PENNSYLVANIAN OSTRACODES OF ILLINOIS

BY

CHALMER L. COOPER

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*Assistant Chief Chemist in interim of absence of Chief Chemist.

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Mechanical Engineering, Sechki Konzo, M.S., University of Illinois

Topographic Mapping in Cooperation with the United States Geological Survey.
This report is a contribution of the Stratigraphy and Paleontology Division.

July 15, 1945
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PENNSYLVANIAN OSTRACODES OF ILLINOIS

BY

CHALMER L. COOPER

INTRODUCTION

The rapid lateral and vertical changes in lithology and thickness of Pennsylvanian strata in Illinois make it particularly difficult to obtain precise correlations, especially in isolated outcrops where few beds are exposed; therefore various means of correlating these rocks are being continually studied by the Illinois State Geological Survey. These methods include the use of electric logs and time logs on drilling wells in oil and gas development areas, and microfaunal studies on plant spores and ostracodes from outcrop and well samples. In addition, other studies based on the smaller Foraminifera, including those on fusulines started by Dunbar and Henbest (1942), are being continued.

Work on the Pennsylvanian ostracodes of Illinois was begun shortly after the completion of similar work on the Chester ostracodes (Cooper, 1941). The present report is based on 178 collections from 120 outcrop localities of 28 fossiliferous zones in the Eastern Interior basin, largely from type sections or from well known localities where stratigraphic relations are clear. Previous reports on Pennsylvanian ostracodes have been confined largely to short papers which treat restricted faunas or few localities. Exceptions are the works of Kellett (1933-35) and Bradfield (1935).

Ostracodes occur abundantly in many Pennsylvanian fossiliferous zones, and if the stratigraphic ranges of ostracode genera and species were known, these data would form a basis for correlation. Ostracodes possess one great advantage over larger fossils in that large suites of specimens can be obtained easily and quickly from shales in which they are abundant, and specimens can often be recovered from the cores and cuttings of wells.

In order to obtain a broad outlook upon the stratigraphic ranges of Pennsylvanian ostracodes in Illinois, representative collections were sought in all of the known marine fossiliferous zones. The results of collecting in some zones were disappointing, and in a few instances entirely negative, but on the whole an excellent series of collections was obtained from all but the lowest part of the Pennsylvanian system as developed in Illinois. The study reported in the following pages is presented with the purpose of outlining in preliminary fashion what has been learned regarding the ranges of ostracode genera and species. It is not complete, as many details remain to be filled in by future work. Since this study is intended to determine only the occurrence of ostracodes in well-known zones, any refinements of the present stratigraphic classification must await future and more detailed work on the questionable horizons. It is planned to continue the ostracode work in an attempt to solve some of the perplexing correlation problems in the Illinois Pennsylvanian.

ACKNOWLEDGMENTS

The wide scope of this report has been possible largely by reason of the generous contribution of two extensive collections of Pennsylvanian ostracodes, both
Fig. 1—Outline map of Illinois and adjacent portions of Indiana and Kentucky showing extent of Pennsylvanian strata in the Eastern Interior basin, and location of samples studied for this report.
in prepared and in washed samples, by H. L. Geis. One collection is composed of over 100 slides of mounted specimens from many fossiliferous Pennsylvanian beds in Illinois. The other collection is made up of several hundred samples from nearly 150 Pennsylvanian and Permian type localities and other well-known exposures in the Midcontinent area, from Kansas to Texas.

Pennsylvanian ostracode faunas from Indiana University, containing the types described by Bradfield (1935) and Payne (1937), were loaned through the courtesy of J. J. Galloway of the Department of Geology of that institution.

J. Marvin Weller and Harold R. Wanless have been of continued assistance throughout the progress of the research, giving invaluable aid in the location of outcrops and furnishing measured sections for most of them. Dr. Weller has critically read the manuscript, including the chart of formations (fig. 2, p. 16), and has contributed the section following, discussing some Pennsylvanian stratigraphic problems in Illinois, especially in the upper part of the system.

Mrs. Helen Jeanne Plummer, Mrs. Betty Kellett-Nadeau, and R. V. Hillingsworth have also contributed specimens and samples from the Midcontinent for purposes of comparison. Various former and present members of the Coal Division of the Illinois Survey, namely J. Norman Payne, E. C. Dapples, George Wilson, and Bryan Parks, have collected numerous samples during field work for that Division. Allen F. Agnew assisted on several collecting trips to Pennsylvanian outcrop areas in southern and western Illinois. All collections made by others than myself are acknowledged in the section describing localities (pp. 35-38). Mrs. Ellen Jordan Shannon assisted with the preparation of the manuscript and plates.

STRATIGRAPHIC SUMMARY

J. Marvin Weller

Although more or less detailed stratigraphic studies of the Pennsylvanian system in Illinois have been in almost continuous progress for more than 15 years, many problems remain unsolved, particularly with regard to the correlation of beds occurring above the Shoal Creek limestone in different parts of the State. These beds are well exposed in numerous disconnected areas separated by regions of thicker glacial drift where outcrops are rare or absent. However, there are few places where a stratigraphic succession of any important thickness is entirely clear, and consequently the building up of a complete stratigraphic sequence is very difficult. Many correlation problems appear to be extremely complex and impossible of solution by field studies alone. This is well illustrated by the very divergent correlations (mostly unpublished) that have been favored by different investigators or even by the same person at different times.

Most of the localities selected for collecting were chosen because the succession of beds there exposed had been carefully studied and identified. The correlations of some of these beds, particularly in the upper part of the Pennsylvanian system, however, are somewhat uncertain as pointed out above, and a brief statement concerning the present status of some of the problems involved is necessary.

Shoal Creek Limestone and Lower Beds

The correlations of most fossiliferous beds in the Illinois Pennsylvanian up to and including the Shoal Creek limestone are satisfactorily established. Those which require comment are as follows:

Fulda and Ferdinand limestones.— These two zones are not known to occur in Illinois. They have been identified in Indiana, however, and their names are taken from a manuscript report, a
summary of which was published by Franklin (1944).

*Seville limestone.*—The Seville limestone of western Illinois has been correlated with the Curlew limestone of southern Illinois and western Kentucky by Wanless and Weller, but Dunbar and Henbest (1942, p. 20) have concluded that the Seville limestone is older than the Curlew. Unfortunately no ostracodes have yet been obtained from the Curlew limestone and associated shales.

“*Craborchard*” limestone.—This limestone is part of a cyclothem which includes the so-called No. 5A coal. It is well developed and apparently persistent in southern Illinois but the entire cyclothem is poorly developed and generally unrecognizable elsewhere in the State. The name “*Craborchard*” is a field term which is not proposed at this time as a permanent stratigraphic name.

*Pokeberry limestone.*—This limestone crops out in a very restricted area west of Illinois River, between No. 6 and No. 7 coals. It is probably equivalent to either the Jamestown or the Bankston Fork limestone of southern Illinois. The latter correlation is favored at this time.

*BroUILlet coal.*—This coal crops out in Edgar County near the Indiana state line, between No. 7 and No. 8 coals of Illinois. Fossiliferous marine limestone occurs intermittently both close below and close above it. This is the position of the Gimlet beds of western Illinois, and the recent recognition (Weller et al., 1942, p. 1592) that two cycloths are represented in the original Gimlet cyclothem suggests that the fossiliferous zone above the Brouillet coal is equivalent to the Exline limestone. The two limestones associated with this coal are probably the local representatives of the West Franklin limestone of southern Indiana.

*Shoal Creek limestone.*—The names Shoal Creek and Carlinville have been used for prominent limestones that crop out in two areas in southwestern Illinois. Although they have generally been cor-

related, their exact equivalence has not been certainly established.

*Hicks cyclothem, etc.*—The Pennsylvanian succession between the Gimlet and LaSalle cycloths, exposed in the upper Illinois valley, is quite different from that developed in other parts of Illinois. It contains several prominent but thin limestones which are the basis for the recognition of several incomplete cycloths to which the field names Turner, Hicks, and Hall have been applied by H. B. Willman. These have been tentatively correlated, according to their relative stratigraphic positions, with better developed cycloths farther south.

**Beds Above Shoal Creek Limestone**

Considerable confusion exists regarding the correlation of some of the strata younger than the Shoal Creek limestone and the proper application of names that have been proposed for them. This confusion is caused largely by the as yet unsolved problem of the correlation of the Omega and Greenup limestones. Weller and Newton believed those beds to be equivalent, but Dunbar and Henbest (1942, p. 28) concluded that the Greenup is considerably younger than the Omega. This latter interpretation now appears more probable.

A good stratigraphic section clearly shows the following sequence of cycloths above the supposed Shoal Creek limestone in Edgar and Clark counties of eastern Illinois (Dunbar and Henbest, 1942, p. 16):

8. Upper Bogota  
7. Lower Bogota  
6. Cohn  
5. Upper Livingston  
4. Lower Livingston  
3. Macoupin  
2. Flannigan  
1. Shoal Creek

In Macoupin County of southwestern Illinois a somewhat comparable section above the Carlinville limestone is classified as follows:

1Burroughs and Shaw Point are local names proposed in a manuscript report on the Carlinville quadrangle by J. R. Ball.
In Jasper and Cumberland counties of southeastern Illinois several cyclothems are well exposed as follows:

5. Woodbury
4. Omega
3. Greenup
2. Newton
1. Bogota

Reconnaissance field studies in south central Illinois by Sidney E. Ekblaw resulted in the tentative recognition of the following cyclothems:

6. Shumway
5. Shelby
4. Omega
3. Effingham
2. Divide
1. LaSalle

Subsequent attempts to fuse these observations into a single standard section based upon the assumption that the Omega and Greenup limestones are equivalent resulted in the following series of cyclothems:

13. Shumway
12. Woodbury
11. Gila
10. Greenup or Omega
9. Newton
8. Upper Bogota
7. Lower Bogota
6. Cohn
5. Upper Livingston } or LaSalle
4. Lower Livingston } or Shaw Point
3. Macoupin
2. "Flannigan" or Burroughs
1. Shoal Creek

In the above list Flannigan and Divide are placed within quotations because the true positions of the beds at the type localities are not certainly known with reference to any others. The name Bogota is not used here because the type Bogota probably closely underlies the Newton but has been used principally for beds closely overlying the Cohn.

Aside from differentiation of the Omega and Greenup limestones, the principal difference of this last section is in the position of the Shumway cyclothem and its possible equivalence to the Newton. If this sequence is correct or nearly so it is probably incomplete, and other cyclothems may occur both above and below the Omega. One other difficulty is encountered in this arrangement because the Shelbyville coal, which according to Sidney E. Ekblaw is a part of the Shelby cyclothem, was assigned to the Newton cyclothem by W. A. Newton (1941, p. 7), who believed that it occurred beneath the Omega in Shelby County. These as well as other matters await further clarification.

Livingston limestone.—The Livingston limestone of eastern Illinois consists of two benches with intervening beds which thicken southward, and they obviously belong to two different cyclothems. On the basis of similar stratigraphic position, lithology, and faunas, they have been tentatively correlated with the LaSalle limestone of the northern part of the State. On the west side of the basin, similar limestones near Ramsey in Fayette County, Millersville in Christian County, Litchfield in Montgomery County, and Carlinville in Macoupin County have also been correlated with the LaSalle. It is entirely possible, however, that these western occurrences are representatives of two different zones
more widely spaced than the Livingston limestones of the east. These or similar beds have not been recognized south of Fayette and Crawford Counties.

*Little Vermilion limestone.*—This bed is a member of a cyclothem that overlies the LaSalle cyclothem of northern Illinois. It has never been correlated with any stratum farther south, and if the LaSalle limestone is equivalent to the Lower Livingston, it may or may not be representative of the Upper Livingston.

*Omega limestone.*—This is a prominently outcropping bed in parts of Clay and Effingham counties, but is not certainly known elsewhere. It may be exposed near Fairfield in Wayne County, and it may be equivalent to the Calhoun limestone of Richland County. If the Omega is older than the Greenup, the former has not been recognized on the east side of the basin except possibly near Calhoun.

*Shumway and Newton.*—These two cyclothems of Effingham and Jasper counties respectively may be equivalent if the Greenup limestone is younger than the Omega. In spite of their occurrence in neighboring areas, however, there seem to be some significant differences both in physical character and stratigraphic association.

The foregoing suggests some of the problems of Pennsylvanian stratigraphy and correlation in Illinois that remain unsolved. The following report suggests conclusions for some of them and may serve as the foundation for more detailed and specialized studies aimed at the solution of others.
STRATIGRAPHIC DISTRIBUTION

The Pennsylvanian strata of the Eastern Interior basin appear to include representatives of all epochs between the Chester and the Permian. The sediments are intermediate in character between those of the Appalachian province, where they are dominantly elastic with few limestones and other marine beds, and those of the Midcontinent region where marine limestones and shales dominate, with relatively few clastic.

Pennsylvanian strata, particularly in Illinois, are commonly arranged in a regular lithologic sequence of beds as follows (Weller, 1930):

1. Sandstone, un conformity at base
2. Shale or sandy shale
3. Limestone, “fresh-water”
4. Underclay
5. Coal
6. Shale, gray
7. Limestone, with marine fossils
8. Shale, black, hard, shee ty, with large limestone concretions
9. Limestone, with marine fossils
10. Shale, gray, with ironstone concretions

The above sequence, the cyclothem, is seldom completely developed at any one place; however, beds 1, 4, 5, 9, and 10 commonly occur. Many cyclothems are characterized by the presence or absence of certain members, and many refinements of the current subdivisions of the Pennsylvanian system in Illinois have been worked out on the basis of cyclothems (Weller, 1931; Wanless, 1931, 1939).

Ostracodes commonly occur in the upper or marine members of the cyclothems, and the collections made are, for the most part, from calcareous shales above and below the marine limestones. In the references to the occurrence of ostracodes which follow, the species are referred to “zones,” preceded by the name of the formation or cyclothem from which they were collected.

A considerable number of Illinois cyclothems have been correlated with the Middle Pennsylvanian strata of the Midcontinent region and many can be traced directly into beds of the Des Moines and Missouri series in the neighboring states of Iowa and Missouri. Below the Des Moines series, sediments are thick, dominantly elastic, with few minable coals and marine strata, and are difficult to correlate in detail. A correlation of Pennsylvanian formations of the Eastern Interior basin has been compiled by Moore, et al. (1944).

Because the Illinois Pennsylvanian section is closely comparable to that of the Midcontinent through the tracing of a number of horizons from Iowa into western Illinois, the subdivisions of the latter classification are used in age designations (p. 16). The desirability of this arrangement is emphasized by the fact that most of the previously described species of Pennsylvanian ostracodes are from formations of the Midcontinent area.

The group names now used in Illinois were first used as formational units, arbitrarily drawn at certain coal or other distinctive horizons. Later some of these divisions were found to lie within cyclothems, and inasmuch as the breaks preferably should occur at the base, this position has since been changed. Therefore the Caseyville-Tradewater contact falls below the Willis coal and the Tradewater-Carbondale break occurs at the base of the Lower Liverpool cyclothem, below coal No. 2. The Carbondale-McLeansboro contact is still drawn at the base of the Sparland cyclothem, above coal No. 6 and the Brereton cyclothem. However, the series of the Pennsylvanian in the Midcontinent area have been defined largely on faunal criteria, which has been used to evaluate the significance of unconformities within the
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Fig. 2—Table showing relative stratigraphic positions of beds from which ostracodes were collected. Except for beds of Des Moines and lower Missouri age, correlations with the Midcontinent are approximate and tentative.
system (Moore, 1944, p. 667). The Morrow is designated the zone of Hustedia miseri, the Atoka the Mesolobus striatus zone, the DesMoines the Mesolobus mesolobus zone, the Missouri the Chonetina zone, and the Virgil the Chonetes transversalis zone. On the basis of the fusulinelines the Des Moines is sharply defined as the zone of Fusulina, while the Fusulina zone occurs below and the zone of Triticites is found above, in the Missouri and Virgil series.

For these reasons the outline of the following discussion of the stratigraphic distribution of the ostracode faunas follows the series and group classification of the Midcontinent, using the formations and cyclothem names applied to the Illinois Pennsylvanian. It is not to be construed that the group names in Illinois are to be replaced by those of the Midcontinent, but it is felt that, because of the faunal basis of the latter classification, it lends itself more readily to a description of the occurrence of the ostracodes. The group names in current use by this Survey are shown on the chart of formations (fig. 2, p. 16) and on the faunal chart (in pocket).

The samples studied yielded some 300 species classified into 47 genera and 15 families (see faunal chart). Of the ostracodes recognized in the Pennsylvanian system in Illinois, by far the largest number of species (95) are referable to the Bairdidiidae (8 genera) followed by the Kirkbyidae (40 species in 9 genera); Healdiidae (33 species in 3 genera); Kloidennellidae (32 species in 8 genera); Cytherellidae (27 species in 3 genera); Hollinellidae (21 species, all Hollinella); Leperdititellidae (17 species in 5 genera); and Cyprididae (12 species in 3 genera). All other families are represented by a single genus with from one to seven species.

The genus Bairdia possesses the largest numbers of identified species (41), followed by Healdiia (29), Cavellina (22), Hollinella (21), Coryellites (17), and Amphissites (12). All other genera are represented by not more than 9 species each.

Three new genera—Fabaliceypris, Hastifaba, and Paraparchitella—are described in this report, and a total of 109 new species is included in the 300 species described and figured. A number of previously described species, based largely on immature specimens, have been eliminated by placing them in the synonymy of earlier described species.

The following previously described genera are recognized in the Pennsylvanian for the first time: Darwinula, Lochriella, Microparaparchites, Proparaparchites, and Sargentina, all known from the Mississippian, and Gutschickia from the Permian. A number of species, holdovers from the Mississippian or carrying over into the Permian, are noted in the following discussion of the detailed stratigraphic distribution of the Pennsylvanian ostracodes.

In the Upper Pennsylvanian, particularly in the upper Des Moines and younger strata, zones in the underclay limestones and associated beds yield distinctive "fresh-water" faunas. These usually contain a very large number of individuals but few species, there being only 16 species known in five genera. Associated fossils are Spiroorbis and plant spores; the typical marine species which usually occur in the limestones and shales above the coal are generally absent. Sometimes typical marine forms sparingly occur in these beds. However, many marine forms can exist in environments having a considerable variation in the degree of salinity so that their presence does not necessarily indicate a truly marine deposit. Since fresh-water forms are unable to exist in saline water, their presence indicates a fresh-water deposit, unless it can be shown that the fresh-water species were transported from their native habitat.

The Sumnum, Lonsdale, Bogota, and Newton zones contain 4 to 6 species each of the genera Candona, Carbonita, and Gutschickia. The other genera repre-
sent are *Darwinula* and *Hastifaba*. Other zones carrying two to four species each are the Seville, "Centralia," and Cohn. In the compilation of the graphs showing species distribution (figs. 3-32) these species have been omitted.

An analysis of the faunal chart shows that most Pennsylvanian species are long ranging and that there are no sharp faunal breaks marking series or group boundaries, such as occur in the Chester series (Cooper, 1941, p. 8). In attempting to make correlations, therefore, reliance must be placed on the relatively few species that appear to be restricted to various zones (see fig. 3). It should be remembered, however, that new species listed as occurring in one zone only may be found by subsequent work to have a much greater stratigraphic range. Only five zones, however, namely in the Seahorne, Wiley, Craborchard, Bankston Fork, and Collinsville, were found to be lacking in apparently restricted species.

**TI VALLEY SERIES**

Since there is no well established name in use for the oldest Pennsylvanian series of the Midcontinent, to which area the Illinois Caseyville and part of the Tradewater groups seem most closely allied, Ti Valley is used here to include all formations between the base of the Pennsylvanian system and the base of the Des Moines series. It appears that formations exposed in this valley in east-central Oklahoma, on the borderline between the Arbuckle and Ouachita mountains, contain beds ranging in age from Morrow through Atoka. Morrow has been used by the U. S. Geological Survey (Wilmarth, 1938, p. 1424) both as a series and as a group name, and by Moore (1944, chart) as a series name. It does not contain beds as young as Atoka. Lampasas (Cheney 1940, pp. 66, 82), used by Moore for the post-Morrow beds, apparently is not acceptable to the Texas Geological Survey, probably because these beds overlap the Des Moines boundary. Atoka seems to be gaining favor among stratigraphers working in that region for the formations between the Morrow and Des Moines. Probably the Stanley and Jackfork formations are older than Morrow and younger than the Chester of the Mississippi Valley and therefore do not form a part of the Ti

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*Fig. 3—Graphic representation of the stratigraphic distribution of ostracode species in the Pennsylvanian strata of Illinois. The open portion of the columns shows the number of restricted species, the solid portion the number of species occurring in other zones.*
Valley series (except possibly some of the Jackfork). It is believed that future work will demonstrate the presence in the Appalachians and the Midcontinent of a post-Chester—pre-Morrow series, to which the names Pushmataha (in the west) and possibly Summers (in the east) can be applied. The latter is the name of the county in West Virginia where the upper Mauch Chunk formations are well exposed.

In Illinois the basal Pennsylvanian sandstones and shales, which rest unconformably on Chester and older formations, are of Ti Valley age and contain zones up to and including the Seville (Curlew) cyclothem. Included are three zones from which ostracodes have been obtained—the Fulda (Morrow) and the Ferdinand and Seville (Atoka). The ostracodes restricted to the series (but not to groups or zones) are Ectodemites harloni Cooper, n. sp., and Kirkbya bendensis Harlton. The boundary between the Caseyville and Tradewater groups occurs in this series, below the Willis coal.

**Morrow Group**

The Morrow ostracode fauna is characterized by a predominance of the Kirkbyiidae with which are classified 10 of the 12 species from the Fulda formation.

**Fulda limestone.**—Only one fossiliferous zone of Morrow age, the Fulda limestone and associated beds (Franklin, 1944) of Spencer County, Indiana, is known to contain ostracodes, although one other fossiliferous zone, the Sellers limestone, is known in Illinois. A good index of the Fulda, *Polytylites wapanuckensis* (Harlton), was described from the Wapanucka limestone of Oklahoma. Of interest is the occurrence of two upper Chester species, *Kirkbya reflexa* Girty and *Kirkbyella* cf. *K. golkei* Croneis and Bristol. The only other restricted species is *Monoceratina ardmorensis* (Harlton). The total absence of *Healdia* is noteworthy. Figure 4 shows that whereas a number of the Morrow species occur in the Des Moines few are found in younger formations.

**Atoka Group**

Two zones of Atoka age, the Ferdinand limestone and the Seville cyclothem, in the Eastern Interior basin contain microfossils. The former yielded only 11 species, but the latter contains 46 species, 5 of which are common to the two zones. These are *Bairdia dissimilis* Cooper, n. sp., *Bairdia pennata* Coryell and Sample, *Fabalicypsis regularis* Cooper, n. sp., *Fabalicypsis wileyi* Cooper, n. sp., and *Kirkbya magna* Roth. Only two species appear to be restricted to the group, *Bairdia dissimilis* and *Fabalicypsis regularis*, both new. The larger fauna of the upper zone contains a greater variety of genera, as might be expected, but it is composed largely of Bairdiidae and Kirkbyidae.

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1. This name is not in accepted use in Illinois. It is employed in this report to conveniently compare Illinois strata with those in the Midcontinent region.
Ferdinand limestone.—Like the Morrow, the beds of Atoka age contain few fossiliferous marine zones in this area, the Ferdinand and Seville limestones and the Boskydell sandstone, the last of which is without identifiable ostracodes. The lowest zone, or Ferdinand, occurs above the Fulda limestone in Spencer County, Indiana (Franklin, 1944). The following species are known in the Eastern Interior basin only in this formation: Bairdia ardmorensis Harlton and Ectodemites plummeri Cooper, n. sp. The last is common in the lower Marble Falls of Texas. The absence of Healdia in this formation is also noteworthy. Figure 5 shows that, although a number of Ferdinand species persist through the Des Moines and a few continue into the younger Missouri and Virgil series, most of the species are restricted to the Ti Valley and to the lower part of the Des Moines series.

Seville zone.—The highest ostracode-bearing beds of Atoka age occur in the Seville cyclothem of western Illinois.

The species restricted to this zone, given in the following list, represent 30 percent of the total number found.

*Bairdia angusta* Cooper, n. sp.  
*Bairdia harltoni* Cooper, n. sp.  
*Bairdia schaurothiana* Kirby  
*Carbonita orbiculata* Cooper, n. sp.  
*Cyathus striatus* Cooper, n. sp.  
*Fabalicypris tenuis* Cooper, n. sp.  
*Healdia fabalis* Cooper, n. sp.  
*Healdia longula* Cooper, n. sp.  
*Jonesina biformis* Bradfield  
*Microcheilinella minutula* Cooper, n. sp.  
*Paraparachitella erata* Cooper, n. sp.  
*Paraparachites claytonensis* Knight  
*Paraparachites semicircularis* Cooper, n. sp.  
*Silenites asymetrica* Cooper, n. sp.

The range of unrestricted species is found to cover most of the other Pennsylvanian horizons.

Correlation is also possible when two or more species are present in a zone, some beginning there and ranging upward, others ranging downward from this stratigraphic level. The presence of any two opposite ranging forms serves as an index. The following are such species which occur in the Seville, the direction of the range indicated by the arrow: (↓) down from the Seville, (↑) up from the Seville.

†*Amphissites centronotus* (Ulrich and Bassler)  
†*Amphissites girtyi* Knight  
†*Ardmorea gibberosa* (Knight)  
†*Basslerella firma* Kellett  
†*Bairdia altifrons* Knight  
†*Bairdia whitesidei* Bradfield  
†*Coryellites firma* Kellett  
†*Coryellites palopintoensis* (Coryell and Sample)  
†*Coryellites pediformis* (Knight)  
†*Ectodemites harltoni* Cooper, n. sp.  
†*Fabalicypris minutula* Cooper, n. sp.  
†*Fabalicypris regularis* Cooper, n. sp.  
†*Healdia boogynsis* Harlton  
†*Healdia elegens* Warthin  
†*Healdia Glennensis* Harlton  
†*Kirkbya bendensis* Harlton  
†*Kirkbya inornata* Roth  
†*Moorites knighti?* (Wilson)  
†*Moorites minutus* (Warthin)  
†*Moorites speciferus* (Wilson)  
†*Moorites scapanuncensis* (Harlton)  
†*Paraparachites exiguus* Cooper, n. sp.  
†*Suleella sulcata* Coryell and Sample  
†*Waylandella vulgaris* Cooper, n. sp.

* Asterisks denote easily recognized forms that are probably good horizon markers.

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**Fig. 6**—Distribution of ostracode species occurring in the Seville and Curlew zones (horizon 3).
DES MOINES SERIES

Thirteen of the 29 ostracode-bearing zones of Illinois are of Des Moines age, which corresponds to the upper Trade-water, Carbondale, and lower McLeansboro groups. The number of species in a single zone ranges from 5 to 66; the variability of the faunas is much greater than in the Morrow. Most of the Pennsylvanian genera are represented in the Des Moines, exceptions being Carbonita, Cyathus, Glyptopleura, Kirkbyella, Kloedenella, Polytylites, Sargentina, and Seminolites. Ardmorea, Microparaparachites, and Waylandella are not known from beds younger than the Des Moines.

Restricted to the series, but not to any particular group or zone, are the following species:

*Amphissites transversus* Roth
*Coryellites paralella* (Knight)
*Coryellites simillima* (Bradfield)
*Coryellites tomlinsonella* Cooper, n. sp.
*Healdia carterensis* Bradfield
*Healdia spinosa* Cooper, n. sp.
*Hollinella kellettiae* Knight
*Macrocypris menardensis* Harlton
*Macrocypris teretis* Cooper, n. sp.
*Microparaparachites elongatus* Cooper, n. sp.
*Microparaparachites ovatus* Cooper, n. sp.
*Microparaparachites wapanuckensis* (Harlton)
*Silenites fabalis* Cooper, n. sp.
*Waylandella bythocytopoides* (Warthin)
*Waylandella dispar* Cooper, n. sp.
*Waylandella obesa* Cooper, n. sp.

CHEROKEE GROUP

The following species are not known to occur outside of this lower Des Moines group:

*Cavellina equalis?* Coryell
*Coryellites locelli* Cooper, n. sp.
*Healdia marginata* Harlton
*Hollinella minuta* Cooper, n. sp.
*Waylandella regularis* Cooper, n. sp.

Seahorne zone.—The Seahorne fauna contains 24 species, predominantly *Amphissites* and *Healdia*. No species restricted to the Seahorne were found. Figure 7 shows the distribution of the species of this zone to be primarily in beds of lower Des Moines age.

The opposite-ranging forms in the Seahorne are:

↑ *Amphissites centronotus elongatus* Payne
↑ *Amphissites roundyi* Knight
↑ *Amphissites transversus* Roth
↓ *Fabalicypris minuta* Cooper, n. sp.
↑ *Healdia granosa* Cooper, n. sp.
↑ *Healdia marginata* Harlton
↑ *Healdia oblonga* Bradfield
↓ *Hollinella minuta* Cooper, n. sp.
↑ *Kellettina montosa* (Knight)
↑ *Kirkbya inornata* Roth
↑ *Waylandella bythocytopoides* (Warthin)
↑ *Waylandella regularis* Cooper, n. sp.

Wiley zone.—None of the 15 species of the Wiley fauna is known to be restricted. The distribution of species as is shown in figure 8, is mostly among beds of lower Des Moines age.

The opposite-ranging forms in the Wiley are as follows:

↑ *Coryellites centralis* (Coryell and Billings)
↑ *Coryellites tomlinsonella* Cooper, n. sp.
↑ *Healdia spinosa* Cooper, n. sp.
↑ *Microparaparachites wapanuckensis* (Harlton)
↑ *Roundyella simplicissima* (Knight)
↓ *Waylandella vulgaris* Cooper, n. sp.

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4This name is not in accepted use in Illinois. It is employed in this report to conveniently compare Illinois strata with those in the Midcontinent region.

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**Fig. 7**—Distribution of ostracode species occurring in the Seahorne zone (horizon 4).

**Fig. 8**—Distribution of ostracode species occurring in the Wiley zone (horizon 5).
Liverpool (Oak Grove) zone.—This zone is one of the most fossiliferous in the Des Moines series, 64 species having been recognized from it. Of these, 77 percent occur in other zones. It contains an unusual number of species of Coryellites, no less than 9 of the 17 Pennsylvanian species being present. The list of apparently restricted species follows.

Cavellina bisecta Bradfield
Cavellina fittsi Kellett
*Coryellites cooki* (Bradfield)

![Fig. 9—Distribution of ostracode species occurring in the Oak Grove beds (horizon 6).](image)

*Fabalyctyris acuminata* Cooper, n. sp.
*Fabalyctyris dispar* Cooper, n. sp.
*Fabalyctyris plana* Cooper, n. sp.
*Healdicyctyris acuminatus* Cooper, n. sp.
Knightina allerismoides (Knight)
Knightina kilettae Bradfield
Microparaparchites cornutus Cooper, n. sp.
Sansabella amplectans Roundy
Sansabella exilis Cooper, n. sp.
Sansabella laevis (Warthin)
Waylandella symetrica Cooper, n. sp.

Although known only in the Oak Grove in Illinois, Cavellina bisecta Bradfield and Sansabella amplectans Roundy are known from older strata in Oklahoma and Texas. Likewise Knightina allerismoides (Knight) occurs somewhat higher in the Fort Scott beds of Missouri and Coryellites cooki (Bradfield) occurs in strata of Liverpool age in the Ardmore basin. Cavellina fittsi Kellett was reported from the lower Virgil in Kansas; *C. casei* Bradfield, believed to be conspecific with Kellett’s *C. fittsi*, was reported from the Otterville and Jolliff in the Ardmore basin. The distribution of unrestricted species is largely confined to the Des Moines, although several are present in the Ti Valley (fig. 9).

The opposite-ranging forms in this zone are:

↓ *Amphissites alticostatus* Bradfield
↑ Bairdia menardensis Harlton
↓ Bairdia pennata Coryell and Sample
↑ Bairdia peracuta Warthin
↑ Cavellina angusta Cooper, n. sp.
↑ Cavellina equalis? Coryell
↑ Cavellina lata Coryell
↑ Cavellina pulchella Coryell
↑ Coryellites elongata Coryell
↑ Coryellites lowelli Cooper, n. sp.
↑ Coryellites parallela (Knight)
↑ Coryellites simillima (Bradfield)
↑ Coryellites subelliptica (Upson)
↑ Ellipsella bradfieldi Cooper, n. sp.
↓ Healdia boggyensis Harlton
↑ Healdia carterensis Bradfield
↓ Healdia marginata Harlton
↑ Hollinella kellettae Knight
↓ Hollinella minuta Cooper, n. sp.
↑ Microparaparchites elongatus Cooper, n. sp.
↓ *Microparaparchites ovatus* Cooper, n. sp.
↑ Moorites punctus (Wilson)
↑ Silenites fabalis Cooper, n. sp.
↑ Waylandella dispar Cooper, n. sp.
↑ Waylandella obesa Cooper, n. sp.
↓ Waylandella regularis Cooper, n. sp.
MARMATON GROUP

Among the ostracode-bearing zones of this group, extending from the Hanover to the Exline limestone inclusive, are some of the best known fossiliferous zones of the entire Pennsylvanian system, which are associated with the most extensively mined coal beds in the Eastern Interior basin, numbers 5 to 7 inclusive. Species apparently restricted to the Marmaton are as follows:

Bairdia crassa Harlton
Bairdia menardvillensis Harlton
Coryellites contracta Cooper, n. sp.
Geisina gregaria Ulrich and Bassler
Geisina warthini Cooper, n. sp.
Healdia rectis Cooper, n. sp.
Hollinella levis Cooper, n. sp.
Microparaparchites brazoensis (Coryell and Sample)
Silenites lenticularis Knight

SUMMUM (Hanover) zone.—This zone contains two species of the genus Gutschickia heretofore recognized only in the Permian, where it occurs in a “freshwater” environment. Associated with these are species of Candona, Darwinula, and Hastifaba. Of the two previously described species from this zone, Healdiacypris perplexa Bradfield occurs in beds of equivalent age in the Ardmore basin. The presence of only one species each of the usually prolific genera of Bairdia and Cavellina is somewhat abnormal. A complete list of apparently restricted species follows. Most of the unrestricted species occur in nearby horizons (see fig. 10).

Candona planidorsata Cooper, n. sp.
*Darevilula pungens (Jones and Kirkby)
Gutschickia levis Cooper, n. sp.
Gutschickia ovata Cooper, n. sp.
*Hastifaba robusta Cooper, n. sp.
Healdiacypris perplexa Bradfield
Microparaparchites angustus Cooper, n. sp.

The opposite ranging species are:

†Amphissites transversus Roth
†Bairdia coryelli Roth and Skinner
†Candona salteriana (Jones and Kirkby)
†Cavellina equalis? Coryell
†Coryellites contracta Cooper, n. sp.
†Coryellites lowelli Cooper, n. sp.
†Coryellites tomlinsonella Cooper, n. sp.
†Fabalticypris wileyensis Cooper, n. sp.
†Geisina warthini Cooper, n. sp.
†Healdia limacoida Knight
†Healdia nucleolata Knight
†Healdia rectis Cooper, n. sp.
†Moorites spiciferus (Wilson)
†Sansabella whitei Bradfield
†Waylandella dispar Cooper, n. sp.

ST. DAVID zone.—Only one species of Healdia, a genus rarely providing good index forms, appears to be restricted to this zone, H. asper Cooper, n. sp. The occurrence of one species of Bairdia and none of Cavellina corresponds closely to a similar scarcity of these genera in the zone below, and as in the Summum, most of the unrestricted species occur in associated zones.

The species ranging up and down from the St. David are:

†Bairdiacypris nebraskensis (Upson)
†Coryellites contracta Cooper, n. sp.
†Coryellites ovata Cooper, n. sp.
†Healdia carterensis Bradfield
†Healdia granosa Cooper, n. sp.
†Healdia rectis Cooper, n. sp.
†Hollinella kellettiae Knight
†Macrocypris teretis Cooper, n. sp.

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*This name is not in accepted use in Illinois. It is employed in this report to conveniently compare Illinois strata with those in the Midcontinent region.
Pennsylvania Ostracodes

Craborchard zone.—No restricted species were found among the five known to occur in this zone which range throughout the Pennsylvanian section. No species of Bairdia or Healdia occur.

Brereton (Herrin) zone.—The cyclothem containing the extensively mined No. 6 coal carries a total of 31 species, 8 of which are restricted in their occurrence. Most of the well known genera are represented. However, only one species of Cavellina was recognized, C. rotunda Cooper, n. sp. The restricted species are as follows:

*Bairdia citiformis Knight
*Geisina gallowayi (Bradfield)
*Hollinella elongata Cooper, n. sp.
Hollinella pulchra (Moore)
Jonesina dubia Bradfield
Microcheilinella quadrata Cooper, n. sp.
Microparaparchites quadratus Cooper, n. sp.
Waylandella armdorensis (Bradfield)

Of these species Geisina gallowayi (Bradfield), Jonesina dubia Bradfield, and Bairdia citiformis Knight occur in correlative horizons in Oklahoma and Missouri. The last named species from the so-called Pawnee (probably Worland) in Missouri, has been reported by Bradfield from a much lower horizon in the Dornick Hills group. Hollinella pulchra (Moore) and Microparaparchites quadratus Cooper, n. sp., are known to occur in younger formations, the South Bend and East Mountain formations respectively of Texas. The unrestricted species have a uniform distribution.

Species ranging up and down from the Brereton are:

†Bairdia beedei Ulrich and Bassler
†Bairdia crassa Harlton
†Bairdia hoxbarensis Harlton
†Bairdia monstabilis Cooper, n. sp.
†Bairdia whitesidei Bradfield
†Bairdiacypris trojana (Wilson)
†Cavellina rotunda Cooper, n. sp.
†Ellipsella bradfieldi Cooper n. sp.
†Geisina gregaria (Ulrich and Bassler)
†Healdia glennensis Harlton
†Healdia oklahomaensis Harlton
Jamestown zone.—No less than 13 genera are represented in the fauna of 18 species found in this zone. Coryellites and Geisina have 3 species each and the others have one or two. Only two species of this moderately large ostracode fauna appear to be restricted. These are Geisina jolliffiana and Hastifaba pervulgata, both new species; the latter occurs in the Dornick Hills group of Oklahoma. The unrestricted species have about equal distribution in the Des Moines, Missouri and Virgil formations.

All except one of the opposite-ranging species of the Jamestown range downward, showing its close affinity with the Brereton. The list follows:

- Coryellites paralela (Knight)
- Geisina gregaria (Ulrich and Bassler)
- Geisina warthini Cooper, n. sp.
- Healdia elegens Warthin
- Hollinella dentata Coryell
- Kirkbya firma Kellett
- Macrocypris teretis Cooper, n. sp.

Bankston Fork zone.—There are no restricted species known from this zone; most of the fauna consists of species of Bairdia and Amphissites and it is uniformly distributed throughout the Pennsylvanian.

Piasa-Sparland zone.—The only apparently restricted form from a fauna totaling 26 species is Waylandella cuyleri Coryell and Booth, originally described from the Wayland shale in Texas, which is considerably higher stratigraphically than the Piasa-Sparland zone. As usual in the Des Moines a large part of this fauna is made up of species of Amphissites, Bairdia, and Coryellites, which account for nearly half of the species distributed among 13 genera. However, only one species of Cavellina is known. The unrestricted species show sporadic “highs” in two zones of each of the upper three series with 10 to 15 species in each as shown in figure 16.

Species ranging up and down from the Piasa-Sparland are:

- Cavellina lata Coryell
- Coryellites elongata Cooper n. sp.
- Coryellites similimina (Bradfield)
- Coryellites texensis (Coryell and Sample)
- Hollinella limata (Moore)
- Hollinella oklahomaensis (Harlton)
- Microparaparchites brazoensis (Coryell and Sample)
- Microparaparchites elongatus Cooper, n. sp.
- Microparaparchites wapanuckaensis (Harlton)
- Silenites lenticularis (Knight)
Lonsdale (Gimlet) zone.—The largest number of species (66) in any zone of the Des Moines and next to the largest number found in any Pennsylvanian zone in Illinois is associated with the Lonsdale limestone. Although 26 genera are represented, about half of the species belong to Basslerella, Bairdia, Coryellites, Healdia, and Hollinella. The unusually large number of species of Basslerella is noteworthy.

Thirty-two percent of the species are restricted. They are as follows:

Basslerella obesa Kellett
Basslerella? parallata Cooper, n. sp.
Basslerella rostrata (Knight)
Bairdiacypris shideleri (Delo)
*Carbonita agnes (Jones)
Cavellina cavellinoides (Bradfield)
Cavellina expansa Bradfield
Cavellina lintris Coryell and Sample
Discoidella convexa? Scott and Borger
Healdia usitata Cooper, n. sp.
*Hollinella novataensis Coryell and Osorio
*Jonesina deesensis Bradfield
Macrocypria garrisonensis Upson
*Microparaparchites cuneatus (Warthin)
Monoceratina levisi Harris and Lalicker
Monoceratina macoupini Scott and Borger
Paraparchites dispar Cooper n. sp.
Paraparchites fabula Cooper, n. sp.
*Proparaparchites paralectus Coope*, n. sp.

Species in the above list, Cavellina cavellinoides (Bradfield), C. lintris Coryell and Sample, Hollinella novataensis Coryell and Osorio, Jonesina deesensis Bradfield, and Microparaparchites cuneatus (Warthin) occur in formations of similar age in Oklahoma and Texas. The following previously described species have been reported from higher formations:—Basslerella obesa Kellett, Cavellina expansa Bradfield, Discoidella convexa? Scott and Borger, Kirkbyella pergrandis Kellett, Kirkbyella hex tensis (Harlton), Macrocypria garrisonensis Upson, Monoceratina levisi Harris and Lalicker and Monoceratina macoupini Scott and Borger. Basslerella rostrata (Knight) occurs in a lower zone, the so-called Pawnee limestone (probably Wolland) of Missouri. The large number of unrestricted species are distributed about equally among other zones.

The species from the Lonsdale (Gimlet) zone are approximately equally divided between those ranging into higher and lower zones; they are:

\[\text{Amphissites robustus Cooper, n. sp.}\]
\[\text{Ardmorea gibberosa (Knight)}\]
\[\text{Basslerella acuminata Cooper, n. sp.}\]
\[\text{Basslerella firma Kellett}\]
\[\text{Basslerella laciniosa Cooper, n. sp.}\]
\[\text{Bairdia crossa Harlton}\]
\[\text{Bairdia menardensis Harlton}\]
\[\text{Bairdia menardvillensis Harlton}\]
\[\text{Bairdia peracuta Warthin}\]
\[\text{Bairdiacypris acuminata Bradfield}\]
\[\text{Bythocypris subpediformis Bradfield}\]
\[\text{Coryellites scotti Cooper n. sp.}\]

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Fig. 17—Distribution of ostracode species occurring in the Lonsdale (Gimlet) zone (horizon 14).
Figure 18—Distribution of ostracode species occurring in the Exline zone (horizon 15).

Exline zone.—This zone, the highest in the Des Moines series, contains a moderately large number of ostracode species of which an unusually high percentage (34 percent) are restricted. The zone contains the usual preponderance of species in the more common genera, but the occurrence of 6 species of Cavellina is a marked increase over the number found in lower formations and slightly more than in any higher formation. The restricted species are

*Bairdia regularis* Cooper, n. sp.
*Cavellina daubeana* (Bradfield)
*Healdia minuta* Bradfield
*Healdia formosa* Harlton
*Jonesina bradyana* (Jones)
*Jonesina trisulcata?* Bradfield

Lochriella? angusta Cooper, n. sp.
Sansabella sulcata? Roundy

*Cavellina jejuna* Bradfield, *Cavellina minuta* Bradfield, *Healdia formosa* Harlton, and *Jonesina trisulcata?* Bradfield are species reported from strata of comparable age in Oklahoma and Texas. However, *Cavellina daubeana* (Bradfield), has been reported from higher formations.

