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GEOLOGICAL SURVEY



MIOCENE  
TEXT

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## Superorder OSTRACODA.

## Family CYTHERIDAE.

Genus CYTHERE Müller.

CYTHERE CLARKANA n. sp.

Plate XXXV, Figs. 1-10.

*Description.*—Carapace rather irregular in outline but usually elongate-ovate, about 1.30 mm. in length, 0.65 mm. high and 0.6 mm. thick. Valve well rounded, the greatest convexity towards the posterior end, unequal, the left overlapping the right at the cardinal angles and in turn overlapped by the right along the ventral edge. Position of anterior hinge teeth marked by an oblique dorsal swelling. Hinge straight, the length being about three-fifths that of the entire carapace. Left valve obliquely rounded posteriorly, most prominent in the lower half; ventral edge straight or slightly arcuate; the posterior edge rather narrowly rounded, the curve generally straightened in the upper half, and the junction with the extremity of the hinge line sometimes obtusely angular. In the right valve the ends are more equal in breadth and curvature, although the ventral half of the anterior is also more strongly curved, and the ventral outline is faintly sinuate instead of arcuate. Surface of both valves coarsely reticulate, the meshes arranged somewhat concentrically about a subcentral point. The ridges forming the raised part of the network bear, especially at their junction angles, spines, the size and number of which vary with age. In the old condition, the surface is quite rough with these spines, the ridges thicker and the reticulation less obviously concentric. The lower two-thirds of the anterior and posterior margins of the left valve bear a series of small spines but on the right valves such spines have been observed only on the anterior edge and they are often wanting even there. Edge view lanceolate with the ends a little blunt or truncate. Hingement consists of a rather large anterior lateral tooth connected by a bar with a somewhat smaller posterior tooth and corresponding sockets in each valve.

This striking and characteristic fossil is very abundant in the Calvert formation at Plum Point. We know of no American species with

which it might be confounded. Compared with European forms, *Cythere striatopunctata* (Roemer), *C. scrobiculata* (Münster), *C. nystiana* and *C. angulatopora* Bosquet as figured by Bosquet,<sup>1</sup> are more or less closely allied but it is so easily distinguished from each of those mentioned by differences in outline and surface markings that we have no doubt of its distinctness.

The specific name is given in honor of Professor William Bullock Clark, the State Geologist of Maryland.

*Occurrence*.—CALVERT FORMATION. Plum Point.<sup>2</sup> CHESAPEAKE GROUP. Yorktown, Pa.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CYHERE CLARKANA VAR. MINUSCULA n. var.

Plate XXXV, Figs. 11-14.

*Description*.—The form for which we propose the above subordinate name is not uncommon in association with *C. clarkana*, yet, despite its very similar aspect, we have not observed any satisfactory connecting links proving it to be, as we believed at first, merely the young of the larger form. For the present therefore we assume that it represents a variety sufficiently distinct to deserve a name. So far as known it is distinguished by its much smaller size and relatively wider anterior end. The latter difference is noticeable in particular when right valves are compared.

*Occurrence*.—CALVERT FORMATION. Plum Point. CHESAPEAKE GROUP. Yorktown, Va.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CYHERE PLANIBASALIS n. sp.

Plate XXXVIII, Figs. 1-3.

*Description*.—Valves ovate subtetragonal, dorsal margin rather short, straight, ventral margin gently convex; ends unequal, the anterior edge

<sup>1</sup> Desc. des Entomostraces Fossiles des Terrains Tertiaires de la France et de la Belgique. Mem. Couron. Acad. Belg., Tome xxiv, 1851.

<sup>2</sup> The OSTRACODA described from this locality were picked by the writers from a small part (about a half pint) of extensive washings secured by Mr. Frank Burns for the United States National Museum. The figured specimens will be preserved in the National Museum, while a duplicate set, as nearly complete as possible, has been selected for the collection of the Maryland Geological Survey.



oblique, most produced about the middle of the lower half; posterior end narrower, the edge strongly curved, most produced about midway of the height, with three or four small spines beneath this point; cardinal angles moderately distinct, subequal in the right valve but in the left the posterior one probably more pronounced than the anterior and more nearly terminal than in the right valve; lower half of anterior margin with a row of small granules or spines. A well defined flattened, unpitted border encloses the ends and ventral side, very narrow in front and below but gaining considerably in width as it passes around the posterior end. Ventral edge very thick and nearly flat, the most prominent portion of the surface being on this side. From this abrupt ventral elevation, which is crowned by a row of blunt spines, the surface descends gradually to the dorsal edge and more rapidly to the anterior and posterior ventral margins. Surface markings consisting of large pits and internodes, the latter increasing in size and prominence toward the crest of the ventral ridge-like elevation. Pits generally occurring in furrows but without any definite order of arrangement except on the ventral edge where they are elongate and arranged longitudinally.

Length of a right valve 1.15 mm., greatest height of same 0.60 mm., greatest thickness of same 0.30 mm.

In a side view this species resembles *C. clarkana* greatly, but may be distinguished at once by its flattened ventral edge. It is probably more closely allied to *C. angulatopora* (Reuss) as figured by Bosquet, but differs slightly in outline and surface markings, and in the greater thickness of the ventral edge. In Reuss' species the surface pits are more regularly arranged in concentric series, and there are no nodes between them, but there is a low submedian swelling, the like of which has not been observed in *C. planibasalis*.

*Occurrence*.—CHESAPEAKE GROUP. James River, Va. Probably also in the CALVERT or CHOPTANK FORMATION in Maryland.

*Collection*.—U. S. National Museum.

CY THERE CALVERTI n. sp.?

Plate XXXVIII, Figs. 11-13.

Comp. *Cythere angulatopora* (?Reuss) Bosquet, 1852, Desc. d. Entomostr. foss. d. Terr. Tert. de la France et Belgique, p. 68, pl. iii, figs. 5, a, b, c, d; also *Cythere nystiana* Bosquet, op. cit., p. 65, pl. iii, figs. 3, a, b, c, d.

*Description.*—The valves of this species are oblong and obscurely trapesoidal in outline, with the dorsal and ventral margins subparallel, the former straight or very gently concave, the latter straight or very slightly convex, the ends subequal but converging dorsally so that the ventral half is longer than the dorsal half. Rim of valves distinct, double on the anterior end and narrow, growing almost obsolete about the middle of the ventral edge and wider again in the postventral region, near which also the surface has its greatest convexity. In the posterodorsal angle there is a well defined submarginal node, and just in front of the center of the valves a less distinctly defined small swelling. Excepting the marginal rims, which are smooth, the entire surface is covered with subangular pits, which occasionally present an irregular concentric arrangement. No marginal spines have been observed.

Length of a left valve 0.86 mm., height of same 0.46 mm., thickness of same 0.22 mm.

It is difficult to decide from the few left valves before us whether the relations of this species are nearer *C. angulatopora* (Reuss) Bosquet<sup>1</sup> or *C. nystiana* Bosquet. In having no marginal spines it corresponds with the latter and differs from the former, but when this feature is left out of consideration the relations are reversed. In most respects our species occupies an intermediate position between the two European OSTRACODA with which we have compared it, yet as it seems to possess a few characters not shared by either of them it has been deemed advisable to refer to the American form provisionally under a new name.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHERE INÆQUIVALVIS n. sp.

Plate XXXV, Figs. 15-17.

