

ABSTRACT: More than a hundred species of ostracodes are described or listed from the Eocene and Oligocene of Trinidad. One genus and thirty-four species are new, forty-six species have been described previously from the Caribbean and the Gulf Coast. It is shown that the genus *Krithe* can be used for biostratigraphic zonation.

Eocene and Oligocene Ostracoda of Trinidad

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INTRODUCTION

This study is the fourth in a series on the Tertiary ostracodes of Trinidad. It deals with species from the Lizard Springs, Navet and San Fernando formations and the so-called "Gaudryina beds" of Eocene age and the lower Cipero formation of Oligocene age. Previous studies have covered the Paleocene and part of the lower Eocene (van den Bold, 1957a), and the lower and possibly part of the middle Miocene (van den Bold, 1957b, 1958b). Information from these papers has been incorporated in the present report, and, in a few cases where the stratigraphic range of some previously described species was extended into Eocene or Oligocene, no mention of the species has been made in the systematic part. Studies of the planktonic foraminifera by H. M. Bolli (1957a, b, c) and others have been used to establish the stratigraphic ranges of the ostracodes. However, to a certain extent, these ranges are still imperfectly known. The material on which this study is based was provided by Texaco Trinidad, Inc.; permission to publish this information is herewith gratefully acknowledged. The ostracodes were picked out of the samples at their laboratory in Pointe-a-Pierre, so that the stratigraphic position of the samples could not be checked against that of the foraminifera. As a result some ideas, based on the study of older publications had to be changed after new and unpublished data had been received from the geologists and paleontologists working in Trinidad. I am particularly indebted to H. G. Kugler and J. B. Saunders for providing me with this necessary information and for criticism of the initial draft of this paper.

Holotypes and paratypes of the new species have been deposited in the collections of the U.S. National Museum in Washington, D. C., except the types for *Pseudocythere cubensis*, which were deposited in the Geological Museum of Utrecht University, from which institution material was received on loan. In this connection, I thank C. R. Drooger for his kind cooperation.

The illustrations of the species were drawn from photographs, enlarged up to about 160 times. H. V. Howe generously allowed the use of his photographic equipment for this purpose.

ECOLOGY

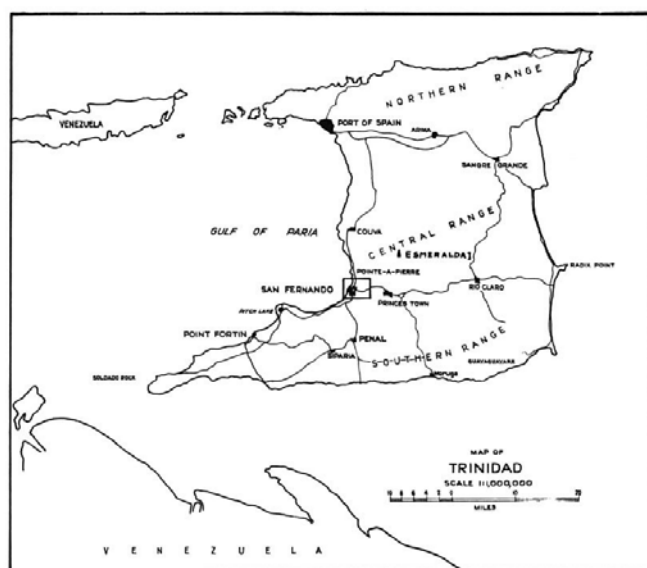
Two types of facies have been found in the Eocene and Oligocene of Trinidad:

- 1) *Open sea facies*: Represented by the marls and calcareous clays of the Lizard Springs, Navet and Cipero formations, rich in planktonic foraminifera. The ostracodes belong mainly to the genera: *Alatocythere*, *Argilloecia**, *Bairdia**, *Bythocypris*, *Cardobairdia*, *Cythereis*?, *Cytherella**, *Henryhowella**, *Krithe**, "Krausella", *Parakrithe** and some species of *Trachyleberis* (species *bollii* and ?*hazela*).

*Genera marked by an asterisk have their main distribution in open sea facies, but they may also occur in shallow water, near shore deposits.

Many of the open sea species have fairly long stratigraphic ranges. In the case of smooth forms, which predominate in these deposits, this could be partly due to inability to separate these apparently long-lived species into shorter-lived groups. However, some of the ornamented species remain unchanged over a long span of time (*Alatocythere maerkyi*, *Cythereis? trinidadensis*, *Trachyleberis? hazela*).

- 2) *Near shore facies*: Represented by the sandy and silty clays, silts and occasional limestones of the San Fernando formation and the "Gaudryina beds", containing more benthonic than planktonic foraminifera. The ostracodes belong to the genera: *Argilloecia**, *Bairdia**, *Bosquetina*?, *Brachyocythere*, *Buntonia*, *Cativella*, *Costa*, *Cytherella**, *Cytheropteron*, *Cytherura*, *Eucytherura*, *Hemicythere*, *Hermanites*, *Krithe**, *Loxoconcha*, *Macrocypris*, *Microcythere*?, *Munseyella*, *Paracypris*, *Parakrithe**, *Protobuntonia*, *Pseudocythere*, *Quadracythere*, *Ruttenella*, *Trachyleberis* (species *bermudezi*, ?*spiniferrima*, ?*hapsida*) and *Xestoleberis**. Most of these shallower water forms have comparatively short stratigraphic ranges, but since they are influenced or even controlled by facies changes, their true ranges are difficult to ascertain. The large horizontal distribution of some of them within a short section of the geological column, however, suggests their usefulness in correlation.



TEXT-FIGURE 1
MAP OF TRINIDAD

A short discussion of the formations follows. For details the reader is referred to the original descriptions and to later discussions by Kugler (1953), Bolli (1957a, b, c), Suter (1951) and others.

STRATIGRAPHY

LIZARD SPRING FORMATION (Cushman and Jarvis, 1928, pp. 85-103).

The Lizard Springs formation consists of greenish-grey marl and calcareous clay grading into the Navet formation by an increase in calcareous content. The Ramdat marl was originally included with the Navet formation and for that reason no reference was made to it in the paper on the Paleocene ostracoda (van den Bold, 1957a). Since then Bolli (1957a) has included it with the Lizard Springs formation, as the increase in calcium carbonate takes place after the deposition of the Ramdat marl.

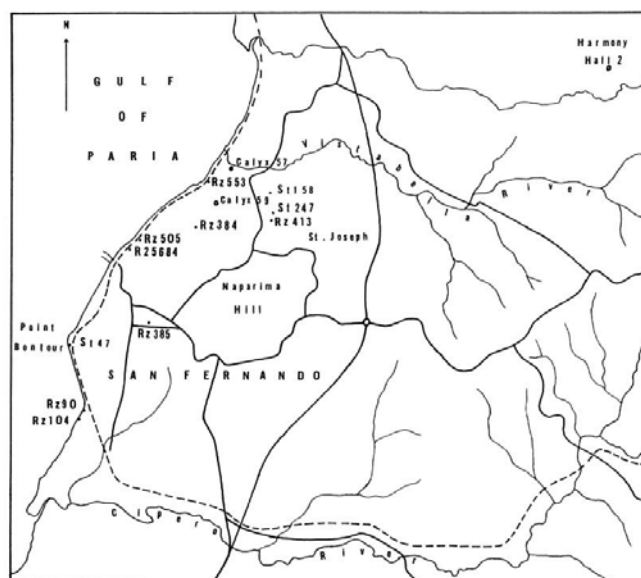
Globorotalia aragonensis zone, Ramdat Marl.

Type sample: Renz 413, location on text-fig. 2 (see also Bolli, 1957a, p. 64).

Ostracode fauna: *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia cespidesensis*, *Bairdia cassida*, *Bythocypris guppyi*, *Krithe guatemalensis*, *Krithe cancuensis*, *Cythereis? trinidadensis*, *Alatacythere maerkyi*.

NAVET FORMATION (Renz, 1942, p. 535).

The Navet formation consists of light grey and greenish grey marls and marly clays with a thickness up to 1000 feet, usually rich in planktonic foraminifera. Bolli (1957c, pp. 156-159) has succeeded in establishing seven biostratigraphic zones, based on planktonic foraminifera, which in part coincide with the previously established members (Cushman and Renz, 1948). Charts 1-4 show



TEXT-FIGURE 2
MAP OF SAN FERNANDO AREA

the correlation of these members with the foraminiferal zones. The Navet includes part of the Wilcox, Claiborne and lower Jackson stages of the Gulf coast of the U.S. and is lower to lower upper Eocene in age.

In this open sea facies of the Navet formation only a small number of ostracode species occur, although specimens may be locally abundant, and most of their representatives have fairly long stratigraphic ranges. However, the *Krithe* can be used for subdividing the Navet formation into five ostracode zones (Chart 2).

Globorotalia palmerae zone (Bolli, 1957c, p. 156, 158).

Type sample: Esmeralda well 1, core 9386-9405 feet (text-fig. 1). The ostracod fauna is very poorly preserved with only *Krithe guatemalensis*, *Argilloecia subcylindrica* and *Xestoleberis* sp. (not described) positively identified.

Hantkenina aragonensis zone, Friendship Quarry marl.

Type sample: Renz, 336 (Bolli, 1957c, p. 158). Ostracode fauna: *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia cespidesensis*, *dolicha*, *Bythocypris guppyi*, "*Bythocypris*" *pykna*, *Cardobairdia ovata*, *Krithe guatemalensis*, *Krithe cancuensis*, *Parakrithe?* sp. (not described), *Trachyleberis? spiniferrima*.

Other typical samples mentioned by Bolli (1957, p. 158): Kugler sample 8781: *Krithe guatemalensis*, *Krithe saundersi*, *Cythereis? sculptilis*, *Cythereis? trinidadensis*, *Cythereis?* sp. (not described); Kugler sample 8820: *Cytherella navetensis*, *Argilloecia subcylindrica*, *Krithe guatemalensis*, *Krithe cancuensis*, *Krithe saundersi*, *Parakrithe?* sp. (not described), *Cytheropteron trinidadensis*, *Trachyleberis bollii*, *Cythereis?* sp. (not described); Kugler sample 8823: "*Krausella*" aff. *minuta*, *Krithe guatemalensis*, *Krithe cancuensis*, *Krithe saundersi*, *Parakrithe?* sp. (not described); Kugler sample 8911: *Krithe cancuensis*, *Krithe saundersi*, *Trachyleberis bollii*, *Cythereis?* sp. (not described), *Henryhowella* sp. (not described).

EOCENE AND OLIGOCENE OSTRACODA OF TRINIDAD

Globigerapsis kugleri zone, Dunmore Hill marl.

Type sample: Renz 476 (Bolli, 1957c, p. 158). Ostracode fauna: *Cytherella navetensis*, *Bairdia cespidesensis*, "*Krausella*" aff. *minuta*, *Krithe saundersi*, *Henryhowella* sp. (not described).

Other sample (Bolli, 1957c, p. 158): Kugler 8821, *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia cespidesensis*, *Bythocypris*? *cancanaensis*, "*Bythocypris*" *pykna*, *Krithe cancenensis*, *Krithe saundersi*, *Parakrithe*? sp. (not described), *Trachyleberis*? *hazela*, *Henryhowella* sp. (not described).

Globorotalia lehneri zone, Fitt Trace marl.

Type sample: Ks 233 (Bolli, 1957c, p. 158). Ostracode fauna: *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia cespidesensis*, *Bairdia dolicha*, *Bairdia cassida*, *Bythocypris*? *cancanaensis*, "*Bythocypris*" *pykna*, "*Krausella*" aff. *minuta*, *Krithe cancenensis*, *Krithe saundersi*, *Parakrithe elongata*, *Trachyleberis bollii*, *Cythereis*? *trinidadensis*, *Henryhowella* sp. (not described), *Uroleberis* aff. *ranikotiana*.

Other samples (Bolli, 1957c, p. 158): Kugler sample 8780, *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia cassida*, *Krithe saundersi*, *Krithe crassicaudata*, *Trachyleberis bollii*; Kugler sample 8815, *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bythocypris guppyi*, *Krithe saundersi*, *Ambocythere* sp. (not described); Kugler sample 8822, *Cytherella navetensis*, *Bairdia cespidesensis*, *Argilloecia subcylindrica*, *Krithe saundersi*, *Cythereis*? sp. (not described). The Navet river marl, type sample Rohr 4347a, is considered to be of the same age: *Cytherella navetensis*, *Argilloecia subcylindrica*, *Bairdia* sp., *Krithe cancenensis*, *Krithe saundersi*, "*Krausella*" aff. *minuta*, *Trachyleberis*? *hazela*, *Xestoleberis* sp. (not described).

Porticulusphaera mexicana zone, Penitence Hill marl.

Type sample: Renz 385, text-fig. 2 (Bolli, 1957c, p. 158). Ostracode fauna: *Cytherella navetensis*, *Bairdia cespidesensis*, *Bairdia* sp. (not described), *Bythocypris guppyi*, *Cardobairdia ovata*, *Argilloecia* sp., (not described), *Krithe saundersi*, *Krithe crassicaudata*, *Parakrithe elongata*, *Trachyleberis bollii*, *Alatocythere maerkyi*, *Xestoleberis* sp. (not described). As the original type locality is no longer accessible, Bolli (1957c, p. 158) replaced it by Kugler, sample 8814: *Cytherella navetensis*, *Argilloecia* sp. (not described), *Bairdia cassida*, *Krithe saundersi*, *Trachyleberis*? *hazela*.

Truncorotaloides rohri zone (Bolli, 1957c, p. 159).

Additional material from this zone, the type sample of which was not available, was received from J. B. Saunders. Sample: Esmeralda well 1, 380–394 feet core. Ostracode fauna: *Argilloecia subcylindrica*, *Krithe saundersi*, *Krithe crassicaudata*, *Parakrithe elongata*, *Parakrithe*? sp. (not described) *Trachyleberis*? *hazela*, *Ambocythere elongata*, *Ambocythere* sp. (not described), *Uroleberis* aff. *ranikotiana*.

Globigerapsis semiinvoluta zone, Hospital Hill formation.

Type sample: Renz 75 (Bolli, 1957c, p. 159). Ostracode fauna: *Cytherella navetensis*, *Bairdia cespidesensis*, *Bythocypris guppyi*, "*Bythocypris*" *pykna*, *Krithe elongata*, *Krithe saundersi*, *Krithe crassicaudata*, *Parakrithe elongata*, *Trachyleberis*? *hazela*, *Cythereis*? *trinidadensis*, *Henryhowella asperrima*, *Alatocythere maerkyi*.

Other samples (see Bolli, 1957c, p. 159): Kugler sample 8829, *Argilloecia* aff. *alexanderi*, *Eucythere* sp. (not described), *Krithe* sp. (indet), *Ambocythere elongata*, *Trachyleberis bermudezi*, *Trachyleberis*? *hazela*; Kugler sample 8832, *Cytherella harmoniensis*, *Bythocypris guppyi*, *Argilloecia* aff. *alexanderi*, *Krithe crassicaudata*, *Krithe saundersi*.

POINTE-A-PIERRE FORMATION (Waring, 1926, p. 39).

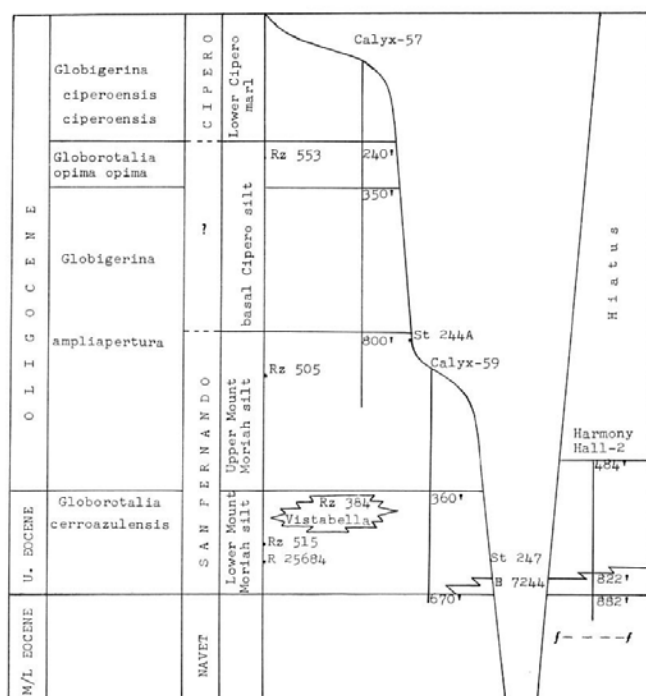
In the gritty sandstones and sandy clays of the Pointe-a-Pierre formation no ostracodes have been found. However, in silty sandy clays, which are believed to be associated with this formation, the so-called "*Gaudryina*" beds, a fairly well preserved ostracode fauna occurs, which bears some resemblance to the fauna of the Concepcion formation (lower and middle Eocene) of the Maracaibo basin (see Kuyl, Muller and Waterbolk, 1955, fig. 7). *Helicolepidina* cf. *spiralis* and *Tremastegina senni* point to a possible middle Eocene age (Kugler, 1953, p. 44). The best preserved fauna was found in Trinidad Petroleum Development's Esmeralda well 1 and in some core holes in the Biche and Charuma areas. The difference of this fauna with the Navet formation of approximately the same age is striking and apparently ecological conditions were not greatly different from those prevailing during the deposition of the San Fernando formation with the fauna of which the "*Gaudryina* beds" have many genera in common.

"*Gaudryina* beds".

Type: Esmeralda well 1, core from 3052–3071 feet. Position of well: N 270297 links, E 415 893 links (Trinidad Government Cadastral coordinates). Ostracode fauna: *Cytherella mexicana* Cushman?, *Bairdia* sp. (not described), *Bythocypris*? *cancanaensis*, *Munseyella* sp., *Munseyella israelskyi*, *Trachyleberis spiniferrima*, *Costa* n. sp., aff. *barri* (not described), *Costa* n. sp., aff. *harmoniensis* (not described), *Hermanites* sp., *Buntonia alabamensis*, *Buntonia seminuda*, *Bosquetina*? *concepcionensis*, *Loxiconcha claibornensis*. In a core 2630–2650: less typical sample: *Eucythere* sp., *Occultocythereis*? sp., *Eucytherura* sp., *Bairdia machaquillaensis* was not in this sample but occurs in typical "*Gaudryina* beds" elsewhere.

SAN FERNANDO FORMATION (Guppy, 1866, p. 570–590).

The San Fernando formation is made up of silts and sands, with conglomerates often at the base, and lenses of clay and orbitoidal limestone. Total thickness up to 800 feet. The lower part of the formation belongs to the *Globorotalia cerroazulensis* zone and can be correlated with the upper Jackson of the U. S. Gulf Coast. The



TEXT-FIGURE 3

Stratigraphic correlation between Calyx well holes 57 and 58, Harmony Hall well 2 and surface samples in the San Fernando area.

ostracode fauna also shows relationship to that of the Pauji formation (upper Eocene) of the Maracaibo basin. The lithological subdivisions shown on Tables 1-4 are those found locally near the type area of Mount Moriah Hill in the northern part and north of the borough of San Fernando. The distribution of the ostracodes is mainly based on their occurrence in samples collected from railway cuts north of San Fernando railway station and in Calyx holes 57 and 59 (text-fig. 2). The lenticular bed of orbitoidal limestone (Vistabella) mentioned by Waring (1926, p. 47) as lying 200 feet above the calcareous beds and which contains the larger foraminifera described by Vaughan and Cole (1941) is tentatively plotted into this section. The position of Harmony Hall well 2 is based entirely on the occurrence of ostracodes as is the position of Barr sample 7244, from St. Joseph village, northeast of San Fernando.

Lower Mount Moriah silt, non-calcareous zone.

Type sample Renz 515 (text-fig. 3). Because of the better development of the ostracode fauna, this sample is replaced by the nearby type locality of the *Globorotalia cerroazulensis* zone (Bolli, 1957, p. 160), *Globorotalia cocoensis* zone, Rohr sample 25604 (text-figs. 2-3): *Cytherella stainforthi*, *Bairdia caraibensis*, *Bairdia* sp. B., *Bairdia* sp. C. *Krithe hiwanneensis*, *Krithe saundersi*, *Munseyella reticulata*, *Brachycythere harmoniensis*, *Costa harmoniensis*, *Costa lehneri*, *Costa barri*, *Jugosocythereis vicksburgensis*, *Echino-*

cythereis okeechobiensis, *Trachyleberis? reticulospinosa*, *Trachyleberis? hapsida*, *Cativella moriahensis*, *Eucytherura kugleri*, *Xestoleberis chamela*.

Lower Mount Moriah silt, *Globorotalia cerroazulensis* zone.

Stainforth sample 247 (text-figs. 2, 3): *Cytherella* aff. *pulchra*, *Costa lehneri*, *Costa harmoniensis*, *Loxoconcha wagneri*, *Eucytherura kugleri*.

Upper Mount Moriah silt, calcareous zone.

Type sample, Renz 505 (text-figs. 2-3), *Globigerina ampliapertura* zone Loc. N 237.430 links, E 356800 links. Ostracode fauna: *Cytherella* aff. *pulchra*, *Argilloecia nutusa*, *Krithe saundersi*, *Krithe cubensis*, *Krithe elongata*, *Parakrithe? ovata*, *Loxoconcha wagneri*, *Cytheropteron montgomeryensis*, *Cytheropteron? trinidadensis*, *Cytherura hermes*, *Xestoleberis moriahensis*; Stainforth sample 244A, *Cytherella* aff. *pulchra*, *Cytherella stainforthi*, *Argilloecia nutusa*, *Krithe hiwanneensis*, *Parakrithe? ovata*, *Costa harmoniensis*, *Henryhowella asperrima*, *Trachyleberis bermudezi*, *Cytherura hermes*, *Cytheropteron montgomeryensis*, *Loxoconcha wagneri*, *Xestoleberis moriahensis*.

Boca de Serpiente marl (Maury, 1929, p. 100, Soldado Rock).

Type sample: Kugler 3692, for location see Kugler, 1938 (Bed 10). Ostracode fauna: *Cytherella harmoniensis*, *Cytherella* aff. *pulchra*, *Cytherella serpentiensis*, *Bairdia cespidesensis*, *Bairdia inequivalvis*, *Bairdia* sp. A., *Ruttenella ovata*, *Trachyleberis? reticulospinosa*, *Trachyleberis? hapsida*, *Trachyleberis bermudezi*, *Costa meka*, *Henryhowella asperrima*, *Cytherura vistabellensis*, *Eucytherura kugleri*, *Xestoleberis moriahensis*, *Xestoleberis* sp.; Kugler sample 3741; south coast of Soldado Rock, Bed 4 of Kugler, 1938, *Globorotalia cerroazulensis* zone: *Cytherella* aff. *pulchra*, *Cytherella harmoniensis*, *Argilloecia* cf. *alexanderi*, *Bairdia cespidesensis*, *Krithe hiwanneensis*, *Krithe cubensis*, *Parakrithe? ovata*, *Microcythere? sp.*, *Munseyella reticulata*, *Ruttenella ovata*, *Trachyleberis bermudezi*, *Costa harmoniensis*, *Henryhowella asperrima*, *Hemicythere crystalriverensis*, *Loxoconcha wagneri*, *Cytherura hermes*, *Eucytherura kugleri*, *Eucytherura tricornis*, *Cytheropteron montgomeryensis*, *Paracytheridea* sp., (not described), *Xestoleberis moriahensis*, *Xestoleberis chamela*, *Xestoleberis dumblei*.

Vistabella marl.

Type sample: Renz 384 (text-figs. 2-3), Loc. N. 238220 links, E 359630 links. Ostracode fauna: *Cytherella stainforthi*, *Argilloecia* aff. *alexanderi*, *Bairdia* sp., *Ruttenella ovata*, *Krithe hiwanneensis*, *Krithe cubensis*, *Parakrithe? ovata*, *Costa barri*, *Costa harmoniensis*, *Costa meka*, *Henryhowella asperrima*, *Munseyella minuta*, *Cytherura vistabellensis*, *Eucytherura tricornis*, *Cytheropteron montgomeryensis*, *Xestoleberis moriahensis*, *Xestoleberis chamela*.

Basal Cipero silt.

