3f(iii), 3f(iv), and two adult male carapaces, Nos. 3f(v), 3f(vi), from locality 3; one adult female carapace, No. 5g, from locality 5.

Genus Eukloedenella Ulrich and Bassler 1923

Type species.--By original designation, Eukloedenella umbilicata, Ulrich and Bassler, 1923b, p. 669; Pl. 57, Figs. 8-12.

Eukloedenella sp.

Description.--Carapace subquadrate in lateral view, elliptical in dorsal view. Slightly larger right valve overlapping smaller left valve; overlap conspicuous only at anterodorsal border. Dorsal border gently convex, ventral border slightly curved in anterior half, straight in posterior half; anterior border semicircular, posterior border broadly rounded. Hinge line straight and hidden in anterior by overlap of triangular extension of right valve. Lateral surface convex, widest posteriorly. Small, narrow, straight sulcus on both valves, extending from just below the dorsal border to approximately two-fifths distance to the ventral border. Anterior border of both valves with slender marginal ridge. Surface smooth. Anterior cardinal angle about 150°, posterior cardinal angle about 100°.

Dimensions.--Greatest length in dorsal quarter of

the carapace; greatest height slightly anterior to sulcus; greatest width in posterior one-third of the carapace.

Measurements.--Length, 1.02 mm.; height, 0.58 mm.; width, 0.43 mm.

Remarks.--These specimens show most of the characteristics similar to Eukloedenella sp. described and illustrated by Stover (1956, p. 1110; Pl. 114, Figs. 21-22). Specimens of this collection differ from Stover's species in having the sulcus straight rather than arcuate and the sulcus is slightly longer than that of Stover's species. From Eukloedenella doverensis Turner, 1939, these specimens differ in having a narrower marginal ridge and a less pronounced posterior widening.

Occurrence.--Common at locality 2.

Specimens.--One male carapace, No. 2h(i), and a female carapace, No. 2h(ii), from locality 2.

Family Primitiidae Ulrich and Bassler 1923a

Subfamily Primitinae Bassler and Kellet, 1934, p. 16

Genus Primitia Jones and Holl 1865

Type species.--By original designation, Primitia strangulata (McCoy)=Beyrichia strangulata McCoy, 1851; designated by Miller, 1889, p. 561. Jones and Holl, 1865, p. 451.

Primitia(?) seriata Stewart

Primitia(?) seriata Stewart, 1936, p. 743; Pl. 100, Figs. 6-7.

Remarks.--Only one valve was available for study.

Generic and specific characteristics are not very distinct.

Occurrence.--Rare at locality 2.

Types.--Hypotypes, one adult right valve, No. 2j, from locality 2.

Family Cytherellidae Sars 1865

Genus Bythocyproidea Stewart and Hendrix 1945

Type species.--By original designation, Bythocyproidea sanduskeyensis Stewart and Hendrix, 1945, pp. 91-92; Pl. 10, Figs. 26-28.

Bythocyproidea eriensis Stewart and Hendrix

Bythocyproidea eriensis Stewart and Hendrix, 1945, pp. 92-93; Pl. 10, Figs. 23-25. (cf) Bythocyproidea eriensis Stover, 1956, p. 1115; Pl. 114, Figs. 9-10. Smith, 1959, pp. 75-76; Pl. XV, Figs. 5-16.

Remarks.--Only one carapace was available for study. This specimen has closer affinity with those described by Smith, 1959, in having less arcuate dorsal border and a weak posterior ridge on right valve.

Occurrence.--Rare at locality 4.

Types.--Hypotype, one complete adult carapace, No. 4t, from locality 4.

Genus Birdsallella Coryell and Booth 1933

Type species.--By original designation, Birdsallella simplex Coryell and Booth, 1933, p. 271; Pl. 5, Figs. 6-7.

Birdsallella tumida Stewart

Birdsallella tumida Stewart, 1936, p. 763; Pl. 102, Figs.

27-28. Kesling and Weiss, 1953, p. 65; Pl. V, Figs. 5-6. Smith, 1959, p. 78; Pl. XV, Figs. 25-31.

Occurrence.--Rare at locality 4.

Types.--Hypotypes, two complete adult carapaces, Nos. 4g(i) and 4g(ii), from locality 4.

Genus Ponderodictya Coryell and Malkin 1936

Type species.--Cytherella? bispinulatus Stewart, 1927, p. 60; Pl. 5, Figs. 18-19; by subsequent designation of Coryell and Malkin, 1936, p. 15; Figs. 28, 28a, 29-30; the species bispinulatus was subsequently considered by its original author, Stewart, 1936, pp. 756-57, to be a synonym of Leperditia punctulifera Hall, 1860, p. 92.

Ponderodictya punctulifera (Hall)

Leperditia punctulifera Hall, 1860, p. 92.

Primitiopsis punctulifera Jones, 1890a, p. 9; Pl. 2, Figs. 7, 12-13. Grabau, 1899, p. 304, Figs. 243. Grabau and Shimer, 1910, p. 345; Figs. 160e-g.

Cytherella? bispinulatus Stewart, 1927, p. 60; Pl. 5, Figs. 18-19.

Primitiopsis unicornis Van Pelt, 1933, p. 326; Pl. 39, Figs. 23-28.

Cytherellina punctulifera Warthin, Jr., 1934, p. 222; Pl. 1, Figs. 24-25. Moore, Lalicker, and Fischer, 1952, p. 530; Fig. 14.

Ponderodictya bispinulata Coryell and Malkin, 1936, p. 16; Figs. 28, 28a, 29, 30. Shimer and Shrock, 1944, p. 687;

Pl. 288, Figs. 55-58. Wright, 1948, p. 120; Pl. 15, Figs. 35-38. Smith, M. L., 1956, Table I.

