

STATE OF FLORIDA
DEPARTMENT OF CONSERVATION

GEORGE W. DAVIS, *Supervisor*

GEOLOGICAL BULLETIN No. 13

OSTRACODA OF THE ARCA ZONE OF THE
CHOCTAWHATCHEE MIOCENE OF FLORIDA

BY

HENRY V. HOWE, Ph.D., Director
School of Geology, Louisiana State University
and graduate students
School of Geology, Louisiana State University

Tallahassee, Florida
1935

STATE OF FLORIDA
DEPARTMENT OF CONSERVATION

GEORGE W. DAVIS, *Supervisor*

GEOLOGICAL BULLETIN No. 13

OSTRACODA OF THE ARCA ZONE OF THE
CHOCTAWHATCHEE MIOCENE OF FLORIDA

BY

HENRY V. HOWE, Ph.D., Director
School of Geology, Louisiana State University
and graduate students
School of Geology, Louisiana State University

Published for
State Board of Conservation
Geological Department
Tallahassee, 1935

Published September 10th, 1935

LETTER OF TRANSMITTAL

*Honorable George W. Davis,
Supervisor of Conservation.*

DEAR MR. DAVIS :

It gives me pleasure to transmit for publication as Geological Bulletin No. 13 a paper by Dr. Henry V. Howe, Director, School of Geology, Louisiana State University, Baton Rouge, in collaboration with a number of students of that institution, entitled "Ostracoda of the Arca Zone of the Choctawhatchee Miocene of Florida." The Florida Survey has published other reports relating to the invertebrates of the Miocene of western Florida. This paper by Dr. Howe and collaborators deals with a special group of micro-fossils from a particular zone in the Choctawhatchee formation, namely, the Ostracoda, and is the first report dealing with this interesting group of fossils in such a detailed manner from Florida. The fauna of this Arca Zone will therefore now be very thoroughly covered. This technical paper with its four excellent illustrations comes without cost to the Florida Survey other than the expense of publication. It is a pleasure to acknowledge this generous contribution and cooperation.

I also wish to express my appreciation of the interest you have always shown in the work of the Geological Division and the cordial support rendered.

Very respectfully,

HERMAN GUNTER, *Assistant Supervisor,
State Board of Conservation,
Geological Department.*

Tallahassee, Florida.
July 27, 1935.

CONTENTS

	PAGE
Introduction	7
List of Stations	8
Description of Genera and Species	9

ILLUSTRATIONS

Plates I-IV. Ostracoda of the Arca Zone of the Choctaw-hatchee Miocene of Florida	39
---	----

OSTRACODA OF THE ARCA ZONE OF THE CHOCTAWHATCHEE MIOCENE OF FLORIDA

By HENRY V. HOWE and others'
Louisiana State University

INTRODUCTION

In the spring of 1930, Mr. Karl E. Young made an extensive collecting trip which extended to Florida, and was kind enough to supply the writer with a large number of samples from many of the famous Miocene localities there. During the Christmas holidays of 1933, the writer accompanied Dr. Richard J. Russell of the School of Geology, Louisiana State University, on a collecting trip to Florida and many additional localities were visited. Later, in the summer of 1934, the writer spent some ten days in Western Florida, and was accompanied by Mr. Merle C. Israelsky, paleontologist for the United Gas Company, Houston, Texas. Mr. Carroll E. Cook has also supplied the writer with several samples of Florida Miocene material. As a result of these collecting trips, the writer has had available for study extensive samples from nearly all of the localities in the Florida Miocene from which Dr. Joseph A. Cushman and Gerald M. Ponton have described foraminifera.² As their papers are so widely known and used, the writer has felt it desirable to arrange his locality list as nearly in agreement with theirs as possible. With the exception of Mr. Young's locality near Ward, Florida, the numbers

¹This paper is the result of a study made by the author's graduate class in micropaleontology at Louisiana State University. Each of the following graduate students has contributed drawings for the plates, has worked out the finer structures of certain species, and has translated certain European works on the *Ostracoda* which have aided in the study: Jack Chambers, Bates Brown, James McGuirt, Wenzel Neill, Leo Hough, Albert D. Ellis, Jr., Morton Stephenson, Julia Spurgeon, Lloyd Pyeatt, Christian Dohm, Wade Hadley, Ralph Taylor, and T. J. Johnson. Their names appear with the senior author's on the new species which they worked out. The writer wishes to express his appreciation of their enthusiastic assistance in the preparation of this manuscript.

²Cushman, J. A., "The Foraminifera of the Choctawhatchee Formation of Florida," Fla. Geol. Surv., Bull. No. 4, 1930.

Cushman, J. A. and Ponton, G. M., "The Foraminifera of the Upper, Middle and a Part of the Lower Miocene of Florida," Fla. Geol. Surv., Bull. No. 9, 1932.

and descriptions have been taken from Florida Geological Survey Bulletin No. 9. Only the localities are given from which species have been described:

LIST OF STATIONS

Sample No. 10.—Tenmile Creek, from bridge to one-half mile below bridge on the Marianna-Clarksville road, 22 miles south of Marianna, Calhoun County. Collected by K. E. Young.

Sample No. 14.—U. S. G. S. locality No. 11732.—Borrow-pit just east of the power dam at Jackson Bluff on Ocklocknee River, Leon County. Collected by Carroll E. Cook.

Sample No. 15.—U. S. G. S. locality Nos. 1/671 and 1/947. Jim Kennedy Branch, one mile east of Red Bay, Walton County. Collected by H. V. Howe and M. C. Israelsky.

Sample No. 26.—U. S. G. S. locality No. 7054.—At old sawmill near Oak Grove on right bank of Yellow River about 100 yards below bridge on Laurel Hill-Oak Grove road, Okaloosa County. Collected by H. V. Howe and M. C. Israelsky.

Sample No. 28.—U. S. G. S. locality No. 10608.—Small gully, 50 feet south of road and 150 feet east of bridge over White's Creek on Eucheeanna-Knox Hill road, one mile west of Valley Church, Walton County. Collected by H. V. Howe and M. C. Israelsky.

Sample No. 29.—U. S. G. S. locality No. 10659.—Senterfiet's or Tanner's Mill (abandoned), four miles southwest of Laurel Hill, Okaloosa County. Collected by H. V. Howe and M. C. Israelsky.

Sample No. 31.—U. S. G. S. locality No. 10658.—Toward upper end of Shell Bluff on right bank of Shoal River, five miles north of Mossyhead, Walton County. Collected by K. E. Young, by H. V. Howe and R. J. Russell, and by H. V. Howe and M. C. Israelsky.

K. E. Young Locality No. 34.—Choctawhatchee Miocene, pit of West Florida Power Company, just east of road at power dam, being about 300 feet east of the hydro-electric power plant near Ward, Florida, which is about 26 miles southwest of Tallahassee, on the Ocklocknee River.

Sample No. 40.—U. S. G. S. locality No. 1/948.—John Anderson's farm, three-quarters of a mile east of Red Bay, Walton County. Collected by H. V. Howe and M. C. Israelsky.

Sample No. 41.—U. S. G. S. locality Nos. 1/673 and 1/950.—At small spring head in E. Gomillion's field at Red Bay, Walton County. Collected by H. V. Howe and M. C. Israelsky.

This paper deals essentially with the ostracodes obtained at Localities Nos. 15, 40 and 41. Locality No. 40 is considered to be the type locality of the Choctawhatchee formation, and the three localities all belong to the *Arca* zone of the formation, and have quite similar assemblages. This zone was selected for study, both because it was the type horizon of the Choctawhatchee, and because it was very difficult to separate it from the underlying *Yoldia* zone and from the Shoal River formation on the basis of foraminifera. Both the *Arca* zone and the Shoal River contain abundant ostracodes and the present study has definitely established that these assemblages are so distinct that they may be easily separated. In this

paper, an attempt has been made to describe or to call attention to such species of the Shoal River as might be confused with those of the *Arca* zone. A few of the species that range above or below the *Arca* zone have been described from younger or older formations in case they were found to have better preservation at these stations. In every case the known vertical range of each species is given.

As the only extensive previous paper dealing with American Miocene ostracodes was the excellent one published by Ulrich and Bassler³ in Maryland Geological Survey, and as their types are preserved in the National Museum, the writer, through the courtesy of Dr. R. J. Russell, obtained some nineteen samples of material from Plum Point, Maryland, their most important locality. When this material had been studied, he took his collections to Washington and compared the species herein described with Ulrich and Bassler's types, which were kindly placed at his disposal by Dr. Bassler. The writer, therefore, feels that in extending the range of a number of species from Maryland to Florida, he has done so with safety.

In conclusion the writer wishes to express his appreciation of the assistance given him by Mr. Morton Stephenson in the assembling of the plates which accompany the paper, and he particularly wishes to thank Miss Louise Lowe, Librarian of the School of Geology, Louisiana State University, who prepared and catalogued the type specimens, and who cheerfully devoted so much of her time to the assembling and final checking of the manuscript.

DESCRIPTION OF GENERA AND SPECIES

Order OSTRACODA Latreille
Suborder PODOCOPA Sars
Family CYTHERIDAE Baird
Genus CYTHERIDEA Bosquet

Cytheridea choctawhatcheensis Howe and Stephenson, n. sp.
Plate II, figure 11; Plate IV, figure 9.

Carapace small, subovate, smooth, thin and transparent. The dorsal margin straight in the right valve, broadly arched in the left. The anterior end broadly and obliquely rounded, and in the right valve bearing a few small marginal spines below the middle. The posterior end obliquely subtruncate, the ven-

³Ulrich, E. O., and Bassler, R. S., Maryland Geol. Surv., Miocene Report, 1904, pp. 94-130, pls. 35-38.

tral margin sinuous, the dorsal and ventral margins converging posteriorly. Viewed from the inside, the valves are moderately deep and are flanked by a faint, narrow, marginal area around the anterior end, which is traversed by a few short radial pore canals. Both valves bear a flange just anterior to the middle of the ventral margin and the sharp, carinate border of the right valve is removed from the outer margin a short distance around the postero-ventral angle. The ventral margin of the left valve is faintly grooved for the reception of the right. The hinge of the right valve consists of a faint row of denticulations just anterior to the middle, behind which the dorsal margin is grooved for a short distance and then it becomes sharply prominent to the postero-dorsal angle. The hinge of the left valve consists of a narrow, elongate, notched socket anterior to the middle, behind which is a short, raised bar and behind that the dorsal margin is faintly grooved to the postero-dorsal angle. The muscle scar pattern is relatively simple and consists of four small scars in a vertical row in front of the summit of which is a fifth.

Dimensions of Holotype No. 1032, a right valve: length, 0.90 mm.; height, 0.48 mm. Paratype No. 1033, a left valve: length, 0.90; height, 0.50.

Both figured specimens are from Locality 41.

The species, while small and fragile, occurs abundantly at most localities from the Chipola through the *Arca* zone of the Choctawhatchee.

Cytheridea floridana Howe and Hough, n. sp.
Plate II, figures 15, 16, 18; Plate IV, figures 6, 10.