Type sample: Stainforth sample 47 (text-fig. 2), *Globigerina ampliapertura* zone. Ostracode fauna: *Cytherella stainforthi*, *Cytherella* aff. *pulchra*, *Cytherella* sp. A, *Argilloecia nutusa*, *Argilloecia* cf. *alexanderi*, *Bairdia cespidesensis*,

Krithe hiwanneensis, *Costa lehneri*, *Costa meka*, *Cativella moriahensis*, *Hermanites* aff. *H. paijenborchiana*, *Henryhowella asperrima*, *Munseyella reticulata*, *Munseyella minuta*, *Cytherura vistabellensis*, *Cytherura byramensis*, *Cytherura* sp., *Loxoconcha wagneri*, *Loxoconcha jacksonensis*, *Xestoleberis moriahensis*; Renz sample 553 (text-figs. 2-3), *Globorotalia opima opima* zone *Cytherella* aff. *pulchra* and var., *Cytherella stainforthi*, *Cytherella* sp. A, *Argilloecia nutusa*, *Bairdia cespidesensis*, *Henryhowella asperrima*, *Costa lehneri*, *Krithe hiwanneensis*, *Loxoconcha wagneri*, *Xestoleberis chamela*.

CIPERO FORMATION (Cushman and Renz, 1945, p. 1-75).

In the San Fernando area the boundary between the San Fernando formation and the Cipero formation is transitional: the silts and sandy clays of the San Fernando formation persist as high as the *Globorotalia opima opima* zone. Higher in the section the Cipero consists of marly clays and marls with a rich planktonic fauna which was used by Bolli (1957b, p. 103) to subdivide the Cipero formation into eleven biostratigraphic zones, four of which represent the Oligocene. With the incoming of open sea conditions the ostracode fauna decreases in the number of species and genera with the genera *Cytherella*, *Bairdia* and *Krithe* predominating, and it shows some similarity to the fauna of the Navet formation. The genus *Krithe* can be used to subdivide the Cipero formation into biostratigraphic zones (Chart 2). Because many samples containing ostracodes have not yet been properly placed in the stratigraphic succession, the ranges of the species are based only on their occurrence in those samples which have been determined as belonging to Bolli's biostratigraphic zones. Unfortunately no material from Bolli's type localities has been available and therefore the fauna of the individual localities has not been listed. In many cases the stratigraphic ranges of the species will be found to be incomplete. Some of the samples through the stratigraphic succession on which the distribution of the ostracodes has been based are:

Renz sample 104, *Globigerina ampliapertura* zone; Renz sample 90, *Globorotalia opima opima* zone (former type locality of Renz and Stainforth's *Globigerina concinna* zone); Saunders samples 845, 847, *Globorotalia kugleri* zone and many other samples mainly by Renz from the Cipero section along the west coast of Trinidad south of San Fernando.

In this paper the San Fernando formation has been shown as extending into the lower Oligocene, mainly because Renz has applied the name Mount Moriah silt to the zone penetrated in Calyx hole 57 below about 800 feet and in Calyx hole 59 from the top to about 360 feet. He also included the basal Cipero silt in the San Fernando formation. However, Kugler (personal communication of May 13, 1959) now wants to restrict the San Fernando formation to the upper Eocene and points out that the silts belonging to the *Globigerina ampliapertura* and *Globorotalia opima opima* zones are lithologically distinct from the Mount Moriah silt. He writes: "The latest large scale excavations for a housing

scheme east of the San Fernando railway station has clearly shown the block conglomerate at the base of the Cipero silts. Huge slipmasses of Mount Moriah silt are surrounded by 'Basal Cipero silt', which in its lithological aspect can be clearly differentiated from the Eocene Mount Moriah silt, hence also from the San Fernando formation. This unconformity is of fundamental importance for there are many indications that lower Oligocene deposits may be completely missing and that an upper Oligocene sea transgressed on upper Eocene sediments." Since it would be very difficult and completely outside the scope of this work to incorporate these new ideas in the range charts and in the correlations on text-figure 3, I have left the San Fernando formation partially extending into the lower Oligocene. As pointed out above, however, this is not in agreement with the latest views of Trinidad geologists.

SYSTEMATIC DESCRIPTIONS

Class CRUSTACEA
Order OSTRACODA Latreille
Suborder PLATYCOPA Sars
Family CYTHERELLIDAE Sars
Genus CYTHERELLA Jones, 1849

Cytherella navetensis van den Bold, new species

Plate 1, figure 1a-c

Cytherella sp., VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 4, pl. 2, fig. 1.

Carapace large, ovate, thick-shelled. Anterior end of the right valve broadly rounded, dorsally slightly more narrow than ventrally; dorsal margin convex, nearly straight in posterior third, greatest height just anterior to the middle, converging towards the ventral margin, which has a shallow concavity just behind the middle; posterior end low, obliquely and narrowly rounded. Left valve highest in anterior half, where dorsal and ventral margin are nearly parallel. Anterior end broadly and obliquely rounded; dorsal margin nearly straight in anterior half, slightly convex and sloping down towards the low posterior end behind the middle; ventral margin nearly straight; posterior end obliquely rounded, more narrowly rounded in the upper part.

Strongest overlap of the right valve in the anterior part of the dorsal margin. Dorsal view with blunt posterior end in the right valve, greatest width just behind the middle.

Dimensions: Holotype, right valve: length 1.50 mm; height 0.91 mm; width 0.31 mm., from Renz sample 336. Paratype, left valve: length 1.50 mm.; height 0.83 mm.; width 0.28 mm., from Renz sample 336. Complete carapace: length 1.25 mm.; height 0.77 mm.; width 0.46 mm., from Barr 6872, Lizard Springs formation.

This species occurs throughout the Navet formation, highest occurrence in the Hospital Hill marl, lowest occurrence in the upper Lizard Springs formation. A

few specimens have been found in the San Fernando formation, but the difference in preservation with the rest of the fauna suggests that they are reworked there.

Holotype: A right valve from Renz sample 336, Friendship Quarry marl, Navet formation, *Hantkenina aragonensis* zone, U.S.N.M. no. 563469; paratypes: U.S.N.M. nos. 563470 and 563471.

***Cytherella harmoniensis* van den Bold, new species**

Plate 1, figure 2a-c

Carapace ovate, both ends broadly rounded, dorsal and ventral margin roughly parallel, greatest height just in front of the middle.

Female: Anterior end broadly rounded, dorsal margin convex in right valve, slightly sinuate in the left; ventral margin nearly straight; posterior end broadly and obliquely rounded, slightly more narrowly below the middle. Overlap of the right valve strongest along dorsal margin just anterior to the middle and along the ventral margin; very little overlap at posterior end; in the anterior end the overlap is largely obscured by a carina in the left valve. Dorsal view wedge-shaped, posterior end wide, broadly rounded, greatest width about one-third from the posterior end.

Male: About the same shape as the female, but posterior end more obliquely rounded in side view. Dorsal view with narrow, wedge-shaped anterior and posterior ends. Greatest width about one third from behind.

Dimensions: Holotype, female: length 0.87 mm.; height 0.57 mm.; width 0.40 mm. Paratype, male: length 0.85 mm.; height 0.56 mm.; width 0.36 mm.

The species occurs throughout the upper Eocene in the San Fernando formation and in the Hospital Hill marl of the Navet formation. In the Oligocene it is apparently replaced by a related species which has been called *Cytherella* sp. aff. *C. sylverinica* Howe and Law (van den Bold, 1958b, p. 396, pl. 1, fig. 1a, b).

Holotype: A female carapace from Harmony Hall well no. 2, 601-613 feet, upper Eocene, San Fernando formation, U.S.N.M. no. 563472; paratypes: U.S.N.M. no. 563474.

***Cytherella stainforthi* van den Bold, new species**

Plate 1, figure 3a-c

Female: Carapace ovate, highest in the middle, both ends broadly rounded. Dorsal margin with slightly concave anterior slope in the left valve and broadly convex in the right, ventral margin strongly convex. Right valve overlapping the left along the entire periphery with strongest overlap along the ventral margin and anterodorsally. The left valve has about the same shape as the right, but the greatest height lies slightly more posteriorly. Dorsal view elongate pear-shaped, posterior end wide, broadly rounded, clearly showing

the overlap of the right valve; anterior end relatively wide and blunt, narrowly rounded. Greatest height about one third from behind, sides slightly concave in front of the middle.

Male: Ovate, higher in front than behind, greatest height just in front of the middle. Anterior end broadly rounded; dorsal margin in both valves almost straight in front of the greatest height, convex and sloping down behind; posterior end narrowly rounded below the middle; ventral margin almost straight in both valves, with a slight concavity just behind the middle in the right valve. Dorsal view narrower than the female, especially the posterior end.

Dimensions: Holotype, female: length 0.68 mm.; height 0.46 mm.; width 0.36 mm. Paratype, male: length 0.67 mm.; height 0.45 mm.; width 0.31 mm.

The species closely resembles *Cytherella texana* Stadinichenko (1927, p. 242, pl. 39, fig. 18) especially as figured by Sutton and Williams (1939, p. 562, pl. 64, figs. 14, 15) and Stephenson (1946, p. 307, pl. 42, figs. 8, 9), but differs by a slight concavity of the anterodorsal margin and the smaller amount of overlap along the dorsal margin.

Cytherella sp. van den Bold (1957b, p. 235, pl. 1, fig. 3, 1958b, p. 396) is closely similar, but has a stronger convexity of the ventral margin and stronger overlap of the right valve in the anterior part of the dorsal margin, besides being slightly higher.

The species has been named in honour of R. M. Stainforth who did much of the initial work on the planktonic foraminifera of Trinidad.

Distribution: Throughout the San Fernando formation and in the lower Cipero formation, highest occurrence observed was in the *Globigerina ciperoensis ciperoensis* zone. In the *Catapsydrax dissimilis* zone it is replaced by the above mentioned *Cytherella* sp.

Holotype: A complete female carapace from Stainforth sample 47, basal Cipero silt, *Globigerina ampliapertura* zone, U.S.N.M. no. 563474; paratypes: U.S.N.M. no. 563475.

***Cytherella* sp. aff. *Cytherella pulchra* Brady**

Cytherella sp. aff. *C. pulchra* Brady. — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 235, pl. 1, fig. 1.

A species which at the present time cannot be separated from the species described previously from the Oligo-Miocene and which is possibly identical to *Cytherella* sp. (Howe and Chambers 1935, p. 6, pl. 4, figs. 17, 18, pl. 5, figs. 11-12) occurs in the upper Eocene and lower Oligocene. Together with it sometimes occurs a form which has been called *Cytherella* aff. *pulchra* var., and which distinguishes itself by concave ventral and dorsal margins. This form occurs only occasionally and does not merit a specific name. It is possibly a local variant of the common species of the San Fernando formation.

The species mentioned in this synonymy are very similar and it is believed to be impractical to separate them. The Trinidad species shows males and females that are very similar to those described by Stephenson, 1946. They have only been found in the "Gaudryina beds".

Cytherella sp. A

Plate 1, figure 8

Female: Carapace ovate, slightly higher in front than behind, ends broadly rounded, surface finely punctate. Anterior end very broadly rounded, dorsal margin a low flat arch, nearly parallel to the ventral margin, slightly converging posteriorly; ventral margin convex; posterior end broadly rounded in the middle, both slopes rather flat. Right valve overlapping the left along the entire periphery, strongest overlap anterodorsally and anteroventrally. The overlap at the anterior end is partly obscured by a thin carina in the left valve. The left valve has a broadly rounded anterior and a slightly obliquely rounded posterior end; dorsal and ventral margin are about parallel and nearly straight.

Dorsal view slightly irregular, with a slight restriction anterior to the middle, stronger in the left valve than in the right. Greatest width about one third from behind, posterior end wide, broadly rounded.

Male: Highest anteriorly to the middle; broadly rounded anterior end, dorsal margin convex, forming a regular curve down to the low posterior end which is obliquely rounded. Overlap of the right valve strongest anterodorsally. Dorsal view widest about one third from behind, posterior end narrowly rounded, anterior end fairly sharp. The surface of the valves in both sexes is finely and regularly pitted.

Dimensions: Male: length 0.78 mm.; height 0.51 mm.; width 0.38 mm. Female: length 0.87 mm.; height 0.57 mm.; width 0.43 mm.

The species has only been found in Stainforth sample 47 and Calyx hole 57 (*Globigerina ampliapertura* zone).

Genus CYTHERELLOIDEA Alexander, 1929

Cytherelloidea sp.

?*Cytherelloidea* sp. VAN DEN BOLD, 1937, *Micropaleontology*, vol. 3, no. 1, p. 5, pl. 4, fig. 1.

The form found in Harmony Hall well 2 at 828–840 feet is very close to the form described from the Paleocene. However, the posterior vertical rib seems to be divided by the two depressions on both sides of the median ridge that continue further backward and cause it to form two nodes with a depression in between and above. In view of the fact that many reworked Paleocene specimens occur in the well mentioned, it is not improbable that this form is also reworked from the Paleocene and that the difference is due to preservation only.

Family CYPRIDIDAE Baird
Subfamily PONTOCYPRIDINAE Müller
Genus ARGILLOECIA Sars, 1866

Argilloecia sp. aff. Argilloecia alexanderi Swain

Argilloecia alexanderi SWAIN, 1948, Maryland Dept. Geol. Mines Water Res., Bull. 2, p. 192, pl. 12, fig. 7.

The species is very close to *Argilloecia alexanderi* as described from the lower Eocene of Maryland. The Trinidad form is slightly more elongate and has not been found lower than upper Eocene. Therefore I prefer to consider this species for the time being as distinct from Swain's.

Argilloecia subcylindrica Alexander

Argilloecia subcylindrica Alexander. – VAN DEN BOLD, 1957, *Micropaleontology*, vol. 3, no. 1, p. 5.

A few specimens of this species from the Paleocene have been found in the lower and middle Eocene of the Navet formation. The highest occurrence is in the *Truncorotaloides rohri* zone.

Argilloecia nutusa van den Bold, new species

Plate 6, figure 1a–b

Name: derived from *nutus* (L), a nod of the head, because of the characteristic shape of the anterior part of the carapace.

Carapace elongate, highest just in front of the middle, slightly less than half the length in height; it gives the impression of being slightly bent downward at the anterior end, which is still accentuated by the strong overlap of the anterodorsal margin of the right valve. Anterior end irregularly rounded, obliquely rounded below the middle like a boat's prow, narrowly rounded almost angled just above the middle, dorsal part gently convex and forming an obtuse angle with the dorsal margin in front of the greatest height; dorsal margin nearly straight in the male, gently convex in the female, almost parallel to the ventral margin which is sinuate, with a small concavity in and slightly in front of the middle. Posterior end obliquely rounded, blunt, almost truncate in the dorsal part, narrowly rounded near the ventral margin; in the male the ventral rounding is sharper than in the female.

Right valve overlapping the left all around, except in the ventral part of the anterior end. Strongest overlap in front of the obtuse angle between dorsal and anterior margins. Dorsal view lanceolate, widest slightly behind the middle. Posterior end broader in the female than in the male. Places of stronger overlap of the dorsal margin clearly visible in dorsal view.

Muscle scar typical for the genus; marginal area could not be observed in detail, but conforms to the general pattern of the genus.

Dimensions: Holotype, female: length 0.57 mm.; height 0.28 mm.; width 0.23 mm. Paratype, male: length 0.59 mm.; height 0.28 mm.; width 0.21 mm. Variation: length 0.55–0.61 mm.; height 0.26–0.29 mm.; ratio: 1–0.44 mm. to 1–0.50 mm.

A few larger forms which are similar in outline and have the same length/height ratio have been found in Harmony Hall well 2: length 0.67–0.70 mm.; height 0.31–0.34 mm.

This species resembles *Argilloecia obtusa* Lienenklaus (1900, p. 508, pl. 19, fig. 4a, b) from the lower Oligocene of Germany, but the German species has a much blunter anterior end. *Argilloecia caudata* G. W. Müller (1894, p. 508, pl. 12, figs. 6, 23–26) differs in the position of greatest height.

Range: Oligocene, highest occurrence in the *Globigerina ciperoensis* *ciperoensis* zone.

Holotype: A complete female carapace from Stainforth sample 47, U.S.N.M. no. 563478; paratypes: U.S.N.M. nos. 563479–563482.

Subfamily CANDONINAE Kaufmann
Genus PARACYPRIS Sars, 1866

Paracypris sp. aff. **Paracypris contracta** (Jones)
Plate 1, figure 5

Bairdia contracta JONES, 1857, Paleontogr. Soc., Monogr., vol. 9, p. 53, pl. 5, fig. 1a–c.

Bairdia cf. *contracta* JONES. – LATHAM, 1938, Roy. Soc. Edinburgh, vol. 69, pt. 1, no. 4, p. 40, fig. 2.

Paracypris contracta (Jones). – KEIJ, 1957, Eocene and Oligocene Ostracoda of Belgium, p. 51, pl. 1, figs. 15–17.

The species of *Paracypris* found only in the *Globigerina ampliapertura* zone is so close to the species from the European middle and upper Eocene, that it is difficult to separate them.

Family BAIRDIIDAE Sars
Genus BAIRDIA McCoy, 1844

Bairdia dolicha van den Bold

Bairdia dolicha VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 5, pl. 2, fig. 2a–b.

This species, originally described from the Paleocene of Soldado Rock, also occurs in the middle Eocene of the Navet formation and (possibly reworked) in the San Fernando formation.

Bairdia cespedesensis van den Bold

Bairdia cespedesensis (sic.) VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 236.

Dimensions: Length 0.90–1.50 mm.; height 0.60–1.00 mm.

This long-ranging species (Upper Cretaceous–Miocene) occurs regularly in the Navet, San Fernando and Cipero formations.

Bairdia cassida van den Bold

Bairdia cassida VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 70, pl. 1, fig. 7. – 1950, Jour. Pal., vol. 24, no. 1, p. 108.

Bairdia exoura VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 4, pl. 2, fig. 6. – 1957, *ibid.*, vol. 3, no. 3, p. 236.

Dimensions: Length 1.10–1.50 mm.; height 0.70–1.00 mm.

After comparison of the two species, I believe that they are identical. The species occurs throughout the Eocene and Oligocene and in the lower Miocene (highest in *Globorotalia fohsi barisanensis* zone).

Bairdia machaquillaensis van den Bold
Plate 2, figure 8

Bairdia machaquillaensis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 72, pl. 4, fig. 3.

Dimensions: Length 0.72–0.82 mm.; height 0.43–0.51 mm.

This species of the lower Eocene and Paleocene of Guatemala has been found in “*Gaudryina* beds” of probably middle Eocene age in Trinidad. Figured specimen is from Esmeralda well 1, 1396–1407 feet, possibly not “*Gaudryina* beds”.

Bairdia inequivalvis van den Bold

Bairdia inequivalvis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 72, pl. 4, figs. 9, 10.

One specimen, which is similar in outline to the species from the lower Eocene and Paleocene of Guatemala and British Honduras has been found in the upper Eocene of Soldado rock. It is, however, possible that it is reworked there.

Bairdia caraibeensis van den Bold
Plate 2, figure 3

Bairdia caraibeensis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 71, pl. 4, fig. 5.

This species has only been found in Rohr sample 25684, *Globorotalia cerroazulensis* zone, non-calcareous Mount Moriah silt of the San Fernando formation. It was originally described from the upper Eocene of Bonaire and from the lower Eocene of Guatemala.

Bairdia amygdaloides Brady

Bairdia amygdaloides Brady. – VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 236, pl. 1, fig. 6a, b.

This species occurs in Trinidad from the *Globigerina ciperoensis* *ciperoensis* zone upward.

Bairdia sp. A
Plate 2, figure 11

Carapace ovate, laterally rather compressed, highest in the middle, surface finely and regularly pitted.

Anterior end obliquely rounded, prow-shaped; dorsal margin regularly arched, posterior end slightly produced subventrally; ventral margin slightly sinuate, almost straight in the centre part. Left valve overlapping the right along the entire periphery except a short distance in the anterior end; amount of overlap about equal everywhere. Dorsal view spindle-shaped, ends slightly compressed, blunt; greatest width in the middle.

Dimensions: Length 0.73 mm.; height 0.46 mm.; width 0.36 mm.

This species has only been found in the upper Eocene of Soldado Rock, Boca de Serpiente marl.

Bairdia sp. B

Plate 2, figure 9

Carapace ovate, thick set, of general subdeltoid shape. Left valve strongly overlapping the right along dorsal margin, less along ventral margin, except midventrally where the overlap is stronger. Small amount of overlap near the ends. Because of its shape the species is not easy to distinguish from others described from the European and American Tertiary. *Bairdia oviformis* Speyer, as figured by Stadnichenko (1927, p. 234, pl. 39, figs. 1-3) is fairly similar, but seems to lack the strong overlap of the left valve. The same can be said for *Bairdia subdeltoidea* (von Münster) (Howe, 1934, p. 389, fig. 1a-c). The species has been found sporadically in the San Fernando formation. Figured specimen is from Rohr sample 25684, type locality for the *Globorotalia cerroazulensis* zone.

Dimensions: Length 0.99 mm.; height 0.69 mm.

Bairdia sp. C

Plate 2, figure 4

Carapace elongate, highest in the middle. Anterior end obliquely rounded, dorsal margin gently convex, much less than the strongly curved ventral margin; posterior end narrowly rounded in the middle.

This species, of which only a few single valves have been found in Rohr sample 25684, is figured for its unusual shape and for the fact that the overlap of the dorsal margin of the left valve terminates abruptly at the anterior and posterior ends.

Dimensions: Length 0.89 mm.; height 0.55 mm.

Genus BYTHOCYPRIS Brady, 1880

***Bythocypris guppyi* van den Bold**

Bythocypris guppyi VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 6, pl. 2, fig. 9.

This species, originally described from the Lizard Springs marl, occurs throughout the Navet formation; its highest occurrence being in the Hospital Hill marl, upper Eocene.

***Bythocypris? cancanaensis* (van den Bold)**

Plate 2, figure 10

Bairdia cancanaensis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 73, pl. 4, fig. 8.

The species from the lower Eocene of Guatemala and British Honduras was found in the middle Eocene Fitt Trace marl and Dunmore marl of the Navet formation and in the "Gaudryina beds" of Esmeralda well 1.

Dimensions: Length 1.08 mm.; height 0.65 mm.

The Trinidad species is slightly smaller than the Central American form, but otherwise quite similar. Originally, it was described as a *Bairdia* but it more probably belongs to *Bythocypris*, although it is slightly intermediate in character.

"Bythocypris" pykna van den Bold, new species

Plate 2, figure 1a-d

Female: Carapace elongate ovate, highest in the middle, greatest height about three fifth of the length, widest behind the middle, greatest width about half the length. The margin is strongly folded inwards making it necessary to distinguish between outer margin and outline of the valve. Anterior end very obliquely rounded, margin parallel to the outline, which passes in continuous curve into dorsal and ventral outlines; dorsal outline arched, hinge margin straight, forming a faint angle with anterior and posterior margins; an accommodation groove occurs above the hinge line; posterior outline straight or very slightly concave above the posterior end, which lies just below the middle and is narrowly rounded; posterior margin not quite parallel to posterior outline; ventral outline strongly and regularly convex, ventral margin almost straight, slightly sinuate in front of the middle. Dorsal view elongate egg-shaped, ends narrowly rounded.

Male: Same general shape as the female, but greatest height just anterior to the middle, slightly lower and narrower. Muscle scar area just behind the center, consisting of a circular area composed of 8 or 9 scars.

Shell thick and heavy. Marginal area fairly broad in anterior and posterior end, small vestibule, no pore canals visible. Hinge in the left valve consists of a straight bar above which is an accommodation groove. In the right valve it consists of a groove below which a narrow straight bar occurs, which is slightly thickened and raised at the ends, forming 2 elongate smooth teeth which fit below the bar in the left valve. The left valve is overlapping the right along the entire periphery, amount of overlap about equal everywhere.

Dimensions: Holotype, single left valve of a female from Rohr sample 18192, (Lengua formation, middle Miocene); length 1.02 mm.; height 0.55 mm. Paratype: length 0.91 mm.; height 0.53 mm.; width 0.47 mm.

The heavy shell and the peculiar infolded margin separate this species from the genus *Bythocypris* and suggest relationship to *Pseudophanassymetria* Sohn and Berdan (1952, p. 10) and to *Cardobairdia* n. gen., described below. It differs from the latter by its smooth hinge and simpler muscle scar. It has some resemblance to the genus *Hungarella* Mehes (1911) from the Triassic of Hungary. In the described forms, however, *Bairdia?* *problematica* Mehes (1911, p. 21, pl. 2, figs. 14-18) and variety *reniformis* (p. 22, pl. 2, figs. 19-23) the number of muscle scars is much greater than in "*Bythocypris*" *tykna*. The species very probably belongs to a new genus.

It occurs infrequently throughout the Navet formation from the Friendship Quarry marl to the Hospital Hill marl. It is absent in the San Fernando formation, but reappears in the Cipero and Lengua formations, where it is also quite rare.