Ponderodictya unicornis Coryell and Malkin, 1936, p. 16; Figs. 31, 31a. Stewart and Hendrix, 1945, p. 94; Pl. 10, Figs. 30-31. Wright, 1948; Pl. 15, Figs. 39-40.

Hamiltonella punctulifera Stewart, 1936, p. 756; Pl. 102, Figs. 1-5.

Ponderodictya punctulifera Turner, 1939, p. 23; Pl. 1, Fig. 7. Kesling and Weiss, 1953, p. 66; Pl. V, Figs. 21-29. Coley, 1954, p. 455; Fig. 2. Stover, 1956, p. 1117; Pl. 114, Fig. 20. Smith, J. E., 1959, pp. 79-80; Pl. XVI, Figs. 1-8.

Remarks.--These ostracods are abundant at locality 2 only and were not collected from any other outcrop of the Ferron Point formation of the present work. Concerning this common Middle Devonian genus Kesling and Weiss stated (1953, p. 66), "The limits of species of this genus have been extremely difficult to define." Referring to some of the difficulties Van Pelt (1933, p. 327) said, "It seems doubtful, if the variation in numbers and location of the tubercles is consistent in a single species. The variation in shape, length of hinge line, and manner of hingement seem inconsistent within a single genus." Turner (1939, pp. 23-24) referred to "three more or less distinct types."

Correlation has not yet been established between the number, size, and position of spines, ridges, and nodes

and the surface texture and shape of the valves. Many combinations are present.

Kesling and Weiss (1953, p. 66) remarked about Michigan specimens that, "Possibly, the Michigan specimens belong to several species of very similar form, all of which lived together in the same geographic province over a long period." Stover (1956, p. 1117) commented that, "This large ostracode is common in the less calcareous shales and is generally associated with Quasillites and Euglyphella numismodes."

Occurrence.--Abundant at locality 2.

Types.--Hypotypes, two complete adult carapaces, Nos. 2s(i), and 2s(ii), from locality 2.

Genus Punctomosea Stover 1956

Type species.--By original designation, Thrallella cristata Swartz and Oriel, 1948, pp. 561-62; Pl. 79, Figs. 22, 23; by subsequent designation of Stover, 1956, pp. 1113-14; Pl. 113, Figs. 26-29.

Punctomosea cristata (Swartz and Oriel)

Thrallella cristata Swartz and Oriel, 1948, pp. 561-62; Pl. 79, Figs. 22, 23.

Menoedinia cristata Coley, 1954, pp. 461-62.

Punctomosea cristata Stover, 1956, p. 1114; Pl. 113, Figs. 26-29.

Occurrence.--Rare at locality 5.

Types.--Hypotype, one complete adult carapace, No. 5k, from locality 5.

Genus Cavellina Coryell 1928

Type species.--Cavellina pulchella Coryell, 1928, p. 379.

Cavellina cuneata Coryell and Malkin

Cavellina cuneata Coryell and Malkin, 1936, p. 14; Fig. 25.

Occurrence.--Rare at locality 4.

Types.--Hypotype, a crushed adult carapace, No. 4w, from locality 4.

Family Thlipsuridae Ulrich 1894

Genus Octonaria Jones 1887

Type species.--By original designation, Octonaria octoformis Jones, 1887, p. 404; Pl. 12, Figs. 2a-b.

Octonaria laevilatata Kesling and Kilgore

Octonaria laevilatata Kesling and Kilgore, 1952, pp. 9-10; Pl. III, Figs. 1-26, 29.

Occurrence.--Abundant at locality 5.

Types.--Hypotypes, two complete carapaces, Nos. 5s(i), 5s(ii), from locality 5.

Octonaria quadricostata Van Pelt

Octonaria quadricostata Van Pelt, 1933, p. 336; Pl. 30, Figs. 41-51. Warthin, Jr., 1934, p. 217; Pl. I, Figs. 16-17. Stewart, 1936, p. 752; Pl. 101, Figs. 7-9. Kesling and Weiss, 1953, p. 59; Pl. IV, Figs. 1-4. Smith, 1959, p. 83; Pl. XVII, Figs. 16-30.

Strepulites quadricostata Coryell and Malkin, 1936, p. 5. Warthin, Jr., 1945, Card 41, Figs. 41-51. Coley, 1954, p. 455, Fig. 2.

Occurrence.--Abundant at localities 2 and 5, common at locality 3, rare at localities 1 and 4.

Types.--Hypotypes, two complete carapaces, Nos. 1e(i), 1e(ii), from locality 1; two complete carapaces, Nos. 2z(i), 2z(ii), from locality 2; two complete carapaces, Nos. 3b(i), 3b(ii), from locality 3; two carapaces, Nos. 4s(i), 4s(ii), from locality 4; two carapaces, Nos. 5t(i), 5t(ii), from locality 5.

Octonaria crescentiformis Van Pelt

Octonaria crescentiformis Van Pelt, 1933, pp. 334-35; Pl. 39, Figs. 55-60. Warthin, Jr., 1934, p. 218; Pl. 1, Fig. 18. Stewart and Hendrix, 1945, p. 91; Pl. 10, Figs. 15-17. Kesling and Kilgore, 1952, p. 9; Pl. 13, Figs. 27-28. Kesling and Weiss, 1953, p. 60; Pl. IV, Figs. 5-7. Smith, 1959, p. 83; Pl. XVII, Figs. 31-34.
Strepulites crescentiformis Coryell and Malkin, 1936, p. 5. Warthin, 1945, Card 35, Figs. 55-60.

Occurrence.--Abundant at locality 2, common at localities 3 and 5, rare at locality 4.

Types.--Hypotypes, two complete carapaces, Nos. 2y(i), 2y(ii), from locality 2; one complete carapace, No. 3k, from locality 3; two complete carapaces, Nos. 4r(i), 4r(ii), from locality 4; two complete carapaces, Nos. 5r(i), 5r(ii), from locality 5.