*Description.*—Carapace elongate, the outline approaching that of a parallelogram, very inæquivalved, 1.1 mm. to 1.2 mm. in length, 0.5 mm.

<sup>1</sup> According to Jones and Sherborn the *C. angulatopora* of Bosquet is not the same species to which Reuss applied that name. They have therefore proposed the new name *C. bosquetiana* for Bosquet's species.

to 0.55 mm. in height, and with the thickness about the same as the height. Valves moderately convex, the most prominent point being a little in front of the postventral fourth, and just beneath the posterior end of a single or double and more or less well defined longitudinal depression. Left valve obliquely rounded in front, the outline here being most produced in the lower half, and merging very gradually into the long dorsal edge, posterior margin also oblique, though less so and with the greatest prominence in the upper half; dorsal and ventral margins nearly straight and parallel, the slight curvature in both being upward; posteriorly a wide and rather sharply defined flattened border, narrowing ventrally, and a rather obscurely defined one anteriorly. Right valve smaller than the left and quite different in outline, the latter being due to two excisions at the extremities of the hinge, the anterior one of which is slight, the posterior one deep. Hingement strong, normal for the genus. Surface with scattered pits, sometimes obscure, often restricted to the broad, subcentral, longitudinal furrow or furrows.

We know of no described species with which this need be closely compared. It is probably nearest our *C. plebeia*, but the median furrow and the well developed posterior border of the left valve are both lacking in that species.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CY THERE PLEBEIA n. sp.

Plate XXXV, Figs. 20-29.

*Description*.—The carapace of this species closely simulates that of *C. inæquivalvis* in outline of both valves, the differences between them being chiefly in their surface markings. Thus, the valves of *C. plebeia* are more evenly convex and show no sign of the broad, subcentral longitudinal furrows characterizing *C. inæquivalvis* nor of the flattened border that is developed, particularly along the posterior edge of the left valve, in that species. The surface pits also are smaller and less irregular, and generally the pits exhibit the peculiarity of occurring in pairs. Comparing outlines of the left valves of the two species, it will

be noticed that in *C. plebeia* the ends are more sharply curved, and the anterior margin often obliquely subtruncate, with the greatest prominence nearer the ventral edge. Finally, the posterior extremity of the right valve is narrower and a less oblique.

Length 1.1 mm. to 1.15 mm., height 0.54 mm. to 0.57 mm., thickness 0.5 mm. to 0.52 mm.

*Occurrence.*—CALVERT FORMATION. Plum Point. CHESAPEAKE GROUP. James River and Yorktown, Va.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE PLEBEIA VAR. MODICA n. var.

Plate XXXV, Figs. 18, 19.

*Description.*—This variety, of which only left valves are known, is distinguished from the typical form of the species by its shorter and more ovate form. The surface pits also constitute a more conspicuous feature.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE PLEBEIA VAR. CAPAX, n. var.

Plate XXXV, Figs. 30-33.

*Description.*—This variety is distinguished from the typical variety by its greater height and finer surface pitting. The latter, in all the specimens seen, is restricted to the postcentral region of the valves. The outline of the right valve, furthermore, is more arcuate in its ventral and dorsal portions, while the posterior extremity is no less sharply rounded.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE BURNSI n. sp.

Plate XXXVI, Figs. 34-39.

*Description.*—This well marked species agrees in many respects with the associated *C. inæquivalvis* and *C. plebeia*, the dorsal half of the outline, especially of the left valve, being much as in the former, while

the ventral half is as in the latter. It differs from both in having the surface punctæ arranged in longitudinal lines between more or less well developed ridges, in the greater width and more uniform curve of the posterior end of the valves, this difference being more particularly apparent when right valves are compared; and in the greater development of the cardinal teeth and thinner connecting bar in the right valve. Compared further with *C. inæquivalvis* it will be found that the carapace is higher, the ventral outline distinctly arcuate, instead of straight or sinuate, the ends of the left valve broader, the projection of the posterior extremity of the left valve beyond the posterior hinge tooth less, and the excision of the outline just behind this tooth also less. Finally, there is no sign of the broad subcentral longitudinal furrows characterizing that species. Continuing the comparison with *C. plebeia* and its varieties, we find that the dorsal outline of the right valve is much straighter and longer, and its ventral outline either faintly arcuate or straight in the middle but never sinuate, while the posterior end of this valve, as has been stated already, is wider and more obtuse. The posterior end of the left valve also is more obtuse and more uniformly curved, and usually is paralleled by a flattened border, while the postdorsal angle is more prominent and the whole dorsal outline straighter.

As in the cases of the preceding species, we have failed to find any exact match for *C. burnsi* among described Tertiary and recent species. A good many species of *Cythere* have been described and the fossil species, as a rule, are widely distributed in Europe, but so far as our investigations of American Tertiary OSTRACODA permit of coming to a conclusion on the point it appears that the number of new forms is far from being exhausted and the species are nearly always distinguishable from their European congeners.

Length about 1.15 mm., height 0.57 mm., thickness about 0.54 mm.

The specific name is given in honor of the veteran collector, Mr. Frank Burns, of the U. S. Geological Survey, who collected the material from which many of the OSTRACODA described in this volume were picked.

*Occurrence.*—CHOPTANK FORMATION. Pawpaw Point. CALVERT FORMATION. Plum Point. CHESAPEAKE GROUP. Yorktown, Va.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

## CYTHERE PAUCIPUNCTATA n. sp.

Plate XXXVIII, Figs. 7-9.

*Description.*—Carapace rather large, strongly convex, subelliptical in outline. Left valve with the ends subequal, slightly oblique, the curve of the anterior edge being a little sharper in the ventral half than in the upper, while the latter merges very gently into the straight dorsal outline; posterior margin with its greatest prominence and curve just above the mid-height, below passing gradually into the convex ventral outline, above turning more rapidly forward to the distinct though obtusely angular junction with the hinge line; ventral edge tumid, slightly overhanging the contact margin. Surface smooth except on the most convex portion, which lies a little behind the center of the valve. Here there are three rows of rather large and sometimes not very closely defined pits, three to five in each row. Right valve unknown, probably narrower than the left and varying similarly in shape as in related species.

Length of an average left valve 1.15 mm., height of same 0.61 mm., greatest thickness of same 0.32 mm.

This and several of the preceding species, notably *C. burnsi* and *C. plebeia*, are American representatives of the well marked section of the genus of which the common European Tertiary *C. jurinei* Münster is a good type. *C. paucipunctata* is distinguished from all the other Tertiary species of the section by slight peculiarities in its outline, greater convexity, and the limited number of surface pits.

*Occurrence.*—CHOPTANK FORMATION. Peach Blossom Creek, 3 miles southwest of Easton.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

## CYTHERE TUOMEYI n. sp.

Plate XXXVIII, Figs. 4-6.

*Description.*—Carapace moderately convex, subovate; anterior end considerably wider than the posterior, somewhat oblique, with the greatest prominence and curve in the lower half, the upper half merging more gradually into the straight dorsal margin; posterior margin rounded; cardinal angles obtuse, the anterior one, especially in the right

valve, barely distinguishable. A wide, smooth, depressed border encloses the ends, grows narrow along the dorsal edge and appears to die out entirely, in a lateral view, along the ventral edge. Remainder of surface moderately tumid and marked by rather large pits arranged in lines, those in the posterior and central parts longitudinal, those along the ventral and anterior sides irregularly concentric and those on the dorsal slope somewhat obscurely radial. Just above and in front of the center of the valves there is sometimes a slight swelling which may cause more or less local irregularity in the arrangement of the pits.