Holotype: A single female left valve from Rohr sample 18192, Lengua formation, U.S.N.M. no. 563483; paratypes: U.S.N.M. nos. 563484 to 563486.

Genus *Cardobairdia* van den Bold, new genus

Type species: *Cardobairdia ovata* van den Bold, new species

Diagnosis: A genus of the Bairdiidae with strongly infolded margin and a hinge consisting of slightly curved elongate sockets at both ends of the dorsal margin of the left valve, separated by a shallow groove, which is obscured by the incurved dorsal margin. Shape ovate; left valve much larger than the right and overlapping along the entire periphery, especially dorsally and ventrally.

Range: Eocene to Miocene (probably much longer).

***Cardobairdia ovata* van den Bold, new species**

Plate 2, figure 2a-c

Carapace egg-shaped, highest just anterior to the middle, widest in the middle. Height nearly two thirds of the length, width more than half of the length. Left valve much larger than the right and overlapping along the entire periphery, strongest overlap along dorsal and ventral margin. The margin of the left valve is strongly folded inwards so that in the description it is necessary to make a sharp distinction between margin and outline of the valve. Anterior end obliquely rounded, narrowly below the middle, continuing without angulation into dorsal and ventral outlines; dorsal outline nearly straight in the posterior part, generally arched; ventral outline strongly convex, continuing without angulation in the posterior end, which is narrowly rounded below the middle, nearly straight or slightly concave above, obliquely truncate, forming an obtuse angle with the dorsal outline. The suture between the valves is obliquely rounded in the anterior end; dorsal margin almost straight, ventral margin convex, but not as strongly convex as the ventral outline; posterior margin obliquely rounded. Dorsal and ventral margin converge posteriorly.

Dorsal view spindle-shaped, ends slightly compressed, narrowly rounded. Muscle scar area circular, consisting of about 15 scars, typical *Bairdia*-like. Hinge consists of terminal elongate sockets which are finely denticulate in the left valve; they are separated by a groove which is covered in side view by the inward-curved dorsal margin. Hinge in the right valve not observed. Marginal area fairly narrow, no vestibule was seen, pore canals not observed. The appearance of the marginal area is rather *Cytherella*-like. The shell is very thick and heavy. No sexual dimorphism was observed.

Dimensions: Holotype: length 0.70 mm.; height 0.44 mm.; width 0.39 mm. Variability: length 0.69-0.74 mm.; height 0.43-0.48 mm.; ratio: 1-0.63 mm.

There were two specimens of much larger dimensions (text-figure 4), but of the same shape. Since the hinge was observed in a specimen of the regular dimensions, which is therefore considered an adult, the two other specimens must either be aberrant forms or belong to a different species. Young moults were about 0.62 mm. in length. No single valves occurred, so in order to observe the interior structure attempts were made to open some of the specimens. As the shell is very thick and heavy, these were generally not successful, but in one case a left valve was obtained with the hinge line broken off. The remnants were more or less fitted together and Plate 2, figure 2c is a reconstruction based on the two parts of the valve. Only a few specimens have been found in the Navet formation (Friendship Quarry marl and Penitence Hill marl). The species is much more common in the Miocene Lengua formation. So far it has not been found in the San Fernando and Cipero formations.

Holotype: A complete carapace from Renz sample 385, Penitence Hill marl, Navet formation, U.S.N.M. no. 563487; paratypes: U.S.N.M. nos. 563488 to 563492.

This genus has much in common with *Pseudophanassymetria* Sohn and Berdan (1952, p. 10) especially in the thick non-porous heavy shell and the great difference in valve size. However, *Pseudophanassymetria* is reported to have a smooth hinge. For comparison with "*Krausella*" see under that genus.

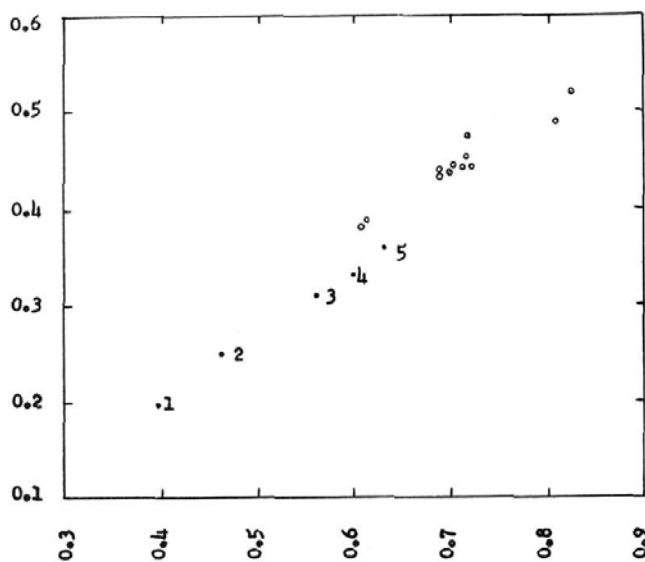
Genus *Krausella* Ulrich, 1894

"*Krausella*" *minuta* Triebel

Plate 6, figure 3

Krausella minuta Triebel. - VAN VEEN, 1936, Natuurhist. Maandbl., vol. 25, no. 12, p. 176, pl. 10 figs. 7-15.

The hinge of this species was studied in a few specimens from the upper Cretaceous of Holland. It proved to have almost the same hingement as *Cardobairdia* and appears to be related to this genus. "*Krausella*" *asymetrica* van den Bold (1946, p. 67, pl. 3, fig. 17) has the same hinge. It seems improbable that the posterior spine as developed in the species mentioned above and in *Krausella?* sp. (Oertli, 1958, p. 1503, pl. 2, figs. 39-41)



TEXT-FIGURE 4

LENGTH/HEIGHT RATIO OF "Krausella" AND *Cardobairdia*.

- 1 *Krausella* sp., Oertli, Aptian-Albian, Apt, France.
- 2 *Krausella minuta* Triebel, Upper Cretaceous, Holland.
- 3 *Krausella minuta* Triebel, van den Bold, 1946, middle Eocene, British Honduras.
- 4 "Krausella" sp. aff. *Krausella minuta* Triebel, middle Eocene, Trinidad.
- 5 *Krausella asymmetrica* van den Bold, Miocene, Cuba.
- 6 *Cardobairdia ovata* van den Bold, n. sp.

and in the species found in the Navet formation of Trinidad is a generic characteristic, but I would hesitate to assign them to *Cardobairdia* which in all other respects is very similar.

"Krausella" sp. aff. *Krausella minuta* Triebel
Plate 6, figure 2

?*Krausella minuta* Triebel. — VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 67, pl. 2, fig. 7.

A few specimens from the Dunmore Hill and Fitt Trace marls are rather similar in outline to "*Krausella*" *minuta* Triebel, but are slightly larger.

Dimensions: Length 0.60 mm.; height 0.33 mm.; width 0.28 mm. The specimen from British Honduras measures length 0.56 mm.; height 0.31 mm.; width 0.26 mm.; and "*Krausella*" *minuta* Triebel length 0.46 mm.; height 0.25 mm.; width 0.24 mm. (text-fig. 4). Moreover the anterior part of the Cretaceous species is shorter. Oertli's species from the upper Albian and lower Aptian is still smaller: length 0.39–40 mm.; height 0.21–22 mm.; width 0.18–19 mm. (measured from his figures). There seems to be a definite trend towards increase in size from the Cretaceous to the Miocene.

Subfamily MACROCYPRIDIDAE Alm

Genus MACROCYPRIS Brady, 1868

***Macrocypris longana* van den Bold, new species**
Plate 1, figure 7a–b

Carapace large, elongate, highest about one third from the anterior end. Anterior margin obliquely rounded, shaped like a prow; dorsal margin regularly arched with only a slight angulation at about one fourth from behind; ventral margin nearly straight, slightly sinuate; posterior end sharply pointed ventrally. Right valve overlapping the left along dorsal and ventral margin and posterior end, strongest overlap in the anterior third of the dorsal margin. Dorsal view elongate, widest in the middle, posterior end pointed, anterior end rather blunt. Dorsal suture strongly undulating, curving to the left in the areas of stronger overlap. Muscle scar area circular with about 18 scars. Only closed carapaces have been found and owing to the thickness of the shell little could be seen of the marginal area.

Dimensions: Holotype: length 1.92 mm.; height 0.67 mm.; width 0.64 mm. Variability: length 1.56–2.08 mm.; height 0.60–0.78 mm.

The name of the species is derived from *longano* (L.), a sausage.

The species differs from *Macrocypris cylindracea* (Bornemann), (= *Bairdia cylindracea* Bornemann, 1855, p. 359, pl. 10, fig. 5; *Nesidea cylindracea* Kuiper, 1918, p. 16, pl. 1, fig. 3) which has the greatest height in the middle.

Holotype: Complete carapace from Harmony Hall well 2, 686 to 698 feet, U.S.N.M. no. 563493; paratypes: U.S.N.M. nos. 563494 and 563495.

***Macrocypris rhodana* van den Bold, new species**
Plate 1, figure 6a–b

Carapace elongate, highest just in front of the middle. Anterior end broadly and slightly obliquely rounded; dorsal margin angled at the greatest height and at about one fourth from the posterior end, the three parts of the dorsal margin nearly straight; ventral margin nearly straight, slightly sinuate in front of the middle; posterior end pointed ventrally. Right valve overlapping the left along the entire periphery, strongest overlap from near the anterior end to about one fourth of the length backward along the dorsal margin, and in the anterior half of the ventral margin. Dorsal suture undulate in dorsal view, curving to the left in the areas of stronger overlap. This feature is brought out in the name, *rhodanos* (Gr.), waving. Dorsal view lanceolate, widest in the middle, both ends compressed. Muscle scar area circular with many scars. Marginal area broad in anterior end, radial pore canals usually divided into three branches.

Dimensions: Holotype: length 1.41 mm.; height 0.55 mm.; width 0.36 mm. Variability: length 1.35–1.74 mm.; height 0.52–0.62 mm.

EOCENE AND OLIGOCENE OSTRACODA OF TRINIDAD

This species occurs often together with *Macrocypris longana* n. sp., and might be suspected to be the male of that species. Students of Recent ostracodes such as Brady (1868, 1880), Müller (1894) and others agree that there is only very slight sexual dimorphism in *Macrocypris*. Moreover its range is slightly shorter; it has not been found above the *Globigerina ampliapertura* zone.

Holotype: A complete carapace from Harmony Hall well 2, 609–613 feet, U.S.N.M. no. 563496; paratypes: U.S.N.M. nos 563497 to 563500. The species appears to be confined to the upper Eocene and lowermost Oligocene.

Family CYTHERIDAE Baird

Subfamily KRITHINAE Mandelstam (in Bubikyan)
Genus KRITHE Brady, Crosskey and Robertson, 1874

***Krithe guatemalensis* van den Bold**

Plate 3, figure 1a–b

Krithe guatemalensis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 77, pl. 17, fig. 7a, b, 8a, b.

Krithe guatemalensis VAN DEN BOLD, 1957 (part, female), Micro-paleontology, vol. 3, no. 1, p. 7, pl. 1, fig. 5a, b (not pl. 1, fig. 5c–e, see *Krithe cancuensis* VAN DEN BOLD).

This species extends from the Paleocene to the lower part of the middle Eocene (Friendship Quarry marl, *Hantkenina aragonensis* zone). It was originally described from the Paleocene of Guatemala and British Honduras.

***Krithe cancuensis* van den Bold**

Plate 3, figure 2a–b

Krithe cancuensis VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 77, pl. 17, fig. 6a, b.

Krithe guatemalensis VAN DEN BOLD, 1957 (part, male), Micro-paleontology, vol. 3, no. 1, p. 7, pl. 1, fig. 5c–e (not 5a, b).

Carapace elongate, highest in front of the middle, widest about the middle. Anterior end rather narrowly rounded; dorsal margin convex, with rather flat central part, angled about one third from behind; posterior part sloping down to the obliquely truncate posterior end; ventral margin slightly convex in the left valve, almost straight in the right. In the right valve the anterior slope of the dorsal margin is slightly concave. The marginal area could not be studied properly due to re-crystallisation of the shell.

Dimensions: Length 0.75 mm.; height 0.35 mm.; width 0.27 mm.

This species which was first (van den Bold, 1957) considered to be the male of *Krithe guatemalensis*, was subsequently found to have a stratigraphic range from lower Eocene (*Globorotalia velascoensis* zone) to middle

Eocene (*Globorotalia lehneri* zone). Moreover slight sexual dimorphism has been observed in both *K. guatemalensis* and *K. cancuensis*.

***Krithe saundersi* van den Bold, new species**

Plate 3, figure 3a–b

Krithe bartonensis (Jones). – VAN DEN BOLD, 1946 (part) Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 76, 77, pl. 4, fig. 15b, d (not fig. 15a or c).

A re-examination of the Cuban material shows that the specimens figured in pl. 4, fig. 15a from Raadshooven 276 and Keyser 214 (slide D 27069) are different from the rest, as is the single specimen from Keyser 207 (slide D 27071) which was figured as fig. 15c. The others are not identical with *Cytherideis bartonensis* Jones (1855, p. 50, pl. 5, figs. 2, 3), which was recently re-figured by Keij (1957, p. 85, pl. 8, figs. 11–17).

Female: Carapace elongate subrectangular. Anterior end evenly rounded, passing into dorsal and ventral margin without angulation in the left valve; in the right valve the dorsal portion of the anterior margin has a slight concavity; ventral margin slightly sinuate in the middle, parallel to the central portion of the dorsal margin; posterior end obliquely truncate with the lower part projecting strongly beyond the posterior margin. Left valve larger than the right and overlapping at both cardinal angles, less in the middle of the dorsal margin and ventrally. Dorsal view lanceolate, widest just behind the middle, anterior end pointed, posterior end deeply incised in the middle, sides of the carapace regularly convex.

Male: General outline similar to the female, but longer and the posterior end is more oblique, more pointed and more deeply incised. The preservation is too poor for a proper description of the marginal area.

Dimensions: Holotype, female: length 0.73 mm.; height 0.37 mm.; width 0.32 mm. Variation, female: length 0.66–0.76 mm.; height 0.34–0.40 mm.; male: length 0.78–0.85 mm.; height 0.35–0.39 mm.

The male is very similar in outline to *Krithe caudata* van den Bold (1946, p. 76, pl. 4, fig. 17) but much larger. It is, however, possible that the Cuban species was a young moult in which case, of course, the name *Krithe caudata* would have priority. *Krithe implicata* Mandelstam (1958, p. 279, pl. 6, fig. 4) is fairly similar in outline but does not show the characteristic overlap of the left valve. The species has been named in honour of J. B. Saunders, paleontologist of Texaco Trinidad, Inc.

Occurrence: Middle Eocene, Friendship Quarry marl (*Hantkenina aragonensis* zone) to lower Oligocene (*Globigerina ampliapertura* zone).

Holotype: A complete carapace from Renz sample 385, Penitence Hill marl, Navet formation, (*Porticulospaera mexicana* zone), U.S.N.M. no. 563503; paratypes: U.S.N.M. nos. 563504 and 563505.

VAN DEN BOLD

CHART 2
RANGE CHART OF KRITHINAE

RANGE CHART OF THE KRITHINAE OF THE EOCENE AND OLIGOCENE OF TRINIDAD				Krithe guatemalensis v.d.Bold	Krithe cancuensis v.d.Bold	Krithe saundersi n.sp.	Krithe crassicaudata v.d.Bold	Krithe cubensis v.d.Bold	Krithe elongata n.sp.	Krithe trinidadensis v.d.Bold	Krithe hiwanneensis Howe and Lea	Krithe morkhoveni n.sp.	Parakrithe vermunti (v.d.Bold)	Parakrithe waiteti n.sp.	Parakrithe elongata n.sp.	Parakrithe ? ovata n.sp.	Parakrithe ? sp.
Stage	Formation	member	Biostratigraphic zone														
MIOCENE	CIPERO		Catapsydrax stainforthi														
			Catapsydrax dissimilis														
OLIGOCENE	SAN		Globorotalia kugleri														
			Globigerina ciperoensis ciperoensis														
EOCENE	FERNANDO	Upper Mount Moriah silt	Globorotalia opima opima														
		Vistabella marl	Globigerina ampliapertura														
	NAVET	Boca de Serpiente marl	Globorotalia cerroazulensis														
		Lower Mount Moriah silt															
		Hospital Hill marl	Globigerapsis semiinvoluta														
			Truncorotaloides rohri														
	LIZARD	Penitence Hill marl	Porticulusphaera mexicana														
		Fitt Trace marl	Globorotalia lehneri zone														
		Dummore Hill marl	Globigerapsis kugleri														
		Friendship Quarry marl	Hantkenina aragonensis														
PALEOCENE	SPRINGS		Globorotalia palmerae														
		Ramdat marl	Globorotalia aragonensis														
			Globorotalia formosa formosa														
			Globorotalia rex														
			Globorotalia velascoensis														
			Globorotalia pseudomenardii														
			Globorotalia pusila pusila														
			Globorotalia trinidadensis														

Krithe crassicaudata van den Bold Plate 3, figure 7a-e

Krithe crassicaudata VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 78, pl. 7, fig. 2a-f.

Female: Ovate in side view, highest about the middle. Anterior end broadly rounded, dorsal margin broadly arched, sloping down sharply into the fairly acute posterior end; ventral margin strongly convex in the left valve, sinuate in the right and in the latter valve partly obscured by the overhanging tumid portion of the valve. In the right valve the anterior part of the dorsal margin is slightly concave and it is there that the strongest overlap of the left valve occurs. Dorsal view widest just behind the middle, posterior end broad, deeply incised.

Male: Much more elongate than the female, posterior end more truncate. In general characters male and female agree, but the male approaches in shape to *Krithe elongata* n. sp., although it is always much more tumid and higher. Marginal area with a strong loop of

the line of concrescence in the anterior part. Only six radial pore canals are visible in the anteroventral area, the upper and lower one of which bifurcate. This anteroventral part is much more irregular than in most species of *Krithe* and the line of concrescence does not parallel the outer margin as is usually the case. Connection of the vestibule with the interior is very narrow.

Dimensions: Female: length 0.83 mm.; height 0.50 mm.; width 0.50 mm. Male: length 0.88 mm.; height 0.52 mm.; width 0.45 mm. Variability: female: length 0.79-0.85 mm.; height 0.49-0.52 mm.

The range of this species as established in Trinidad is from the middle Eocene (Fitt Trace marl, *Globorotalia lehneri* zone) to the lower part of the upper Eocene (Hospital Hill marl, *Globigerapsis semiinvoluta* zone). In Cuba this species was reported from the lower Oligocene, but it has not been found in the Cipero formation of Trinidad. It remains to be seen, whether the actual stratigraphic range is longer, or it may be reworked in the Cuban Oligocene. It has also been found in the Chapapote, upper Eocene of Mexico.

***Krithe cubensis* van den Bold**

Plate 3, figure 4a-b

Krithe cubensis VAN DEN BOLD, 1946, part, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 75, pl. 4, fig. 13b-d (not fig. 13a, see *K. elongata* n. sp.). - 1950, Jour. Pal., vol. 24, no. 1, p. 108 (part).

Re-examination of the types revealed the fact that different species have been included under *Krithe cubensis*. The species *K. cubensis* occurs with certainty only in the samples P 28, holotype (Finca Adelina, see Palmer and Bermudez, 1936), Tschopp sample 2393 (see van Bellen et. al., 1941) and in Bermudez samples 18, 36, 209 and 7 (see van den Bold, 1950, p. 108) making the range of *K. cubensis* upper Eocene to middle Oligocene. In the other samples from which the species was mentioned in 1946: Keyser sample 245 contains *Krithe trinidadensis* van den Bold, 1958, *Krithe hiwanneensis* Howe and Lea, and *Krithe elongata* n. sp. The age of this sample judging from the planktonic foraminifera determined by Keyser (1945, p. 55) is lower Miocene and we would place it near the base of the *Globorotalia fohsi* zone, *sensu lato*.

Locality T1479, which contains the larger foraminifera *Heterostegina texana*, *Miogyssina* sp., and *Lepidocyclina giraudi* and the planktonic foraminifera *Globoquadrina altispira*, *Globigerina venezuelana*, *Globorotalia scitula* should be of roughly the same age. It contains the species *Krithe trinidadensis* van den Bold and *Krithe elongata* n. sp. This reduction of the stratigraphic range is in agreement with the range found in Trinidad which is from upper Eocene to lowermost Miocene.

Female: Ovate in side view, highest just posterior to the middle. Dorsal margin broadly arched with a slight sinuation in the anterior slope; anterior end broadly rounded, ventral margin slightly sinuate, posterior end projecting slightly beyond the regular curve of the posterior margin. Dorsal view spindle shaped, anterior end acute, posterior truncate and incised in the middle, greatest width in the middle.

Male: More elongate than the female, ventral margin less convex, dorsal margin more evenly arched.

Marginal area with anterior loop of line of concrescence, which shows eleven radial pore canals in the part parallel to the anterior margin; three false radial canals in the upper part of the loop, the middle one much longer than the others.

Dimensions: Male: length 0.79 mm.; height 0.42 mm.; width 0.38 mm.

The range of this species as established in Trinidad is from the upper Eocene (San Fernando formation, *Globorotalia cerroazulensis* zone) to lowermost Miocene (*Catapsydrax dissimilis* zone of the Cipero formation). In Cuba the species occurs in the upper Eocene, Oligocene and Oligo-Miocene. It was erroneously reported from the lower Eocene (Bermudez sample 20), van den Bold, 1950.

***Krithe elongata* van den Bold, new species**

Plate 3, figure 5a-c

Krithe cubensis VAN DEN BOLD, 1946 (part), Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 75, pl. 4, fig. 13a.

Krithe sp. aff. *K. producta* Brady. - VAN DEN BOLD, 1958, Micropaleontology, vol. 4, no. 4, p. 398 (part, male), pl. 2, fig. 3b, f (not pl. 2, fig. 3a, c, d, see *Krithe morkhoveni* n. sp.).

Krithe trinidadensis VAN DEN BOLD, 1958 (part), *ibid.*, pl. 1, fig. 3g (not fig. 3a-f).

As has been pointed out under the preceding species *Krithe elongata* was included under *Krithe cubensis*. In van den Bold 1958, a drawing of the interior of the right valve of what was then supposed to be the male of *Krithe* sp. aff. *K. producta* Brady was shuffled with the figures for *Krithe trinidadensis*. In fact, plate 1, figure 3g should have read plate 2, figure 3g.

Carapace elongate, highest about the middle. Anterior end regularly rounded; dorsal outline convex in the left valve, slightly irregular in the right; posterior end very obliquely truncate, subventral; ventral outline slightly convex in the left valve, sinuate behind the middle in the right. Dorsal view elongate spindle-shaped, subacute in front, deeply incised behind, greatest width in the middle. Left valve overlapping the right along the dorsal margin and the posterior half of the ventral margin. Marginal area broad in anterior end with loop of the line of concrescence towards the outer margin, paralleling it from slightly above the middle to the ventral margin. In this area eleven radial pore canals occur, in the upper part of the loop there are five additional false radial canals, the one at the junction of line of concrescence and inner margin being much longer than the others. At the posterior end a similar but smaller loop occurs, which could not be observed accurately due to the thickness of the shell at the posteroventral angulation.

Dimensions: Length 0.76 mm.; height 0.37 mm.; width 0.32 mm.

The species is very similar in outline to *Krithe cancuensis* van den Bold, but differs in being less angular, but slightly more truncate at the posterior end. The difference is not great and *K. cancuensis* should be considered as a direct ancestor of *K. elongata*.

Krithe elongata has its first occurrence in the upper Eocene (Hospital Hill marl, Navet formation, *Globigerina seminvoluta* zone). In the *Porticulusphaera mexicana* zone (Penitence Hill marl) and the *Truncorotaloides rohri* zone, neither *K. elongata* nor *K. cancuensis* has been observed. The latest occurrence of *K. elongata* so far, has been in the middle Miocene (*Globorotalia menardii* zone, Lengua formation).

Holotype: A complete carapace from Wirz sample 214, *Globorotalia fohsi robusta* zone, upper Cipero formation, U.S.N.M. no. 563501; paratypes: U.S.N.M. no. 563502.

Krithe morkhoveni van den Bold, new species

Plate 3, figure 6

Krithe sp. aff. *producta* Brady. — VAN DEN BOLD, 1958, Micropaleontology, vol. 4, no. 4, p. 398 (part, female), pl. 2, fig. 3a, c, d (not 3b, f, see *Krithe elongata*).