Genus Hyphasmaphora Van Pelt 1933

Type species.--By original designation, Hyphasmaphora

textiligera Van Pelt, 1933, p. 340; Pl. 39, Figs. 3-7.

Hyphasmaphora textiligera Van Pelt

Hyphasmaphora textiligera Van Pelt, 1933, p. 340; Pl. 39, Figs. 3-7. Warthin, Jr., 1934, p. 219; Pl. 1, Figs. 20; 1945, Card 80, Figs. 3-7. Wright, 1948, p. 96; Pl. 11, Fig. 46. Moore, Lalicker, and Fischer, 1952, p. 531, Fig. 5. Kesling and Weiss, 1953, p. 60; Pl. IV, Figs. 34-36. Jones, 1956, p. 165, Figs. 8-11. Smith, 1959, p. 84; Pl. XVIII, Figs. 1-2.

Occurrence.--Rare at localities 2 and 5.

Types.--One complete carapace, No. 5q, from locality 5.

Superfamily Cypridacea

Family Bairdiidae Sars 1887

Genus Bairdia McCoy 1844

Type species.--By original designation, Bairdia curta McCoy, 1844, p. 164; Pl. 23, Fig. 6.

Bairdia amplectens Kesling and Kilgore

Bairdia amplectens Kesling and Kilgore, 1952, pp. 12-13; Pl. IV, Figs. 1-3.

Occurrence.--Common at localities 2 and 5, rare at locality 4.

Types.--Hypotypes, three adult broken carapaces, Nos. 2k(i), 2k(ii), 2k(iii), from locality 2; two adult complete carapaces, Nos. 4h(i), 4h(ii), from locality 4; two adult complete carapaces, Nos. 5h(i), 5h(ii), from locality 5.

Bairdia emaciata Kesling and Kilgore

Bairdia emaciata Kesling and Kilgore, 1952, p. 13; Pl. IV, Figs. 4-8.

Occurrence.--Abundant at locality 5, common at locality 2, rare at localities 1 and 4.

Types.--Hypotypes, two adult complete carapaces, Nos. 1a(i), 1a(ii), from locality 1; two complete mature carapaces, Nos. 2t(i), 2t(ii), from locality 2; one complete carapace, No. 4g, from locality 4; and two complete adult carapaces, Nos. 5d(i), 5d(ii), from locality 5.

Bairdia summacuminata Coryell and Malkin

Bairdia summacuminata Coryell and Malkin, 1936, p. 9; Fig. 23. Stover, 1956, p. 1119; Pl. 115, Figs. 10-11. Smith, 1959, pp. 85-86; Pl. XVI, Figs. 9-15.

Remarks.--These specimens differ in some characteristics from those of the holotype from the Arkona shale. The amount of overlap along the dorsal border in the average specimen is considerably less than is illustrated by Coryell and Malkin (1936, p. 12, Fig. 23); the adult carapaces in this collection, in ventral view, show an almost elliptical depression midway along the ventral border. This depression on some specimens is rimmed laterally by faint ridges seen in lateral view.

The Ferron Point specimens are more similar to the hypotypes (Stover, 1956, p. 1119, Pl. 115, Figs. 10-11) from the Windom Shale (Hamilton) than the holotype.

Occurrence.--Abundant at locality 5, rare at locality 4.

Types.--Hypotypes, two adult broken carapaces, Nos. 4j(i), 4j(ii), from locality 4; two adult carapaces, Nos. 5j(i), 5j(ii), from locality 5.

Genus Bythocypris Brady 1880

Type species.--By original designation, Bythocypris reniformis Brady, 1880, p. 46; Pl. 5, Figs. 1a, 1.

Bythocypris transptyxis Stover

Bythocypris transptyxis Stover, 1956, p. 1120; Pl. 115, Figs. 15-16. Smith, 1959, pp. 90-91; Pl. XVII, Figs. 3-7; Pl. XVIII, Figs. 5-8.

Occurrence.--Abundant at locality 2, rare at locality 1.

Types.--Hypotypes, two adult broken carapaces, Nos. 1b(i) and 1b(ii), from locality 1; two complete mature carapaces, Nos. 2n(i), 2n(ii), and two immature instars, Nos. 2n(iii), 2n(iv), from locality 2.

Bythocypris devonica Ulrich

Bythocypris devonica Ulrich, 1891, p. 196; Pl. 17, Fig. 1. Wilson, 1935, p. 644. Smith, 1959, p. 90; Pl. XVII, Figs. 1, 2.

Occurrence.--Common at locality 5.

Types.--Hypotype, one complete adult carapace, No. 51, from locality 5.

Bythcypris augustai Pribyl and Snajdr

Bythocypris augustai Pribyl and Snajdr, 1950, p. 158 (English); Pl. 3, Figs. 10-11; Pl. 4, Figs. 6-9.

Remarks.--These specimens show the characteristics that are common to both B. augustai Pribyl and Snajdr and B. parsonia Wilson (1935, pp. 645-46; Pl. 78, Figs. 9a-c). The only difference between these two species is the size. B. parsonia is larger and narrower than B. augustai and on the basis of the size and length-height ratio it seems that the specimens of this collection should be B. augustai.

Measurements of hypotype.--Length, 1.2 mm.; height, 0.6 mm.; width, 0.4 mm.

Occurrence.--Abundant at locality 2.

Types.--Hypotypes, two complete mature carapaces, Nos. 2m(i) and 2m(ii), from locality 2.

Bythocypris geisi Wilson

Bythocypris geisi Wilson, 1935, p. 645; Pl. 78, Figs. 7a-e.

Occurrence.--Rare at locality 4.

Types.--Hypotypes, two complete adult carapaces, Nos. 4v(i) and 4v(ii), from locality 4.