Length of a left valve 0.65 mm., greatest height of same 0.33 mm., length of a right valve 0.62 mm., greatest height of same 0.32 mm.

A number of living and European Tertiary species of this type are known, but we could not satisfy ourselves that the exact specific match of *C. tuomeyi* has been described heretofore. Of American species the closest allies known to us are figures on Plate XXXVI. Among these *C. nitidula* and *C. calvertensis* are probably nearer than *C. porcella* and *C. burnsi*, agreeing better in their outlines and size, and in having a flattened border at their ends. They exhibit, however, appreciable differences even in the points of outline and surface contour, and a more obvious one in their surface ornamentation. In the last respect *C. tuomeyi* agrees rather better with *C. burnsi*, but that species commonly attains a much larger size and has nearly equal instead of decidedly unequal ends.

*Occurrence*.—CHOPTANK FORMATION. Peach Blossom Creek, 3 miles southwest of Easton. CHESAPEAKE GROUP. Yorktown, Va.

*Collection*.—U. S. National Museum.

CYTHERE PORCELLA n. sp.

Plate XXXVI, Figs. 26-33.

*Description*.—Carapace rather full and often appearing quite smooth, somewhat obliquely acuminate ovate, the anterior outline more or less produced below, the posterior outline much narrower, most prominent about the middle, and with the projection emphasized by usually three, occasionally four or even five minute marginal spines; length about 0.85 mm., greatest height about 0.45 mm. Right valve with the hinge



line very gently arcuate and the dorsal angles generally obtuse and sometimes scarcely distinguishable. Left valve with the dorsal half of the outline more arcuate than the ventral, the latter sometimes being even a trifle sinuate near the middle. Posterior extremity of both valves generally with a rather faintly defined border. Surface porcellaneous and sometimes appearing quite smooth, but when the preservation is obviously good it usually exhibits numerous minute punctures, generally arranged in four to six curved series, over the post-central region of each valve. A small central spot, often slightly depressed, is usually distinguishable by its darker color. Hinge teeth rather strong in right valve, the anterior one the weaker. In the left valve here is a large socket only at the posterior end of the hinge and a small tooth and socket at the anterior extremity.

The small size and shape of the valves of this very common species are so distinctive when compared with associated species of the genus that little trouble is likely to be experienced in their recognition. Some of the species of *Cytheridae*, especially *C. subovata* of this report, might be confused with *Cythere porcella*, but it will require only a glance at the hingement to see that they have no true relation to each other.

*Occurrence*.—CALVERT FORMATION. Plum Point. Also at Yorktown, Va., in the CHESAPEAKE GROUP.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CYTHERE NITIDULA n. sp.

Plate XXXVI, Figs. 21-23.

*Description*.—This neat species is not nearly so common as *C. porcella*, and at present the typical variety is known only from five or six left valves. These, however, are very constant in their peculiarities so that we cannot doubt they represent a distinct specific type. Compared with *C. porcella*, which they resemble more than any other species known to us, they are distinguished by the constant development of a well defined flattened border margining both ends. Then the posterior outline is blunter and differs particularly in the postcardinal region which is more prominent. Finally, the posterior margin is not spin-



iferous. The punctæ in the five or six centrally situated surface striæ are very fine, and the test unusually fragile.

Length about 0.87 mm., height of left valve about 0.48 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CY THERE NITIDULA VAR. CALVERTENSIS n. var.

Plate XXXVI, Figs. 24-25.

*Description*.—This variety or closely related species differs from the typical form of *C. nitidula* in being a little more elongate and in the coarser pattern of the surface punctation. The test also is stronger and the anterior border narrower. While the three rows of surface puncture, on the left valve, occur in a flattened area defined below by a faint ridge. The outline approaches more nearly to that of *C. porcella* but is still clearly distinguished by the greater prominence of the dorsal third of the posterior curve.

The right valve represented by Plate XXXVI, fig. 25, is believed to belong to a variety of *C. nitidula* rather than to *C. porcella*, principally because of the slight arcuation of the ventral outline. The corresponding portion of the outline of right valves of *C. porcella* is always a trifle sinuate.

Length 0.8 mm., height 0.42 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CY THERE PUNCTISTRIATA n. sp.

Plate XXXVIII, Figs. 22-24.

*Description*.—Carapace compressed convex, subrhomboidal in outline; anterior margin obliquely subtruncate, narrowly rounded below; posterior end, in the left valve especially, somewhat acuminate, sinuate above, convex and curving rapidly forward beneath the extremity; dorsal and ventral margins subparallel, the former gently convex, the latter very slightly sinuate. Posterior end with a wide, flattened border, anterior and ventral sides with a narrow one. Surface of valves having the greatest convexity just behind and a little beneath the center, the

anterior and dorsal slopes appearing rather flat. Surface ornament consisting of single or double rows of minute punctæ situated in five or six shallow grooves, having their best development in the posterior half and so arranged that they converge toward the anteroventral angle. Most of the grooves and punctæ, however, become obsolete before reaching that point. Marginal spines wanting.

Length of a right valve 0.62 mm., greatest height of same 0.33 mm., greatest thickness of same 0.15 mm.

*C. punctistriata* might be compared with a number of European species, but we are at a loss to say to which of a dozen or more it is most allied. Under the circumstances it may suffice to express our conviction that it is specifically distinct from all previously described species of which we have seen either specimens or good figures. The next species, *C. vaughani*, is probably a nearer ally than any other known to us.

*Occurrence.*—CHOPTANK FORMATION. Peach Blossom Creek, 3 miles southwest of Easton. CALVERT FORMATION. Church Hill.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE VAUGHANI n. sp.

Plate XXXVIII, Figs. 25-27.

*Description.*—Valves subacuminately produced posteriorly, oblique anteriorly, this end being rounded below and subtruncate above, also much wider than the other; dorsal outline wavy on account of the surface ornament, convex on the whole, with the cardinal angles fairly distinct in the right valve; left valve not seen; dorsal half of posterior edge sinuate, as is also the ventral outline; lower half of anterior rim and posterior two-thirds of ventral edge with a fringe of minute spines. Surface with four longitudinal ridges, of which the first forms the anterior half of the dorsal outline; the second begins at the post-cardinal angle and extends forward beneath the first to a point under the anterocardinal angle where it is lost; the third begins a little in front of the postcardinal angle, near which it is very prominent, and extends quite across the valve to about the middle of the anterior rim; the fourth likewise extends nearly the full length of the valve, beginning at the posterior extremity and running parallel with and close to

the ventral edge until it becomes obsolete near the anteroventral angle, attaining its greatest altitude in front of the midlength of the valve. The furrows separating the first and second and the second and third ridges are each occupied by a row of large pits, each pit of the second row being divided into two compartments. The middle third of the space between the third and fourth ridges contains three or four strong cross bars, the depressed spaces between these being taken up by small pits. The anterior third is divided longitudinally by a small ridge separating a row of large pits above from a row of smaller ones beneath. Between the posterior half of the ventral ridge and the ventral edge the steep slope is occupied by four pits decreasing in size posteriorly, while in front of these the slope carries several rows of much smaller pits. Between the ventral ridge and the postcardinal border there is a large depressed space.