Carapace ovate, highest just behind the middle, widest behind the middle. Anterior end evenly rounded; dorsal margin strongly arched in the left valve, sinuate anteriorly in the right valve; ventral outline regularly convex; margin slightly sinuate, almost straight in posterior part; posterior end very obliquely rounded to almost truncate, narrowly rounded ventrally; posterior margin steeply truncate. Dorsal view more or less ovate, subacute at anterior end, rounded and incised at the posterior end, widest behind the middle. Hingeline straight in the posterior two-third, separated from the dorsal outline in the left valve by a depressed area forming a kind of accommodation groove. Duplicature broad in anterior end. The loop of the line of concrescence has eleven radial pore canals in the part parallel to the anterior margin. In the upper part of the loop four false radial pore canals occur, the one near the junction of line of concrescence and inner margin being the longest. Posterior loop much smaller and showing only a few radial canals. Muscle scars: a posterior row of four, the upper one of which is slightly U-shaped, with a big cloverleaf shaped scar in front.

Dimensions: Length 0.68 mm.; height 0.41 mm.; width 0.39 mm.

Oldest occurrence of this species is in the *Catapsydrax stainforthi* zone of the Cipero formation. The latest occurrence observed is in the *Globorotalia menardii* zone of the Lengua formation. Range lower Miocene—?middle Miocene. The species has been named in honour of F.C.P.M. van Morkhoven, paleontologist with the Shell Oil Co, Lafayette, Louisiana.

Holotype: A complete carapace from Wirz sample 214, *Globorotalia fohsi robusta* zone, upper Cipero formation, U.S.N.M. no. 563506; paratypes: 563507.

Krithe hiwanneensis Howe and Lea

Krithe hiwanneensis Howe and Lea. — HOWE AND LAW, 1936, Louisiana Dept. Cons., Geol. Bull. 7, p. 72, pl. 5, figs. 32–34. — VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 76, pl. 4, fig. 20. — 1950, Jour. Pal., vol. 24, p. 108. — 1957, Micropaleontology, vol. 3, no. 3, p. 237.

Dimensions: Female: length 0.61–0.72 mm.; height 0.33–0.37 mm. Male: length 0.61–0.71 mm.; height 0.30–0.34 mm.

Range: Trinidad, from the middle of the upper Eocene (non-calcareous Mount Moriah silt, *Globorotalia cerroazulensis* zone) to the lower part of the Miocene (*Globorotalia fohsi barisanensis* zone). In the United States this species was also observed in the upper Jackson.

Genus **PARAKRITHE** van den Bold, 1958**Parakrithe vermunti** (van den Bold)

Cytheridea (*Doloccytheridea*) *vermunti* VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 83, pl. 7, fig. 12a–c.

Parakrithe vermunti (van den Bold). — VAN DEN BOLD, 1958, Micropaleontology, vol. 4, no. 4, p. 399, pl. 4, fig. 7a–f.

The range of this species is lower Oligocene (upper part of the *Globigerina ampliapertura* zone, Calyx hole 57, 425–430 feet), to middle Miocene.

Parakrithe waitei van den Bold, new species

Plate 6, figure 5a–b

Carapace elongate ovate; anterior end evenly rounded; dorsal margin gently convex, ventral margin sinuate, concave in front of the middle; dorsal and ventral outline subparallel; posterior end obliquely rounded or obliquely truncate, narrowly rounded ventrally, dorsal slope only very slightly convex, nearly straight. Left valve overlapping the right along dorsal and ventral margins and the dorsal slope of the posterior end; greatest overlap anterodorsally; only a very slight overlap in the anterior end. Dorsal view lanceolate, widest just behind the middle; anterior end slightly compressed, posterior end rather blunt. Surface smooth. Normal pore canals few and widely scattered, open. Marginal area broad in the anterior end; line of concrescence forming a small, blunt-nosed loop in the direction of the outer margin; vestibule fairly large; radial pore canals eleven in anterior end with a few false radial ones.

Muscle scars: a posterior vertical row of 4 elongate scars with a V-shaped scar in front of the middle two above which is another rounded spot.

Dimensions: Holotype: length 0.50 mm.; height 0.26 mm.; width 0.23 mm.

The species is slightly shorter and wider than *Parakrithe vermunti* and the marginal area in the anterior end is different. The species is confined to the San Fernando formation. It is named in honour of S. T. Waite, former chief geologist of Shell Trinidad.

Holotype: A complete carapace from Harmony Hall well 2, 865 feet, San Fernando formation, upper Eocene; U.S.N.M. no. 563508; paratypes: U.S.N.M. no. 563509.

Parakrithe elongata van den Bold, new species

Plate 6, figure 6a–b

Carapace elongate, highest near the anterior end, which is evenly rounded, slightly projecting over dorsal and ventral margins. Dorsal margin straight, ventral margin sinuate, slightly concave anterior to the middle, subparallel; posterior end very obliquely truncate, angled ventrally, dorsal slope almost straight. Left valve overlapping the right along dorsal and ventral margin,

especially at both ends of the dorsal margin. Dorsal view elongate, lanceolate widest in front of the middle; anterior end compressed, posterior end blunt. Surface smooth, normal pore canals few and widely scattered, open.

Marginal area very similar to *Parakrithe vermunti*, line of concrescence and inner margin not coinciding in the anterior end; line of concrescence about parallel to the outer margin, vestibule sickle shaped; radial pore canals about 7 in number in anterior end with a few false radial ones, some bifurcating. Muscle scars: a posterior vertical row of four elongate scars; in front of the two middle ones a V-shaped scar above the posterior leg of which occurs another rounded scar.

Dimensions: Holotype: length 0.65 mm.; height 0.28 mm.; width 0.18 mm. This species is more elongate than the male of *Parakrithe vermunti*.

It has a range from middle Eocene (*Globigerapsis kugleri* zone) to lower Oligocene (*Globorotalia opima opima* zone).

Holotype: A complete carapace from Harmony Hall well 2, 865 feet, upper Eocene, San Fernando formation; U.S.N.M. no. 563513; paratypes: U.S.N.M. nos. 563514 to 563516.

***Parakrithe? ovata* van den Bold, new species**

Plate 6, figure 7a-c

Carapace short, ovate, highest just behind the middle. Anterior end evenly rounded, dorsal margin convex, ventral margin slightly convex with a faint concavity in the middle; posterior end very steeply truncate, slightly angled or narrowly rounded ventrally; dorsal slope almost straight, very slightly convex. Left valve overlapping the right only very slightly along dorsal, posterior and midventral margin; strongest overlap anterodorsally. Dorsal view ovate, widest behind the middle, posterior end blunt, rounded; anterior end tapering, but not strongly compressed. Marginal area not observed. Muscle scars: a posterior vertical row of four elongate scars, the upper one of which is faintly U-shaped; in front of the two higher ones is a V-shaped scar with a single rounded scar just above the posterior leg of the V.

Dimensions: Holotype: length 0.43 mm.; height 0.28 mm.; width 0.23 mm.

The species cannot be assigned with certainty to *Parakrithe* as the marginal area was not observed. It is different in shape from *Parakrithe waitei*. It occurs in the San Fernando formation above the non-calcareous Mount Moriah silt.

A fairly similar species occurs in the Dunmore Hill and Friendship Quarry marls of the Navet formation. It differs by stronger convexity of the dorsal margin and stronger overlap of the left valve at the anterodorsal margin, which is slightly, but distinctly concave in the right valve. Only few specimens of this species have been found, and it is referred to as *Parakrithe? sp.*, on the range chart (Chart 2) and the description of the type localities.

Holotype: A complete carapace from Renz sample 384, Vistabella marl, San Fernando formation, upper Eocene, U.S.N.M. no. 563510; paratypes: U.S.N.M. nos. 563511 and 563512

**Subfamily EUCYTHERINAE Puri
Genus EUCYTHERE Brady, 1868**

***Eucythere* sp.**

Plate 6, figure 4

Carapace elongate triangular, highest about one third from the anterior end. Anterior end slightly obliquely rounded; dorsal margin angled at the greatest height and at about one fourth from behind, all three parts of the dorsal margin nearly straight, very slightly convex; ventral margin nearly straight, generally with a small concavity in the middle; posterior end very narrowly rounded, almost subacute, ventrally. Left valve overlapping the right slightly along most of the periphery, except in the anterior end and both ends of the ventral margin. Strongest overlap anterodorsally and mid-ventrally. Dorsal view narrow, lanceolate, widest just anterior to the middle.

Dimensions: Length 0.55 mm.; height 0.28 mm.; width 0.10 mm.

The species is rather similar to *Eucythere triordinis* Schmidt (1948, p. 411 pl. 63, figs. 26, 27), also Munsey (1953, p. 15, pl. 3, fig. 6) and Key (1957, p. 88, pl. 2, fig. 13), but more elongate. It has been found only in Esmeralda well 1, 2630-2650 feet, "Gaudryina beds", lower or middle Eocene.

**Subfamily MICROTHERINAE Klie
Genus MICROCYTHERE G. W. Müller, 1894**

Microcythere? sp.

Plate 6, figure 8

Carapace small, trapezoid in side view, slightly higher in front. Anterior end obliquely rounded, dorsal margin nearly straight, very slightly convex; ventral margin sinuate; posterior end obliquely rounded, slightly angled in the middle, narrowly rounded below the middle, dorsal slope almost straight, ventrally passing gradually into the ventral margin. Valves about equal in size, the right one may be overlapping very slightly along the dorsal margin. Dorsal view spindle-shaped, widest about the middle, ends compressed with slightly concave outline.

Muscle scars: A posterior vertical row of four scars, the middle two are rather elongate, with a small V-shaped scar in front.

Marginal area: Line of concrescence and inner margin widely separated in the anterior end, where the line of concrescence forms a loop towards the outer margin. Radial pore canals apparently few, some of them may be bifurcating. As only closed carapaces were found, no detailed study could be made of the marginal area and

nothing is known of the hinge. In fig. 8, the pore canals are shown to have the tendency to stand in groups of two. It is possible that this is caused by the fact that the drawing was made in transmitted light through both valves at the same time, so that one of the pair belongs to one valve and the other one to the other valve.

The shape approaches the species assigned to *Microcythere* in the American Tertiary, but is different from the species described by Muller, Klie and Hartmann from the Recent seas. The muscle scar is figured by Muller with one rounded spot in front of the posterior row, which is also different from the Trinidad species. The marginal area is very similar to the one figured by de Vos (1953, p. 25, figs. 4a-l, 5a-e) for *Redekea perpusilla* de Vos, while the shape is generally similar. However, only on this basis an assignment to this recent commensal ostracode genus seems highly questionable.

Dimensions: Length 0.43 mm.; height 0.25 mm.; width 0.19 mm.

This species has been found only in the upper Eocene San Fernando formation in Harmony Hall well 2, 686-804 feet, and Kugler sample 3741, Soldado Rock, bed no. 4 (*Globorotalia cerroazulensis* zone).

Subfamily LEPTOCYTHERINAE Hanai

Hanai (1957, p. 471) places the genus *Munseyella* in the Pectocytherinae, but I see no reason at present for separating Pectocytherinae and Leptocytherinae, one with three, the other with two genera. The difference in the marginal area to which Hanai points seems hardly a point for dividing the two, since simple and complicated marginal areas also occur in the Hemicytherinae.

Genus MUNSEYELLA van den Bold, 1957

Munseyella minuta (van den Bold)

Munseyella minuta (van den Bold). — VAN DEN BOLD, 1958, Micropaleontology, vol. 4, no. 4, p. 402, pl. 4, fig. 1a-e, pl. 5, fig. 2a-c.

This species has been found also in the upper Eocene from the Vistabella marl upward. Its range as visualized at present is from uppermost Eocene to middle Miocene.

Munseyella reticulata van den Bold, new species

Plate 7, figure 1a-d

Cytheromorpha sp. aff. *C. warneri* Howe and Spurgeon. — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 238, pl. 3, fig. 5a, b.

Carapace elongate subquadrate, highest at the anterior cardinal angle. Anterior end broadly rounded with a very small concavity just below the projecting anterior cardinal angle in the left valve; dorsal margin slightly convex; ventral margin somewhat sinuate in front of the middle, slightly converging posteriorly; posterior end

subtruncate in the dorsal part, forming almost a right angle with the dorsal margin at the projecting posterior cardinal angle, rounded below. There is weak sexual dimorphism: males are more elongate and have a slightly more obliquely rounded anterior end. Surface reticulate, meshes more or less rounded and rather irregularly distributed with a tendency to be arranged in longitudinal rows in the ventral portion of the carapace. Anterior and posterior end are faintly rimmed. Just below and behind the anterior cardinal angle is a small eye spot. There is a faint subdorsal median sulcus.

Dimensions: Holotype, female: length 0.42 mm.; height 0.24 mm.; width 0.18 mm. Male: length 0.43 mm.; height 0.22 mm.; width 0.17 mm.

The species is very similar in exterior characters to *Cytheromorpha warneri* Howe and Spurgeon (Howe and others, 1935, p. 11 pl. 2, figs. 5, 8, 9, pl. 4, fig. 4) although it is much shorter. The hinge and marginal area, however, are quite different and very similar to those described for *Munseyella*. In external characters the species is different from most species of *Munseyella* as this species does not possess the characteristic thickened rim along the periphery, so that it resembles in this respect *Pectocythere* Hanai (1957, p. 472), from which on the other hand it differs in many respects. The species has been found throughout the San Fernando formation and occurs also in the Mejias Quarry (lower Miocene *Catapsydrax dissimilis* zone).

Holotype: A complete carapace of a female from Kugler sample 3741, bed 4 of Kugler on Soldado Rock, U.S. N.M. no. 563517; paratypes: U.S.N.M. nos. 563518 to 563520.

Munseyella israelskyi Marianos and Valentine

Plate 7, figure 3

Munseyella israelskyi MARIANOS AND VALENTINE, 1958, Micropaleontology, vol. 4, no. 4, p. 366, pl. 2, fig. 6a-b, text-fig. 3.

Dimensions: Length 0.33 mm.; height 0.18 mm.; width 0.16 mm.

This species occurs in the "Gaudryina beds" of Esmeralda well 1, 2630-3071 feet.

Munseyella sp.

Plate 7, figure 2

Shape very similar to *Munseyella minuta* (van den Bold). Ornamentation consists of a regular reticulate pattern in which two curved anterior ridges (same as in *M. minuta*) can be observed. Preservation does not allow a complete description, and the species is only figured to show the occurrence of this type of *Munseyella* in the "Gaudryina beds" of Esmeralda well 1, 3052-3071 feet.

Dimensions: Length 0.43 mm.; height 0.24 mm.; width 0.15 mm.

EOCENE AND OLIGOCENE OSTRACODA OF TRINIDAD

CHART 3

RANGE CHART OF TRACHYLEBERIDINAE, HEMICYTHERINAE, BRACHYCYTHERINAE, CYTHERETTINAE, LEPTOCYTHERINAE AND INCERTAE SUBFAMILIAE.

RANGE CHART OF THE TRACHYLEBERIDINAE, HEMICYTHERINAE,

BRACHYCYTHERINAE, CYTHERETTINAE, LEPTOCYTHERINAE,

AND INCERTAE SUBFAMILIAE OF THE EOCENE AND OLIGOCENE OF TRINIDAD

Trachyleberis bollii n.sp.
Trachyleberis bermudezi (v.d.Bold)
Trachyleberis ? reticulospinosa (v.d.Bold)
Trachyleberis ? spiniferima (Jones and Sherborn)
Trachyleberis ? hapsida n.sp.
Trachyleberis ? hazelae (v.d.Bold)
Cythereis ? trinidadensis v.d. Bold
Cythereis ? sculptilis Alexander
Costa barri n.sp.
Costa harmoniensis n.sp.
Costa lehneri n.sp.
Costa meka n.sp.
Cativalia moriahensis n.sp.
Buntonia ? sp.
Echinocythereis okeschoiensis (Swain)
Henryhowella asperima (Reuss)
Jugosocythereis vicksburgensis (Howe)
Hermanites aff. H. pajenborchiana Keij
Quadracythere ? sp.
Hemicythere cristalliverensis Puri
Brachyocythere harmoniensis n.sp.
Brachyocythere fernandensis n.sp.
Alatacythere maerkyi (v.d.Bold)
Protobuntonia ? sp.
Cythereta alexanderi Howe and Chambers
Munseyella reticulata n.sp.
Munseyella minuta (v.d.Bold)
Microcythere ? sp.
Ambocythere elongata v.d.Bold
Ruttenella ovata v.d.Bold

Stage	Formation	member	Biostratigraphic zone
MIOCENE	CIPERO		Catapsydrax stainforthi
			Catapsydrax dissimilis
OLIGOCENE	SAN		Globorotalia kugleri
			Globigerina ciperoensis ciperoensis
EOCENE	FERNANDO		Globorotalia opima opima
			Globigerina ampliapertura
	U	Upper Mount Moriah silt	
		Vistabella marl	Globorotalia cerroazulensis
	NAVET	Boca de Serpiente marl	
		Lower Mount Moriah silt	
	M	Hospital Hill marl	Globigerapsis seminivoluta
			Truncorotaloides rohri
		Penitence Hill marl	Porticulospira mexicana
		Pitt Trace marl	Globorotalia lehneri zone
L	LIZARD	Dunmore Hill marl	Globigerapsis kugleri
		Friendship Quarry marl	Hantkenina aragonensis
PALEOCENE	SPRINGS		Globorotalia palmerae
		Ramdat marl	Globorotalia aragonensis
			Globorotalia formosa formosa
			Globorotalia rex
			Globorotalia velascoensis
			Globorotalia pseudomenardii
	Globorotalia pusilla pusilla		
		Globorotalia trinidadensis	

Subfamily TRACHYLEBERIDINAE Sylvester-Bradley
Genus TRACHYLEBERIS Brady, 1902

Trachyleberis bollii van den Bold, new species Plate 4, figure 2a-b

Trachyleberis? sp., VAN DEN BOLD, 1957, Micropaleontology,
vol. 3, no. 1, p. 9, pl. 3, fig. 5a-b.

Carapace elongate ovate, spinose, highest at the anterior cardinal angle. Anterior end obliquely rounded in the left valve, almost evenly rounded in the right; dorsal margin straight, slightly depressed behind the projecting anterior cardinal angle in the left valve; ventral margin generally convex, slightly sinuate in front of the middle, converging slightly towards the dorsal margin posteriorly; posterior end laterally compressed, triangular, angled in the middle, straight above, convex below. The anterior end bears a triple row of blunt nodules, the outer row on the margin itself, the inner row shows as a heavy anterior rim broken up into about 10-12 heavy nodules, the middle row consists of nodules projecting forwards from the inner row, they are much larger in the ventral portion of the margin. The ventral part of the carapace

also has three rows of spines, paralleling the ventral margin. Most of the spines are broad and often flattened on top with the tendency to bi- or trifurcate. A double row of small nodules fringes the entire posterior margin. A row of three very heavy spines flanks the dorsal margin, the spines projecting over it in side view. A cluster of small spines occurs at the subcentral swelling, behind it some groups of spines form an irregular longitudinal row, others are scattered over the surface of the valves. A prominent spine usually occurs at the anterior cardinal angle. The left valve is overlapping the right one clearly only at the anterior cardinal angle. In the anterior part of the carapace a few obscure remnants of a fine reticulation can be seen.

Dorsal view, widest behind the middle, irregularly spinose with heavy anterior rim and compressed posterior portion. Interior of the valves deep; in the muscle scar pit a posterior row of four scars can be seen, the second one from the top is divided into two separate scars, which is an unusual phenomenon in the Trachyleberidinae and much more common in the Hemicytherinae; in front is a single V-shaped scar.

Marginal area broad in the anterior end. Line of concrescence and inner margin coincide; radial pore canals numerous, slightly wavy and thickened towards the outer margin. Hinge in the right valve consists of a small anterior tooth, postjacent round socket and very faint groove in the dorsal margin; it could not be made out whether this groove is crenulate or not; at the posterior cardinal angle a large, blunt, ovate and oblique tooth occurs.

Dimensions: Holotype: length 0.73 mm.; height 0.42 mm.; width 0.32 mm.

Apart from the Paleocene and lower Eocene in which this species has previously been recorded, it occurs in the Penitence Hill and Fitt Trace marls and Friendship Quarry marls of the Navet formation. In the upper Eocene it is replaced by the much larger *Trachyleberis bermudezi*. The species has been named after H. M. Bolli, in recognition of his valuable stratigraphic work on the planktonic foraminifera of Trinidad.

Holotype: A complete carapace from Renz sample 385, Penitence Hill marl, Navet formation, U.S.N.M. no. 563521; paratypes: U.S.N.M. nos. 563522 and 563523.

***Trachyleberis bermudezi* (van den Bold)**

Plate 4, figure 1; plate 8, figure 1

Cythereis bermudezi VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 99, pl. 10, fig. 18a, b.

Cythereis spinosa LIENENKLAUS. — VAN DEN BOLD, 1946, *ibid.*, p. 90, pl. 10, fig. 10 (moult).

Not *Cythereis spinosa* LIENENKLAUS, 1900, Zeitschr. d. Deutsche Geol. Gesell., p. 516, pl. 20, fig. 4.

Cythereis montgomeryensis Howe and Chambers. — VAN DEN BOLD, 1950, Jour. Pal., vol. 24, no. 1, p. 108.

Not *Cythereis montgomeryensis* HOWE AND CHAMBERS, 1935, Louisiana Dept. of Cons., Geol. Bull. no. 5, p. 37, pl. 1, figs. 13, 16; pl. 2, figs. 22, 23; pl. 6, figs. 19, 20.

Both description and figure of this species as given by the writer in 1946 are very poor and are insufficient for recognizing the species. *Cythereis spinosa* as figured in 1946, probably represents a young moult of this species. In 1950 this was considered to represent a moult stage of *Cythereis rosefeldensis* Howe and Law, but it is much more probable that it belongs to *Trachyleberis bermudezi* instead. Carapace elongate subquadrate, highest at the anterior cardinal angle, where the left valve overlaps the right conspicuously. Anterior end almost evenly rounded, spinose, and bearing a flat spinose rim; dorsal margin straight, obscured in side view by some of the spines of the dorsal ridge; ventral margin convex, fringed with small flattened spines; posterior end bluntly angled in the middle, strongly spinose. The ornamentation consists of several rows of spines with others scattered over the surface. Many of the spines are either flattened on top or exhibit small secondary spines near the top.

Usually they are quite heavy. Most conspicuous is a group of spines forming the subcentral tubercle; behind that, separated from it by a rather deep depression is a median row of five spines. Another row of four spines parallels the dorsal margin, while a longer ventral row of eight spines shows the size of the spines increasing towards the posterior end of the row. Below this ventral row is a narrow sharp, denticulate ventral ridge. Other spines occur between dorsal and median row and in front of the subcentral group and especially between median and ventral row. The dorsal view is spinose and very irregular. Interior of the valves deep. Marginal area broad, crossed by numerous, thin, long, pore canals. Line of concrescence and inner margin coincide. Hinge and muscle scar are typical for the genus.

Dimensions: Length 1.21 mm.; height 0.70 mm.

Cythereis montgomeryensis Howe and Chambers differs by its oblique anterior end, which has a heavier and higher rim and also in details of the spinose ornamentation.

The species seems to be very close to *Trachyleberis tridens* Hornibrook (1952, p. 33, pl. 3, figs. 42, 43, 49), which has, however, higher spines on the subcentral tubercle while the median row of spines is less pronounced; also the spines at the anterior cardinal angle are longer.

In Cuba the species occurs in the upper Eocene and lower Oligocene. In Trinidad it has been found in the upper Eocene, Oligocene and lowermost Miocene (*Catapsydrax dissimilis* zone). San Fernando formation localities are Calyx well 57, 830–840 feet, Stainforth samples 153 and 244A, Kugler sample 3692 (Soldado Rock) and Kugler sample 8829 from Hospital Hill marl.

***Trachyleberis? spiniferrima* (Jones and Sherborn)**

Trachyleberis? spinosissima (Jones and Sherborn). — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 9, pl. 3, fig. 4a–b.

This species has been found in the Friendship Quarry marl and in the "Gaudryina beds". *Pterygocythereis mucronata* (Sars) was described by Brady in 1865 under the name *Cythereis spinosissima* and not *Cythereis spinosissima* as erroneously claimed in the synonymy of this species (van den Bold, 1957). Therefore the name *spinosissima* is preoccupied for *Cythereis*.

***Trachyleberis? reticulospinosa* (van den Bold)**

Cythereis reticulospinosa VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 100, pl. 6, fig. 18.

Trachyleberis reticulospinosa (van den Bold). — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 241, pl. 1, fig. 10.