Genus Tubulibairdia Swartz 1936

Type species.--By original designation, Tubulibairdia tubulifera Swartz, 1936, p. 581; Pl. 89, Figs. 2a-r.

Tubulibairdia windomensis Swartz and Oriel

Tubulibairdia windomensis Swartz and Oriel, 1948, p. 563; Pl. 81, Figs. 10-14. Smith, 1959, p. 95; Pl. XVII, Figs. 8-15.

Occurrence.--Common at locality 3.

Types.--Hypotype, one complete adult carapace, No. 3g, from locality 3.

Family Quasillitidae Coryell and Malkin 1936

Genus Quasillites Coryell and Malkin 1936

Type species.--By original designation, Quasillites obliquus Coryell and Malkin, 1936, p. 18; Figs. 36, 36a.

Quasillites binodusus Swartz and Oriel

Quasillites binodusus Swartz and Oriel, 1948, pp. 559-60; Pl. 79, Figs. 18-21. Kesling and Weiss, 1953, p. 62; Pl. IV, Figs. 27, 29-30.

Description of interior of the right valve.--The interior of the right valve of this specimen shows a few distinct features. There is a groove along the margins all around the valve. This groove is less conspicuous along the dorsal border. The groove has its inner edge extended outward to fit inside of the left valve. From near the dorsal border there is a ridge-like structure running across the valve dividing it in anterior and posterior halves. The ridge extends to the point where there is a smooth spot on the exterior surface of the valve. This ridge-like structure has developed two almost hemispherical bowl-shape depressions in the two halves of the valve.

Occurrence.--Rare at locality 4.

Types.--Hypotypes, two adult right valves, Nos. 4p(i), 4p(ii), from locality 4.

Quasillites obliquus Coryell and Malkin

Quasillites obliquus Coryell and Malkin, 1936, p. 18, Figs. 36, 36a. Turner, 1939, pp. 25-26; Pl. I, Figs. 15, 18. Kesling and Weiss, 1953, p. 62; Pl. IV, Figs. 50-51. Kesling, Kavary, Takagi, Tillman, and Wulf, 1959, p. 22, Pl. II, Figs, 1-24; Pl. IV, Figs. 28-34.

Occurrence.--Abundant at localities 2 and 3.

Types.--Hypotypes, two adult carapaces, Nos. 2v(i) and 2v(ii) from locality 2; two adult carapaces, Nos. 3m(i) and 3m(ii), from locality 3.

Quasillites ornatus Swartz and Oriel

Quasillites ornatus Swartz and Oriel, 1948, pp. 558-59; Pl. 80, Figs. 11-17. Kesling and Weiss, 1953, p. 60; Pl. IV, Figs. 22-24, 31. Smith, 1959, pp. 103-107; Pl. VIII, Figs. 1-9; Pl. XIX, Figs. 13-25.

Occurrence.--Abundant at localities 2, 3, and 4.

Types.--Hypotypes, two adult carapaces, Nos. 2w(i), 2w(ii), from locality 2; two complete carapaces, Nos. 3j(i), 3j(ii), from locality 3; and two mature complete carapaces, Nos. 4q(i), 4q(ii), from locality 4.

Genus Bufina Coryell and Malkin 1936

Type species.--By original designation, Bufina elata Coryell and Malkin, 1936, p. 8; Fig. 22.

Bufina coloba Smith

Bufina coloba Smith, 1959, pp. 107-109; Pl. VII, Figs. 1-10.

Occurrence.--Rare at locality 4, top bed.

Types.--Hypotypes, one complete adult carapace, No. 4k(i), one left valve, No. 4k(ii), and two right valves, Nos. 4k(iii) and 4k(iv), from locality 4.

Genus Euglyphella Warthin, Jr., 1934

Type species.--By original designation, Strepula sigmoidalis Jones, 1890a, p. 11; Pl. 2, Fig. 4; by subsequent designation of Warthin, Jr., 1934, p. 220; Pl. 1, Fig. 21.

Euglyphella sigmoidalis (Jones)

Strepula sigmoidalis Jones, 1890a, p. 11; Pl. 2, Fig. 4.
Grabau, 1899, p. 305, Fig. 245.

Strepula plantaris Jones, 1890b, p. 540; Pl. 20, Figs. 8a-b.
Grabau, 1899, pp. 305-06, Fig. 246.

Euglyphella sigmoidalis Warthin, Jr., 1934, p. 220; Pl. 1, Fig. 21. Bassler and Kellet, 1934, pp. 37, 311; Fig. 16. Coryell and Malkin, 1936, p. 7; Fig. 17. Shimer and Shrock, 1944, p. 681; Pl. 286, Fig. 7. Warthin, Jr., 1945, Card 78, Fig. B. Wright, 1948, p. 101; Pl. 12, Figs. 36-37. Kesling and Kilgore, 1952, p. 10; Pl. III, Figs. 30-36. Coley, 1954, p. 455, Fig. 2. Smith, M. L., 1956, Table I. Jones, D. J., 1956, p. 165, Figs. 8-11. Smith, J. E., 1959, p. 113; Pl. XVIII, Figs. 31, 32; Pl. XIX, Figs. 1-12.

Occurrence.--Abundant at localities 2, 3, and 5, rare at locality 1.

Types.--Hypotypes, two adult carapaces, Nos. 1d(i) and 1d(ii), from locality 1; two complete mature carapaces,

Nos. 2u(i), and 2u(ii), from locality 2; two adult carapaces, Nos. 3h(i), 3h(ii), from locality 3; and two adult carapaces, Nos. 5n(i), 5n(ii), from locality 5.

Genus Ropolonellus Van Pelt 1933

Type species.--By original designation, Ropolonellus papillatus Van Pelt, 1933, p. 330; Figs. 29-30.