Length of a right valve 0.81 mm., greatest height of same 0.39 mm., greatest thickness of same 0.29 mm.

Although related to our *C. punctistriata*, the differences between their respective surface markings are so striking that they cannot be confused. A closer ally perhaps is found in *C. truncata* (Reuss), a Tertiary fossil of Austria and France, but *C. vaughani* is more elongate and more acuminate posteriorly and differs also quite obviously in its surface markings.

Named for Mr. T. Wayland Vaughan, of the U. S. Geological Survey in appreciation of the excellent work he is doing on the Tertiary corals.

*Occurrence.*—CHESAPEAKE GROUP. James River, Va. Probably also in Maryland.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE FRANCISCA n. sp.

Plate XXXVIII, Figs. 19-21.

*Description.*—Valves moderately and rather uniformly convex, acuminate-ovate in outline, the posterior extremity small, subacute, compressed, the anterior end broad, with a slightly oblique margin, curving most in the lower half, the upper portion turning very gradually into the dorsal outline; posterocardinal angle very obtuse; ventral outline

long, nearly straight in the middle, though on the whole gently convex. Anterior end with a narrow border that continues on around the ventral side, but in a side view appears to die out before reaching half the distance to the posterior extremity. A similar but superimposed border encloses the postventral portion of the valve, while just within is a thin, raised line that above the posterior extremity forms a distinct margin to the anterodorsal region. Excepting the marginal portions and the compressed part of the posterior end, the entire surface is covered with minute pits, arranged more or less regularly in lines, many of them disposed in a concentric manner.

Length of a right valve 0.50 mm., greatest height of same 0.27 mm., thickness of same 0.11 mm.

A search of the literature has failed to reveal any described species to which this very neat little form might be referred. Of a number of related species those which seem to offer the greatest degree of resemblance are two of the species described in this contribution, viz., our *C. punctistriata* and *C. subovalis*. As may be seen by comparing the figures of the three species on Plate XXXVIII, *C. francisca* is longer and much more delicately pitted than *C. subovalis*, and further that it has narrow rim-like borders that do not occur in that species. From *C. punctistriata* it differs decidedly in outline, the difference being particularly evident when the comparison is restricted to the anterior halves. Then the surface ornamentation occupies a raised field in that species and the pits, instead of occurring in concentric or irregular rows, are placed in shallow, diverging furrows.

The specific name is intended as a small tribute to Miss Francisca M. Wieser, who has shown rare ability and care in her work on the illustrations of the OSTRACODA described in this volume.

*Occurrence.*—CHOPTANK FORMATION. Peach Blossom Creek, 3 miles southwest of Easton.

*Collection.*—U. S. National Museum.

CYTHERE SUBOVALIS n. sp.

Plate XXXVIII, Figs. 14-15.

*Description.*—Left valve moderately convex, with blunt edges, acuminate-ovate in outline, the posterior end small, the anterior end broad,

scarcely oblique, and almost uniformly curved; ventral margin gently convex, the dorsal edge more arcuate, though the anterior extremity of the hinge seems to be about midway between the obtuse postcardinal angle and the anterior extremity of the valve. Surface with pits of moderate size, rather widely separated and with no very evident arrangement.

Length of a left valve 0.88 mm., greatest height of same 0.55 mm., greatest thickness of same 0.26 mm.

Of this species we have seen only a single left valve, but as it is a Maryland fossil and from an horizon from which comparatively few OSTRACODA are known, and as other specimens of it will almost certainly occur in our unpecked washings, we considered ourselves justified in proposing a new name for it and offering a brief description in this work.

In its general aspect this species reminds of *Cytheridae*, and to a less extent of *Xestoleberis*, rather than *Cythere*, but on account of the shape of its posterior end, in which it agrees with the two preceding species, it has seemed best to refer it, at least provisionally, to the same genus. For comparisons with other species see under *C. shattucki*.

*Occurrence*.—CHOPTANK FORMATION. Pawpaw Point.

*Collection*.—U. S. National Museum.

CY THERE MARTINI n. sp.

Plate XXXVI, Figs. 11-15.

*Description*.—Carapace small, suboblong, widest anteriorly though the difference between the heights of the two ends is variable and sometimes does not exceed the difference between five and six. Right valve with a long, straight dorsal edge, terminating anteriorly and posteriorly in rather distinct angles; anterior edge with a thick border, obliquely subtruncate, and usually with a fringe of short spines in the middle and lower thirds; posterior outline sometimes uniformly curved, backward from the anterodorsal angle and then forward again into the nearly straight ventral margin, the curve into the latter being gradual. More commonly, however, especially when the posterior fringe of five or six spines is well developed, there is a small excision in the upper third of the outline. Often a small prominence is noticeable about the

middle of the ventral edge. Left valve generally a little higher than the right, which it overlaps ventrally, and enclosed, except along the dorsal edge, by a thick rim, heaviest anteriorly and barely distinguishable in the anteroventral region. Usually there are no marginal spines at either end of this valve. Both valves exhibit a broad swelling, occupying the greater part of the anterior half, but it is nearly always more conspicuous on the left valves. The surface of the right valves, on the contrary, seems to be more protuberant near the posterior margin than the left. Occasionally the right valve bears also a small central protuberance. Surface of both valves reticulate or simply pitted, the pattern, as shown by the illustrations, being somewhat variable.

Length 0.75 mm. to 0.8 mm., height 0.39 mm. to 0.42 mm.

Named for Dr. G. C. Martin, of the Maryland Geological Survey.

*Occurrence.*—CHOPTANK FORMATION. Pawpaw Point, Peach Blossom Creek. CALVERT FORMATION. Plum Point. Also at Yorktown, Va., in the CHESAPEAKE GROUP.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHERE DORSICORNIS n. sp.

Plate XXXVI, Fig. 16.

*Description.*—Of this species we have two varieties, both apparently rare. The Calvert form, with its single conical node or spine near the middle of the posterior half of the dorsum, should be considered as the typical variety. The general aspect of the valves of these two varieties is greatly like that of the associated *C. martini*. Still they may be distinguished even without taking into consideration the conical nodes which are wanting in that species. Thus, in *C. dorsicornis* the swelling of the anterior half of the valves is a little larger and moreover is divided into two parts by a curved sulcus. Next the posterior extremity is more produced and compressed while the length of the valve is proportionately less and the height of the anterior end slightly greater. Finally, the arrangement of the surface pits varies from that generally obtaining in *C. martini*. These differences are all of subordinate value and we were inclined at first to rank the Calvert form as a variety under that much more abundant species. When, however, the second variety was

secured it seemed a better plan to regard the two as representing a distinct though closely related species. Perhaps it is worth while to add that *C. dorsicornis* is a trifle smaller than average specimens of *C. martini*.

Length of a left valve 0.68 mm., height of anterior end 0.39 mm., height of posterior end 0.27 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collection*.—U. S. National Museum.

CYHERE DORSICORNIS VAR. BICORNIS n. var.

Plate XXXVIII, Figs. 32, 33.

*Description*.—This variety differs from the typical form of the species (1) in having two instead of a single spine, the second one being situated near the opposite border of the valve; (2) in having fewer surface pits, these being restricted to the central part of the valve and mostly to the posterior half; (3) in having two low and inconspicuous swellings on the depressed portion of the dorsal slope between the dorsal spine and the anterocardinal node; and (4) in being smaller.