Carapace subovate, dorsal margin evenly arched, ventral outline slightly down-curved; the anterior end broadly rounded, the posterior end subtruncate. The left valve larger and overlapping the right around practically the entire periphery, the greatest overlap being just anterior to the middle of the dorsal margin. The ventral half of the anterior end of the right valve carries several obscure, blunt spines. Viewed from above, the anterior end keeled, the posterior end blunt. Surface of the valves nearly smooth except for the widely spaced normal pore canals. Greatest height just in front of the middle, thickness nearly uniform from just in front of the middle almost to the posterior end. Viewed from the inside, the valves moderately deep, fringed around the anterior end

with a moderately broad marginal area which narrows considerably around the ventral and posterior margins. The margin of the right valve is acute and fits into a faint lipline along the ventral and posterior margins of the left valve. The marginal areas of both valves are crossed by numerous closely spaced radial pore canals; in both valves the ventral margin is slightly flanged just anterior to the middle. The hinge of the right valve consists of an elongate, notched cusp anterior to the middle, the cusp bearing twelve to fifteen small denticulations. Immediately behind it, there is a small, deep pit which has several faint denticulations on its lower side. Behind this pit there is a narrow bar which, toward the posterior end, becomes more and more prominent and breaks up into a number of small teeth. The bar and teeth are separated from the dorsal margin by an incised line. The hinge of the left valve consists of a deep, channeled, crenulate groove anterior to the middle, behind which is an elongate, smooth, oblique protuberance, behind which the dorsal margin is deeply grooved to the junction of the dorsal and posterior margins, where a shallow, crenulate socket occurs. The muscle scar pattern of this species is very complex and unlike that of any other *Cytheridea* with which the writer is familiar. It is very clearly marked on both specimens and is shown in detail in Figure 18, Plate 2.

Dimensions of Holotype No. 1037, Locality 15: length, 1.03 mm.; height, 0.60 mm.; thickness, 0.50 mm.

This is the most abundant species in the *Arca* zone of the Choctawhatchee; Localities 15, 40 and 41. *Cytheridea subovata* Ulrich and Bassler, which is very abundant in the Shoal River Miocene of Florida, differs from it in being more elongate and in having a more pointed posterior end.

Genus CYTHEROMORPHA Hirschmann

Cytheromorpha warneri Howe and Spurgeon, n. sp.
Plate II, figures 5, 8, 9; Plate IV, figure 4.

Carapace oblong ovate in outline, the males being more elongate than the females. Dorsal and ventral margins are nearly straight and converge gently toward the posterior, the upper third of the anterior end is obliquely truncate, the remainder regularly rounded; the upper two-thirds of the narrower posterior end is obliquely truncate, the lower one-third

rounded so as to form an obscure angulation below the middle. Greatest height at the anterior cardinal angle, thickness approximately equal throughout most of the length; surface finely and regularly reticulate, the reticulations being roughly hexagonal in outline and arranged in rows more or less parallel to the margins. There is a faint tendency to a median sulcus. Viewed from the inside, the valves are moderately shallow, shiny, translucent. The marginal area which is broad around the anterior end, narrows considerably in the middle of the ventral margin, widens again in the posterior half of the ventral margin and becomes narrower around the posterior end. The line of concrescence lies near the outer margin around the anterior end, but elsewhere coincides with the inner margin. The hinge of the right valve consists of a small, button-shaped anterior tooth below the dorsal margin; on either side of this tooth there is a small pit for the reception of the two anterior teeth of the left valve. The dorsal margin is nearly straight and grooved for the reception of a bar in the opposite valve. The posterior cardinal angle is occupied by an oval, oblique socket which has a bulbous swelling on either side of it and a raised rim above it. The hinge of the left valve consists of an anterior socket in front of which lies a small, knob-like tooth and behind which lies the swollen anterior end of the hinge bar. The posterior cardinal angle is occupied by a small, knob-like tooth with depressions in front of and behind it. The tooth and depressions are flanked above by the raised postero-dorsal margin. The pore canals are few in number and regularly spaced around the anterior end.

Dimensions of Cotype No. 1070, a female: length, 0.58 mm.; height, 0.30 mm.; thickness, 0.24 mm.

The figured specimens are all from the Choctawhatchee Miocene, K. E. Young Locality 34, and are identical to numerous specimens with which they have been compared from the Calvert Miocene of Plum Point, Maryland.

This species is named in honor of Mr. A. D. Warner, Cincinnati, Ohio.

Cytheromorpha warneri Howe and Spurgeon, var. *okaloosaensis*
Howe and Spurgeon, n. var.

This variety differs from the above described species in that the anterior one-third to one-half of the carapace is covered by fine, circular pits instead of angular reticulations.

There is also a pronounced median sulcus separating the two types of ornamentation, which is most prominent near the center of the valves and which curves backward as it approaches the dorsal margin.

Cotypes No. 1077 from the Upper Oak Grove Miocene, Locality 29. This variety occurs likewise abundantly in the Shoal River Miocene, Locality 28, and in the *Arca* zone of the Choctawhatchee at Localities 15, 40 and 41. While these two varieties appear to mark separate stratigraphic horizons in the Florida Miocene, they occur together in the Calvert formation of Plum Point, Maryland.

Genus CYTHERIDEIS Jones

Cytherideis agricola Howe and Hadley, n. sp.
Plate III, figures 27-30; Plate IV, figure 8.

Carapace elongate, inflated; dorsal margin gently arched, ventral margin nearly straight, central half slightly concave; anterior end blunt and obliquely rounded; posterior end more blunt and very obliquely rounded. Carapace nearly uniform in height; greatest height being just in front of the center. Viewed from above, the sides are nearly parallel except for the pointed extremities. Exterior surface of the carapace decorated with small pits arranged in curved lines nearly parallel to the margins, tending to develop slight ridges on the anterior half; valves otherwise smooth. Marginal area widest at anterior and posterior extremities; line of concrescence nearly coincides with the inner margin except at the anterior, where the inner lamella widens notably and slopes strongly away from the median plane. The marginal area bears a raised rim around the anterior, ventral and posterior portions. This rim parallels the ventral margin near the outside, but on the posterior it cuts straight and obliquely across the end, approaching the inner margin; at the anterior end it comes nearer the inner margin than it does the outer. This feature is more pronounced in the left valve than in the right. Anterior half of the hinge line of the right valve marked by a groove which opens into the inner cavity anteriorly; posterior end marked by a small, depressed socket, between the groove and the socket there projects a narrow, raised bar separated from the dorsal margin by a narrow, incised line.

Dimensions of Cotype No. 1072: length, 0.90 mm.; height, 0.38 mm.; thickness, 0.36 mm.

The figured specimens are all from the *Arca* zone of the Choctawhatchee at Locality 40. This species occurs also at Locality 41.

Cytherideis ashermani Ulrich and Bassler.

Plate III, figures 8-10.

Cytherideis ashermani Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 126, pl. 37, figs. 10-16.

Cytherideis longula Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 128, pl. 37, figs. 21-27.

Cytherideis semicircularis Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 127, pl. 37, figs. 18-20.

Carapace elongate, subcylindrical, slightly curved with broadest portion just posterior to middle. Ventral outline almost straight in left valve, slightly sinuate in right, dorsal margin arcuate, ends rounded with posterior more acute than anterior, particularly in right valve; surface strongly pitted and slightly reticulate. Left valve slightly larger than right and overlapping it except along posterior half of dorsal margin. Right valve, viewed from interior, moderately deep; marginal area narrow except around anterior end and flanged from point anterior to dorsal margin around anterior, ventral and posterior margins; the flange being distinctly removed from outer margin along anterior end and around acute basal tip of posterior end. This flange fits into a lipline which parallels the outer margin of the left valve. The hinge of the right valve consists of an elongate narrow groove on the inrolled dorsal margin and extends from a point just anterior to the middle to the posterior cardinal angle and is terminated at both ends by the projection of the flange previously mentioned. The hinge of the left valve consists of an elongate groove or socket open to the anterior and situated below the dorsal margin just anterior to the middle. A similar, but much smaller, socket is situated at the posterior cardinal end. Between these sockets the dorsal margin is flattened and projecting and fits into the groove of the right valve. The line of concrescence coincides with the inner margin except for short distance around the anterior end, where it lies just inside of it. Normal pore canals are inconspicuous; radial pore canals not well enough preserved to establish pattern, but in several specimens appear to be numerous and grouped in bunches about anterior end.

Dimensions of Plesiotype No. 1051, bivalved specimen: length, 0.90 mm.; thickness, 0.40 mm.; Plesiotype No. 1050, right

valve: length, 1 mm.; height, 0.41 mm.; Plesiotype No. 1049, left valve: length, 0.96 mm.; height, 0.46 mm.

The figured specimens are all from the *Arca* zone of the Choctawhatchee at Locality 40. The *Arca* zone specimens are larger and somewhat more coarsely pitted than the specimens found at Plum Point, Maryland, the type locality, but the differences are too slight to be worthy of even varietal mention.

Cytherideis fabula Howe and Dohm, n. sp.
Plate III, figures 15, 16, 20, 23; Plate IV, figure 2.

Carapace elongate, convex, the ventral outline slightly concave, the dorsal outline nearly semicircular. Greatest thickness of the carapace just behind and a little below the middle. The ends obliquely rounded, the anterior end much broader than the posterior. Greatest length near the ventral margin. Surface smooth. The left valve larger than the right and overlapping it along the dorsal margin and along the middle of the ventral margin. The interior of the valves moderately deep, somewhat irregular with the normal pore canals showing as larger pits on the interior than on the exterior. The marginal area of each valve bears a thin, raised line just within the outer margin. The marginal areas are broad around the anterior end and fairly broad near the acute posterior extremity. The line of concrescence lies near the outer margin around the central portion of the two extremities. The radial pore canals are clearly marked under transmitted light; the anterior and posterior ends carrying about fifteen each, occurring, for the most part, on the ventral half and somewhat irregularly spaced, the ventral side carrying about twenty-one or twenty-two, also irregularly spaced. Hingement simple; the hinge of the left valve consisting of an elongate, projecting bar lying back of the middle and not separated from the dorsal margin. Anterior to the bar there is a deep, slightly arcuate groove. Below the dorsal margin and posterior to the bar, there is a shorter, narrower groove, the posterior end of which is open to the interior of the valve. In the right valve, the posterior half of the dorsal margin carries a narrow groove into which the projecting bar-like extension of the opposite valve is received.

Dimensions of Cotype No. 1056: length, 0.88 mm.; height, 0.38 mm.; thickness, 0.39 mm.

The figured specimens are all from Locality 40.

The species is also abundant at Localities 15 and 41.

Cytherideis ulrichi Howe and Johnson, n. sp.
Plate III, figures 11-14.

Carapace elongate, inflated particularly toward the posterior end. The dorsal margin gently arched, the ventral margin nearly straight, slightly concave just in front of the middle. The anterior and posterior ends obliquely rounded, subequal in the right valve, the posterior slightly larger in the left. Surface of the carapace smooth, but marked with fairly numerous white spots where the normal pore canals approach the surface. Viewed from the inside, the valves are moderately deep, flanked by a well defined marginal area, which is broadest around the anterior end, where, for a short distance, the line of concrescence leaves the inner margin and approaches the outer. Radial pore canals moderately numerous and occurring in bunches of two or three around the anterior end, fewer in number along the ventral and posterior margins. The marginal area of right valve bears a low, sharp flange except for a short distance along the hingeline, where the dorsal margin is grooved. This groove starts at the middle and extends about one-third the distance to the posterior extremity. The marginal area of the left valve bears a faint lipline near the outside and the hinge consists of a sharp infolding of the dorsal margin from the center one-third the distance to the posterior extremity. Behind and below this fold is a short, horizontal gash, in front of it and below the dorsal margin is an elongate, shallow socket.