Ropolonellus plenus Kesling and Weiss

Ropolonellus plenus Kesling and Weiss, 1953, p. 64; Pl. IV, Fig. 39, Smith, 1959, p. 117; Pl. XIX, Figs. 26-27.

Occurrence.--Abundant at localities 2 and 5.

Types.--Hypotypes, two complete carapaces, Nos. 2x(i), 2x(ii), from locality 2 and two complete carapaces, Nos. 5p(i), 5p(ii), from locality 5.

Triambon n. genus

Description.--Carapace of moderate size; subtriangular to subovate in lateral view. Dorsal border arcuate, ventral border straight or slightly concave at the midcenter. Left valve larger than the right, overlapping the latter on all borders; overlap greater and more conspicuous along dorsal and ventral borders. Prominent, sharp-crested, posteriorly convex ridge present at the posterior end of each valve; a crescent shape anterodorsally convex ridge, less prominent than the posterior ones, present in the anterodorsal quarter of the right valve. Valve surface granular to very finely punctate.

Remarks/Relationships.--Genus Triambon differs from

Parabufina Smith, 1956, in lacking the anterior ridge on the left valve. In Triambon there is a crescentic ridge in the anterodorsal quarter of the right valve and there is no ridge of any kind in the anterior part of the left valve; whereas in Parabufina there are prominent anterior and posterior ridges on both valves. Parabufina ridges flare out from the valves but in Triambon posterior ridges project backward and do not flare out from the valves. In dorsal view Triambon is wedge shape, and Parabufina is about panduriform.

Genus Triambon differs from Punctomosea Stover, 1956, in having the anterior crescentic ridge on the right valve and in lacking coarse reticulation on valve surface. Punctomosea has posterior ridges but does not have anterior ridge on either of the valves. In Punctomosea reticulation is restricted to the lateral surfaces of the valves anterior to the posterior ridge. In genus Triambon the whole surface of the valves is either granular or very finely punctate.

Genus Triambon differs from Bythocyproidea of Stewart and Hendrix, 1945, in the respect that Triambon has its posterior ridges equally developed on both valves and has an anterior ridge on the right valve; whereas Bythocyproidea has left posterior ridge less developed than the right posterior ridge and it does not have anterior ridge on either of the valves. Triambon has the valve surface very finely punctate or granular, but Bythocyproidea is coarsely punctate.

Triambon differs from Healdia Roundy, 1929, in having the anterior crescentic ridge on right valve which is lacking in Healdia. Moreover, the ridge-like structures that Healdia has on the posterior swollen area of the valves are either elevated ridges or semicircular sinus or backward pointing spines; whereas in case of Triambon they are backward pointing, posteriorly convex, sharp-crested distinct ridges. Furthermore, the dorsal margin of Healdia is somewhat angular at the middle and in most species the posterodorsal corner is truncated. Dorsal margin of Triambon is not angular in any of the specimens studied and no specimen was found with posterodorsal corner truncated.

Triambon differs from Birdsallella Coryell and Booth, 1933, in having anterior crescentic ridge on right valve. Some species of Birdsallella have a slight marginal flattening of the posterior end which gives rise to ridge-like structure; but it is not sharp-crested ridge as in Triambon. Moreover, in Birdsallella right valve is larger and overlaps the left. Birdsallella has its surface smooth and Triambon has granular or very finely punctate surface.

Type species.--Triambon argutum n. sp.

Triambon argutum n. sp.

Pl. 1, Figs. 5-9

Description.--Carapace subtriangular in lateral view. Dorsal border arcuate; midventral border straight. Valves evenly convex. In lateral view posterior part of

the dorsal border steeper than the anterior part. Posterior end broadly rounded, anterior end narrowly rounded. Left valve larger than the right, overlapping the latter on all borders, stronger overlap on the dorsal and ventral borders. Right valve reniform in lateral view. A prominent sharp crested ridge at the posterior end of each valve; ridges occupying the central half of the posterior end, curving posteriorly paralleling the posterior borders. A crescent shape ridge, less prominent than the posterior ridges, in the anterodorsal quarter of right valve. Anterior ridge convex anterodorsally. Hinge line straight. Hingement consisting of a groove along interior of anterior and posterior contact margins, accommodating a ridge in corresponding positions on left valve. Surface very finely punctate.

Measurements.--Greatest length a little ventral from midpoint between dorsal and ventral borders; greatest height in the posterior two-thirds of the carapace; greatest width through posterior ridges.

Dimensions of holotype, a complete carapace.--Length, 0.92 mm.; height, 0.60 mm.; width, 0.42 mm.; length-height ratio, 1.53.

Occurrence.--Abundant at localities 2 and 5, rare at localities 1 and 4.

Types.--Holotype, a complete adult carapace, No. 5z, from locality 5; paratypes, one eroded adult carapace, No. 1c, from locality 1; one complete adult carapace, No.

2dd, from locality 2; one complete mature carapace, No. 4x(i), and a complete carapace of an instar, No. 4x(ii), from locality 4; one adult left valve, No. 5x(i), one adult right valve, No. 5x(ii), a complete adult carapace, No. 5x(iii), from locality 5.

Triambon acrojubatum n. sp.

Pl. 1, Figs. 4, 10, 11, 12

Description.--Carapace subtriangular to elongate in lateral view. Dorsal border arcuate, ventral border straight or slightly concave. Left valve larger than the right and overlapping it on all sides; overlap greater along the dorsal and ventral borders. Anterior end narrowly rounded, posterior end broadly rounded. A sharp crested prominent posterior ridge convex posteriorly on each valve; a crescent shape prominent ridge in the anterodorsal quarter of right valve. Posterior ridges projecting outward from lateral surface and posteriorly, resembling wings extending posteriorly parallel to the posterior border, in dorsal and ventral views. Posterior slope of ridge concave and recessed beneath the lip of the ridge in the outer half, convex in the inner half. Left posterior ridge slightly longer than the right posterior ridge, and projecting farther out from the vertical plane between the valves than the right posterior ridge.