Length 0.47 mm., greatest height 0.28 mm.

This form and, in a smaller degree, the typical variety of the species, as well, exhibits certain features that are more strongly developed in *C. baccata*, Jones and Sherborn, from the Pliocene of England. Our species probably is more intimately related to this English species than appears at first sight, but their specific distinctness is too obvious to be questioned.

*Occurrence*.—CHOPTANK FORMATION. Pawpaw Point.

*Collection*.—U. S. National Museum.

CYHERE LIENENKLAUSI n. sp.

Plate XXXVIII, Fig. 31.

*Description*.—This very pretty and on the whole well marked species seems to be more closely related to our *C. martini* than to any other known to us. It occurs associated with that species at Plum Point, but is a much less common and even smaller fossil. The left valve, which is usually a little higher than the other in species of this type,



is a trifle more elongate than the same valve of *C. martini*, but the principal difference lies in the marginal ridge which in that species is generally confined to the ends. In the present species, however, the ridge is distinguishable also along the ventral side, and moreover it is a double ridge, the outer division gradually turning into a narrow flattened border and thickening up again as it passes along the posterior edge. The inner division starts at a small knob in the anterodorsal angle and passes downward in a course paralleling the anterior edge into the ventral region where it bifurcates, the lower division continuing on and remaining parallel with the margin to the postcardinal angle, a second bifurcation occurring as it passes the postventral angle. The inner division of the first bifurcation diverges at first slowly and then more rapidly in its course to a point lying a short distance in front of the postcardinal angle where it joins the upper extremity of the more nearly vertical inner part of the second bifurcation. A rather distinct though low and broad swelling of the surface occurs on the anterior half of the surface and behind this a second but smaller elevation is distinguishable. Between the dorsal edge and the marginal ridge, and also between the bifurcations of the latter, the surface is distinctly pitted, the pits being small and elongate and exhibiting a tendency to longitudinal arrangement.

Length of a left valve 0.60 mm., greatest height of same 0.31 mm., height of posterior extremity 0.20 mm.

Named for Mr. E. Lienenklaus, of Osnabrück, Germany, whose "Monographie der Ostrakoden des nordwest-deutschen Tertiärs" is a very capable piece of work.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collection.*—U. S. National Museum.

CYTHERE PRODUCTA n. sp.

Plate XXXVI, Fig. 17. Plate XXXVIII, Figs. 28-30.

*Description.*—This species agrees in its more important characters rather closely with *C. martini* and its allies, but is distinguished from them all by its much greater proportional length, more nearly parallel ventral and dorsal edges, in having marginal spines at both ends of the



left valve as well as the right and in being at least one-fifth larger. Compared further with average specimens of *C. martini*, the posterior extremity is much more produced and compressed, while the marginal spines are coarser. The surface markings are also coarser, but the anterior swelling is relatively smaller. The specimens exhibit some variety in the relative height of the posterior end, but as a rule it is nearly or quite as great here as across the middle of the valve.

Bosquet figures several related European Tertiary species but none is deemed close enough to require more than ordinary care in discriminating our species. It appears to be one of the most elongate of its section of the genus. In this respect as well as in its outline it is almost matched by *C. venustula* described by Jones and Sherborn from the Eocene of England, but in all other external features the two forms are very different, so that it is doubtful even that they have any close genetic relations.

Length of left valve 1.05 mm., greatest height of same 0.47 mm., length of right valve 0.90 mm., greatest height of same 0.40 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CY THERE MICULA n. sp.

Plate XXXVI, Figs. 18-20.

*Description*.—This species also may be said to be rather closely related to *C. martini*, but it is very constant in its peculiarities and clearly deserves specific recognition. Closely compared with that species it is found to be constantly of much smaller size, with the posterior end relatively narrower, the marginal rim much thinner, causing the surface of the valves to appear more uniformly convex, and the pitting of the surface much finer. Furthermore, the surface swellings are relatively broader and so placed that a slight central depression is left that has no parallel in *C. martini*. Both ends of the left valve bear an extremely delicate fringe of spines. Such spines, however, have not been observed on the right valve.

This is the smallest species of the genus known to us, and on this account, though not uncommon, easily overlooked.

Length 0.5 mm. to 0.58 mm., height 0.27 mm. to 0.3 mm.

*Occurrence.*—CALVERT FORMATION. Plum Point. Also in the CHESAPEAKE GROUP of Virginia, on the James River and at Yorktown.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE EXANTHEMATA n. sp.

Plate XXXVI, Figs. 1-5.

*Description.*—Carapace oblong subquadrate or elongate subovate, obliquely rounded at the ends, the greater curvature and prominence in both cases being in the ventral half. Entire outline, excepting the straight or slightly concave ventral edge, fringed with flattened spines, those along the dorsal edge being of larger size than those on the ends. Posterior end compressed and carrying a double series of spines, the outer row sometimes occupying a low marginal ridge. Anterior end with a thick border or marginal ridge within the spiny fringe, but this ridge also breaks up into node-like spines in its lower third. Surface of valves between these two end ridges covered with fifteen to eighteen large irregular blunt spines or excrescences. These spines may at first sight seem to be arranged wholly without regard to any system, but on closer inspection they arrange themselves into three longitudinal rows, a rather irregular one projecting over the dorsal line, a second regular series beginning with the nodes on the lower end of the anterior marginal ridge and continuing in an increasing curve across the ventral and posterior slopes, and a third and much less regular row lying between the other two. Several of the nodes of the middle series are grouped on the summit of a broad anterior swelling of the valves. Hingement strong, typical for the genus. The interior marginal plate is usually wide.

This extremely nodose and spiny carapace belongs to a section of the genus of which one extreme is represented by our *C. martini* and *C. producta* and the other led up to by numerous Tertiary species figured by Bosquet and ending in species that Jones has included in his subgenus *Cythereis*. We believe, however, that *Cythereis* should be restricted to the *C. ceratoptera* section, of which our *C. cornuta* var. *americana* is a good example, and the *C. exanthemata* section left with *Cythere* until the time shall have arrived when a thorough revision of the family is possible. The monographic work upon which the writers are engaged, it is hoped,

may result in a more natural and serviceable classification of the fossil species than the one now in use.

There is no described American species with which *C. exanthemata* might be compared. Of numerous European allies, among which *C. aculeata* and *C. formosa* of Bosquet are perhaps the closest, none is so coarsely tuberculated.

Dimensions of an average left valve: greatest length 0.9 mm., greatest height of anterior half 0.5 mm., height just beneath postcardinal angle 0.38 mm.

*Occurrence.*—CHOPTANK FORMATION. Pawpaw Point. CALVERT FORMATION. Plum Point. Also in the CHESAPEAKE GROUP, on the James River, and at Yorktown.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CY THERE RUGIPUNCTATA n. sp.

Plate XXXVIII, Figs. 16-17.

*Description.*—This species is too much like the preceding *C. exanthemata* to require detailed description. Compared with that species it is distinguished at once by its peculiar surface marking, which is a combination of irregular, twisted or wrinkled plications, commonly arranged vertically across the posterior half of the valves—and unequal though usually rather large pits between the plications. Another striking difference is brought out in comparing the outlines of the valves of the two species. In *C. exanthemata* all of the margins except the central part of the ventral portion, or it may be its greater part, is lined with a row of spines producing a dentate outline. In *C. rugipunctata*, on the contrary, marginal spines occur only at the ends of the valves, the posterior end having three or four and the anterior margin about the same number.