The species ranging up and down from the Exline are:

*Bairdia ampla* Reuss
*Bairdia menardvillensis* Harlton
*Bairdiacypris nebraskensis* (Upson)
*Cavellina cunningensis* Payne
*Coryellites centralis* (Coryell and Billings)
*Coryellites johnsoni* (Upson)
*Healdia aspinosa* Cooper, n. sp.
*Healdia cara* Bradfield
*Healdia colony* Coryell and Booth
*Hollinella varthini* Cooper, n. sp.
*Microparaparchites brasoeensis* (Coryell and Sample)
*Moorites indentus* Cooper, n. sp.

MISSOURI SERIES

As indicated in the stratigraphic summary the correlation of Illinois beds above the Shool Creek limestone with those of the Midcontinent are uncertain and those indicated on the chart (fig. 2) are tentative and approximate, based on an analysis of the ostracode faunas that have been studied to date. The middle McLeansboro group is correlated with this series.

*Glyptopleura* is the only genus occurring in the Missouri series which has not been recorded from lower Pennsylvanian horizons, although it reaches its greatest development in the Chester. It is represented by the easily recognized *G. coryelli* found in several upper Pennsylvanian formations. Genera which do not occur above the Missouri series in Illinois are *Fabalicypris* and *Paraparchites*. The only species other than those restricted to a group or zone in this series are *Kirkbya arcuata* Roth and *Sansabella carbonaria* Cooper, n. sp.

\*This name is not in accepted use in Illinois. It is employed in this report to conveniently compare Illinois strata with those in the Midcontinent region.
Bronson Group

There are no species restricted to the group, other than those listed under its various zones.

Trivoli zone.—As usual, species of a few common genera, namely Amphissites, Bairdia and Healdia, make up about half of the total fauna of this zone. Cavellina, Coryellites, and Hollinella are each represented by two species. Restricted species are as follows:

*Bairdia symmetrica* Cooper, n. sp.  
*Healdia bicornis* Cooper, n. sp.  
*Paraparchites inornatus?* (McCoy)

The species ranging up and down from the Trivoli are:

↓*Healdia aspinosa* Cooper, n. sp.  
↓*Healdia cincta* Coryell and Billings  
↓*Healdia colonyi* Coryell and Booth  
↑*Hollinella shaevenensis* Kellett  
↑*Sansabella carbonaria* Cooper, n. sp.  
↑*Sansabella ovale* Cooper, n. sp.

Collinsville zone.—There is nothing unusual about this small fauna which contains no restricted species. The unrestricted species are found principally in the Upper Des Moines and lower Missouri series.

The following species range up and down from the Collinsville:

↓*Amphissites centronotus elongatus* Payne  
↑*Bairdia ciscoensis* Harlton

![Fig. 19: Distribution of ostracode species occurring in the Trivoli and Turner zones (horizon 16).](image)

![Fig. 20: Distribution of ostracode species occurring in the Collinsville zone (horizon 17).](image)

Shoal Creek zone.—Nearly three-fourths of the 15 species from this zone belong to Amphissites and Bairdia. Only one species, *Bairdia spinosa* Cooper, n. sp., is restricted but it is so distinctive that it is very easily recognized and may be considered (with the usual caution) a good marker. No species of Cavellina or *Healdia* are present. Most of the unrestricted species occur above the Des Moines.

The species ranging up and down from the Shoal Creek are:

↓*Amphissites girtyi* Knight  
↓*Bairdia coryelli* Roth and Skinner  
↓*Bairdia hoxbarensis* Harlton  
↑*Bairdia pomplioides* Harlton  
↑*Hollinella cushmani* Kellett  
↑*Kirkbya arcuata?* Roth

Kansas City Group

"Centralia" zone.—"Centralia" is a field term formerly used for certain beds a short distance above the Shoal Creek limestone. This name is now considered unsatisfactory, and the exact correlation

![Fig. 21: Distribution of ostracode species occurring in the Shoal Creek and Hicks zones (horizon 18).](image)
of beds referred to it, from which certain collections were obtained, is not definitely known. They may actually represent more than one ostracode-bearing zone (see p. 16). Collections referred to the "Centralia" have yielded 31 species, more than are known from any other identified zone in the Missouri series. This fauna is extremely varied, since 17 genera are represented, of which only three contain as many as three species each, namely Bairdia, Bythocypris, and Moorites. The following species are known to occur only in these collections:

- **Bairdia summa** Coryell and Billings
- *Bairdiacypris deloi* Bradfield
- Bythocypris disparilis Cooper, n. sp.
- Bythocypris quadrata Cooper, n. sp.
- Jonesina infrequens (Bradfield)
- *Microcheilinella bicornuta* Cooper n. sp.
- Sansabella bolliaformis (Ulrich and Bassler)
- *Sargentina tumida* Cooper, n. sp.

*Bairdiacypris deloi* Bradfield and *Jonesina infrequens* (Bradfield) occur in comparable beds in the Hoxbar group of Oklahoma and *Bairdia summa* Coryell and Billings is found considerably higher in the Wayland shale of Texas. Most of the unrestricted species are found in the Missouri and Virgil series.

Species apparently ranging up and down from the "Centralia" are:

- Amphissites robustus Cooper, n. sp.
- *Bairdia oklahomaensis* Harlton
- *Healdia simplex* Roundy
- *Holindia grandis* Cooper, n. sp.
- *Kellettina montosa* (Knight)
- *Kirkbya punctata* Kellett
- *Sansabella whitei* Bradfield

**Macoupin zone.**—This fauna contains 14 genera, the species of which are well distributed, *Bairdia* containing four species and *Coryellites* three, the other 12 having one to two species each. Although containing one of the larger ostracode faunas (26 species) in the Missouri series, only one, *Healdia ehlersi* Bradfield from a slightly lower horizon in Oklahoma is restricted to it. With a few exceptions the distribution of the unrestricted species is rather uniform from the Des Moines on.

The following species range up and down from the Macoupin:

- Amphissites robustus Cooper, n. sp.
- *Bairdia oklahomaensis* Harlton
- *Healdia simplex* Roundy
- *Holindia grandis* Cooper, n. sp.
- *Kellettina montosa* (Knight)
- *Kirkbya punctata* Kellett
- *Sansabella whitei* Bradfield

![Fig. 22—Distribution of ostracode species occurring in the "Centralia" zone (horizon 19).](image1)

![Fig. 23—Distribution of ostracode species occurring in the Hall and Macoupin zones (horizon 20).](image2)
LaSalle-Livingston-Millersville zone.—In this fauna of 41 species, more than half are classed under Amphissites, Bairdia, Healdia, and Hollinella. Of the comparatively large numbers of species restricted to this zone, Hollinella raderiae (Harlton) with its three nodes is the most easily recognized. Although this species has a wide range in the Midcontinent, as now known it is restricted to this zone in Illinois. The species which occur only in this zone are as follows (S = LaSalle, M = Millersville, L = Livingston):

- *Amphissites adjunctio* Cooper, n. sp. (L)
- *Amphissites congruens* Cooper, n. sp. (L)
- *Bairdia hooverae* Kellett (S)
- *Bairdia lunata* Bradfield (M)
- *Bairdicypris haydenbranchensis* Payne (M)
- *Ectodemitis geneae* (Roth) (M)
- *Ectodemitis sullivansensis* Payne (M)
- *Glyptopleura irregularis* Delo (M)
- *Healdia alba* Coryell and Billings (L)
- *Healdia carinata* Cooper, n. sp.
- *Healdia cf. H. obsolens* Delo (S)
- *Hollinella radlerae* (Harlton) (S)
- *Knightina harltoni* Kellett (M)

The LaSalle is comparable to the Stanton of Kansas, which also contains *Bairdia hooverae* Kellett. The presence of this and several other species in the Hayden Branch beds of Indiana indicates that the latter also is correlative with this zone. Other restricted species, common to the Millersville and Hayden Branch, are *Ectodemitis sullivansensis* (Payne), *Bairdicypris haydenbranchensis* (Payne) and *Knightina harltoni* (Kellett). Other species common to these two zones, but not restricted in the Illinois basin are *Amphissites centronotus* (Ulrich and Bassler) *Bairdia beedei* Ulrich and Bassler, *B. pompilioides* Harlton, and *Cavellina symmetrica* (Payne). The Livingston has *Healdia simplex* Roundy and *Cavellina pulchella* Coryell in common with the Hayden Branch.

*Bairdia lunata* Bradfield was first identified from the Hoxbar group in the Ardmore basin of Oklahoma while *Ectodemitis geneae* (Roth) is known from the Fort Scott into the Permian. *Ectodemitis sullivansensis* (Payne), *Bairdicypris haydenbranchensis* (Payne), and *Knightina harltoni* Kellett were all described from lower zones. *Glyptopleura irregularis* Delo heretofore has been known only from the Permian.

A number of species are common to two of the three zones. Those in the LaSalle-Millersville are *Amphissites centronotus* (Ulrich and Bassler) and *Glyptopleura coryelli* Harlton; those in the LaSalle-Livingston are *Bairdia monstrabilis* Cooper, n. sp., *Ectodemitis duttonensis* (Harlton), and *Kirkbya punctata* Kellett; and *Bairdia seminalis* Knight occurs in the Livingston-Millersville. The distribution of unrestricted species is quite uniform from middle Des Moines through the Virgil.
The following species range up and down from this zone:

- **Amphissites rothi** Bradfield
- **Bairdia crassimarginata** Cooper, n. sp.
- **Bairdia hurwitzi** Coryell and Booth
- **Bairdiacypris ardua** Cooper, n. sp.
- **Cavellina ovidiformis** (Harlton)
- **Cavellina symmetrica** (Payne)
- **Glyptopleura coryelli** Harlton
- **Hollinella limata** (Moore)
- **Kirkbya arcutata** Roth
- **Sansabella carbonaria** Cooper, n. sp.

**VIRGIL SERIES**

Although there are no significant breaks between beds of Missouri and Virgil age in Illinois the classification of the Midcontinent utilizing both of these terms is shown in the left column of the stratigraphic chart (fig. 2). This series is the equivalent of the upper McLeansboro. Missouri uses only one series for the Upper Pennsylvanian formations above the Des Moines.

Of the 33 genera represented in the Virgil, only one, *Kloedenella*, is not found in any of the lower Pennsylvanian series. The zones of this series contain increasing numbers of Permian species known largely from the Midcontinent region. Restricted species, other than those listed under the subordinate zones, are as follows:

- **Amphissites carinatus** Cooper, n. sp.
- **Bairdia blakei** Harlton
- **Bairdia scholii** Coryell and Booth
- **Candonina bairdioides** (Jones and Kirkby)
- **Carbonita inflata** (Jones and Kirkby)
- **Cavellina laevis** (Bradfield)
- **Cavellina subpulchella** Coryell
- **Gutschickia ninevehensis** (Holland)
- **Seminolites truncatus** Coryell

**DOUGLAS GROUP**

No strata of Peedee age in Illinois are definitely recognized and beds next above the LaSalle or its equivalents may be of Douglas age.

**Cohn zone.**—The few species known from this zone have a distinctly “fresh-water” aspect. The only restricted species are *Carbonita tenuis*, *Hastifata spinosa*, and *Kloedenella carbonica*, all new species.

![Distribution of ostracode species occurring in the Cohn zone (horizon 22).](image)

**Bogota zone.**—Of the 19 species found in the Bogota, 17 occur in other zones. The restricted species are *Hollinella grahamensis* (Harlton) and *Microcheilinella inflata* Kellett.

*Hollinella grahamensis* (Harlton) occurs in slightly older beds in Oklahoma and Texas, and *Microcheilinella inflata* Kellett is known from both lower and higher beds in Kansas. The unrestricted species are found in various zones above the middle Des Moines.

Species ranging up and down from the Bogota are:

- **Amphissites carinatus** Cooper, n. sp.
- **Bairdia blakei** Harlton
- **Candonina salteriana** (Jones and Kirkby)
- **Carbonita inflata** (Jones and Kirkby)
- **Cavellina laevis** (Bradfield)
- **Cavellina pulchella** Coryell
- **Cavellina subpulchella** Coryell
- **Hollinella crassimarginata** Kellett
- **Kirkbya kellettae** Harlton
- **Seminolites truncatus** Coryell

![Distribution of ostracode species occurring in the Bogota zone (horizon 23).](image)
SHAWNEE GROUP

Little Vermilion zone.—An unusually large number of genera (19) is represented in this moderately large fauna of 30 species. The only genera represented by more than two species are Bairdia and Coryellites. This zone has the following restricted species:

Discoidella perminuta? (Kellett)
Healdia masoni Coryell and Booth
Knightina ampla Kellett
*Microcheiinella unispinosa Cooper, n. sp.
*Monoceratina bradfieldi Cooper, n. sp.
Sansabella brevis Cooper, n. sp.
Sargentina elongata Cooper, n. sp.

The presence of the Wayland and Deer Creek species, Healdia masoni Coryell and Booth and Knightina ampla Kellett, indicate the Shawnee age of this zone, although the latter species has been reported from the Belle City, an older zone in Oklahoma. As in other Upper Pennsylvanian zones the unrestrict species find their greatest distribution above the middle Des Moines.

Species ranging up and down from the Little Vermilion are:

↓ Bairdia scholli Coryell and Booth
↓ Bythocypris subediformis Bradfield
↓ Cavellina ovoidiformis (Harlton)

*Healdia oklahomaensis Harlton
↓ Jonesinina subquadrate? Delo
↓ Kelletina robusta? (Kellett)
↓ Lochriella elongata Cooper, n. sp.
↓ Sansabella ovale Cooper, n. sp.

Omega zone.—This small fauna contains one restricted species, Carbonita magna (Upson).

Newton-Shumway zone.—The largest fauna (68 species) found in the Pennsylvanian of Illinois occurs in this zone. This fauna comprises 23 genera, with unusually large numbers of Bairdia (18 species), Coryellites (9 species) and Cavellina (7 species), and Hollinella (8 species). Others well-represented are Healdia and Moorites with four species each. Of the total number of species about one-third come from the Newton, more than one-third from the Shumway, while less than one-fourth occur in both zones. The fauna is a mixture of marine and “fresh-water” types and probably indicates a brackish water habitat, although the possibility of the mixing of faunas by current transportation must be recognized. The “fresh-water” genera represented are Candona, Carbonita, and Gutschickia, present in both the Newton and Shumway. These make up a group of easily recognized forms which occur in or associated with underclay limestones. More than one-fourth of the species (28 percent) are restricted, as follows (N = Newton, S = Shumway):

Basslerella ovata Cooper, n. sp. (N)
Bairdia garrisonensis Upson (S)
Bairdia kingii Reuss (N)
Bairdia pinula Coryell and Booth (S)
*Bairdia cf. B. rhomboidea Kirkby (S)
Bairdia verwiebei Kellett (N, S)
Cavellina lirata (Bradfield) (N)
*Cavellina nebraseensis (Geinitz) (N)
Coryellites mytiliformis (Bradfield) (N)
Gutschickia subanguilata (Jencks and Kirkby) (N)
* Healdia coryelli Kellett (N, S)  
* Hollinella emaciata (Ulrich and Bassler) (N)  
* Hollinella gibbosa Kellett (N, S)  
* Hollinella moorei Cooper, n. sp. (N)  
* Jonesina elongata Cooper, n. sp. (S)  
* Lochriella ampla Cooper, n. sp. (S)  
* Seminolites elongatus Coryell (S)  
* Silenites silenus Coryell and Booth (N)

A number of species indicate a close correlation of this zone with the Wayland shale of Texas and the middle Virgil of Kansas. Good markers, suggesting that this zone is of upper Shawnee or even possibly lower Waubaumsee age, are Bairdia pinnula Coryell and Booth (Wayland shale), Cavellina nebrascensis (Geinitz) (Burlingame-Permian), Healdia coryelli Kellett (Howard formation), Hollinella moorei Cooper, n. sp., (Wayland shale), and Silenites silenus Coryell and Booth (Wayland shale).

This large fauna is fairly evenly distributed between the Newton (22 species) and Shumway (28 species); 18 species are common to both. As would be expected most of the unrestricted species are found in the zones below this one (fig. 29).

The following species range above and below this zone. About 60 percent are from the Newton, and as in the Shumway the predominance is downward.

\[\downarrow\text{Basslerella lacrimosa Cooper, n. sp. (N)}\]
\[\downarrow\text{Basslerella ovata Cooper, n. sp. (N)}\]
\[\downarrow\text{Bairdia altifrons Knight (S)}\]
\[\downarrow\text{Bairdia beedei Ulrich and Bassler (S)}\]
\[\uparrow\text{Bairdia blakei Harlton (S)}\]
\[\uparrow\text{Bairdia demissa Cooper n. sp. (S)}\]
\[\downarrow\text{Bairdia kurwitzi Coryell and Booth (N)}\]
\[\downarrow\text{Bairdia monstrabilis Cooper, n. sp. (S)}\]
\[\downarrow\text{Bairdicypris ardua Cooper, n. sp. (S, N)}\]
\[\downarrow\text{Carbonita inflata (Jones and Kirkby) (N)}\]
\[\downarrow\text{Cavellina footei (Coryell and Booth) (N)}\]
\[\downarrow\text{Cavellina laevis (Bradfield) (N)}\]
\[\downarrow\text{Cavellina symmetrica (Payne) (S, N)}\]
\[\downarrow\text{Cavellina tongia? (Coryell and Sample) (N)}\]
\[\downarrow\text{Cornicella tuberculosipinosa (Jones and Kirkby) (N)}\]
\[\downarrow\text{Coryellites firma Kellett (N)}\]
\[\downarrow\text{Coryellites ovata Cooper, n. sp. (S)}\]
\[\downarrow\text{Coryellites palopintoensis (Coryell and Sample) (S)}\]
\[\downarrow\text{Coryellites pediformis (Knight) (S)}\]
\[\downarrow\text{Coryellites subelliptica (Upson) (S)}\]
\[\downarrow\text{Coryellites texensis (Coryell and Sample) (S, N)}\]
\[\downarrow\text{Discoidella lingulata Cooper, n. sp. (N)}\]
\[\downarrow\text{Ellipsella calcar (Harlton) (N)}\]
\[\downarrow\text{Healdia simplex Roundy (N)}\]
\[\uparrow\text{Hollinella burlingamensis Kellett (N)}\]
\[\uparrow\text{Hollinella oklahomensis (Harlton) (N)}\]
\[\uparrow\text{Hollinella shawensis Kellett (S, N)}\]
\[\downarrow\text{Moorites elongatus? (Jones and Kirkby) (S)}\]
\[\downarrow\text{Moorites indentus Cooper, n. sp. (S)}\]
\[\downarrow\text{Moorites knighti (Wilson) (N)}\]
\[\downarrow\text{Seminolites truncatus Coryell (S)}\]
\[\downarrow\text{Sucella sulcata Coryell and Sample (N)}\]
WABAUNSEE GROUP

There are no species that are known to be restricted to this group.

Greenup zone.—The Greenup fauna is small (12 species in 5 genera), but contains a disproportionately large number of Bairdia.

There are no species of ostracodes common to the Greenup and Omega, thought by some to be equivalent horizons. All species of the small Omega fauna are fresh-water types, while none of this character are known to occur in the Greenup. The following are known only from the Greenup:

Bairdia concava Cooper, n. sp.
Macrocypris bicurvata Cooper, n. sp.
Macrocypris lenticularis Cooper, n. sp.

Fig. 30—Distribution of ostracode species occurring in the Greenup zone (horizon 27).

This name is not in accepted use in Illinois. It is employed in this report to conveniently compare Illinois strata with those in the Midcontinent region.

Woodbury zone.—The youngest ostracode-bearing zone in the Pennsylvanian of Illinois includes only one restricted species Ectodemies edsonae (Bradfield) previously known from the Hoxbar group of Oklahoma. The fauna is small (20 species in 10 genera) and is dominated by the presence of 5 species of Bairdia. Other genera are represented by one to two species each. The unrestricted species are predominately Virgil in age, with lesser numbers in the Missouri and upper Des Moines.

Fig. 31—Distribution of ostracode species occurring in the Woodbury zone (horizon 28).
1. NW.\(\frac{1}{4}\) sec. 11, T. 5 S., R. 4 W., Spencer County, Indiana. Shale on top of Fulda limestone; collection 942-2.

2. NW.\(\frac{3}{4}\) sec. 20, T. 6 S., R. 4 W., Spencer County, Indiana. Shale below Ferdinand limestone; collection 943-1, 2.

3. NE.\(\frac{1}{4}\) sec. 21, T. 17 N., R. 1 E., Henry County, Illinois. Shale below Seville limestone; collection 510 by H. L. Geis.

4. SW.\(\frac{1}{4}\) sec. 32, T. 14 N., R. 2 W., Mercer County, Illinois. Shale between Seville limestone beds; collection 500 by H. L. Geis.


6. SW.\(\frac{1}{4}\) sec. 24, T. 15 N., R. 4 W., Mercer County, Illinois. Shale parting in upper part of Seville limestone; collection 504A by H. L. Geis.

7. SW.\(\frac{1}{4}\) sec. 26, T. 17 N., R. 1 W., Rock Island County, Illinois. Shale on top of Seville limestone; collection 508 by H. L. Geis.


9. NW.\(\frac{1}{4}\) sec. 32, T. 1 N., R. 2 W., Brown County, Illinois. Shale below Seaver limestone; collection 608-1.

10. Sec. 1, T. 73 N., R. 20 W., Lucas County, Iowa. Shale above, between, and below lower Seaver limestone; collection 663-1 by J. M. Weller.

11. SE.\(\frac{1}{4}\) sec. 13, T. 72 N., R. 16 W., Monroe County, Iowa. Shale below lower Seaver limestone; collection 664-1 by J. M. Weller.

12. NE.\(\frac{1}{4}\) sec. 36, T. 17 N., R. 4 W., Rock Island County, Illinois. Irregular shale bands in Seaver limestone; collection 507 by H. L. Geis.

13. SW.\(\frac{1}{4}\) sec. 36, T. 17 N., R. 9 W., Vermilion County, Indiana. Shale from Wiley cyclothem; collection 575-1.

14. SW.\(\frac{1}{4}\) sec. 6, T. 2 S., R. 3 W., Brown County, Illinois. Shales adjacent to Oak Grove limestone beds; collection 607-1, 2, 3, 5.

15. SE.\(\frac{1}{4}\) sec. 6, T. 5 N., R. 3 E., Fulton County, Illinois. Shale between Oak Grove limestone beds; collection 487C by H. L. Geis.

16. NW.\(\frac{1}{4}\) sec. 17, T. 5 N., R. 4 E., Fulton County, Illinois. Shale above Liverpool limestone; collections 486A and 553B by H. L. Geis.

17. SE.\(\frac{1}{4}\) sec. 17, T. 8 N., R 3 E., Fulton County, Illinois. Shale in Liverpool marine zone; collection 620-1, 2; clod from limestone in Liverpool marine zone; collection 620-3, 4.

18. NW.\(\frac{1}{4}\) sec. 20, T. 8 N., R. 3 E., Fulton County, Illinois. Shale between Liverpool limestone beds; collection 496C by H. L. Geis.

19. S.\(\frac{1}{4}\) sec. 36, T. 17 N., R. 4 E., Henry County, Illinois. Shale above and below upper bed, Liverpool limestone; collection 627-2.

20. SW.\(\frac{1}{4}\) sec. 35, T. 34 N., R. 1 E., LaSalle County, Illinois. Shale between thin limestones of Oak Grove formation; collections 403A, B by H. L. Geis.

21. NE.\(\frac{1}{4}\) sec. 36, T. 12 N., R. 1 W., Warren County, Illinois. Shale below Liverpool limestone; collection 498 by H. L. Geis.

22. SE.\(\frac{1}{4}\) sec. 29, T. 2 S., R. 6 W., Adams County, Illinois. Shales in and below lower limestone, Liverpool cyclothem; collection 470-1, 2, 3.

23. NW.\(\frac{1}{4}\) sec. 21, T. 6 N., R. 3 E., Fulton County, Illinois. Shales between limestone members, Liverpool cyclothem; collection 618-1.

24. NW.\(\frac{1}{4}\) sec. 13, T. 10 N., R. 3 E., Knox County, Illinois. Shales between limestone members, Liverpool cyclothem; collection 626-1, 2, 3.

25. SE.\(\frac{1}{4}\) and NE.\(\frac{1}{4}\) sec. 13, T. 1 N., R. 5 W., Adams County, Illinois. Shale below base of Hanover limestone; collection 606-1.

26. NW.\(\frac{1}{4}\) sec. 24, T. 1 N., R. 5 W., Adams County, Illinois. Shale below Hanover limestone; collection 471B by H. L. Geis, 471-3 by C. L. Cooper.

27. NW.\(\frac{1}{4}\) sec. 8, T. 11 N., R. 4 E., Knox County, Illinois. Summum cyclothem; shale between nodular limestone, below coal no. 4, collection 491-I, by H. L. Geis.

28. SW.\(\frac{1}{4}\) sec. 8, T. 32 N., R. 2 E., LaSalle County, Illinois. Shales above and in top of Hanover limestone; collection 629-2, 3.

29. SW.\(\frac{1}{4}\) sec. 21, T. 6 N., R. 3 E., Fulton County, Illinois. Shales above and below St. David limestone; collections 488A, B, and C by H. L. Geis.

30. SW.\(\frac{1}{4}\) sec. 17, T. 6 N., R. 4 E., Fulton County, Illinois. Shale above St. David limestone; collection 615-1.
31. NW 1/4 sec. 8, T. 11 N., R. 4 E., Knox County, Illinois. St. David cyclothem; shale above no. 5 coal; collection 491A by H. L. Geis.

32. SW 1/4 sec. 8, T. 32 N., R. 2 E., LaSalle County, Illinois. Shales below St. David limestone; collection 629-4.

33. SW 1/4 sec. 9, T. 5 S., R. 6 W., Randolph County, Illinois. Shale below St. David limestone; collection 443-1.


36. SE 1/4 SW 1/4 sec. 30, T. 9 S., R. 4 E., Williamson County. Shale above Crab-orchard limestone; collection 519-1.


38. NW 1/4 sec. 1, T. 7 N., R. 4 E., Fulton County, Illinois. Shale above and below Brereton limestone; collection 489A, B by H. L. Geis.


40. NE 1/4 sec. 8, T. 14 N., R. 5 E., Henry County, Illinois. Shale at base of Brereton limestone; collection 602-1 by B. C. Parks.

41. NW 1/4 sec. 13, T. 33 N., R. 1 E., LaSalle County, Illinois. Shale below Brereton limestone; collection 406A by H. L. Geis.


43. NE 1/4 sec. 3, T. 2 S., R. 10 W., Monroe County, Illinois. Shale above no. 6 coal, Brereton cyclothem; collection 342-1 by J. N. Payne.

44. SE 1/4 sec. 25, T. 13 N., R. 11 W., Morgan County, Illinois. Shale beneath Brereton limestone; collection 109-3 by E. C. Dapples.

45. SW 1/4 sec. 31, T. 5 S., R. 2 W., Perry County, Illinois. Shale below Brereton limestone; collection 603-1 by B. C. Parks.

46. SW 1/4 sec. 9, T. 5 S., R. 6 W., Randolph County, Illinois. Shale above Brereton limestone; collection 427-1.


50. NE 1/4 sec. 18, T. 12 N., R. 9 W., Macoupin County, Illinois. Shale between and beneath Jamestown (?) limestone; collection 109-3, 8 by E. C. Dapples.


54. NE 1/4 NE 1/4 sec. 25, T. 8 S., R. 10 W., Jersey County, Illinois. Shale below Piasa limestone; collection 636-1.

55. NE 1/4 sec. 11, T. 16 N., R. 6 W., (Ralls Ford), Sangamon County, Illinois. Sparland cyclothem, one foot above coal, collection 102-3 by E. C. Dapples.


57. SE 1/4 sec. 24, T. 16 N., R. 10 E. on Negro Creek, 1/2 mile southwest of Seatonville, Bureau County, Illinois. Shales near base of stratigraphic section, Gimlet cyclothem; collection 410-1, 2.


59. NW 1/4 sec. 6, T. 8 N., R. 5 E., Peoria County, Illinois. Shale between thin limestone 8 feet below Lonsdale limestone; collection 598-1 by E. C. Dapples.

60. NE 1/4 sec. 10, T. 8 N., R. 6 E., Peoria County, Illinois. Shale from nodular zone in lower part of upper bench of Lonsdale limestone; collection 83-1 by E. C. Dapples.

61. NE 1/4 sec. 11, T. 8 N., R. 6 E., Peoria County, Illinois. Shale below Lonsdale limestone; collection 79-2 by E. C. Dapples.

COLLECTING LOCALITIES 37


64. NE. 1/4 sec. 28, T. 14 N., R. 10 W., Edgar County, Illinois. Shale above Brouillet coal; collection 727-2 by A. F. Agnew.


68. SW. 1/4 sec. 29, T. 14 N., R. 10 W., Edgar County, Illinois. Shale above Trivoli limestone; collection 538-1, 2.

69. SW. 1/4 sec. 3, T. 8 N., R. 5 E., Peoria County, Illinois. Shale above limestone at type locality of Trivoli (No. 8) coal; collection 62-1 by E. C. Dapples.

70. SW. 1/4 sec. 3, T. 8 N., R. 5 E., Peoria County, Illinois. Shale between upper and lower Trivoli limestone; collection 417 by H. L. Geis.

71. SE. 1/4 sec. 30, T. 16 N., R. 5 W., Sangamon County, Illinois. Shale 1 1/2 feet above Trivoli (No. 8) coal; collection 100-1 by E. C. Dapples.


73. SW. 1/4 sec. 34, T. 3 N., R. 8 W., Madison County, Illinois. Shale from Collinsville limestone; collection 379-1 by J. N. Payne.


75. SW. 1/4 sec. 11, T. 2 N., R. 4 W., Clinton County, Illinois. Shale above Shoal Creek limestone; collection 820-1.

76. NE. 1/4 sec. 34, T. 2 N., R. 4 W., Clinton County, Illinois. Shale below Shoal Creek limestone; collection 373-1 by J. N. Payne.

77. NW. 1/4 sec. 36, T. 10 N., R. 7 W., Macoupin County, Illinois. Shale parting in upper Shoal Creek limestone; collection 449A by H. L. Geis.


79. SE. 1/4 sec. 6, T. 6 N., R. 4 W., Bond County, Illinois. Shale above “Centralia” limestone; collection 420 by H. L. Geis.


81. SE. 1/4 sec. 4, T. 1 N., R. 1 E., Marion County, Illinois. “Centralia” formation; collection 428-1, 2, 3.

82. SW. 1/4 sec. 19, T. 7 N., R. 4 W., Montgomery County, Illinois. Shales above and below “Centralia” limestone; collections 419A, B by H. L. Geis.

83. SW. 1/4 sec. 10, T. 9 N., R. 14 W., Clark County, Illinois. Shale below Macoupin limestone; collection 542-1, 2.

84. SW. 1/4 sec. 2, T. 14 N., R. 11 W., Edgar County, Illinois. Shale on top of Macoupin limestone; collection 571-1, 2.


86. NW. 1/4 sec. 2, T. 9 N., R. 7 W., Macoupin County, Illinois. Shale above Macoupin coal; collection 334-1 by J. N. Payne.


89. NW. 1/4 sec. 33, T. 16 N., R. 11 E., Bureau County, Illinois. Marl below LaSalle limestone; collection 338-1 by J. M. Schopt.


91. NE. 1/4 sec. 6, T. 32 N., R. 2 E., LaSalle County, Illinois. Shale from LaSalle cyclothem; collection 446A by H. L. Geis.

92. NW. 1/4 sec. 5, T. 3 N., R. 11 W., near old highway bridge over Embarrass River, Lawrence County, Illinois. Shale above Livingston (?) limestone; collection 359-1.

93. NE. 1/4 sec. 12, T. 7 S., R. 9 E., White County, Illinois. Shale below and within Livingston (?) limestone; collection 745-1, 2.

94. SE. 1/4 sec. 1, T. 11 N., R. 12 W., Clark County, Illinois. “Fresh-water” limestone and shale in Cohn cyclothem; collection 543-1a.

96. NW 1/4 sec. 29, T. 8 N., R. 1 E., Fayette County, Illinois. Shale above limestone bed, Cohn cyclothem; collection 749-3.
100. SE 1/4 sec. 20, T. 5 N., R. 8 E., Jasper County, Illinois. Shale below limestone bed, Bogota cyclothem; collection 741-2.
101. NW 1/4 sec. 27, T. 7 N., R. 10 E., Jasper County, Illinois. Shale below limestone, Bogota cyclothem; collection 734-2.
102. SW 1/4 sec. 11, T. 33 N., R. 1 E., LaSalle County, Illinois. Shales between limestone beds in the Little Vermilion cyclothem; collection 404A, B by H. L. Geis.
103. SE 1/4 sec. 36, T. 33 N., R. 1 E., LaSalle County, Illinois. Shale in Little Vermilion limestone; collection 401A by H. L. Geis; collection 401-1 by C. L. Cooper.
104. NE 1/4 sec. 4, T. 4 N., R. 5 E., Clay County, Illinois. Shale below Shelbyville limestone; collection 436B by H. L. Geis.
107. SW 1/4 sec. 22, T. 10 N., R. 6 E., Shelby County, Illinois. Shale above and below upper limestone, Shumway cyclothem; collection 752-1, 2.
108. SE 1/4 sec. 35, T. 9 N., R. 7 E., Cumberland County, Illinois. Shale parting in Newton limestone; collection 719-1, 2.
110. NW 1/4 sec. 6, T. 6 N., R. 10 E., Jasper County, Illinois. Shale below Newton limestone; collection 711-1.
111. NW 1/4 sec. 15, T. 7 N., R. 10 E., Jasper County, Illinois. Shale below Newton limestone; collection 732-1.
112. SW 1/4 sec. 33, T. 12 N., R. 3 E., Shelby County, Illinois. Shales above and below thin limestone, Newton cyclothem; collection 440A, B by H. L. Geis; 440-1, 2 by C. L. Cooper.
114. NW 1/4 sec. 10, T. 9 N., R. 9 E., Cumberland County, Illinois. Shale above Greenup limestone; collection 723-1.
117. Shale pit of Hydraulic Pressed Brick Company, east of Dallas, road between Conway and Olive Streets, St. Louis County, Missouri. Shale portions in Lexington caprock, Knight's (1928, p. 336) locality 9; collection 598-1 by R. V. Hollingsworth.
118. NW 1/4 sec. 18, T. 4 N., R. 17 E., Pittsburg County, Oklahoma. Wapanucka limestone in old cement-plant quarry 1 1/2 miles south of Hartshorne; hard dark shale at west end of cut, 30-40 feet above base; collection 217B by H. L. Geis.
119. High north bank of Concho River, just east of Concho-Tom Green County line, Texas, and 200 yards west of ford on J. W. Bailey farm. Shaly limestone at top of section of "Arroyo" (Canyon) formation; collection 188A by H. L. Geis.
120. State Highway 21, 0.65 mile south of Barnett's store, near Wirt Wood County line, West Virginia. Shale below a limestone about 125 feet below the Nineveh limestone member, Greene formation, Dunkard series; collection 693-3.
SYSTEMATIC DESCRIPTIONS

Family Acronotellidae Swartz, 1936
Genus Monoceratina Roth, 1928

Monoceratina ardmorensis (Harlton)

Plate 1, figure 9


Monoceratina ardmorensis, Harlton, 1933, Jour. Paleontology, vol. 7, p. 21, pl. 7, figs. 14a, b; Johns Valley shale, Oklahoma.

Carapace small, elongate; dorsal margin straight; ventral margin convex, anterior end rounded; posterior end acuminate; ventral spine large, sharp, flaring at base, and extended laterally for considerable distance.

Length, 0.60 mm; height, 0.28 mm.
Fulda limestone, locality 1.

Monoceratina bradfieldi Cooper, n. sp.

Plate 1, figures 1-6


Carapace small, elongate, lateral outline subrectangular; hinge line long, straight, ends subequally rounded; ventral margin convex; depressed areas medially and anteriorly broad and very shallow; ventral spine short, widely flaring at base, joining an inflated portion of posterior half of shell; posterior end unusually wide; surface punctate.

Length, 0.50 mm; height, 0.25 mm; width, 0.22 mm.
This species is characterized by the low, broad anterior and posterior inflations and by the unusually wide posterior end.
Little Vermilion cyclothem, locality 105.

Monoceratina lewisi Harris and Lalicker

Plate 1, figures 10-12

Monoceratina lewisi Harris and Lalicker, 1932, Am. Midland Naturalist, vol. 13, p. 398, pl. 36, figs. 6a, b; Ft. Riley limestone, Kansas. —Kellett, 1935, Jour. Paleontology, vol. 9, p. 158, pl. 16, figs. 4a, b; Kanwacka shale to Winfield formation, Kansas.

Triceratina wrefordensis Upson, 1933, Nebraska Geol. Survey, Bull. 8, p. 29, pl. 3, figs. 1a-c; Hughes Creek shale, Nebraska.

Carapace small, elongate; dorsal margin straight; ventral margin convex, almost straight in central portion; anterior end rounded, posterior end acuminate to bluntly rounded; ventral spine long, slender, sharply directed laterally with only slight inclination posteroven-trally; central node above spine, slightly closer to dorsal margin, anterior node about central in anterior half; surface punctate.

Length, 0.43 mm; height, 0.21 mm; width, 0.21 mm.
Gimlet zone, locality 62.

Monoceratina macoupeni Scott and Borger

Plate 1, figure 13

Monoceratina macoupeni Scott and Borger, 1941, Jour. Paleontology, vol. 15, p. 355, pl. 49, figs. 2, 3; Macoupin formation, Illinois.

Monoceratina lawrencevillensis Scott and Borger, 1941, Idem, p. 355, pl. 49, figs. 8, 9; Macoupin formation, Illinois.

Carapace small, elongate; dorsal margin straight, and produced into very long acuminate posterior termination; ventral margin flat to slightly convex; anterior end rounded.

Length, 0.50 mm; height, 0.22 mm; width, 0.18 mm.
The ventral spine is the only surface ornamentation showing on this specimen, which is a cast.
Gimlet zone, locality 62.

[39]
Family **Acemminidae** Swartz, 1936
Genus **Ardmorea** Bradfield, 1936
**Ardmorea gibberosa** (Knight)

Plate 1, figures 7, 8

**Acemina? giberosa** Knight, 1928, Jour. Paleontology, vol. 2, p. 235, pl. 31, figs. 9a, b; Pawnee limestone,\(^{16}\) Missouriana.


Carapace subelliptical to semicircular in lateral outline, dorsal margin arched, ventral margin convex, ends equally rounded; hinge long, straight, depressed in central portion; centrodorsal region inflated; surface smooth, unornamented.

Length, 0.47 mm; height, 0.27 mm; width, 0.21 mm.

Lateral outline is almost identical to **Acemina cuspidata** Jones and Holl, (1869, p. 218), but the long medial spine has degenerated until only a slightly inflated area remains.

Seville and Gimlet zones, localities 6, 62.

**Family Bairdiidae** Sars, 1887
Genus **Bairdia** McCoy, 1846
**Bairdia acuminata** Cooper, n. sp.

Plate 1, figures 27, 28

Carapace elongate, dorsum broadly arched, ventral margin slightly convex, curving very gradually from a point slightly ahead of middle to anterior end; posteroventral curvature slight to meet short, low, acuminate posterior back; anterior end narrow, rounded, slightly below midheight; overlap conspicuous along dorsum, wanting along venter; surface smooth.

Length, 1.05 mm; height, 0.51 mm; width, 0.34 mm.

**B. acuminata** can be recognized by its very short acuminate beak lying well below midheight.

Bogota and Little Vermilion zones, localities 103, 107.

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**Bairdia altifrons** Knight

Plate 1, figures 20-22

**Bairdia altifrons** Knight, 1928, Jour. Paleontology, vol. 2, p. 324, pl. 43, figs. 6a, b; upper Ft. Scott formation, Missouri. Warthin, 1930, Oklahoma Geol. Survey Bull. 55, p. 70, pl. 5, figs. 10a, b; Wewoka-Holdenville formations, Oklahoma. —Kellett, 1934, Jour. Paleontology, vol. 8, p. 135, pl. 18, figs. 6a, b; Ft. Scott formation, Kansas. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 42, pl. 4, figs. 4, 5; Stanton formation, Nebraska.

**Bairdia chasae** Kellett, 1934, Jour. Paleontology, vol. 8, p. 135, pl. 18, figs. 5a-d; pl. 19, figs. 5a-d; Upper Shawnee group, Kansas.


Carapace ovate or subellipsoid; dorsal margin strongly convex; ventral margin straight to slightly concave except near anterior; anterior end broadly rounded; posterior beak short and well below midheight; greatest height nearly central; overlap strong, complete around entire margin, even along posterodorsal slope.

Length, 1.14 mm; height, 0.54 mm; width, 0.42 mm.

**B. altifrons** is characterized by the broadly arched dorsum, the prominent overlap, and a short, steep posterodorsal slope to the beak.

This species, reported from the upper Des Moines and Missouri series of the Midcontinent, is found in almost every zone throughout the Pennsylvanian system in Illinois, from the Seville to the Shumway, localities 8, 14, 38, 40, 53, 54, 62, 66, 68, 77, 83, 85, 88, 99, 103, and 109.

**Bairdia ampla** Reuss

Plate 1, figures 45-49


\(^{16}\)According to recent correlations, (see Weller, Wanless, Cline, and Stookey, 1945) the beds originally designated by Knight as upper Fort Scott and Pawnee limestone in the St. Louis area are now referred to the St. David (Ill.-Houx (La.-Mo.) and Pissa (III.-Worland (La.-Mo.) limestones respectively.
Bairdia texana H bulbs 1927 (not H bulbs, 1929), Jour. Paleontology, vol. 1, p. 210, pl. 33, fig. 9, Hoxbar group, Oklahoma.

Carapace elongate, dorsal margin regularly arched, ventral margin convex; centrodorsal and anterodorsal margins merge imperceptibly; posterodorsal slope short and steep, resulting in a small posterodorsal angle; beak short, wide, and acuminate; anterior end broadly rounded; overlap pronounced around dorsal margins, slight along venter, especially near each end; surface smooth.

Length, 1.16 mm; height, 0.59 mm; width, 0.46 mm.

There is considerable variation in the forms described under B. ampla, which range in age from Lower Mississippian to Upper Permian. If the types were assembled, at least four distinct species probably could be recognized; two from the Permian of Great Britain (Jones and Kirkby, 1860) and Germany (Richter, 1867) one from the Carboniferous (Chester) of Great Britain and Mongolia (Jones & Kirby, 1879, 1892) and one from the Tournasian (Kinderhook) of Germany (Kummerow, 1939). The Illinois and Oklahoma forms from the uppermost Pennsylvanian formations appear to be comparable to B. ampla, Jones and Kirkby, 1860.

B. altifrons Knight also possesses the regularly arched dorsum of B. ampla, but lacks the concave venter.


Bairdia angusta Cooper, n. sp.

Plate 1, figures 41-44

Carapace short, tumid; dorsal margin arched, ventral margin straight; posterodorsal and anteroven- tral margins merge smoothly with dorsum; anterior end very broad, rounded, termination above midheight; posterodorsal slope straight or slightly convex; beak short, wide, and acuminate; overlap greatest on middorsal and ventral margins; very slight on anterior margin; surface granulose.

Length, 1.21 mm; height, 0.79 mm; width, 0.62 mm.

B. angusta has a wider anterior and a straighter dorsum than B. seminalis although the posterior development seems identical. It also lacks the acuminate anterior of B. blakei Harlton and the extended beak of B. crassa Harlton.

Seville formation, locality 4.

Bairdia ardmoresensis Harlton

Plate 1, figures 14, 15

Bairdia ardmoresensis Harlton, 1929 (not 1933), Am. Jour. Sci., ser. 5, vol. 18, p. 267, pl. 2, fig. 11; Dornick Hills group, Oklahoma.