Measurements.--Greatest length slightly ventral from the midpoint between dorsal border and ventral border; greatest height slightly posterior from the midpoint between

anterior and posterior ends; greatest width through posterior ridges.

Dimensions of holotype, a complete carapace.--Length, 0.94 mm.; height, 0.55 mm.; width, 0.50 mm.; length-height ratio, 1.70.

Remarks.--Triambon acrojubatum differs from Triambon argutum in having all the ridges more prominent. The posterior ridges in Triambon acrojubatum are much more sharply crested and more extended outward and backward than those in Triambon argutum. Triambon acrojubatum is more elongate than Triambon argutum. In some specimens of Triambon acrojubatum the difference in length of posterior ridges is very distinct.

Occurrence.--Abundant at locality 5, common at locality 2, rare at localities 1 and 4.

Types.--Holotype, a complete adult carapace, No. 2cc, from locality 2; paratypes, two eroded carapaces, Nos. 1f(i), 1f(ii), from locality 1; a complete carapace of an instar, No. 2ee(i), a complete adult carapace, No. 2ee(ii), from locality 2; an adult carapace, No. 4y, from locality 4; a mature complete carapace, No. 5y(i), and a right valve, No. 5y(ii), from locality 5.

Family Barychilinidae Ulrich 1891

Genus Barychilina Ulrich 1891

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

Barychilina embrithes Kesling and Kilgore

Barychilina embrithes Kesling and Kilgore, 1952, p. 12; Pl. II, Figs. 36-44. Kesling and Wiss, 1953, p. 64; Pl. IV, Fig. 52. Smith, 1959, pp. 118-119; Pl. XIX, Figs. 30-34; Pl. XX, Figs. 1-4.

Remarks.--Variations in surface ornamentation are remarkable, especially the variation in number of parallel ridges which ranges from 9 to 14 in the specimens of this collection.

Barychilina punctostriata Ulrich

Barychilina punctostriata Ulrich, 1891, p. 199; Pl. 13, Figs. 1a-e, 2a-c.

Occurrence.--Abundant at locality 5.

Types.--Hypotype, one complete carapace, No. 5m, from locality 5.

Barychilina tryphera Kesling and Kilgore

Barychilina tryphera Kesling and Kilgore, 1952, p. 11; Pl. II, Figs. 27-30.

Occurrence.--Rare at locality 2.

Types.--Hypotype, a complete carapace of an immature instar, No. 2r, from locality 2.

Barychilina sp.

Description.--Carapace subovoidal and elongate in lateral view. Hinge line straight to very slightly curved dorsally. Right valve larger, overlapping the left on all sides except posterior half of the dorsal border. Deep,

well-defined, elongate pit in dorsocentral part of both valves. Surface of both valves ornamented with fine inosculating ridges except in marginal areas. Space between the ridges are punctate.

Dimensions.--Greatest length central, greatest height and greatest width through the posterior half of the carapace.

Measurements.--Length, 1.10 mm.; height, 0.60 mm.; width, 0.54 mm.

Remarks.--This specimen is similar to Barychilina labyrinthea Kesling and Kilgore (1952, pp. 11-12; Pl. II, Figs. 31-35) in most of the characteristics except in shape and size. This specimen is more ovoidal than rhomboidal and elongate. It is larger and longer than Barychilina labyrinthea.

Occurrence.--Rare at localities 2 and 4.

Specimens.--Two complete adult carapaces, Nos. 4n(i), 4n(ii), from locality 4; one crushed carapace, No. 2q, from locality 2.

Superfamily Entomidacea

Family Entomidae Jones 1873

Genus Entomis Jones 1861

Type species.--By original designation, Entomis tuberosa Jones, 1861, p. 137; Pl. 2, Figs. 5, 5a.

Entomis rhomboidea Jones

Entomis rhomboidea Jones, 1890a, p. 10; Pl. 2, Figs. 9-10.

Grabau, 1899, pp. 304-05, Fig. 244.

Occurrence.--Rare at locality 2.

Types.--Hypotype, one complete adult carapace, No. 2aa, from locality 2.

Family incertae cedis

Genus Kirkbyella Coryell and Booth 1933

Type species.--By original designation, Kirkbyella typa Coryell and Booth, 1933, p. 262.

Kirkbyella bellipuncta (Van Pelt)

Amphissites bellipunctus Van Pelt, 1933, p. 332; Pl. 39, Figs. 37-40.

Hollinella bellipuncta Warthin, Jr., 1934, p. 208; Pl. I, Fig. 2. Stewart, 1936, p. 746; Pl. 100, Figs. 15-16. Turner, 1939, p. 12; Pl. I, Fig. 3. Kesling, 1952b, p. 26; Pl. I, Figs. 16-25.

Kirkbyella bellipuncta Warthin, Jr., 1937, Card 80. Shiner and Shrock, 1944, p. 671; Pl. 282, Figs. 43-44. Smith, 1959, p. 120; Pl. XX, Figs. 8-12.

Occurrence.--Abundant at locality 5.

Types.--Hypotypes, two adult left valves, Nos. 5x(i), 5x(ii), and two adult right valves, Nos. 5x(iii), 5x(iv), from locality 5.

Genus Amphisella Stover 1956

Type species.--By original designation, Amphisella papillosa Stover, 1956, pp. 1134-35; Pl. 119, Figs. 11-12.

Amphisella tenuis (Warthin)

Amphisella tenuis Warthin, 1934, pp. 215-16; Pl. I, Fig. 13. Stover, 1956, p. 1134. Smith, 1959, pp. 122-23; Pl. XX, Figs. 18-24.