Length of a left valve 0.71 mm., height at anterodorsal angle 0.38 mm., height at posterodorsal angle 0.31 mm., thickness of single valve 0.20 mm.

*Occurrence.*—CHESAPEAKE GROUP. James River, Va. Probably also in Maryland.

*Collection.*—U. S. National Museum.

## CYTHERE EVAX n. sp.

Plate XXXVI, Figs. 6-8.

*Description.*—Right valves somewhat obliquely subovate, the middle halves of the dorsal and ventral edges nearly straight or very slightly arcuate, the cardinal angles rounded. Left valves differ in having more pronounced cardinal angles, the anterior one especially being much more prominent and thicker, and in the greater length and straightness of the dorsal margin. Both valves are decidedly narrower behind than in front. Entire surface of valves coarsely spinulose and pitted between the spines. The middle of the valves exhibits a more or less distinct vertical depression, separating an undefined swelling just in front of it from two more ridge-like prominences lying just behind it. Of the latter the lower one is the longer, and usually is prolonged anteriorly beneath the broader anterior swelling. Between this ridge and the ventral edge there is a furrow.

The only described species known to us, having close relations to *C. evax* is the *C. lyelliana* Bosquet, from the Eocene of Belgium. The typical form of our species, however, is much shorter and differs decidedly in the character, form, and marking of the swellings occupying the central part of the valves. The following *var. oblongula* agrees much better in its outline with the Belgian species, but differs, like the typical variety, in the lesser development of the anterior swelling and in the extension of the spinous surface ornament over the swelling. Bosquet represents the latter as perfectly smooth.

Length of a left valve 0.78 mm., greatest height of same 0.49 mm. In an average right valve of the same length the height is about 0.46.

*Occurrence.*—CALVERT FORMATION. Plum Point. Also in the CHESAPEAKE GROUP at Yorktown, Va.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

## CYTHERE EVAX VAR. OBLONGULA n. var.

Plate XXXVI, Figs. 9-10.

*Description.*—This variety is distinguished from the typical form of *C. evax* by the much greater length of its valves and in the more nearly equal height of their two ends, this greater equality of the ends being

particularly striking when right valves are compared. In consequence of these differences the whole outline assumes a different shape so that it would be described as oblong subquadrate instead of subovate. The surface swelling and ornament are about the same in the two varieties.

Length of right valve 0.84 mm., greatest height of same 0.42 mm., length of left valve 0.90 mm., greatest height of same 0.48 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point.

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CY THERE SPINIPLICATA n. sp.

Plate XXXVIII, Fig. 18.

*Description*.—Valves moderately convex, subovate, the anterior end somewhat oblique and a fifth or only a sixth wider than the posterior end; entire outline, excepting the central part of the ventral edge, denticulate, the anterior edge being provided with a double row of flattened spines; surface roughly echinulate, the spines irregularly disposed or covering the sides and crests of very irregular but on the whole vertically arranged plications. In certain lights the latter appear twice interrupted, this appearance being due to a low longitudinal central ridge and two narrow sulci defining it that in other lights are obscured by the plications.

Length of a right valve 0.90 mm., greatest height of same (across anterior end) 0.49 mm., thickness of same about 0.25 mm.

The rough surface and general aspect of this species is such that it could not for a moment be confounded with any of the known American forms, excepting possibly our *C. evax oblongula*. There are, however, several species in Tertiary and later deposits of Europe with which it might be compared, notably *C. scabropapulosa* Jones, from the Eocene of England, and *C. scabra* Münster, from the Miocene of Germany and France. Still, our species seems sufficiently distinct to render detailed comparisons unnecessary. In *C. evax* the surface ornament is not the same, though somewhat similar, and the central ridge is more prominent and broken up into two parts. Beneath it there is another ridge that has no counterpart in *C. spiniplicata*.

*Occurrence*.—CALVERT FORMATION. Plum Point (Rare).

*Collection*.—U. S. National Museum.

## CYTHERE (?) SHATTUCKI n. sp.

Plate XXXVIII, Fig. 10.

*Description.*—Valves rather strongly convex in the ventral portion, subtrapezoidal in outline, the dorsal angles very obtuse, the anterior margin obliquely rounded and somewhat truncate, the posterior end smaller, drawn out below so that the extremity is very sharply rounded and the outline from that point to the postdorsal angle only very slight convex; dorsal margin short, nearly straight, ventral edge long and straight excepting a slight protrusion just behind the mid-length; anterior end with a narrow flattened border; no spines of any sort. Surface somewhat tumid in the median ventral region, slightly depressed centrally and posteriorly, sloping more gradually toward the anterior and dorsal margins. Ornament consisting of small, widely separated pits.

Length of a left valve 0.63 mm., greatest height of same 0.32 mm., greatest thickness of same 0.17 mm.

This species resembles several of the species referred to *Cytherideis* in this work, and when the hinge, which is not clearly shown in the specimens so far obtained, is better known it may become necessary to remove it to that or one of the other genera of the family—perhaps *Cytheropteron*. Comparing *C. shattucki* with our *Cytherideis ashermanni* and *C. longula* it may be distinguished at once by its ventral swelling. From the former it differs further in its more acuminate posterior extremity, and from the latter by its shorter form. The surface punctæ, finally, are smaller and more distant than in either of the species that, so far as we know, resemble it most.

Named for Dr. George Burbank Shattuck, of the Maryland Geological Survey.

*Occurrence.*—CHOPTANK FORMATION. Pawpaw Point.

*Collection.*—U. S. National Museum.

Genus CYTHEREIS Jones.

CYTHERE CORNUTA (Roemer).

*Cytherina cornuta* Roemer, 1838, Neucs Jahrb. f. Minerl., p. 518, pl. vi, fig. 31;—Reuss, 1845, Verstein. böhm. Kreideform., I, p. 105, pl. 24, fig. 20.

*Cythere cornuta* Bosquet, 1850, Desc. d. Entomost. Foss. d. Terr. Tert. de la Fr. et Belg., p. 117, pl. vi, figs. 4a, b, c, d, Reuss, 1855; Egger, 1858; Speyer, 1863; Lienenklaus, 1894.

*Cythereis cornuta* Jones, 1856, Monog. Tert. Entomost, Paleontogr. Soc., p. 39, pl. iv, fig. 19, and pl. v, figs. 15a, 15b.



## CYTHEREIS CORNUTA VAR. AMERICANA n. var.

Plate XXXVII, Figs. 29-33.