Dimensions of Cotype No. 1052, a right valve: length, 1.03 mm.; height, 0.47 mm.; Cotype No. 1053, a left valve: length, 1.04 mm.; height, 0.47 mm.

Both figured specimens came from Locality 40. It occurs also at Locality 15.

The species is named for Dr. E. O. Ulrich, who has contributed so much to our knowledge of American Ostracoda.

Genus CYTHERIDELLA Daday.

Cytheridella chambersi Howe, n. sp.
Plate III, figures 1-2; Plate IV, figures 16, 20.

Carapace in side view ovate, the dorsal and ventral margins nearly straight and converging strongly toward the posterior. Posterior obliquely truncate above, rounded below and subangular near the middle. The anterior end broadly rounded

and bearing a few flattened tubercles along the lower half of the margin. The junction of the ends with the dorsal margin forms mild angulations. Surface of the carapace swollen, finely reticulate over the central portion and bearing a sub-central node at the position of the muscle scars behind which is a broad, semicircular, shallow sulcus. The eye spots are well marked and there are two small spines, one near the dorsal margin about one-third of the distance from the posterior cardinal to the anterior cardinal angle, the other below and slightly in front of it on the inflated portion. These two spines are more pronounced in the right valve than in the left and are not present on all specimens. Viewed from the inside, the valves are moderately deep, irregular and sufficiently transparent so that the reticulate pattern shows through from the outside. The marginal area is very narrow throughout and bears only a small number of radial pore canals. The ventral margins of both valves are flanged, that of the right valve at about the middle; that of the left valve, slightly behind the middle. The flange of the left valve tends to be bifid. The hinge of the right valve consists of two, low, elongate teeth which reach their greatest height toward the extremities. The dorsal margin is straight between them and carries a very faint, narrow groove, which is minutely crenulate. The hinge of the left valve is wholly toothless. The straight, sharp edge of the dorsal margin fits into the fine groove of the opposite valve and the margin at anterior and posterior cardinal angles is gently arched to fit over the teeth of the opposite valve. The muscle scar pattern consists of four, oval muscle scars in a vertical row, in front of and below which is a second row of four muscle scars which are spaced at unequal distances.

Dimensions of Holotype No. 1043, a right valve, from Locality 41: length, 0.66 mm.; height, 0.38 mm.; and Paratype No. 1044, a left valve, from Locality 41: length, 0.68 mm.; height, 0.39 mm.

Named in honor of Mr. Jack Chambers, Paleontologist, United Gas Company, Houston, Texas, who helped in the preliminary study of this fauna.

The species also occurs at Locality 40. This species belongs to a genus which has a large number of representatives in the Miocene of the Gulf and Atlantic coasts. It is closely related to *Cythere dorsicornis* Ulrich and Bassler, var. *bicornis* Ulrich

and Bassler, described from the Choptank Miocene of Pawpaw Point, Maryland, which variety, however, differs in having reticulations over the entire carapace.

Genus CYTHEREIS Jones

Cythereis exanthemata (Ulrich and Bassler), var. *marylandica* Howe and Hough, n. var.

Plate I, figures 1-5; Plate IV, figure 7.

Carapace oblong, subquadrate, obliquely rounded at the ends, the greater curvature being below the middle of the anterior end and at the middle of the posterior end. The anterior end is fringed with numerous small, flattened spines, bordered by a marginal ridge which starts at the ocular spot just below the dorsal margin and continues almost to the middle, where it breaks up into a second row of broad, flattened spines. The posterior end is fringed by a double row of spiny tubercles, and the ventral margin carries a few obscure, spiny protuberances. The central portion of the valve is decorated with three distinct, longitudinal rows of vertically elongated spines. One of these rows parallels the dorsal margin and the spines project over it. The second row starts at the central bump formed by the muscle scar attachment and continues obliquely across the central portion of the carapace to a point below and in front of the posterior cardinal angle, where a vertical row of three or four nodes connects with the dorsal row. The third row is situated just above the ventral margin and parallels the second row. Viewed from the inside, the valves are moderately shallow and the depressed portion is bordered by a wide, distinct marginal area around the anterior, ventral and posterior. This marginal area is crossed by numerous paired radial pore canals which terminate in the flattened spines on the ends. The marginal areas of both valves have two, parallel "lip-lines" or faintly incised grooves, and both are infolded slightly just anterior to the middle of the ventral side. The hinge of the right valve consists of a prominent anterior tooth, in front of which is a deep depression leading to the "eyespot." Behind and beneath the tooth is an oblique socket, which continues as a narrowing, shallow furrow below the dorsal margin to the posterior cardinal angle, where is situated a rounded, backwardly curved tooth. The hinge of the left valve consists of a large, deep socket at the anterior, separated from the "eyespot" depression by a thin, oblique septum. Behind the

socket is a small, blunt knob, the upper edge of which connects with a high, straight bar leading to the posterior cardinal angle. The bar is separated from the dorsal margin by an incised line. The posterior cardinal angle is marked by a large, deep socket open to the interior. Muscle scars consist of four oval spots in a vertical row, in front of the middle of which is a fifth, and below it a sixth.

Dimensions of Cotype No. 896: length, 0.93 mm.; height, 0.56 mm.; thickness, 0.52 mm.

All figured specimens are from the Calvert formation Miocene of Plum Point, Maryland. The variety occurs rarely in the Arca zone of the Choctawhatchee at Localities 15, 40 and 41. It is somewhat commoner in the Upper Choctawhatchee at Locality 14 and K. E. Young Locality 34. It is much higher and more coarsely ornamented than the typical form which was described from the Calvert formation of Maryland.

Cythereis exanthemata (Ulrich and Bassler), var. *gomillionensis* Howe and Ellis, n. var.

Plate I, figures 6-12; Plate IV, figure 3.

Variety differing from the preceding in its much smaller size, more elongate form, more delicate ornamentation and in the greater number of nodes which decorate the central portion of the carapace. In particular there are usually three additional nodes in front of the central row of spines placed approximately equidistant between the muscular tubercle and the anterior rim. In addition this variety possesses a supplementary row of very fine, globular nodes situated above the dorsal row of spines along the hinge-line of the right valve. In most specimens this line of nodes extends the entire distance from the anterior cardinal angle to the posterior cardinal angle, but in some specimens is found only on the anterior half of the hinge-line. This supplementary row of nodes easily separates this variety from either the preceding variety or from the typical species.

Dimensions of Cotype No. 888, a complete female specimen: length, 0.79 mm.; height, 0.43 mm.; thickness, 0.43 mm.; and Cotype No. 899, a male left valve: length, 0.73 mm.; height, 0.39 mm.

All figured specimens came from the *Arca* zone of the Choctawhatchee Miocene, Locality 41. The variety occurs commonly also at Localities 15 and 40.

Cythereis garretti Howe and McGuirt, n. sp.
Plate III, figures 17-19; Plate IV, figures 5, 15.

Carapace ovate, the dorsal and ventral margins nearly parallel so that the height varies but little between the anterior and posterior cardinal angles; greatest thickness just posterior to the middle and being equal to somewhat more than one-half the length. The surface is irregularly papillate except in the anterior and posterior margins. The dorsal margin is nearly straight, the ventral margin inwardly flexed toward the middle, the anterior and posterior ends broadly rounded and bordered by a moderately broad marginal area, which is crossed by numerous fine, nearly straight radial pore canals. The inner margin and line of concrescence coincide throughout. The marginal area of the right valve bears four, well-defined lip-lines. The outermost two of these grooves start above the anterior hinge tooth and parallel the outer margin to the posterior side of the posterior hinge tooth. They are flanked on the inside by a moderately high flange, inside of which are two faintly incised lines. The outer margin of the left valve is acute and is only faintly marked by lip-lines. The hinge of the right valve consists of a high, strong anterior tooth, situated immediately above a small, circular, ocular pit and behind which is a deep, subcircular socket. Extending from this socket to the posterior cardinal angle is a well defined groove below a narrow, sharp bar, which is separated from the dorsal margin by a faintly incised line. The posterior tooth is large, blunt, slightly curved and is elongated parallel to the postero-dorsal slope. The hinge of the left valve is more delicate and consists of a large, anterior socket above and separated from a small, ocular pit by a thick, low septum. Behind the socket is a nearly circular tooth, from the posterior side of which extends a long, straight bar to a broad, oval, shallow, posterior socket. The bar is separated from the dorsal margin by a deeply incised groove and it continues as a semicircular rim around the outside of the posterior socket. The muscle scar pattern consists of four small spots in a vertical row, with two in front and two near the ventral margin.

Dimensions of Cotype No. 1058, a right valve from the *Arca* zone, Locality 41: length, 0.96 mm.; height, 0.61 mm.; and Cotype No. 1057, a left valve from the *Arca* zone, Locality 40: length, 0.92 mm.; height, 0.61 mm.

The species is based on these two specimens, which were the only ones found in the samples from the *Arca* zone. There is a somewhat similar species which occurs rarely in the *Ecphora* zone of the Choctawhatchee, at Jackson Bluff, Leon County, Florida. The *Ecphora* specimens, however, are much less ornate. The species is related to *Cythere clarkana* Ulrich and Bassler from the Calvert formation of Maryland, but that species is more elongate and the ventral side of it is distinctly flattened.

Named in honor of Julius B. Garrett, Jr., Chief Paleontologist, Stanolind Oil and Gas Co., Houston, Texas.

Cythereis gunteri Howe and Chambers, n. sp.
Plate I, figures 13-17; Plate IV, figure 1.

Carapace small, subovate; highest at the anterior cardinal angle, thickest at the small node just anterior to the middle. Dorsal outline straight except for slight projections at the cardinal angles. Ventral outline slightly sinuous. Anterior end broadly and obliquely rounded, slightly produced ventrally with a faintly raised rim, below which are eight or more small tubercles situated below the middle. Posterior end narrower, yet broadly rounded and slightly produced dorsally. The surface of the valves is ornamented with a number of raised lines which radiate irregularly from a small node just anterior to the middle. Surface of the valves smooth, sparsely punctate. The hinge of the right valve consists of a high, sharp anterior tooth, behind which is a small, nearly circular socket, which continues as a narrow groove below the sharp edge of the dorsal margin to the posterior cardinal angle, where a high, blunt tooth is situated oblique to the dorsal margin. The ventral margin has a small, inordinately curving flange just in front of the middle. The hinge of the left valve has a deep, nearly circular anterior socket, which is flanked in front by a knob-like projection of the dorsal margin, behind by a dorsally curved, sharp, almost tooth-like plate. At the posterior end of the hingeline there is a deep, oblique socket and between the anterior and posterior hingements, the dorsal margin is straight and sharp without any noticeable sign of a groove. The posterior, ventral and anterior margins are doubly grooved by two faint incised lines and the ventral margin is thickened and slightly flanged near the middle. The line of concrescence corresponds to the inner margin ex-

cept for a very short distance around the anterior end. The marginal area is broad and traversed by numerous thread-like radial pore canals, the pore canals being grouped in bunches of two, three and four.