Occurrence.--Common at localities 2 and 5.

Types.--Hypotypes, three complete carapaces, Nos. 2bb(i), 2bb(ii), 2bb(iii), from locality 2; two complete carapaces, Nos. 5w(i), 5w(ii), from locality 5.

CHART I

OCCURRENCE OF SPECIES IN FERRON POINT FORMATION OF CHEBOYGAN AND PRESQUE ISLE COUNTIES OF MICHIGAN

Species	Localities				
	1	2	3	4	5
FAMILY LEPERDITELLIDAE					
Macronotella hypercala					R
Dictyogramma scabratum		C			
Schmidtella fabiformis					R
FAMILY HOLLINIDAE					
Adelphobolbina megalia				R	
A. papillata				R	C
A. papillosa					A
Ctenoloculina eurybathrota		R			
Parabolbina oxypages		C			
Hollinella cuspibulbata			C		
H. plauta				R	
H. pumila		A		R	
H. rana				R	
H. vegrandis		R	C	R	A
FAMILY DREPANELLIDAE					
Bollia disjuncta					R
FAMILY KLOEDENELLIDAE					
Dizygopleura euglyphea		A	A	R	A
D. trisinuata		A	A		
Kloedenella trisulca		A	A		
Eukloedenella sp.		C			
FAMILY PRIMITIIDAE					
Primitia seriata		R			
FAMILY CYTHERELLIDAE					
Bythocyproidea eriensis			R		
Birdsallella tumida				R	
Ponderodictya punctulifera		A			
Cavellina cuneata				R	
Punctomosea cristata					R
FAMILY THLIPSURIDAE					
Octonaria laevilatata					A
O. quadricostata	R	A	C	R	A
O. crescentiformis		A	C	R	C
Hyphasmaphora textiligera		R			R
FAMILY BAIRDIIDAE					
Bairdia amplectens		C		R	C
B. emaciata	R	C		R	A
B. summacuminata				R	A
Bythocypris devonica				R	C
B. transptyxis	R	A			
B. augusti		A			
B. geisi				R	
Tubulibairdia windomensis			C		

CHART I (contd.)

Species	Localities				
	1	2	3	4	5
FAMILY QUASILLITIDAE					
Quasillites binodusus				R	
Q. obliquus		A	A		
Q. ornatus		A	A		
Bufina coloba				R	
Euglyphella sigmoidalis	R	A	A		A
Ropolonellus plenus		A			A
Triambon argutum	R	A		R	A
T. acrojubatum	R	C		R	A
FAMILY BARYCHILINIDAE					
Barychilina embrithes		C		R	
B. punctostriata					A
B. tryphera		R			
Barychilina sp.		R		R	
FAMILY ENTOMIDAE					
Entomis rhomboidea		R			
FAMILY incertae cedis					
Kirkbyella bellipuncta					A
Amphisella tenuis			C		C

A = Abundant, more than 25 valves per 750 grams of sample.
C = Common, more than 10, but less than 25 valves per 750 grams of sample.
R = Rare, less than 10 valves per 750 grams of sample.

CONCLUSION

This work on the ostracods of the Middle Devonian Ferron Point formation of Cheboygan and Presque Isle Counties of Michigan established the identity of 51 species belonging to 31 genera representing 12 families and four superfamilies of which one genus and two species are new.

The fossils studied in this work possess the characteristics that are typical of the Middle Devonian ostracods resembling those reported from other formations of the same stratigraphic horizon in Michigan and in the Windom shale (Hamilton) of New York state.

R. V. Kesling (1952c, p. 45) stated that,

> The ostracod fauna of this formation (Ferron Point) is distinct from that of the underlying Rockport Quarry limestone and from that of the overlying Genshaw formation. Its closest affinities are with the fauna of the Bell shale which underlies the Rockport Quarry limestone.

The present study of the Ferron Point ostracods established the fact that the ostracod fauna of the Ferron Point formation is distinct from that of the Rockport Quarry limestone since no Ferron Point ostracod was found similar to any of those so far reported from the Rockport Quarry limestone. But the ostracod fauna of the Ferron Point formation is not very distinct from that of the Genshaw formation. Out of 31 genera and 51 species listed in this work, 12 genera and 13 species are the same as those identified

from the Genshaw formation by Kesling and Tabor (1952), Kesling and Kilgore (1952), and Kesling and Tabor (1953). There are some affinities of the Ferron Point ostracods with those of the Bell shale. It was found in the present study that eight genera and five species of the Ferron Point ostracods are similar to those so far reported from Bell shale. The closest affinities of the Ferron Point ostracods, however, are found with those of the Gravel Point formation and also with those of the Petoskey formation. The Gravel Point formation is younger than the Genshaw formation and the Petoskey formation overlies the Charlevoix formation which, in turn, overlies the Gravel Point formation.

Dr. Jane E. Smith worked on ostracods from Traverse group of northwestern Southern Peninsula of Michigan. Her specimens come mainly from Gravel Point and Petoskey formations. It is found that out of 31 genera and 51 species identified from Ferron Point formation, in the present work, 24 genera and 25 species are the same as reported by Dr. Jane E. Smith (1959) from the Gravel Point formation and 19 genera and 19 species of the Ferron Point ostracods are similar to those identified, also by the same author, from the still younger Petoskey formation.

Ostracod fauna, in general, are mostly found in shale beds and in argillaceous limestones. They are more abundant in pure shales than in pure limestones, which may indicate that ostracods prefer muddy water and muddy bottom

conditions favorable for shale deposits than clear water good for limestone deposition. It is true with the Ferron Point ostracods also since most of the specimens of the present collection come from the shale beds of the formation.