This species occurs in the San Fernando formation, the lowest stratigraphic occurrence is in Calyx well 59 at 480 feet. It also occurs in the Boca de Serpiente marl on Soldado rock. Range: upper Eocene — lower Miocene.

Trachyleberis? hapsida van den Bold, new species
Plate 4, figure 3a-b

Carapace elongate, highest at the anterior cardinal angle, widest about one third of the length from the posterior end. Anterior end slightly obliquely rounded, bearing a row of anteriorly projecting spines, 4 to 5 small ones above the middle, 3 to 4 larger ones with flattened base, almost nipple shaped, below the middle and 5 to 6 small ones in the ventral part. The anterior margin is paralleled by a row of laterally projecting spines, ending dorsally in the anterior cardinal angle, which is pronounced, especially in the left valve. Dorsal margin straight, slightly depressed between the projecting cardinal angles in the left valve; ventral margin sinuate, converging posteriorly; posterior end sharply produced, laterally compressed, angled in the middle, concave above, convex and bearing 4 to 5 spines below. Posterior cardinal angle in the left valve projecting. Left valve overlapping the right at both cardinal angles and in the dorsal part of the posterior end. Surface reticulate, provided with a strong ventral ridge in which the ridges of the reticulation project to form spines, the posterior one of which is much larger than the others and it is here that the greatest width occurs. Close to the ventral margin is a short, sharp, parallel ridge. A similar ridge parallels the dorsal margin, flattening the dorsal portion of the carapace. In the anteroventral portion of the carapace some of the reticulations exhibit spines projecting into the meshes. There is a faint, curved depression in the centre of the valves, suggesting the presence of a subcentral tubercle.

Dimensions: Length 0.79 mm.; height 0.43 mm.; width 0.35 mm.

This species is related to both *Trachyleberis? spiniferrima* and *reticulospinosa*. A closely similar species occurs in the upper Eocene Pauji formation of the Maracaibo basin. Another undescribed related species occurs in the Jackson upper Eocene of the Gulf Coast. It is quite possible that this group of species which seems to be intermediate between *Trachyleberis* and *Costa*, belongs to an undescribed genus.

The species occurs throughout the San Fernando formation, as high as the upper Mount Moriah silt. The name is derived from *hapsis* (Gr.), net or mesh.

Holotype: A complete carapace from Kugler sample 3692, Soldado Rock, U.S.N.M. no. 563524; paratypes: U.S.N.M. no. 563525.

Trachyleberis? hazelae (van den Bold)

Trachyleberis? hazelae (van den Bold). — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 241, pl. 1, fig. 11.

The range of this species has been established from middle Eocene to middle Miocene. Lowest occurrence in the Dunmore Hill marl, *Globigerapsis kugleri* zone.

Genus CYTHEREIS Jones, 1849

Cythereis? trinidadensis van den Bold

Cythereis? trinidadensis VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 8, pl. 3, fig. 1a-d.

As reported before, the range of this species is Upper Cretaceous to middle Miocene. It occurs scattered throughout the Navet formation.

Cythereis? sculptilis Alexander

Cythereis? sculptilis Alexander. — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 8, pl. 3, fig. 2a-b.

Highest occurrence of this species is in the Friendship Quarry marl.

Genus COSTA Neviani, 1928

Costa barri van den Bold, new species
Plate 4, figure 4a-b

Carapace subrectangular, highest about one-fourth from the anterior end at the anterior cardinal angle. Anterior end broadly and somewhat obliquely rounded, very finely denticulate, rimmed; dorsal margin depressed behind the anterior cardinal angle in the left valve, straight, converging posteriorly towards the ventral margin, which is nearly straight with a small concavity anterior to the middle; posterior end strongly compressed laterally, triangular in side view, concave above the middle, convex and bearing four rather large spines below.

Valves reticulate and ornamented with three longitudinal ridges and an anterior rim. Anterior rim parallel to anterior margin with a small eye-tubercle at the dorsal end. Transverse ridges project anteriorly of the rim, especially in the lower half of the valve. Dorsal ridge rising behind a small depressed area, posterior to the eye-tubercle, straight, obscuring the dorsal margin in the posterior two-thirds and terminating just in front of the posterior cardinal angle. Just anterior to the center of the valve lies a subcentral tubercle which is ill-defined in its anterior portion; from its dorsal part extends a median ridge parallel to the dorsal one, ending vertically below the posterior end of the dorsal ridge, just in front of the compressed posterior triangle.

Ventral ridge actually consisting of two ridges, starting as one in the second ridge of the reticulation behind the anterior rim and becoming divided into two just below the subcentral tubercle. The upper one parallels the ventral margin, the lower one converges towards it, reaching it just at its posterior end, vertically below the ends of dorsal and median ridge. These two ventral ridges form a narrow, oblique, meshed surface in the middle third of the carapace. The surface between the ridges is coarsely reticulate, the reticulations spreading out from the subcentral tubercle. The shape of the meshes is characteristic in the posterior part of the area between dorsal and median ridge, where they form

interlocking Vs. In dorsal view the posterior end is much more strongly compressed than the heavily rimmed anterior end. The two median ridges converge slightly towards the posterior, the ventral ridges diverge slightly and are only visible in their posterior third, being obscured by the median ridges and the subcentral tubercles in the anterior part. Dorsal ridges nearly parallel, diverging very slightly posteriorly. The greatest width occurs at the posterior end of the ventral ridges, but is only very slightly more than the width at the subcentral tubercle, so that the sides of the carapace give the impression of being parallel.

Dimensions: Holotype: length 0.78 mm.; height 0.43 mm.; width 0.36 mm.

Sexual dimorphism is present but only very slightly. The species has been named in honour of K. W. Barr, chief geologist of Texaco Trinidad, Inc.

The species has been found in Barr's samples 7244 and 7244a-c, St. Joseph village, San Fernando and in two zones of Harmony Hall well 2, 828-840 feet and 1988-2000 feet, also in the non-calcareous Mount Moriah silt and the Vistabella marl.

Holotype: A complete carapace from Barr sample 7244, U.S.N.M. no. 563526; paratypes: U.S.N.M. no. 563527.

Costa lehneri van den Bold, new species

Plate 4, figure 5a-b, plate 8, figure 4a-b

Carapace more or less pyriform in side view, highest near the anterior end at the anterior cardinal angle, which projects strongly in the left valve.

Anterior end broadly rounded, finely denticulate in the upper half, slightly more coarsely so in the lower half, bearing a denticulate rim; dorsal margin straight, in the left valve depressed between the two projecting cardinal angles; ventral margin sinuate, in general slightly convex downward but with a small concavity just in front of the middle; posterior end short, bluntly angled in the middle, lower part rounded and bearing a double row of small blunt spines, upper part straight, laterally compressed. Surface reticulate, irregular, with small nodes on some of the ridges.

Three longitudinal ridges can be recognized, but all are rather ill-defined and irregular. Dorsal ridge, slightly higher in front than behind, curving down anteriorly towards the median ridge; some of the ridges of the reticulation form projecting spines above the dorsal margin. Median ridge in general parallel to the dorsal one and converging towards the ventral ridge, slightly angled in the center and curving slightly downward in the anterior part. Ventral ridge convex downward, parallel to the ventral margin, sometimes rather obscure in the middle portion of the valve. The denticulate anterior rim continues parallel to the ventral margin below the ventral ridge. Between the ridges the valves are reticulate. The arrangement of the meshes between dorsal and median ridge is characteristic. One large

group of meshes is formed between the down-curving dorsal ridge and the downwardly deflected anterior part of the median ridge; behind this are three parallel cross ridges, perpendicular to both median and dorsal ridge and at the end of the shorter median ridge a large inverse V-shaped mesh occurs which is divided into secondary meshes by cross ridges.

Muscle scar: a vertical row of four scars, the third and especially the second from above being much more elongate, lying at the posterior side of a shallow pit; on the anterior side of the pit occurs a single V-shaped scar, horizontally in front of the two topmost scars of the posterior row. Marginal area broad in anterior end. Line of concrescence and inner margin coincide; radial pore canals very numerous, long, slightly sinuous, slender and apparently all simple. They are slightly widened near the anterior margin. Hinge in the right valve consists of an anterior knoblike tooth, placed on a broader, flat base, a small but deep, round socket and a narrow, straight, smooth groove; posterior tooth large, blunt, slightly lobate. In the left valve rounded terminal sockets and an intermediate smooth bar with a small rounded tooth at the anterior end.

Dimensions: Holotype: length 0.83 mm.; height 0.53 mm.; width 0.37 mm.

The species has been named after Dr. E. Lehner in recognition of his contributions to Trinidad geology. It occurs in the Oligocene, its highest occurrence being in the *Globigerina ciperoensis ciperoensis* zone, its lowest occurrence in the non-calcareous Mount Moriah silt (*Globorotalia cerroazulensis* zone).

There is slight sexual dimorphism; the females have a variation in length from 0.75-0.88 mm. and from 0.48-0.55 mm. in height, while the males vary from 0.84-0.88 mm. in length and 0.50-0.53 mm. in width.

Holotype: A complete carapace from Calyx hole 57, 250-260 feet, U.S.N.M. no. 563528; paratypes: U.S.N.M. no. 563529.

Costa harmoniensis van den Bold, new species

Plate 4, figure 6a-b

Carapace elongate subrectangular, reticulate, spinose in parts, highest about one fourth from the anterior end at the anterior cardinal angle. Anterior end broadly rounded, denticulate and with denticulate rim, which continues as a low flat ridge parallel to the ventral margin; ventral margin somewhat sinuate, dorsal margin straight, slightly depressed behind the anterior cardinal angle in the left valve, converging very slightly towards the ventral margin; posterior end short, angled about the middle, straight or slightly concave above, rounded and denticulate below.

Ventral ridge rather obscure, sometimes only consisting of a row of knoblike spines, such as are scattered all over the carapace in well preserved specimens. It is convex downward. Dorsal ridge equally obscure, consisting of

the pointed or spinose tops of the reticulations, only locally obscuring the dorsal margin. Median ridge occupying the exact median line in the posterior portion of the carapace in front of the compressed posterior triangle. It diverges slightly from dorsal and ventral margins anteriorly; just in front of the center it divides into two branches, the upper one continuing in the same general direction, but concave upwards, the lower one paralleling the upper one at a distance of one mesh. Just behind and below the posterior end of the second ridge is a slight depression of the muscle scar pit. The male is relatively longer and narrower and dorsal and ventral margin are converging more strongly posteriorly. The median ridge is about parallel to the ventral margin and converges towards the dorsal margin posteriorly. Dorsal view with compressed ends, the posterior one much more strongly than the anterior; greatest width about one third from the posterior end.

Dimensions: Holotype, female: length 0.86 mm.; height 0.50 mm.; width 0.42 mm.; male: length 0.89 mm.; height 0.50 mm.; width 0.39 mm. Variability; female: length 0.79–0.86 mm.; height 0.46–0.50 mm; male: length 0.81–0.89 mm.; height 0.46–0.50 mm.

This species appears to be related to *Costa lehneri* n. sp., the main difference being the direction of the median ridge. It occurs in the upper Eocene and lowermost Oligocene, its highest known occurrence is in Calyx hole 57, 910–920 feet, *Globigerina ampliapertura* zone. A fairly similar species occurs in the "Gaudryina beds" of Esmeralda well 1 which will not be described because of insufficient material.

Holotype: A complete carapace from Calyx well 57, 910–920 feet, U.S.N.M. no. 563530; paratypes U.S.N.M. nos. 563531 to 563534.

***Costa meka* van den Bold, new species**
Plate 4, figure 7a–b

Carapace elongate, quadrangular, highest about one-fifth from anterior end at the anterior cardinal angle. Anterior end obliquely rounded with four to six coarse teeth in the lower half and smaller denticles in the upper, bearing a strong smooth ridge with a glassy eye-tubercle near the upper end. In the lower part, this ridge bears scalloped, rounded, nodules and it continues as a smooth ridge along, very close to and almost parallel to, the ventral margin. Dorsal margin straight, depressed behind the anterior cardinal angle, converging posteriorly slightly to the ventral margin, which is gently sinuate, almost straight; posterior end laterally compressed, triangular in side view, angled in the middle, slightly concave above, rounded below and with a raised rim which bears a few blunt spines in the lower part.

The carapace is reticulate with a fairly regular pattern and ornamented with three longitudinal ridges: dorsal ridge lobate, slightly convex, just obscuring part of the

dorsal margin; ventral ridge shorter, often ill-defined in the middle or near its posterior end; median ridge very long, horizontal, slightly above the middle, splitting off a lower branch which runs obliquely forward and downward from just in front of the middle. The main ridge converges slightly towards the posterior end of the dorsal one. Dorsal view with compressed ends, of which the posterior one is more strongly compressed; sides almost parallel; width at the median ridge just in front of the middle almost equal to the greatest width at the posterior end of the ventral ridge. The two ventral ridges diverge posteriorly in dorsal view while the median ridges converge slightly. Males are more slender than the females and possess a stronger concavity at the junction of ventral and posterior margins.

Hinge and marginal area are similar to *Costa lehneri*, except for a widening of the median groove of the hinge in the right valve near the posterior tooth.

Dimensions: Holotype, female: length 0.79 mm.; height 0.42 mm.; width 0.37 mm; male: length 0.79 mm.; height 0.37 mm.; width 0.30 mm.

The name is derived from the Greek *mekos* meaning length. The species may be related to *Isocythereis*? aff. *fissicostis* Triebel (van den Bold, 1957a, p. 9, pl. 3, fig. 3a, b). It occurs scattered in the San Fernando formation, but is nowhere common.

Holotype: A female carapace from Harmony Hall well 2, 1988–2000 feet, U.S.N.M. no. 563535; paratypes: U.S. N.M. nos. 563536 to 563538.

Genus *CATIVELLA* Coryell and Fields, 1937

***Cativella moriahensis* van den Bold, new species**
Plate 4, figure 8; plate 8, figure 5

?*Cativella* sp. cf. *semitranslucens* (Crouch).—VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 243, pl. 2, fig. 6.
Not *Cativella* aff. *semitranslucens* (Crouch).—VAN DEN BOLD, 1958, Micropaleontology, vol. 4, no. 4, p. 404, pl. 3, fig. 3.

Carapace elongate, quadrangular, highest about one-fourth from the anterior end at the anterior cardinal angle below which lies a glassy eye-tubercle.

Anterior end obliquely rounded, bearing three large spines in the ventral half and up to nine small ones above and below these; dorsal margin depressed between the two prominent cardinal angles, straight, converging posteriorly towards the ventral margin, which is nearly straight, with a small concavity anterior to the middle; posterior end laterally compressed, triangular, angled in or slightly below the middle, concave above, convex and bearing a double row of spines below. The inner row of spines projects laterally, the outer row is only slightly deflected laterally.

Ornamentation consists of very high, longitudinal crests and a reticulation. The ridges of the reticulation support the crests and the shell of the crests between these

ridges is very thin and in cases even perforated. Anterior ridge, very obliquely curved, more strongly than the anterior margin and continuing dorsally a short distance beyond the eye-tubercle, and ventrally parallel to the ventral margin, obscuring it as far as the posterior end. A thin, slightly alate ventral ridge, running obliquely down from just behind the anterior ridge towards the ventral margin, curves upward near its posterior end and terminates in a strong spine. A long median ridge extends from near the anterior ridge till inside the posterior triangle. It is slightly convex upward. A dorsal ridge starts from just behind the eye-tubercle and is convex upward, obscuring the dorsal margin completely and joining it in front of the posterior cardinal angle. Between the ridges the valves exhibit a reticulate pattern, standing at right angles to the longitudinal crests. Locally small tubercles are raised from the junctions of the ridges of the reticulation. The inside of the valves shows a fairly deep subcentral pit, which is not visible on the outside. At the posterior side of the pit is a vertical row of four muscle scars; the second one from the top is much longer than the others. In front of this scar and at the anterior side of the pit lies a small V-shaped scar with the sharp end of the V pointing forward.

Marginal area broad in anterior end, slightly less in posterior. Line of concrescence and inner margin coincide; radial pore canals numerous, straight, slightly widened near the middle. Hinge in the right valve consists of a strong anterior tooth, a postadjacent rounded socket, which opens into a straight groove and a posterior, blunt, knoblike tooth. In the left valve a bar with a small knoblike tooth at its anterior end lies between terminal rounded sockets.

This species shows a variation in the thickness of the shell. The specimens from Stainforth sample 47 are all very thin and fragile, on the other hand similar specimens from Harmony Hall well 2, 1894–1906 feet, and the Paloma Alta formation of Venezuela are much more robust. The same holds true for the specimen from the Mejias Quarry which has been questionably referred to this species. In Rohr sample 25684, type locality for the *Globorotalia cerroazulensis* zone, both the fragile and the robust types occur. Another peculiarity is that there seem to be two sizes of adults: two male carapaces from Stainforth sample 47 are much larger than an apparently adult female.

Dimensions: Holotype, large male: length 0.74 mm.; height 0.42 mm. Adult female, Harmony Hall well no. 2: length 0.60 mm.; height 0.35 mm.; female, Harmony Hall well no. 2: length 0.75 mm.; height 0.42 mm.; female, Paloma Alta: length 0.75 mm.; height 0.39 mm. The measurements are taken from margin to margin and do not include the spines.

Holotype: A left valve from Stainforth sample 47, *Globigerina ampliapertura* zone, Point Bontour. U.S.N.M. no. 563539; paratypes: U.S.N.M. no. 563540.

Genus BUNTONIA, Howe 1935

Buntonia alabamensis (Howe and Pyeatt)

Buntonia alabamensis (Howe and Pyeatt). – VAN DEN BOLD, 1957, *Micropaleontology*, vol. 3, no. 1, p. 8.

This species has only been found in the “*Gaudryina* beds” of the Nariva Cocal well 1 of Shell Trinidad and in T.P.D.’s Esmeralda well 1 and in the Paleocene of Shell Trinidad’s well FC-98 and T.T.C.’s Rochard well 1, also in samples from the Marac Quarry. It does not occur in the Navet and Lizard Springs formations, the deeper water facies of which was apparently unfavorable to the development of this species.

Buntonia seminuda (Stephenson)

Pyricitythereis seminuda STEPHENSON, 1944, *Jour. Pal.*, vol. 18, no. 5, p. 453, pl. 76, fig. 5, 6. – VAN DEN BOLD, 1946, *Contribution to the study of Ostracoda*, Univ. Thesis, Utrecht, p. 103.

This species occurs in Trinidad only in the “*Gaudryina* beds”.

Buntonia? sp.

Plate 5, figure 2a–b; plate 8, figure 11a–b

Carapace elongate triangular, highest about one third from the anterior end. Anterior end broadly rounded, continuing with regular curve into dorsal and ventral margin in the left valve, slightly obliquely rounded in the right and forming an obtuse angle with the dorsal margin; dorsal outline sinuate in the left valve, regularly but gently convex in the anterior two third, concave and curving upward to the produced posterior cardinal angle in the posterior part, straight in the right valve; ventral margin regularly convex with a slight concavity in the middle; ventral and dorsal margin converging posteriorly; posterior end angled about the middle, slightly concave above, forming a continuation of the ventral margin below and bearing a few small denticles in the right valve. Left valve overlapping the right along the periphery; greatest amount of overlap anterodorsally.

Dorsal view elongate, spindle-shaped, ends compressed, greatest width just behind the middle in the ventral portion of the carapace. Valves sometimes finely striate with faint longitudinal ridges, more pronounced and convex downward in the ventral portion, about horizontal in the center; the ridges become fainter towards dorsal and anterior margins. Many specimens appear to be entirely smooth, in others the ribs show only in the posterior half of the carapace. A small but distinct eye-spot occurs just below the greatest height. Muscle scars: a posterior row of four, with a small V-shaped scar in front.

Marginal area moderately broad; line of concrescence and inner margin coincide; radial pore canals very numerous, straight, simple, often standing in groups of two or three. Hinge in the right valve: a high knob-like tooth standing on a flattened, oblique, curved base, a postjacent small rounded socket, opening into a

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straight crenulate groove; posterior tooth large, outwardly deflected, subtriangular in dorsal view, faintly carved. Hinge in the left valve is complementary to the one in the right. Sexual dimorphism pronounced: males are longer and slenderer than females and their posterior end is much narrower.

Dimensions: Female: length 0.74 mm.; height 0.45 mm.; width 0.35 mm.; male: length 0.80 mm.; height 0.45 mm.; width 0.35 mm.

Only few specimens of this species have been found in the San Fernando formation, Calyx well 59, 440–450 feet, Barr sample 7244. It is much more common in the upper Eocene Pauji formation of the Maracaibo basin.

The following genera are usually assigned to the Trachyleberidinae, but in some of the characters they appear to be intermediate between these and the Hemicysterinae. As the characters of these subfamilies have not been described in detail by their authors it is left undecided here to which subfamily they belong.

Genus *Henryhowella* Puri, 1957

Howella PURI, 1956, Jour. Pal., vol. 30, no. 2, pp. 274, 275, not *Howella* OGILBY, 1899.

Type species: *Cythere evax* Ulrich and Bassler, 1904 p. 119, pl. 36, figs. 6–8.

The description of the genus as given by Puri has to be amended in the following ways: radial pore canals long and sinuous, often joined together at the base or branching, especially in the lower half of the anterior margin. Hinge in the right valve with blunt, fairly elongate, very slightly lobate anterior tooth (plate 8, fig. 3), which in side view is comma-shaped; the median groove is finely crenulate, posterior tooth blunt, knoblike.

The material on which this description is based comes from Dr. Howe's collection of material from Plum Point, Maryland, at about 18 feet above the base of the cliff. It was compared to *Henryhowella asperrima* (Reuss) from Baden, one of Reuss' original localities. In general the European species seems to be somewhat more finely built than the American one. Hinge and marginal area are practically identical. The species from Trinidad figured as *Henryhowella asperrima* (Reuss) is so similar to both *Henryhowella evax* and the European species that it does not seem to serve any practical purpose to try and separate them. The inside of the right valve as figured is identical to both of them.

Howella echinata Puri (1956, p. 275, pl. 35, figs. 9–14) as identified by the present writer from the Cooper marl is very similar in exterior to the other forms, but in the single specimen where the marginal area could be studied in transmitted light, the radial pore canals are slightly more simply built although some of them are seen to be branching. It should be pointed out, however, that the name *Henryhowella echinata* is preoccupied by *Henryhowella asperrima echinata* (Reuss).

Henryhowella asperrima (Reuss)

Plate 4, figure 10, plate 8, figure 2

Henryhowella asperrima (Reuss). – VAN DEN BOLD, 1957, Micro-paleontology, vol. 3, no. 3, p. 242, 243 (with synonymy).

This species has been observed throughout the upper Eocene in both San Fernando and Hospital Hill formation; it also occurs in all stages of the Oligocene. A fairly similar, undescribed species, occurs in the middle Eocene, but preservation does not allow a description, hence it has been referred to, in the list of the faunas of the type localities, as *Henryhowella* sp.

Dimensions: Female: length 0.70–0.82 mm.; height 0.44–0.52 mm.; male: length 0.73–0.84 mm.; height 0.43–0.48 mm.

Genus *Echinocythereis* Puri, 1954

Echinocythereis okeechobiensis (Swain)

Plate 4, figure 9

Cythereis? okeechobiensis SWAIN, 1946, Jour. Pal., vol. 20, p. 378¹ pl. 54, fig. 10a–b, pl. 55, fig. 3a–b.

Echinocythereis okeechobiensis (Swain). – PURI, 1954, Florida Geol. Surv., Bull. 36, p. 260. – PURI, 1957, Florida Geol. Surv., Bull. 38, p. 196, pl. 8, fig. 7–10, pl. 9, figs. 1–4.

This species occurs in the upper Eocene of the Hospital Hill marl (Navet formation) and in the San Fernando formation.

Genus *Jugosocythereis* Puri, 1957

This genus is accepted here provisionally, but it is pointed out, that no distinct separation has been made from genera like *Quadracythere* or *Hermanites*, and that the muscle scar pattern as described by Puri (1957, p. 200) is totally inconsistent with the Trachyleberidinae. Moreover, some of the species described by Puri under this genus do not seem to belong here.

Jugosocythereis vicksburgensis (Howe)

Cythereis vicksburgensis HOWE. – HOWE AND LAW, 1956, Louisiana Dept. of Cons., Geol. Bull. 7, p. 34, pl. 4, fig. 4, pl. 5, fig. 1–2.

Cythereis vicksburgensis HOWE. – VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 69, pl. 10, fig. 5. – VAN DEN BOLD, 1950, Jour. Pal., vol. 24, no. 1, p. 82.

Cythereis bicarinata SWAIN, 1946, Jour. Pal., vol. 20, p. 376, pl. 54, fig. 7a–d, pl. 55, fig. 1a–c.