*Description.*—Carapace obliquely subquadrate, the dorsal margin straight and equaling a little more than half the entire length, the ventral edge straight in the middle and at the ends, curving more rapidly into the anterior margin, which is most prominent in the lower half, than into the posterior outline. The latter is the most prominent at a point about a third of the height of the left valve beneath the line of the dorsal edge, and from this point the outline turns anteriorly, at first at a right angle, then with a gentle upward curve on to the well defined postcardinal angle. The anterocardinal angle is sometimes indistinct and always blunter than the posterior angle. The right valve differs from the left principally in this, that both of the cardinal angles are indistinct. Both valves bear a fluted crest, always divided about its mid-length, along the cardinal margin; and a ventral ridge that begins about the middle of the anterior margin with a gradually coalescing series of spines and continues to rise posteriorly until it terminates in a prominent sharp spine, projecting obliquely downward and backward, about one-third of the length of the valve from the posterior extremity. The inner slope of this ridge is fluted like the dorsal crest. From the terminal spine the ridge turns upward toward the postcardinal angle, gradually growing obsolete before reaching it. Two-thirds of the distance intervening between the two points are marked by prominences, the first being a rather prominent node, the second much more obscure. The compressed posterior end terminates in a series of strong spines, six on the left valve and five on the right, while a fringe of smaller spines forms the anteroventral edge. Surface of valves smooth and depressed between the marginal ridges, the valves being on the whole very shallow.

Length of a relatively short left valve 1.10 mm., greatest height of same 0.60 mm.; length of a proportionally long valve 1.20 mm., greatest height of same 0.58 mm. Height at posterior and anterior angles of cardinal margin respectively as nine is to twelve, or four is to five.

These American specimens are too near the common European Tertiary *C. cornuta* (Roemer) to be distinguished specifically, but they exhibit sufficient minor differences to justify the subordinate name above proposed.

*Occurrence.*—CALVERT FORMATION. Plum Point. CHESAPEAKE GROUP. James River and Yorktown, Va.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHEREIS ALARIS n. sp.

Plate XXXVIII, Figs. 34-36.

*Description.*—Carapace rather elongate, somewhat acuminate-subovate, the anterior half about one-third wider than the posterior; dorsal and ventral margins nearly straight, anterior outline broadly rounded, the dorsal angle indefinite; posterior edge most prominent near the middle, the lower half rounding regularly up from the ventral margin, the upper half distinctly concave and sloping strongly forward to the obtusely angular postercardinal angle. Excepting the dorsal halves of both the anterior and posterior edges the rest of the outline is fringed with flattened spines, of which those along the dorsal edge and one on each side of the middle of the ventral edge are much larger than the others. Of the five or six spines along the dorsal edge the one just in front of the postcardinal angle is the largest and most prominent, especially in a view of the back. Valves on the whole appearing compressed, but exhibiting a broad swelling that takes up most of the anterior half of the surface, while behind it and beneath its center there is a wing-like ridge the crest of which is broken up into four or five unequal spines directed obliquely downward and forward. Posterior fourth of surface depressed, with a small tubercle near the postdorsal angle. Surface smooth.

Length of a left valve 0.34 mm., greatest height of same 0.50 mm., thickness at anterior swelling 0.18 mm., to summit of ventral ridge 0.22 mm.

The low swelling of the anterior half of the valves brings this well-marked species into comparison with Bosquet's *Cythere dumontiana*, with which it agrees rather closely also in outline and in the length of the spiny ventrolateral alation. That species, however, differs in wanting the marginal spines on the ventral and anterior edges, and in this respect our species agrees very closely with *C. fimbriata* Münster, which Lienenklaus says is the same as *Cythere ceratoptera* Bosquet. *C. alaris* therefore appears to occupy an intermediate position between the two European species mentioned.



*Occurrence.*—CHESAPEAKE GROUP. James River, Va. Probably also in Maryland.

*Collection.*—U. S. National Museum.

Genus CYTHERIDEA Bosquet.

CYTHERIDEA SUBOVATA n. sp.

Plate XXXVII, Figs. 1-8.

*Description.*—Carapace apparently somewhat variable in outline, subovate, a little narrower posteriorly than anteriorly; the ventral outline less arcuate than the dorsal. Right valve narrower than the left, both its ventral and dorsal edges being overlapped; lower half of anterior margin usually carrying six to eight small spines, diminishing in size downwardly, while only three or four similar spines occur on the post-ventral corner. No spines have been observed on the left valve. Surface of valves usually nearly evenly convex and appearing quite smooth, but on close inspection a few very small scattered punctæ may be observed.

The specimens before us indicate two varieties that, should they prove constant enough, may later on be distinguished. Of the one we have seen only the right valve shown in fig. 1 on plate XXXVII. This differs from the typical form in the more uniform curve and relative bluntness of the posterior outline, and in the obtusely conical instead of almost uniformly convex elevation of the surface.

The second variety seems to be normal in all respects save that the left valves, which alone we have observed, are considerably narrower.

The crenulated hinge, as well as all other characters of the valves of this species, very clearly indicate *Cytheridea*, but it does not appear to have very close affinities with any of the described species of the genus. In a broad way these fall into two groups, the first, including such forms as *C. mülleri*, *C. debilis* and *C. sorbyana*, being characterized by an acuminate posterior extremity, while the second, embracing such species as *C. perforata*, *C. pinguis* and *C. incrassata*, the posterior end is blunt and the anterior end so wide that the outline is subtriangular, *C. subovata* evidently occupies an intermediate position though its affinities probably are with the second group rather than the first.

Length of a typical left valve 0.58 mm., height of same 0.50 mm., length of a typical right valve 0.93 mm., height of same 0.50 mm., thickness of perfect carapace 0.40 mm., length of left valve of a narrow variety 0.90 mm., height of same 0.47 mm., length of right valve of the short variety 0.78 mm., height of same 0.47 mm.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHERIDEA (?) CHESAPEAKENSIS n. sp.

Plate XXXVII, Fig. 9.

*Description.*—Right valve ovate-subtriangular, obtusely acuminate posteriorly, the dorsum areuate and curving gradually into the anterior outline, which is rather narrowly rounded in the lower half; ventral margin straight in the anterior half and gently areuate posteriorly. Surface rather strongly convex in the posterior half, sloping more gently forward. Ornament, consisting of small pits arranged in six or seven curved longitudinal rows, almost confined to the postventral third. Posterior extremity with a fringe of five or six small spines. Anterior edge with a narrow but sharply defined flat border. Test very thin. Hingement not satisfactorily determined, but it is certainly not like that of a true *Cythere*. The cardinal edge looks like that of a *Cytheridea*, but we failed to make out the denticles if these are really present. Possibly the species belongs to *Cytherideis*. Left valve unknown.

We are not entirely satisfied that the valve above described may not turn out to be the right valve of a species of *Cythere* like our *C. porcella*, but as the hinge, which appears to be in good condition, presented not a sign of the terminal teeth and sockets observed in that and all other species of *Cythere*, we felt obliged to classify the specimen in accordance with its known characteristics.

Length of a right valve 0.8 mm., greatest height of same 0.43 mm.

*Occurrence.*—CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

Genus CYTHERIDEIS Jones.

CYTHERIDEIS ASHERMANI n. sp.

Plate XXXVII, Figs. 10-16.

*Description.*—Carapace moderately elongate, considerably wider posteriorly than anteriorly; ventral outline nearly straight, ends narrowly rounded and most prominent beneath the midheight, above curving toward the cardinal edge which is more gently arcuate. Ventral edge of right valve slightly sinuate. Surface rather coarsely punctate, the punctæ having no very striking arrangement though they often form irregular rows on the dorsal slope. On the longer specimens they constitute less of a feature than on the smaller examples.

Hingement consisting of a slight central overlap by the right valve and thin terminal bars that fit into corresponding sulci in the cardinal edge of the left valve.

This species compares perhaps best with *Cytherideis trigonalis* Jones, but is readily distinguished by its smaller size, more elongate form, more obtuse cardinal angles, and coarser markings.