Considering the relative abundance of ostracods in different geologic formations of the Traverse group stratigraphically above and below the Ferron Point formation it is found that the subjacent Rockport Quarry limestone has very few ostracods and none of them are similar to those of Ferron Point species of the present study. The Bell shale, underlying the Rockport Quarry limestone, has more numerous ostracods than Rockport Quarry limestone. The overlying Genshaw formation which is more calcareous than the Ferron Point formation has fewer ostracods than the more shaly Ferron Point formation. The present work reveals that the ostracods of the Ferron Point formation have more affinities with those of the Genshaw ostracods than with those of the Bell shale, though the Genshaw formation is more calcareous than the Bell shale. It may be due to the fact that the Genshaw ostracods probably have been more thoroughly studied than the Bell shale ostracods. Similar generalization may be made about the other formations of the Traverse rocks in this area. The limestone formations of the Traverse group in the area have very few ostracod species or none at all, but the shaly formations invariably

have some ostracod fauna present in them, and the closer the lithologic characters of the formations are to those of the Ferron Point formation the closer affinities of the ostracods of those formations are found with the ostracods of the Ferron Point formation. Ferron Point ostracods have closer affinities with those of the younger Gravel Point and Petoskey formations because lithologically the Gravel Point formation is shaly and the part of the Petoskey is highly argillaceous.

Again, the Norway Point formation (Fig. 1) which has almost similar lithologic characters as the Ferron Point formation contains 13 genera and 11 species of the Ferron Point ostracods listed in the present work. No ostracod fauna has been reported yet from the intermediate limestone formations (Newton Creek limestone and Alpena limestone) between the Genshaw and the Norway Point formations. The same is true with the Charlevoix formation which consists of purer limestones and dolomites and from which no ostracods have been described.

The above discussion makes the writer believe that further work on Bell shale ostracods will prove that the Ferron Point ostracods have closer affinities with those of Bell shale as R. V. Kesling stated (1952c, p. 45).

The presence of the same ostracod species in the shale formations of different stratigraphic positions in

the Traverse group of the area indicates fluctuation of the bottom conditions or depositional environment.

Many of the Ferron Point ostracods show a long time range. They range from the very early stage of Traverse to the middle of the Upper Traverse time.

Of all the specimens collected and identified from the five localities for this study, the genus Quasillites has the greatest representation. Several hundred individuals were identified as Quasillites in the materials collected from localities 2, 3, and 4.

This work on Ferron Point ostracod fauna has brought forth some questions that should be answered by some future workers. All the five localities concerned in this work are within an area of about 100 square miles; but faunal distribution in all the localities is quite uneven. Locality 1 is the most poorly fossiliferous; only 5 genera and 6 species come from this locality, though 60% of the total material studied came from locality 1. Moreover, most of the specimens of this locality are badly weathered and distorted and all are rare. This probably indicates that these ostracod carapaces were transported here from some other places. The forms that are present at locality 1 are also found in the other four localities generally in great numbers. No form is restricted to locality 1 only.

Another question that should be solved is the absence of the most abundant genus Quasillites at localities

1 and 5, especially at locality 5. Some other genera of the Quasillitidae family are present at locality 5, some genera in great abundance, and only one genus at locality 1; but not a single species of the genus Quasillites was found at these two localities. This must be due to some unknown ecological factors that restricted the thriving of the Quasillites at these localities. It should be noted that Ponderodictya, one of the most abundant Middle Devonian ostracods, is also missing from collections at 1 and 5.

All the known outcrop localities of the Ferron Point formation in this area are studied in the present work. The study of ostracods of this formation from well samples from scattered points in the area should complete the study of the Ferron Point ostracod fauna of the area.

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EXPLANATION OF PLATE I

Eukloedenella sp.

Fig. 1, Left lateral view of a female carapace, X30.

Fig. 2, Right lateral view of a male carapace, X30.

Barychilina sp.

Fig. 3, Left lateral view of a carapace, X30.

Triambon argutum, n. sp.

Fig. 5, Left lateral view of a carapace, X30.

Fig. 6, Dorsal view of a carapace, X30.

Fig. 7, Interior view of a left valve, X30.

Fig. 8, Interior view of a right valve, X30.

Fig. 9, Right lateral view of a carapace, X30.

Triambon acrojubatum, n. sp.

Fig. 4, Right lateral view of a carapace, X30.

Fig. 10, Left lateral view of a carapace, X30.

Fig. 11, Dorsal view of a carapace, X30.

Fig. 12, Interior view of a right valve, X30.

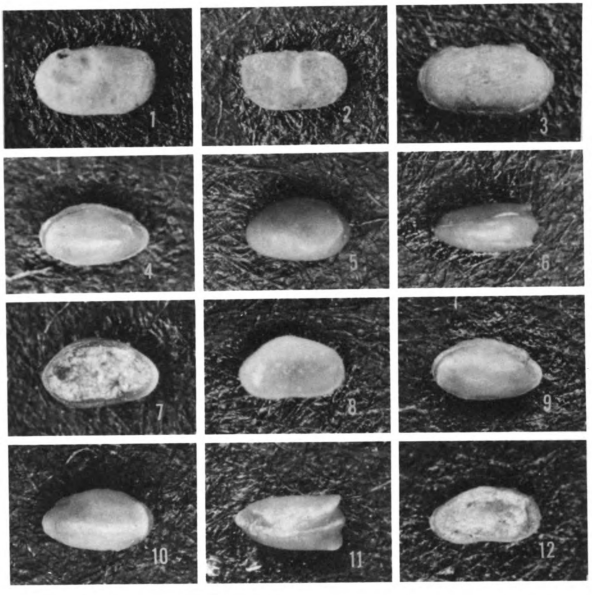

PLATE I

Figs. 1, 2. Eukloedenella sp.

Fig. 3. Barychilina sp.

Figs. 5-9. Triambon argutum, n. sp.

Figs. 4, 10-12. Triambon acrojubatum, n. sp.

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