Dimensions of Cotype No. 1000: length, 0.85 mm.; height, 0.48 mm.; thickness, 0.37 mm.; Cotype No. 1009: length, 0.86 mm.; height, 0.50 mm.; and Cotype No. 1010: length, 0.83 mm.; height, 0.43 mm.

Named in honor of Herman Gunter, for many years State Geologist of Florida.

This species is closely related to *Cythere martini* Ulrich and Bassler, described from the Choptank and Calvert formations of Maryland. It differs from it in having much fewer and coarser ribs over the central portion of the carapace. In *Cythere martini*, the ornamentation consists of a reticulate network formed by small transverse bars between the radial ribs.

The figured specimens are described from the *Arca* zone of the Choctawhatchee Miocene, Locality 41. It occurs also at Localities 15 and 40, but has not been observed elsewhere.

Cythereis producta (Ulrich and Bassler).

Plate I, figures 31, 32, 35-37; Plate IV, figures 11, 12.

Cythere producta Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 115, pl. 36, fig. 17; pl. 38, figs. 28-30.

Carapace in side view elongate ovate, dorsal and ventral margins slightly sinuous and nearly parallel, the anterior end broadly and obliquely rounded and forming a distinct and prominent angulation with the dorsal margin, produced ventrally, faintly rimmed and decorated with eight to ten small, marginal teeth below the middle. The posterior end rounded, but tending to a slight angularity just above the middle. It, too, tends to be faintly denticulate. The remainder of the surface is reticulate with a tendency for the reticulations to be elongated longitudinally. There is a low swelling marking the position of the muscle attachment just anterior to the middle and the eyespots are small, circular and very clearly defined. Greatest height at the anterior cardinal angle; greatest thickness near the posterior end, but it is only slightly more than the thickness near the anterior end. Viewed from the inside, the valves are moderately shallow, particularly at the anterior ends and fringed with a fairly wide marginal area. The line

of concrescence lies between the inner and outer margins, around the anterior end and around the central portion of the posterior end. The marginal area of the right valve bears a broad, shallow lip-line near the outer margin, into which the acute outer margin of the left valve fits. The ventral margins of both valves are incurved and flanged just anterior to the center, the flange of the left valve being bifid. The hinge of the right valve consists of a high, sharp anterior tooth, whose base curves posteriorly downward below a deep anterior socket which is situated, immediately above and behind, a small circular, ocular pit. The inner edge of the dorsal margin appears to be faintly grooved and the posterior cardinal angle is occupied by a large, oval, mushroom-shaped tooth. The hinge of the left valve consists of a deep, circular, anterior socket, situated above and behind a small, circular, ocular pit and separated from it by a low, thick septum. The dorsal margin projects in a tooth-like manner immediately in front and behind the socket, otherwise it is straight, narrow and sharp to the posterior angle, where is situated an ovate pit, partially open to the interior. The radial pore canals are numerous; normal pore canals are few and widely spaced and mostly obscured by the reticulate ornamentation.

Dimensions of Plesiotype No. 1023: length, 0.90 mm.; height, 0.42 mm.; thickness, 0.37 mm.

The figured specimens are all from Locality 41 at Red Bay, Florida. The species occurs also at Localities 15 and 40. The Florida Miocene specimens have been compared with numerous specimens from the Calvert formation of Plum Point, Maryland, the type locality, and are apparently identical in every particular. So far, the species has been found only in the *Arca* zone of the Choctawhatchee Miocene of Florida.

Cythereis rugipunctata (Ulrich and Bassler).

Plate I, figures 18, 20-22; Plate IV, figures 22, 23.

Cythere rugipunctata Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 118, pl. 38, figs. 16, 17.

Carapace in side view elongate ovate; highest at the anterior cardinal angle; thickest at the muscular protuberance. Anterior end broadly and obliquely rounded with a distinct rim and with four or five small marginal spines in the ventral half; posterior end concave in the dorsal half, convex and ornamented with three or four prominent spines in the ventral

half. Dorsal margin nearly straight, ventral margin sinuous, with two margins tending to converge posteriorly. Ornamentation of the central portion of the carapace consisting of a prominent node just anterior to the center, behind and below which is a curved sulcus. The surface of the posterior half of the carapace is a complex of oblique plications which tend to produce a divaricate effect along the median line of the valves. Anterior to the central node, the plications are irregularly distributed. There is a small, ocular spot just below the anterior cardinal angle. Viewed from the inside, the valves are moderately deep and are bordered with a wide marginal zone, widest along the posterior half of the ventral margin. The marginal area of the right valve possesses a well marked "lip-line" just inside the outer margin, into which the acute outer margin of the left valve articulates. The radial pore canals are moderately few in number, being most abundant around the anterior end. The hingement of the right valve is elongate and consists of a small, high anterior tooth, behind which is a deep socket, tending to be open to the interior. From this socket a narrow, straight groove parallels the dorsal margin to the oblique, blunt, recurved posterior tooth. There is also a second groove below the first, which starts at the anterior socket and continues back about one-fifth the distance to the posterior cardinal angle. The hinge of the left valve consists of a small anterior socket, behind which is a moderately high tooth, followed by a straight bar parallel to and separated from the dorsal margin by a faint incised line. This bar terminates at its posterior end in a small swelling and is in turn followed by a wide, oblique socket, which is open to the interior of the valve.

Dimensions of Plesiotype No. 1011: length, 0.65 mm.; height, 0.38 mm.; thickness, 0.36 mm.

The figured specimens are all from the *Arca* zone of the Choctawhatchee Locality 40, where the species is quite common. It occurs also at Localities 15 and 41 and is increasingly more abundant in Miocene and Pliocene localities younger than the *Arca* zone. The writer's collections do not, however, show it to be present in beds older than the *Arca* zone, though there is a closely related but much smaller species in the Byram marl (Oligocene of Mississippi).

Cythereis vaughani (Ulrich and Bassler).

Plate III, figures 24-26; Plate IV, figure 13.

Cythere vaughani Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 109, pl. 38, figs. 25-27.

Carapace elongate with an obliquely rounded anterior end and a posterior end that is rounded below the middle and concave above. The dorsal margin is nearly straight, the ventral subparallel to it and slightly sinuous. The anterior, ventral and lower half of the posterior margins are finely and evenly denticulate, particularly in the right valve. Viewed from the outside, the anterior end carries a thin marginal rim. Surface with three or four longitudinal ridges and an irregular number of transverse raised bars, forming an angularly reticulate pattern which is somewhat variable. In addition to the pattern of ridges, the valves bear a small, round, almost glassy knob just in front of the center and a somewhat similar glassy tubercle at the "eyespot" just below the anterior cardinal angle. Viewed from the interior, the valves are moderately deep and are fringed with a fairly broad marginal area, which, in the right valve, carries a deeply grooved lip-line near the outer margin to receive the rather acute marginal edge of the opposite valve. Radial pore canals are numerous and closely spaced around the anterior end, becoming fewer and wider spaced along the ventral and posterior margins. The hinge of the right valve consists of a small, knob-like anterior tooth, in front and below which lies a small, ocular pit and behind which is a large, shallow depression open to the interior. This pit is situated below a long, straight, narrow, oblique hinge bar, which terminates at the posterior cardinal angle above a small, round, knob-like tooth which is situated on the posterior margin. The hinge of the left valve consists of a small anterior socket, situated above and behind a deep ocular pit and separated from it by a low rim, and with two tooth-like projections, one just in front, formed by an overlap of the dorsal margin, the other immediately behind and below the dorsal margin. The dorsal margin is nearly straight and oblique and faintly grooved. The posterior cardinal angle is occupied by a large, shallow socket, which is elongated parallel to the posterior slope.

Dimensions of Plesiotype No. 1073: length, 0.73 mm.; height, 0.38 mm.; thickness, 0.30 mm.

The figured specimens are all from the Choctawhatchee Miocene, K. E. Young Locality 34. The species occurs rarely

in the *Arca* zone, Locality 41. It occurs with increasing abundance in Miocene localities younger than the *Arca* zone of the Choctawhatchee, and is one of the commonest ostracodes in the Caloosahatchee Pliocene of Florida, and an almost identical form is living off the coast of Haiti. It has not so far been observed in deposits older than the *Arca* zone.

Cythereis (*Pterygocythereis*) *cornuta*, var. *americana* Ulrich and Bassler.

Plate II, figures 19, 21-24; Plate IV, figure 24.

Cythereis cornuta var. *americana* Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 122, pl. 37, figs. 29-33.

This species was described from the Calvert formation at Plum Point on Chesapeake Bay, Maryland. The writer has had numerous specimens from the type locality for comparison and is convinced that the common *Pterygocythereis* of the Florida Middle Miocene should be considered as no more than a variant of the Maryland species. The present author will describe some of the details of the carapace, not mentioned in the original description, as an aid in recognition.

The hinge of the right valve is rather delicate and consists of a moderately small, knob-like tooth on the anterior end, behind which is a small, circular depression which continues as a narrow groove below and parallel to the dorsal margin to the anterior cardinal angle, where is located a low, oval, blunt tooth. The hinge of the left valve is slightly more robust and consists of an anterior socket open below, behind which is a small, sharp tooth situated immediately below the dorsal margin. The dorsal margin is thin and sharp and fits into the groove of the opposite valve. The posterior cardinal angle is occupied by an elongate socket open in the interior. The marginal areas are moderately broad on the anterior and posterior ends and carry a few widely spaced radial pore canals. These pore canals tend to be grouped in pairs, particularly on the anterior end. The species ranges from the Chipola to the Upper Choctawhatchee; Localities 10, 15, 28, 40, 41 and K. E. Young Locality 34.

Dimensions of Plesiotype No. 1039, from Shoal River Miocene, one mile west of Valley Church, Walton County, Florida; length, 0.95 mm.; height, 0.44 mm.; thickness, 0.63 mm.

Genus HEMICYTHERE Sars

Hemicythere conradi Howe and McGuirt, n. sp.

Plate III, figures 31-34; Plate IV, figure 17.

Carapace small; thickest near the middle, greatest thickness being slightly less than one-half the length; highest at the anterior cardinal angle; in side view subovate. Dorsal margin faintly arched, ventral margin with a slight concavity near the middle; both margins converging posteriorly. Anterior end broadly rounded, dorsal portion oblique; posterior end narrow, compressed and with distinct angles where it meets the dorsal and ventral margins; both anterior and posterior ends possess a low, rounded rim. Surface of the valves reticulate, the reticulations being somewhat linear in arrangement. Interior of the valves deep, nearly smooth. The inner margin projects around the anterior, ventral and posterior ends, and the line of concrescence lies nearer the outer margin on the anterior end, and nearer the inner margin on the posterior end. The marginal area of the left valve possesses a faint groove into which is fitted a low, sharp ridge in the marginal area of the right valve. The ventral margins of both valves are slightly flanged just anterior to the middle. The hinge of the right valve consists of a large, high, knob-like tooth on the anterior end, behind which is a large, broad pit, followed by a narrow groove which parallels the dorsal margin and is terminated at a large, oval, oblique, projecting tooth at the posterior cardinal angle. The hinge of the left valve consists of a deep, nearly circular socket, behind which is a low, broad, blunt tooth, the upper edge of which joins a low, sharp bar, which parallels the dorsal margin and which is separated from the dorsal margin by a broad, depressed area. The posterior end of the hinge is occupied by a large, shallow, oval socket. The muscle scar pattern is situated somewhat anterior to the middle of the carapace and consists of eleven, irregular, small, lucid spots. The muscle scar pattern is taken from Paratype No. 1076, a specimen found in the *Cancellaria* zone of the Choctawhatchee Miocene at Jackson Bluff, Locality 14.