Hermanites? pannosa (Brady). – VAN DEN BOLD, 1957, Micro-paleontology, vol. 3, no. 3, p. 240, pl. 2, fig. 2.

Jugosocythereis bicarinata (Swain). – PURI, 1957, Florida Geol. Surv., Bull. 38, p. 200, pl. 12, figs. 11–20.

The writer compared this species with *Cythere pannosa* Brady (1869, *Fonds de la Mer*, p. 154, pl. 19, fig. 1–2), but now doubts that the species are really identical. Therefore, it seems better to give it the name under which it was first described in detail. In Trinidad the

species occurs in the Oligo—Miocene (St. Croix, Mejias, Kapur, Morne Diablo and Quinam quarries), ranging from the *Globorotalia opima opima* zone to the *Globorotalia mayeri* zone, and in a few samples from the San Fernando formation (upper Eocene).

Genus HERMANITES Puri, 1955

Hermanites sp. aff. **Hermanites paijenborchiana** Keij Plate 8, figure 10

Hermanites paijenborchiana KEIJ, 1957, Inst. Roy. Sci. Belgique, Mém. 136, p. 110, pl. 17, figs. 11–14, pl. 21, figs. 10–11.

The Trinidad species differs from *Hermanites paijenborchiana* Keij, in having a longer ventral ridge and the tendency of two of the radiating anterior ridges to become raised. From *Hermanites haidingeri* (Reuss) and *Hermanites tschoppi* (van den Bold) it differs by a lesser development of the dorsal ridge and a slightly more irregular arrangement of the anterior reticulation.

This species has been found in Stainforth sample 47, *Globigerina ampliapertura* zone, Point Bontour. After a comparison of specimens of *Cypridina haidingeri* Reuss, *Cythereis tschoppi* van den Bold and *Hermania reticulata* Puri, I have come to the conclusion that the last two species are identical. They differ from *Hermanites haidingeri* in their general coarser appearance: the subcentral tubercle is thicker, but not higher, the ribs of the reticulation are heavier and the alae are slightly blunter. There is, however, no doubt about it that they are very closely related. The species referred to as *Hermanites haidingeri* (Reuss), (van den Bold, 1957b, p. 239, pl. 2, fig. 1a–b) should be known as *Hermanites tschoppi* (van den Bold).

Hermanites? sp.

Plate 8, figure 7

A few complete pyritized specimens which could possibly be referred to *Hermanites* have been found in the "Gaudryina beds" of Esmeralda well 1. One is figured merely to illustrate its occurrence.

Genus QUADRACYTHERE Hornibrook, 1952

Quadracythere? sp.

Plate 8, figure 8

Carapace subquadrate, highest very near the anterior end, which is very broadly and slightly obliquely rounded. Dorsal outline slightly irregular, ventral outline sinuate, converging gently posteriorly; posterior end short, rounded and irregularly nodular below the middle, concave above. Ventral part of the anterior margin very finely denticulate. Left valve overlapping strongly at both cardinal angles. Ornamentation with an irregular pattern of ridges among which the dorsal and ventral ridge stand out. Ventral ridge parallel to the ventral margin, consisting of two parallel ridges behind the middle; dorsal ridge starting slightly above and in front of the ventrally placed subcentral node,

which is also irregular in outline. This ridge forms almost a semicircle and is nodular in the upper part, where it obscures the dorsal margin; it ends in a kind of node just below and in front of the posterior cardinal angle. A weaker ridge connects the node with the posterior end of the ventral ridge. Behind this ridge the carapace is strongly compressed.

Dimensions: Length 0.69 mm.; height 0.42 mm.

Several species of *Quadracythere?* occur as single carapaces in the upper Eocene San Fernando formation. They are generally similar to undescribed species occurring in the upper Jackson of the Gulf Coast, but are not identical. One of these specimens has been selected for illustration because it is well preserved and shows a more complicated pattern of ridges than most of the others.

Genus AMBOCYTHERE van den Bold, 1958

Ambocythere elongata van den Bold

Plate 8, figure 6

Hemicythere? stolonifera (Brady). — VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 102 (part).

Not *Cythere stolonifera* BRADY, 1880, Challenger Report.

Hemicythere stolonifera (Brady). — VAN DEN BOLD, 1950, Jour. Pal., vol. 24, no. 1, p. 108 (part).

Ambocythere elongata VAN DEN BOLD, 1958, Ann. Mag. Nat. Hist., ser. 12, vol. 10, p. 811, figs. 9, 10.

This species, which was originally found in the upper Eocene and possible lower Oligocene of Cuba, occurs in Trinidad in four places: Calyx well 57, 258–260 feet, *Globorotalia opima opima* zone, lower Oligocene; Harmony Hall well 2, 494–852 feet; non-calcareous Mount Moriah silt and Mount Moriah boulder bed?, *Globorotalia cerroazulensis* zone, San Fernando formation and Kugler sample 8829, *Globigerapsis semiinvoluta* zone of the Navet formation, upper Eocene; and Esmeralda well 1, 300–394 feet, *Truncorotaloides rohri* zone, uppermost Middle Eocene. A few specimens of an undescribed species of *Ambocythere* have been found in the *Truncorotaloides rohri* and the *Globorotalia lehneri* zones of the Navet formation, middle Eocene. Their poor preservation makes a thorough description impossible, but their presence is mentioned here because they mark the oldest occurrence of this genus so far.

Genus OCCULTOCYTHEREIS Howe, 1952

Occultocythereis? sp.

Plate 8, figure 9

Carapace elongate, subquadrate, highest at anterior cardinal angle. Anterior end obliquely rounded, dorsal margin almost straight, ventral margin concave, almost parallel; posterior end slightly angled in the middle, almost obliquely rounded. The anterior end is heavily rimmed, the rim terminating dorsally in an eye-tubercle, just below the anterior cardinal angle. Ventral ridge

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short, occupying the middle third of the carapace. Just above the anterior end of the ventral ridge an elongate, oblique swelling represents the subcentral tubercle.

Dimensions: Length 0.62 mm.; height 0.30 mm.

Only a few specimens have been found in the "Gaudryina beds" of the Esmeralda well 1. Because of strong pyritization no internal structures can be described.

Subfamily HEMICYTHERINAE Puri

Genus HEMICYTHERE Sars, 1925

Hemicythere crystalriverensis Puri

Hemicythere crystalriverensis PURI, 1957, Florida Geol. Surv., Bull. 38, p. 202, pl. 13, figs. 21-24.

The species has been found at one locality of the San Fernando formation only: Kugler sample 3741, Bed 4 of Kugler on Soldado Rock.

Subfamily CYTHERETTINAE Triebel

Genus CYTHERETTA G. W. Muller, 1894

Cytheretta alexanderi Howe and Chambers

Cytheretta alexanderi HOWE AND CHAMBERS, 1935, Louisiana Dept. Cons., Geol. Bull. 5, p. 45, pl. 5, figs. 17-21, pl. 6, figs. 27, 28. — MONSOUR, 1937, Am. Assoc. Petr. Geol., Bull. no. 21, p. 95, table 1. — BERGQUIST, 1943, Miss. Geol. Surv., Bull. 49, p. 109, pl. 11, fig. 20. — BLAKE, 1950, Jour. Pal., vol. 24, p. 177, pl. 30, figs. 1-3. — PURI, 1952, Jour. Pal., vol. 26, p. 208, pl. 39, fig. 16. — SWAIN, 1952, U.S. Geol. Surv., Prof. Paper, 234-A, p. 47, pl. 6, figs. 23-25. — WILBERT, 1953, Arkansas Div. of Geol., Bull. 19, p. 125, pl. 1, fig. 15. — PURI, 1957, Florida Geol. Surv., Bull. 38, p. 195, pl. 7, figs. 1-4.

Only one complete carapace, which fits exactly the description of this species has been found in Calyx hole 59, 320-330 feet, *Globigerina ampliapertura* zone.

Subfamily BRACHYCYTHERINAE Puri

Genus BRACHYCYTHERE Alexander, 1933

Brachycythere? harmoniensis van den Bold, new species

Plate 2, figure 5a-b

Carapace ovate, highest in front of the middle, widest behind the middle.

Female: Anterior end broadly and slightly obliquely rounded, denticulate in the lower half; anterior cardinal angle prominent in the right valve, obscure in left; dorsal margin slightly convex, nearly straight in both valves; ventral outline convex, margin slightly sinuate, converging towards the dorsal margin posteriorly; posterior end angled about the middle, straight above, convex below, bearing a few small blunt spines. Left valve overlapping the right along the entire periphery, strongest overlap along ventral and dorsal margin and in the dorsal part of the anterior and posterior margins. Surface of the valves finely pitted, almost smooth near

the periphery. Small but distinct eye spot below anterior cardinal angle. Ventral portion of the carapace swollen in the middle, but never to such an extent that it obscures the ventral outline in side view. Dorsal view spindle-shaped, ends compressed, greatest width at about one third from the posterior end.

Sexual dimorphism pronounced; male similar in general aspect to the female, but more slender and dorsal and ventral margin converge more strongly posteriorly, so that the posterior end in the male is lower. Marginal area moderately broad in anterior end, line of concrescence and inner margin coincide; radial pore canals numerous, sinuous, slightly thickened in anterior third, sometimes branching. Hinge in the right valve consists of an anterior tooth, which has a long anterior slope rising from the selvage; an adjacent round socket and crenulate groove. Unfortunately in the material at hand the posterior tooth could not be observed.

Dimensions: Holotype, female: length 0.94 mm.; height 0.59 mm.; width 0.46 mm. Male: length 0.91 mm.; height 0.52 mm.; width 0.43 mm. Variability: female, length 0.92-1.06 mm.; height 0.58-0.67 mm.; male, length 0.92-1.06 mm.; height 0.52-0.53 mm.

This species and the following one were found in a zone of reworked material, containing *Cytherella guasarensis* van den Bold and *Cytherella kellestae* (Munsey). However, it also occurs in the type sample of the *Globorotalia cerroazulensis* zone (Rohr sample 25684) in which no reworked ostracodes have been found. The species is believed to belong to the fauna of the San Fernando formation, but apparently only occurs in the basal portion.

Holotype: A complete carapace of a female from Harmony Hall well 2, core 828-840 feet, U.S.N.M. no. 563541; paratypes: U.S.N.M. no. 563542.

Brachycythere fernandensis van den Bold, new species

Plate 2, figure 6a-b

Carapace pyriform-triangular, highest in front of the middle behind the anterior cardinal angle, widest just behind the middle. Anterior end broadly rounded, slightly oblique, finely denticulate in lower two-third; dorsal margin in the left valve very slightly convex, straight in the right; ventral margin convex in left valve, sinuate in the right, strongly converging posteriorly; posterior end bluntly angled below the middle, slightly concave above, convex below. Left valve overlapping the right strongly on dorsal and ventral side and the dorsal part of anterior and posterior margin. Dorsal view spindle-shaped, ends compressed.

Surface of the valves almost smooth, very finely pitted. Small eye spot just below the anterior cardinal angle. Ventral portion of the carapace swollen, obscuring the middle of the ventral margin in the right valve only. Sexual dimorphism pronounced, males more slender and more drawn out posteriorly.

Dimensions: Holotype; female: length 0.81 mm.; height 0.49 mm.; width 0.43 mm.; male: length 0.86 mm.; height 0.48 mm.; width 0.43 mm. Variability: female: length 0.79–0.84 mm.; height 0.47–0.51 mm.; male: length 0.78–0.89 mm.; height 0.47–0.51 mm.

This species was originally thought identical with *Brachycythere? kugleri soldadensis* van den Bold (1957a, p. 11), but the length-height ratios are different and the anterior end is longer in the upper Eocene species. Also the features of overlap in *Brachycythere? kugleri* and subspecies are different, since the left valve does not overlap at the posterior cardinal angle in the Paleocene material. Also this species occurs (like the preceding) in a zone of reworked material from the Paleocene (*Cytherella guasarensis* and *Cytherella kelletiae*).

Holotype: A complete female carapace from Barr sample 7244, St. Joseph village, San Fernando, San Fernando formation, U.S.N.M. no. 563543; paratypes: U.S.N.M. no. 563544.

Genus ALATACYTHERE Murray and Hussey, 1942

Alatacythere maerkyi (van den Bold)

Brachycythere maerkyi VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 1, p. 10, pl. 3, fig. 8a, b.

This species has been found in the Penitence Hill marl and Hospital Hill marl of the Navet formation and ranges from Paleocene to lower upper Eocene.

Genus PROTOBUNTONIA Grekoff, 1953

Protobuntonia? sp.

Plate 2, figure 7

Carapace triangular-ovate, highest in front of the middle. Anterior end slightly obliquely rounded; dorsal margin slightly convex with in the left valve a small concavity in front of the projecting anterior cardinal angle; ventral margin convex in the left valve, slightly sinuate in the right; posterior end angled just above the middle, convex below, almost straight above. Left valve overlapping the right strongly along the ventral margin, less at the cardinal angles, no appreciable overlap elsewhere. Dorsal view lanceolate, widest in front of the middle, slightly compressed near the anterior end, posterior end gradually tapering. There is a small eye spot just below the anterior cardinal angle. Surface finely but deeply pitted. Only closed carapaces occurred and the interior could not be studied.

Dimensions: Length 0.79 mm.; height 0.47 mm.; width 0.34 mm. Variability: length 0.75–0.82 mm.; height 0.44–0.48 mm.

This species is very similar in outline and shape to the male of *Protobuntonia numidica* Grekoff (1953, p. 400, text-fig. 1a–f) from the Upper Cretaceous of Algeria. The species has been found only in the San Fernando formation in Harmony Hall well 2, 828–840 feet, in the

same zone of reworking as *Brachycythere harmoniensis* n. sp. It is conceivable that it has been derived from older deposits.

Genus BOSQUETINA Keij, 1957

Bosquetina? conceptionensis van den Bold, new species

Plate 5, figure 3a–b

Carapace pyriform, highest at the anterior cardinal angle, widest just behind the middle. Anterior end broadly rounded, faintly rimmed and finely denticulate; dorsal margin slightly depressed behind the anterior cardinal angle in the left valve, slightly convex in both valves, more strongly so in the left and converging towards the ventral margin which is almost straight, slightly sinuate; posterior end short, laterally compressed, bluntly angled in the middle, convex below, straight above in the left valve, slightly concave in the right. Left valve overlapping the right along the dorsal part of the anterior margin, anterior and posterior cardinal angles, the dorsal margin and the dorsal part of the posterior margin. Dorsal view ovate, ends slightly compressed. Surface finely punctate to very delicately reticulate, deepest punctations in the middle, near the ventral side, shallower and larger towards the center and from there onward towards the dorsal, anterior and posterior margins the punctations become more and more insignificant until the surface is almost smooth near the posterior margin. There is a faint ventral ridge paralleling the ventral margin and partly obscuring it. It is not visible in dorsal view since it is obscured by the swollen central portion of the carapace. Just below the anterior cardinal angle is a small eye tubercle with a faint oblique groove just behind it. Slight sexual dimorphism occurs: males are more slender than females and have an almost straight dorsal margin in the left valve. The hinge could only be studied in part: it consists in the left valve of a round anterior socket, followed by a smooth bar which is slightly raised at its anterior end, but does not form a distinct tooth. Marginal area fairly broad in anterior end, no vestibule observed. Pore canals numerous, a number of them pierce the outer lamella before reaching the outer margin.

Dimensions: Holotype, length 0.61 mm.; height 0.36 mm.; width 0.32 mm.

The species occurs in Trinidad only in the "Gaudryina beds" of the subsurface, probably lower or middle Eocene in age. It is common in the Concepcion formation of the Maracaibo Basin where the stratigraphic range is from lower Eocene to middle Eocene. The species has been questionably assigned to *Bosquetina* with which genus it has the following characteristics in common: hinge without a strong anterior tooth in the left valve; marginal area with numerous radial pore canals, part of them false, slightly sinuous and sometimes branching; general shape; weak ornamentation. It differs in having only a very weak ventral ridge which

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CHART 4

RANGE CHART OF LOXOCONCHINAE, CYTHERURINAE AND XESTOLEBERIDINAE.

RANGE CHART OF THE LOXOCONCHINAE, CYTHERURINAE, BYTHOCYTHERINAE AND XESTOLEBERIDINAE OF THE EOCENE AND OLIGOCENE OF TRINIDAD				Loxoconcha wagneri n.sp. Loxoconcha jacksonensis Howe and Chambers Loxoconcha aff. L. diverta Murray Loxoconcha sp. Cytherura vistabellensis n.sp. Cytherura byramensis Howe and Law Cytherura hermes v.d.Bold Cytherura ? Eucytherura kugleri n.sp. Eucytherura murdereckensis Howe and Law Eucytherura tricornis Weingeist Cytheropteron ? trinidadensis n.sp. Cytheropteron montgomeryensis Howe and Chambers Cytheropteron pinarense v.d.Bold Cytheropteron aff. C. tricornis (Bornemann) Bythoceratina scabra n.sp. Pseudocythere cubensis n.sp. Xestoleberis moriahensis n.sp. Xestoleberis chamela n.sp. Xestoleberis dumlei Stephenson Xestoleberis sp. Uroleberis aff. Cythere ranikotiana Latham.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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does not terminate posteriorly in a strong spine. Moreover, it is much smaller than the species assigned by Keij to *Bosquetina*.

It is named after the Concepcion formation of Maracaibo, in which it occurs in much greater numbers than in Trinidad.

Holotype: A complete carapace of a female from Esmeralda well 1, core 2630-2650 feet, U.S.N.M. no. 563545; paratypes: U.S.N.M. no. 563546.

Subfamily LOXOCONCHINAE Sars

Genus LOXOCONCHA Sars, 1866

***Loxoconcha wagneri* van den Bold, new species**

Plate 7, figure 4a-b

Carapace subquadrate. Anterior end broadly and somewhat obliquely rounded, often slightly angular just above the middle; dorsal and ventral margin almost straight and parallel; posterior end pointed or narrowly rounded in the middle, the dorsal side convex, forming an angle of about 120° with the dorsal margin at the

posterior cardinal angle, and almost perpendicular to the convex ventral part. Anterior cardinal angle in the left valve slightly produced, overlapping the right valve; other areas of overlap are the ventral margin and the ventral part of the posterior end. Dorsal view spindle-shaped, swollen, widest in the middle, ends very strongly compressed, sharp. Mid-ventral portion of the carapace swollen, but not overhanging, the ventral margin bordered ventrally by a few faint ridges. Valves reticulate or deeply punctate, the punctations forming concentric rows in the ventral part, no definite pattern discernable in the dorsal part. There is a small eye-spot at the anterior cardinal angle. Just in front of the posterior cardinal angle is a short, low, convex dorsal ridge which just obscures part of the dorsal margin.

Dimensions: Holotype, female, length 0.47 mm.; height 0.29 mm.; width 0.27 mm. Variability: female, length 0.47-0.55 mm.; height 0.27-0.33 mm.; male, length 0.47-0.56 mm.; height 0.26-0.31 mm.

In the male the dorsal and ventral margins converge very slightly posteriorly.

The species is close to *Loxoconcha claibornensis* Murray (1938, p. 588, pl. 68, figs. 2, 19) but the dorsal view, as can be seen in *Pyriclythereis delicata* Sutton and Williams (1939, pl. 64, figs. 5-7), has much less strongly compressed ends. *Loxoconcha delemontensis* Oertli (1956, p. 68, pl. 8, figs. 211-219) differs in the shape of the posterior end and does not possess the small dorsal ridge. Moreover, it is somewhat smaller.

This species has been named in honour of Dr. C. Wagner, paleontologist with N.V. de Bataafsche Petroleum Maatschappij, The Hague, Holland. It has been found in most of the localities of the San Fernando formation and appears to range upward to the *Globigerina ciperoensis* *ciperoensis* zone of the Oligocene Cipero formation.

Holotype: A complete carapace from Kugler sample 3741, Bed 4 of Kugler on Soldado Rock, U.S.N.M. no. 563547; paratypes: U.S.N.M. nos. 563548-563551.

***Loxoconcha jacksonensis* Howe and Chambers**

Loxoconcha jacksonensis HOWE AND CHAMBERS, 1935, Louisiana Dept. Cons., Geol. Bull. 5, p. 41, pl. 4, fig. 20, pl. 5, fig. 14, pl. 6, figs. 8, 9. — MONSIEUR, 1937, Am. Assoc. Petr. Geol., Bull. no. 21, table 1. — BERGQUIST, 1942, Mississippi Geol. Surv., Bull. no. 49, p. 109, pl. 11, fig. 18. — WILBERT, 1953, Arkansas, Div. of Geol., Bull. 19, p. 125.

This species has been found in abundance only in Stainforth sample 47, *Globigerina ampliapertura* zone.

***Loxoconcha* sp. aff. *Loxoconcha diverta* Murray Plate 7, figure 5**

This species is rather similar to *Loxoconcha chamfera* var. *diverta* Murray (1938, p. 592, pl. 68, figs. 11, 12) in respect to the reticulate pattern and the long posterior end, but differs in having a much less pronounced dorsal ridge. It has been found only in the lower Oligocene.

***Loxoconcha* sp. Plate 7, figure 6a-c**

Carapace small, ovate, walnut-shaped, pointed behind, highest in the middle. Anterior end obliquely rounded, a small concavity within the right valve just below the anterior cardinal angle; dorsal outline convex, hinge margin straight; ventral margin sinuate in front of the middle; posterior end fairly sharply pointed above the middle, concave above, convex below. Tumid portion of the carapace overhanging part of the ventral margin. Valves reticulate with rounded meshes and strongly raised ridges which produce a sponge-like appearance. The lower rows visible in side view are parallel to the strongly curved rim of the overhanging, tumid portion of the carapace, the lower row of meshes splitting off a second one in the anterior part. In the centre the alignment is indistinct and in the dorsal part roughly parallel to the dorsal outline. In the anterior portion some meshes are joined to form longitudinally elongate excavations which seem to spread out fan-like from the middle of the anterior margin. Dorsal view widest in the

middle, walnut-shaped with short but sharply drawnout ends. Hinge consists in the right valve of a median crenulate groove; at its anterior end it widens and curves around a small tooth situated on the low bar separating the groove from the interior of the valve; at the posterior end this bar forms a curved elongate tooth, curving around a small open socket. The shell is very thick and heavy and consequently the pore canals could only be seen very indistinctly in transmitted light. Therefore no description of the marginal area is given.

Dimensions: Length 0.45 mm.; height 0.32 mm.; width 0.30 mm.

The shape is reminiscent of *Loxoconcha subovata* (Münster), compare Oertli (1956, p. 69, pl. 8, figs. 220-223); but this species lacks the peculiar alignment of the meshes in the anterior end. A species which appears to show this has been figured as *Loxoconcha* sp. A, by Brown (1958, p. 66, pl. 6, fig. 8) from the upper Castle Hayne limestone, ?upper Eocene of North Carolina. Only two specimens of this very distinct species have been found, one in the Oligocene, one in the lowermost Miocene.

***Loxoconcha claibornensis* Murray**

Loxoconcha claibornensis MURRAY, 1938, Jour. Pal., vol. 12, p. 588, pl. 68, figs. 2, 19. — STEPHENSON, 1946, Jour. Pal., vol. 20, p. 315, pl. 43, fig. 13. *Pyriclythereis delicata* SUTTON AND WILLIAMS, 1939, Jour. Pal., vol. 13, p. 568, pl. 64, figs. 5-7. *Loxoconcha delicata* (Sutton and Williams). — STEPHENSON, 1944, Jour. Pal., vol. 18, p. 454, pl. 76, fig. 10. *Loxoconcha* sp. aff. *L. claibornensis* Murray. — SWAIN, 1951, U.S. Geol. Surv., Prof. Paper 234-A, p. 26, pl. 2, figs. 16, 17.

This species has the shape and the sharply angled posterior end of *Loxoconcha claibornensis*, but differs in having a sharper angle between the ventral and lateral surfaces. At present this difference does not seem sufficient to distinguish the two forms. It has only been found in the "Gaudryina beds".