The specific name is derived from that of Mr. George Asherman, of Cincinnati, Ohio, who has for years spent much time in the collection of these minute crustacea and to whom we are indebted for disinterested aid in the laborious task of picking specimens from our washings.

Length of a very large and unusually elongate right valve 0.94 mm., greatest height of same 0.44 mm., corresponding dimensions of a small right valve 0.62 mm. and 0.31 mm., length of a rather large left valve 0.80 mm., greatest height of same 0.41 mm., thickness of a complete carapace, having a length of 0.85 mm., about 0.3 mm.

*Occurrence.*—CALVERT FORMATION. Plum Point. Also in the CHESAPEAKE GROUP at Yorktown, Virginia.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHERIDEIS CYLINDRICA n. sp.

Plate XXXVII, Fig. 17.

*Description.*—Carapace very frail, elongate, cylindrical, with rounded and nearly equal ends; ventral outline straight, dorsal very gently arcuate. A narrow marginal rim on the ends. Surface finely reticulate.

This is the most fragile of the Ostracoda occurring in the Plum Point washings. Its valves are always separated and they are not only difficult to mount without breaking, but, on account of the approximate quality of their ends, it is also difficult to distinguish the right from the left. The obtuse, subequal ends, the cylindrical form fragile test and reticulate ornament constitute a combination of characters not possessed by another species of the genus known to us. It is probably nearest our *Cytherideis longula*.

Length 0.9 mm., greatest height 0.37 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point. (Not common.)

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CYTHERIDEIS SUBÆQUALIS n. sp.

Plate XXXVII, Fig. 28.

*Description*.—Carapace elongate subreniform, with rounded, approximately equal ends, distinctly arcuate dorsum and slightly sinuate ventral outline. Left valve overlapping the right along the ventral margin. Test strong, surface sparsely pitted.

The general aspect of the closed carapace of this species is decidedly like that of a *Bythocypris*, and we deem it quite possible that its relations are with that family rather than the *Cytherida*. Still, considering the rather close agreement in external characters exhibited between it and the following two species, whose hingement is known to be in accordance with that of *Cytherideis*, we have considered ourselves justified in assuming provisionally that the same type of hingement pertains also to *C. subæqualis*. Compared with described Tertiary species there is none known to us from which it may not be distinguished with ease.

Length 0.88 mm., height 0.37 mm., thickness 0.35 mm.

*Occurrence*.—CALVERT FORMATION. Plum Point (Rare).

*Collections*.—U. S. National Museum, Maryland Geological Survey.

CYTHERIDEIS SEMICIRCULARIS n. sp.

Plate XXXVII, Figs. 18-20.

*Description*.—Carapace nearly semicircular in outline, the ventral border straight, the ends abruptly rounded. Left valve the larger, form-

ing a slight dorsal and a longer ventral overlap. Greatest thickness of carapace just behind and a little below the middle. Surface closely pitted.

Distinguished by its semicircular outline.

Length of entire carapace 0.84 mm., greatest height of same 0.40 mm., thickness of same 0.37 mm., length of a right valve 0.75 mm., height of same 0.35 mm.

*Occurrence.*—CHOPTANK FORMATION. On Peach Blossom Creek, 3 miles southwest of Easton. CALVERT FORMATION. Plum Point.

*Collections.*—U. S. National Museum, Maryland Geological Survey.

CYTHERIDEIS LONGULA n. sp.

Plate XXXVII, Figs. 21-27.

*Description.*—Carapace elongate, subcylindrical, slightly curved, the ventral outline straight, the dorsal gently arcuate, the ends rounded, the posterior one much narrower than the anterior. Right valve the smaller, more arcuate dorsally than the left and very gently sinuate ventrally. Left valve with a sharply defined though narrow marginal rim on the anterior end; right valve with a similar flattened border on both ends. Surface pitted or reticulated, some variation in the size and distribution of the pits being shown among the abundant specimens before us. Hinge-ment as demanded by the genus.

Distinguished from *C. subaqualis* by its greater length, unequal ends and marginal rims. *C. semicircularis* is shorter, a little thicker and differently outlined in lateral and ventral views. *C. cylindrica* has wider and more equal ends, a finer surface reticulation, and a less arcuate dorsal edge. The general aspect of *C. longula* is also very similar to that of the Eocene *Bythocypris parilis* Ulrich, but there are recognizable differences in their respective outlines, the dorsum of the *Bythocypris* being more arcuate and its ends more equal and without the flattened borders which are always present on the valves of *C. longula*. The reticulation or pitting of the surface also is a more conspicuous feature in the latter.

Length of entire carapace 0.90 mm., greatest height of same 0.36 mm., thickness of same 0.33 mm., length of a left valve 0.95 mm., greatest height of same 0.37 mm., length of a right valve 0.90 mm., greatest height of same 0.34 mm.

*Occurrence.*—CHOPTANK FORMATION. On Peach Blossom Creek, 3 miles southwest of Easton. CALVERT FORMATION. Plum Point and Church Hill.

*Collection.*—U. S. National Museum.

Genus CYTHEROPTERON G. O. Sars.

CYTHEROPTERON NODOSUM n. sp.

Plate XXXVIII, Figs. 37-40.

*Description.*—Of this remarkable species a single right valve only has been observed. It is strongly but very irregularly convex, with a low and broad swelling in the anterior half, another large protuberance in the postcardinal fourth, a third smaller node just within the depressed and somewhat produced posterior extremity, and a fourth, wing-like prominence, that attains a greater altitude than the other nodes, on the posterior end of a well-defined ventral ridge. In addition to these there is a small spine near the posteroventral angle and a small knob just within the anterodorsal angle. The outline is elongate, subtrapezoidal, the ends subequal, with the anterior slightly the wider, obliquely truncate, converging dorsally. The ventral outline is gently convex and slightly overhung by the posterior third of the ventral ridge. The dorsal outline is slightly concave, the concavity being due chiefly to the projection of the postcardinal node. The central part of the surface is depressed, forming a broad though not sharply defined sulcus. A sharply outlined, bevelled border encloses the ends, the posterior border continuing forward to about the middle of the ventral edge where the bevel is reversed and turned inward to form the small concave area that is more or less readily distinguishable on the majority of the OSTRACODA of this family. The anterior border does not meet the border coming from the opposite end but passes on above it as an impressed line which gradually becomes obsolete a short distance behind the middle of the ventral side. The surface ornament consists of somewhat scattered pits of moderate size.

Length of a right valve 0.68 mm., height of both ends each about 0.30 mm., greatest thickness about 0.25 mm.

The rudely nodose or hummocky surface of the valves of this species

will serve, we believe, in distinguishing it from all other described forms of the genus. Corresponding protuberances are indicated in two of Lienenklaus' species from the Miocene and Upper Oligocene of Germany, viz., in *C. denticulatum* very faintly, in *C. caudatum* more distinctly. This indication, however, consists of little more than what may be produced by the development of a median sulcus, so that there is still left a considerable gap between them and *C. nodosum*. Some resemblance is noted in comparing *C. nodosum* with *Cythere harrisiana* Jones, but we are not prepared to say that it indicates genetic relationship. However that may be, there can be no question concerning the specific distinctness of the two forms.

*Occurrence.*—CHESAPEAKE GROUP. James River, Va. Probably also in Maryland.

*Collection.*—U. S. National Museum.