Carapace large, elongate; dorsal margin highly arched, ventral margin convex; anterior end rounded but narrow; posterior end long, narrow, and terminated well below midheight; overlap very wide in centrodorsal area, decreasing on downward slope towards ends, very faint along postero- and anteroven- tral margins, increasing appreciably in center; posterodorsal slope long and straight.

Length, 1.30 mm; height, 0.69 mm; width, 0.45 mm.

Bairdia ef. B. ardmoresensis (Bradfield, 1935, p. 92) may be young moul of this species.

Ferdinand zone, locality 2.

Bairdia beedei Ulrich and Bassler

Plate 1, figures 35-40

Bairdia beedei Ulrich and Bassler, 1906, U. S. nat. Museum Proc., vol. 30, p. 161, pl. 11, figs. 19, 20; Cottonwood shale, Kansas. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 69, pl. 5, figs. 9a, b; Holdenville formation, Oklahoma. —Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 16, pl. 1, figs. 4a-c; Garrison shale, Nebraska. —Kellett, 1934, Jour. Paleontology, vol. 8, p. 123, pl. 14, figs. 1a-h, 2; Upper Pennsylvanian and Permian, Kansas. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 38, pl. 4, figs. 1, 2; Missouri series, Nebraska. —Payne, 1937, Jour. Paleontology, vol. 11, p. 282, pl. 38, figs. 9a, b; pl. 39, figs. 1a, b; Hayden Branch formation, Indiana.
Bairdia beedei abrupta Ulrich and Bassler, 1906, U. S. Nat. Museum Proc., vol. 30, p. 162, pl. 11, figs. 21, 22; Cottonwood shale, Kansas.

Bairdia beedei inflata Payne, 1937, Jour. Paleontology, vol. 11, p. 283, pl. 39, figs. 2a, b; Hayden Branch formation, Indiana.

Bairdia hispida Harlton, 1928, Jour. Paleontology, vol. 2, p. 140, pl. 21, fig. 11; Cisco, Texas. —Harlton. 1929, Univ. Texas Bull. 2901, p. 155, pl. 3, figs. 2a, b; Canyon, Texas. —Delo, 1930, Jour. Paleontology, vol. 4, p. 163, pl. 12, figs. 14a, b; Pennsylvania, Texas.

Bairdia hispida alta Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 88, pl. 6, figs. 6a, b; Hoxbar, Oklahoma.


Bairdia wrefordensis Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 22, pl. 2, figs. 5a, b; Wreford limestone, Nebraska.

Carapace large, tumid, dorsal and ventral margins broadly rounded, forming acuminate anterior where termination is at midheight; beak short, blunt, just below midheight; overlap conspicuous along all margins except anterior; articulation at center of hinge line almost straight for half of length forming obtuse angle at its junction with posteriorodorsal slope; sinuous articulation of anteroventral angle very marked; surface smooth.

Length, 1.39 mm; height, 0.90 mm; width, 0.63 mm.

There is considerable variation in the general features and form ratio of this species. Kellett (1934, p. 124) lists a variation of 1.65 to 1.74 in form ratio, and the length of described species of 0.77 to more than 1.4 mm. Due to this variation it does not seem feasible to list varieties of B. beedei, and for this reason the several varieties described have been placed in synonymy.

Brereton to Shumway zones, localities 46, 51, 90, 109.

Bairdia Blakei Harlton

Plate 1, figures 16-19

Bairdia blakei Harlton, 1931, Jour. Paleontology, vol. 5, p. 163; new name for B. nitida Harlton, 1925. —Upson, 1933, Nebraska Geol. Survey Bull. S, p. 21, pl. 2, figs. 1a, b; Wreford limestone, Nebraska. —Not Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 84, pl. 6, figs. 1a, b, 2; Hoxbar formation, Oklahoma.

Bairdia bidorsalis Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 81, pl. 5, figs. 6a, b; Deese formation, Oklahoma.

Bairdia crassa Bradfield, 1935, idem, p. 80, pl. 5, figs. 8a, b; Deese formation, Oklahoma.

Bairdia nitida Harlton, 1925, Jour. Paleontology, vol. 2, p. 139, pl. 21, figs. 12a, b; Hoxbar formation, Oklahoma. —Harlton. 1929, Texas Univ. Bull. 2909, p. 155, pl. 3, figs. 3a, b; Canyon series, Texas.

Carapace short, tumid, dorsal outline arched, ventral margin convex; overlap most prominent on dorsal margin; posteriorodorsal slope formed by the regular continuation of the arched dorsal outline, giving upper margin a regular, hemispherical aspect; posterior beak short, acuminate, and at or a little below midheight, anterior termination pointed and above midheight.

Length, 0.95 mm; height, 0.69 mm; width, 0.46 mm.

B. blakei is easily recognized by its unusual tumidity, its semicircular dorsal outline, and its low form ratio (1.4-1.5).

Bogota and Shumway zones, localities 100, 109.

BairdiaCiscoensis? Harlton

Plate 1, figures 29, 30; plate 4, figures 5, 6


Carapace short; dorsal margin arched, anterior end rounded with extremity above midheight, ventral margin
straight to slightly convex; posterior beak short, acuminate, and below mid-
height; posterodorsal slope steep, slightly bowed upward in midportion; overlap
moderate; surface smooth.
Length (pl. 1, figs. 29, 30), 0.53 mm;
height, 0.32 mm; width, 0.24 mm.
The Illinois specimens are probably young individuals since they are smaller
than any previously described.
Collinsville to Woodbury zones, locali-
ties 73, 109, 110, 115.

**BAIRDIA CITRIFORMIS** Knight

Plate 1, figures 23-26

*Bairdia citriformis* Knight, 1928, Jour. Paleon-
tology, vol. 2, p. 321, pl. 43, figs. 4a-d;
Pawnee limestone, Missouri.

*Bairdia* cf. *B. citriformis*, Bradfield, 1935,
5, figs. 2a, b; Dornick Hills formation, 
Oklahoma.

Carapace elongate, dorsal margin
highly arched, ventral margin slightly
convex, almost straight; anterior end
acuminate with termination just above
center; posterodorsal slope steep; poste-
rior beak narrow and acuminate, with a
tendency to turn upward; overlap great-
est on anterodorsal and mesoventral
margins; juncture of anterodorsal and anter-
ior lines of articulation forms a
prominent angle; surface smooth to
granulose.

Length, 1.0 mm; height, 0.57 mm;
width, 0.48 mm.

The distinguishing features of *B. cit-
riformis* are the attenuated terminations
as seen in the dorsal view and the nar-
row, pointed beak.

Brereton zone, locality 45.

**BAIRDIA CONCAVA** Cooper, n. sp.

Plate 1, figures 31-34

*Bairdia pompiiloidea*, Warthin, 1930 (not
Harlton, 1928), Oklahoma Geol. Survey
Bull. 53, p. 70, pl. 5, figs. 11a, b; Holden-
ville formation, Oklahoma.

*Bairdia nitida*, Warthin, 1930 (not Jones and
Kirkby, 1879 nor Harlton, 1928), idem, 
p. 72, pl. 6, figs. 3a, b; Holdenville form-
ation, Oklahoma.

Carapace short, tumid, dorsal margin
acutely arched, ventral margin convex;
posterodorsal slope straight, anterodor-
sal slope markedly concave; overlap very
great in centrodorsal and ventral re-
gions; posterior beak very short, but
wide and well below midheight; anterior
end rounded but asymmetrical due to its
concave and convex bordering margins
above and below; anterior termination
at midheight.

Length, 1.31 mm; height, 0.82 mm;
width, 0.72 mm.

This species, although found much
higher in the section than the Oklahoma
occurrence, is thought to be the same by
reason of the extremely high arch of the
dorsum and the marked concavity of the
anterodorsal slope.

Greenup zone, locality 114.

**BAIRDIA CORYELLI** Roth and Skinner

Plate 2, figures 8-10; plate 4, figures 16, 17

*Bairdia coryelli* Roth and Skinner, 1931,
Jour. Paleontology, vol. 5, p. 48; new
name for *B. ventricosa*.

*Bairdia ventricosa* Roth and Skinner, 1930,
Jour. Paleontology, vol. 4, p. 352, pl. 28,
figs. 12-14, McCoy formation, Colorado.

*Bairdia gibbosa* Payne, 1937, Jour. Paleon-
tology, vol. 11, p. 283, pl. 39, figs. 4a, b;
 Hayden Branch formation, Indiana.

Carapace short, extremely tumid, dor-
sal margin arched, ventral margin con-
 vex, anterior end broadly rounded and
terminated about midheight; posterior
beak short and wide; overlap greatest
along middorsal and ventral articula-
tion, especially along anterior portion of
the latter and least along anterior and
posteroventral margins; posterodorsal
slope begins as part of the regular curva-
ture of the arched dorsum, becoming
straighter in lower half to form upper
margin of the wide beak; surface finely
granulose.

Length, 1.44 mm; height, 0.95 mm;
width, 0.90 mm.

The most distinguishing feature of *B. 
coryelli* is its great tumidity, which may
approach 0.9 of the height. The rela-
tively large overlap along the anteroven-
tral articulation is also noteworthy.
Shoal Creek to Greenup zones, localities 25, 77, 114.

Bairdia crassa Harlton
Plate 2, figures 1, 2

Bairdia crassa Harlton, 1929, Texas Univ. Bull. 2901, p. 158, pl. 4, figs. 3a-c; Canyon series, Texas. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 71, pl. 6. figs. 1a, b; Holdenville formation, Oklahoma. —Kellett, 1934, Jour. Paleontology, vol. 8, p. 129, pl. 15, figs. 5a-g; Staunton Limestone, Kansas.


Carapace short, tumid, dorsal margin highly arched, ventral margin straight; posterior beak fairly long, very acuminate, and well below midheight; anterior end rounded in ventral angle, terminating in a point well above midheight; overlap very strong in centrodorsal region, less so on ventral and anterior margins, and very faint on posterodorsal slope, which is very long and steep (ca. 55°); surface granulose.

Length, 1.26 mm; height, 0.85 mm; width, 0.66 mm.

This species may be recognized by its strongly arched dorsum with large overlap and the very long and steep posterodorsal slope.

Brereton and Gimlet zones, localities 40, 60.

Bairdia crassimarginata Cooper, n. sp.
Plate 2, figures 3-5

Carapace of medium size, dorsal margin flat but slightly convex, ventral margin convex; posterod- and anterodorsal slopes steep, approximately equal; posterior beak fairly long, very acuminate, and below midheight; anterior end acuminate, and rounded; anterodorsal and ventral slopes about equal; termination above midheight; dorsal and anterodorsal overlap very pronounced; centroventral overlap quite distinct and forms part of an unusual thickening of central portion of ventral margin of the left valve; surface smooth.

Length, 1.13 mm; height, 0.64 mm; width, 0.25 mm.

In lateral view B. crassimarginata somewhat resembles B. perincerta Warthin from a comparable horizon in Oklahoma, but is less elongate. The thickened portion of the centroventral edge of the left valve makes this an easily recognized species.

LaSalle to Woodbury zones, localities 88, 109, 115.

Bairdia demissa Cooper, n. sp.
Plate 2, figures 23-26

Carapace low, elongate; dorsal arch broad and low, merging imperceptibly into posterodorsal slope; ventral margin straight; anterior end broadly, rounded, and terminated at midheight; posterior beak long, acuminate, with termination exceptionally low; greatest height slightly anterior; overlap moderate along anterodorsal and midventral margins; slight at other points; surface smooth.

Length, 1.08 mm; height, 0.54 mm; width, 0.48 mm.

B. demissa is similar to B. perincerta Kellett from comparable beds in the Midecontinent, but the former is more elongate, the dorsal arch is lower and broader, with the greatest height anterior. It does not possess the dorsal ridge of B. perincerta and B. powersi Kellett, nor the angle on the posterodorsal slope of B. scholli Coryell and Booth, formed by the junction of lines of articulation.

Shumway and Woodbury zones, localities 109, 115.

Bairdia dissimilis Cooper, n. sp.
Plate 2, figures 27-29

Carapace tumid, dorsal margin of left valve broadly arched, of right valve flattened, giving appearance of variable overlap along dorsum; ventral margin straight; posterior beak short, wide, acuminate and below midheight; anterior end rounded, termination at midheight; greatest thickness posterior; overlap apparently due to much greater size of left valve; line of articulation depressed, es-
pecially along dorsal and ventral margins; surface smooth.

Length, 1.05 mm; height, 0.67 mm; width, 0.52 mm.

_B. dissimilis_ is differentiated by its unequal valves, both as to size and shape, by the lateral outline and by the depressed articulation along the dorsum and venter. It differs from _B. seminalis_ Knight in that the dorsum of the right valve of the latter is arched, as compared to the flat dorsum of the Illinois species.

Ferdinand and Seville zones, localities 2, 8.

**Bairdia garrisonensis** Upson

*Plate 2, figures 14-18*

*Bairdia garrisonensis* Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 20, pl. 1, figs. 10a-c; Garrison shale, Nebraska. —Kellett, 1934, Jour. Paleontology, vol. 8, p. 134, pl. 17, figs. 5a-c; Deer Creek to Wreford formations, Kansas. —Scott and Borger, 1941, Jour. Paleontology, vol. 15, p. 354, pl. 49, fig. 19, Macoupin formation, Illinois.

*C Bairdia auricula*, Bradfield, 1935 (not Knight, 1928), Bull. Am. Paleontology, vol. 22, p. 89, pl. 6, figs. 13a, b; Hoxbar group, Oklahoma.

Carapace large, somewhat tumid, dorsal margin very highly arched, ventral margin slightly convex; overlap very pronounced in centrodorsal region, less so along venter, very slight along anterior and posterodorsal margins; posterior beak short, wide, below midheight; anterior end rounded with termination at midheight; posterodorsal slope straight; surface smooth to granulose.

Length, 1.52 mm; height, 0.95 mm; width, 0.63 mm.

Shumway zone, locality 109.

**Bairdia** cf. _B. glennensis_ Harlton

*Plate 2, figures 6, 7*

*Bairdia glennensis* Harlton, 1927, Jour. Paleontology, vol. 1, p. 210, pl. 33, fig. 10; Upper Glenn formation, Oklahoma. —Knight, 1928, Jour. Paleontology, vol. 2, p. 325, pl. 43, figs. 8a, b; Pawnee limestone, Missouri. —Kellett, 1935, Jour. Paleontology, vol. 9, p. 133, pl. 18, figs. 4a-e; Upper Pennsylvanian and Lower Permian, Kansas.

*Bairdia subelongata*, Harlton, 1927 (not Jones and Kirkby), Jour. Paleontology, vol. 1, p. 210, pl. 33, fig. 11, Upper Glenn formation, Oklahoma.

Carapace very elongate, dorsal margin slightly bowed, antero- and posterodorsal slopes very low, ventral margin straight except near extremities, where margin swings upward in a gradual curve; anterior end rounded, terminated about midheight; posterior beak long and narrow; overlap greatest along dorsum.

Length (fig. 6), 1.42 mm; height, 0.62 mm; width, 0.43 mm.

This long-ranging species (Lower Pennsylvanian into Permian) has an unusually large but variable form ratio (2.25-2.75). It also may be distinguished by its very low dorsal arch and straight venter. Its general outline is somewhat similar to _B. legumen_ Jones and Kirkby, but lacks the acute anterior end of the latter.

Fulda and Seahorne zones, localities 1, 9.

**Bairdia harltoni** Cooper, n. sp.

*Plate 2, figures 30, 31*

*Bairdia ardmoresis* Harlton, 1933 (not Harlton, 1929), Jour. Paleontology, vol. 7, p. 25, pl. 7, fig. 8; Johns Valley shale, Oklahoma.

Carapace elongate, lenticular, dorsal margin arched, antero- and posteroventral slopes straight, the latter more acute; ventral margin straight in midportion only, curving broadly toward each end; overlap prominent on dorsum and on midventor, less prominent on posterodorsal slope, very faint elsewhere; anterior end somewhat acuminate but rounded; beak long and slightly below midheight; surface smooth to faintly granulose.

Length, 1.26 mm; height, 0.69 mm; width, 0.48 mm.

*B. harltoni* differs from _B. ardmoresis_ in its lesser form ratio (1.74 cf. 1.84), broader terminations, and in its slightly greater angle of the posterodorsal slope.

Seville zone, locality 8.
Bairdia hoooverae Kellett
Plate 2, figures 21, 22

*Bairdia* hoooverae Kellett, 1934, Jour. Paleontology, vol. 8, p. 126, pl. 14, figs. 5a, b; Stanton limestone to Oread formation, Kansas. —Not Payne, 1937, Jour. Paleontology, vol. 11, p. 284, figs. 5a, b; Hayden Brach formation, Indiana.

Carapace short, tumid, ovate; dorsal arch high, broad; ventral margin straight; anterior end rounded and at midheight; posterior beak short, wide, and acuminate; overlap distinct around entire margin, greatest along anterodorsal slope; surface smooth.

Length 1.03 mm; height, 0.66 mm; width, 0.51 mm.

The Illinois form is slightly less tumid and the central portion flatter in dorsal view than is shown in Kellett's figure, but agrees, however, in other respects. Payne's form, from a somewhat lower horizon in Indiana, does not possess the acuminate beak and prominent overlap of the younger forms. Payne's specimen does not appear to belong to this species as it does not have the characteristic posterior beak. His drawing is seen to be somewhat misleading when compared with his specimen.

LaSalle zone, locality 88.

*Bairdia* hoxbarensis Harlton
Plate 2, figures 43, 44

*Bairdia* hoxbarenisis Harlton, 1927, Jour. Paleontology, vol. 1, p. 211, pl. 33, fig. 12; Hoxbar group, Oklahoma.


*Bairdia* haworthi Knight, 1928, Jour. Paleontology, vol. 2, p. 225, pl. 43, figs. 7a, b: upper Ft. Scott formation, Missouri.

*Bairdia* subelongata?, Knight, 1928 (not Jones and Kirkby), Jour. Paleontology, vol. 2, p. 326, pl. 43, fig. 9; upper Ft. Scott formation, Missouri.

*Bairdia* acetalata Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 173, pl. 17, fig. 5; Wayland shale, Texas.

Carapace elongate, dorsal margin regularly arched, antero- and posterodorsal slopes a regular continuation of low dorsal curvature; ventral margin slightly concave; anterior end rounded; posterior beak wide, sharply acuminate; terminations at midheight; overlap conspicuous only along dorsal margin.

Length, 1.05 mm; height, 0.46 mm; width, 0.35 mm.

In addition to the species listed above, Bassler and Kellett (1935, p. 173) included *B. nebraskensis* Upson, *B. acetalata* Coryell and Billings (also Coryell and Booth, 1933), and *B. subelongata* Knight 1927 and 1928 in synonymy with *B. hoxbarenisis*. These species, because of the atypical developments of the posterior termination, have been transferred to the new genus *Fabalicypsis* (p. 59). *B. hoxbarenisis* Harlton (Bradfield, 1935) with which *B. altifrons* Knight was placed in synonymy does not appear to be conspecific with the former, and has been placed with *B. altifrons*, as has *B. hoxbarenisis*, Harlton, 1929.

Brereton to Shoal Creek zones, localities 38, 68, 76, 77.

*Bairdia* hurwitzii Coryell and Booth
Plate 2, figures 11-13

*Bairdia* hurwitzii Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 262, pl. 3, figs. 8, 9; Graham formation, Texas.

*Bairdia* longirostris Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 89, pl. 6, figs. 11a, b; Hoxbar group, Oklahoma.

Carapace subrhomboidal, dorsal margin strongly arched, ventral margin convex; posterodorsal slope straight and slightly steeper than anterodorsal slope; anterior end narrow but rounded; posterior beak short, wide, and terminated slightly below midheight; overlap conspicuous along all margins except antero- and posteroventral; surface smooth.

Length, 1.23 mm; height, 0.77 mm; width, 0.52 mm.
B. hurwitzi is characterized by the high arching of the left valve above the hinge line, and by the polygonal appearance formed by the intersection of the straight lines of articulation bordering the dorsal margins.

LaSalle and Newton zones, localities 90, 108.

Bairdia kingii Reuss

Plate 2, figures 36, 37


Cythere (Bairdia) kingii Schmidt, 1867, Neues Jahrb., p. 581, pl. 6, figs. 32, 33; Zechstein, Germany.

Bairdia kingii compressa Jones and Kirkby, ibid., p. 148, pl. 9, figs. 7a, b; Permian, England.

Bairdia plebia compressa Kirkby, 1858, ibid., pp. 325, 328, pl. 10, figs. 7a, b; Permian, England.


Carapace thin, elongate, dorsal margin broadly arched in center, becoming some what flatter towards ends; ventral margin straight to slightly concave; posterior beak, short, wide, acuminate; anterior end rounded; overlap wanting or faint along all margins except in centro-dorsal area; carapace smooth.

Length, 1.10 mm; height, 0.47 mm; width, 0.30 mm.

The size and shape of the Illinois specimens appear to agree in all respects with the European species. The variety compressa (Kirkby), which seems too close to the species for separation, comes from the same horizons and localities.

Newton zone, locality 108.

Bairdia lunata Bradfield

Plate 2, figures 19, 20


Carapace elongate, dorsal outline broadly arched; ventral margin straight, anterior and posterior terminations well below midheight; the postero- and anterodorsal slopes are a regular continuation of the dorsal arch, the former somewhat steeper; posterior beak narrow, rounded; overlap moderate on dorsal and midventral margins, slight or lacking at other points.

Length, 1.26 mm; height, 0.56 mm; width, 0.40 mm.

B. lunata is marked by the extremely low position of the terminations in the lateral view.

Millersville zone, locality 90.

Bairdia menardensis Harlton

Plate 2, figures 32-35


Carapace tumid, dorsal margin highly arched, ventral margin straight or slightly convex in central portion, rising in broad symmetrical curves to meet terminations; posterodorsal slope straight except lower third, where it becomes distinctly concave, resulting in a decidedly upturned beak; anterodorsal slope slightly concave; overlap great along entire dorsal margin, faint along venter except in the midportion where it is moderate; surface finely granulose to punctate.

Length, 1.32 mm; height, 0.77 mm; width, 0.63 mm.

B. menardensis is characterized by its great tumidity as compared to its very acuminate terminations as seen in dorsal view, and by its distinctly upturned beak.
Oak Grove and Gimlet zones, localities 14, 62.

**Bairdia menardvilensis** Harlton
Plate 2, figures 38-42; plate 4, figures 9-11

*Bairdia marginata* Harlton, 1929 (not Bosquet), Texas Univ. Bull. 2901, p. 158, pl. 4, fig. 2; Canyon series, Texas.


Carapace large, tumid, dorsal margin arched, ventral margin concave; postero-dorsal slope long, straight, steep, slightly upturned near beak; anterodorsal slope straight; overlap greatest along dorsal and midventral articulation; posterior beak acuminate and well below midheight; anterior end broad, rounded; a sudden lessening of thickness of carapace in the posterovesentral angle gives appearance of a shallow furrow; surface finely granulose.

Length, 1.54 mm; height, 0.95 mm; width, 0.61 mm.

*B. menardvilensis* appears quite similar to *B. menardensis* Harlton. However, the following differences in the former are noted: greatest tumidity posterior; more elongate anteroventral margin; broader and less acuminate anterior end and a somewhat larger form ratio.

Gimlet and Exline zones, localities 62, 66.

**Bairdia monstrabilis** Cooper, n. sp.
Plate 3, figures 5-10

Carapace large, tumid, subrhomboidal; dorsal margin arched, antero- and posterodorsal slopes steep; ventral margin straight, and marked by sharp, thin, but conspicuous ridge parallel to venter; dorsal articulation forms straight lines, giving upper part of carapace an appearance of angularity, overlap conspicuous along these margins; posterior beak short, acuminate, and slightly upturned; both ends slightly below midheight; surface smooth to granulose.

Length (pl. 2, figs. 38-42), 1.26 mm; height, 0.72 mm; width, 0.52 mm.

This species may be easily recognized by the sharp thin ridge parallel to the venter.

Brereton to Shumway zones, localities 40, 81, 83, 84, 86, 88, 93, 102, 109.

**Bairdia oklahomaensis** Harlton
Plate 3, figures 15-20

*Bairdia oklahomaensis* Harlton, 1927, Jour. Paleontology, vol. 1, p. 209, pl. 33, fig. 7; Glenn formation, Oklahoma.—Harlton, 1929, Univ. Texas Bull. 2901, p. 156, pl. 3, figs. 5a, b; canyon series, Texas.

—Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 69, pl. 5, figs. 8a, b; Wewoka-Holdenville formations, Oklahoma.


*Bairdia auricula* Knight, 1928, Jour. Paleontology, vol. 2, p. 319, pl. 43, figs. 3a, b; upper Ft. Scott formation, Missouri.

—Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 263, pl. 25, fig. 6: East Mountain shale, Texas. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 68, pl. 5, figs. 7a, b; Wetunka-Holdenville formations, Oklahoma.


*Bairdia seminalis* Payne, 1937 (not Knight, 1928), Jour. Paleontology, vol. 11, p. 285, pl. 39, figs. 9a, b; Hayden Branch formation, Indiana.

Carapace short, tumid, dorsal margin acutely arched, ventral margin straight, except anteriorly and very near posterior end; shell flat to slightly depressed in anterodorsal half; overlap strongest on anterodorsal slope and midventral margin; overlap on posterodorsal slope interrupted by a swelling of carapace in the midportion of the slope; beak short, well below midheight; anterior termination well above midheight; surface granulose.
BAIRDIIDAE

Length, 1.36 mm; height, 0.85 mm; width, 0.61 mm.

*B. oklahomaensis* is easily recognized by the acutely arched dorsal, the swelling on the posterodorsal slope, and the point of anterior termination well above midheight.

The long range of this species as reported by its occurrence in the Midcontinent is reflected in its Illinois distribution in various zones from the Fulda to the Macoupin, localities 1, 3, 8, 10, 13, 19, 21, 29, 30, 32, 38, 40, 54, 55, 58, 60, 64, 67, 69, 73, 86.

**BAIRDIA pennata** Coryell and Sample

Plate 3, figures 1-4; plate 4, figures 3, 4

*BAIRDIA angulata* Coryell and Sample, 1932 (not Brady, 1870), Am. Midland Naturalist, vol. 13, p. 262, pl. 25, fig. 16; East Mountain shale, Texas.


Carapace elongate, somewhat tumid, dorsal margin arched; posterodorsal slope long and gently inclined; beak long, narrow, acuminate and below midheight; anterior end rounded, somewhat narrow, above midheight; ventral margin straight; overlap moderate around entire carapace.

Length (pl. 3, figs. 1, 2), 0.87 mm; height, 0.46 mm; width, 0.40 mm.

Ferdinand to Shoal Creek zones, localities 2, 5, 13, 21, 77.

**BAIRDIA peracuta** Warthijn

Plate 3, figures 11, 12; plate 4, figures 1, 2


Carapace elongate, acuminate; dorsal margin rounded; ventral margin regularly convex to ends; posterodorsal slope steep in upper two-thirds, acutely concave in lower third, making the beak very slender with a slightly upturned appearance; anterior end acuminate; overlap greatest along anterodorsal margin, least along venter; surface distinctly granulose.

Length (pl. 3, figs. 11, 12), 1.34 mm; height, 0.62 mm; width, 0.49 mm.

*BAIRDIA peracuta* appears to have a more acuminate appearance both in dorsal and lateral views, than most any other Pennsylvanian species. *B. pennata* Coryell and Sample from the Liverpool resembles this species but is slightly more tumid and possesses a distinct dorsal overlap not present in *B. peracuta*.

Liverpool to Gimlet zones, localities 17, 38, 53, 54, 60.

**BAIRDIA pinnula** Coryell and Booth

Plate 3, figures 13, 14

*BAIRDIA pinnula* Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 263, pl. 3, fig. 14; Wayland shale, Texas.

Carapace rather small, dorsal margin arched, ventral margin straight; anterior end rounded, termination at midheight; posterodorsal slope low, slightly convex; beak wide, acuminate, and slightly below midheight; greatest overlap along anterior half of dorsal; surface smooth.

Length, 0.95 mm; height, 0.59 mm; width, 0.44 mm.

*BAIRDIA pinnula* differs from *B. seminalis* Knight and *B. angusta* n. sp. in its long, low posterodorsal slope and is less elongate than *B. demissa* n. sp. The very large overlap on the anterodorsal slope is also characteristic.

Shumway zone, locality 109.

**BAIRDIA pompilioides** Harlton

Plate 3, figures 39-43

*BAIRDIA pompilioides* Harlton, 1928, Jour. Paleontology, vol. 2, p. 140, pl. 21, fig. 13; Hoxbar group, Oklahoma. —Harlton, 1929, Texas Univ. Bull. 2901, p. 154, pl. 2, fig. 7; pl. 3, fig. 8; Canyon group, Texas. —Coryell and Osorio, 1932, Am. Midland Naturalist, vol. 13, p. 33; Nowata shale, Oklahoma. —Kellett, 1934, Jour. Paleontology, vol. 8, p. 130, pl. 16, figs. 2-4; Stanton limestone to Wreford formation, Kansas. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 87, pl. 6, figs. 5a, b; Hoxbar group, Okla-
more elongate in species being Reuss. 

finely granulose. below the centroventral concave cavity in 0.63 width. 

Carapace large, dorsal margin highly arched, somewhat flat in centroventral region, steepening toward ends; posterodorsal slope short and very steep (ca. 55°), beak very low, thin, acuminate; anterior slope straight to slightly concave; anterior end high, acuminated; ventral margin convex; greatest tumidity central, decreasing rapidly toward ends; greatest overlap along centro- and anterodorsal articulation. least along antero- and posterodorsal margins; surface granulose.

Length, 1.68 mm; height, 0.82 mm; width, 0.60 mm.


**Bairdia regularis** Cooper, n. sp.

Plate 3, figures 30-32

Carapace large, elongate, dorsal margin broadly arched, curvature merging smoothly with slightly convex anterodorsal slope, and posterodorsal slopes: the latter merges with short, very slightly upturned beak almost without producing concavity in outline; ventral margin slightly concave; overlap prominent along centroventral and dorsal margins; terminations below midheight; surface finely granulose.

Length, 1.67 mm; height, 0.90 mm; width, 0.63 mm.

*B. regularis* is somewhat similar to *B. summa* Coryell and Billings and some of the various forms described as *B. plebeia* Reuss, being intermediate between these species in form ratio. It is larger and more elongate than the Wayland species.

It is almost bilaterally symmetrical due to the very short, wide beak. The upturned beak and position of greatest height posterior distinguishes it from *B. hoffmaenei* Kellett.

Exline zone, locality 66.

**Bairdia cf. B. rhomboidea** Kirkby

Plate 3, figures 25, 26


Carapace elongate, subrhomboidal, dorsal margin low and broadly arched; posterodorsal slope low, but steeper than anterior slope; ventral margin broadly convex, the regular curvature becoming more acute near anterior end, but no marked upward swing on posterior; beak very long and below midheight; anterior end acuminate with termination above midheight; overlap moderate on dorsal margin; negligible on venter.

Length, 1.34 mm; height, 0.64 mm; width, 0.42 mm.

The Illinois form seems to be more closely related to *B. rhomboidea* from the Permian of England than to any other known species. In the English form the posterior slopes appear symmetrical about a horizontal line through the center of the carapace, while in the Illinois form the posterodorsal slope is somewhat shorter and steeper.

Shumway zone, locality 109.

**Bairdia schaurothiana** Kirkby

Plate 3, figures 21-24

**Bairdia schaurothiana** Kirkby, 1858, Annals and Mag. Nat. History, p. 329, pl. 10, fig. 14; Permian, British Isles. —Jones and Kirkby, 1860, Tyneside Nat. Field Club Trans., vol. 4, p. 147, pl. 9, fig. 14; Permian, British Isles.

**Cythere schaurothiana** Geinitz, 1861, Die anamalischen Uberreste der Dyas, vol. 1 of "Dyas oder die Zechsteinformation und das Rothliegende," Leipsig, p. 36; Permian, Germany.

Carapace very elongate, thin, dorsal margin straight or slightly convex in central portion, ventral margin slightly concave, resulting in almost parallel upper and lower margins; posterodorsal slope short and steep; anterodorsal slope long and low, merging into the rounded anterior end, termination at midheight; posterior beak about midheight, short and broad; overlap moderate along dorsal and centroventral line of articulation, but slight or wanting entirely at other points; surface smooth.

Length, 1.57 mm; height, 0.77 mm; width, 0.58 mm.

B. schaurothiana, occurring well down in the Illinois Pennsylvanian section, appears to be the same as the species described from the Permian and Carboniferous of the British Isles. Listed in synonymy with B. hisingeri by Bassler and Kellett (1934, p. 173), it appears to be sufficiently different from those from the Carboniferous limestone and Calci-ferous sandstone (Lower Carboniferous, probably Chester) to be considered as a distinct species. It is more elongate than most species of Bairdia with a form ratio of more than 2.2. B. schaurothiana is characterized by a straight dorsal margin, a short, steep posterodorsal slope, a less acute anterodorsal slope, a concave centroventral margin, merging into a broad upward swing which meets the terminations at about midheight.

Seville zone, locality 4.

Bairdia scholli Coryell and Booth

Plate 3, figures 33, 34

Bairdia scholli Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 264, pl. 4, figs. 3, 4; Wayland shale, Texas.

Carapace medium sized, moderately tumid, tenuity carrying well out to ends, resulting in lens-shaped dorsal outline; dorsum asymmetrically arched, greatest height anterior, sloping gradually back toward posterodorsal angle, where posterodorsal slope increases the angle perceptibly; centroventral margin straight, swings upward smoothly to meet the ends; posterior beak short, wide, below midheight; anterior end rounded, terminated above midheight; anterodorsal and centroventral overlap prominent, surface smooth to granulose.

Length, 1.13 mm; height, 0.62 mm; width, 0.51 mm.

Resembles B. demissa n. sp. in the position of greatest height but differs in the presence of bulge and angulation in the posterodorsal region.

Little Vermilion to Woodbury zones, localities 103, 110, 115.

Bairdia seminalis Knight

Plate 3, figures 27-29


Bairdia blakei, Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 84, pl. 6, figs. 1a, b; Hoxbar group, Oklahoma.

Bairda crassa, Delo, 1930 (not Harlton), Jour. Paleontology, vol. 4, p. 164, pl. 12, fig. 15; Graham group, Texas. —Delo, 1931, Washington Univ. Studies, n. ser. Sci. and Tech., no. 5, p. 49, pl. 4, fig. 9; Pennsylvanian, Kansas.

Bairdia samplei Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 264, pl. 3, figs. 12, 13; Graham formation, Texas.

Bairdia tumida Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 21, pl. 2, figs. 3a-c; Garrison shale, Nebraska.

Carapace small, ovate, somewhat tumid; dorsal and ventral margins semi-circular, giving lens-shaped outline;
lateral view; postero- and anterodorsal slopes approximately equal; posterior beak short, wide, and slightly below mid-height; overlap pronounced on all margins, but least on postero- and anterodorsal articulation.

Length, 1.05 mm; height, 0.91 mm; width, 0.48 mm.

*B. seminalis* is characterized by a complete lack of angularity marginal or between lines of articulation, as viewed from lateral and dorsal positions. It is differentiated from *B. blakei* Harlton by the very pronounced dorsal overlap.

Pokeberry to Woodbury zones, localities 53, 62, 70, 75, 76, 81, 90, 93, 99, 109, 112, 114, 115.

**Bairdia spinosa** Cooper, n. sp.

Plate 3, figures 44-46

Carapace small, tumid, rather short; dorsal margin convex, ventral margin straight, anterior end rounded; posterior termination short, acuminate, to rather high; junction of anterior and dorsal margins angular; posteroventral slope short, very steep; overlap moderate and rather uniform around all margins except anterodorsal, where it is wanting; posterior two-thirds of hinge line incised; surface granular, ornamented by a large number of short, wart-like spines scattered promiscuously over the shell surface.

Length, 0.80 mm; height, 0.51 mm; width, 0.44 mm.

*B. spinosa* is readily differentiated by the peculiar wart-like spines, and differs from *B. wordensis* Hamilton (1942, p. 716) in that the spines appear over the entire shell surfaces as well as along the dorsum.

Shoal Creek zone, locality 77.

**Bairdia summa** Coryell and Billings

Plate 3, figures 35, 36

*Bairdia summa* Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 170, pl. 17, fig. 1; Wayland shale, Texas.

Carapace large, dorsal margin strongly bowed, ventral margin straight in central portion, curving upward at ends; beak short, blunt, well below midheight; overlap very slight along ventral margin and anterior end, very pronounced along dorsum and posteroventral slope, greatest in centrodorsal region; greatest height central; surface smooth to granulose.

Length, 1.44 mm; height, 0.77 mm; width, 0.54 mm.

*B. summa* is distinguished by its strong, broadly arched dorsum and by its large, elongate carapace (form ratio, 1.84).

“Centralia” zone, locality 82.

**Bairdia symmetrica** Cooper, n. sp.

Plate 3, figures 37, 38

Carapace elongate, tenuous, symmetrical in lateral and dorsal views; dorsal margin broadly arched, merging smoothly into the equally inclined antero- and posterodorsal slopes; ventral margin straight in center, swinging upward gradually to meet the ends; anterior termination at midheight and slightly above posterior beak; posterior beak sharply acuminate; overlap prominent along dorsal margin, absent along venter; surface finely granulose.

Length, 1.0 mm; height, 0.48 mm; width, 0.36 mm.

The lateral outline of *B. symmetrica* is similar to *B. galei* Croneis and Thurman but lacks the concavity in the centrodorsal margin, and lacks the strongly curved ventral extremities to *B. graminensis* Harlton. The dorsal margin is more acutely arched and the anterior end lower than *B. tegumen* Jones and Kirkby.

Trivoli zone, locality 70.

**Bairdia verwiebei** Kellett

Plate 4, figures 7, 8

*Bairdia verwiebei* Kellett, 1934, Jour. Paleontology, vol. 8, p. 129, pl. 17, figs. 2a-c; Winfield to Wreford, Kansas.

Carapace elongate, thin, dorsal margin flattened, ventral margin straight, parallel to dorsum; anterodorsal slope but
little less steep than posterior; beak below midheight, fairly long, narrow, bluntly acuminated; anterior end narrow, rounded, and at midheight; overlap pronounced along dorsum, lacking on venter.

Length, 1.05 mm; height, 0.51 mm; width, 0.32 mm.

The first occurrence of this species below the Permian is in the younger beds of the Illinois Pennsylvanian, the Shumway zone, localities 109, 112.

**Bairdia whitesidei** Bradfield

Plate 4, figures 12-15

*Bairdia whitesidei* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 82, pl. 5, figs. 10a, b; Deese group, Oklahoma.

Carapace large, elongate, dorsal margin arched, anterior and posterodorsal slopes slightly concave, about equal; ventral margin convex; overlap greatest in centrodorsal and centroventral margins; greatest tenuity central, decreasing abruptly toward each end, giving terminations an acuminated appearance in dorsal view; posterior end long, moderately wide; anterior end rounded; surface finely granulose.

Length, 1.72 mm; height, 0.97 mm; width, 0.87 mm.

*B. whitesidei* resembles *B. summa* Corry and Billings but is more acuminated in dorsal view. The great overlap along the centroventral articulation is characteristic.

Seville to Brereton zones, localities 6, 10, 12, 38.

**Genus Bairdiacypris** Bradfield, 1935

**Bairdiacypris acuminata**

Cooper, n. sp.

Plate 4, figures 24, 25

Carapace elongate, lateral outline lens-shaped; dorsal margin arched, posterodorsal slope convex, joining dorsal margin with little interruption of regular curvature of the latter; ventral margin concave; anterior end broadly rounded; posterior end quite acuminated, but sharply rounded, and depressed wellbelow midheight; overlap on dorsum and posterodorsal slope wide and uniform, thin on ventral margin.

Length, 1.12 mm; height, 0.52 mm; width, 0.40 mm.

*B. acuminata* may be distinguished by its unusually narrow posterior termination and by the slightly convex posterodorsal slope.

Gimlet to Woodbury zones, localities 62, 81, 88, 115.

**Bairdiacypris ardua** Cooper, n. sp.

Plate 4, figures 18, 19

Carapace elongate; lateral outline sublenticular; dorsal margin convex, but rather flat, ventral margin slightly concave; posterodorsal margin steep, abruptly joining dorsal margin; anterior end broadly rounded, posterior narrow, rounded, and terminated about midheight; overlap moderate along dorsal and centroventral margins, slight on other margins.

Length, 1.10 mm; height, 0.49 mm; width, 0.36 mm.

*B. ardua* may be recognized by its steep abrupt posterodorsal slope and by the unusually high position of the posterior termination.

Millersville and Shumway zones, localities 90, 109, 112.

**Bairdiacypris deloi** Bradfield

Plate 4, figures 22, 23

*Bairdiacypris deloi* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 93, pl. 7, figs. 8a, b; 9a, b; Hoxbar group, Oklahoma.

Carapace ovate, lenticular in dorsal outline; dorsal margin arched; ventral margin concave; ends rounded, posterior acuminated and terminated below midheight; dorsal overlap moderate in center thinning toward anterior end and down fairly long, straight posterodorsal slope; ventral overlap narrow in center decreasing to nothing at each end.

Length, 1.23 mm; height, 0.51 mm; width, 0.42 mm.

“Centralia” zone, locality 82.
Bairdiacypris haydenbrachensis (Payne)
Plate 4, figures 20, 21

Carapace sublenticular in lateral outline; dorsal margin arched, somewhat flat in central portion, curving downward at unequal angles toward somewhat acuminate ends, both terminated below midheight; ventral margin concave; overlap moderately wide, fairly uniform around all margins, widest in centrodorsal area, narrowest around ends.
Length, 1.22 mm; height, 0.55 mm; width, 0.48 mm.
Millersville zone, locality 90.

Bairdiacypris nebraskensis (Upson)
Plate 4, figures 28, 29
Bairdia nebraskensis Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 18, pl. 1, figs. 6a, b; Wreford formation, Nebraska.

Bairdia subelongata. Harlton, 1929 (not Jones and Kirkby), Texas Univ. Bull. 2901, p. 157, pl. 3, figs. 6a-d; Canyon series, Texas.

Bairdia rogatzi Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 264, pl. 25, fig. 7; East Mountain shale, Texas.

Bairdia acetatata. Upson, 1933 (not Coryell and Billings), Nebraska Geol. Survey Bull. 8, p. 17, pl. 1, fig. 5a; Garrison shale, Nebraska.

Bairdia hoxbarensis. Kellett, 1934 (not Harlton), Jour. Paleontology, vol. 8, p. 131, pl. 16, figs. 5a-c; Topeka to Wreford formations, Kansas. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 40, pl. 4, fig. 8; Wyandotte to Stanton formation, Nebraska.


Carapace elongate, semieliptical in lateral outline; dorsal margin strongly convex, ventral margin concave; anterior end broadly rounded, posterior also rounded but more acuminate and depressed below midheight; posterodorsal slope short and straight; overlap fairly broad along dorsum, narrow in centroventral region and faint or lacking around ends.
Length, 1.26 mm; height, 0.54 mm; width, 0.38 mm.

Most of the species listed in the synonomy were considered to be Bairdia hoxbarensis by Kellett (1934, p. 131) and Johnson (1936, p. 40). However, they lack the acuminate posterior termination, highly arched dorsum and depressed articulation of the posterodorsal slope of Bairdia.

St. David to Exline zones, localities 29, 46, 53, 66.

Bairdiacypris shideleri (Delo)
Plate 4, figures 26, 27
Bairdia shideleri Delo, 1930, Jour. Paleontology, vol. 4, p. 167, pl. 13, fig. 2; Pennsylvanian, Texas.

Carapace ovate, flat, dorsal margin strongly arched, ventral margin flat; anterior end broadly rounded; posterior end narrow and terminated well below midheight; dorsal overlap uniformly narrow for entire length and down the short, straight posterodorsal slope; ventral overlap narrow at ends, widening somewhat in central portion.
Length, 1.10 mm; height, 0.54 mm; width, 0.36 mm.