Dimensions of Cotype No. 1066, a complete specimen, Locality 41: length, 0.60 mm.; height, 0.38 mm.; thickness, 0.26 mm.; Cotype No. 1068, a right valve: length, 0.58 mm.; height, 0.34 mm.; and Cotype No. 1067, a left valve, Locality 40: length, 0.60 mm.; height, 0.40 mm.

Named in honor of Timothy Conrad, the pioneer paleontologist of the Gulf Coast.

This species has a range in our collections from the Chipola formation to the top of the Choctawhatchee.

Hemicythere dalli Howe and Brown, n. sp.
Plate II, figures 1-3; Plate IV, figure 18.

Carapace small, elongate, thickest in front of the middle, highest toward the anterior. Dorsal margin nearly straight; anterior cardinal angle has a small, glassy tubercle just below it in each valve. Anterior end broadly rounded and rather strongly produced ventrally. Ventral margin concave inward, the point of greatest concavity lying in front of the middle. Dorsal half of the posterior margin obliquely truncated, ventral half more rounded. Surface marked with very faint ribs, the most pronounced running parallel to and near the posterior margin. Behind this rib the thickness decreases sharply. The remaining ribs, six or seven in number, when present, are very faint and tend to run longitudinally, though curving near the anterior end. The inner surface of the valves finely granular in appearance except in the marginal areas which are crossed by numerous straight, nearly evenly spaced, radial pore canals. The hinge of the right valve consists of a small, knob-like anterior tooth, behind which is a deep, oval, oblique socket from which extends a narrow groove, parallel to and just below the dorsal margin, which is faintly arched. The posterior end of the hingement consists of a large, blunt tooth, elongated parallel to the postero-dorsal slope. There is a small, sharp, inwardly curved flange near the center of the ventral margin. Immediately below this flange there is a shallow groove which continues along the center of the margin to the posterior end. The hinge of the left valve consists of a deep, anterior socket, behind which is a nearly circular, pointed tooth. A straight, narrow bar extends from the upper edge of this tooth to a large posterior socket; the bar is separated from the dorsal margin by a narrow, incised line.

Dimensions of Cotype No. 1026: length, 0.65 mm.; height, 0.34 mm.; and Cotype No. 1027: length, 0.67 mm.; height, 0.33 mm.

Named in honor of Dr. William Healey Dall, who will be forever remembered for his monumental work on Tertiary faunas of Florida.

This species is abundant in the upper Oak Grove sand, Locality 29. The species shows considerable variation in the matter of ornamentation, ranging from specimens which have a completely smooth surface to ones in which the low ribs, above described, are clearly discernable. In the *Arca* zone of the Choctawhatchee, a single complete specimen was found in which the ribs were so pronounced that the authors felt it advisable to give it a tentative varietal name.

Hemicythere dalli Howe and Brown, var. *redbayensis* Howe and Brown,
n. var.
Plate II, figures 4, 7.

This variety differs from the typical form in being much lower posteriorly and in having much more pronounced ornamentation. It possesses much of the same pattern of longitudinal ribs as *Cythere punctistriata* Ulrich and Bassler of the Maryland Miocene, but that species has a definite reticulate pattern of cross riblets between the main ribs, and the left valve is considerably more pointed posteriorly. It is based on a single complete specimen, Holotype No. 1028, found in the *Arca* zone of the Choctawhatchee, Locality 40.

Dimensions of Holotype No. 1028: length, 0.54 mm.; height, 0.30 mm.; thickness, 0.21 mm.

Hemicythere sellardsi Howe and Neill, n. sp.
Plate II, figures 6, 10.

Carapace small, compressed, subtriangular in outline, the dorsal and ventral margins sinuous and converging toward the posterior. The anterior end broadly rounded, the posterior end much narrower and distinctly angled where it meets the dorsal and ventral margins. The ornamentation consists of a prominent, raised rim, which starts at the anterior cardinal angle, follows for some distance the anterior and ventral margins, then turns sharply upward to the posterior cardinal angle, where it tends to form a knob. From this knob, a low rim parallels the dorsal margin about one-half the distance back toward the anterior cardinal angle. There are a number of short, transverse, raised ribs on either side of this rim which produce subreticulate effects about the borders. Central portion of the carapace is nearly smooth.

Dimensions of Holotype No. 1031: length, 0.59 mm.; height, 0.32 mm.; thickness, 0.20 mm.

Named in honor of E. H. Sellards, formerly State Geologist of Florida.

The species is based on a single complete carapace found in the Choctawhatchee Miocene, Locality 40. The author felt that its appearance was so unique that, even though based on a single specimen, it was worthy of a specific name.

Genus *BASSLERELLA* Howe, n. gen.

Genotype *Basslerella miocenica* Howe.

Carapace elongate, ovate, nearly twice as long as high; thickest and highest posterior to the middle; the dorsal and ventral margins subparallel; the anterior end regularly rounded; the posterior end rounded below, subtruncate above, forming almost a right angle with the dorsal margin; surface smooth; the left valve considerably larger than the right and overlapping it, the greatest overlap being at the postero-dorsal angle and along the middle of the ventral margin. Viewed from above, the carapace is bluntly wedge-shaped, the sides sloping from near the posterior end toward the anterior, which is narrowly rounded. Viewed from the inside, the valves are moderately shallow and smooth. The marginal area is moderately broad and the line of concrescence lies between the inner and outer margins around the anterior end. The radial pore canals around the anterior end are comparatively few in number and are bent upward in the upper half and downward in the lower half. They are few in number along the ventral and posterior margins. The hinge of the right valve consists of a strong, high, sharp, anterior tooth, which lies immediately below a faint depression of the antero-dorsal slope. Immediately behind it lies a deep, oblique socket, behind which there extends a narrow groove below and parallel to the dorsal margin, the groove becoming deeper as the posterior is approached. The posterior cardinal angle is occupied by a high, dorsally recurved, oblique, mushroom-shaped tooth. This tooth projects above and back from the dorsal margin and is responsible for the pronounced angulation at the posterior socket of the opposite valve. The hinge of the left valve consists of a deep anterior socket, which is open to the interior in front. It is flanked behind by a narrow, high, pointed, almost blade-like tooth, which is distinctly separated from the dorsal margin by a well defined groove. This groove, or in-

cised line, extends along the edge of the dorsal margin all the way from the anterior socket to the posterior socket. Below the groove lies a heavy, thick bar, the anterior end of which is downward and outwardly curved to form the previously mentioned blade-like tooth. The posterior cardinal angle is occupied by a deep, oval, oblique socket, flanked on either side by slight swellings of the margin.

To this genus the writer assigns the specimens figured by Muller⁴ as *Cythereis teres* Brady. The Florida Miocene specimens, while common, do not show the muscle scars well. Muller's figure shows four oval scars in a verticle row near the center, a short distance in the front of the middle of which is a small, heart-shaped spot.

Basslerella miocenica Howe, n. sp.

Plate I, figures 19, 24-26.

Carapace elongate, ovate, bean-shaped, smooth; thickest and highest posterior to the middle. Dorsal and ventral margins slightly arched and subparallel, the anterior end regularly rounded and the posterior end rounded below, subtruncate above, forming almost a right angle with the dorsal margin. The left valve is considerably larger than the right and overlaps it; the greatest overlap being at the posterior cardinal angle and along the middle of the ventral margin. Viewed from above, the carapace is bluntly wedge-shaped, the sides sloping from near the posterior end toward the anterior, which is narrowly rounded. Viewed from the inside, the valves are moderately shallow and smooth, flanked by a broad marginal area around the anterior end and a much narrower marginal zone along the ventral and posterior sides. The line of concrescence coincides with the inner margin except around the central portion of the anterior end, where it comes close to the outer margin. The radial pore canals are only moderately common around the anterior end and tend to be inclined away from the center of the anterior. They are fewer in number along the ventral and posterior margins. The margin of the right valve carries a sharp lip near the outside, which is slightly incurved near the middle of the ventral margin. It fits into a faintly incised lip-line in the left valve. The hinge of the right valve consists of a strong, high, sharp anterior

⁴Muller, G. W., "Fauna and Flora des Golfes von Neapel," Berlin, 1894, p. 379, pl. 29, figs. 6, 15; pl. 31, figs. 35-39.

tooth, which lies immediately below a faint depression of the antero-dorsal slope. Immediately behind it lies a deep, oblique socket, behind which there extends a narrow groove below and parallel to the dorsal margin, the groove becoming deeper as the posterior is approached. The posterior cardinal angle is occupied by a high, dorsally recurved, oblique, mushroom-shaped tooth. This tooth projects above and back from the dorsal margin and is responsible for the pronounced angulation at the posterior socket of the opposite valve. The hinge of the left valve consists of a deep, anterior socket which is open to the interior in front. It is flanked behind by a narrow, high, pointed, almost blade-like tooth, which is distinctly separated from the dorsal margin by a well defined groove. This groove, or incised line, extends along the edge of the dorsal margin all the way from the anterior socket to the posterior socket. Below the groove lies a heavy, thick bar, the anterior end of which is downward and outwardly curved to form the previously mentioned blade-like tooth. The posterior cardinal angle is occupied by a deep, oval, oblique socket, flanked on either side by slight swellings of the margin.

Dimensions of Cotype No. 1014: length, 0.51 mm.; height, 0.28 mm.; thickness, 0.22 mm.

Cotypes Nos. 1014 and 1015 came from the Choctawhatchee Miocene near Ward, Florida, K. E. Young Locality 34. Paratype No. 1016 came from the *Arca* zone of the Choctawhatchee, Locality 40. The species is rare in the *Arca* zone, but is much more common in the upper part of the Choctawhatchee. It has not as yet been observed in the Caloosahatchee Pliocene.

Genus CYTHERETTA Muller

Cytheretta bassleri Howe, n. sp.
Plate III, figures 21, 22.

Carapace elongate, ovate, highest and thickest near the posterior. Dorsal margin gently curved upward; the ventral margin slightly concave immediately in front of the center. The anterior end of the right valve obliquely rounded, produced ventrally. The posterior end subacute just above the middle. At either end of the dorsal margin there is a concave notch for the overlap of the cardinal projections of the dorsal margin of the opposite valve. The outline of the left valve is nearly oblong ovate. The valves are ornamented near the

center by fine, sinuous lines, arranged in an obliquely longitudinal direction. Viewed from the inside, the valves are only moderately deep and the margins are flanked by the characteristic marginal area of the genus. The right valve possesses a raised rim immediately inside and parallel to the outer margin around the anterior, ventral and posterior sides. The hinge of the right valve consists of a strong, blunt, anterior tooth, behind which is a much smaller oblique socket, the posterior side of which continues as a narrow groove beneath the straight dorsal margin to the posterior cardinal angle. There is also a narrow, blade-like tooth which parallels the posterior slope. The hinge of the left valve is identical of that of *Cytheretta burnsi*.