Subfamily CYTHERURINAE G. W. Müller Genus CYTHERURA Sars, 1866

***Cytherura vistabellensis* van den Bold, new species Plate 7, figure 7a-b**

Carapace elongate, subquadrate, higher posteriorly and swollen posterodorsally. Anterior end obliquely rounded; dorsal margin straight; ventral margin sinuate, curving upwards posteriorly; dorsal and ventral margin converging slightly anteriorly; posterior end a subdorsal caudal process, the upper margin forming a convex continuation of the dorsal margin, lower margin concave. Dorsal view more or less elongate hexagonal, lateral outlines almost parallel, ends pointed and compressed with concave lateral outlines. Posterodorsal part swollen; in front of this swelling, about in the middle of the valves lies a deep rounded sulcus, divided into a dorsal and ventral part by an obliquely longitudinal ridge, which becomes obscure in front of the centre. In

the posteroventral portion there is another rounded sulcus, bordered on the dorsal side by a horizontal, longitudinal ridge which extends from the anterior margin to the compressed posterior end; on the ventral side it is bordered by a short ventral ridge which forms the ventral side of the tumid portion of the carapace. Anterior to the second sulcus is another longitudinal ridge, parallel to the upper one and divided into two parallel ridges near the anterior margin.

Dimensions: Holotype: length 0.34 mm.; height 0.20 mm.; width 0.17 mm. Largest specimen: length 0.45 mm.; height 0.25 mm.; smallest specimen: length 0.32 mm.; height 0.20 mm.

Cytherura sp. *B* (Brown, 1958, p. 59, pl. 7, fig. 7) from the upper Castle Hayne limestone in North Carolina appears to be rather similar in also possessing a posteroventral depressed area.

The species is rare and has been found at Stainforth 47 (*Globigerina ampliapertura* zone) Point Bontour, Kugler sample 3962 (Boca de Serpiente marl, Soldado Rock) and Renz sample 384 (Vistabella marl).

Holotype: A complete carapace from Stainforth sample 47, U.S.N.M. no. 563552; paratypes: U.S.N.M. nos. 563553 and 563554.

Cytherura byramensis Howe and Law

Cytherura byramensis HOWE AND LAW, 1936, Louisiana, Dept. Cons., Geol. Bull. 7, p. 69, pl. 6, fig. 3.

The species has only been found at Stainforth 47, *Globigerina ampliapertura* zone.

Cytherura hermes van den Bold

Cytherura hermes VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 117, pl. 14, fig. 15a-b. - 1957, *Micropaleontology*, vol. 3, no. 3, p. 245, pl. 4, fig. 10a-b.

This is the most common species of *Cytherura* in the Trinidad Tertiary. It has a range from upper Eocene to middle Miocene. In the present material it has been found in the lower Oligocene of Calyx well 57, and the upper Eocene of Soldado Rock, Kugler sample 3741.

Cytherura sp.

Plate 7, figure 8a-b

Carapace elongate, subquadrate. Anterior end vertically truncate in the middle part, rounded above and below; dorsal margin very slightly convex, ventral margin slightly sinuate, parallel; posterior end forming a blunt caudal process, just above the middle, concave dorsally and ventrally. Ornamentation: a short ventral ridge, parallel to the ventral margin and forming the edge of the flattened ventral surface; it curves sharply towards the ventral margin slightly behind the middle, thus reducing the ventral surface by half. Below the middle there is a long horizontal, longitudinal ridge, convex

downward, starting very near to the anterior margin and becoming slightly irregular at its posterior end. Near the anterior end it gives off a branch which is convex upward and irregular and which is shorter than the main ridge and ends diagonally below the posterior cardinal angle, against the posterior leg of an inverted Y which is formed by a system of smaller ribs. The vertical branch of this inverted Y is very short and terminates against the thickened dorsal margin. Ends abruptly compressed in dorsal view; greatest width in the posterior half of the lower longitudinal ridge. Hinge in the right valve consists of a broad and deep groove in the dorsal margin below the ends of which occur two short, faintly cusped terminal teeth. Above this groove is a narrow bar separating it from the dorsal margin. Marginal area broad in both ends, line of concrescence and inner margin coincide except in the anterior end where they lie at a short distance. Pore canals few, sinuous, often not quite reaching the outer margin. Seven or eight in the anterior end. Muscle scar a vertical posterior row of four with a group of three in front.

Dimensions: Length 0.40 mm.; height 0.20 mm.; width 0.13 mm. (single valve)

Only one right valve of this very typical and easily recognizable species has been found in Stainforth sample 47, *Globigerina ampliapertura* zone. The species has been described in some detail because the hinge does not seem to fit completely the description given by Wagner (1957, p. 74, pl. 33) for the genotype.

Genus EUCYTHERURA G. W. Müller, 1894

Eucytherura kugleri van den Bold, new species

Plate 7, figure 9a-b

Carapace small, subquadrate. Anterior end very broadly and obliquely rounded; dorsal outline gently convex with the dorsal margin sunk in between two rather ill-defined ridges, which form the flattened dorsal portion of the carapace, straight with a small concavity in front of the projecting posterior cardinal angle; ventral margin slightly sinuate, slightly converging posteriorly towards the dorsal margin, obscured by a ventral ridge in most of its length; posterior end short, obtusely angled above the middle, straight above and below. Left valve overlapping the right at both cardinal angles and the dorsal part of the anterior end.

Carapace coarsely reticulate, the reticulations starting from a point lying below and in front of the centre of the valve. A strong ventral ridge slopes obliquely down from near the anterior margin until it obscures the ventral margin, after that it parallels more or less the dorsal outline. Above this ridge, from just in front of the middle backward, there is a second ridge which projects laterally over the ventral one, especially in the anterior part. The posterior portion of the carapace is rather strongly swollen, the posterior end is very strongly compressed behind a line running from just in front of the posterior cardinal angle obliquely downward to the posterior end

of the two ventral ridges. In front of the second ventral ridge the carapace shows a longitudinal depression lying above the ventral ridge; another depressed area occurs just above the second ridge in the posterior half of the carapace. A few of the ridges of the reticulation are more pronounced in some of the specimens than in others; they run vertically down from the dorsal outline. The anterior one, which lies just behind the anterior cardinal angle is usually the best developed.

Dorsal view, short and wide; anterior end bluntly angled and slightly irregular because of the anterior ridge mentioned above. Greatest width at the anterior end of the second ventral ridge. Above it the carapace is slightly compressed, but widens gently posteriorly until it is abruptly and strongly compressed just in front of the posterior cardinal angle.

Dimensions: Holotype: length 0.34 mm.; height 0.18 mm.; width 0.20 mm.

Of all species of *Eucytherura* described, *Eucytherura hiwanneensis* Weingeist (1949, p. 374, pl. 73, fig. 10) seems most similar to our species, but it shows so many points of difference, that it is certainly not identical. The species is named for H. G. Kugler of Texaco Trinidad Inc. It is fairly common in some samples from the San Fernando formation (Kugler samples 3741, 3692, Boca de Serpiente marl, Rohr sample 25684, *Globorotalia cerroazulensis* zone).

Holotype: A complete carapace from Kugler sample 3741, U.S.N.M. no. 563555; paratypes: U.S.N.M. no. 562556.

Eucytherura murdercreekensis Howe and Law

Eucytherura murdercreekensis HOWE AND LAW, 1936, Louisiana, Dept. Cons., Geol. Bull. 7, p. 71, pl. 4, fig. 31; pl. 5, fig. 26. — WEINGEIST, 1949, Jour. Pal., vol. 23, no. 1, p. 7, pl. 73, fig. 16.

This species has only been found in Calyx well 57, 310–320 feet and elsewhere in the *Globorotalia opima opima* zone of the Oligocene.

Eucytherura tricornis Weingeist

Eucytherura tricornis WEINGEIST, 1949, Jour. Pal., vol. 23, no. 1, p. 378, pl. 73, fig. 20.

This species is locally fairly common in the San Fernando formation (Kugler sample 3741, bed 4 on Soldado Rock, Renz sample 384, Vistabella marl and Harmony Hall well 2, 712–721 feet.)

Eucytherura sp.

Plate 7, figure 10

Carapace small, subquadrangular, highest at the anterior cardinal angle. Anterior end obliquely and very broadly rounded, forming above a pronounced anterior cardinal angle in the left valve; dorsal margin sinuate, depressed in the posterior half; ventral margin sinuate in front of the middle, generally convex, continuing into

the lower part of the subdorsally angled posterior end; the upper part of the posterior end is straight and forms an obtuse angle with the dorsal margin. Left valve overlapping the right conspicuously only at the posterior cardinal angle. Valves faintly reticulate with an irregular pattern. Ventral portion of the carapace swollen and obscuring the ventral margin in its posterior part; anterior swelling just in front of the middle and subventrally, slightly more pronounced than a posterior swelling just behind the middle. Between the two swellings there is a faint subventral sulcus. An obscure dorsal ridge parallels the dorsal margin in its posterior half, ending at the posterior cardinal angle, behind which the carapace is strongly compressed. Greatest width at the anterior swelling.

Dimensions: Length 0.26 mm.; height 0.17 mm.

The species occurs occasionally in the "Gaudryina beds", figured specimen is from Esmeralda well 1, 2630–2650 feet.

Genus CYTHEROPTERON Sars, 1866

Cytheropteron? trinidadensis van den Bold, new species

Plate 5, figure 5a–c

Carapace pyriform, alate, with subventral caudal process, highest and widest in the middle. Anterior end obliquely rounded, more narrowly rounded subventrally, slightly more evenly rounded in the right valve than in the left; dorsal margin arched in the left valve, nearly straight in the right; ventral margin slightly sinuate just behind the anterior end, convex in the posterior part; posterior end narrowly rounded or slightly angled subventrally, dorsal part concave, more strongly so in the right valve than in the left. Left valve overlapping the right strongly along the dorsal margin. Dorsal view regularly ovate, ventral portion of the valves in the female strongly swollen in the middle; near the ends the ala projects more strongly beyond this tumid portion. Near the ends the valves are strongly compressed; the anterior end is shorter than the posterior. In the male the ala is more visible in dorsal view because the ventral part of the carapace above it is less swollen than in the female. In side view the ala obscures the greater part of the ventral margin; it possesses a thick flattened rim. Between the ala and the ventral margin lies a longitudinal ridge on the ventral surface. Surface of the valves minutely pitted.

Muscle scars: A vertical row of four, the second from the top lying slightly more backward; four more scars form an upwardly deviating, oblique row in front of the two upper scars of the posterior row. Of these the topmost, second and fourth are parallel, while the third stands at almost right angles to the others. Normal pore canals, about 20 in each valve, widely spaced and large, apparently open. Marginal area fairly broad in both ends; line of concrescence and inner margin coincide; radial pore canals few, simple, straight and widely spaced, often not reaching the outer margin; about 9 in anterior end. The selvage lies close and parallel to the outer margin in the left valve, rather far inside in the right.

Hinge: In the right valve terminal cusped teeth with four cusps in the anterior one and five in the posterior; a shallow, straight, crenulate groove in between lies below the dorsal margin. In the left valve there are terminal, crenulate sockets and a shallow, finely crenulate, median bar. Above this bar is a deep accommodation groove.

Dimensions: Holotype, female: length 0.72 mm.; height 0.50 mm.; width 0.42 mm. Male: length 0.68 mm.; height 0.45 mm.; width 0.39 mm.

The shape of this species is strongly reminiscent of young instars of *Brachycythere russelli* Howe and Lea (for synonymy see Stephenson, 1946, p. 333; *Digmocythere russelli* (Howe and Lea) in Mandelstam, 1958, p. 277), but the wide marginal area and well developed radial pore canals show this species to be an adult form. Its shape and strongly overlapping dorsal margin are so different from normal *Cytheropteron* species that it can be assigned only questionably to this genus, and it may prove to belong to an, as yet, undescribed genus. The species appears to be long ranging. It is very common in the middle Miocene Lengua formation, fewer specimens have been found in the middle and upper Eocene and the lower Oligocene.

Holotype: A complete carapace of a female from Barr sample 7689, U.S.N.M. no. 563557; paratypes: U.S.N.M. nos. 563558 to 563562.

***Cytheropteron montgomeryensis* Howe and Chambers**

Cytheropteron montgomeryensis HOWE AND CHAMBERS, 1935, Louisiana Dept. Cons., Geol. Bull. 5, p. 19, pl. 3, figs. 14-16, pl. 4, figs. 11, 12, 16. — MONSOUR, 1937, Am. Assoc. Petr. Geol., Bull. no. 21, table 1. — VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 114, pl. 2, fig. 12. — BERGQUIST, 1942, Mississippi, Geol. Surv., Bull. 49, p. 106, pl. 11, fig. 6. — VAN DEN BOLD, 1950, Jour. Pal., vol. 24, no. 1, p. 108. — WILBERT, 1953, Arkansas, Div. Geol., Bull. 19, p. 125.

This species appears to be confined to the upper part of the San Fernando formation (uppermost Eocene and lowermost Oligocene).

***Cytheropteron pinarense* van den Bold**

Cytheropteron pinarense VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 113, pl. 16, fig. 2a, b.

Only one specimen has been found in Calyx well 59, 460-470 feet, San Fernando(?) formation, *Globigerina ampliapertura* zone. In Cuba it is also confined to the lower Oligocene.

***Cytheropteron* sp. aff. *Cytheropteron tricornis* (Bornemann)**

Plate 5, figure 6a-b

?*Cythere tricornis* Bornemann, 1855, Deutsch. Geol. Ges., Zeitschr., vol. 7, pt. 2, p. 367, pl. 21, fig. 8.

?*Cytheropteron tricornis* (Bornemann). — LIENENKLAUS, 1900, Deutsch. Geol. Ges., Zeitschr., vol. 52, p. 541, pl. 22, fig. 2.

Cytheropteron tricornis (Bornemann). — VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 114, pl. 16, fig. 3a-b.

The anterior end of the Cuban and Trinidad specimens is less angular than the figures of Lienenklaus and Bornemann indicate. The specimens from Trinidad are slightly more punctate than the Cuban ones, but otherwise quite similar. The species has been found only in the upper Eocene of the San Fernando formation at Barr sample 7244a and b. The Cuban specimens came from the lower Oligocene.

**Subfamily BYTHOCYOTHERINAE Sars
Genus BYTHOCERATINA Hornibrook, 1952**

***Bythoceratina scabra* van den Bold, new species
Plate 5, figure 4a-b**

Bythoceratina sp. aff. *Bythoceratina scaberrima* (Brady). — VAN DEN BOLD, 1957, Micropaleontology, vol. 3, no. 3, p. 246, pl. 2, fig. 8a-b.

Not *Cytherura scaberrima* BRADY, 1878, *Les fonds de la Mer*, vol. 4, p. 198, pl. 14, figs. 10, 11.

Carapace irregularly ovate in side view, strongly spinose. Anterior end very broadly and slightly obliquely rounded in the left valve, almost evenly rounded with a slightly concavity in the dorsal part in the right valve, margins in both valves denticulate; dorsal margin slightly sinuate, with spinose outline, especially in the anterior half, depressed between the projecting cardinal angles in the left valve; ventral margin strongly sinuate, roughly parallel to the dorsal one; posterior end a sub-dorsal caudal process, the margin in the dorsal part concave, in the ventral part broadly convex and denticulate. Left valve overlapping the right at both cardinal angles.

Ventral part of the carapace strongly swollen and divided into two swellings by a deep, curved, vertical, median sulcus, which starts just below and in front of the middle of the dorsal margin. Both swellings culminate in a strong, laterally projecting spine. Small spines, many of them flattened and blade-like in appearance, are scattered over the surface, which is smooth. A number of these spines stand in distinct rows. Two rows more or less parallel the ventral margin, the lower one obscuring it for the greater part of its existence, terminating below the posterior of the two large spines. Another row runs obliquely forward and upward from the anterior spine. Two other rows run obliquely upward and backward from the posterior spine. A row of nodular spines parallels the dorsal margin in its posterior half, below this row the swelling of the carapace begins and the dorsal region is compressed. The dorsal margin is obscured in the anterior part by a weakly convex and spinose boss. Dorsal view very irregular, ends compressed, posterior end incised in the middle, greatest width at the posterior spine but only slightly more than the width at the anterior or ventral spine. The ventral view shows four curved, sinuous, rows of spines, the exterior one of which running from near the ventral margin to the anterior spine the two next ones, between the outer row and the

ventral margin end near the posterior spine. The innermost one is short; starting in the middle of the valve and running forward.

Interior of the valves deep, marginal area moderately broad in anterior end. Line of concrescence and inner margin coincide. Radial pore canals are few, slightly sinuous or straight, 8–10 in the anterior end. The strong, blade-like, inward curved, extension of the selvage in the middle of the ventral margin of the right valve is characteristic. Hinge in the right valve consists of short, terminal teeth, the posterior one of which is faintly bilobate; the median hinge element is a narrow, straight, crenulate groove. Muscle scars consist of a curved row of six scars, situated on the deepest part of the median sulcus.

Dimensions: Holotype: length 0.61 mm.; height 0.34 mm.; width 0.45 mm.

The species differs from *Bythoceratina scaberrima* (Brady) in being considerably smaller and having a less well developed anterodorsal boss. It is closely related to a new species of *Bythoceratina*, living off the coast of Trinidad, which was described by Keij (1954, p. 229, pl. 5, fig. 10) as *Bythoceratina* sp. aff. *B. utilazea* Hornibrook, which species, however, is much less spinose than the fossil one.

In the present material this species has only been found in Calyx well 57, 250–260 feet. The stratigraphic range

is from lower Oligocene (*Globorobalia opima opima* zone) to middle Miocene (*Globorobalia menardii* zone).

Holotype: A right valve from Mühlemann sample 14873 at 16 foot depth, St. Croix Quarry, U.S.N.M. no. 563563; paratypes: U.S.N.M. nos. 563564 and 563565.

Genus PSEUDOCY THERE Sars, 1927

Pseudocythere cubensis van den Bold, new species

Plate 5, figure 7a–b

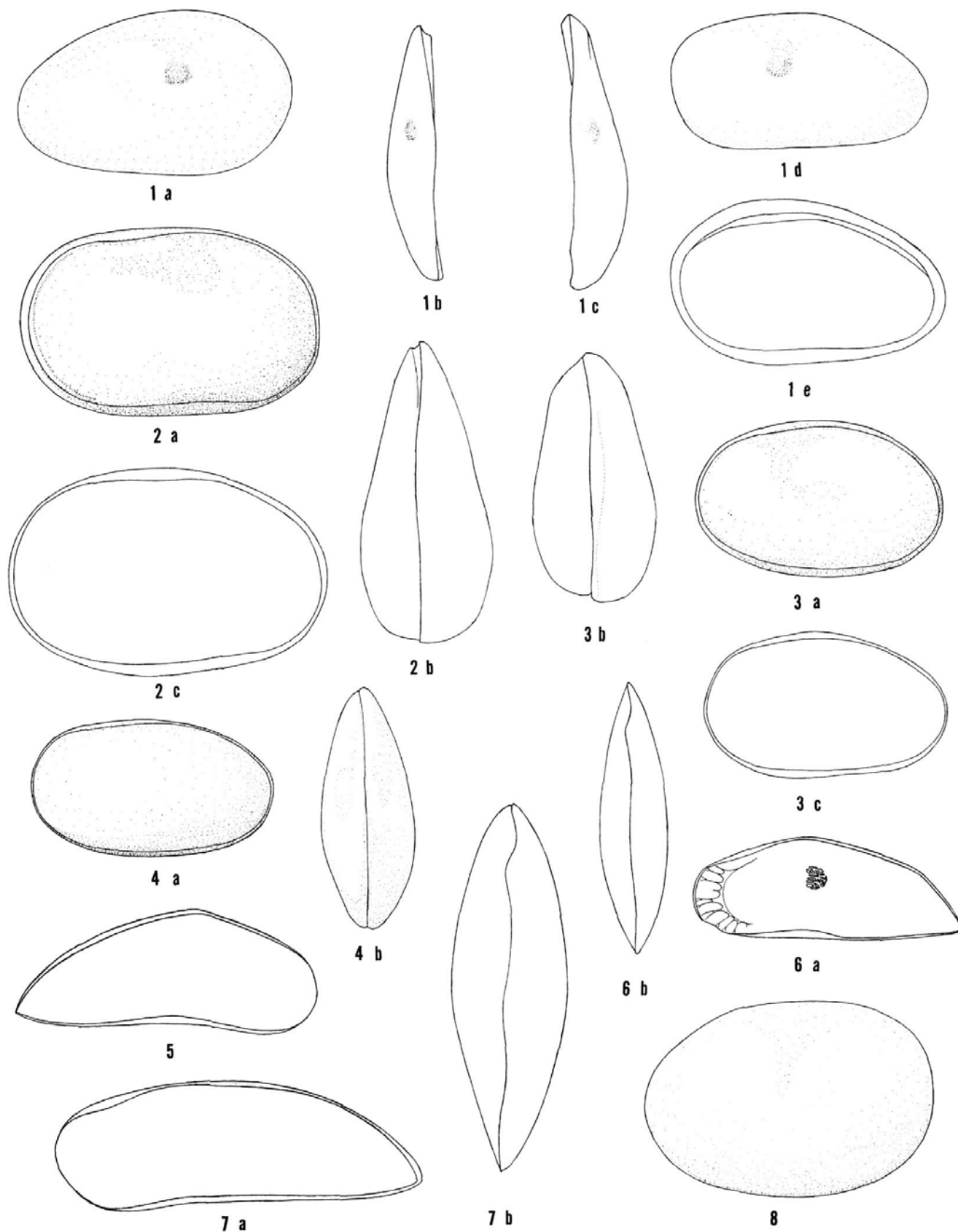
Pseudocythere cretacea BONNEMA. – VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 115, pl. 3, fig. 14a–b. – VAN DEN BOLD, 1950, Jour. Pal., vol. 24, no. 1, p. 108.

Not *Pseudocythere cretacea* BONNEMA, 1941, Natuurhist. Maandbl., vol. 30, no. 4, p. 43, pl. 7, figs. 28–30.

Carapace elongate, height less than half the length, greatest height near the anterior end, strongly produced behind. Anterior end evenly rounded; dorsal margin slightly sinuate, concave in the posterior third, convex in the middle; ventral margin strongly sinuate with a concavity just in front of the middle and forming a broad upward sweep in the posterior half, the posterior part being concave again just before reaching the dorsally situated caudal process; it bears a small spine just where the convexity changes to concavity. The posterior part of the ventral margin is strongly compressed laterally and is separated from the more tumid portion

PLATE 1

- 1 *Cytherella navetensis* van den Bold, n. sp.
a, exterior of right valve, holotype, U.S.N.M. no. 563469, $\times 35$; c, dorsal view of same valve, $\times 35$; d, exterior of left valve, paratype, U.S.N.M. no. 563470, $\times 30$; b, dorsal view of same left valve, $\times 30$; e, interior of right valve, holotype, $\times 31$. All from Renz sample 336, Friendship Quarry, *Hantkenina aragonensis* zone, middle Eocene.
- 2 *Cytherella harmoniensis* van den Bold, n. sp.
a, left valve view of female, holotype, U.S.N.M. no. 563472; b, dorsal view of same specimen; c, left valve view of male, paratype, U.S.N.M. no. 563473. All from Harmony Hall well 2, 601–613 feet, $\times 60$.
- 3 *Cytherella stainforthi* van den Bold, n. sp.
a, left valve view of female, holotype, U.S.N.M. no. 563474; b, dorsal view of same specimen; c, left valve view of male, paratype, U.S.N.M. no. 563475. All from Stainforth 47, *Globigerina ampliapertura* zone, $\times 65$.
- 4 *Cytherella serpentiensis* van den Bold, n. sp.
a, left valve view of holotype, U.S.N.M. no. 563476; b, dorsal view of same specimen. From Kugler sample 3692, Boca de Serpiente marl, Soldado Rock, $\times 70$.
- 5 *Paracypris* sp. aff. *Paracypris contracta* (Jones).
Right valve view of a complete specimen from Stainforth sample 47, *Globigerina ampliapertura* zone, $\times 60$.
- 6 *Macrocypris rhodana* van den Bold, n. sp.
a, left valve view, holotype, U.S.N.M. no. 563496; b, dorsal view of same specimen. Harmony Hall well 2: 609–613 feet, $\times 35$.
- 7 *Macrocypris longana* van den Bold, n. sp.
a, left valve view, holotype, U.S.N.M. no. 562493; b, dorsal view of same specimen. Harmony Hall well 2, 686–698 feet, $\times 35$.
- 8 *Cytherella* sp. A.
Exterior of right valve from Stainforth sample 47, *Globigerina ampliapertura* zone, $\times 60$.



of the carapace by a slightly concave line, running upwards from the midventral concavity to the caudal process. Dorsal view very thin, widest in front of the middle at about one third from the anterior end, both ends compressed, outline of the valves concave near the ends.

Dimensions: Holotype, length 0.58 mm.; height 0.28 mm.; width 0.18 mm.

Only two representatives of this species have been found in the upper Eocene and lower Oligocene of Trinidad, Calyx well 59, 290–310 feet and Harmony Hall well 2, 494 feet.