Gimlet formation, locality 62.

Bairdiacypris trojana (Wilson)
Plate 4, figures 36-38
Bairdia trojana Wilson, 1933, Jour. Paleontology, vol. 7, p. 418, pl. 50, figs. 9a-c; McAlester shale, Oklahoma.

Carapace elongate, somewhat tumid; dorsal margin convex, ventral margin concave; anterior end broadly rounded, posterior end acuminate but narrow, due to short straight posterodorsal slope; overlap fairly wide and uniform along dorsal margin, narrow to absent along ventral margin.
Length, 1.26 mm; height, 0.49 mm; width, 0.42 mm.

Fulda to Brereton zones, localities 1, 23, 38.
Genus *Bythocypris* Brady, 1880

*Bythocypris disparilis* Cooper, n. sp.

*Bythocypris disparilis* differs from *B. subpediformis* Coryell and Booth by the unequal height of its ends and a slightly greater form ratio; the form ratio is considerably larger than in *B. erectus* Harris and Worrel.

"Centralia" zone, localities 81, 82.

*Bythocypris quadrata* Cooper, n. sp.

*Bythocypris quadrata* Cooper, n. sp.

By the same token, the form ratio is considerably larger than in *B. erectus* Harris and Worrel.

"Centralia" zone, localities 81, 82.

*Bythocypris subpediformis* Bradfield

*Bythocypris subpediformis* Bradfield

*Bythocypris pediformis*, Coryell and Booth, 1933 (not Knight), Am. Midland Naturalist, vol. 14, p. 266, pl. 4, fig. 5; Wayland shale, Texas.

*Bythocypris subpediformis* Bradfield, 1935

Bull. Am. Paleontology, vol. 22, p. 102, pl. 5, figs. 9a, b; Deese and Hoxbar groups, Oklahoma.

Carapace small, reniform, dorsal margin arched, ventral margin slightly convex; ends rounded; overlap moderate, varies little around entire margin; greatest height nearly central; greatest thickness posterior.

Length, 0.57 mm; height, 0.34 mm; width, 0.27 mm; form ratio, 1.68.

*B. subpediformis* Bradfield is distinguished from similar-appearing species of *Coryellites* by the lack of angulation on the posterodorsal margin.

Gimlet and Little Vermilion zones, localities 62, 81, 105.

Genus *Coryellites* Kellett, 1936


Carapace ovate in lateral view, somewhat tumid. Dorsal margin broadly convex; ventral margin straight to slightly convex; anterior end broadly rounded, posterior end flatly convex to almost straight, posterodorsal angle 90° or nearly so; overlap, left valve over right, usually greatest on posterodorsal and ventral margins, less along anterior margin and sometimes wanting on posterior margin. Posterodorsal angle acuminate in contrast to opposite, smoothly rounded posterior angle; hingement cardine, left valve grooved to receive flange on the right valve (Cooper, 1941, p. 38); greatest height and thickness usually posterior; surface smooth. The principal means of specific differentiation is the form ratio (length divided by height).


*Coryellites* is somewhat similar to *Harlonella* Bradfield, but the angulation in the posterodorsal margin in no way resembles the ridge of the latter, the rounded posterodorsal margin of *Bythocypris*, or the spine of *Waylandella* Coryell and Billings; likewise the greatest height is always posterior, while it may be anterior in some species of *Harlonella*. *Bythocypris* also differs in possessing a concave venter. The separation of the genera *Coryellites* Kellett and *Silenites* Coryell and Booth of the Pennsylvanian and the subgenus *Bairdiacypris* Kegel of the Devonian from *By-
thocypris has shown the need for a reexamination of remaining species, in order to determine whether or not these species should properly be classified with a genus based primarily on Recent species. The genus ranges through the Pennsylvanian system in Illinois.

Coryellitis centralis (Coryell and Billings)
Plate 4, figures 45, 46
Bythocypris centralis Coryell and Billings, 1932. Am. Midland Naturalist, vol. 13, p. 174, pl. 17, fig. 11; Wayland shale, Texas. —Coryell and Sample, 1932, ideem., p. 265, pl. 25, fig. 12; East Mountain shale, Texas.
Bythocypris bullifera Wilson, 1933. Jour. Paleontology, vol. 7, p. 420, pl. 50, figs. 5a-c; McAlester shale, Oklahoma.
Bythocypris pediformis, Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 43, pl. 4, figs. 13-15; Missouri series, Nebraska.

Carapace elongate, semielliptical, dorsal margin arched, ventral margin straight, anterior end rounded, posterior straight and almost vertical; posteroventral angle about 90°; overlap pronounced, especially along ventral margin; greatest height central.

Length, 0.77 mm; height, 0.40 mm; width, 0.33 mm; form ratio 1.84.

C. centralis differs from C. palopin-tocensis (Coryell and Sample) in its smaller form ratio.

Wiley to Exline zones, localities 13, 19, 26, 67.

Coryellitis contracta Cooper, n. sp.
Plate 4, figures 41, 42
Carapace, short, ovate, dorsal margin arched, ventral margin nearly straight, anterior end symmetrically rounded, posterior end straighter and vertical; anteroventral termination somewhat rounded and lacks usual acuminate character; overlap very prominent on centro-dorsal margin and along venter; greatest height central, greatest thickness posterior.

Length, 0.66 mm; height, 0.41 mm; width, 0.30 mm; form ratio, 1.70.

This species differs from C. johnsoni (Upson) in having a straighter and more vertical posterior margin and from C. subelliptica (Upson) in having a greater overlap along the entire ventral margin.

Summum and St. David zones, localities 26, 30.

Coryellites cooki (Bradfield)
Plate 4, figures 39, 40
Bythocypris cooki Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 97, pl. 8, figs. 1a, b; Deese? group, Oklahoma.

Bythocypris scapha, Bradfield, 1935 (not Coryell and Billings), idem., p. 98, pl. 8, figs. 2a, b; Deese? group, Oklahoma.

Carapace thin, elongate, semiquadrilateral, dorsal margin slightly arched; ventral margin almost straight; anterior end rounded; posterior margin straight, nearly vertical; overlap moderate, most pronounced along ventral margin; greatest height central.

Length, 0.61 mm; height, 0.36 mm; width, 0.19 mm; form ratio, 1.72.
Liverpool zone, locality 19.

Coryellites elongata Cooper, n. sp.
Plate 4, figures 43-44
Carapace elongate, subquadrilateral, dorsal margin flat or broadly convex, little more curved than the ventral margin; anterior end rounded; posterior end somewhat convex and almost vertical; posteroventral angle slightly rounded; overlap greatest along venter, inconspicuous along other margins; greatest height and thickness posterior.

Length, 0.85 mm; height, 0.37 mm; width, 0.33 mm; form ratio, 2.24.

This species is characterized by its high form ratio, the slightly curved almost flat dorsum, and the almost vertical posterior end. It is more elongate than C. texensis (Coryell and Sample) and has a lower arched dorsum than the form described by Scott and Borger as this species, but which may be C. frivola (Bradfield).
Liverpool to Bogota zone, localities 20, 56, 107.
Coryellites firma Kellett
Plate 5, figures 3, 4

Coryellina firma Kellett, 1935, Jour. Paleontology, vol. 9, p. 138, pl. 16, figs. 7a-c; Deer Creek and Howard formations, Kansas.


Bythocypris deesensis Bradfield, 1935, idem., p. 95, pl. 7, figs. 12a, b; Deese group, Oklahoma.

Bythocypris hoxbarana Bradfield, 1935, idem., p. 101, pl. 8, figs. 8a, b; Hoxbar group, Oklahoma.

Bythocypris pediformis, Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 74, pl. 6, figs. 6a-b; Wetumka, Wewoka and Holdenville formations, Oklahoma.

Healdia leguminoida Knight, 1928, Jour. Paleontology, vol. 2, p. 332, pl. 44, figs. 7a, b; Labette formation, Missouri.

Carapace ovate, dorsal margin arched, ventral margin slightly convex; anterior end rounded, posterior end convex and almost vertical; greatest overlap along dorsal and posteroventral margins.

Length, 0.69 mm; height, 0.39 mm; width, 0.28 mm; form ratio, 1.80.

Seville to Shumway zones, localities 5, 17, 22, 24, 48, 55, 56, 62, 88, 100, 112.

Coryellites johnsoni (Upson)
Plate 5, figures 5, 6

Bythocypris johnsoni Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 25, pl. 2, fig. 12a; Funston limestone, Nebraska.

Carapace ovate, dorsal margin broadly arched, venter straight, curved upward to meet ends; anterior end rounded, termination below midheight; posteroventral angulation sharp, about midway between venter and midheight; overlap moderate around entire margin.

Length, 0.65 mm; height, 0.37 mm; width, 0.28 mm; form ratio, 1.68.

Exline to Woodbury zones, localities 65, 100, 115.

Coryellites lowelli Cooper, n. sp.
Plate 5, figures 11-14

Carapace ovate, dorsal and ventral margins about equally convex; anterior end rounded, termination at midheight; posterior end less convex, inclined from vertical, termination well below midheight; greatest height and thickness just back of center, which is position of greatest overlap on dorsal and ventral margins; posteroventral angle of right valve about 90°.

Length, 1.02 mm; height, 0.47 mm; width, 0.33 mm; form ratio, 1.78.

C. lowelli is recognized by its equal and distinct dorsal and ventral overlap, located posteriorly.

Liverpool zone, localities 19, 21, 22.

Coryellites mytiliformis (Bradfield)
Plate 5, figures 1, 2

Bythocypris mytiliformis Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 102, pl. 8, figs. 10a, b; Hoxbar group, Oklahoma.

Argilloecia regularis Delo, 1930, Jour. Paleontology, vol. 4, p. 174, pl. 13, figs. 11a, b; Pennsylvanian, Texas.

?Argilloecia regularis, Upson, Nebraska Geol. Survey Bull. 8, p. 27, pl. 3, figs. 4a, b; Hughes Creek shale, Nebraska.

Carapace elongate, ovate, anterior margin arched, ventral margin straight, anterior end rounded and terminated at midheight; posterior end acuminate; posteroventral angle about 90°.

Length, 0.64 mm; height, 0.32 mm; width, 0.27 mm; form ratio, 2.0.

This species can be recognized by the acuminate posterior truncation.

Newton zone, locality 112.

Coryellites ovata Cooper, n. sp.
Plate 5, figures 7, 8

Coryellites pediformis, Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 267, pl. 25, fig. 18; East Mountain shale, Texas. —Kellett, 1935, Jour. Paleontology, vol. 9, p. 135, pl. 16, figs. 8a-f; Stanton to Ft. Riley limestone, Kansas.

Carapace short, ovate, dorsal margin arched, ventral margin convex, anterior....
end rounded; posteroventral angulation sharp; greatest height nearly central; overlap faint, nearly equal around entire margin.

Length, 0.50 mm; height, 0.30 mm; width, 0.24 mm; form ratio 1.58.

St. David to Newton zones, localities 34, 52, 53, 62, 83, 84, 86, 100, 107, 108.

**Coryellites palopintoensis** (Coryell and Sample)

Plate 5, figures 9, 10

*Bythocypris palopintoensis* Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 267, pl. 25, fig. 17; East Mountain shale, Texas.

*Bythocypris paralela*, Bradfield, 1935 (not Knight). Bull. Am. Paleontology, vol. 22, p. 95, pl. 8, figs. 4a, b; Hoxbar group, Oklahoma.

Carapace elongate, semielliptical, dorsal margin slightly convex, ventral margin straight; anterior end rounded; posterior end almost straight, nearly vertical; posteroventral angle slightly greater than 90°; overlap moderate, uniform.

Length, 0.60 mm; height, 0.31 mm; width, 0.23 mm; form ratio, 2.0.

This species is characterized by its nearly parallel dorsal and ventral margins and its nearly straight and vertical posterior. Differs from *C. centralis* (Coryell and Billings) in the larger form ratio (2.0 cf. 1.84).

Seville to Newton zones, localities 6, 16, 19, 56, 68, 69, 72, 74, 85, 103, 108.

**Coryellites paralela* (Knight)

Plate 5, figures 15, 16

*Bythocypris paralela* Knight, 1928, Jour. Paleontology, vol. 2, p. 327, pl. 44, figs. 2a, b; Labette formation, Missouri.

Carapace ovate, somewhat elongate, ends rounded; posteroventral angle obtuse, rather inconspicuous; dorsal margin arched, venter straight to slightly concave; overlap prominent, especially along venter.

Length, 0.54 mm; height, 0.28 mm; width, 0.22 mm; form ratio, 2.0.

Liverpool to Jamestown zones, localities 17, 38, 46, 51.

**Coryellites pediformis** (Knight)

Plate 5, figures 19-21

*Bythocypris pediformis* Knight, 1928, Jour. Paleontology, vol. 2, p. 327, pl. 44, figs. 3a-c; Labette formation, Missouri.

—Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 100, fig. 6a, b; Hoxbar group, Oklahoma.

*Bythocypris scapha* Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 174, pl. 17, fig. 10; Wayland shale, Texas.


Carapace ovate, dorsal margin arched, ventral margin straight to slightly concave; anterior end rounded, posterior angulation moderate; overlap faint along all margins except posteroventral where it is moderate; greatest height slightly back of center.

Length, 0.65 mm; height, 0.39 mm; width, 0.30 mm; form ratio, 1.75.

Seville to Shumway zones, localities 5, 7, 48, 54, 69, 73, 103, 109.

**Coryellites scotti** Cooper, n. sp.

Plate 5, figures 17, 18

*Bythocypris paralela*, Scott and Borger, 1941 (not Knight), Jour. Paleontology, vol. 15, p. 354, pl. 50, fig. 6; Macoupin formation, Illinois.

Carapace elongate, dorsal margin broadly convex, almost straight, venter straight, anterior end rounded; posterior angulation moderate; overlap inconspicuous, slightly greater along ventral margin; greatest height central.

Length, 0.60 mm; height, 0.28 mm; width, 0.25 mm; form ratio, 2.13.

Gimlet to Shumway zones, localities 62, 103, 107, 109, 112, 115.
CORYELLITIDES SIMILLIMA (Bradfield)
Plate 5, figures 24, 25
Bythocypris simillima Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 96, pl. 7, figs. 10a, b; Deese group, Oklahoma.
Carapace semielliptical, dorsal margin elongate, arched; ventral margin convex; anterior end rounded, posterior end convex, truncation moderate; overlap greatest along ventral and centrodorsal margins; greatest height just back of center; greatest thickness near posterior end.
Length, 0.78 mm; height, 0.39 mm; width, 0.30 mm; form ratio, 2.0.
Liverpool and Sparland zones, localities 22, 24, 56.

CORYELLITIDES SUBElliPTica (Upson)
Plate 5, figures 29, 30
Argilloecia subeelliPTica Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 26, pl. 3, figs. 3a-c; Hughes Creek shale, Nebraska.
Carapace short, ovate, dorsal margin strongly arched, gradually merges into curved anterior and posterior ends; posteroverentral angle 90°; overlap conspicuous along centrodorsal and posterior half of ventral margins; greatest height central.
Length, 0.60 mm; height, 0.33 mm; width, 0.24 mm; form ratio, 1.80.

CORYELLITIDES TEXENSIs (Coryell and Sample)
Plate 5, figures 27, 28
Bythocypris texensis Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 266, pl. 25, fig. 13; East Mountain shale, Texas.
Bythocypris parallelula, Coryell and Sample, 1932, (not Knight), idem, p. 266, pl. 25, fig. 11; East Mountain shale, Texas.
Bythocypris procera Coryell and Billings, 1932, idem, vol. 13, p. 174, pl. 17, fig. 12; Wayland shale, Texas.
Carapace elongate, subelliptical, dorsal margin broadly convex; ventral margin straight; anterior end rounded, posteroverentral angulation low, prominent; overlap moderate along venter, faint on other margins; greatest height central.
Length, 0.69 mm; height, 0.36 mm; width, 0.27 mm; form ratio, 1.95.
Sparland to Shumway zones, localities 55, 81, 84, 100, 103, 108, 109, 112.

CORYELLITIDES TOMLINSONella
Cooper, n. sp.
Plate 5, figures 22, 23
Bythocypris tomlinsoni, Harlton, 1933, (not Harlton, 1929), Jour. Paleontology, vol. 7, p. 25, pl. 7, fig. 9; Johns Valley shale, Oklahoma.
Carapace semielliptical, somewhat elongate, anterior end rounded, posterior end less rounded and almost vertical; posteroverentral angle prominent, acuminate, greater than 90°; overlap greatest along posteroverentral margin, less along dorsum, faint on ends; greatest height and thickness posterior.
Length, 0.63 mm; height, 0.33 mm; width, 0.25 mm; form ratio, 1.9.
Since the holotype of C. tomlinsoni is now recognized to be C. pediformis, C. tomlinsoni, (Harlton, 1933) is a homonym and this species requires a new name.
Wiley to Summum zones, localities 13, 16, 19, 26.

Genus Fabalicypris Cooper, n. gen.
Carapace tumid, ovate to lenticular in lateral outline, posterior end slightly more acuminate than anterior; dorsal and ventral margins convex; overlap left over right, greatest on centrodorsal and ventral margins; ventral overlap decreasing abruptly in anterior third to form an offset or step-like process, surface smooth.
Genotype: Fabalicypris wileyensis, Cooper, n. sp.
Fabalicypris resembles several other genera of the Bairdiidae. It differs from Bairdia and Bairdiacypris by its lack of a pronounced posterodorsal slope and highly arched centrodorsal margin, and from Bairdia by the absence of an acuminate posterior end. It is more
tumid than Bairdia cypris, which lacks the peculiar offset on the anteroventral overlap. Macrocypris and Bythocypris do not have the lens-shaped lateral outline.

In addition to the species described below Bairdia warthini Bradfield (1935, p. 83, pl. 5, figs. 11a, b), Bairdia acetata Coryell and Billings (1932, p. 173, pl. 17, fig. 5) and Macrocypris ovata Cooper (1941, p. 34, pl. 4, figs. 25, 26) should be transferred to this genus.

Range: Pennsylvanian and Mississippian systems.

**Fabalicypris acuminata** Cooper, n. sp.
Plate 5, figures 33-36

Carapace elongate, lens-shaped in lateral outline; dorsal and ventral margins convex; anterior end rounded, posterior end acuminate; overlap wide on centro-dorsal margin; moderate on centroventral margin; ventral offset moderate, sinuous rather than abrupt; greatest height anterior.

Length, 1.10 mm; height, 0.54 mm; width, 0.40 mm.

*F. acuminata* resembles *F. dispar* to some extent, but differs in having symmetrical terminations and dorsal and ventral overlaps. The anterior position of greatest height in *F. acuminata* is peculiar to this species.

Liverpool zone, locality 16.

**Fabalicypris dispar** Cooper, n. sp.
Plate 5, figures 37-39

Carapace lens-shaped in lateral outline; dorsal and ventral margins uniformly convex; ends subequally rounded; dorsal overlap greatest in central area, decreasing gradually anteriorly, rapidly posteriorly; ventral overlap also greatest centrally but decreasing rapidly anteriorly, gradually posteriorly; the ends are oppositely curved, the anterior most sharply curved dorsally, the posterior ventrally, giving a somewhat "skewed" appearance to the lateral outline; offset slope very low, producing a sinus-uous curve to the ventral line of articulation.

Length, 1.03 mm; height, 0.55 mm; width, 0.42 mm.

Liverpool zone, localities 16, 17.

**Fabalicypris minuta** Cooper, n. sp.
Plate 5, figures 31, 32

Carapace small, lens-shaped in lateral outline; dorsal and ventral margins subequally convex; anterior end rounded, posterior acuminate; overlap greatest in central half of dorsal and ventral margins, very narrow around ends; ventral offset moderate; anterodorsal slope unusually steep; greatest thickness posterior.

Length, 0.93 mm; height, 0.41 mm; width, 0.36 mm.

This species is distinguished by its small size, narrow overlaps and its low anterior end accompanied by a steep anterodorsal slope.

Seville and Seahorne zones, localities 7, 11.

**Fabalicypris plana** Cooper, n. sp.
Plate 5, figure 26

Carapace flat, thin, rather high; subelliptical in lateral outline; dorsal and ventral margins equally convex; anterior end rounded, posterior acuminate; overlap wide along entire dorsum and in central half of ventral margin, very narrow around ends; ventral offset somewhat inconspicuous.

Length, 1.0 mm; height, 0.53 mm; width, 0.28 mm.

*F. plana*, in some ways resembles Bairdia hawarthi Knight, but lacks the straight or concave posterodorsal slope of Bairdia. Its extreme thinness distinguishes it from other species of Fabalicypris.

Liverpool zone, localities 16, 19.

**Fabalicypris regularis** Cooper, n. sp.
Plate 6, figures 1-3

Carapace of medium size, somewhat tumid; lens-shaped in lateral outline; ends subequally rounded, posterior
somewhat acuminate; dorsal margin convex, ventral margin concave; overlap uniformly narrow around all margins; ventral offset broadly curved.

Length, 1.0 mm; height, 0.42 mm; width, 0.36 mm.

*F. regularis* may be recognized by its narrow, uniform overlap around all margins.

Ferdinand and Seville zones, localities 2, 6.

**Fabalicypris tenuis** Cooper, n. sp.

Plate 6, figures 9-11

Carapace slender, somewhat tumid; lens-shaped in lateral outline; dorsal margin strongly arched, ventral margin less so; overlap very pronounced in centrodorsal region, decreasing to nothing at each end; ventral overlap and offset rather inconspicuous; greatest thickness near center of posterior half; surface smooth.

Length, 1.16 mm; height, 0.51 mm; width, 0.40 mm.

*F. tenuis* may be distinguished from *F. wileyensis* by the unequal centrodorsal and ventral overlaps and by the lack of overlap around the ends.

Seville zone, localities 3, 5.

**Fabalicypris wetumkaensis**

Cooper, n. sp.

Plate 6, figures 12-19

*Bairdia haworthi*, Warthin, 1930 (not Knight), Oklahoma Geol. Survey Bull. 53, p. 72, pl. 6, figs. 4a, b; Wetumka formation, Oklahoma.

Carapace elongate, slender; lens-shaped in lateral outline; dorsal margin convex, ventral straight to slightly concave; ends rounded; dorsal overlap uniform, very wide from posterior end to anterodorsal angle where it becomes quite narrow, widening again in medial half of the ventral margin; anterovelar offset of overlap broadly rounded; greatest thickness posterior; surface smooth.

Length (figs. 12-15), 1.07 mm; height, 0.45 mm; width, 0.39 mm.

This species is distinguished by its large form ratio and the broad, uniform overlap along its dorsal margin.

Ferdinand to Collinsville zones, localities 2, 3, 28, 29, 30, 33, 38, 53, 54, 55, 58, 62, 66, 67, 69, 73.

**Fabalicypris wileyensis** Cooper, n. sp.

Plate 6, figures 4-8

Carapace elongate, somewhat tumid; lens-shaped in lateral outline; dorsal and ventral margins arched; overlap greatest in centrodorsal and ventral margins, decreasing almost completely around anterior end, moderate around posterior end; anterovelar offset very pronounced; greatest thickness near posterior end; surface smooth.

Length, 1.02 mm; height, 0.53 mm; width, 0.42 mm.

Ferdinand to Summum zones, localities 2, 8, 11, 13, 21, 28.

**Genus Macrocypris** Brady, 1867

**Macrocypris bicornuta** Cooper n. sp.

Plate 6, figures 25-27

Carapace semilenticular in lateral view; tumid; dorsal margin strongly arched; ends pointed; ventral margin sinuous, concave posteriorly, convex anteriorly; overlap inconspicuous.

Length, 0.75 mm; height, 0.35 mm; width, 0.37 mm.

Greenup zone, locality 114.

**Macrocypris garrisonensis** Upson

Plate 6, figures 50, 51

*Macrocypris garrisonensis* Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 25, pl. 2, figs. 14a, b; Garrison Limestone, Nebraska. —Kellett, 1935, Jour. Paleontology, vol. 9, p. 139, pl. 16, figs. 10d, e; Deer Creek and Howard formations, Kansas.


Carapace slender, elongate; dorsal margin smoothly convex, curvature increasing slightly to meet ends; posterior
end acuminate and well below midheight; anterior end rounded and also terminated below midheight; ventral margin almost straight, slightly convex; overlap uniform, inconspicuous.

Length, 0.90 mm; height, 0.35 mm; width, 0.28 mm.

Gimlet zone, locality 63.

**Macrocypris illinoiensis**
Scott and Borger
Plate 6, figures 22-24

*Macrocypris illinoiensis* Scott and Borger, 1941, *Jour. Paleontology*, vol. 15, p. 358, pl. 50, figs. 1, 2; Macoupin formation, Illinois.

Carapace small, short; dorsal margin arched, curving rapidly to meet ends; ventral margin convex; dorsal view lens-like in outline; posterior end acuminate, anterior end also somewhat acuminate but broader than posterior; both ends terminated well below midheight; greatest height and thickness slightly back of middle; overlap inconspicuous.

Length, 0.64 mm; height, 0.31 mm; width, 0.28 mm.

‘*Centralia’*, Macoupin and Greenup zones, localities 79, 83, 114.

**Macrocypris lenticularis**
Cooper, n. sp.
Plate 6, figures 38-40

Carapace lenticular in lateral outline; dorsal margin very slightly convex, curvature changing abruptly to form steep, almost straight, anterior and posterior slopes; ventral margin slightly convex, almost straight; overlap moderate along venter only, very slight on other margins.

Length, 0.85 mm; height, 0.39 mm; width, 0.39 mm.

This species lacks the reversed curvature of the ventral margin of *M. bicurvata* and has a flatter dorsal margin.

Greenup zone, locality 114.

**Macrocypris menardensis** Harlton
Plate 6, figures 45, 46


Carapace elongate, semilenticular in lateral outline; anterior end rounded, posterior end tenuous, sharply pointed; dorsal margin broadly arched, ventral margin slightly convex.

Length, 0.92 mm; height, 0.35 mm; width, 0.24 mm.

Brereton and Gimlet zones, localities 42, 62.

**Macrocypris teretis** Cooper, n. sp.
Plate 6, figures 28-30

Carapace elongate, subelliptical; dorsal margin gently convex, sloping toward narrow rounded posterior end; ventral margin nearly straight; greatest height and thickness near broadly rounded anterior end; overlap moderate, uniform around entire margin.

Length, 0.74 mm; height, 0.35 mm; width, 0.30 mm.

*M. teretis* differs from *M. delicatula* Bradfield, *M. garrisonensis* Upson, and *M. menardensis* Harlton in the absence of an acuminate posterior end.

St. David and Jamestown zones, localities 32, 50.

Genus Microcheilinella Geis, 1932

**Microcheilinella bicornuta**
Cooper, n. sp.
Plate 6, figures 34-37

Carapace very small, short, tumid; lateral outline elliptical, hinge line sinuous and deeply incised, especially in posterior half, ventral line of articulation curved; posterointernal portion of each valve produced into a short, thick spine; greatest thickness posterior; anterior end acuminate in dorsal view.

Length, 0.49 mm; height, 0.24 mm; width, 0.37 mm.

‘*Centralia’* zone, locality 82.
Microcheilinella inflata Kellett
Plate 6, figures 20, 21

Microcheilinella inflata Kellett, 1935, Jour. Paleontology, vol. 9, p. 140, pl. 16, figs. 12a-e; Stanton to Elmdale formations, Kansas.

Carapace small, very tumid, ovate to elliptical in lateral and dorsal outlines; dorsal and ventral margins strongly convex; overlap wide around all margins except posterior; hinge line sinuous, deeply incised.

Length, 0.45 mm; height, 0.26 mm; width, 0.38 mm.

Bogota zone, locality 97.

Microcheilinella minuta Cooper, n. sp.
Plate 6, figures 47-49

Carapace very small, tumid; lateral outline almost perfectly elliptical; hinge line straight, incised, especially in posterior half; overlap moderate, fairly uniform.

Length, 0.41 mm; height, 0.22 mm; width, 0.22 mm.

M. minuta may be distinguished by its elliptical lateral outline and its small size.

Seville zone, locality 6.

Microcheilinella quadrata
Cooper n. sp.
Plate 6, figures 41-44

Carapace large, tumid, elongate; semi-elliptical in lateral outline; dorsal margin very slightly convex, almost straight; ventral margin concave; ends rounded; overlap broad around all margins; hinge line incised, almost straight; greatest thickness posterior.

Length, 0.75 mm; height, 0.36 mm; width, 0.44 mm.

M. quadrata resembles M. obesa Cooper 1941 (p. 331) but is much larger, more elongate, has flatter dorsal and ventral margins, and a more nearly straight hinge line.

Brereton zone, locality 45.

Microcheilinella unispinosa
Cooper, n. sp.
Plate 6, figures 31-33

Carapace small, tumid; lateral outline elongate and semielliptical; ends rounded; dorsal and ventral margins almost straight; overlap moderate; hinge line straight, incised in shallow, V-shaped trough; the posteroventral angle of left valve is produced into a short thick spine.

Length, 0.41 mm; height, 0.19 mm; width, 0.22 mm.

M. unispinosa is characterized by its elongate, semielliptical shape and the single very prominent spine.

Little Vermilion zone, locality 104.

Genus Waylandella Coryell and Billings, 1932


Carapace short to elongate, ovate or semielliptical, overlap uniform around entire margin, right over left; dorsal margin usually more convex than ventral; posterior end marked by one or two posteriorly directed spines at dorsal and ventral angles; when only one is present it is located in ventral angle.

Genotype: Waylandella spinosa Coryell and Billings.

Coryell and Billings genotype species and others later placed in synonymy with it by Kellett (1936) possess two spines. However, later described species from Oklahoma and Texas have only one spine in the posteroventral angle, as do all known species from the Illinois basin. Harltonella Bradfield does not have a spine, but the posteroventral angle is developed into a downward-pointing ridge, and is thought to be a specific variation of the genus Waylandella just as the single spined form is a variant of two spined holotype species.
Waylandella ardmorensis (Bradfield)
Plate 7, figures 4-6


Harltonella elongata Bradfield, 1935, idem., p. 120, pl. 10, fig. 13.

Harltonella macropleura Bradfield, 1935, idem., p. 120, pl. 10, fig. 14.

Harltonella robusta Bradfield, 1935, idem., p. 120, pl. 10, fig. 15.

Carapace elongate, ends rounded, dorsal margin arched, ventral margin slightly convex, nearly straight, overlap nearly uniform, except along ventral margin, where it is slightly more pronounced; greatest height slightly anterior, greatest thickness posterior; spine absent, but its position marked by a swelling which forms an angularity in the posteroventral corner, especially noticeable in the ventral view.

Length, 0.72 mm; height, 0.41 mm; width, 0.34 mm.

The figured Illinois specimen is a female and corresponds closely to Bradfield’s plate 10, figure 15; his other specimens (pl. 10, figs. 12-14) including the genotype are males, and all except figure 12 are from the same horizon in the lower or Morrow portion of the Dornick Hills group.

Brereton zone, locality 41.

Waylandella bythocyproidea (Warthin)
Plate 7, figures 14-16

Healdia bythocyproidea Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 76, pl. 6, figs. 12a, b; Wewoka formation, Oklahoma.

Healdia aff. H. bythocyproidea, Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 107, pl. 9, figs. 9a, b; Deese group, Oklahoma.

Waylandella deesensis Bradfield, 1935, idem., p. 104, pl. 8, figs. 11a, b; Deese group, Oklahoma.

Carapace elongate, outline semieliptical in lateral view; dorsal and ventral margins convex; ends rounded; overlap moderate and fairly uniform around all margins, though slightly greater in centroventral and somewhat less in posteroventral portions; the single spine very small and located well down in posteroventral angle.

Length, 0.64 mm; height, 0.38 mm; width 0.30 mm.

An examination of the holotype of W. deesensis showed only one small spine, located in the posteroventral angle.

Seahorne to Craborechard zones, localities 11, 16, 23, 26, 36.

Waylandella cuyleri Coryell and Booth
Plate 7, figures 7-10

Waylandella cuyleri Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, pp. 268, pl. 5, fig. 5; Wayland shale, Texas.

Carapace very elongate, semielliptical, dorsal margin slightly convex, ventral margin straight, parallel to dorsal; ends rounded; curvature around posterior angles short compared to curving of anterior end; the single spine in posteroventral angle very low, based very near posterior end; overlap uniform around all margins except near spine where it is obscured by swelling of left valve.

Length, 0.63 mm; height, 0.31 mm; width, 0.27 mm.

Sparland zone, locality 56.

Waylandella dispar Cooper, n. sp.
Plate 7, figures 27, 28

Carapace elongate, semielliptical in lateral outline; dorsal margin asymmetrically convex, ventral margin straight; anterior end rounded, posterior angles sharply curved forming rather straight ventral margin in midportion; overlap uniform, rather conspicuous; greatest height anterior; greatest thickness near anterior end; very small spine located just above angle formed by ventral and posterior margins.

Length, 0.82 mm; height, 0.41 mm; width, 0.36 mm.

Liverpool to Summum zones, localities 17, 23, 26.
WAYLANDELLA OBESA Cooper, n. sp.

Plate 7, figures 22-26

Carapace large, tumid; lateral outline semielliptical; dorsal and ventral margins convex; end rounded; overlap variable, greatest in centrodorsal and posteroventral portions, least around anterior end; greatest height central, greatest thickness near posterior end; surface smooth.

Length, 0.82 mm; height, 0.45 mm; width, 0.36 mm.
Liverpool zone, locality 22.

WAYLANDELLA VULGARIS Cooper n. sp.

Plate 7, figures 1-3

Carapace elongate, semielliptical in lateral outline; dorsal margin arched, ventral margin slightly convex; ends rounded, posterodorsal angle more sharply curved than others; overlap moderate, uniform; backward directed spine moderately low, rather blunt, and based near posterior margin; base broad, flaring, tapering gradually; greatest height anterior, greatest thickness about center of posterior half of shell.

Length, 0.67 mm; height, 0.36 mm; width, 0.28 mm.
Seville to Wiley zones, localities 3, 9, 13.

Family CYPRIDAE Baird, 1850

GENUS CANDONA Baird, 1845

CANDONA BAIRDIOIDES (Jones and Kirkby)

Plate 8, figures 3-10


Carapace elongate, dorsal margin arched, slightly flattened in medial portion, ventral margin straight to slightly convex; outline in dorsal view is lens-shaped; greatest height posterior, greatest thickness central, greatest length well below midportion; hinge along central half of dorsum; overlap slight to lacking on free margins, except anterior two-thirds of venter where it is right over left; surface smooth.

Length, (figs. 7-10) 1.28 mm; height, 0.63 mm; width, 0.51 mm.
Cohn to Omega zones, localities 94, 95, 104.
Candona planidorsata Cooper, n. sp.
Plate 8, figures 11-14
Carapace large, tumid, lateral outline semielliptical; dorsal and ventral margins nearly straight, parallel; ends subequally rounded in lateral view, acuminate in dorsal view; hinge line short, incised, with left valve extending above right; overlap right over left along venter, lacking around ends; greatest height and width posterior; surface smooth.
Length, 1.06 mm; height, 0.56 mm; width, 0.50 mm.
C. planidorsata lacks the arched dorsum of all described Paleozoic species except C. bairdioides (Jones and Kirkby). It does not possess the acuminate ends of the latter species.
Summum zone, locality 27.

Candona salteriana
(Jones and Kirkby)
Plate 8, figures 21-25
Carbonita roederiana Jones and Kirkby, 1890, Manchester Geol. Soc. Trans., vol. 21, p. 135, plgs. 5-6b; Upper Coal Measures, England.

Carapace elongate, ventrodorsal margin straight, venter straight to slightly convex, ends rounded, dorsal outline lenticular with tenuous ends; hinge occupies central half of dorsum, with left valve raised slightly above, but no overlapping right valve; no overlap along free margins except along venter, where right valve overlaps left; surface smooth.
Length, 1.35 mm; height, 0.72 mm; width, 0.54 mm.
C. salteriana differs from C. bairdioides in its much higher posterior.
Summum and Bogota zones, localities 27, 106.

Genus Carbonita Strand, 1928

Carbonita agnes (Jones)
Plate 8, figures 1, 2
Carbonia agnes Jones, 1870, Geol. Mag., vol. 7, p. 218, pl. 9, figs. 6, 7; Coal Measures, South Wales. —Jones, 1870, Monthly Microscopical Jour., vol. 4, p. 185, pl. 61, fig. 7; Coal Measures, South Wales.

?Carbonia agnes rugulosa Jones, 1870, idem, p. 218, pl. 9, figs. 8, 9; Coal Measures, South Wales.

?Carbonia agnes subrugulosa Jones, 1870, idem, p. 218, pl. 9, fig. 10; Coal Measures, South Wales.

Carapace ovate, elongate; dorsal margin arched; ventral margin straight; ends rounded; hinge line straight, slightly incised, with edge of left valve slightly higher than right; line of ventral overlap narrow, sinuous, with marked curvature in center; overlap around ends narrow, uniform; overlap around contact margins right over left; surface covered by fairly large, shallow circular pits.
Length, 0.64 mm; height, 0.32 mm; width, 0.34 mm.

The character of the surface markings varies considerably, even among associated specimens, from deeply pitted to smooth or extremely finely granulose.
Gimlet zone, locality 62.

Carbonita inflata (Jones and Kirkby)
Plate 8, figures 40-42
Carbonia fabulina inflata Jones and Kirkby, 1879, Annals and Mag. Nat. History, ser. 5, vol. 4, p. 34, pl. 2, figs. 15-19; Coal Measures, Scotland.
Bythocypris tumidus Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 24, pl. 2, figs. 11a-c; Garrison shale, Nebraska.
Carbonita tumida, Kellett, 1935, Jour. Paleontology, vol. 9, p. 160, pl. 16, figs. 9a-d; Elmdale to Wreford formation, Kansas.

Whipplella depressa Holland, 1934, idem., p. 345, pl. 25, figs. 7a-c; Nineveh limestone, Pennsylvania. —Scott, 1944, op. cit., p. 143, pl. 24, figs. 21-23.

Carapace tumid, ovate to subelliptical, dorsal margin arched, ventral margin straight, ends round; greatest height and thickness posterior; hinge short, depressed, left valve sometimes rising above lateral outline along hinge; over-
The genus *Whipplella* Holland was restudied by Scott (1944, pp. 143-147) who reassigned five of Holland’s seven species to the genera *Cypridopois* Brady, *Candona* Baird, and *Gutschickia* Scott. A comparison of those from Illinois with the holotype and topotype collections from the Nineveh limestone of West Virginia and with *C.? tumida* (Upson) of the Permian (Wreford limestone) of Kansas, shows that those from Illinois are identical to the others in all respects except size. However, when the length-height dimensions are plotted (fig. 32) they appear to represent three moult stages of a single species. In the Nineveh topotype collection four molts are represented, the two larger ones corresponding to *W. tumida* and *W. cuneiformis* respectively. The excellent illustration of *C. fabulina inflata* (Jones & Kirkby) from the Coal Measures of Scotland, while larger than the common North American forms, is identical in all other details and has the same form ratio. Therefore, the three North American species should be considered moul stages of and conspecific with the Scottish species *C. inflata*.

Bogota and Newton zones, localities 106, 111.

**Carbonita magna** (Upson)

*Bythocypris tumidus magnus* Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 24, pl. 2, figs. 13a, b; Garrison shale, Nebraska.

*Carbonita? tumida magna* Kellett, 1935, Jour. Paleontology vol. 9, p. 161, pl. 16, figs. 11a-f; Stanton formation to Neva limestone, Kansas.

*Whipplella carbonaria* Scott, 1944, Jour. Paleontology, vol. 18, p. 143, pl. 24, figs. 3-5; Cohn formation, Illinois.

Carapace semielliptical, elongate, dorsal margin arched, venter straight to slightly concave, ends rounded, overlap right over left around entire margin except along short hinge near midhalf of dorsum; greatest height and thickness just back of center; surface reticulate.

Length, 0.65 mm; height, 0.34 mm; width, 0.36 mm.

Omega zone, locality 105.
Carbonita orbiculata Cooper, n. sp.
Plate 8, figures 43-45

Carapace nearly circular, tumid dorsal margin highly arched, ventral margin straight; ends equally rounded; overlap moderate around all free margins except posterodorsal, which is somewhat infolded, forming shallow trough; greatest height central, greatest thickness posterior; surface marked by small very shallow puncti.

Length, 0.95 mm; height, 0.77 mm; width, 0.58 mm.

This species is the shortest of all known species of Carbonita (form ratio 1.24).

Seville zone, locality 6.

Carbonita? tenuis Cooper, n. sp.
Plate 8, figures 33-35

Carapace elongate, slender; lateral outline semielliptical; dorsal margin strongly convex; ventral margin concave; ends equally rounded; overlap fairly prominent around ends, decreasing along flattened venter; hinge fairly short, slightly incised; surface covered with polygonal to very elongate reticulations which sometimes give the appearance of longitudinal striae.

Length, 0.60 mm; height, 0.31 mm; width, 0.32 mm.

G. tenuis is recognized by its elongate carapace with a very low, broadly arched dorsum, which accentuates its slender appearance.

Cohn zone, localities 94, 96.

Genus Gutschickia Scott, 1944

Gutschickia levis Cooper, n. sp.
Plate 8, figures 15, 16

Carapace relatively small, tumid; lateral outline ovate, dorsal margin arched, ventral margin straight; ends sub-equal, rounded, anterior end narrow; hinge line short, left valve slightly higher than right; overlap right over left along venter, little or no overlap around ends; greatest height and width posterior, surface smooth.

Length, 0.64 mm.; height, 0.44 mm.; width, 0.38 mm.

G. levis is recognized by its unequal ends and the smooth, unornamented surface.

Summum zone, locality 27.

Gutschickia ninevehensis (Holland)
Plate 8, figures 36-39


Whipplella deltoidea Holland, 1934, idem, p. 345, pl. 25, figs. 1a-c; Nineveh limestone, Pennsylvania.

Gutschickia ninevehensis Scott, 1944, Jour. Paleontology, vol. 18, p. 146, pl. 23, figs. 5-8.

Gutschickia deltoidea Scott, 1944, idem, vol. 18, p. 146, pl. 23, figs. 1-4.

Carapace tumid, ovate, dorsal margin highly arched, ventral margin slightly convex; antero- and posterodorsal slopes steeply inclined to the low rounded ends; greatest height and thickness slightly posterior, greatest length ventral; hinge occupies medial half of dorsum where left valve extends above line of concrescence; ventral overlap right over left; surface granulose to smooth.

Length, 1.24 mm; height, 0.76 mm; width, 0.61 mm.

Cohn and Omega zones, localities 95, 105.

Gutschickia ovata Cooper, n. sp.
Plate 8, figures 17-20

Carapace, large, very tumid; lateral outline ovate to subelliptical; dorsal margin broadly convex; ventral margin straight; ends subequally rounded; overlap moderate along dorsum decreasing around ends, becoming very narrow in centroventral region; venter flat, surface reticulate with uniform shallow polygonal pits.

Length, 1.16 mm.; height, 0.73 mm.; width, 0.78 mm.

G. ovata is distinguished by a low, broadly arched dorsum and by the almost equally rounded ends.

Summum zone, locality 27.
**GUTSCHICKIA SUBANGULATA**
(Jones and Kirkby)

Plate 8, figures 26-32


Carapace short, tumid, semiovate in outline, dorsal margin gently convex to almost flat, curving downward abruptly into almost straight antero- and posterodorsal slopes; ventral margin slightly convex; hinge line occupies most of the flat dorsal area, marked by protuberance of left valve; right valve overlaps left along venter; surface smooth to granulose.

Length (figs. 29-32), 1.36 mm.; height, 0.87 mm.; width, 0.73 mm.

*G. subangulata* is much shorter than *G. ninevehensis* (Holland) and has a proportionally longer hinge.

Newton zone and Greene formation, localities 111, 120.