Dimensions of Holotype No. 1059: length, 1.14 mm.; height, 0.55 mm.

This species is based on numerous specimens from the *Arca* zone at Locality 40. This species is closely related to *Cythere inaequivallis* Ulrich and Bassler which occurs abundantly in the Shoal River Miocene of Florida. The fine, longitudinal lines, which decorate the central portion of the carapace, easily separate it from that species, however. There is another variant of it in the Upper Choctawhatchee of Ward, Florida, the ventral side of which species is longitudinally striate throughout.

Cytheretta burnsi (Ulrich and Bassler).

Plate II, figures 12-14, 17, 20; Plate IV, figures 14, 21.

Cythere burnsi Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 103, pl. 36, figs. 34-39.

Carapace elongate ovate, highest and thickest near the posterior end, the dorsal margin straight, the ventral margin sinuous, the anterior and posterior ends broadly rounded. The central part of the valves is ornamented by a reticulate pattern of pits and ridges; many of the pits occurring in pairs and tending to be hexagonal in outline and the sculpture being longitudinal in its arrangement. The left valve is larger than the right and overlaps it, particularly at the cardinal angles. Viewed from the inside, the valves are moderately deep with a broad marginal area, the inner margin of the anterior end possessing the characteristic "S" shape of the genus. The radial pore canals are very elongate and fairly numerous. On the anterior end they radiate from a point just in front of the muscle scars. The outer edge of the right valve is thick-

ened and sharp and slightly keeled toward the center of the ventral margin. In the left valve there is a faint lipline which lies just within the outer margin. The hinge of the right valve consists of a strong anterior tooth, shaped like a pointed triangular pyramid. Behind it lies a deep socket open to the interior. From the posterior side of this socket, a shallow groove extends half-way back along the hingeline. The edge of the dorsal margin is straight and carries a faint groove. The posterior tooth is strong, rounded, oblique and recurved in the direction of the posterior extremity. The hinge of the left valve consists of large terminal sockets which are at least partially open to the interior. The anterior socket is flanked in front by a strong, tooth-like projection of the dorsal margin; behind by a heavy, blunt, inwardly deflected tooth. The posterior socket is flanked behind and partially covered by a long pointed fold of the margin. Between the sockets there is a narrow, minutely crenulate, straight bar, separated from the dorsal margin by a faintly incised line.

Dimensions of Plesiotype No. 1034, a left valve: length, 1.28 mm.; height, 0.66 mm.; and Plesiotype No. 1035, a right valve: length, 1.24 mm.; height, 0.63 mm.

Both Plesiotypes are from the *Arca* zone of the Choctaw-hatchee, Locality 41. This species occurs in all the *Arca* zone localities.

Cytheretta karlana Howe and Pyeatt, n. sp.
Plate I, figures 30, 34; Plate III, figures 3, 4.

Carapace in side view sub-rectangular, highest anteriorly. Dorsal margin straight or very slightly convex; ventral margin slightly concave. Anterior outline broadly and obliquely rounded and produced ventrally. Posterior end narrower, smooth, rounded and faintly denticulate in the left valve; produced, sub-angulate and bluntly denticulate in right valve. Left valve larger than the right and overlapping it at both ends of the hinge line and at the middle of the ventral margin. The surface covered with a reticulate pattern of elongate pits which are arranged in rows more or less concentric to the middle. The ridges between the rows of pits are mostly low and rounded, but several of them are more prominent than the others and these, tending to converge toward the posterior end, are responsible for the principal irregularities in the pattern. The valves are tumid, being very strongly inflated

ventral and posterior to the middle. Viewed from the inside, the valves are moderately deep, thick and smooth. The marginal areas are broad, the inner margin extending far into the interior of the carapace and forming an "S"-shaped outline in the interior as it extends from a point below the anterior tooth to a point above the middle of the ventral margin. The species is composed of such dense material that the radial pore canals could not be discerned. The outer margin of the right valve is sharp and slightly keeled toward the middle of the ventral side and when it approaches the posterior end, a sharp rim turns directly up, leaving a flattened area behind it. The outer margin of the left valve is marked by a faint lip-line. The hinge of the right valve consists of a high, strong, pyramidal anterior tooth, behind which is a deep socket. From this socket extends a deep, straight groove below a narrow bar to the anterior cardinal angle. This bar is separated from the dorsal margin by a wide, shallow depression. The posterior tooth is ovate in outline, high and recurved toward the posterior. The hinge of the left valve consists of a deep, pointed anterior socket, flanked in front and behind by tooth-like lobes of the dorsal margin. It is partially closed by a thickened rim. The posterior socket is almost identical, but smaller. Between these sockets the dorsal margin is thin and sharp.

Dimensions of Cotype No. 1045: length, 0.95 mm.; height, 0.50 mm.; thickness, 0.47 mm.

Named in honor of Karl E. Young, who supplied so much Florida material used in this report.

All figured specimens are from the Chipola Miocene, Locality 10.

Cytheretta karlana Howe and Pyeatt, var. *choctawhatcheensis* Howe
and Taylor, n. var.
Plate I, figures 28, 29, 33.

This variety differs from the typical species in being smaller and much higher near the posterior end, particularly in the left valve. The anterior end is more regularly rounded and the hinge is much more delicate. The dorsal margin of the right valve is much lower and the groove above the dorsal bar is narrow instead of being wide. The description is based on six specimens found in the *Arca* zone of the Choctawhatchee at Locality 40. This variety has not been observed elsewhere.

Dimensions of Cotype No. 1019: length, 0.88 mm.; height, 0.50 mm.; thickness, 0.42 mm.

Genus CYTHERURA Sars.

Cytherura wardensis Howe and Brown, n. sp.
Plate I, figures 23, 27; Plate IV, figure 19.

Carapace small, elongate, sub-quadrangular in side view, of about same height throughout the length, thickest toward the posterior, valves sub-equal. Dorsal margin high and straight. Ventral margin somewhat sinuate and, in general, parallel to the dorsal margin. Anterior end rounded, compressed; posterior end compressed and marked by a distinct caudal process situated slightly above the middle and turned up slightly toward the dorsal side. Surface marked with fine reticulations. There is a low sulcus just in front of the middle and a small glassy tubercle just below the anterior angle. Surface drops gently toward the dorsal margin, drops off sharply to the ventral margin, forming a broad, flattened ventral surface, longitudinally striated. Ventral margin keeled, especially toward the posterior, the keels of the two valves forming a sharp ridge where the valves meet. Hinge structure imperfectly developed, apparently consisting in the left valve of two terminal teeth connected by a lower bar; in the right valve, two rimmed sockets connected by a faint groove.

Dimensions of Cotype No. 1075, K. E. Young Locality 34, at which place the species is common: length, 0.52 mm.; height, 0.29 mm.; thickness, 0.27 mm.

A single right valve of this species was found in the *Arca* zone of the Choctawhatchee, Locality 15.

Genus PARACYTHERIDEA Muller.

Paracytheridea chipolensis Howe and Stephenson, n. sp.
Plate III, figures 5, 6.

The carapace is elongate, strongly and irregularly alate, with a low, broad, swollen node just in front of the middle, another near the dorsal margin in front of the posterior cardinal angle (this swelling is so great that in side view it obscures about one-third of the hinge line), a small one immediately below and behind it and a high, pointed ala on the posterior end of the well defined ventral ridge. This ridge bifurcates just in front of the middle, so that one portion crosses the sub-central node, the other continues straight along the ventral side. The posterior slope of the ala carries a small carina and behind it there is a short spine on the ventral margin. The dorsal and ventral margins are nearly straight and converging; the anterior end is broadly rounded; the posterior end is dis-

tinguished by a prominent dorsally flexed caudal process in the right valve, which is concavely truncate behind. The posterior end of the left valve is subangulate. It is obliquely truncate in the dorsal and ventral thirds and vertically truncate behind. The eyespots are fairly small and situated immediately below the anterior cardinal angle. Viewed from the inside, the valves are irregularly deep, the margin of the right valve carries a faint lip-line near the outside. Both valves are slightly flanged just in front of the middle of the ventral margin. The marginal area is narrow and is traversed by only a very few small radial pore canals. The hinge of the right valve consists of a long, straight, narrow, crenulate groove immediately below the dorsal margin. Below each end of this groove there is a narrow, curved, prominent, crenulate cusp. The hinge of the left valve consists of two, terminal, deep, crenulate sockets at the cardinal angles, over which the dorsal margin is gently arched. Between these sockets, the dorsal margin is straight, narrow, sharp and crenulate.

Dimensions of Cotype No. 1047, a right valve: length, 0.66 mm.; height, 0.36 mm.; and Cotype No. 1046, a left valve: length, 0.70 mm.; height, 0.38 mm.

These Cotypes are from the Chipola Miocene, Locality 10.

This species, with minor variations, is found also in the type Oak Grove, Locality 26, and in the Shoal River Miocene, Locality 28. In the Arca zone of the Choctawhatchee, however, it is replaced by *Paracytheridea nodosa* (Ulrich and Bassler).

Paracytherida nodosa (Ulrich and Bassler).

Plate III, figure 7.

Cytheropteron nodosum Ulrich and Bassler, Md. Geol. Surv., Mio. Rept., 1904, p. 129, pl. 38, figs. 37-40.

This differs from the preceding species in being less reticulate and in lacking the divaricating rib along the ventral keel. It is also somewhat more elongate and has a well defined, oblique sulcus, which starts just behind the anterior cardinal angle and continues to a point in front of the sub-central node.

Dimensions of the Plesiotype No. 1048, a left valve from the Choctawhatchee Miocene, Locality 41: length, 0.70 mm.; height, 0.32 mm.

This species occurs rarely in all of the Arca zone localities examined.