Family **CYTHERIDAE** Baird, 1850

Genus **BASSLERELLA** Kellett, 1935

**BASSLERELLA ACUMINATA** Cooper, n. sp.

Plate 9, figures 8-10

Carapace small, tumid; lateral outline semiovate; dorsal margin strongly convex; ventral margin nearly straight; anterior end broadly rounded; posterior end narrow, posterodorsal slope composed of two nearly straight slopes, a short steep lower portion beginning at ventral margin and a much longer, less steep portion above; overlap very narrow around contact margins; surface smooth.

Length, 0.40-0.43 mm.; height, 0.24-0.27 mm.; width, 0.22 mm.

*B. acuminata* is similar to *B. crassa* Kellett but has a more acuminate posterior termination and the angulation of the posterodorsal slope is more pronounced.

Gimlet and “Centralia” zones, localities 62, 79.

**BASSLERELLA FIRMA** Kellett

Plate 9, figures 1, 2

*Basslerella firma* Kellett, 1935, Jour. Paleontology, vol. 9, p. 156, pl. 17, figs. 5a-g; Stanton formation to Winfield limestone, Kansas.

Carapace ovate, tumid, dorsal margin arched; posterodorsal slope gently inclined, slightly convex, posterior end narrow, rounded, and terminated well below midheight; ventral margin slightly convex; anterior end broadly rounded; greatest height anterior; overlap slight.

Length, 0.47 mm.; height, 0.28 mm.; width, 0.24 mm.

Seville and Gimlet zones, localities 6, 62.

**BASSLERELLA LACRIMOSA** Cooper, n. sp.

Plate 9, figures 3, 4

*Basslerella unispinosa* Scott and Borger, 1941 (part), Jour. Paleontology, vol. 15, p. 358, pl. 50, fig. 15 only; Macoupin formation, Illinois.

Carapace semiovate, tumid; dorsal margin arched, merging smoothly into posterodorsal slope; ventral margin straight in posterior half, curving upward into broadly rounded anterior end; posterior end narrow, rounded, and very low, anterior end very broad; overlap prominent along dorsum and posterodorsal slope; surface smooth.

Length, 0.53 mm.; height, 0.31 mm.; width 0.24 mm.

The species figured does not possess the spine of the Macoupin form but seems to be similar in other respects.

Gimlet to Newton zones, localities 62, 82, 108.

**BASSLERELLA OBESA** Kellett

Plate 9, figures 5-7

*Basslerella obesa* Kellett, 1935, Jour. Paleontology, vol. 9, p. 156, pl. 17, figs. 6a-f; Wakarusa limestone, Kansas.

Carapace small, tumid, lateral outline semiovate; dorsal and ventral margins convex, the latter less acute; anterior end broadly rounded, posterior end more acuminate; posterodorsal slope steep in
lower part, breaking into gentle slope to highest point on the dorsum; dorsal and ventral margins straight; overlap narrow around free margins; surface smooth.

Length, 0.58 mm; height, 0.35 mm; width, 0.30 mm.

Gimlet zone, locality 62.

**Basslerella ovata** Cooper, n. sp.

Plate 9, figures 19, 20

Carapace ovate, dorsum arched, venter slightly convex, curving upward gradually toward and merging with the broadly rounded anterior end; posterior termination well below midheight; overlap moderate.

Length, 0.52 mm; height, 0.30 mm; width, 0.22 mm.

*B. ovata* lacks the acuminate anterior end of *B. rostrata* (Knight) and *B. rothi* Kellett, and the tumidity of *B. obesa* Kellett and *B. crassa* Kellett.

"Centralia" and Newton zones, localities 82, 108.

**Basslerella? parallela** Cooper, n. sp.

Plate 9, figures 14, 15

Carapace small, elongate, somewhat tumid; lateral outline semielliptical; ends acuminate; dorsal and ventral margins straight and subparallel; the straight dorsal margin abruptly joins curvature at each end, in contrast to that of the venter, where this juncture is a smooth but sharp curve, especially on the posterior; overlap very narrow, surface smooth.

Length, 0.46 mm; height, 0.23 mm; width, 0.21 mm.

This species is easily recognized by the very long straight dorsal margin, in which it more nearly resembles *B. rostrata* (Knight). However, the latter has a more acuminate anterior end and the dorsal margin is not parallel to the ventral margin.

Gimlet zone, locality 62.

**Basslerella rostrata** (Knight)

Plate 9, figures 16-18

*B. rostrata* Knight, 1928, Jour. Paleontology, vol. 2, p. 328, pl. 44, figs. 1a-c; Pawnee limestone, Missouri.

Carapace small, elongate; dorsal margin convex; ventral margin straight; anterior end sharply rounded; posterior end acuminate; lower portion of posterior-dorsal margin is short, steep, and breaks abruptly into a long very flat slope which extends to the highest point on the dorsal margin, well forward of midlength; overlap narrow; surface smooth.

Length, 0.42 mm; height, 0.22 mm; width, 0.18 mm.

Gimlet zone, locality 62.

**Family Cytherellidae**, Sars, 1865

**Genus Cavellina** Coryell, 1928

**Cavellina angusta** Cooper, n. sp.

Plate 7, figures 29-31

Carapace elongate, somewhat tumid, dorsal margin rounded, ventral margin nearly straight; anterior end broadly rounded, posterior narrow and acuminate due to a pronounced posteroventral truncation; overlap greatest along anterior portion of dorsum and venter, decreasing slightly around anterior end, but decreasing rapidly posteriorly; greatest height anterior, height decreasing rapidly near midpoint to form an extremely narrow posterior; greatest thickness posterior; surface granulose.

Length, 0.69 mm; height, 0.38 mm; width, 0.21 mm.

The lateral outline of this species closely resembles that of *Sulcella*, but lacks the sulcus. It is easily recognized by the very narrow posterior end.

Liverpool to Craborchard zones, localities 16, 22, 36.

**Cavellina bisecta** Bradfield

Plate 7, figures 36, 37

*Cavellina bisecta* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 130, pl. 12, figs. 1a, b; Dornick Hills group, Oklahoma.
Carapace ovate, somewhat tumid; dorsal and ventral margins convex; end rounded, posterovertral truncation inconspicuous; overlap greatest in centro-dorsal and ventral regions, becoming less towards ends; greatest height central, greatest thickness posterior; surface granulose.

Length, 0.78 mm; height, 0.51 mm; width, 0.24 mm.

Bradfield's holotype appears to be corroded, and the "bisection" is thought to be due to a slight crushing of the valves. The Illinois form appears identical in all other respects.

Liverpool zone, locality 16.

**Cavellina cavellinoides** (Bradfield)

Plate 7, figures 34, 35

*Cytherella cavellinoides* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 124, pl. 11, figs. 3a, b; Deese group, Oklahoma.

Carapace elongate, semielliptical, dorsal margin convex, ventral margin nearly straight, ends rounded, the faint posterovertral truncation almost vertical; overlap uniform and moderate around all margins, being only slightly less around ends; greatest height nearly central; greatest thickness just back of center, surface smooth.

Length, 1.05 mm; height, 0.59 mm; width, 0.29 mm.

This species is distinguished by its elongate lateral outline, uniform overlap of valves, and by the very steep anterovertral truncation.

Lonsdale zone, locality 13.

**Cavellina cumingsi** Payne

Plate 7, figures 32, 33

*Cavellina cumingsi* Payne, 1937, Jour. Paleontology, vol. 11, p. 287, pl. 46, figs. 8a, b; Hayden Branch formation, Indiana.

Carapace elongate, convexity of dorsal and ventral margins slight; anterior end rounded, posterior end pointed due to pronounced posterovertral truncation; overlap very prominent, especially along dorsum and venter, least along end margins; greatest thickness posterior.

Length, 1.05 mm; height, 0.54 mm; width, 0.27 mm.

Exline to Woodbury zones, localities 65, 115.

**Cavellina daubeana** (Bradfield)

Plate 9, figures 28, 29

*Cytherella daubeana* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 126, pl. 11, figs. 8a, b; Hoxbar group, Oklahoma.

—Payne, 1937, Jour. Paleontology, vol. 11, p. 286, pl. 40, figs. 4a, b; Hayden Branch formation, Indiana.

Carapace semielliptical, dorsal margin convex, ventral margin straight; ends rounded, with very slight posterovertral truncation; overlap moderate and fairly uniform around entire margin; greatest thickness just back of center.

Length, 1.10 mm; height, 0.59 mm; width, 0.36 mm.

Exline to Woodbury zones, localities

**Cavellina equalis?** Coryell

Plate 9, figures 11-13

*Cavellina equalis* Coryell, 1928, Jour. Paleontology, vol. 2, p. 92, pl. 11, fig. 6; Boggy shale, Oklahoma.

Carapace elongate, dorsal and ventral margins equally convex; ends rounded, posterovertral truncation lacking in male, faint on female; overlap fairly uniform around entire margin, slightly greater in central portion of dorsum and venter, unusually prominent around ends; greatest height central, greatest thickness posterior on female, nearly central on male; surface smooth.

Male: Length, 1.16 mm; height, 0.66 mm; width, 0.43 mm; form ratio 1.75.

Female (figs. 11-13). Length, 1.26 mm; height, 0.74 mm; width, 0.59 mm; form ratio, 1.70.

The illustration of Coryell's specimen shows a form ratio of 1.84 while the calculated value from his dimensions gives only 1.62. The Illinois form is intermediate between these two values and the female agrees closely in detail to Coryell's figure.

Oak Grove and Summum zones, localities 14, 26.
**Cavellina expansa** Bradfield

Plate 9, figures 33-35

*Cavellina expansa* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 132, pl. 12, figs. 3a, b; Hoxbar group, Oklahoma.

Carapace elongate, somewhat tumid, semielliptical, dorsal margin convex, ventral margin straight; anterior end rounded, posterior end sharply pointed due to pronounced posteroventral truncation; overlap moderate, greatest along dorsum, least along venter; surface smooth.

Length, 1.05 mm; height, 0.57 mm; width, 0.39 mm.

Lonsdale zone, locality 63.

**Cavellina fittsi** Kellett

Plate 9, figures 21-27

*Cavellina fittsi* Kellett, 1935, Jour. Paleontology, vol. 9, p. 147, pl. 18, figs. 2a-e, 3a-g; Deer Creek formation to Howard shale, Kansas.

*Cavellinella casei* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 136, pl. 12, figs. 11a, b; Dornick Hills group, Oklahoma.

Carapace tumid, semielliptical, dorsal and ventral margins strongly convex; ends rounded, posteroventral truncation about 45°; overlap pronounced on dorsum and venter, particularly the former; overlap around ends greater than in most species; greatest height nearly central; greatest thickness posterior; surface smooth.

Length (figs. 25-27), 1.21 mm; height, 0.74 mm; width, 0.57 mm.

*Cavellinella casei* Bradfield is a very small specimen with a curved ridge bordering the posterior margin similar to the young of many species of *Cavellina*, particularly *C. fittsi*, so Bradfield’s species has been tentatively placed in synonymy with this species.

Liverpool zone, localities, 14, 20.

**Cavellina footei** (Coryell and Booth)

Plate 9, figures 46, 47

*Cytherella footei* Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 270, pl. 4, fig. 11; Wayland shale, Texas.

Carapace small, tumid, ovate in lateral outline; dorsal and ventral margins strongly convex; ends rounded, posteroventral truncation faint; overlap greatest in centrodorsal and ventral areas, diminishing towards ends, very faint around anterior end; greatest height central; greatest thickness posterior; surface, granulose.

Length, 0.72 mm; height, 0.49 mm; width, 0.34 mm.

Collinsville to Newton zones, localities 73, 81, 82, 86, 110.

**Cavellina jejuna** Coryell and Sample

Plate 9, figures 36-37

*Cavellina jejuna* Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 274, pl. 26, fig. 16; East Mountain shale, Texas.

Carapace semielliptical, dorsal and ventral margins convex; ends rounded, posteroventral truncation moderate; overlap around entire margin, most prominent along dorsum and venter; greatest thickness posterior; round muscle scar in center of left valve.

Length, 1.13 mm; height, 0.66 mm; width, 0.47 mm.

Exline zone, locality 65.

**Cavellina laevis** (Bradfield)

Plate 9, figures 30-32

*Cytherella laevis* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 125, pl. 11, figs. 5a-b; Hoxbar group, Oklahoma.

Carapace semielliptical, dorsal margin convex, ventral margin nearly straight; ends rounded, posteroventral truncation nearly absent; overlap fairly uniform, except slightly less around ends, greatest thickness just back of center, greatest height central; surface smooth.

Length, 1.08 mm; height, 0.62 mm; width, 0.43 mm.

Bogota and Newton zones, localities 100, 103, 112.
**Cythereellidae**

_Cavellina lata_ Coryell

Plate 9, figure 40

*Cavellina lata* Coryell, 1928, Jour. Paleontology, vol. 2, p. 94, pl. 11, fig. 11, Seminole and Holdenville formations, Oklahoma. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 79, pl. 7, figs. 5a, b; Holdenville formation, Oklahoma.

*Cavellina altoides* Payne, 1937, Jour. Paleontology, vol. 11, p. 287, pl. 40, figs. 7a, b; Hayden Branch formation, Indiana.

Carapace thin, semieliptical, dorsal and ventral margins about equally convex; ends rounded; posteroventral truncation slight; overlap continuous around entire margin, greatest along dorsum and venter; surface smooth.

Length, 1.21 mm; height, 0.67 mm; width, 0.44 mm.

Newton zone, locality 112.

_Cavellina minuta_ Bradfield

Plate 10, figures 5, 6


Carapace short, ovate, dorsal and ventral margins convex, ends rounded; posteroventral truncation slight, greatest height central; greatest thickness back of center, overlap greatest along dorsum, least around ends, surface granulose.

Length, 0.67 mm; height, 0.41 mm; width, 0.23 mm.

Exline zone, locality 65.

_Cavellina nebrascensis_ (Geinitz)

Plate 10, figures 1-4


*Cavellina nebrascensis*, Kellett, 1935, Jour. Paleontology, vol. 9, p. 146, pl. 18, figs. 1a-h; Burlingame to Neva formations, Kansas. —Lalicker, 1935, idem, p. 744, figs. 1-3c. —not Scott and Borger, 1941, idem, vol. 15, p. 357, pl. 50, figs. 3, 9, 10.

Carapace large, elongate, tumid, dorsal and ventral margins convex; ends rounded, posteroventral truncation in conspicuous; overlap most prominent along midportion of dorsal and ventral margins; greatest height and thickness near midportion of posterior half, surface smooth.

Length, 1.26 mm; height, 0.77 mm; width, 0.54 mm.

Shumway zone, locality 112.

_Cavellina lirata_ (Bradfield)

Plate 9, figures 41-45

_Cytherella lirata_ Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 125, pl. 11, figs. 6a, b; Hoxbar group, Oklahoma.

—Payne, 1937, Jour. Paleontology, vol. 11, p. 287, pl. 40, figs. 5a, b; Hayden Branch formation, Indiana.

Carapace semieliptical, dorsal margin convex, ventral margin nearly straight; ends rounded, posteroventral truncation almost absent; overlap uniform around entire margin; greatest height central or nearly so; greatest thickness just back of center.

Length, 1.21 mm; height, 0.67 mm; width, 0.44 mm.

Oak Grove and Sparland zones, localities 14, 55.


**Cavellina ovoidiformis** (Harlton)

Plate 10, figures 7, 8

*Cavellina ovoidiformis* Harlton, 1928, Jour. Paleontology, vol. 2, p. 141, pl. 21, figs. 15a, b; Graham formation, Texas. —Harlton, 1929, Texas Univ. Bull. 2901, p. 161, pl. 4, figs. 8a-c; Canyon group, Texas. —DeLo, 1930, Jour. Paleontology, vol. 4, p. 177, pl. 13, fig. 15; Pennsylvanian, Texas.

Carapace large, tumid, ovate in lateral outline, dorsal and ventral margins equally convex; ends rounded, though somewhat acuminate; overlap very prominent along dorsum, less along venter, very slight around ends; greatest height slightly posterior; greatest thickness near posterior; surface smooth.

Length, 1.21 mm; height, 0.77 mm; width, 0.48 mm.

LaSalle to Little Vermilion zones, localities 88, 100, 103.

**Cavellina pulchella** Coryell

Plate 10, figures 9-18


*Cavellina subpulchella* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 129, pl. 11, figs. 20a, b; Deese group, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 46, pl. 5, figs. 1-6; Plattsburg and Chanute formations, Nebraska.


**Cytherella intermedia** Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 78, pl. 7, figs. 1a, b; Wewoka and Holdenville formations, Oklahoma.

**Cytherella missouriensis** Knight, Jour. Paleontology, vol. 2, p. 334, pl. 44, figs. 8a-i; Labette formation, Missouri.

**Cytherella wewokana** Coryell and Sample, 1932, (not Warthin, 1932), Am. Midland Naturalist, vol. 13, p. 272, pl. 26, fig. 13, East Mountain shale, Texas.

Carapace ovate, somewhat tumid, dorsal and ventral margins convex, the former more pronounced; anterior end rounded, posterior end acuminate due to posteroventral truncation; overlap considerable on all margins except posteroventral, greatest along dorsum and venter; greatest thickness posterior.

Length (figs. 12-16), 1.16 mm; height, 0.72 mm; width, 0.47 mm.

Liverpool to Bogota zones, localities 14, 17, 20, 36, 51, 68, 86, 93, 107.

**Cavellina rotunda** Cooper, n. sp.

Plate 10, figures 19-22

Carapace elongate, semielliptical, dorsal and ventral margins straight, almost parallel; anterior end rounded, posterior somewhat acuminate due to fairly prominent nearly vertical posteroventral truncation; overlap moderate, uniform along dorsum and venter, continuing undiminished around posterior end, but slight around anterior margin; greatest height anterior, greatest thickness near posterior end; surface granulose.

Length, 0.77 mm; height, 0.41 mm; width, 0.30 mm.

This species is distinguished by the parallel dorsal and ventral margins, in which it somewhat resembles *C. ellipticus* Hamilton, but this Permian species has a more rounded posterior margin.

Brereton to "Centralia" zones, localities 43, 62, 65, 79.

**Cavellina subpulchella** Coryell

Plate 10, figures 23, 24

*Cavellina subpulchella* Coryell, 1928, Jour. Paleontology, vol. 2, p. 93, pl. 11, fig. 9; Boggy shale, Oklahoma. —Warthin,

Carapace semielliptical, somewhat tumid, dorsal and ventral margins strongly and almost equally convex; ends rounded, almost no posteroverventral truncation; overlap very great in central portion of dorsum and venter, decreasing in each direction toward ends, where it is very faint or lacking; greatest height central, greatest thickness posterior; surface smooth; muscle spot marked by faint indentation near middle of shell surface.

Length, 1.21 mm; height, 0.79 mm; width, 0.34 mm.

C. subpulchella differs from C. pulchella Coryell in its shorter form and marked ventral overlap.

Little Vermilion and Woodbury zones, localities 103, 115.

CAVELLINA SYMMETRICA (Payne)

C. SYMMETRICA Payne, 1937, Jour. Paleontology, vol. 11, p. 287, pl. 40, figs. 6a, b: Hayden Branch formation, Indiana.

Carapace ovate to semielliptical, slightly tumid, dorsal and ventral margins about equally convex, ends rounded, posteroverventral truncation moderate; overlap very pronounced in midportion of dorsum and venter, decreasing toward ends; surface smooth to granulose.

Length, 0.97 mm; height, 0.62 mm; width, 0.42 mm.

C. SYMMETRICA has about the same form ratio as C. pulchella but the latter possesses a greater posteroverventral truncation and lacks the pronounced overlap in the midventral area.

Millersville to Shumway zones, localities 90, 107, 109, 112.

CAVELLINA TONGIA? (Coryell and Sample)

Plate 10, figures 27, 28


Carapace elongate, semielliptical; dorsal margin slightly less convex; ends rounded with little or no posteroverventral truncation; overlap fairly uniform along dorsum and venter decreasing toward ends; greatest height central, greatest thickness slightly posterior.

Length, 1.05 mm; height, 0.62 mm; width, 0.45 mm.

The Illinois form lacks the degree of uniformity of overlap along the dorsum and venter shown by the drawings of Bradfield and Coryell and Sample, but seems to agree in other respects.

Collinsville and Newton zones, localities 73, 110.

Genus Silenites Coryell and Booth, 1933

SILENITES ASYMMETRICA Cooper, n. sp.

Plate 10, figure 29

Carapace large, reniform, dorsal margin strongly arched, ventral margin concave; ends broadly rounded; overlap greatest along dorsum; the usual positions of the longer and steeper dorsal slopes are reversed in this species making the left valve the smaller one; greatest height slightly back of middle.

Length, 1.46 mm; height, 0.92 mm.

In addition to the arrangement of its valves being reversed S. ASYMMETRICA is intermediate between the extremely angular Lower Mississippian and Devonian species, S. Marginiferus (Geis) and S. Transversa (Roth), and the smoothly reniform S. Lenticularis (Knight).

Seville zone, locality 4.
Silenites fabalis Cooper, n. sp.

Plate 10, figures 30-32

Carapace reniform, somewhat elongate, tumidity moderate, dorsal outline merging gradually into postero- and anteroventral slope to form semicircle; ventral margin concave; ends rounded, terminated well below midheight; overlap greatest along posterodorsal slope, least along end margins; greatest height and thickness posterior.

Length (figs. 31, 32), 1.17 mm; height, 0.64 mm; width, 0.48 mm.

S. fabalis is slightly more elongate and less tumid than the average of S. lenticularis (Knight) and does not have the angularity of S. silenus Coryell and Booth.

Liverpool and St. David zones, localities 23, 33.

Silenites lenticularis (Knight)

Plate 10, figures 33-36

Carbonia? lenticularis Knight, 1928, Jour. Paleontology, vol. 2, p. 335, pl. 44, figs. 9a, b; Pawnee limestone, Missouri.

Silenites lenticularis Kellett, 1935, Jour. Paleontology, vol. 9, p. 151, pl. 17, figs. 9a-l; Elmdale formation to Ft. Riley limestone, Kansas. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 44, pl. 4, fig. 12; Eudora shale, Nebraska.

Bythocypris faba Coryell and Osorio, 1932, Am. Midland Naturalist, vol. 13, p. 36, pl. 5, fig. 4; Nowata shale, Oklahoma.

Bythocypris gallowayi Coryell and Osorio, 1932, Am. Midland Naturalist, vol. 13, p. 35, pl. 5, fig. 3; Nowata shale, Oklahoma.

Bythocypris sasakwaensis Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 73, pl. 6, figs. 5a, b; Holdenville formation, Oklahoma. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 96, pl. 7, fig. 13; Hoxbar group, Oklahoma.

Carapace reniform, dorsal margin highly convex, smoothly curved, almost semicircular from end to end; ventral margin slightly concave; overlap greatest along dorsum, diminishing towards ends, increasing again toward center of venter; greatest thickness back of center.

Length (figs. 35, 36), 1.10 mm; height, 0.69 mm; width, 0.48 mm.

S. lenticularis differs from S. silenus Coryell and Booth in its more symmetrical lateral outline, and lacks the angulation in the centrodorsal area between the lines forming the antero- and posterodorsal slopes.

St. David to Piasa zones, localities 35, 38, 47, 54.

Silenites silenus Coryell and Booth

Plate 10, figures 37, 38

Silenites silenus Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 265, pl. 4, figs. 1, 2; Wayland shale, Texas.

Carapace short, tumid; dorsal margin highly arched, somewhat flattened, inclined posteriorly; postero- and antero-dorsal slopes steep, ventral margin concave; end rounded, terminated well below midheight; overlap greatest along dorsal margin; greatest height and thickness just back of center.

Length, 0.97 mm; height, 0.62 mm; width, 0.47 mm.

Kellett, 1935, placed S. silenus in synonymy with S. lenticularis (Knight). However, the latter has more regularly curved margins and lines of articulation, while S. silenus presents a more angular or polygonal appearance in lateral view. S. silenus is also somewhat shorter and more tumid than S. lenticularis.

Newton zone, locality 108.

Genus Sulcella Coryell and Sample, 1932

Sulcella sulcata Coryell and Sample

Plate 11, figures 1-15

Jonesina texana Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 60, pl. 4, fig. 10; Wewoka formation, Oklahoma.

Sansabelloides texana Harris and Lalicker, 1932, Am. Midland Naturalist, vol. 13, p. 402, pl. 37, figs. 4a, b; Francis formation, Oklahoma.

Sansabelloides edminstoni Harris and Lalicker, 1932, idem., p. 402, pl. 37, fig. 5; Garrison shale, Kansas.

Sulcella sulcata Coryell and Sample, 1923, Am. Midland Naturalist, vol. 13, p. 275, pl. 26, fig. 18; East Mountain shale, Texas. —Kellett, 1935, Jour. Paleontol-
Fig. 33—Graph of length-height dimensions of *Sulcella*. 1, *S. warthini* Coryell and Sample; 2, *S. edmistoni* (Harris and Lalicker); 3, *S. texana* (Warthin); 4, *S. celsa* Cooper; 5, *S. ovata* Cooper; 6, *S. harrisi* Bradfield; 7, *S. harrisi* and *S. texana*, Harris and Lalicker; 8, *S. sulcata* Coryell and Sample, stated measurement of holotype; 9, measured figure of holotype at stated magnification (compare with 8).

**Sulcella warthini** Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 275, pl. 26, fig. 17; East Mountain shale, Texas.


Carapace elongate, semielliptical in lateral outline; dorsal and ventral margins convex; anterior end symmetrically rounded; posterior end rounded to truncate on anteroventral margin; overlap prominent, greatest in centroventral and anterodorsal margins, narrower around ends and posterior dorsal margin; anterior end of left valve bordered by a low, narrow ridge; a small, deep pit, shallower on dorsal margin, is located slightly anterior to and well above midpoint; on left valve this pit adjoins a slightly flattened area of the anterodorsal portion of the valve, giving the pit a somewhat sulcate appearance; this flat area is absent on right valve, the pit being equally well-defined on all margins; greatest height posterior, greatest length above midheight; surface smooth.

Female: length, 1.0 mm; height, 0.54 mm; thickness, 0.42 mm.

Male: length, 0.95 mm; height, 0.51 mm; thickness, 0.37 mm.

Unusually good collections from the Newton of Illinois and the Wewoka of Oklahoma contain a large number of specimens of various sizes, which when their proportions are plotted, show the existence of at least six instars. The described Pennsylvanian species are closely related to four of these instars as follows: the genoholotype, *S. sulcata* Coryell and Sample is an adult form (M); *S. harrisi* Bradfield (from the Hoxbar) and *S. texana* (Harris and Lalicker), instar M—1; *S. harrisi* Bradfield (from the Dornick Hills), instar M—2; *S. texana* Warthin, *S. warthini* Coryell

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Coryell and Sample's (1932, pl. 26, fig. 18) figure of the genoholotype does not have either pit or sulcus, and does not correspond to the dimensions given in the description. However, a photograph of the type, furnished by the senior author, does have the pit as described in the original paper, but it also is at variance with the published dimensions.
and Sample, and *S. edmistoni* (Harris and Lalicker), instar M—4.

In 1929 Harlton described *Jonesina texana* from the East Mountain shale, Menard County, Texas, which is now referred to *Knozina* (Coryell and Rogatz, 1932). Later Warthin (1930) erroneously identified a specimen from the Wewoka formation of Oklahoma as *J. texana* (Harlton). Coryell and Sample considered Warthin’s Wewoka specimen identical with one of their new species of *Sulcella*, namely *S. warthini*. In the same year Harris and Lalicker described *Sansabelloides texana* (Warthin) from the Francis formation in Oklahoma. Bradford (1935) described *Sulcella harrisi* from the Dornick Hills group, designating as the holotype Harris and Lalicker’s Francis specimen, but figuring two specimens each of which appears to be a distinct species. Kellett (1935, p. 149) after a study of the size and shape variations between young and old specimens, listed *Jonesina texana*, Warthin and *Sansabelloides texana* Harris and Lalicker as synonyms of *Sulcella warthini*. Finally Johnson placed all of these species in synonymy with *S. sulcata*.

In the Midcontinent the beds from which “species” of *Sulcella* have been described, range in age from the upper Dornick Hills group (lower Atoka series) to the Kanwacka shale (middle Virgil series). In Illinois *S. sulcata* ranges from the Seville to the Newton cyclothem, localities 6, 14, 16, 26, 62, 82, 107, 112.


*Darwinula hollandi* Scott, 1944, Jour. Paleontology, vol. 18, p. 146, pl. 24, figs. 6-8; Nineveh limestone, Pennsylvania.

Carapace elongate, slender; lateral outline semiovate; dorsal margin broadly convex; ventral margin straight; ends rounded, posterior very broad, anterior acuminate; hinge line nearly straight, the valves meeting evenly; overlap greatest around ends, decreasing along venter where the line of junction is curved in anterior third; greatest height and thickness posterior; surface smooth.

Length, 0.76 mm; height, 0.35 mm; width, 0.30 mm.

This species has been removed from *Carbonita* because of the differences in hinge structure and character of overlap. *D. hollandi* is thought to be an immature moult of this species, inasmuch as it has an identical form ratio.

Summum zone, locality 27.

Family *Drepanellidae* Swartz, 1936

Genus *Cornigella* Warthin, 1930

*Corningella tuberculospinosa* (Jones and Kirkby)

Plate 11, figures 16-23


*Cornigella tuberculospinosa* Warthin, 1930

Cornigella longispina Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 254, pl. 24, fig. 12; East Mountain shale, Texas.

Cornigella pushmatahensis Harlton, 1933, Jour. Paleontology, vol. 7, p. 19, pl. 7, fig. 2; Johns Valley shale, Oklahoma.

Cornigella minuta Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 59, pl. 4, figs. 7a-c; Wewoka formation, Oklahoma.
—Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 253, pl. 24, fig. 6; East Mountain shale, Texas.
—Johnson, 1938, Nebraska Geol. Survey Paper 11, p. 18, pl. 1, figs. 15, 16; Chinitu shale, Nebraska.

Carapace small, subquadrate, dorsal margin straight, ventral margin convex; greatest height posterior, producing distinct retral swing in lateral view; valves equal, ornamented by coarse reticulation and a variable number (usually 6 to 8) of short rounded nodes of considerable diameter, one or more of which (nearest hinge line) may be elongated to form a thick tapering spine.

Length (figs. 21-23), 0.50 mm; height, 0.30 mm; width, 0.15 mm.

There is considerable variation within species of this genus with regard to the number of spines or nodes. Some individuals have no spines and many have less than 8 nodes whereas others have as many as two spines extending above the hinge line, although the anterior one is always the longer. Also some specimens from the same sample seem more elongate than others.

Summum to Newton zones, localities 26, 62, 66, 79, 82, 112.

Family Glyptopleuridae Girty, 1910
Genus Glyptopleura Girty, 1910

Glyptopleura coryelli Harlton
Plate 10, figures 43-45


Glyptopleura coryelli Harlton, in Coryell and Brackmier, 1931, Am. Midland Naturalist, vol. 12, p. 513, pl. 2, fig. 18. —John-

son, 1936, Nebraska Geol. Survey Paper 11, p. 36, pl. 3, fig. 15; Stanton formation, Nebraska.

Carapace subquadrate, tumid, hinge line straight; ventral margin convex, though sometimes slightly flattened in midportion; ribs wide, prominent, broad, straight to sinuous, inclined toward anteroventral corner at a fairly low angle; rib next above pit bifurcates just in front of pit into two short equally prominent portions; short rib is located just back of pit, another is located in the anterodorsal angle and a third short acuminate rib borders the ventral margin and equals about half the length of the shell; all ribs seem to bend downward at the ends to merge with the shell surface, also bending upward and downward as if gathered together into a bundle at each end of the shell; circular pit anterior of center is located below first rib.

Length, 0.95 mm; height, 0.57 mm; width, 0.54 mm.

Gimlet to Millersville zones, localities 57, 89, 90.

Glyptopleura irregularis Delo
Plate 10, figures 41, 42

Glyptopleura irregularis Delo, 1931, Washington Univ. (St. Louis) Studies, new ser., Sci. and Tech. no. 5, p. 44, pl. 4, fig. 5.

Carapace somewhat elongate, hinge line straight, ventral margin convex; ends rounded; ribs few, straight, crossing diagonally from posterodorsal to anteroventral portions, ending abruptly posteriorly with ends raised above shell surface to form spine-like terminations; pit small, circular, fairly deep, anterior to center.

Length, 0.77 mm; height, 0.46; width, 0.34 mm.

Millersville zone, locality 90.

Family Healdiidae Harlton, 1933
Genus Healdia Roundy, 1926

Healdia alba Coryell and Billings
Plate 11, figures 24, 25

Healdia alba Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 178, pl. 18, fig. 13; Wayland shale, Texas. —Cor-
yell and Sample, 1932, idem, p. 270, pl. 26, fig. 3; East Mountain shale, Texas.

Carapace short, tumid, ovate in lateral outline; dorsal margin strongly convex, ventral margin nearly straight; ends about equally rounded; overlap slight; posterodorsal truncation slightly convex; spines small, widely spaced, with a strong lateral deflection; greatest height slightly anterior, greatest thickness posterior.

Length, 0.56 mm; height, 0.37 mm; width, 0.29 mm.

The spines of *H. alba* rise almost 90° from the surface of the shell as contrasted to the strong posterior deflection of the spines on most species of *Healdia*. LaSalle zone, locality 92.

**Healdia asper** Cooper, n. sp.

Plate 11, figures 41, 42

Carapace semiovate, dorsal margin strongly arched, ventral margin slightly concave; ends rounded, anterior somewhat flattened; overlap broad, variable, being least around ends and greatest along posterodorsal and posteroventral margins; spines large, slightly curved, flaring at base, and closely spaced; bases of spines joined by short pronounced carina forming a prominent shoulder; greatest height slightly back of center, greatest thickness near posterior end.

Length, 0.52 mm; height, 0.36 mm; width, 0.27 mm.

St. David zone, locality 30.

**Healdia aspinosa** Cooper, n. sp.

Plate 11, figures 39, 40

Carapace elongate, dorsal margin broadly arched, ventral margin slightly convex; ends rounded, anterior end somewhat flattened in midportion; posterodorsal slope straight to slightly concave; overlap very narrow, uniform; posterior shoulder high, rounded; greatest height and thickness posterior.

Length, 0.54 mm; height, 0.30 mm; width, 0.26 mm.

Exline and Trivoli zones, localities 65, 66, 71.

**Healdia bicornis** Cooper, n. sp.

Plate 11, figures 26-33

Carapace of medium size, semiovate, dorsal margin broadly arched, ventral margin straight, ends rounded, with slight angulation of the margin anterodorsally, posterodorsal margin slightly concave; overlap moderate, variable; long spines very close together, cone-shaped, flaring at base, and curved toward posterior; greatest height central; greatest thickness near center of posterior half, posterior shoulder inconspicuous, rounded.

Length, 0.65 mm; height, 0.38 mm; width, 0.30 mm.

*H. bicornis* differs from *H. formosa* Harlton and *H. ampla* Roundy in its higher, angulated anterior and the very closely-spaced spines, and in addition differs from the latter by the laterally directed spines and obtuse posterior outline as seen in dorsal view.

Trivoli zone, locality 71.

**Healdia boggyensis** Harlton

Plate 11, figures 29-31

*Healdia boggyensis* Harlton, 1927, Jour. Paleontology, vol. 1, p. 209, pl. 35, figs. 5a, b; Glenn group, Oklahoma. —Harlton, 1929, Am. Jour. Sci., ser. 5, vol. 18, p. 265, pl. 2, figs. 7a, b; Boggy formation, Oklahoma.

Carapace ovate, rather short, dorsal margin curved, ventral margin slightly convex; anterior end low, somewhat pointed; posterior end rounded; greatest height and thickness posterior; overlap variable, greatest around anterior margin, least along posterio and posterodorsal margins; posterior shoulder marked by a sharp line which bends forward toward the centro-dorsal portion of hinge but which does not rise above surface of shell.

Length, 0.54 mm; height, 0.32 mm; width, 0.28 mm.

This species is distinguished from *H. marginata* Harlton by its smaller form
ratio and by the lack of a ridge on the posterior shoulder.

Seville to Lowell zones, localities 4, 11, 14, 22.

Healdia cara Bradfield
Plate 11, figures 37, 38

Healdia cara Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 110, pl. 9, figs. 16a, b; Deese? group, Oklahoma.

Carapace semielliptical, dorsal margin gently arched, ventral margin quite convex, ends rounded, posterior end slightly more acuminate than anterior; overlap moderate and uniform around entire margin; posterior shoulder inconspicuous, edge rounded; greatest height central, greatest thickness near middle of posterior half.

Length, 0.54 mm; height, 0.34 mm; width 0.27 mm.

Exline to Woodbury zones, localities 65, 66, 100, 109, 112, 115.

Healdia carinata Cooper, n. sp.
Plate 11, figures 35, 36

Carapace of medium size, semielliptical, dorsal and ventral margins convex, ends broadly rounded; moderate overlap uniform on all margins; spine very short, widely flaring at base, forming ventral end of very sharp-edged shoulder which extends vertically upward above the line of articulation where it bends abruptly forward toward the hinge; greatest height and thickness posterior; surface smooth.

Length, 0.59 mm; height, 0.35 mm; width, 0.27 mm.

H. carinata may be distinguished from H. glennensis by its low arched dorsal outline and the straight, vertical position of the sharp ridge marking the posterior shoulder.

LaSalle zone, locality 92.

Healdia carterensis Bradfield
Plate 11, figures 48, 49


Carapace elongate, semielliptical, dorsal and ventral margins convex; ends rounded; overlap moderate, uniform; spine long, cylindrical, flaring at base and joined by a very prominent, narrow ridge located very near the posterior terminus, giving the posterior end a squared appearance; greatest height and thickness posterior.

Length, 0.53 mm; height, 0.30 mm; width, 0.24 mm.

Liverpool and St. David zones, localities 23, 29, 30.

Healdia cincta Coryell and Billings
Plate 11, figures 32-34

Healdia cincta Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 177, pl. 17, fig. 17; Wayland shale, Texas.

Carapace small, semiovate, dorsal and ventral margins convex; ends rounded, anterior slightly higher than posterior; overlap slight, uniform on all margins; spines large, elongate, rising abruptly from shell surface, widely spaced so that they occur near dorsal and ventral margins some distance in from posterior end; greatest height slightly anterior, greatest thickness posterior.

Length, 0.50 mm; height, 0.30 mm; width, 0.27 mm.

Gimlet and Trivoli zones, localities 58, 69.

Healdia colonyi Coryell and Booth
Plate 11, figures 43-47

Healdia colonyi Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 266, pl. 4, figs. 9, 10; Wayland shale, Texas.


Carapace large; dorsal margin very highly arched, with equal slopes from central high point; ventral margin straight in center, curving to meet rounded ends; posterodorsal area flattened; overlap greatest along centrodorsal and ventral margins; spines prominent, directed backward, elongate, the upper one merging with well-developed ridge which is especially noticeable in
the dorsal view; greatest height central, greatest thickness posterior.

Length, 0.72 mm; height, 0.41 mm; width, 0.40 mm.

Exline and Trivoli zones, localities 64, 69, 71.

**Healdia coryelli** Kellett

Plate 12, figures 14-16

*Healdia compressa* Kellett, 1935 (not Coryell and Billings, 1932), Jour. Paleontology, vol. 9, p. 142, pl. 16, figs. 1a-l; Howard formation, Kansas.


Carapace ovate, dorsal margin strongly arched, ventral margin convex; ends rounded and of equal height; greatest height central, greatest thickness posterior, gradually tapering anteriorly forming a wedge-shaped, rather acuminate anterior outline in dorsal view; overlap prominent in centrodorsal and ventral regions, moderate around ends; posterior shoulder rounded and of slight prominence.

Length, 0.61 mm; height, 0.41 mm; width, 0.34 mm.

Newton-Shumway zones, localities 109, 112.

**Healdia ehlersi** Bradfield

Plate 12, figures 6-8

*Healdia ehlersi* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 109, pl. 9, figs. 11a, b; Deese? group, Oklahoma.

*Healdia angulata* Bradfield, 1935, idem, p. 110, pl. 9, figs. 12a, b; Deese? group, Oklahoma.

Carapace ovate, somewhat tumid, dorsal margin strongly arched; ventral margin nearly straight; ends rounded; posterodorsal slope straight; overlap variable, accentuated around anterior by development of narrow flat margin, showing in dorsal view, as narrow protrusions on both valves which often do not quite meet; spines short, widely spaced, directed outward and backward, joined by a thick, knife-edged ridge.

Length, 0.78 mm; height, 0.45 mm; width, 0.38 mm.

The holotype of *H. angulata* is slightly smaller than that of *H. ehlersi* and is somewhat mashed and slightly distorted. However, they agree in all other respects and are identical to the Illinois specimens.

Macoupin zone, locality 84.

**Healdia elegans** Warthin

Plate 12, figures 19-21

*Healdia elegans* Warthin, 1930, Oklahoma Geol. Survey, Bull. 53, p. 76, pl. 6, figs. 11a, b; Wetumka formation, Oklahoma.

*Healdia arcuata* Coryell and Osario, 1932, Am. Midland Naturalist, vol. 13, p. 37, pl. 5, fig. 6, Nowata shale, Oklahoma.

*Healdia glennensis*, Coryell and Sample, 1932, idem, p. 269, pl. 26, fig. 6; East Mountain shale, Texas.

*Healdia cf. H. glennensis*, Bradfield, 1935, Bull. Am. Paleontology, vol. 23, p. 111, pl. 19, figs. 17a, b only (not fig. 18); Hoxbar group, Oklahoma.

Carapace large, dorsal margin strongly convex, ventral margin straight in center; overlap most prominent on centrodorsal margin; posterodorsal area broad and flat, slope of left valve distinctly conceave; spines long, prominent, directed outward and backward; greatest height central, greatest thickness posterior.

Length, 0.85 mm; height, 0.54 mm; width, 0.37 mm.

Seville to Jamestown zones, localities 7, 11, 13, 20, 41, 51.

**Healdia fabalis**, Cooper, n. sp.

Plate 12, figures 3-5

Carapace elongate, semielliptical; dorsal margin broadly convex, ends equally rounded; overlap very narrow around all margins; spines short, knoblike, the dorsal one poorly developed and considerably anterior to ventral spine; posterior shoulder rounded and quite prominent; greatest height central, greatest thickness near center of posterior half.

Length, 0.59 mm; height, 0.33 mm; width, 0.29 mm.

This species is somewhat similar to *H. oblonga* Bradfield but lacks the conceavi-
ty of the posterodorsal slope and the pronounced overlap of the latter.
Seville zone, localities 3, 7.

HEALDIA FORMOSA Harlton
Plate 12, figures 9, 10

Healdia formosa Harlton, 1928, Jour. Paleontol., vol. 2, p. 209, pl. 23, figs. 6a, b; Captank formation, Texas. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 102, pl. 9, fig. 10; Deese? group, Oklahoma.


Carapace semielliptical, elongate, dorsal margin arched, ventral margin almost straight; ends rounded; prominent overlap uniform around all margins; posterior spines large, elongate, often curved inward toward each other; prominent posterior shoulder lacking; greatest height anterior, greatest thickness posterior.

Length, 0.77 mm; height, 0.44 mm; width, 0.32 mm.

An examination of the holotypes shows that H. bovicornis is a broken and distorted specimen of H. formosa from the same locality and horizon.

Exline zone, locality 64.

HEALDIA GLENNENSISS Harlton
Plate 12, figures 1, 2


Carapace ovate; dorsal margin moderately arched, anterior and posterior slopes equal; ventral margins straight; ends equally rounded; overlap moderate, greater along centrodorsal and ventral margins, least around ends; usually only one spine, the lower one, developed, posterior shoulder rather prominent; greatest height central, greatest thickness posterior.

Length, 0.57 mm; height, 0.37 mm; width 0.28 mm.

Seville to Brereton zones, localities 3, 9, 26, 47.

HEALDIA GRANOSA Cooper, n. sp.
Plate 12, figures 27-31

Carapace fairly large, semiovate, dorsal margin strongly arched, ventral margin slightly convex, ends rounded; posterodorsal slope straight to slightly concave; spines short, flaring at base, and directed backward about 45°; overlap moderate and uniform around all margins; surface covered by elongate punctae arranged concentrically around center of the shell; greatest height anterior, greatest thickness posterior; posterior shoulder broadly rounded, with no ridge between spines.

Length, 0.77 mm; height, 0.48 mm; width, 0.36 mm.

H. granosa resembles H. ehlersi Bradfield and H. elegans Warthin, but lacks the ridge between spines and the somewhat acuminate anterior end of the former and the distinct concavity of the posterodorsal slope of the latter.

Seahorne to St. David zones, localities 11, 16, 21, 22, 24, 28, 29, 30.

HEALDIA LIMACOIDEA Knight
Plate 12, figures 17, 18

Healdia limacoidea Knight, 1928, Jour. Paleontology, vol. 2, p. 333, pl. 44, figs. 5a-c; Labette formation, Missouri. —Wilson, 1933, Jour. Paleontology, vol. 7, p. 421, pl. 50, figs. 1a-d; McAlester shale, Oklahoma.

Healdia longa Knight, 1928, idem, p. 332, pl. 44, figs. 6a-c; Labette formation, Missouri. —Warthin, 1930, idem, p. 75, pl. 6, figs. 10a, b; Wewoka and Holdenville formations, Oklahoma.

Carapace ovate, dorsal margin arched, ventral margin straight, ends rounded; overlap moderate, fairly uniform; spines of small diameter, short, and widely separated.
Length, 0.64 mm; height, 0.39 mm; width, 0.28 mm.
Summum and Gimlet zones, localities 26, 59.

**Healdia longula** Cooper, n. sp.

Plate 12, figures 22–24

_Healdia formosa_, Warthin, 1930 (not Harlton), Oklahoma Geol. Survey Bull. 53, p. 77, pl. 6, figs. 13a, b; Wewoka formation, Oklahoma. —Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 270, pl. 26, fig. 7, East Mountain shale, Texas.

_Healdia longa_, Coryell and Sample, 1932 (not Knight), idem, vol. 13, p. 270, pl. 26, fig. 5; East Mountain shale, Texas.

Carapace elongate, semielliptical, dorsal margin broadly arched, ventral margin straight to slightly convex, ends rounded; spines short, widely flaring at base, fairly widely spaced, and located very near posterior margin; overlap moderate, fairly uniform; greatest height slightly anterior, greatest thickness near center of posterior half.

Length, 0.61 mm; height, 0.33; width, 0.28 mm.

The species described by Warthin (1930) and Coryell and Sample (1932) have been placed in synonymy with _H. limacoidea_ Knight (Kellett, 1936), but the difference in form ratios of 1.85 compared to 1.60 seems to indicate a different species.

Seville zone, locality 3.

**Healdia marginata** Harlton

Plate 12, figures 39–41


_Healdia dentisi_ Harlton, 1929, idem, p. 262, pl. 1, fig. 12; Springer formation.

Carapace ovate, dorsal margin arched; ventral margin slightly convex; ends about equally rounded; posterodorsal slope straight; greatest height central to slightly posterior; posterior end marked by a vertical knife-edged ridge rising abruptly from posterior shoulder, sometimes with short knob-like spine at each end; greatest thickness posterior; overlap moderate and uniform around all margins except posterodorsal.

Length, 0.50 mm; height, 0.30 mm; width, 0.22 mm; form ratio, 1.68 to 1.75.

_Healdia marginata_ varies considerably in the length-height proportions of the lateral view, the more slender forms being characterized by a longer posterodorsal slope. However, the species may be recognized by the prominent ridge on the posterior shoulder.

Seahorne and Liverpool zones, localities 9, 13, 16.

**Healdia masoni** Coryell and Booth

Plate 12, figures 25, 26

_Healdia masoni_ Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 267, pl. 4, figs. 7, 8; Wayland shale, Texas.

Carapace small, semielliptical, dorsal and ventral margins convex, ends rounded; posterior shoulder abrupt, nearly vertical, and very close to posterior extremity; overlap uniform, and moderate; greatest height central, greatest thickness posterior.

Length, 0.37 mm; height, 0.22 mm; width, 0.17 mm.

Little Vermilion zone, locality 105.

**Healdia nucleolata** Knight

Plate 12, figures 42–45

_Healdia nucleolata_ Knight, 1928, Jour. Paleontology, vol. 2, p. 329, pl. 44, figs. 4a–c; Labette formation, Missouri. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 75, pl. 6, figs. 9a, b; Wewoka formation, not —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 114, pl. 10, figs. 5a, b.

Carapace ovate, of medium length; dorsal margin strongly arched, ventral margin convex; overlap moderate and uniform around all margins except mesoventral, where it is quite pronounced; posterior shoulder marked by narrow sharp ridge which curves forward toward the hinge; this ridge may carry short knob-like spines at upper and
lower extremities, often with only the lower one; in well-preserved specimens the margin of each valve flares out at anterodorsal angle into a spine-like pro-
tuberance.

Length, 0.67 mm; height, 0.44 mm; width, 0.36 mm.

Ferdinand to Summum zones, locali-
ties 2, 14, 22, 26.

HEALDIA OBLONGA Bradfield

Plate 12, figures 46-48

Paleontology, vol. 22, p. 106, pl. 9, figs.
4a, b; Deese group, Oklahoma.

Carapace elongate, dorsal and ventral
margins broadly convex, ends rounded;
pronounced overlap uniform except
along posterodorsal slope; spines very
short, flaring, and located well back
from posterior end; posterior shoulder
prominent, rounded, with no ridge be-
tween spines; greatest height central;
greatest thickness posterior.

Length, 0.77 mm; height, 0.40 mm;
width, 0.36 mm.

The form ratio of this species (1.94)
makes it one of the most elongate in the
genus.

Seahorne to Gimlet zones, localities,
11, 14, 16, 22, 26, 46, 47, 54, 55, 58.

HEALDIA cf. H. obsolens Delo

Plate 12, figures 32, 33

Healdia obsolens Delo, 1930, Jour. Paleon-
tology, vol. 4, p. 168, pl. 13, figs. 4a-c;
Pennsylvanian, western Texas.

Carapace very short, ovate, dorsal and
ventral margins strongly convex; ends
rounded; overlap very prominent, and
uniform around all margins except an-
terior; posterior shoulder inconspicu-
ous; greatest height central, greatest
thickness posterior; spines absent.

Length, 0.41 mm; height, 0.30 mm;
width, 0.24 mm.

Although smaller than Delo’s speci-
mens, those from Illinois agree in all
other features. This species is easily
recognized by its low form ratio (1.41)
which is smaller than for any other
known species of Healdia.

LaSalle zone, locality 88.

HEALDIA OKLAHOMAENSIS Harlton

Plate 12, figures 34, 35

Healdia oklahomaensis Harlton, 1927, Jour.
Paleontology, vol. 1, p. 208, pl. 33, figs.
3a-c; Hoxbar group, Oklahoma. —Harl-
ton, 1929, Am. Jour. Sci., ser. 5, vol. 18,
p. 263, pl. 2, fig. 5. —Coryell and
Sample, 1932, Am. Midland Naturalist,
vol. 13, p. 268, pl. 26, fig. 4; East Moun-
tain shale, Texas.

Carapace ovate, dorsal margin sym-
metrically arched, ventral margin slight-
ly convex, ends rounded; overlap moder-
ate; posterior shoulder abrupt, and bor-
dered by a sharp line whose upper end
bends forward toward hinge; greatest
height central; greatest thickness poste-
rior.

Length, 0.48 mm; height, 0.31 mm;
width, 0.23 mm.

The forms described by Harlton
(1929) and Coryell and Osorio (1932)
appear to differ in many respects from
Harlton’s holotype, especially in the
character of the lateral outline.

Brereton to Little Vermilion zones,
localities 39, 46, 48, 51, 54, 69, 70, 81,
93, 103.

HEALDIA RECTIS Cooper, n. sp.

Plate 12, figures 36-38

Carapace subrectangular, dorsal mar-
gin broadly convex, ventral margin
straight; ends asymmetrically rounded,
anterior end narrower; overlap moder-
ately wide, uniform; shoulder very ab-
rupt, marked by sharp, narrow slightly
curved vertical carinae bearing a very
faint spine at each end; greatest height
central, greatest thickness at posterior
end, tapering with almost straight sides
to anterior end, producing distinct
wedgeshaped outline in dorsal view.

Length, 0.51 mm; height, 0.30 mm;
width, 0.23 mm.

This species is similar to H. cuneata
Coryell and Sample which, however,
lacks the high posterior and distinctly
wedge-shaped dorsal outline.
Summum to St. David zones, localities 27, 30.

**Healdia simplex** Roundy
Plate 13, figures 1, 2


*Healdia ciscoensis* Bradfield, 1935 (not Hard- ton), Idem, vol. 22, p. 113, pl. 9, figs. 20a, b; Hoxbar group, Oklahoma.

*Healdia malotti* Payne, 1937 Jour. Palaeontology, vol. 11, p. 286, pl. 40, figs. 3a, b; Hayden Branch formation, Indiana.

Carapace semiovate, dorsal margin arched, ventral margin convex, posterior end rounded; anterior end angular, straight portion inclined slightly forward; overlap moderate and fairly uniform, slightly less around ends; posterior shoulder prominent with rounded edge; greatest height nearly central, greatest thickness near center of posterior half; surface smooth.

Length, 0.74 mm; height, 0.46 mm; width, 0.35 mm.

Macoupin to Shumway zones, localities 84, 92, 93, 109.

**Healdia spinosa** Cooper, n. sp.
Plate 12, figures 11-13

Carapace small, semiovate, dorsal margin arched, ventral margin slightly convex, ends rounded; overlap very narrow, uniform; spines elongate, cylindrical, rising abruptly from shell surface and directed laterally to high degree; posterior shoulder broadly rounded, lacking abruptness of most species; greatest height anterior; greatest thickness posterior, sides of posterolateral outline nearly parallel.

Length, 0.53 mm; height, 0.33 mm; width, 0.27 mm.

Wiley to Gimlet zones, localities 13, 16, 26, 58.

**Healdia usitata** Cooper, n. sp.
Plate 13, figures 8, 9

Carapace semielliptical, dorsal margin arched, ventral margin convex; end rounded; overlap moderate, somewhat variable; spines very short, widely flaring at base, and fairly widely spaced; posterior shoulder fairly prominent, rounded, posterodorsal slope broad and flat, with articulation somewhat incised; greatest height anterior, greatest thickness posterior.

Length, 0.72 mm; height, 0.45 mm; width, 0.38 mm.

Gimlet zone, locality 58.

**Genus Healdiacypris** Bradfield, 1935

**Healdiacypris acuminatus** Cooper, n. sp.
Plate 13, figures 10-13

Carapace sublenticular, dorsal margin strongly convex, ventral margin almost straight; ends pointed or acuminated in both lateral and dorsal views; anterior termination very low, well below mid-height, posterior termination at mid-height; overlap right over left, wide on all margins except along hingeline; posterodorsal and anteroventral slopes long, less curved than opposite slopes; hinge very short, with reversal of overlap; greatest height and thickness posterior.

Length, 0.69 mm; height, 0.41 mm; width, 0.30 mm.

Although more acuminated and with a reversal of overlap as compared with the genotype species, *H. acuminatus* is, with-
out doubt, a *Healdicypris* since it agrees in all other respects. The left over right overlap of *H. perplexa* Bradfield is not considered to be a generic character, which is true of a number of ostracode genera, notably *Sansabella*.

Liverpool zone, locality 15.

**Healdicypris perplexa** Bradfield

*Plate 13, figures 17-20*

*Healdicypris perplexa* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 103, pl. 8, figs. 13a, b; Deese group, Oklahoma.

Carapace ovate to reniform, dorsal and ventral margins convex; ends narrowly rounded; overlap left over right, wide, and uniform on all margins except along hingeline; hinge short, extending from just forward of midpoint of dorsum to about two-thirds of distance to posterior end, its length almost exactly half total length of carapace; greatest height anterior, greatest thickness posterior.

Length, 0.78 mm; height, 0.44 mm; width 0.37 mm.

Summum zone, locality 28.

**Genus Seminolites** Coryell, 1928

**Seminolites elongatus** Coryell, 1928

*Plate 13, figures 14-16*

*Seminolites elongatus* Coryell, 1928, Jour. Paleontology, vol. 2, p. 89, pl. 11, fig. 2; Holdenville formation, Oklahoma.


*Seminolites truncatus* Coryell, 1928, idem, p. 89, pl. 11, fig. 4, Francis formation, Oklahoma.

Carapace small, elongate; lateral outline subelliptical; dorsal margin arched; ventral margin straight; ends subequally rounded; overlap moderate, and uniform around all margins, except posterior; ridge bordering posterior margin prominent, with slightly depressed furrow on inside edge; surface smooth except for numerous scattered round shallow pits.

Length, 0.83 mm; height, 0.33 mm; width, 0.27 mm.

Shumway zone, locality 109.

**Seminolites truncatus** Coryell

*Plate 13, figures 3-7*

*Seminolites truncatus* Coryell, 1928, Jour. Paleontology, vol. 2, p. 58, pl. 11, fig. 1; Wewoka formation, Oklahoma. —Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 180, pl. 18, fig. 3; Wayland shale, Texas.


*Seminolites compressus* Coryell, 1928, Jour. Paleontology, vol. 2, p. 89, pl. 11, fig. 3; Francis formation, Oklahoma. —Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 180, pl. 18, fig. 1; Wayland shale, Texas.


Carapace small, short, rather tumid; lateral outline subovate; dorsal margin highly arched; ventral margin straight in center, turning upward anteriorly in wide curve to end margin, posterior curve sharper; anterior end much higher than posterior; overlap wide except around posterior end; posterior ridge moderate to low, indistinct; shallow circular pits sparse to fairly numerous.

Length, 0.64 mm; height, 0.49 mm; width, 0.34 mm.

Bogota and Shumway zones, localities 101, 109.

**Family Hollinidae** Swartz, 1936

**Genus Hollinella** Coryell, 1928


The genotype of *Hollinella*, *H. dentata* Coryell, is an unfrilled form, as shown by Kellett’s (1929) analysis of the genus in which the three different specific forms were first recognized—the unfrilled, narrow-frilled, and wide-frilled specimens. Kellett (1936, p. 779) also inferentially recognized a fourth form with granulose shell surface, a variant of species having a papillose surface ornamentation. The original description contains no discussion of generic relationships and the close affinity of *Hollinella* to *Hollina*, which was erected by Ulrich and Bassler (1908) to include certain frilled nodose forms from the Sellersberg limestone (Devonian) at the Falls of the Ohio, was not mentioned. This is further shown by the fact that, while accepting Kellett’s thesis of the tripartite character of *Hollinella*, Coryell and Sample (1932) described still another genus, *Hollites*, also an unfrilled form. Apparently Latham (1932) was not aware of the papers by Coryell and Kellett when she described *Hollina avonensis*.

A number of ideas have been advanced to explain the three divergent forms of *Hollinella* species. In Kellett’s (1929, pp. 197-198) opinion the unfrilled forms are immature males and females and the frilled forms are unproductive (narrow frill) and productive (wide frill) females. However, Blake (1930) takes emphatic exception to this explanation, pointing out that periodomorphosis is not known in any of the Entomostraca, and that the frills may have served as “outriggers to prevent the animal from sinking too deeply into the soft mud, on the surface of which many forms live” or that “the frill subserved no function whatever.” He also pointed out the difficulties involved in Ulrich and Bassler’s (1923, p. 275) idea that when the shell was closed the frill formed a pouch “for the temporary lodgement and protection of broods of young.” The study of living species does not reveal that any crustacean cares for its young after they leave the mother. However, a living fresh-water species of Illinois, *Darwinula stevensoni*, retains the eggs during development, but in the postero-dorsal part of the shell cavity, whereas all other species are oviparous (Hoff, 1942, p. 37). Blake also pointed out the fact that the filling of the space between frills with a brood of young would seriously interfere with feeding and locomotion.

A more reasonable explanation of the various specific forms of *Hollinella* can be gained by applying the methods of moult studies recently applied to a species of *Ectodemites* (Cooper, 1943, p. 49) in which nine instars (forms assumed in successive moult stages) were recognized from the probable nauplius to the mature adult. In plotting the length and height of all available frilled and unfrilled specimens of *H. limata* (Moore) from a sample of the Exline zone of Illinois six instars were recognized (see p. 93). Younger specimens may have been present in the sample but were not recovered. However, the five smaller instars are unfrilled, while all of the frilled forms are larger than the largest unfrilled instar. Of the frilled forms those with narrow frills have slightly larger body cavities to than those with wide convex frills.

In other genera in which the male and female forms of a species can be recognized, the female is the larger. Therefore, by inference, the narrow-frilled *Hollinella* is the female, which is contra-

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18 In measuring all forms of *Hollinella*, the single valve is mounted with the inside of the shell exposed, and the dimensions between the lines of articulation are measured. This eliminates a slight variation due to minor differences in shell thickness and the considerable variation which would result by the comparison of measurements of wide- and narrow-frilled forms, as well as variation in the convexity of wide-frilled forms.
HOLLINIDAE

Hollinella menardensis, Kellett, 1929 (not Harlton); idem, vol. 3, p. 215, pl. 26, figs. 9a, b; p. 216, pl. 26, figs. 1a, b; Graham formation, Kansas.

Hollinella verrucula Moore, 1929, Denison Univ. Bull. Jour. Sci. Lab., vol. 24, p. 107, pl. 5, fig. 4; pl. 7, figs. 5, 6; pl. 8, figs. 3, 4; South Bend shale, Texas.

Carapace elongate; hinge long, straight; frill fairly wide, flaring, and incurved, especially in posterior portion; anterior nodes large, prominent, each rising so abruptly from the shell surface that the base of the node seems smaller than its diameter; sulcus deep and bordered ventrally by longitudinal swelling of shell surface (not a node); surface granulose.

Length, 1.10 mm; height, 0.59 mm.

Shumway to Woodbury zones, localities 110, 113, 115.

HOLLINELLA CRASSIMARGINATA Kellett

Plate 13, figures 25-27

Hollinella crassimarginata Kellett, 1929, Jour. Paleontology, vol. 3, p. 206, pl. 26, figs. 3a, b, 7; Stanton to Ft. Riley formations, Kansas. —Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 31, pl. 4, fig. 5a; Permian, Nebraska.

Carapace elongate; hinge shorter than shell length; anterior node low, well-developed, and of large diameter; posterior node but little higher than shell surface; sulcus deep, flaring at ventral end below nodes; frill narrow, thickened on outer edge becoming wide, flaring, and slightly incurved anteriorly; surface smooth to granulose.

Length, 1.13 mm; height, 0.66 mm; width, 0.54 mm.

This species is a good example of the variably frilled forms of Hollinella, as it includes wide, narrow, and unfrilled forms.

Bogota to Woodbury zones, localities 103, 107, 115.

dictory to previously expressed opinions. Other implications revealed by this analysis are that the unfrilled forms are all immature instars, as in modern forms the adult is represented by only one instar, there being no further moults (Müller, 1927, p. 422); and that only the frilled forms are adults, these being sexually differentiated.

No unfrilled form has been observed to be as large as either male or female frilled adult of the same species. A similar analysis of specimens of H. radlareae and H. kellettii from the Pennsylvanian of Illinois showed identical results.

The lack of understanding of the ontogeny of the species assigned to this genus has resulted in a taxonomic snarl of no mean proportions. The failure to recognize uniform criteria as a basis of specific discriminations has also added to the confusion. While it is admittedly difficult, a sound method of separating immature and adult specimens and the recognition of sex differences in the frilled forms should clarify the situation. Obviously no species should be founded on immature or unfrilled specimens. Since the genotype is not an adult form, a description of adult specimens from the same formation near the type locality (Wewoka formation, section 4, T. 3 N., R. 7 E., Oklahoma) is presented under the systematic descriptions (p. 90).

Specific variations include size of the adult, character of the lateral outline, minor surface markings (smooth, granular, papillosive), and size and relative position of the two nodes. Variations in the frill are not regarded as of specific importance.

HOLLINELLA BURLINGAMENSIS Kellett

Plate 13, figure 39

Hollinella burlingamensis Kellett, 1933, Jour. Paleontology, vol. 7, p. 72, pl. 14, figs. 28-30; Burlingame limestone, Kansas.
Hollinella cushmani Kellett

Plate 13, figure 40


Hollinella emaciata, Upson, (not Ulrich and Bassler), Nebraska Geol. Survey Bull. 8, p. 32, pl. 4, figs. 2a-c; Garrison shale, Nebraska.

Carapace comparatively short, high; hinge short; frill wide, flaring, and strongly uncurved posteriorly, nodes prominent, defining deep sulcus which curves ventrally below small node; surface granulose.

Length. 1.26 mm; height, 0.70 mm.

Shoal Creek to Woodbury zones, localities 78, 81, 90, 115.

Hollinella dentata Coryell

Plate 13, figures 32-33

Hollinella dentata Coryell, 1928, Jour. Paleontology, vol. 2, p. 379, pl. 51, fig 1; Wewoka formation, Oklahoma.

Basslerina limbata Moore, 1929, Denison Univ. Bull. Jour. Sci. Lab., vol. 24, p. 110, pl. 6, fig 7; pl. 7, figs. 11, 12; pl. 8, figs. 13, 14; Wewoka formation, Oklahoma.

Not Hollinella limbata, Warthin, 1930. Oklahoma Geol. Survey Bull. 53, p. 58, pl. 4, fig. 4.

Hollinella bassleri, Warthin, 1930 (not Knight), idem, p. 57, figs. 3a, b; Wewoka formation, Oklahoma.

Hollinella bulbosa Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 251, pl. 24, fig. 7; East Mountain shale, Texas.

Hollinella harltoni, Coryell and Sample, 1932, (not Kellett), idem, p. 251, pl. 24, fig. 8.


Carapace large, somewhat flat, subrectangular, with little forward "swing"; hinge line long, straight, with long anterior spine; anterior node very large, rising abruptly from shell, upper edge coincident with hinge line; posterior node small, poorly developed, hardly more than slight swelling of shell surface; frill wide, flaring, very thin, so it often is irregularly broken; sulcus wide, shallow; surface finely granulose, without spines.

Length. 1.03 mm; height, 0.58 mm.

A close examination of toptype specimens from Warthin’s localities in the Wewoka formation of Oklahoma and specimens from comparable horizons in Illinois shows that the largest unfrilled forms, when compared with the genotype species, are indistinguishable and

Fig. 34—Graph of length-height dimensions of Hollinella dentata Coryell.
therefore probably conspecific. The plotting of measurements of the genotype species with a large number of specimens of *H. limbata* shows that the former is a next-to-last instar (M—1) in the moult series. The broad very fragile frill and large conspicuous nodes make this a distinctive species.

Fulda to Jamestown zones, localities 1, 4, 12, 16, 20, 22, 26, 30, 31, 36, 37, 50.

**Hollinella elongata** Cooper, n. sp.

*Plate 13, figures 28, 29*

Carapace rather small, elongate, tumid; hinge line long, straight; frill quite narrow, flaring; anterior node large, prominent, slightly ovate in outline; posterior node small, low, inconspicuous; surface finely granulose, without spines or papillae except along anterior margin between end of frill and dorsal angle.

Length, 0.95 mm; height, 0.47 mm; thickness, 0.50 mm.

Brereton zone, locality 37.

**Hollinella emaciata** (Ulrich and Bassler)

*Plate 13, figures 21-24*


Carapace subtrapeziform; hinge fairly short; frill narrow, outer rim thickened; anterior node large, flat, upper edge even with hinge line; posterior node small, low, and indistinct, especially on posteroventral margin where it merges imperceptibly with the shell surface; surface pitted, anterior surface and edge spinose.

Length, 1.08 mm; height, 0.57 mm; width, 0.51 mm.

Shumway zone, locality 112.

**Hollinella gibbosa** Kellett

*Plate 13, figure 31*

*Hollinella gibbosa_, Kellett, 1929, Jour. Paleontology, vol. 3, p. 208, pl. 25, figs. 3a-c; pl. 26, figs. 2a-c, 5, 11; Burlingame to Ft. Riley formations, Kansas. —Bradfield, 1925, Bull. Am. Paleontology, vol. 22, p. 47, pl. 2, fig. 1; Deese group, Oklahoma.

*Hollina granifera_, Harlton, 1927 (not Ulrich), Jour. Paleontology, vol. 1, p. 204, pl. 32, fig. 3, Hoxbar group, Oklahoma.

Carapace somewhat elongate, hinge straight, of moderate length; nodes raised conspicuously above shell surface, larger one often rising above hinge line; sulcoid deep, expanding ventrally so that a narrow ridge seems to join the nodes (shown in accenuated manner by Harlton’s figure); frill wide, flaring, and incurved posteriorly; surface smooth to finely granulose; anterior margin faintly spinose.

Length, 1.13 mm; height, 0.63 mm.

Shumway zone, localities 109, 112.

**Hollinella grahamensis** (Harlton)

*Plate 13, figure 30*

*Hollina grahamensis_ Harlton, 1927, Jour. Paleontology, vol. 1, p. 203, pl. 32, figs. 2a, b; Upper Glenn (Hoxbar group), Oklahoma.


*Hollinella harltoni_ Kellett, 1929, Jour. Paleontology, vol. 3, p. 213, pl. 26, figs. 10a-c; Belle City limestone, Oklahoma.

Carapace fairly short; hinge long, almost equal to length of shell, anterior node of large diameter, high, and often protruding above hinge line; diameter of posterior node about two-thirds that of larger node, extending well above shell surface, even along posteroventral margin; sulcoid wide, shallow, flaring ventrally; curvature of shell regular, and uninterrupted in ventral half except for row of short nodose spines in lieu of a flange subparallel to the ventral margin.
Length, 0.90 mm; height, 0.52 mm.

As no described specimen of this species (and also H. harltoni) shows the frilled form, it is therefore identified with some uncertainty (see remarks under H. oklahomaeensis, p. 94).

Bogota zone, locality 100.

**Hollinella grandis** Cooper, n. sp.

Plate 13, figures 41-46

Carapace large, tumid; hinge line long, straight; frill moderately wide, thin, flaring to slightly incurved near posterior end, with only a rudimentary spine developed on some specimens; anterior node very large, rises abruptly from shell surface and is wholly on anterior portion of shell; posterior node small, but prominent; sinus fairly broad, deep, and centrally located; surface finely granulose.

Length, 1.23 mm; height, 0.64 mm; width, 0.75 mm.

H. grandis is probably the largest known Pennsylvanian Hollinella. It is further differentiated by the extreme anterior position of the very prominent anterior node.

Gimlet and Macoupin zones, localities 58, 86.

**Hollinella kellettae** Knight

Plate 14, figures 6-10

_Hollina ulrichi_ Knight, 1928, Jour. Paleontology, vol. 2, p. 237, pl. 31, figs. 4a, b; Labette formation, Missouri. —Hartton, 1929, Texas Univ. Bull. 2901, p. 141, pl. 1, fig. 3, Canyon series, Texas.


_Hollinella ulrichi_, Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 56, pl. 4, figs. 6a, b, Holdenville formation, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 13, pl. 1, figs. 1-4; Upper Missouri group, Nebraska.


Not _Hollinella kellettae_. Coryell and Booth, 1933, Am. Midland Naturalist, vol. 15, p. 271, pl. 5, figs. 8-10.

Carapace large, with pronounced backward "swing"; hinge line long, straight, right valve has short spine on posterior end and a much longer slightly curved spine on anterior end; anterior node of large diameter stands high above shell surface and carries the same markings as rest of shell, namely granulations and numerous short rounded spines; posterior node about half as thick, merges with shell surface posteroventrally; frill wide, flaring, incurved for half its length posteriorially, terminated near anterior end by large spine.

Length (figs. 7, 8), 1.06 mm; height, 0.60 mm.

When renaming _Beyrichia? radiata_ Jones and Kirkby to _Hollinella digitata_, Kellett (1929, p. 209), overlooked the fact that Knight (1928, p. 237) previously had renamed this species _H. ulrichi_. Later Kellett postulated differences between the forms collected from the Middle Pennsylvanian of Missouri and those from the Permian of Kansas. In the meantime other species called _H. digitata_ and _H. ulrichi_ were described from the Middle Pennsylvanian of Oklahoma (Warthin, 1930; Coryell and Sample, 1932; Bradfield, 1935). Still later Johnson (1936, p. 133) pointed out that the criteria proposed for recognizing differences between the Permian and Middle Pennsylvanian species did not hold because they could be applied equally well to specimens of _Hollinella_ from either system. He placed all of the above, as well as other papillose forms, in synonymy with _H. ulrichi_, recognizing wide-frilled, narrow-frilled, and unfilled forms in the Upper Kansas City and Lansing groups of the Pennsylvanian of Nebraska.

However the papillose forms, ranging in age from middle Des Moines to Lower Permian, are now thought to represent three separate and distinct species, namely _H. kellettae_, _H. oklahomaeensis_, and _H. ulrichi_. The separation is based on differences in size and form ratio, as follows:
Species | Length (adults) | Height | Form | Ratio |
<table>
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<tr>
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<td>(mm)</td>
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<tr>
<td><em>H. kellettae</em></td>
<td>1.005</td>
<td>1.005</td>
<td>0.552</td>
<td>0.355</td>
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<tr>
<td><em>H. oklahomaeensis</em></td>
<td>1.08</td>
<td>1.11</td>
<td>0.57</td>
<td>0.58</td>
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<tr>
<td><em>H. ulrichi</em></td>
<td>0.97</td>
<td>0.50</td>
<td>1.95</td>
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As in other species of *Hollinella* the unfrilled forms can be shown to be immature instars, which in themselves cannot be recognized specifically.

Stratigraphically *H. kellettae* in Illinois ranges from the Liverpool to St. David zones (localities 14, 16, 17, 22, 31), and thus is restricted to the upper Des Moines series from the Ardmore to the Labette. *H. oklahomaeensis* is known from the Sparland (No. 7 coal horizon) to the top of the Pennsylvanian section and is distinct from the smaller, shorter *H. ulrichi* (pl. 14, figs. 16, 17) which has not yet been found in the Pennsylvanian and appears to be restricted to the Permian.

**Hollinella levit** Cooper, n. sp.

Plate 14, figure 1

Carapace large, subquadrangular; hinge line long, straight; anterior node large, fairly low, rising gradually from shell surface; posterior node small, low, indistinct, and located high on the shell; sulcus unusually broad, shallow, and widely flaring in lower part; frill thick, narrow, flaring, and terminated anteriorly by broad short spine; surface very smooth, except for occasional short papillose spines.

Length, 1.13 mm; height, 0.62 mm.

*H. levit* may be distinguished by its very smooth surface broken by very sparsely distributed papilae.

Brereton and Gimlet zones, localities 44, 59, 62.

**Hollinella limata** (Moore)

Plate 14, figures 31-36

*Basslerina limata* Moore, 1929, Denison Univ. Bull. Jour. Sci. Lab., vol. 24, p. 106, pl. 6, fig. 1; pl. 7, fig. 3, pl. 8, figs. 5, 6; Graham group, Texas.

Carapace elongate, tumid; hinge line long, straight; anterior node of large diameter and considerable height, posterior node about half as large; sulcus very broad and shallow, flaring at base so that edge of posterior node is well defined around most of its perimeter; flange of moderate width, flaring outward for its entire length, and terminated anteriorly by a large forward-curving spine; surface granulose.
Length, 1.26 mm; height, 0.64 mm; width, 0.66 mm.

Piasa to Millersville zones, localities 54, 66, 90.

**Hollinella minuta** Cooper n. sp.

Plate 14, figures 11, 12

Carapace small, somewhat inflated; form ratio average; hinge line straight; anterior node very large, high on carapace, upper edge slightly overlapping the hinge line; frill very wide, flaring to convex in posterior portion, anterior end marked by a short thick spine; surface extremely coarsely granulose, with a few short spines scattered sparsely over the surface of the shell and nodes.

Length, 0.79; height, 0.46 mm.

_H. minuta_ is the smallest adult species known, and may be further differentiated by its very coarsely papillose surface and relatively wide frill.

Seahorne to Lowell zones, localities 11, 14, 16, 22.

**Hollinella moorei** Cooper, n. sp.

Plate 14, figures 13, 14

*Basslerina regularis* Moore, 1929, Denison Univ. Jour. Sci. Lab. vol. 24, p. 108, pl. 6, fig. 3; pl. 8, figs. 7, 8, 15; Graham group, Texas.

_Hollinella bassleri_ Coryell and Billings, 1932 (not Knight), Am. Midland Naturalist, vol. 13, p. 185, pl. 18, fig. 4; Wayland shale, Texas.

Carapace large, slightly flat, somewhat elongate, with little forward "swing"; hinge almost as long as shell; anterior node large, hemispherical, standing slightly above hinge line; posterior node one-fifth to one-fourth as large, low, and inconspicuous; surface coarsely punctate, devoid of spinelets except near anterior margin and an occasional one near hinge line; flange relatively narrow, flaring, terminated by large blunt spine.

Since _Basslerina_ is a synonym of _Hollinella_, _B. regularis_ Moore on being transferred becomes a junior homonym to _H. regularis_ Coryell, 1928.

Length, 1.10 mm; height, 0.60 mm. 
Shumway zone, locality 112.

**Hollinella nowataensis** Coryell and Osorio

Plate 14, figure 19

_Hollinella nowataensis_ Coryell and Osorio, 1932, Am. Midland Naturalist, vol. 13, p. 29, pl. 5, fig. 1; Nowata shale, Oklahoma.

_Hollinella inflata_ Coryell and Osorio, 1932, idem, p. 29, pl. 5, fig. 2; Nowata shale, Oklahoma.

Carapace short, hinge line straight and relatively short; anterior node very large, rising abruptly from shell surface, slightly spinose; posterior node less than one-half as wide, rising only slightly above shell surface, except where it borders sulcus; sulcus narrow and deep, widening ventrally; nodes seem to be joined ventrally by a wide curved ridge, formed by inflated shell surface between the nodes and the flange; flange moderately wide, with terminal spine flaring anteriorly, incurved posteriorly where it merges imperceptibly with shell surface; shell surface very finely granulose except anteriorly where it is somewhat spinose.

Length, 1.30 mm; height, 0.60 mm.
Gimlet zone, localities 58, 62.

**Hollinella oklahomaensis** (Harlton)

Plate 14, figures 37-45

_Jonesina oklahomaensis_ Harlton, 1929, Jour. Paleontology, vol. 2, p. 133, pl. 21, figs. 3a, b; Belle City limestone, Oklahoma.

_Hollinella oklahomaensis_, Harlton, 1929, Texas Univ. Bull. 2901, p. 146, pl. 1, figs. 8a, b; Canyon series, Texas. —Kellett, 1929, Jour. Paleontology, vol. 3, p. 215, pl. 26, figs. 13a, b; Belle City limestone, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 18, pl. 1, figs. 13, 14; Chanute shale, Nebraska.

_Hollites papillosus_ Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 252, pl. 24, fig. 9; East Mountain shale, Texas.

Carapace elongate; hinge line fairly long; anterior node large; posterior
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node about one-fourth as wide, faint, inconspicuous; sulcus deep, moderately wide; flange wide, anteriorly terminated by large spine; shell surface rather coarsely granulose, with numerous short spines.

Length (figs. 37-39) 1.30 mm; height, 0.63 mm; width, 0.63 mm.

A number of unfrilled forms have been described from various parts of the Missouri series in Oklahoma and Texas. It is not possible to recognize some of these species with any degree of certainty until larger collections containing both young and adult instars are studied. The Exline zone of Illinois contains a large number of variously sized specimens of *H. oklahomaensis* among which five instars can be recognized, as well as the wide-frilled and narrow-frilled adults. *H. papillosus* is the third instar removed from the adult (M—3). See remarks under *H. kellettiae* (p. 92).

Sparland to Shumway zones, localities 54, 55, 66, 67, 70, 76, 86, 87, 102, 112.

**Hollinella pulchra** (Moore)

Plate 14, figure 15

*Basslerina pulchra* Moore, 1929, Denison Univ. Bull. Jour. Sci. Lab., vol. 24, p. 109, pl. 6, fig. 5; pl. 7, figs. 1, 2; pl. 8, figs. 1, 2; South Bend shale, Texas.

Carapace small, subquadrate, hinge line slightly concave; frill moderately wide, thin, and flaring; anterior node rather small, but prominent; posterior node relatively large, situated close to larger node; surface finely granulose.

Length, 0.88 mm; height, 0.46 mm. Brereton zone, locality 47.

**Hollinella radlaree** (Harlton)

Plate 14, figures 2-5

*Hollina radlaree* Harlton, 1928, Jour. Paleontology, vol. 2, p. 133, pl. 21, figs. 2a, b; Bell City limestone, Oklahoma. —Harlton, 1929, Texas Univ. Bull. 2901, p. 141, pl. 1, figs. 2a-c; Canyon series, Texas.


*Hollina tricollina*, Harlton, 1927 (not Ulrich), Jour. Paleontology, vol. 1, p. 204, pl. 32, figs. 4a, b; Lower Glenn (?Dornick Hills group), Oklahoma.

*Hollina obsita* Moore, 1929, Denison Univ. Bull. Jour. Sci. Lab., vol. 24, p. 104, pl. 6, fig. 4; pl. 7, figs. 9, 10; pl. 8, figs. 11, 12; Francis formation, Oklahoma.

Carapace large, very tumid; hinge line straight, almost as long as shell; anterior node very large, often overlapping hinge line; usual posterior node very small, inconspicuous, but a somewhat

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**Fig. 36**—Graph of length-height dimensions of *Hollinella oklahomaensis* Harlton.
larger third node lies above and behind the usual position of the posterior node; this third node stands above the hinge line on a level with the large anterior node; frill wide, heavy, smooth, posterior portion incurved, posterior end terminated by small spine; sulcus quite wide and deep; shell below sulcus is deeply depressed near the flange; surface of shell and nodes covered with extremely coarse granulations, some of which appear to become small spines on anterior end.

Length, 1.05 mm; height, 0.60 mm; width, 0.60 mm.

LaSalle zone, locality 88.

**Hollinella regularis** Coryell

**Plate 14, figures 20-26**

_Hollinella regularis_ Coryell, 1928, Jour. Paleontology, vol. 2, p. 380, pl. 51, fig. 3; Francis formation, Oklahoma.

_Hollinella ovata_ Coryell, 1928, idem, p. 380, pl. 51, fig. 2; Francis formation, Oklahoma.

Not _Bassierina regularis_ Moore, 1929, Denison Univ., Jour. Sci. Lab., vol. 24, p. 108, pl. 6, fig. 3; pl. 8, figs. 7, 8, 15; Graham group, Texas.

_Hollinella menardensis_ Harlton, 1929, Texas Univ. Bull. 2901, p. 145, pl. 1, figs. 6a, b; Canyon series, Texas.

_Hollinella forstcottensis_, Harlton, 1929 (not Knight), idem, p. 145, pl. 1, fig. 5.

_Hollinella buehleri_, Harlton, 1929 (not Knight), idem, p. 144, pl. 1, fig. 4.

Carapace of medium size, somewhat tumid; hinge line long, straight; anterior node of very large diameter, quite high; posterior node about one-half as large, low, and close to anterior node, forming very narrow deep sulcus, which flares ventrally, particularly toward posterior, thus accentuating the smaller node; shell below sulcus is depressed rapidly toward flange, giving somewhat the appearance of a ridge joining the two nodes; flange broad, prominently flaring anteriorly, slightly incurved posteriorly, a large curved spine marks anterior end of flange; surface granulose, with a few short spines.

Length, 1.02 mm; height, 0.60 mm; width, 0.54 mm.

A comparison of frilled forms from well known localities in the Francis formation, a short distance south of Coryell's type locality, shows the occurrence of unfrilled with frilled forms. According to the measurements of the holotype it is an instar two removed from the adult (M—2). _H. ovata_ from the same horizon and locality is thought to be a slightly mashed specimen of this species, since it differs only in thickness. The size and shape of most specimens of _Hollinella_ from this locality have been modified to some extent by the pressure of the enclosing shale.

Gimlet to Woodbury zones, localities 59, 62, 79, 81, 88, 100, 107, 115.

**Hollinella shawnensis** Kellett

**Plate 14, figure 18**

_Hollinella shawnensis_ Kellett, 1929, Jour. Paleontology, vol. 3, p. 209, pl. 25, figs. 4a-c; pl. 26, fig. 8; Deer Creek to Howard formations, Kansas.

_Hollinella kellettiae_, Coryell and Booth, 1933 (not Knight), Am. Midland Naturalist, vol. 14, p. 271, pl. 5, figs 8-10; Wayland shale, Texas.

Carapace large, rather short; hinge line relatively short; anterior node large, circular to slightly ovate in outline, rising above hinge line; posterior node about one-third as large, low, and inconspicuous, flange wide, radially "laminated," posterior portion incurved, anterior half flaring and terminated by a long thick curved spine; surface very coarsely granulose, with several short stubby spinelets scattered over surface of shell and large node.

Length, 1.08 mm; height, 0.63 mm.

Trivoli to Shumway zones, localities 70, 72, 109, 112.

**Hollinella warthini** Cooper, n. sp.

**Plate 14, figures 27-30**

_Hollinella digitata_, Warthin, 1929 (not Kellett), Oklahoma Geol. Survey Bull. 53, p. 57, pl. 4, fig. 5; Holdenville formation,
Oklahoma. ?—Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 250, pl. 24, fig. 15; East Mountain shale, Texas.


Carapace elongate, hinge line straight; nodes unusually prominent, anterior node of very large diameter, rising abruptly from shell surface, its upper edge extending above the hinge line; posterior node small but well defined; frill of moderate width, flaring surface covered by small very uniform granulations.

Length, 1.21 mm; height, 0.64 mm; width, 0.60 mm.

Representatives of this species have been erroneously identified as H. digitata and H. ulrichi (see p. 92).

Brereton to Exline zones, localities 37, 49, 58, 66.

Family Kirkbyiidae Ulrich and Bassler, 1923

Genus Amphissites Girty, 1910

Amphissites adjunctio Cooper, n. sp.

Plate 15, figures 29-31

Carapace large, subquadrate, ends rounded, hinge long; medial and dorsal-posterior nodes high, rising abruptly from surface of shell; outer carina well developed, heavy, bordered by row of very large reticuli, inner carina similarly bordered, prominent, parallel to outer ridge, curving upward in the ventral angles where it becomes progressively lower and finally merges with the surface of the shell; short but prominent curved carina beginning at anterior edge of pit beneath center of medial node extends horizontally for a short distance, then curves upward parallel to the inner carina, and merges with the shell surface at a point even with the center of the medial node; pit large, ovate, below and slightly back of center of median node, axis inclined anteriorly; surface marked by medium to coarse reticulations.

Length, 1.16 mm; height, 0.64 mm; width, 0.63 mm.

This species may be easily recognized by the presence of the short, curved carina, ventroanterior to the medial node.

Livingston zone, locality 93.

Amphissites alticostatus Bradfield

Plate 15, figures 9-11


Carapace small, subquadrate; hinge depressed; dorsal margin distinctly concave in young specimens (see Bradfield, 1935) less so in older forms; ventral margin straight to slightly convex; carinae very prominent, smooth, and present on medial, anterior, and posterior swellings; inner carina prominent in midportion where it parallels outer carina, but on turning upward at ventral angles, soon merges with the surface of the shell; carina on the slight median node inclined slightly to posterior; carinae on terminal swelling low, thin, but distinct, posterior one more prominent; surface covered by reticulations of medium size.

Length, 0.77 mm; height, 0.45 mm; width, 0.42 mm.

Fulda to Liverpool zones localities 1, 2, 16.

Amphissites carinatus Cooper, n. sp.

Plate 15, figures 15-18; 21, 22

Carapace elongate, ends rounded, hinge straight; medial node small but prominent, and characterized by a short transverse carina on posteroventral margin bordering the pit; carina high, thin, the inner one parallel to outer along venter, merging around ends and meeting at the dorsal angles; two fairly prominent thin ridges occupy a midposition between node and inner carina, extending from the dorsal margin to a point slightly below the ventral margin of the node.
Length, (figs. 17, 18) 0.77 mm; height, 0.45 mm; width, 0.38 mm.