PLATES I-IV

PLATE I

- Figures 1-5. *Cythereis exanthemata* (Ulrich and Bassler), var. *marylandica* Howe and Hough, n. var. X 25. Fig. 1, Cotype No. 893, interior of a left valve. Figs. 2, 3, Cotype No. 894, interior and exterior of a right valve. Fig. 4, Cotype No. 895, exterior of a left valve. Fig. 5, Cotype No. 896, dorsal view. Calvert formation, Plum Point, Chesapeake Bay, Maryland.
- 6-12. *Cythereis exanthemata* (Ulrich and Bassler), var. *go-millionensis* Howe and Ellis, n. var. X 33. Fig. 6, Cotype No. 897, interior of a left valve. Fig. 7, Cotype No. 897, exterior of a female left valve. Figs. 8, 9, Cotype No. 898, interior and exterior of a female right valve. Figs. 10, 11, Cotype No. 899, interior and exterior of a male left valve. Fig. 12, Cotype No. 888, dorsal view. Locality 41.
- 13-17. *Cythereis gunteri* Howe and Chambers, n. sp. X 28. Fig. 13, Cotype No. 1000, dorsal view. Fig. 14, Cotype No. 1009, exterior of a left valve. Fig. 15, Cotype No. 1010, exterior of a right valve. Fig. 16, Cotype No. 1010, hinge of a right valve. Fig. 17, Cotype No. 1009, hinge of a left valve. Locality 41.
- 18, 20-22. *Cythereis rugipunctata* (Ulrich and Bassler). X 43. Fig. 18, Plesiotype No. 1011, dorsal view. Fig. 20, Plesiotype No. 1012, interior of a left valve. Figs. 21, 22, Plesiotype No. 1013, exterior and interior of a right valve. Locality 40.
- 19, 24-26. *Basslerella miocenica* Howe, n. sp. X 50. Fig. 19, Cotype No. 1014, dorsal view. Fig. 24, Paratype No. 1016, interior of a left valve. Fig. 25, Cotype No. 1014, left valve view of a complete specimen. Fig. 26, Cotype No. 1015, interior right valve view of a complete specimen. K. E. Young Locality 34.
- 23, 27. *Cytherura wardensis* Howe and Brown, n. sp. X 48. Fig. 23, Cotype No. 1017, interior of a left valve. Fig. 27, Cotype No. 1018, exterior of a right valve. K. E. Young Locality 34.
- 28, 29, 33. *Cytheretta karlana* Howe and Pyeatt, var. *choctawhatcheensis* Howe and Taylor, n. var. Figs. 28, 29, X 30; Fig. 33, X 28. Fig. 29, Cotype No. 1019, right valve view of a complete specimen. Fig. 29, Cotype No. 1020, interior of a left valve. Fig. 33, Cotype No. 1019, dorsal view. Locality 40.
- 30, 34. *Cytheretta karlana* Howe and Pyeatt, n. sp. X 26. Fig. 30, Cotype No. 1021, interior of a right valve from Chipola Miocene. Fig. 34, Cotype No. 1022, interior of a left valve from Chipola Miocene. Locality 10.
- 31, 32, 35-37. *Cythereis producta* (Ulrich and Bassler). X 30. Fig. 31, Plesiotype No. 1023, dorsal view. Figs. 32, 36, Plesiotype No. 1024, exterior and interior of a right valve. Figs. 35, 37, Plesiotype No. 1025, exterior and interior of a left valve. Locality 41.

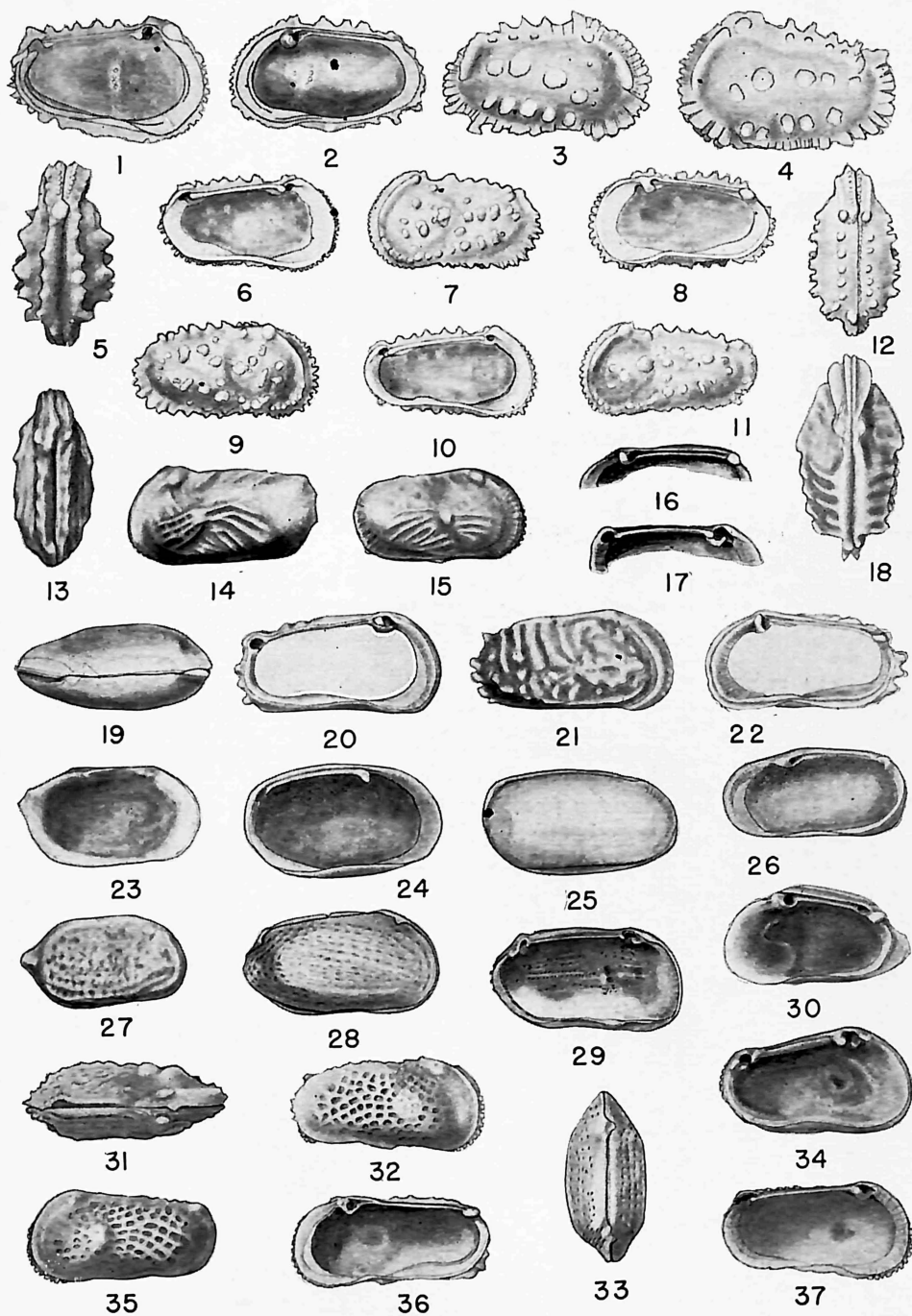


PLATE II

- Figures 1-3. *Hemicythere dalli* Howe and Brown, n. sp. X 50. Figs. 1, 2, Cotype No. 1026, Oak Grove Miocene, interior and exterior of a right valve. Fig. 3, Cotype No. 1027, Oak Grove Miocene, interior of a left valve. Locality 29.
- 4, 7. *Hemicythere dalli* Howe and Brown, var. *redbayensis*, n. var. X 40. Fig. 4, Holotype No. 1028, exterior of right valve. Fig. 7, Holotype No. 1028, dorsal view. Locality 40.
- 5, 8, 9. *Cytheromorpha warneri* Howe and Spurgeon, n. sp. X 56. Figs. 5, 8, Cotype No. 1029, exterior and interior of a left valve. Fig. 9, Cotype No. 1030, interior of a right valve. K. E. Young Locality 34.
- 6, 10. *Hemicythere sellardsi* Howe and Neill, n. sp. X 50. Fig. 6, Holotype No. 1031, exterior of a left valve. Fig. 10, Holotype No. 1031, dorsal view. Locality 40.
11. *Cytheridea choctawhatcheensis* Howe and Stephenson, n. sp. X 28. Holotype No. 1032, exterior of a right valve. Locality 41.
- 12-14, 17, 20. *Cytheretta burnsi* (Ulrich and Bassler). X 26. Figs. 12, 20, Plesiotype No. 1035, exterior and interior of a right valve. Figs. 13, 17, Plesiotype No. 1034, exterior and interior of a left valve. Fig. 14, dorsal view drawn from Plesiotype No. 1034 and No. 1035. Locality 41.
- 15, 16, 18. *Cytheridea floridana* Howe and Hough, n. sp. Figs. 15, 18, X 30; Fig. 16, X 28. Fig. 15, Paratype No. 1036, interior of a right valve. Fig. 16, Holotype No. 1037, exterior, right valve view. Fig. 18, Paratype No. 1038, interior of a left valve. Figs. 15, 18, Locality 41; Fig. 16, Locality 15.
- 19, 21-24. *Cythereis* (*Pterygocythereis*) *cornuta*, var. *americana* (Ulrich and Bassler). X 39. Fig. 19, Plesiotype No. 1039, dorsal view. Fig. 21, Plesiotype No. 1042, interior of a left valve. Figs. 22, 23, Plesiotype No. 1041, interior and exterior of a right valve. Fig. 24, Plesiotype No. 1040, exterior of a left valve. Locality 28.