This species is similar to A. centronotus (Ulrich and Bassler) in all respects except for the small ridge which partially crosses the ventral node.

Bogota and Woodbury zones, localities 101, 115.

**Amphissites centronotus** (Ulrich and Bassler)

Plate 15, figures 19-22


**Amphissites centronotus** Roundy, 1926, U. S. Geol. Survey, Prof. Paper, 146, p. 7. —Harlton, 1927, Jour. Paleontology, vol. 1, p. 207, pl. 32, figs. 10a, b; Hoxbar group, Oklahoma. —Knight, 1928, idem, vol. 2, p. 259, pl. 32, figs. 6a-e; pl. 34, fig. 2; Labette formation, Missouri. —Warthin, 1930, Oklahoma Geol. Survey Bull 53, p. 66, pl. 5, figs. 4a-c; Wetumka, Wewoka, Holdenville formations, Oklahoma. —Delo, 1930, Jour. Paleontology, vol. 4, p. 160; pl. 12, fig. 9. —Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 184, pl. 18, fig. 9; Wayland shale, Texas. —Coryell and Sample, 1932, idem, vol. 13 p. 258, pl. 25, fig. 1; East Mountain shale, Texas. —Kellett, 1933, Jour. Paleontology, vol. 7, p. 95, pl. 16, figs. 16-22; Middle Pennsylvanian to Wreford formation, Kansas. —Coryell and Booth, 1933, Am. Midland Naturalist, vol. 14, p. 260, pl. 3, figs. 1, 2; Wayland shale, Texas. —Upson, Nebraska Geol. Survey Bull. 8, p. 42, pl. 3, figs. 7a-c; Florena-Cottonwood formations, Kansas. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 59, pl. 3, fig. 3; Deese formation, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 30, pl. 3, figs. 12-14; Island Creek, Captain Creek, Stark, Quivira, Muncie Creek, Lane, Spring Hill, Endora, and South Bend formations, Nebraska.

*Albanella gouldii* Harris and Lalicker, 1932, Am. Midland Naturalist, vol. 13, p. 397, pl. 36, figs. 2a, b; Wreford limestone, Kansas.


Not *Amphissites centronotus*, Kummerow, 1939, Preuss, geol. Landesanstalt, Abbh., n.f., no. 194, pt. A, p. 29, pl. 3, fig. 4; Tournaisian-Visean, Germany.


Not *Amphissites centronotus elongatus* Payne, 1937, Jour Paleontology, vol. 11, p. 280, pl. 38, figs. 2a-c; Hayden Branch formation, Indiana.

Length (figs. 21, 22), 0.80 mm; height, 0.45; width, 0.44 mm.

This well known species needs no further description. Its occurrence throughout most of the Pennsylvanian and well into the Permian makes its range one of the longest authenticated to date. In Illinois it is known from the Seville to the Woodbury, or from almost all of the known ostracode-bearing strata of the Pennsylvanian system, localities 6, 12, 13, 26, 38, 46, 53, 54, 55, 66, 67, 68, 71, 74, 81, 82, 88, 90, 102, 109, 113, 114, 115.

**Amphissites centronotus elongatus** Payne

Plate 15, figures 23-25

*Amphissites centronotus elongatus* Payne 1937, Jour. Paleontology, vol. 11, p. 280, pl. 38, figs. 2a-c; Hayden Branch formation, Indiana.

Carapace elongate, dorsal and ventral margins parallel, ends rounded, inner and outer carina tenuous, complete around free margins, parallel along ventral margin; vertical carina distinct though low and thin, very long, about equidistant between edge of medial node and inner carinae; node circular, of medium size, and slightly forward of center; pit ovate, axis inclined anteriorly; surface marked by irregular reticulations of small to medium size.

Length, 0.82 mm; height, 0.41 mm; width, 0.45 mm.

*A. centronotus elongatus* differs from *A. centronotus* by its unusual length (form ratio of 1.9 or greater). The Illinois specimens are identical with the
Indiana form in all respects except that the vertical carinae are not continuous around the node.

Seahorne and Shoal Creek zones, localities 12, 74.

**AMPHISSITES CONGRUENS** Cooper, n. sp.

_Plate 15, figure 43_

Carapace subquadratc, dorsal and ventral margins straight and parallel, ends rounded; inner carina low and indistinct anteriorly, becoming more prominent, and gradually diverging from outer carina around ventral margin to the posteroventral angle, where it disappears; posterior swelling distinct, surmounted by a false carina formed by ridge joining two rows of reticulations; median node fairly large, irregular in outline, located above and forward of oval pit; axis of pit deflected to anterior, surface covered by reticulations of irregular shape, medium size, tending toward a regular alignment near the major features of shell sculpture.

Length, 0.82 mm; height, 0.48 mm.

This species, occurring well up in the Pennsylvanian (Missouri series), is remarkably similar to two Chester species namely, _A. golcondensis_ Croneis and Gale and _A. quadratus_ Cooper from the Golconda and Kinkaid formations respectively. The Pennsylvanian species lack the convex ventral outline of _A. golcondensis_ and the retral swing of _A. quadratus_ due to a difference in the cardinal angles. The reticulate pattern of the Chester species seems finer and less regular.

LaSalle zone, locality 88.

**AMPHISSITES GIRTYI** Knight

_Plate 15, figures 12-14_

_Amphissites girtyi_ Knight, 1928, Jour. Paleontology, vol. 2, p. 260, pl. 32, figs. 7a, b; pl. 34, fig. 1; Labette formation, Missouri. —Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 65, pl. 5, fig. 3; Wetumka formation, Oklahoma. —Corryell and Sample, 1932, Am. Midland

Naturalist, vol. 13, p. 259, pl. 25, fig. 4; East Mountain shale, Texas.

_Amphissites mesacostata_ Roth, 1929, Wagner Free Inst. Sci., Publ. 1, p. 48, pl. 3, figs. 15a-c; Wetumka formation, Oklahoma.

Carapace elongate, subquadratc, dorsal margin straight, ventral margin distinctly convex; surface finely reticulate; median node well forward of center, small ovate to elongate vertically; a horizontal costa extends anteriorly almost to anteroventral costa; inner and outer keels high, distinct, narrow, with several rows of coarse reticulations between them; pit circular, not much larger than coarsest reticulations, below and almost completely behind medial node.

Length, 0.72 mm; height, 0.39 mm; width, 0.34 mm.

_A. girtyi_ is easily recognized by its horizontal costa extending from the node toward the anterior end and by the prominent smooth keels or carinae.

This species ranges from the Seville to the Shoal Creek cyclothems in Illinois, where, as elsewhere, it is found most abundant in the zones of the upper Des Moines series. Localities 6, 11, 16, 22, 26, 29, 30, 41, 50, 54, 71, 77, 78

**AMPHISSITES PARVUS** Cooper, n. sp.

_Plate 15, figures 3-6_

Carapace small, irregularly ovate, posterior end slightly higher than anterior; reticulations fine to medium; central node small and directly over pit; inner keel absent or poorly developed; vertical costa on each side of ventral node thin, short or absent entirely.

Length (figs. 3, 4), 0.46; height, 0.26 mm; width 0.25 mm.

This species resembles _A. ciscoensis_ Harlton in size and in the lack of an inner ridge but the reticulations seem smaller and the cardinal angles are less obtuse.

Seville and Oak Grove zones, localities 3, 4, 14.
Amphissites robustus Cooper, n. sp.  
Plate 15, figures 34-36

Carapace large, subquadrate, ends rounded, dorsal margin straight to convex, ventral margin straight; carinae prominent, though tenuous, inner one complete to cardinal angles; vertical carinae long, straight to slightly curved; posterior swelling very faint; median node prominent, circular, and immediately above ovate pit whose axis is horizontal; surface reticulations irregularly polygonal and large to medium in size.

Length, 0.97 mm; height, 0.57 mm; width, 0.56 mm.

A. robustus closely resembles A. centronotus (Ulrich and Bassler) but is more robust, less elongate and the node and pit are more centrally located. It appears to be very close to the Chester A. carinatus Cooper from the Golconda and Glen Dean, although the latter does not have the straight ventral margin.

Gimlet to Macoupin zones, localities 60, 76, 84, 85.

Amphissites rothi Bradfield  
Plate 15, figures 26-28


Carapace subquadrate, cardinal angles obtuse, ends rounded, hinge straight and fairly short; nodes low and indistinct, posterodorsal node more prominent, sometimes obscuring cardinal angle; reticulations distinct, medium to coarse, and uniform in size; pit on posteroventral side of median node, ovate, with axis inclined sharply to anterior; carinae lacking or poorly developed between the ventral angles only.

Length, 0.90 mm; height, 0.51 mm; width, 0.48 mm.

Although the medial node of Bradfield's species is slightly larger than those observed on some of the Illinois specimens, this feature appears to be variable, consequently the specimens are believed to be the same species, although occurring much higher in the section.

Amphissites rondeyi Knight  
Plate 15, figures 7, 8

Amphissites rondeyi Knight, 1928, Jour. Paleontology, vol. 2, p. 262, pl. 32, figs. 8a, b; pl. 34, fig. 5; Labette formation, Missouri. —Warthin, 1939, Oklahoma Geol. Survey Bull. 53, p. 63, pl. 4, fig. 14; Wewoka formation, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 31, pl. 3, figs. 29-31; Upper Missouri series, Nebraska.

Carapace subquadrate, ends rounded, dorsal margin straight, ventral margin concave; outer carina low, tenuous, forming margins between cardinal angles; inner carina low, indistinct, irregular, tenuous, paralleling central ventral margin, dying out at ventral extremities; posterior swelling marked by a pseudocarinate ridge formed by the boundry adjoining rows of reticulations; median node low, inconspicuous, slightly back of center; pit central and on anteroventral margin of medial node; surface marked by coarse deep reticulate network which is continuous over surface of shell, uninterrupted by the medial node and inner carina.

Length, 0.79 mm; height, 0.45 mm; width, 0.38 mm.

The Nebraska specimens seem to be more elongate than those from Illinois and Missouri and possibly should be designated as a variety (form ratio 1.66 compared to 1.77).

Seahorne to 'Centralia' zones, localities 11, 20, 29, 38, 44, 81.

Amphissites transversus Roth  
Plate 15, figures 1, 2

Amphissites centronata transversa Roth, 1929, Wagner Free Inst. Sci. Pub. 1, p. 52, pl. 3, figs. 17a-c; Francis formation, Oklahoma.

Carapace large, subquadrate, ends rounded, hinge long; dorsal margin straight, ventral margin concave; carinae well developed but tenuous, inner carina extending to cardinal angles, vertical carina developed to point even with
lower side of median node; node central immediately above oval pit with axis horizontal; surface covered by reticulations of medium size.

Length, 0.82 mm; height, 0.46 mm; width, 0.48 mm.

Seahorne to Summum zones, localities 9, 13, 22, 26.

Genus Discoidella Croneis and Gale, 1938

Discoidella convexa? Scott and Borger
Plate 16, figures 7, 8

Discoidella convexa Scott and Borger, 1941, Jour. Paleontology, vol. 15, p. 356, pl. 49, figs. 15, 16; Macoupin formation, Illinois.

Carapace small, subcircular, valves convex, height slightly greater than length, greatest thickness above center on medial line; surface sculpture and hinge ment obscured by poor preservation.

Length, 0.43 mm; height, 0.45 mm; width, 0.25 mm.

Gimlet zone, locality 62.

Discoidella lingulata Cooper, n. sp.
Plate 16, figures 3, 4

Carapace small, ovate, convex, with a lateral outline and postcentral inflation resembling characteristic linguloid brachipods; dorsal margin sharply ar- cuate, ventral margin rounded, surface reticulate.

Length, 0.41 mm; height, 0.50 mm; width, 0.27 mm.

Macoupin to Shumway zones, locali- ties 83, 112.

Discoidella perminuta? (Kellett)
Plate 16, figures 5, 6

Paraparchites? perminutus Kellett, 1933, Jour. Paleontology, vol. 7, p. 67, pl. 13, figs. 31, 32; Oread or Iatan limestone, Kansas.

Offa? perminuta Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 48, pl. 5, fig. 10; Chanute shale, Nebraska.

Carapace small, lateral outline irregularly subcircular; valves strongly con- vex, greatest thickness above center; surface finely reticulate.

Length, 0.37 mm; height, 0.33 mm; width, 0.19 mm.

These small almost featureless specimens seem to agree with Kellett’s de- scription and illustration and occur at a horizon comparable to that from which the Kansas form was obtained.

Little Vermilion zone, locality 105.

Genus Ectodemites Cooper, 1941

Ectodemites dattonensis (Harlton)
Plate 16, figures 1, 2


Amphissites irregularis Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 261, pl. 25, fig. 5; East Mountain shale, Texas.

Carapace subquadrate, dorsal margin straight to somewhat convex, ventral margin concave; surface coarsely reticulate; median node absent; pit below mid- dle, equidistant from extremities, axis inclined anteriorly; posterior shoulder marked by thin, almost vertical costa; inner keel low, indistinct, and only about half as long as shell.

Length, 0.85 mm; height, 0.46 mm; width, 0.42 mm.
E. dattonensis can be distinguished by the tenuous shoulder bordering the depressed posterior and by the lack of well developed medial node or of an anterior carina.

Ferdinand to Woodbury zones; localities 2, 20, 22, 26, 30, 36, 37, 50, 54, 55, 79, 81, 83, 84, 88, 92, 93, 102, 107, 109, 115.

Ecotbedemites edsonae (Bradfield)

Plate 16, figures 15-17

Carapace subquadrate, ends rounded, dorsal margin straight, ventral margin straight to slightly convex; greatest height anterior; inner carinae absent; position of median node marked by a short vertical costa, located just ahead of ovate node, whose axis is inclined anteriorly about 45°; surface reticulate.

Length, 0.59 mm; height, 0.36 mm; width, 0.20 mm.

E. edsonae closely resembles E. dattonensis (Harlton) in general shape and outline, but is distinguished by the absence of an inner carina.

Woodbury zone, locality 115.

Ecotbedemites harltoni Cooper, n. sp.

Plate 15, figure 44
Amphissites sp. Harlton, 1933, Jour. Paleontology, vol. 7, p. 23, pl. 6, fig. 6; Johns Valley shale, Oklahoma.

Carapace subrectangular, cardinal angles obtuse, dorsal and ventral margins straight and parallel; surface marked with very coarse irregular polygonal reticulations; two swellings, one nearly central, the other in posterocardinal angle, are covered with similar reticulations that are not interrupted by the nodes or swellings; pit small, ovate, and indistinct because of coarse reticulation; inner keel subparallel to outer, closest anteriorly.

Length, 0.97 mm; height, 0.60 mm.

E. harltoni is similar in every respect to the specimen described by Harlton from the Johns Valley shale, except that the Illinois specimens are slightly smaller.

Fulda and Seville zones, localities 1, 7.

Ecotbedemites geneae (Roth)

Plate 15, figures 32, 33
Amphissites geni Roth, 1929, Wagner Free Inst. Sci., Publ. 1, p. 42, pl. 12, figs. 12a-e; Francis formation, Oklahoma.

Amphissites geneae, Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 64, pl. 5, fig. 2; Holdenville formation, Oklahoma.

Amphissites gregeri Delo, 1931, Washington Univ. (St. Louis) Studies, n. ser., Sci. Tech. 5, p. 48, pl. 4, figs. 8a-c; Pennsylvanian, Kansas.


Amphissites minuta Roth, 1929, Wagner Free Inst. Sci., Publ. 1, p. 44, pl. 2, figs. 15a-c; Francis formation, Oklahoma.

—Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 43, pl. 3, figs. 12a-c; Florena and Cottonwood formations, Nebraska.


—Knight, 1928, Jour. Paleontology, vol. 2, p. 263, pl. 32, fig. 9; pl. 34, fig. 3; Labette formation, Missouri.

—Delo, 1931, Washington University (St. Louis) Studies, n. ser., Sci. Tech. 5, p. 46, pl. 4, figs. 7a-c; Pennsylvanian, Kansas.

—Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 260, pl. 25, fig. 3; East Mountain shale, Texas.

—Kellett, 1933, Jour. Paleontology, vol. 7, p. 94, pl. 15, figs. 12-22, 41; Dover to Wreford formations, Kansas.

—Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 43, pl. 3, figs. 11a, b; Garrison shale, Nebraska.


Carapace ovate, dorsal margin straight, venter convex; carinae absent; median node low, indistinct, and directly above oval pit; posterior shoulder faint; surface covered with small reticulations.

Length, 0.91 mm; height, 0.54 mm; width, 0.50 mm.

This species which ranges in age from Ft. Scott to Permian in the Mid-Continent region, has been found only in the Millersville zone in Illinois, locality 90.
ECTODEMITES PLUMMERI Cooper, n. sp.

Plate 15, figures 37-42

Carapace short, tumid; lateral outline ovate or subrectangular; dorsal margin straight, ventral slightly convex; ends subequally rounded; cardinal angles nearly 90°, ventral corners rounded; posterior shoulder prominent, extending above dorsal margin; center of shell inflated, in some almost nodular; inner carina low, thin, and very inconspicuous, and subparallel to margin; surface coarsely reticulate; pit oval and slightly back of center.

Length (holotype), 0.75 mm; height, 0.46 mm; width, 0.44 mm.

Ferdinand formation, locality 2. (Holotype from Marble Falls formation, San Saba County, Texas; Mrs. Helen J. Plummer, locality 2103E).

ECTODEMITES SULLIVANENSIS (Payne)

Plate 16, figures 9, 10

Amphissites sullivanensis Payne, 1937, Jour. Paleontology, vol. 11, p. 281, pl. 33, figs. 3a-c, 4; Hayden Branch formation, Indiana.

Carapace elongate, dorsal and ventral margins straight, ends rounded; greatest height anterior; carinae absent except for a faint development along ventral margin; central node and posterior swelling little developed; pit ovate, sub-central, axis inclined anteriorly; surface reticulations small.

Length, 0.85 mm; height, 0.45 mm; width, 0.38 mm.

This species is characterized by its greater proportional length and by the small size of the reticulations. The figured specimen is compressed vertically and appears more elongate than the holotype.

Millersville zone, locality 90.

Genus KELLETTINA Swartz (1936)

KELLETTINA MONTOSA (Knight)

Plate 16, figures 23-26

Ulrichia montosa Knight, 1928, Jour. Paleontology, vol. 2, p. 252, pl. 32, figs. 1a, b; pl. 33, fig. 1; Labette formation, Missouri. —Warthin, 1939, Oklahoma Geol. Survey Bull. 53, p. 62, pl. 4, fig. 13; Wewoka formation, Oklahoma. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 53, pl. 3, figs. 9, 11a-c; Deese group, Oklahoma. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 34, pl. 3, figs. 1-3; Stanton and Iola formations, Nebraska.

Carapace elongate, semiovate in lateral view; dorsal margin long, straight to slightly convex; ventral margin convex; posterior margin flat in upper portion, curving around ventral portion to meet the ventral margin; anterovelar curve broader, involving the entire anterior margin, meeting dorsal margin at an acute angle; nodes large, reticulate, circular to ovate, anterior nodes usually projecting above hinge line; flange prominent, thick, wide; surface coarsely reticulate; pit fairly large, ovate, and on anterovelar margin of posterior node.

Length, 1.08 mm; height, 0.54 mm; width, 0.53 mm.

Seahorne to Macoupin zones, localities 12, 26, 29, 30, 53, 54, 62, 85.

KELLETTINA ROBUSTA? (Kellett)

Plate 16, figures 11-14

Ulrichia robusta Kellett, 1933, Jour. Paleontology, vol. 7, p. 92, pl. 15, figs. 33-40, 42; Wreford formation, Kansas. —Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 45, pl. 4, fig. 1a; Wreford and Fourmile limestone, Nebraska. —Swartz, 1936, Jour. Paleontology, vol. 10, p. 585, pl. 87, fig. 9.

KELLETTINA VIDRIENSIS Hamilton, 1942, Jour. Paleontology, vol. 16, p. 714, pl. 110, fig. 9; Word limestone, Texas.

Carapace large, elongate, semiovate; dorsal margin straight; ventral margin strongly convex; curvature of end margins subequal; cardinal angles acute, anterior angle slightly more so; nodes large, elongate, especially the anterior which projects well above the hinge; surface coarsely reticulate; flange fairly wide, smooth, and stands abruptly up from shell surface.
Length, 1.05 mm; height, 0.59 mm; width, 0.46 mm.

The small variation in the character of the frill described by Hamilton is not considered to be a specific distinction.

Gimlet to Little Vermilion zones, localities 61, 62, 88, 98, 102.

Genus Kirkbya Jones, 1859

The recognition of species of Pennsylvanian Kirkbya is difficult for several reasons. The shells are comparatively thin and, as a result, a large number of specimens are broken, crushed, or otherwise distorted. Only exceptional shale samples contain a sufficiently large number of specimens for comparison of the various moult stages, consequently a number of species have been described on immature forms. Different species vary inconsistently through the instars, so that unless a complete series is present in a sample it is often impossible to recognize immature forms specifically. For example, in Kirkbya valida Kellett the surface features become less and less conspicuous from adult to immature specimens; the lateral outline becomes less rectangular and more semicircular and the shoulder less prominent, finally all but disappearing in the youngest stages. On the other hand, in K. kellet-tae Harlton the shoulder and convolutions in the center of the shell become more pronounced from old to young instars, whereas the lateral outline varies but little. It has been my observation that most adult shells are one millimeter or more in length, and any Pennsylvanian specimen less than 1 mm. long should be considered immature unless the study of a complete moult series proves it to be otherwise.

Kirkbya arcuata ? Roth
Plate 16, figures 31-34

Kirkbya arcuatum Roth, 1929, Wagner Free Inst. Sci., Publ. 1, p. 18, pl. 1, fig. 3a; Nellie Bly formation, Oklahoma.

Carapace semiovate, dorsal margin slightly convex, ventral margin flat in posterior, thick and curving upward to meet dorsal margin at unequal angles, resulting in a much broader curve on anteroventral margin; flange heavy, fairly wide, separated from, but not parallel to, the free margins; surface broadly inflated and coarsely reticulate; shoulder not conspicuous; pit small and ovate.

Length, 1.13 mm; height, 0.57 mm; width 0.48 mm.

The form figured by Roth is probably an immature moult as it is smaller than most adult specimens of Kirkbya.

Shoal Creek and LaSalle zones, localities 76, 77, 93.

Kirkbya bendensis Harlton
Plate 16, figures 27-30

Kirkbya bendensis Harlton, 1933, Jour. Paleontology vol. 7, p. 22, pl. 6, fig. 2; Johns Valley shale, Oklahoma. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 50, pl. 3, fig. 5; Dornick Hills group, Oklahoma.

Carapace small, semiovate; dorsal margin almost straight, bent slightly down toward posterior near shoulder; ventral margin slightly convex, bending upward to meet dorsal margin at high angles (90° or nearly so); flange wide, prominent, and parallel to free margins; shoulder moderately abrupt; pit small and nearly central; surface coarsely reticulate.

Length, 0.97 mm; height, 0.49 mm; width, 0.40 mm.

Fulda to Seville zones, localities 1, 3, 6.

Kirkbya firma Kellett
Plate 16, figures 36, 37

Kirkbya firma, Kellett, 1933, Jour. Paleontology, vol. 7, p. 87, pl. 14, figs. 9, 10; Stanton formation, Kansas. Kirkbya permiana, Roth, 1929 (not Jones) Wagner Free Inst. Sci., Publ. 1, p. 21, pl. 1, figs. 5a-c; Belle City formation, Oklahoma.

Kirkbya permiana varica Roth, 1929, idem, p. 25, pl. 1, figs. 6a-c; Francis formation, Oklahoma.
KIRKBYIIDAE

Carapace elongate; hinge line long and straight; ventral margin convex; ends rounded, anterior cardinal angle 90°, posterior angle acute; flange low, smooth, subparallel to free margin; surface uniformly covered by reticulations of medium size; pit small, subcircular, and central.

Length, 0.97 mm; height, 0.51 mm; width, 0.42 mm.

Jamestown to Woodbury zones, localities 52, 53, 76, 77, 83, 102, 113, 114, 115.

KIRKBYA INORNATA Roth

Plate 16, figures 18-20


*Kirkbya* sp. Bradfield, 1935, idem, p. 53, pl. 3, fig. 7; Dornick Hills group, Oklahoma; probably a young specimen.

Carapace elongate; dorsal margin nearly straight, except over shoulder; ventral margin convex, curving uniformly upward at ends to meet dorsal margin at almost equal angles, posterior angle slightly more acute; flange thin, regular, and parallel to free margins; shoulder only moderately developed, curvature of shell uniform; pit slightly anterior to center; surface marked by reticulations of medium size.

Length, 1.08 mm; height, 0.50 mm; width, 0.46 mm.

Seville and Seahorne zones, localities 4, 12.

KIRKBYA KELLETAEAE Harlton

Plate 16, figures 38-42

*Kirkbya kelletaeae* Harlton, 1929, Texas Univ. Bull. 2901, p. 152, pl. 2, figs. 2a-e; Canyon series, Texas.

*Kirkbya canyonensis* Harlton, 1929, idem, p. 153, pl. 2, figs. 5a, b; Canyon series, Texas. —Kellett, 1933, Jour. Paleontology, vol. 7, p. 89, pl. 15, figs. 1-7; Stanton limestone, Kansas. —Scott and Borger, 1941, Jour. Paleontology, vol. 15, p. 356, pl. 49, fig. 21; Macoupin formation, Illinois.

*Kirkbya knighti* Harlton, 1929, Texas Univ. Bull. 2901, p. 153, pl. 2, figs. 4a, b; Canyon series, Texas. —Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 27, pl. 3, figs. 9-11, Stanton formation, Nebraska.

Carapace subrectangular; hinge line straight; ventral margin slightly convex, almost straight and subparallel to dorsal margin; ends subequally and slightly rounded, cardinal angles obtuse; surface reticulate, with shell curvature interrupted by wavy or knobby undulations; flange wide, smooth and prominent; pit small and nearly central; posterior shoulder prominent.

Length, 0.93 mm; height, 0.46 mm; width, 0.43 mm.

This species, formerly reported only from the Missouri series is now known to extend down in the Pennsylvanian section to the Seahorne and Fulda zone of the Illinois basin and the Barnett Hill and Marble Falls formations of the Midcontinent. *K. canyonensis*, *K. knighti*, and *K. kelletaeae* appear to be moult stages of a single species, since they were described by Harlton (1929, pp. 151-152) from one horizon and locality.

Fulda to Bogota zones, localities 1, 2, 3, 44, 83, 84, 97.

KIRKBYA MAGNA Roth

Plate 16, figure 35

*Kirkbya magnum* Roth, 1929, Wagner Free Inst. Sci., Publ. 1, p. 16, pl. 1, figs. 2a, b; Wapanucka limestone, Oklahoma.

Carapace large, hinge line long and nearly straight; ventral margin very convex, rounding broadly toward ends, anterior and posterior curvature almost equal, terminating in flaring, wing-like cardinal angles; shell surface strongly inflated in midportion, decreasing rapidly to form a broad distinctly concave area bordering the very wide prominent flange; pit large, subcentral; surface reticulations moderate in size.

Length, 1.28 mm; height, 0.62 mm.

Ferdinand to Brereton zones, localities 2, 4, 38.
Kirkbya pergrandis Kellett

Plate 17, figure 10

*K. pergrandis* Kellett, 1933, Jour. Paleontology, vol. 7, p. 85, pl. 14, fig. 31; Stanton and Deer Creek formations, Kansas.

Carapace very large, elongate; ventral margin straight to broadly convex, curving widely at ends to meet dorsal margin at subequal angles, posterior more acute; flange wide, smooth, and extends far beyond free margins; shoulder very prominent; surface smooth? to finely reticulate.

Length, 2.05 mm; height, ca. 0.75 mm. Lonsdale zone, locality 63.

Kirkbya punctata Kellett

Plate 17, figures 5-8

*K. punctata* Kellett, 1933, Jour. Paleontology, vol. 7, p. 87, pl. 14, figs. 46-49; Stanton formation, Kansas. —Scott and Borger, 1941, idem, vol. 15, p. 356, pl. 49, fig. 6; Macoupin formation, Illinois.

*K. clarocarinata*, Johnson, 1936 (not Knight), Nebraska Geol. Survey Paper 11, p. 24, pl. 3, figs. 22-24; Iola to Stanton formation, Nebraska.

*K. clarocarinata* (part), Harlton, 1929, Texas Univ. Bull. 2901, p. 152, pl. 2, figs. 3c, d, g, h (not 3a, b, e, f): Upper Canyon series, Texas. —Kellett, 1933, Jour. Paleontology, vol. 7, p. 86, pl. 14, figs. 50, 52, 53 (not 51); Stanton limestone, Kansas.

Carapace of medium size, semiovate in lateral outline; hinge line straight and somewhat incised; dorsal margin arched over shoulder; ventral margin nearly straight in central portion, curving broadly upward to meet dorsal margin at obtuse nearly equal angles; flange low, marginal; shoulder fairly prominent; pit of moderate size, ovate, and well anterior to midpoint; surface reticulations fairly coarse.

Length, 1.16 mm; height, 0.57 mm; width, 0.56 mm.

There is considerable difference of opinion concerning the discrimination of *K. clarocarinata* Knight and *K. punctata* Kellett, there being no uniform specific criteria given in the descriptions of these species. Johnson (1936, p. 26) did not consider the size and shape of the pit of importance while Kellett (1936, p. 780) believed this feature to be constant for all moults of a species, and therefore important in specific determinations. However considering other features, such as lateral outline, position of flange, development of shoulder, and cardinal angles, it appears that these species are distinct.

*K. clarocarinata* from the Labetta shale has more acute cardinal angles, little development of the shoulder, a flange much higher on the shell. Little or no variation in curvature at the posteroventral angles gives the lateral outline a semicircular appearance.

Macoupin to Woodbury zones, localities 84, 89, 93, 115.

Kirkbya reflexa Girty

Plate 17, figures 1-4


Carapace large, inflated; dorsal margin straight, ventral margin convex; ends nearly equal; usual shoulder absent; surface coarsely reticulate, frill broad, fluted; strongly reflexed, forming a trough parallel to the contact margins; pit oval, and central, just below point of highest inflation.

Length, 1.0 mm; height, 0.54 mm.

Fulda zone, locality 1.

Genus Kirkbyella Coryell and Booth, 1933

*Kirkbyella* cf. *K. gutkei* Croneis and Bristol

Plate 17, figure 9

Carapace small; lateral outline ovate, dorsal margin straight; ventral margin slightly convex, ends rounded ventrally, straightening upward to form cardinal angles slightly in excess of 90°; sulcus central, vertical, wide, and fairly deep; ventral ridge wide, low, and inconspicuous; terminated abruptly posteriorly.

Length, 0.56 mm; height, 0.31 mm.

The single valve figured has been flattened and broken, the distortion resulting in a greater relative height than in the Chester forms, otherwise they are similar.

Fulda zone, locality 1.

Genus Knightina Kellett, 1933

Knightina allermisoides (Knight)
Plate 17, figure 12

*Amphissites allermisoides* Knight, 1928, Jour. Paleontology, vol. 2, p. 265, pl. 32, figs. 1a-c; pl. 34, fig. 4; Labette formation, Missouri.

Carapace elongate, outline subquadrate, dorsal margin straight, ventral margin convex; inner carina prominent and close to outer one; posterior shoulder moderate; pit large, ovate, subcentral, though somewhat indistinct because of the extremely coarse reticulation.

Length, 0.75 mm; height, 0.37 mm.

*K. allermisoides* is distinguished by its coarse reticulation, large form ratio (2.0), and by the prominent, closely spaced carinae.

Liverpool zone, locality 20.

Knightina ampla Kellett
Plate 17, figure 11

*Knightina ampla* Kellett, 1933, Jour. Paleontology, vol. 7, p. 100, pl. 16, figs. 43-46; Deer Creek formation, Kansas.

*Kirkbya perplexa* Roth, 1929, Wagner Free Inst. Sci. Publ. 1, p. 29, pl. 1, figs. 8a-c; Belle City formation, Oklahoma.


*Knightina harltoni*, Payne, 1937 (not Kellett, 1933), Jour. Paleontology, vol. 11, p. 281, pl. 38, figs. 7a, b; Hayden Branch formation, Indiana.

Carapace elongate, subquadrate, dorsal and ventral margins subparallel, ends almost equally rounded, posterior end slightly more acute; inner carina marginal and very close to outer one which is somewhat indistinct; posterior shoulder prominent; pit subcentral, circular; reticulation coarse, irregular, ovate to polygonal.

Length, 0.77 mm; height, 0.38 mm.

The subparallel dorsal and ventral margins, the subequal rounded ends, coarse reticulation and almost circular, subcentral pit mark this Upper Pennsylvanian species and serve to distinguish it from those in younger and older formations.

Little Vermilion zone, locality 103.

Knightina harltoni Kellett
Plate 17, figures 14-16


Not *Knightina harltoni*, Payne, 1937, Jour. Paleontology, vol. 11, p. 281, pl. 38, figs. 7a, b.

Carapace short, subquadrate, ends rounded, dorsal and ventral margins almost straight, subparallel; shoulder prominent but rising little above dorsal margin; inner carina marginal, separated from outer by two rows of reticulations; pit oval, subcentral; reticulation coarse and fairly uniform in size and shape.

Length, 0.72 mm; height, 0.41 mm; width, 0.36 mm.

The relatively low form ratio (1.7 to 1.8), coarse, uniform reticulation, large pit surrounded by 8 reticulations serve to differentiate this species.

Millersville zone, locality 90.
Knightina hex tensis (Harlton)

Plate 17, figures 17, 18

Amphissites hex tensis Harlton, 1929, Texas Univ. Bull. 2901, p. 152, pl. 2, figs. 6a-d; Canyon group, Texas.

Carapace small, very elongate, tumid, dorsal and ventral margins straight, subparallel, greatest height anterior; ends rounded; inner carina submarginal, separated from outer by two rows of reticulations, diverging slightly anteriorly due to an enlargement of reticulations; pit subcentral, surrounded by 8 reticuli.

Length, 0.64 mm; height, 0.31 mm; width, 0.28 mm.

K. hex tensis is characterized by its large form ratio (2.0 to 2.08), its greatest height anterior, and by the divergent carinae.

Gimlet zone, locality 57.

Knightina kelle tae Bradfield

Plate 17, figure 13


Carapace large, elongate; dorsal margin straight except where interrupted by prominent posterior shoulder, ventral margin slightly convex, almost straight; anterior end straight at cardinal angle of slightly more than 90°, posterior end rounded and extended; carinae distinct, closely spaced; pit subcentral, small, ovate, axis almost horizontal; reticulations large irregularly polygonal.

Length, 0.83 mm; height, 0.46 mm.

Liverpool zone, locality 22.

Genus Polyty lites Cooper, 1941

Polyty lites wapanuckensis (Harlton)

Plate 16, figures 21-22

Amphissites wapanuckensis Harlton, 1929, Am. Jour. Sci., ser. 5, vol. 8, p. 257, pl. 1, figs. 4a, b; Wapanucka limestone, Oklahoma. —Harlton, 1933, Jour. Paleontology, vol. 7, p. 23, pl. 6, fig. 8; Johns Valley shale, Oklahoma.

Carapace small; lateral outline ovate; dorsal margin straight; ventral margin convex; ends subequally rounded and of unequal height; contact margins bordered by a thin, low carina, the centroventral region bordered by a high, prominent inner carina half as long as the shell or more; central node circular, of moderate diameter and high; anterior node of slightly lesser diameter, very long, projects well above dorsal margin; pit ovate, immediately below central node; surface reticulate.

Length, 0.90 mm; height, 0.54 mm.

Fulda limestone, locality 1.

Genus Roundyella Bradfield, 1935

Roundyella Bradfield, 1935, p. 66.


The genotypes of Roundyella and Scaberina are single valves; in one (Roundyella) the shell appears to have been scoured smooth and all spines removed leaving only the reticulation showing. In Scaberina the surface reticulation is matrix filled, leaving only the spines protruding. A comparison of the hinge and shape of the valves shows their similarity, in fact the genotypes Scaberina nodomarginata Bradfield and R. simplicissima (Knight) are believed to be conspecific. R. bellatula probably does not belong to this genus because of the extreme roundness of the cardinal angles and the distinct pit as contrasted to the flat area marking the muscle spot on the characteristic forms of Roundyella.

Roundyella simplicissima (Knight)

Plate 17, figures 29-36

Amphissites simplicissimus Knight, 1928, Jour. Paleontology, vol. 2, p. 266, pl. 32, figs. 11a-d; pl. 34, fig. 6; Labette shale, Missouri. —Harlton, 1929, Texas Univ. Bull. 2901, p. 151, pl. 1, figs. 13a-c; Canyon group, Texas. —Delo, 1930, Jour. Paleontology, vol. 4, p. 158, pl. 12, figs. 8a, b; Pennsylvanian, Texas. —Warthin, 1930, Oklahoma Geol. Survey Bull. 55, p. 67, pl. 5, figs. 1a, b; Wetumka to Holdenville formations, Oklahoma. —Coryell and Billings, 1932, Am. Midland Natural-
ist, vol. 13, p. 184, pl. 18, fig. 10, Wayland shale, Texas. —Kellett, 1933, Jour. Paleontology, vol. 7, p. 97, pl. 15, fig. 8; Elmdale formation, Kansas. —Upson, 1933, Nebraska Geol. Survey Bull. 8, p. 41, pl. 3, figs. 6a; Garrison shale, Nebraska.

Not Amphissites simplicissimus Coryell and Malkin, Am. Mus. Noviates, no. 891, p. 4, fig. 11.


Carapace small, elongate, flat; lateral outline elliptical; dorsal and centroventral margins straight; ends of equal height, equally rounded; cardinal angles abrupt, ventral angles broadly rounded; hinge straight, slightly incised and terminated at each end by indistinct notch; muscle attachment marked by a comparatively smooth flat area slightly forward of center; surface reticulate, papillose or both.

Length(figs. 31, 32), 0.74 mm; height, 0.39 mm; width, 0.30 mm.

Wiley to Greenup zones, localities 4, 13, 16, 28, 38, 40, 45, 54, 60, 102, 109, 113.

Family Kloedenellidae Ulrich and Bassler, 1923

Genus Ellipsella Coryell and Rogatz, 1923

Lochriella Scott (1942, p. 155) appears to be very nearly equivalent to Ellipsella, and further study may show that the two genera are synonymous. Although the lateral outlines differ somewhat in shape, the type of overlap around the contact margins and the character of the hingement are similar, particularly in the development of a flap-like overlap at the posterior end of the hinge. Species in each genera have been described both with and without sulci.

**Ellipsella calcar (Harlton)**

Plate 17, figures 24-28

_Cytherella calcar_ Harlton, 1928, Jour. Paleontology, vol. 2, p. 141, pl. 21, figs. 16a, b; Graham formation, Texas. —Harlton, 1929, Texas Univ. Bull. 2901, p. 161, pl. 4, fig. 9; Canyon series, Texas.

_Jonesina acuneata_ Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 61, pl. 4, figs. 9a, b; Wetumka formation, Oklahoma. —Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 254, pl. 24, fig. 10; East Mountain shale, Texas.

_Jonesina ampla_ Warthin, 1930, idem, p. 61, pl. 4, figs. 8a, b; Holdenville formation, Oklahoma. —Coryell and Sample, 1932, idem, p. 255, pl. 24, fig. 14, East Mountain shale, Texas.


_Jonesina mccoyi_ Roth, 1930, Jour. Paleontology, vol. 4, p. 348, pl. 2, figs. 10a, b; McCoy formation, Colorado.

_Ellipsella ampla_, Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 23, pl. 2, figs. 8-10; Chanute shale, Nebraska.

_Ellipsella? distenta_ Kellett, 1933, Jour. Paleontology, vol. 7, p. 82, pl. 13, figs. 18-20; Stanton to Winfield formations, Kansas.


Carapace small, tumid; lateral outline subelliptical; dorsal and ventral margins nearly straight; ends subequally rounded, of nearly equal height; overlap inconspicuous around ends, fairly wide along ventral margin; line of concrescence incurred along venter and posterior margins; hinge line relatively short, straight, incised in gradually widening furrow on posterior end, and terminated anteriorly by a pronounced overlap of right valve over left; sulcus fairly wide, shallow, and centrally constricted; greatest height and width posterior; surface smooth to faintly punctate.

Female: length, 0.84 mm; height, 0.46 mm; width, 0.42 mm.

Male: length, 0.80 mm; height, 0.46 mm; width, 0.32 mm.

Gimlet to Newton zones, localities 1, 62, 63, 65, 66, 86, 100, 107, 108.
Ellipsella bradfieldi Cooper, n. sp.

Plate 17, figures 19, 20

Jonesina craterigera, Ulrich and Bassler, 1908, (not Brady), U. S. Nat. Mus. Proc., vol. 35, p. 324, pl. 44, figs. 13, 14; Lower Glenn, Oklahoma. —Harlton, 1927, Jour. Paleontology, vol. 1, p. 205, pl. 32, figs. 5a, b; Lower Glenn, Oklahoma.

Carapace elongate, semiovate in lateral outline; hinge line long, straight; ends rounded; ventral margin convex; overlap wide along venter, moderate around ends; sulcus wide, shallow, and indistinct.

Length, 0.72 mm; height, 0.36 mm; width, 0.33 mm.

The original Beyrichia craterigera Brady from the Carboniferous (lower Chester) of Great Britian is larger and has somewhat different outlines in lateral and dorsal views than the elongate Pennsylvanian forms. The anterodorsal overlap is characteristic of Ellipsella.

Liverpool and Brereton zones, localities 20, 47.

Genus Geisina Johnson, 1936

Geisina gallowayi (Bradfield)

Plate 17, figures 21-23

Jonesina gallowayi Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 39, pl. 2, figs. 8a, b; Deese group, Oklahoma.

Carapace subrectangular, ends rounded, ventral margin curved at ends, and straight in center due to thickening of the edge of right valve; sulcus deep, U-shaped in cross-section, slightly constricted in central part, flaring at top; channel along posterodorsal area wide, very shallow; overlap prominent and uniform, except along thickened portion of ventral edge of right valve; surface smooth.

Length, 0.95 mm; height, 0.57 mm; width, 0.48 mm.

Brereton zone, locality 48.

Geisina gregaria (Ulrich and Bassler)

Plate 18, figures 1, 2


Carapace elongate, hinge line straight, ends rounded, ventral margin convex; sulcus deep, anterior to center, inclined toward anterior end, upper part flaring to form low area around anterodorsal angle, outlining the node in the centroanterior area; spine in posterodorsal angle short and directed upward and slightly outward; surface smooth.

Length, 0.85 mm; height, 0.51 mm.

This species is distinguished from G. arcuata (Bean) by the presence of the spine in the posterodorsal angle. The reticulate surface appears to be preserved only on the more perfect specimens.

Brereton and Jamestown zones, localities 48, 52.

Geisina jolliffina Cooper, n. sp.

Plate 18, figures 3, 4

Jonesina arcuata, Harlton, 1927, Jour. Paleontology, vol. 1, p. 205, pl. 32, figs. 6a-c; Lower Glenn (Jolliff limestone) formation, Oklahoma. —Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 38, pl. 2, fig. 6 (‡ fig. 7); Jolliff limestone, Dornick Hills group, Oklahoma.

Carapace short, convex, hinge line straight, but topped by swollen valve in posterior half, giving the dorsal outline a sinuous appearance; anterior end rounded; posterior end straight near dorsal angle of almost 90°, and curving from the midportion to meet the regul-
larly convex ventral margin; ventral and anterior margins bordered by a prominent but narrow flange; sulcus deeply incised, slightly anterior to midportion, somewhat flaring at lower end; surface uniformly covered by polygonal reticulations.

Length, 0.87 mm; height, 0.51 mm.

There is considerable variation in the form ratio of this species (1.50-1.70), within which Bradfield’s specimen falls. Bradfield’s drawing does not show the marginal flange, which is much less prominent than on the Illinois specimens.

Jamestown zone, locality 52.

**Geisina warthini** Cooper, n. sp.

Plate 18, figure 5

*Jonesina gregaria*, Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 60, pl. 4, fig. 11; Wewoka formation, Oklahoma.

Carapace very short, semicircular, convex; hinge line straight, channelled in posterior half; ventral margin convex; posterior end slightly less convex than anterior; sulcus just anterior to center, deep, flaring at upper anterior to form a low shelf bordering hinge; short spine high in posterodorsal angle; surface smooth to finely granulose.

Length, 0.66 mm; height, 0.46 mm.

Warthin’s specimen is probably a male as his drawing shows no protrusion of the posterodorsal swelling above the hinge.

Hanover to Jamestown zones, localities 28, 52.

**Genus Hastifaba** Cooper, n. gen.

Large, tumid kloedenellids with deep prominent sulcus forward of midlength, and greatly inflated posterior which may be extended dorsally into a short rounded spine protruding well above the hinge line; hingement sansabelloid; contact margin of left valve simple, sharp edged, fitting into rabbeted margin of right valve; often a short, round spine is developed on the margin of each valve near anterior extremity; overlap prominent, especially along ventral margin.

Genotype: *Hastifaba spinosa* Cooper, n. sp.

*Hastifaba* is distinguished from other Kloedenellidae by the prominence of the inflated and often spine-tipped posterodorsal portion of the carapace.

**Hastifaba spinosa** Cooper, n. sp.

Plate 18, figures 27-32

Carapace large, tumid; lateral outline semiovate; dorsal margin straight anteriorly, arched posteriorly due to projection of inflated valve above hinge line; ventral margin straight, turning upward in broad curve anteriorly, posterior curve more abrupt; overlap moderate around ends increasing along ventral, reaching maximum at posteroventral angle; sulcus wide, deep, flaring at top to join low area just below hinge which outlines faint node anterior to sulcus; posterior end greatly inflated, becoming constricted dorsally into a short round spine that projects well above the hinge line; a small spine projects forward from the anterior margin just below its termination; surface smooth.

Length, 1.08 mm; height, 0.66 mm; width, 0.55 mm.

Cohn zone, locality 96.

**Hastifaba pervulgata** Cooper, n. sp.

Plate 18, figures 33-37

Carapace convex, dorsal margin sinuous, ends rounded; ventral margin regularly convex, except for slightly flattened portion near center which results from thickened border of right valve, increasing the apparent overlap at that point; overlap uniform around remainder of free margins; sulcus slightly anterior to center, quite deep in lower half, becoming shallower upward; hinge line straight, bordered posteriorly by the sharp curved edges of the posterior inflations; surface smooth.
Length, 0.97 mm; height, 0.64 mm; width, 0.43 mm.
Similar to *H. robusta*, but lacks the thickened ventral edge of the left valve.
Jamestown zone, locality 52.

**Hastifaba robusta** Cooper, n. sp.
Plate 18, figures 22-26

Carapace large, tumid; dorsal margin sinuous; ventral margin irregular due to development of a shelf or lip-like thickened rim of valve near midportion, producing a V-shaped channel in ventral view; ends rounded; sulcus U-shaped in cross-section, slightly forward of center, deeply incised, inclined toward anterior; posterior portion of shell greatly inflated, rising above straight hinge line, forming the sinuous dorsal margin in lateral view; upper edge of inflated portion produced into a narrow ridge, most sharply defined along midportion of the hinge; line of articulation around free margins bordered by narrow rim, very short, slender spine on each valve just below midpoint of anterior portion of this rim; surface smooth.
Length, 1.05 mm; height, 0.64 mm; width, 0.53 mm.
Summum zone, locality 28.

Genus *Jonesina* Ulrich and Bassler, 1908

**Jonesina biformis** Bradfield
Plate 18, figures 20, 21

*Jonesina biformis* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 40, pl. 2, figs. 9a, b; 11a, b; Deese group, Oklahoma.

Carapace semiovate in lateral outline; hinge line short, straight; ventral margin slightly convex; ends rounded, the anterior more convex and higher than posterior; sulcus wide, shallow; overlap wide and uniform around anterior and ventral margins, narrower around posterior margin.
Length, 0.77 mm; height, 0.48 mm; width, 0.30 mm.
Seville zone, locality 6.

**Jonesina bradyana** (Jones)
Plate 18, figures 12, 13

*Beyrichia bradyana* Jones, 1886, Geol. Mag., n. ser., dec. 3, vol. 3, p. 438, pl. 12, figs. 11a, b; Carboniferous limestone, Great Britain.—Ulrich and Bassler, 1908, U. S. Nat. Mus. Proc., vol. 55, pl. 44, figs. 15, 16; Upper Glenn group, Oklahoma.—Harlton, 1927, Jour. Paleontology, vol. 1, p. 205, figs. 7a, b; Upper Glenn, Oklahoma.


Carapace ovate in lateral outline; hinge line straight; ends rounded, the anterior being narrower; ventral margin concave; sulcus posterior to middle, fairly wide, shallow, extends down from dorsum one-half shell height; overlap moderate, uniform around free margins; short spine in anterior cardinal angle, very close to hinge line, but some distance in from anterior margin.
Length, 0.67 mm; height, 0.41 mm; width, 0.34 mm.
Exline zone, locality 65.

**Jonesina deesensis** Bradfield
Plate 18, figures 16, 17


Carapace ovate in outline; hinge line straight; ends subequally rounded; ventral margin almost straight, subparallel to hinge; sulcus narrow, shallow, and nearly central; overlap very narrow, uniform.
Length, 0.68 mm; height, 0.38 mm; width, 0.36 mm.
Gimlet zone, locality 62.

**Jonesina dubia** Bradfield
Plate 18, figures 10, 11

*Jonesina dubia* Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 43, pl. 3, figs. 1a, b; Deese group, Oklahoma.

Carapace very short, somewhat tumid; semiovate in lateral outline; hinge line short, straight; ventral margin convex; ends almost equally rounded; sulcus
fairly narrow, deep, and elongate, extending somewhat below midheight; overlap narrow, uniform around free margins.

Length, 0.47 mm; height, 0.32 mm; width, 0.25 mm.

Though slightly smaller than the holotype, the Illinois specimens agree in other respects. The straight posterior margin of Bradfield’s figure is a result of crushing.

Brereton zone, locality 37.

**Jonesina elongata** Cooper, n. sp.

Plate 18, figures 18, 19

Carapace elongate, semiquadrilateral in outline, hinge line straight except posterior quarter which is somewhat downcurved; ventral margin straight, subparallel to hinge line; ends rounded, anterior more convex than posterior; sulcus slightly posterior, elongate, narrow and fairly deep; overlap narrow.

Length, 0.57 mm; height, 0.27 mm; width 0.25 mm.

Bogota zone, locality 103.

**Jonesina infrequens** (Bradfield)

Plate 18, figures 6, 7

**Nuferella infrequens** Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 46, pl. 3, figs. 4a, b; Hoxbar group, Oklahoma.

Carapace semiovate in lateral outline; hinge line long, straight, without overlap or incision; ventral margin strongly convex; ends rounded, posterior end higher; sulcus elongate, narrow, and deep; spine small, short, high in anterodorsal angle; overlap moderate, and fairly uniform.

Length, 0.42 mm; height, 0.28 mm; width, 0.21 mm.

The quite low anterior end of the holotype, giving an accentuated “backward swing” is due to crushing. The hollinellid node of the original description is in no way different from the usual dorsolateral sculpture of *Jonesina*. The articulation of the hinge is also typical of the latter.

“Centralia” zone, locality 80.

**Jonesina subquadrata**? Delo

Plate 18, figures 14, 15

**Jonesina subquadrata** Delo, 1930, Jour. Paleontology, vol. 4, p. 161, pl. 12, figs. 11a, b; Pennsylvanian, Texas.


Carapace ovate in lateral outline; hinge line straight, fairly short; ends subequally rounded, posterior end somewhat flattened; ventral margin straight, parallel to hinge; overlap very narrow around free margins; sulcus shallow, indistinct.

Length, 0.73 mm; height, 0.40 mm; width, 0.37 mm.

Gimlet to Little Vermilion zones, localities 59, 62, 65, 88, 100, 103.

**Jonesina trisulcata**? Bradfield

Plate 18, figures 8, 9

**Jonesina trisulcata** Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 43, pl. 2, figs. 15; 16a, b; 17a, b; Deese group, Oklahoma.

Carapace small, subrectangular in lateral outline; hinge line convex; ends rounded, posterior less convex than anterior; ventral margin slightly concave; sulcus central, fairly deep, somewhat narrow; overlap faint.

Length, 0.55 mm; height, 0.28 mm; width, 0.24 mm.

The two sulci of Bradfield’s species are very faint or lacking on the Illinois specimens. However, the dorsal area near the hinge line is somewhat less inflated than normal, especially in the anterodorsal angle. Examination of the holotype shows these features to be over emphasized in Bradfield’s figure 15.

Exline zone, locality 65.
Genus Kloedenella Ulrich and Bassler, 1908

Kloedenella carbonica Cooper, n. sp.
Plate 19, figures 20-22

Carapace large, flat, and very thin; lateral outline subelliptical; dorsal margin straight, ventral margin convex, ends rounded and unequal in height; cardinal angles obtuse; overlap faint around ends, increasing slightly around ventral margin; contact margins bordered by a very thin, narrow margin raised slightly above shell surface; hinge straight, sansabelloid, slightly incised posteriorly; two sulci, one central the other anterior, are narrow, shallow, and vertical, central one shorter; surface finely punctate.

Length, 1.28 mm; height, 0.78 mm; width, 0.50 mm.

This is the only known Pennsylvanian species of Kloedenella and is distinguished by its very thin shell, faint sulci and very finely punctate surface.

Cohn zone, locality 96.

Genus Lochriella Scott, 1942

Lochriella ampla Cooper, n. sp.
Plate 19, figures 12, 13

Carapace large, somewhat tumid; lateral outline subelliptical; dorsal and centroventral margins straight, the latter turning upward in a broad curve to meet rounded end margins; ends of subequal height, posterior slightly higher; overlap uniformly wide around contact margins; hinge long, straight, incised posteriorly, and terminated at each end by a triangular notch overlapping from right valve; sulcus well forward of midlength; elongate, deep, inclined anteriorly, and flaring at top to join a fairly wide depressed area bordering the hinge; surface very finely punctate.

Length, 1.26 mm; height, 0.64 mm; width, 0.50 mm.

L. ampla can be recognized by the subparallel dorsal and ventral margins, and the very prominent, inclined sulcus.

Bogota zone, locality 106.

Lochriella? angusta Cooper, n. sp.
Plate 19, figures 18, 19

Carapace elongate, thin; lateral outline subelliptical; dorsal margin straight, ventral margin broadly convex; ends subequally rounded, the posterior slightly narrower; forward "swing" moderate; sulcus well forward of midlength; deep, of uniform width, inclined toward anterior; overlap narrow and uniform around contact margins; hinge line straight and incised only on posterior end.

Length, 0.80 mm; height, 0.45 mm; width, 0.32 mm.

L. angusta is recognized by its elongate form (ratio 1.78) and the straight, inclined sulcus.

Exline zone, locality 65.

Lochriella elongata Cooper, n. sp.
Plate 19, figures 23, 24

Carapace fairly large, elongate; lateral outline subelliptical; dorsal and centroventral margins straight; ends unequally rounded but of equal height; posteroventral angle markedly truncate, resulting in a posterior termination well above midheight; hinge long, straight, and moderately incised posteriorly; overlap of moderate width, uniform around contact margins; sulcus wide, deep, vertical, widening slightly ventrally, and joining depressed area near hinge without much flaring; surface very finely punctate.

Length, 1.04 mm; height, 0.54 mm; width, 0.29 mm.

L. elongata is easily recognized by its elongate form (ratio 1.92) and truncate posteroventral margin.

Cohn and Bogota zones, localities 95, 106.

Genus Sansabella Roundy, 1926

Sansabella amplectans Roundy
Plate 19, figures 10, 11

Sansabella amplectans Roundy, 1926, U. S. Geol. Survey Prof. Paper 146, p. 6, pl. 1, figs. 3a-5; Marble Falls formation, Texas.
Carapace semiovate in lateral view; fairly tumid; dorsal margin straight, ventral margin convex; ends unequally rounded, with distinct retral "swing"; hinge line straight, incised, and notched at each end; overlap prominent around free margins, especially along the posterior two-thirds of venter; greatest height and width posterior; small portion of a frill showing on posteroventral angle, emerging at line of articulation; sulcus wide and shallow; pit short, well back from margins; surface smooth.

Length, 0.74 mm; height, 0.46 mm; width, 0.36 mm.

Liverpool zone, locality 16.

**Sansabella bolliaformis** (Ulrich and Bassler)

Plate 19, figures 14-17

*Beyrichiella bolliaformis* Ulrich and Bassler, 1906, U. S. Nat. Mus. Proc., vol. 30, p. 158, pl. 11, fig. 7, 8; Cottonwood formation, Kansas.

*Beyrichiella bolliaformis tumida* Ulrich and Bassler, 1906, idem, p. 158, pl. 11, figs. 9-11; Cottonwood formation, Kansas.

*Jonesina bolliaformis*, Ulrich and Bassler, 1908, idem, pl. 35, figs. 3-5. —Kellett, 1933, Jour. Paleontology, vol. 7, p. 78, pl. 14, figs. 1-8, 17-19, 32-38; Cottonwood formation, Kansas.


*Jonesina subquadrata*. Delo, 1933, Nebraska Geol. Survey Bull. 8, p. 47, pl. 3, fig. 5a; Cottonwood limestone, Nebraska.

*Coryella stovalli* Harris and Lalicker, 1933, Nebraska Geol. Survey Bull. 8, p. 50, pl. 3, figs. 2a-c; Wreford limestone, Nebraska.

Carapace small, somewhat flat; dorsal margin slightly convex, nearly flat; ventral margin strongly convex; ends rounded and of unequal height; hinge straight, channeled, typically sansabelloid; overlap moderate around ends, becoming wider along ventral margin; two nodes just below dorsal margin, on either side of a wide shallow sulcus, are joined ventrally by a low distinct ridge which is marked by a rather abrupt ventral margin; remnants of a very tenuous frill at line of juncture of valves present on some well-preserved specimens.

Length, 0.74 mm; height, 0.41 mm; width, 0.32 mm.

The species belongs to *Sansabella* because of the typically channeled (mentioned in the original description) hinge, which feature definitely excludes it from *Jonesina*. The *Bollia*-like surface sculpture serves to distinguish it from other species of *Sansabella*.

"Centralia" zone, locality 82.

**Sansabella brevis** Cooper, n. sp.

Plate 19, figures 25, 26

Carapace short, tumid; lateral outline subcircular to subovate; dorsal margin flatly convex; ventral margin convex, merging into uniformly rounded ends of equal height; hinge line short, incised; overlap very wide along ventral margin, decreasing rapidly and becoming very narrow at cardinal angles; sulcus broad, deep, and of uniform width.

Length, 0.62 mm; height, 0.50 mm; width, 0.41 mm.

This species is recognized by its short, high lateral outline (form ratio 1.12).

Little Vermilion zone, locality 103.

**Sansabella carbonaria** Cooper, n. sp.

Plate 19, figures 30-35

Carapace small, tumid; lateral outline semielliptical; dorsal margin straight; ventral margin strongly convex, merging smoothly into ends of about equal height but subequally curved, resulting in a distinct forward "swing"; overlap prominent, widest along centroventral margin, decreasing gradually to cardinal angles; hinge line straight, relatively short and incised; sulcus pit-like; deepest near lower end, becoming shallow upward, in some specimens almost disappearing and resembling a pit instead of a sulcus.

Length, 0.81 mm; height, 0.52 mm; width, 0.41 mm.
S. carbonaria has a less angulated lateral outline than S. whitei Bradfield and lacks the posterodorsal node of S. truncata—Cooper (1941, pl. 13, figs. 36-41). Trivoli to LaSalle zones, localities 70, 72, 81, 88.

**Sansabella exilis** Cooper, n. sp.

Plate 19, figures 27-29

Carapace small, tumid, elongate to slender, lateral outline semi-elliptical; dorsal margin nearly straight; ventral margin broadly convex; ends unequally rounded, posterior quite narrow or almost acuminate, terminating unusually high above midheight; overlap wide, prominent especially along centroventral margin; anteroventral angle sharp; surface smooth.

Length, 0.82 mm; height, 0.46 mm; width, 0.41 mm.

*S. exilis* is recognized by its elongate lateral outline (form ratio 1.75), the narrow posterior end and sharply curved anteroventral angle.

Liverpool zone, locality 16.

**Sansabella laevis** (Warthin)

Plate 19, figures 1-9


*Sansabella laevis*, Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 11, pl. 5, figs. 11-15; Chanute and Plattsburg formations, Nebraska.

Carapace small, tumid to thin; lateral outline ovate; dorsal margin slightly convex; ventral margin strongly convex; ends unequally rounded, resulting in a distinct forward "swing"; anterior termination below midheight, posterior above; hinge line straight and incised, with larger overlapping valve slightly higher than smaller; in females greatest length central, greatest thickness posterior; surface smooth.

Female (figs. 4-6): Length, 0.82 mm; height, 0.54 mm; width, 0.43 mm.

Male (figs. 1-3; 7-9): Length, 0.84 mm. height, 0.51 mm; width, 0.32 mm. Liverpool zone, localities 16, 20.

**Sansabella ovale** Cooper, n. sp.

Plate 20, figures 42, 43

Carapace small, flat; lateral outline ovate; dorsal margin slightly convex; ventral margin strongly convex, curving smoothly into subequally rounded end margins; posterior end narrow and terminated above midheight; forward "swing" prominent; overlap moderate near cardinal angles, increasing to very broad in centroventral margin, widest just below sulcus; sulcus deep, fairly wide hour-glass shaped; anterior end flat accentuating the anterior node.

Length, 0.78 mm; height, 0.51 mm; width, 0.35 mm.

*S. ovale* is recognized by the variable overlap, the hour-glass shaped sulcus and the prominence of the anterior node.

Trivoli to Little Vermilion zones, localities 72, 86, 103.

**Sansabella sulcata**? Roundy

Plate 20, figures 37-39

*Sansabella sulcata* Roundy, 1938, U. S. Geol. Survey Prof. Paper 146, p. 6, pl. 1, figs. 6a-7; Barnett shale, Texas.

Carapace fairly large, tumid; lateral outline semiovate; ends unequally rounded, posterior higher; dorsal and centroventral margins straight; hinge line long, straight, and incised; overlap wide, uniform around contact margins; sulcus deep, narrow in lower part, flaring rapidly above into a depressed area bordering the anterodorsal margin; posterior end greatly inflated; posteroven
tral margin nearly straight.

Length, 0.97 mm; height, 0.56 mm; width, 0.40 mm.

This species corresponds to *S. sulcata* in the shape of the lateral outline, the
character of overlap, and position of sulcus. However, the sulcus is more prominent and the posterior end is more tumid, which differences could readily be due to the greater inflation of female specimens.

Exline zone, locality 65.

**Sansabella whitei** Bradfield

*Plate 20, figures 35, 36*


Carapace small, tumid; lateral outline semiovate; ends unequally rounded, anterior being much narrower; dorsal margin nearly straight; ventral margin broadly convex; hinge line straight, incised, and terminated by a notch at each end; sulcus shallow, anterior; greatest height immediately below sulcus; greatest length dorsal due to the high position of posterior termination; overlap prominent around contact margins, with a small portion of frill showing in anterodorsal angle, greatest thickness posterior.

Length, 0.76 mm; height, 0.48 mm; width, 0.38 mm.

Summum to Macoupin zones, localities 26, 51, 62, 86.

Genus **Sargentina** Coryell and Johnson, 1939

*Sargentina* was classified under the Cytherellidae by Coryell and Johnson (1939, p. 223) and Cooper (1941, pp. 38, 39) but further study shows that it probably belongs in the Kloedenellidae because of its prominently sulcate form which allies it closely with *Sansabella, Lochriella, and Jonesina*.

**Sargentina elongata** Cooper, n. sp.

*Plate 20, figures 40, 41*

Carapace small, moderately tumid; lateral outline subovate, dorsal and ventral margins subequally convex; ends rounded, of about equal height, but terminating on opposite sides of midheight, giving a distinct forward "swing"; overlap relatively narrow around contact margin, greatest centroventrally; sulcus very wide, shallow sides merging gradually with the curvature of shell; projection of larger shell above hinge line moderate; hinge straight and incised.

Length, 0.83 mm; height, 0.50 mm; width, 0.41 mm.

*S. elongata* is recognized by its long form ratio (1.68) and by the broad shallow sulcus, as contrasted to the deep narrow sulci with abrupt margins of other described species.

Little Vermilion zone, locality 103.

**Sargentina tumida** Cooper, n. sp.

*Plate 20, figures 21-23*

Carapace small, short, tumid; lateral outline ovate; dorsal and ventral margins subequally convex; ends rounded and of about equal height, but terminating below and above midheight, giving the lateral outline a pronounced forward "swing"; sulcus long, shallow, narrowing upward to a mere line; overlap variable, greatest along ventral and posterior margins; right valve rises considerably above left along hinge line, especially in the central portion; hinge straight.

Length, 0.62 mm; height, 0.40 mm; width, 0.32 mm.

*S. tumida* is smaller, more elongate, and has a narrower sulcus than previously described Chester species.

"Centralia" zone, locality 80.

Family **LEPERDITELLIDAE** Ulrich and Bassler, 1906

Genus **Cyathus** Roth and Skinner, 1930

**Cyathus striatus** Cooper, n. sp.

*Plate 20, figures 5-8*

Carapace small, elongate, semielliptical; valves equal; dorsal margin straight, ventral margin convex; lenticular in dorsal outline; ends rounded, anterior less regular than posterior; hinge
straight, slightly incised in a fairly wide, shallow, V-shaped groove, notched at each end of left valve much as in \textit{San-sabella}; ventral margin infolded to line of commissure, forming a broad, shallow U-shaped channel along venter; greatest height central, greatest thickness just back of midlength; surface completely covered, even in shallow dorsal and ventral channels, with extremely fine striations subparallel to the margins; subcircular muscle spot just below and slightly anterior to center discernable on well-preserved specimens.

Length, 0.48 mm; height, 0.30 mm; width, 0.28 mm.

\textit{C. striatus} seems sufficiently distinctive, particularly in dorsal outline and character of channels, to be a new species, although it comes from beds comparable to those which produced the genotype \textit{C. ulrichi} Roth and Skinner.

Seville zone, localities 5, 6.

**Genus Microparaparchites** Croneis and Gale, 1939

\textbf{Microparaparchites angustus}

Cooper, n. sp.

Plate 20, figure 12

Carapace small, very short; dorsal outline short, straight; lateral outline tear-drop shaped; spine very short, wide at base, protruded downward to form indistinct shoulder; forward swing pronounced.

Length, 0.51 mm; height, 0.45 mm.

\textit{M. angustus} has the lowest form ratio (1.14) of any described species of \textit{Microparaparchites}.

Summum zone, locality 26.

\textbf{Microparaparchites brazoensis}

(Coryell and Sample)

Plate 20, figures 16-18


\textbf{Paraparchites latidorsalis} Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 55, pl. 4, figs. 1a, b; Wewoka formation, Oklahoma.

\textbf{Paraparchites oblongus}, Coryell and Sample, 1932 (not Jones and Kirkby), Am. Midland Naturalist, vol. 13, p. 250, pl. 24, fig. 3; East Mountain shale, Texas.

\textbf{Paraparchites palopintoensis} Coryell and Sample, 1932, idem, p. 248, pl. 24, fig. 4; East Mountain shale, Texas.

Carapace small, rather tumid, subovate in lateral outline, ventral margin convex; dorsal margin slightly bowed in center; hinge line straight and somewhat incised in posterior half; posterodorsal portions of both valves produced into proportionally large thick spines directed outward and upward from shell surface; overlap very faint around free margins.

Length, 0.63 mm; height, 0.46 mm; width, 0.35.

Sparland to Exline zones, localities 56, 59, 62, 66.

\textbf{Microparaparchites cornutus}

Cooper, n. sp.

Plate 20, figures 13-15

Carapace small, tumid, lateral outline semiovate; dorsal margin convex posteriorly and concave anteriorly; hinge line fairly long, incised; spines very long, tapered, flaring at base, and directed sharply upward and laterally, overlap very faint.

Length, 0.54 mm; height, 0.38 mm; width, 0.32 mm.

\textit{M. cornutus} is differentiated by its unusually long, heavy spines and by the irregular dorsal outline.

Liverpool zone, locality 18.

\textbf{Microparaparchites cuneatus}

(Warthin)

Plate 20, figures 1, 2

\textit{Paraparchites cuneatus} Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 56, pl. 4, figs. 2a, b; Holdenville formation, Oklahoma.

\textit{Paraparchites thomasi} Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 248, pl. 24, fig. 1; East Mountain shale, Texas.
Carapace very small, lateral outline semiovate; anterior end broadly curved, posterior much more narrow; spines very large and directed outward and upward; overlap inconspicuous.

Length, 0.29 mm; height, 0.188 mm; width, 0.13 mm.

The unusually small size of this species raises the question as to whether or not this is a young moult of *M. brazoensis* Coryell and Sample (1932, p. 249) which occurs in correlative beds in Texas, Oklahoma and Illinois. However, this cannot be determined until the entire moult series has been studied.

Gimlet zone, locality 59.

**Microparaparchites elongatus**
Cooper, n. sp.

Plate 20, figures 9-11

Carapace small, elongate, lateral outline subelliptical; ventral margin strongly convex; ends unequally rounded, forward "swing" pronounced; hinge line relatively long, incised; spines short, widely flaring at base; overlap narrow around free margins.

Length, 0.61 mm; height, 0.36 mm; width, 0.30 mm.

*M. elongatus* is easily recognized by its unusually large form ratio (1.70).

Liverpool to Sparland zones, localities 17, 20, 37, 56.

**Microparaparchites ovatus**
Cooper, n. sp.

Plate 20, figures 3, 4

Carapace small, relatively short, lateral outline, semiovate; dorsal margin slightly arched in center; ventral margin and ends broadly curved, almost hemispherical; forward "swing" very slight; hinge line of moderate length, straight, and incised for most of its length; spines very short, widely flaring at base to join shell surface without interruption of regular curvature; overlap very faint.

Length, 0.40 mm; height, 0.34 mm; width, 0.23 mm.

*M. ovatus* is distinguished by its short form ratio, small spines, and nearly semicircular lateral outline.

Liverpool to St. David zones, localities 16, 18, 22, 26, 30.

**Microparaparchites quadratus**
Cooper, n. sp.

Plate 20, figures 19, 20

*Paraparchites latidorsatus*, Coryell and Sample, 1932 (not Warthin), Am. Midland Naturalist, vol. 13, p. 249, pl. 24, fig. 2; East Mountain shale, Texas.

Carapace small, somewhat tumid; ends subequally rounded; dorsal margin straight; spines short, thick, directed more upward than laterally; overlap inconspicuous; hinge line straight and incised.

Length, 0.57 mm; height, 0.35 mm; width, 0.29 mm.

Brereton zone, locality 37.

**Microparaparchites wapanuckaensis**
( Harlton)

Plate 20, figures 24-26

*Paraparchites wapanuckaensis* Harlton, 1928, Jour. Paleontology, vol. 2, p. 132, pl. 21, figs. 1a, b; Wapanucka limestone, Oklahoma.—Harlton, 1929, Am. Jour. Sci., ser. 5, vol. 18, p. 255, pl. 1, figs. 3a, b; Wapanucka limestone, Oklahoma.—Harlton, 1933, Jour. Paleontology, vol. 7, p. 19, pl. 6, figs. 1a, b; Johns Valley shale, Oklahoma.—B. Adfield, 1935, Bull. Am. Paleontology, vol. 22, p. 28, pl. 1, fig. 1; Dornick Hills group, Oklahoma.

*Paraparchites ottervillicus* Bradfield, 1935, idem, p. 30, pl. 1, fig. 2, Dornick Hills group, Oklahoma.

Carapace small, asymmetrical, somewhat tumid; dorsal margin short, straight, with posterior half of hinge line deeply incised; anterior end broadly curved, posterior quite narrow; spines rather large, broad at base, posterior edge extending downward as a prominent ridge or shoulder almost to the margin of shell; overlap indistinct.

Length, 0.55 mm; height, 0.40 mm; width, 0.26 mm.

Wiley to Sparland zones, localities 13, 14, 18, 20, 30, 31, 55.
Genus Paraparchites Ulrich and Bassler, 1906

Paraparchites claytonensis Knight
Plate 20, figures 27-34

Paraparchites claytonensis Knight, 1928, Jour. Paleontology, vol. 2, p. 231, pl. 31, figs. 8a-d; Pawnee limestone, Missouri.

Carapace large, semiovate in lateral outline, hinge line relatively short, straight, ends subequally rounded; ventral margin convex; a short, slender spine projects upward from anterodorsal angle, well in back of the hinge termination; surface smooth.

Length (figs. 27-30), 1.75 mm; height, 1.30 mm; width, 0.80 mm.

Seville zone, locality 4.

Paraparchites dispar Cooper, n. sp.
Plate 21, figures 35, 36

Carapace small, rather flat; lateral outline semiovate; hinge line long, straight; posterior end straight dorsally, gradually merging below into broad curve around the posteroventral and ventral margins resulting in a very high posterior end; anterior end rounded; overlap narrow around free margins.

Length, 0.64 mm; height, 0.45 mm; width, 0.37 mm.

In many respects P. dispar resembles P. acutus (Jones and Kirkby), particularly the form shown by Kummerow (1939, pl. 1, fig. 3). However, the latter has a distinctly more rounded posterior end and greater overlap.

Gimlet zone, locality 62.

Paraparchites exiguis Cooper, n. sp.
Plate 21, figures 22-27

Carapace small, tumid; lateral outline semiovate; dorsal margin convex in center; ventral margin and ends broadly convex; anterior end quite narrow; overlap around free margins narrow; dorsal overlap reversed and accentuated by the convexity of the dorsal margin of left valve; surface smooth.

Length (figs. 25-27), 0.46 mm; height, 0.34 mm; width, 0.27 mm.

P. exiguis because of its extremely small size may be an immature moult of an undetermined species. It somewhat resembles the smallest specimen of P. humerosus Ulrich and Bassler figured by Kellett (1933, pl. 7, figs. 7, 12).

Seville and Gimlet zones, localities 5, 62.

Paraparchites fabula Cooper, n. sp.
Plate 21, figures 28-30

Carapace small, tumid, lateral outline ovate; dorsal margin straight; ends and ventral margins convex; hinge line short, straight; overlap very narrow.

Length, 0.34 mm; height, 0.22 mm; width, 0.20 mm.

P. fabula closely resembles P. exiguis n. sp. but lacks the convex dorsal margin of the latter.

Gimlet zone, locality 62.

Paraparchites inornatus? (McCoy)
Plate 21, figure 39
See Bassler and Kellett (1934, p. 426) and Cooper (1941, p. 62) for synonymy.

This crushed specimen possesses the typical outline of the species with its distinct retral swing and unequal height of anterior and posterior ends. Of specimens listed from the Pennsylvanian it has a longer hinge line than that figured by Harlton (1927, p. 203) from the Cisco series of Texas, and a more pronounced retral "swing" than the Delo’s form from Hamilton County, Kansas. Possibly these differ from those of the Chester, in which series they are very widely distributed.

Length, 1.25 mm; height, 0.80 mm.
Trivoli zone, locality 68.

Paraparchites semicircularis Cooper, n. sp.
Plate 21, figure 31-34

Carapace medium sized, short, tumid; lateral outline subcircular; hinge line
very short, straight; ends equally rounded; ventral margin strongly convex; spine very small, short, and near dorsal margin, well back from anterior margin; surface smooth.

Length, 1.30 mm; height, 1.0 mm; width, 0.69 mm.

This species resembles *P. claytonensis* Knight, except for its very small length (form ratio, 1.3) and differs from *P. humerosus* Ulrich and Bassler and *P. inornatus* (McCoy) in the lack of a retral ‘‘swing’’. It also bears some resemblance to *P. discoideus* Kummerow (1939, p. 12).

Seville zone, locality 4.

Genus *Paraparchitella* Cooper, n. gen.

Carapace ovate in lateral outline, dorsal and ventral margins strongly convex, ends rounded; dorsal and ventral overlaps reversed, left valve overlapping right nearly to one-third its height ventrally; dorsal overlap narrow, right over left; hinge line short, shallowly depressed.

Genotype: *Paraparchitella ovata* Cooper, n. sp.

*Paraparchitella* differs from *Paraparchites* by its highly arched dorsum and from this and other Leperditellidae by its extreme ventral overlap.

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**Paraparchitella ovata** Cooper, n. sp.

Plate 21, figures 40-43

Carapace small, tumid; lateral outline ovate; dorsal and ventral margins subequally convex, the latter slightly truncate posteriorly; ends unequally rounded, anterior quite narrow in lateral and dorsal views; dorsal overlap short, narrow; ventral overlap reversed, extending around ventral margin and one-third the distance up the left valve; hinge short and incised in a short, shallow, lens-shaped depression; greatest height and thickness posterior; surface smooth.

Length, 0.65 mm; height, 0.41 mm; width, 0.33 mm.

Seville zone, locality 6.

Genus *Proparaparchites* Cooper, 1941

**Proparaparchites parallelus**

Cooper, n. sp.

Plate 21, figures 37, 38

Carapace small, thin; lateral outline subrectangular; dorsal and ventral margins straight; ends subequally rounded, with very faint backward ‘‘swing’’; hinge line straight; cardinal angles obtuse; surface smooth; shell walls very thin.

Length, 0.55 mm; height, 0.35 mm; width, 0.18 mm.

This may be distinguished from the Chester species by its parallel dorsal and ventral margins and the very thin shell walls.

Gimlet zone, locality 62.

Family *Youngiellidae* Kellett, 1933

Genus *Moorites* Coryell and Billings, 1932

The genotype species *M. hewetti* has been shown by Kellett (1933, p. 104) to be a synonym of *M. minutus* (Warthin) and since then a number of additional occurrences of this species have been noted. Other described species, which also probably should be placed in synonymy with *M. minutus*, have appeared in the literature.

There is considerable variation in the dimensions of the specimens which have been referred to *M. minutus*. Plotting their length and height results in an aggregation of points which cannot be resolved into a moult series. The form ratios vary from 1.68 to 2.30, which together with the scattered positions of the plotted points, indicates the presence of more than one species. Until a number of moult studies can be made from topotype collections, it will not be possible to clear up this matter. The genotype is probably an immature moult of *M. minutus*, as it has the same form ratio but is considerably smaller.

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19 In a previous report (Cooper, 1941, p. 64) this family was erroneously credited to Jones and Kirkby.
Many species originally described as Youngiella have been transferred to this genus because they do not possess the transverse teeth along the hinge line of the genotype species, Y. rectidorsalis Jones and Kirkby. The hinge of Moorites is cardine (Cooper, 1941, p. 38).

Moorites elongatus? (Jones and Kirkby)
Plate 21, figures 7-10
Cytherella? elongata Jones and Kirkby, 1886, Annals and Mag. Natural History, ser. 5, vol. 18, p. 262, pl. 9, figs. 2, 3; Lower limestone, Scotland.
?Mooea elongata Coryell and Sample, 1932, Am. Midland Naturalist, vol. 13, p. 258, pl. 25, fig. 19; East Mountain shale, Texas.
Youngiella? gracilis Bradfield, 1935, idem, p. 73, pl. 4, figs. 15a, b; Deese group, Oklahoma.
Moorites elongatus. Cooper, 1941 Illinois Geol. Survey Report, Invest. 77, p. 64, pl. 14, figs. 20, 21; Paint Creek formation, Illinois.
Length (figs. 7, 8), 0.38 mm; height, 0.19 mm; width, 0.13 mm.
These small unornamented forms are probably small molts belonging to a larger, undetermined species, and the Chester forms cannot be differentiated from those from the Pennsylvania. Moorites elongata (Bradfield) is a homonym, and probably an imperfectly preserved specimen of M. minutus (Warthin).
Brereton to Shumway zones, localities 37, 59, 62, 70, 83, 103, 109.

Moorites indentus Cooper, n. sp.
Plate 21, figures 1, 2
Carapace small, elongate; lateral outline semiovate; dorsal and ventral margins straight, parallel; ends subequally rounded; backward "swing" moderate; marginal ridge very wide, low, and bordering end margins only; surface smooth, with a very shallow circular pit located in center of shell.
Length, 0.39 mm; height, 0.20 mm; width, 0.15 mm.
M. indentus is recognized by the small indistinct circular central pit.
Exline to Newton zones, localities 66, 82, 112.

Moorites knighti? (Wilson)
Plate 21, figures 5, 6
Youngiella knighti Wilson, 1933, Jour. Paleontology, vol. 7, p. 417, pl. 50, figs. 2a-c; McAlester shale, Oklahoma.
Carapace small, elongate; lateral outline semiovate, dorsal and ventral margins straight, parallel; ends subequally rounded; backward swing fairly prominent; marginal ridges absent or very faint around ends; surface smooth.
Length, 0.35 mm; height, 0.18 mm; width, 0.13 mm.
The small size and featureless surface of this species indicates that it is probably an immature moult, possibly of M. wapanuckensis (Harlton).
Seville to Newton zones, localities 4, 26, 29, 30, 66, 79, 82, 83, 112.

Moorites minutus (Warthin)
Plate 21, figures 11-17
Glyptopleurina? minutus Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p.67, pl. 5, figs. 6a, b; Holdenville formation.
Moorites minutus, Coryell and Billings, 1932, Am. Midland Naturalist, vol. 13, p. 183, pl. 18, fig. 6; Wayland shale, Texas.—Coryell and Sample, 1932, idem, p. 256, pl. 24 fig. 18; East Mountain shale, Texas.—Kellett, 1933, Jour. Paleontology vol. 7, p. 104, pl. 14, figs. 37-39; Stanton to Howard formations, Kansas.—Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 73, pl. 5, figs. 1a, b; Deese and Hoxbar groups, Oklahoma.—Johnson, 1936, Nebraska Geol. Survey Paper 11, p. 37, pl. 3, figs. 20, 21; Stanton and Plattsburg formations, Nebraska.
Youngiella minutus, Wilson, 1933, Jour. Paleontology, vol. 7, p. 416, pl. 50, figs. 7; McAlester shale, Oklahoma.
Youngiella? convergens Bradfield, 1935, Bull. Am. Paleontology, vol. 22, p. 72, pl. 4, figs. 16a, b; Deese group, Oklahoma.
**Youngiellidae**

*Youngiella? elongata*, Bradfield. 1935, idem, p. 72, pl. 4, fig. 14; Deese group, Oklahoma.

*Moorites hexcetti* Coryell and Billings, 1932. Am. Midland Naturalist, vol. 13, p. 182, pl. 18, fig. 5; Wayland shale, Texas.—Coryell and Sample, 1932, idem, p. 257, pl. 24, fig. 17; East Mountain shale, Texas.

*Moorites truncatus* Coryell and Billings, 1932, idem, p. 153, pl. 18, fig. 7; Wayland shale, Texas.

Carapace very small, elongate; dorsal margin long, straight; hinge line incised; ventral margin concave; anterior end almost straight, posterior end rounded; backward "swing" pronounced, resulting in an obtuse anteriodorsal angle and an acute angle posteriorly; the wide end prominent marginal ridge is especially noticeable in dorsal view; surface punctate, with low, inosculating ridges separating rows or groups of punctae.

Length, 0.42 mm; height, 0.24 mm; width, 0.16 mm.

This species, common throughout the entire Pennsylvanian section, is recognized by the prominent rounded ridge that borders the free margins and the pattern of costae or other small inflated portions that separate the punctae. It resembles *M. rhomboïdalis* (Croneis and Gale) but the backward swing is less pronounced in the Chester species.


**Moorites punctus** (Wilson)

Plate 21, figures 3, 4

*Youngiella puncta* Wilson, 1933, Jour. Paleontology, vol. 7, p. 416, pl. 50, figs. 4a-d; McAlester shale, Oklahoma.

Carapace small, lateral outline subrectangular; dorsal and ventral margins straight; ends about equally rounded and bordered by fairly prominent wide ridge which dies out at the ventral margin; surface flat and marked by numerous small punctae.

Length, 0.40 mm; height, 0.20 mm; width, 0.11 mm.

*M. punctus* lacks the backward "swing", and the ridge bordering the ventral margin of *M. minutus*.

Liverpool to Gimlet zones, localities 14, 16, 17, 62.

**Moorites spiciferus** (Wilson)

Plate 21, figures 20, 21

*Youngiella spicifera* Wilson, 1933, Jour. Paleontology, vol. 7, p. 417, pl. 50, fig. 8a (only); McAlester shale, Oklahoma.

Carapace small, elongate, somewhat tumid; dorsal margin straight, ventral margin concave; ends subequally rounded, the posterior much higher; ends bordered by marginal ridge which is lacking along venter; backward "swing" prominent; surface coarsely punctate.

Length, 0.46 mm; height, 0.21 mm; width, 0.17 mm.

*M. spiciferus* may be recognized by its elongate form (ratio, 2.2) and the coarsely punctate surface.

Seville and St. David zones, localities 6, 29.

**Moorites wapanuckensis** (Harlton)

Plate 21, figures 18, 19

*Youngiella wapanuckensis* Harlton, 1933, Jour. Paleontology, vol. 7, p. 25, pl. 7, figs. 3a, b; Johns Valley shale, Oklahoma.

Carapace, small, short, thin; dorsal and ventral margins straight; posterior end rounded, anterior end nearly straight; free margin bordered by a very wide smooth, prominent ridge; surface inside ridge flat and marked by numerous pits.

Length, 0.49 mm; height, 0.26 mm; width, 0.13 mm.

*M. wapanuckensis* is recognized by the straight parallel dorsal and ventral margins, its extreme thinness and the very prominent marginal ridge.

Seville to Collinsville zones, localities 4, 63, 73.
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Monoceratina bradfieldi Cooper, n. sp. Dorsal, end, lateral, and ventral views; 1, 2, paratype; 3-6, holotype; Little Vermilion zone, loc. 103, X 40

Ardmorea gibberosa (Knight). Lateral and dorsal views; Lonsdale zone, loc. 62, X 40

Monoceratina ardmorensis (Harlton). Lateral view; Fulda formation, loc. 1, X 40

Monoceratina lewisii Harris and Lalicker. Lateral and end views; Lonsdale zone, loc. 62, X 40

Monoceratina macoupeni Scott and Borger. Lateral view; Gimlet zone, loc. 62, X 40

Bairdia ardmorensis Harlton. Lateral and dorsal views; Ferdinand limestone, loc. 2, X 20

Bairdia blakei Harlton. Lateral, dorsal, ventral, and end views; Shumway zone, loc. 109, X 30

Bairdia altifrons Knight. Lateral, dorsal, anterior, and end views; Lonsdale zone, loc. 62, X 20

Bairdia citiformis Knight. Dorsal, lateral, ventral, and end views; Brereton zone, loc. 45, X 30

Bairdia acuminata Cooper, n. sp. Lateral and dorsal views of holotype; Little Vermilion zone, loc. 103, X 30

Bairdia ciscoensis? Harlton. Lateral and dorsal views; Woodbury zone, loc. 115, X 40

Bairdia concava Cooper, n. sp. Dorsal, ventral, lateral, and end views of holotype; Greenup zone, loc. 114, X 20

Bairdia beedei Ulrich and Bassler. 35-38, Lateral, dorsal, ventral, and end views; Millersville limestone, loc. 90, X 20. 39-40, Lateral and dorsal views; Brereton zone, loc. 46, X 20

Bairdia angusta Cooper, n. sp. Lateral, dorsal, and end views of holotype; Seville zone, loc. 4, X 20

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