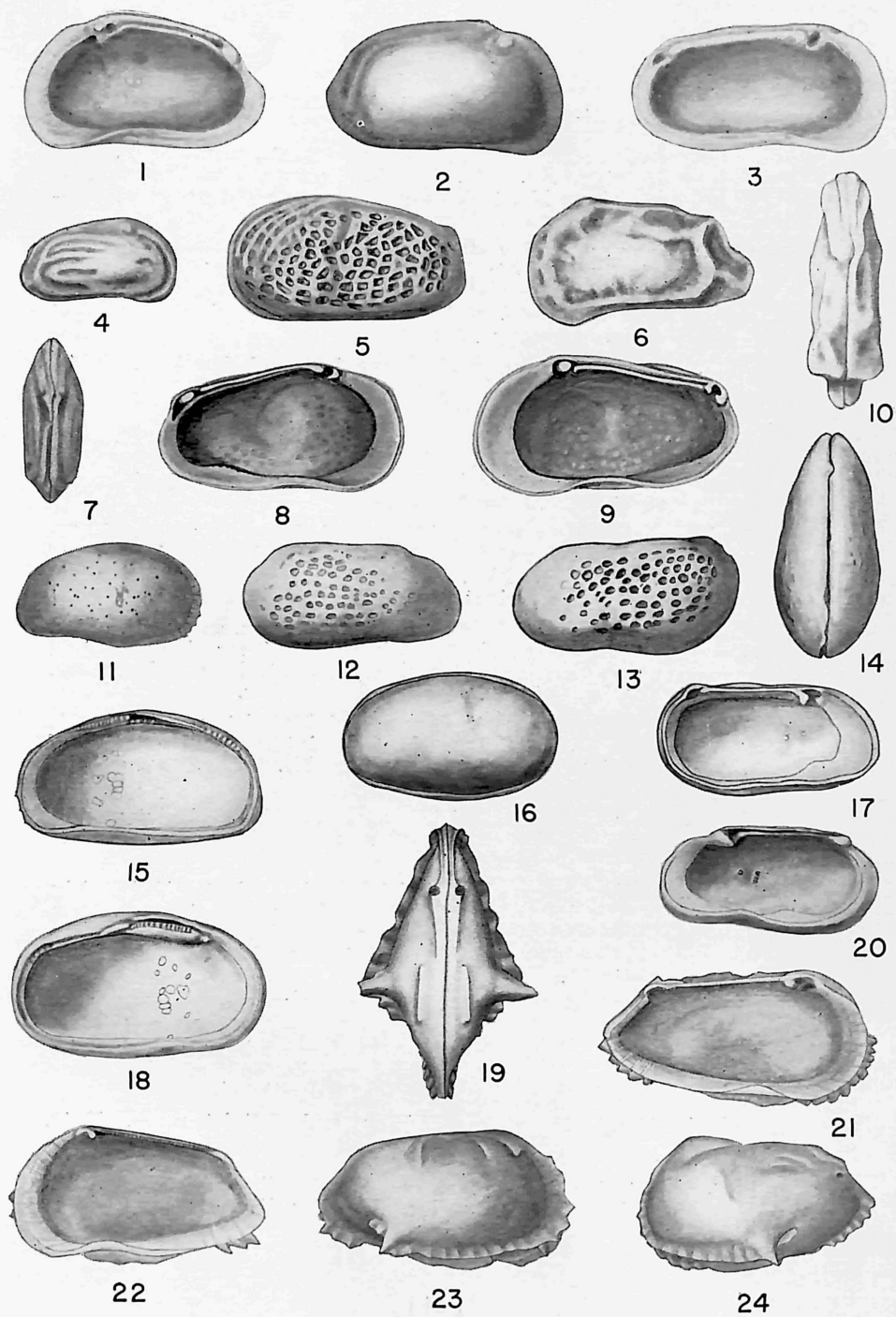


PLATE III

- Figures 1-2. *Cytheridella chambersi* Howe, n. sp. Fig. 1, X 38; Fig. 2, X 43. Holotype No. 1043, interior and exterior of a right valve. Locality 41.
- 3-4. *Cytheretta karlana* Howe and Pyeatt, n. sp. X 29. Fig. 3, Cotype No. 1045, Chipola Miocene, dorsal view. Fig. 4, Cotype No. 1045, exterior of a right valve of complete specimen. Locality 10.
- 5-6. *Paracytheridea chipolensis* Howe and Stephenson, n. sp. Fig. 5, X 44; Fig. 6, X 38. Fig. 5, Cotype No. 1046, Chipola Miocene, exterior of a left valve. Fig. 6, Cotype No. 1047, Chipola Miocene, exterior of a right valve. Locality 10.
7. *Paracytheridea nodosa* (Ulrich and Bassler). X 40. Plesiotype No. 1048, exterior of a left valve. Locality 41.
- 8-10. *Cytherideis ashermani* Ulrich and Bassler. X 22. Fig. 8, Plesiotype No. 1049, interior of a left valve. Figs. 9, 10, Plesiotype No. 1050, exterior and interior of a right valve. Locality 40.
- 11-14. *Cytherideis ulrichi* Howe and Johnson, n. sp. X 27. Figs. 11, 13, Cotype No. 1053, exterior and interior of a left valve. Figs. 12, 14, Cotype No. 1052, exterior and interior of a right valve. Locality 40.
- 15, 16, 20, 23. *Cytherideis fabula* Howe and Dohm, n. sp. X 25. Figs. 15, 23, Cotype No. 1054, interior and exterior of a right valve. Fig. 16, Cotype No. 1055, interior of a left valve. Fig. 20, Cotype No. 1056, dorsal view. Locality 40.
- 17-19. *Cythereis garretti* Howe and McGuirt, n. sp. X 32. Figs. 17, 18, Cotype No. 1057, interior and exterior of a left valve. Fig. 19, Cotype No. 1058, interior of a right valve. Locality 41.
- 21, 22. *Cytheretta bassleri* Howe n. sp. X 30. Holotype No. 1059, exterior and interior of a right valve. Locality 40.
- 24-26. *Cythereis vaughani* (Ulrich and Bassler). X 45. Fig. 24, Plesiotype No. 1061, exterior of a left valve. Fig. 25, Plesiotype No. 1062, interior of a right valve. Fig. 26, Plesiotype No. 1063, interior of a left valve. Locality 34.
- 27-30. *Cytherideis agricola* Howe and Hadley, n. sp. X 37. Figs. 27, 28, Cotype No. 1064, exterior and interior of a right valve. Figs. 29, 30, Cotype No. 1065, interior view of the posterior and anterior ends of a left valve, showing prominent flanges. Locality 41.
- 31-34. *Hemicythere conradi* Howe and McGuirt, n. sp. X 42. Fig. 31, Cotype No. 1066, dorsal view. Fig. 32, Cotype No. 1066, exterior, left valve. Fig. 33, Cotype No. 1067, interior of a left valve. Fig. 34, Cotype No. 1068, interior of a right valve. Locality 40.

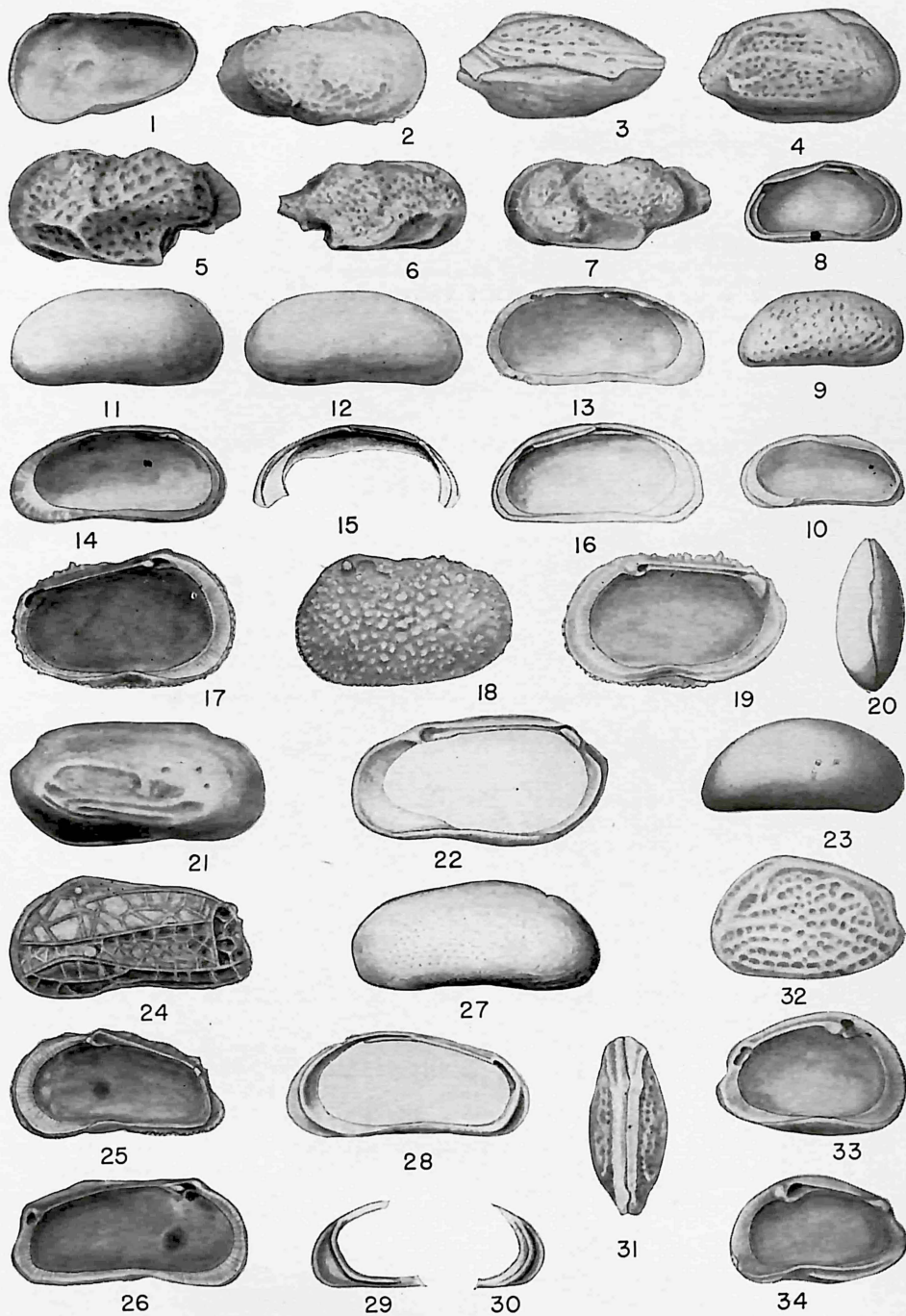


PLATE IV

- Figure 1. *Cythereis gunteri* Howe and Chambers, n. sp. X 40. Cotype No. 1009, right valve, showing radial pore canals. Locality 41.
2. *Cytherideis fabula* Howe and Dohm, n. sp. X 42. Cotype No. 1069, right valve, showing radial pore canals. Locality 41.
3. *Cythereis exanthemata* (Ulrich and Bassler), var. *gomillionensis* Howe and Ellis, n. var. X 40. Cotype No. 898, right valve, showing radial pore canals. Locality 41.
4. *Cytheromorpha warneri* Howe and Spurgeon, n. sp. X 42. Cotype No. 1070, dorsal outline. K. E. Young Locality 34.
- 5, 15. *Cythereis garetti* Howe and McGuirt, n. sp. X 28. Fig. 5, Cotype No. 1058, right valve, showing radial pore canals. Locality 41. Fig. 15, muscle scar pattern.
- 6, 10. *Cytheridea floridana* Howe and Hough, n. sp. Fig. 6, X 37, Paratype No. 1071, anterior end of a left valve, showing radial pore canals; Locality 41. Fig. 10, X 22, Holotype No. 1037, dorsal outline; Locality 40.
7. *Cythereis exanthemata* (Ulrich and Bassler), var. *marylandica* Howe and Hough, n. var. X 35. Cotype No. 895, a left valve showing radial pore canals, Calvert formation, Plum Point, Chesapeake Bay, Maryland.
8. *Cytherideis agricola* Howe and Hadley, n. sp. X 32. Cotype No. 1072, dorsal outline. Locality 40.
9. *Cytheridea choctawhatcheensis* Howe and Stephenson, n. sp. X 41. Holotype No. 1032, right valve, showing radial pore canals and muscle scars. Locality 41.
- 11, 12. *Cythereis producta* (Ulrich and Bassler). X 37. Plesiotype No. 1024, right valve, showing radial pore canals. Locality 41.
13. *Cythereis vaughani* (Ulrich and Bassler). X 40. Plesiotype No. 1073, dorsal view. K. E. Young Locality 34.
- 14, 21. *Cytheretta burnsi* (Ulrich and Bassler). Fig. 14, X 46; Plesiotype No. 1074, left valve showing radial pore canals; Calvert formation, Miocene, Plum Point, Maryland. Fig. 21, X 50; Plesiotype No. 1034, left valve showing radial pore canals; Locality 41.
- 16, 20. *Cytheridella chambersi* Howe, n. sp. X 43. Fig. 16, muscle scar pattern. Fig. 20, Holotype No. 1043, dorsal outline of a right valve. Locality 41.
17. *Hemicythere conradi* Howe and McGuirt, n. sp. Muscle scar pattern.
18. *Hemicythere dalli* Howe and Brown, n. sp. X 40. Cotype No. 1027, left valve, showing radial pore canals. Locality 29.
19. *Cytherura wardensis* Howe and Brown, n. sp. X 32. Cotype No. 1075, dorsal outline. K. E. Young Locality 34.
- 22, 23. *Cythereis rugipunctata* (Ulrich and Bassler). X 32. Fig. 22, Plesiotype No. 1012, outline of left valve. Fig. 23, Plesiotype No. 1013, outline of right valve. Locality 40.
24. *Cythereis* (*Pterygocythereis*) *cornuta*, var. *americana* Ulrich and Bassler. X 40. Plesiotype No. 1039, posterior outline showing lateral alae. Locality 28.