Holotype: A complete carapace from Tschopp sample 1147 (upper Eocene), near Nuevitas, Province of Camagüey, Cuba (Hermes, 1946, p. 11, 37–40). Coll. Min. Geol. Institute, Utrecht, no. S5805; paratypes no. S5806.

Subfamily XESTOLEBERIDINAE Sars

Genus XESTOLEBERIS Sars, 1866

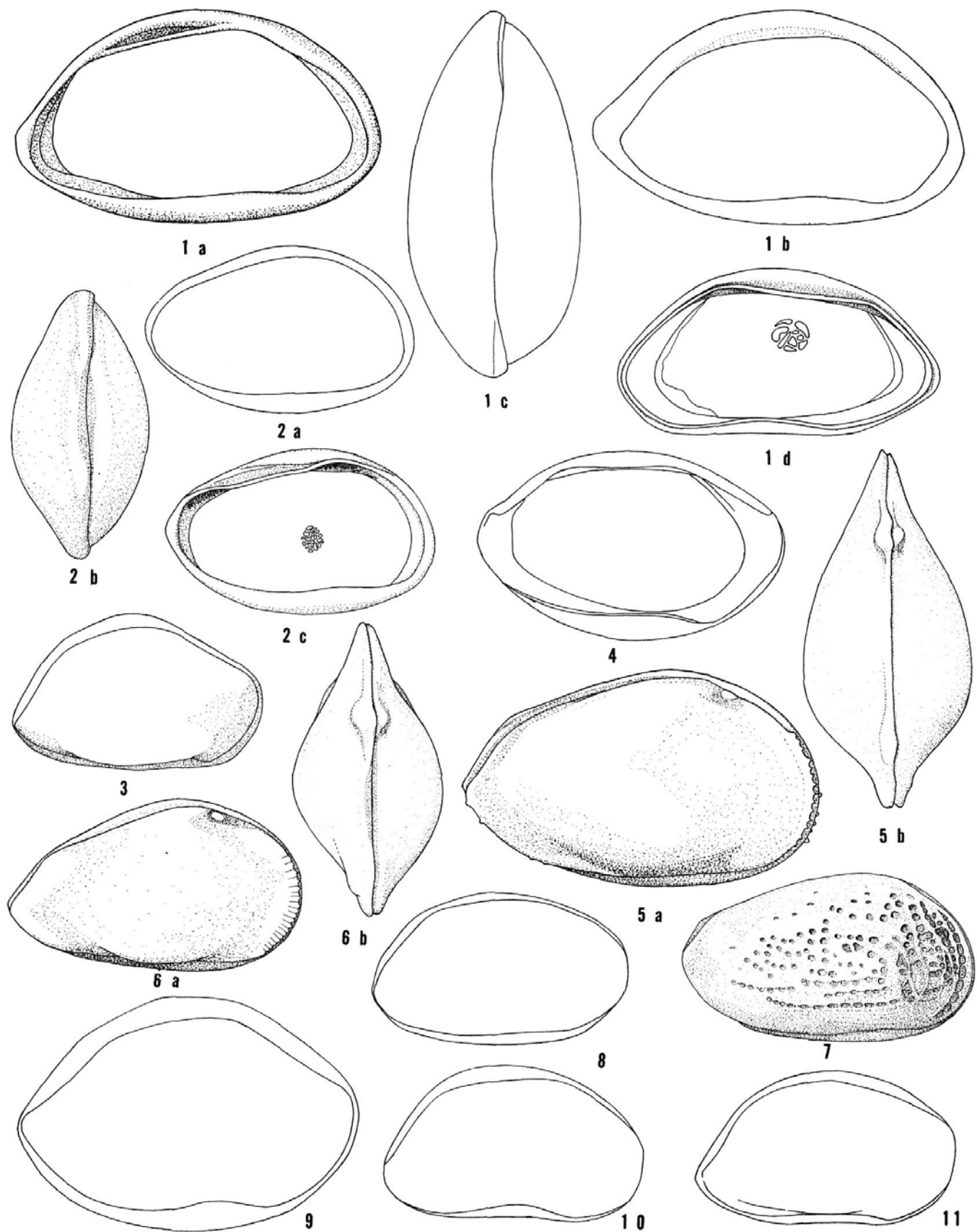
Xestoleberis moriahensis van den Bold, **new species**

Plate 6, figure 9a–b

Carapace small, pyriform, highest in the middle. Anterior end obliquely rounded, low, anterodorsal slope long and convex; dorsal margin behind the greatest height slightly convex and sloping down; ventral margin slightly sinuate in front of the middle; posterior end very broadly rounded, slightly oblique, greatest convexity above the middle. Left valve overlapping the right along the entire periphery, strongest overlap along the dorsal margin. Dorsal view egg-shaped, widest behind the middle, posterior end broadly rounded, anterior end slightly angled, showing the overlap of the left valve. Surface smooth except for a few scattered papillae in the

PLATE 2

- 1 *"Bythocypris" pykna* van den Bold, n. sp.
a, interior of left valve, holotype, U.S.N.M. no. 563483, Rohr sample 18192, Lengua formation, *Globorotalia menardii* zone, middle Miocene, $\times 65$; b, right valve view of complete carapace, paratype, U.S.N.M. no. 563485, Wirz sample 214, *Globorotalia fohsi robusta* zone, lower Miocene, $\times 75$; c, dorsal view of same specimen; d, interior of right valve, paratype U.S.N.M. no. 563484, from Rohr sample 18192, $\times 75$.
- 2 *Cardobairdia ovata* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563487, from Renz sample 385, *Porticulusphaera mexicana* zone, Navet formation, middle Eocene, $\times 70$; b, dorsal view of same specimen; c, interior of left valve, reconstructed from broken valve from the Lengua formation, *Globorotalia mayeri* zone, augerhole in Nariva area, $\times 65$.
- 3 *Bairdia caraibeensis* van den Bold.
Right valve view, Rohr sample 25684, *Globorotalia cerroazulensis* zone, upper Eocene, $\times 65$.
- 4 *Bairdia* sp. C
Interior of left valve, Rohr sample 25684, *Globorotalia cerroazulensis* zone, upper Eocene, $\times 65$.
- 5 *Brachycythere harmoniensis* van den Bold, n. sp.
a, right valve view of holotype, U.S.N.M. no. 563543; b, dorsal view of same specimen, Harmony Hall well 2, 828–840 feet, lower Mount Moriah silt, $\times 70$.
- 6 *Brachycythere fernandensis* van den Bold, n. sp.
a, right valve view; b, dorsal view, holotype, U.S.N.M. no. 563543, from Barr sample 7244, St. Joseph village, $\times 65$.
- 7 *Protobuntonia?* sp.
Right valve view, Harmony Hall well 2, 828–840 feet, lower Mount Moriah silt, $\times 65$.
- 8 *Bairdia machaquillaensis* van den Bold
Right valve view, Esmeralda well 1, 1394–1407 feet, $\times 65$.
- 9 *Bairdia* sp. B
Right valve view, from Rohr sample 25684, *Globorotalia cerroazulensis* zone, upper Eocene, $\times 65$.
- 10 *Bythocypris cancanaensis* (van den Bold)
Right valve view, Kugler sample 8821, *Globigerapsis kugleri* zone, $\times 45$.
- 11 *Bairdia* sp. A
Right valve view, Kugler sample 3692, Boca de Serpiente marl, Soldado Rock, $\times 60$.



posterior portion. Muscle scars: a posterior vertical row of four with one V-shaped scar in front.

Marginal area narrow in the whole free border, line of concrescence and inner margin widely separated in anterior end, pore canals moderately numerous, short and thick; vestibule deep in the ventral part of the anterior end. Hinge in the right valve consists of an anterior, elongate crenulate tooth lying on the selvage in front of the greatest height, on the dorsal slope of the anterior end; posterior tooth also elongate and crenulate situated at the point of greatest convexity of the posterior end and extending on either side of it; in between is a deep, crenulate groove, below the dorsal margin. In the left valve are terminal elongate crenulate sockets between which is a rather broad, crenulate bar.

Dimensions: Holotype, female: length 0.45 mm.; height 0.31 mm.; width 0.30 mm.; ?male: length 0.40 mm.; height 0.27 mm.; width 0.26 mm.

In the male the carapace is highest just behind the middle; the anterodorsal slope is slightly longer and the anterior end lower; dorsal margin slightly sinuate in the left valve, straight in the right; ventral margin sinuate in front of the middle; posterior end broadly and obliquely rounded. Greatest width almost in the middle. There is only slight difference between males and females. And there is some doubt whether this separation into males and females is correct, as only males appear to occur in two samples (Stainforth sample 47, Kugler sample 3741).

Range: Upper Eocene — lower Oligocene.

Holotype: A complete female carapace from Calyx well 59, 70–80 feet, U.S.N.M. no. 563566; paratypes: U.S. N.M. nos. 563567 and 563568.

***Xestoleberis chamela* van den Bold, new species**

Plate 6, figure 10a–b

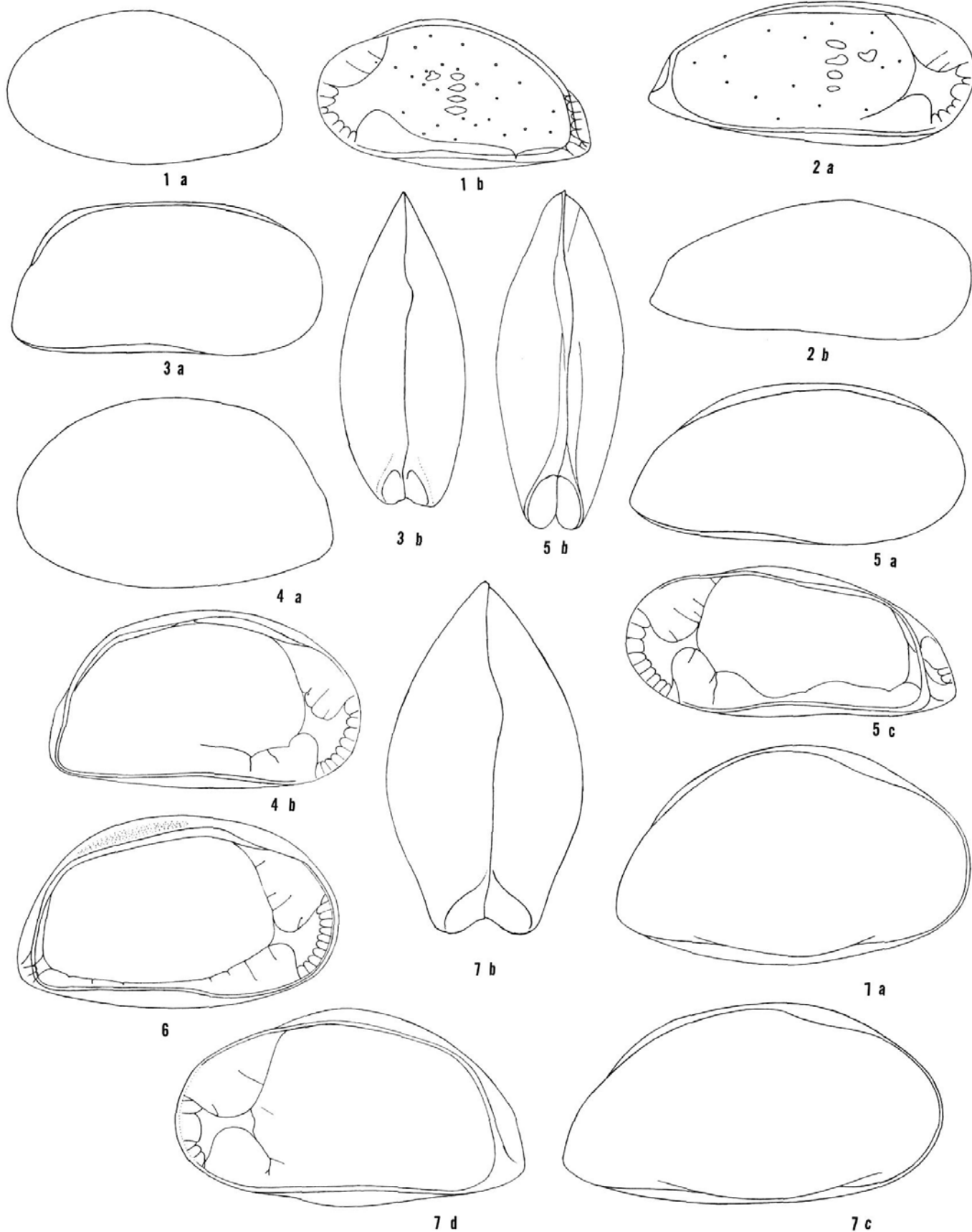
Carapace pyriform in side view, highest in the middle, angular in dorsal view. Anterior end very obliquely rounded, anterodorsal slope almost straight; dorsal margin slightly convex behind the greatest height and sloping down, forming an angle of about 120° with the anterodorsal slope; ventral margin slightly convex in front of the middle, usually obscured by the overhanging tumid ventral portion of the valve, ventral side of the carapace flat; posterior end rounded upward from the ventral margin and obtusely angled against the dorsal margin above the middle. Dorsal view with broadly rounded posterior end, sides in the middle third almost parallel, slightly tapering in front. Left valve overlapping along the entire periphery with a small but regular overlap. Hinge, marginal area and muscle scars as described for *X. moriahensis*.

Dimensions: Holotype, length 0.45 mm.; height 0.30 mm.; width 0.30 mm.

The name *chamelos* (Gr.), on the ground, creeping, is suggested by the flattened ventral surface and does not imply a mode of locomotion for the species.

PLATE 3

- 1 *Krithe guatemalensis* van den Bold
a, exterior of left valve; b, interior of right valve. Kugler sample 1831, Lizard Springs formation, *Globorotalia rex* zone, lower Eocene, $\times 80$.
- 2 *Krithe cancenensis* van den Bold
a, interior of left valve; b, exterior of right valve. Kugler sample 1831, Lizard Springs formation, *Globorotalia rex* zone, lower Eocene, $\times 80$.
- 3 *Krithe saundersi* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563503; b, dorsal view of same specimen. Renz sample 385, *Porticulospira mexicana* zone, Navet formation, Penitence Hill marl, $\times 75$.
- 4 *Krithe cubensis* van den Bold
a, exterior of left valve; b, interior of left valve. Sample SE 451, $\times 75$.
- 5 *Krithe elongata* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563501; b, dorsal view of same specimen; c, interior of right valve. Wirz sample 214, *Globorotalia fohsi robusta* zone, upper Cipero marl, $\times 80$.
- 6 *Krithe morkhoveni* van den Bold, n. sp.
Interior of left valve, paratype: U.S.N.M. no. 563507. Wirz sample 214, *Globorotalia fohsi robusta* zone, upper Cipero marl, $\times 75$.
- 7 *Krithe crassicaudata* van den Bold
a, right valve view of female; b, dorsal view of same specimen; c, right valve view of male; d, interior of right valve, female. Sample Ky 7, *Globigerapsis semiinvoluta* zone, Hospital Hill marl, Navet formation, upper Eocene, $\times 75$.



This species was thought for a time to represent the male of *X. moriahensis* until males were recognized in that species. It often occurs together with that species, but has a shorter vertical range. It has not been found in the *Globorotalia opima opima* zone. *Xestoleberis vicksburgensis* Howe (Howe and Law, 1936, p. 78, pl. 6, figs. 19–21) is less angular and more elongate in side view.

Holotype: A complete carapace from Calyx well 59, 266–270 feet, U.S.N.M. no. 563569; paratypes: U.S.N.M. nos. 563570 and 563571.

***Xestoleberis dumblei* Stephenson**

Xestoleberis dumblei STEPHENSON, 1946, Jour. Pal., vol. 20, p. 320, pl. 43, fig. 16.

Only two specimens of this species have been found in Kugler sample 3741, Bed 4 of Kugler on Soldado Rock, which conform in every respect to the description and dimensions given by Stephenson.

***Xestoleberis* sp.**

Plate 6, figure 11

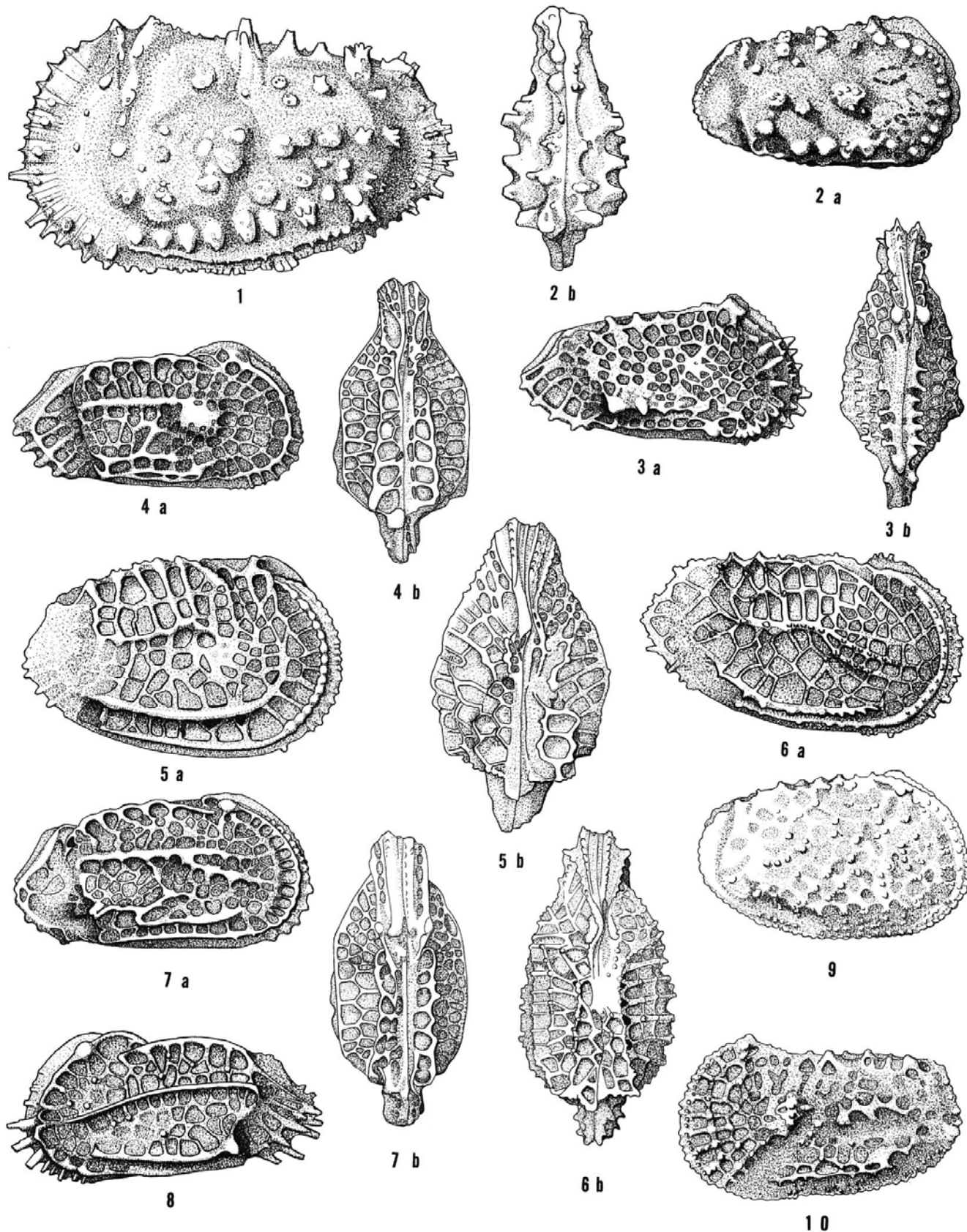
Carapace small, ovate, highest just behind the middle. Anterior end obliquely rounded, dorsal margin convex, ventral margin nearly straight, slightly concave just in front of the middle; posterior end broadly rounded, slightly angled at the junction with the dorsal margin. Left valve overlapping the right along the entire periphery, strongest overlap along the dorsal margin. Dorsal view egg-shaped, widest behind the middle. Posterior end broadly rounded, anterior end narrowly rounded.

Dimensions: length 0.32 mm.; height 0.21 mm.; width 0.20 mm.

This species has only been found at two localities: Stainforth 47 and Kugler sample 3692 (Soldado Rock).

PLATE 4

- 1 *Trachyleberis bermudezi* (van den Bold)
Exterior of left valve, *Catapsydrax dissimilis* zone, lower Miocene, $\times 65$.
- 2 *Trachyleberis bollii* van den Bold n. sp.
a, right valve view, holotype, U.S.N.M. no. 563521; b, dorsal view of same specimen. Renz sample 385, Penitence Hill marl, Navet formation, *Porticulusphaera mexicana* zone, middle Eocene, $\times 65$.
- 3 *Trachyleberis? hapsida* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563524; b, dorsal view of same specimen. Kugler sample 3692, Boca de Serpiente marl, Soldado Rock, $\times 65$.
- 4 *Costa barri*, van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. 563526; b, dorsal view same of specimen. Barr sample 7244, St. Joseph village, San Fernando, $\times 65$.
- 5 *Costa lehneri* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563528; b, dorsal view of same specimen. Calyx well 57, 250–260 feet, *Globorotalia opima opima* zone, Oligocene, $\times 70$.
- 6 *Costa harmoniensis* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563530; b, dorsal view of same specimen. Calyx well 57, 910–920 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 70$.
- 7 *Costa meka* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563535; b, dorsal view of same specimen. Harmony Hall well 2, 1988–2000 feet, lower Mount Moriah silt, $\times 70$.
- 8 *Cativella moriahensis* van den Bold, n. sp.
Exterior of left valve, holotype, U.S.N.M. no. 563539, Stainforth sample 47, *Globigerina ampliapertura* zone, lower Oligocene, $\times 70$.
- 9 *Echinocythereis okeechobiensis* (Swain)
Right valve view, Calyx well 59, 430–440 feet, *Globorotalia cerroazulensis* zone, $\times 60$.
- 10 *Henryhowella asperrima* (Reuss)
Exterior of left valve, Calyx well 57, 850–860 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 65$.



Genus UROLEBERIS Triebel, 1958

Uroleberis sp. aff. **Cythere ranikotiana** Latham

?*Cythere ranikotiana* LATHAM, 1936, Proc. Roy. Soc. Edinburgh, vol. 59, p. 41, fig. 4a-b.

Xestoleberis ranikotiana (Latham)? - VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, p. 121, pl. 17, fig. 4a-b.

Only a few specimens that may belong to Latham's species and which are identical to the ones described from the lower Eocene of Guatemala and British Honduras, were found in the Fitt Trace marl (Renz 335), *Globorotalia lehneri* zone, and in the *Truncorotaloides rohri* zone of Esmeralda well 1, 380-394 feet.

INCERTA SUBFAMILIA

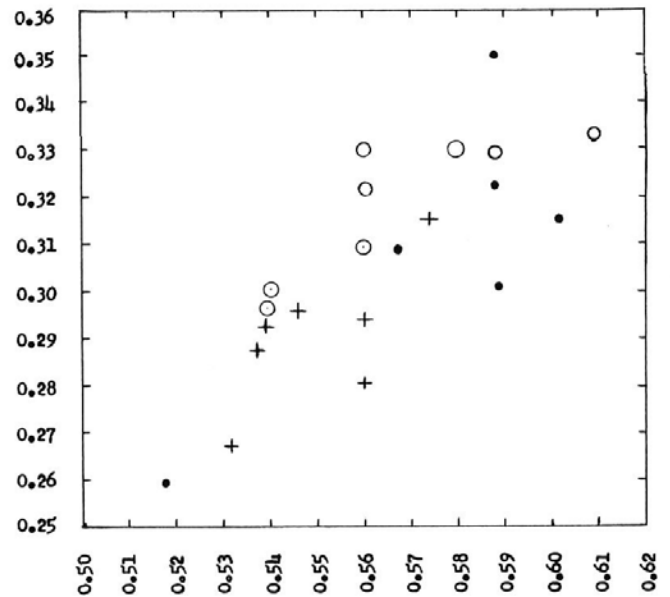
Genus RUTTENELLA van den Bold, 1946

Ruttenella ovata van den Bold

Plate 5, figure 1a-f

Ruttenella ovata VAN DEN BOLD, 1946, Contribution to the study of Ostracoda, Univ. Thesis, Utrecht, pp. 84-85, pl. 7, fig. 3a-b, pl. 9, fig. 13a-b.

Carapace elongate ovate, highest just in front of the middle. Anterior end evenly rounded; dorsal and ventral margin convex, posterior end subtruncate above, narrowly rounded and minutely denticulate below; posterior cardinal angle projecting in both valves, more



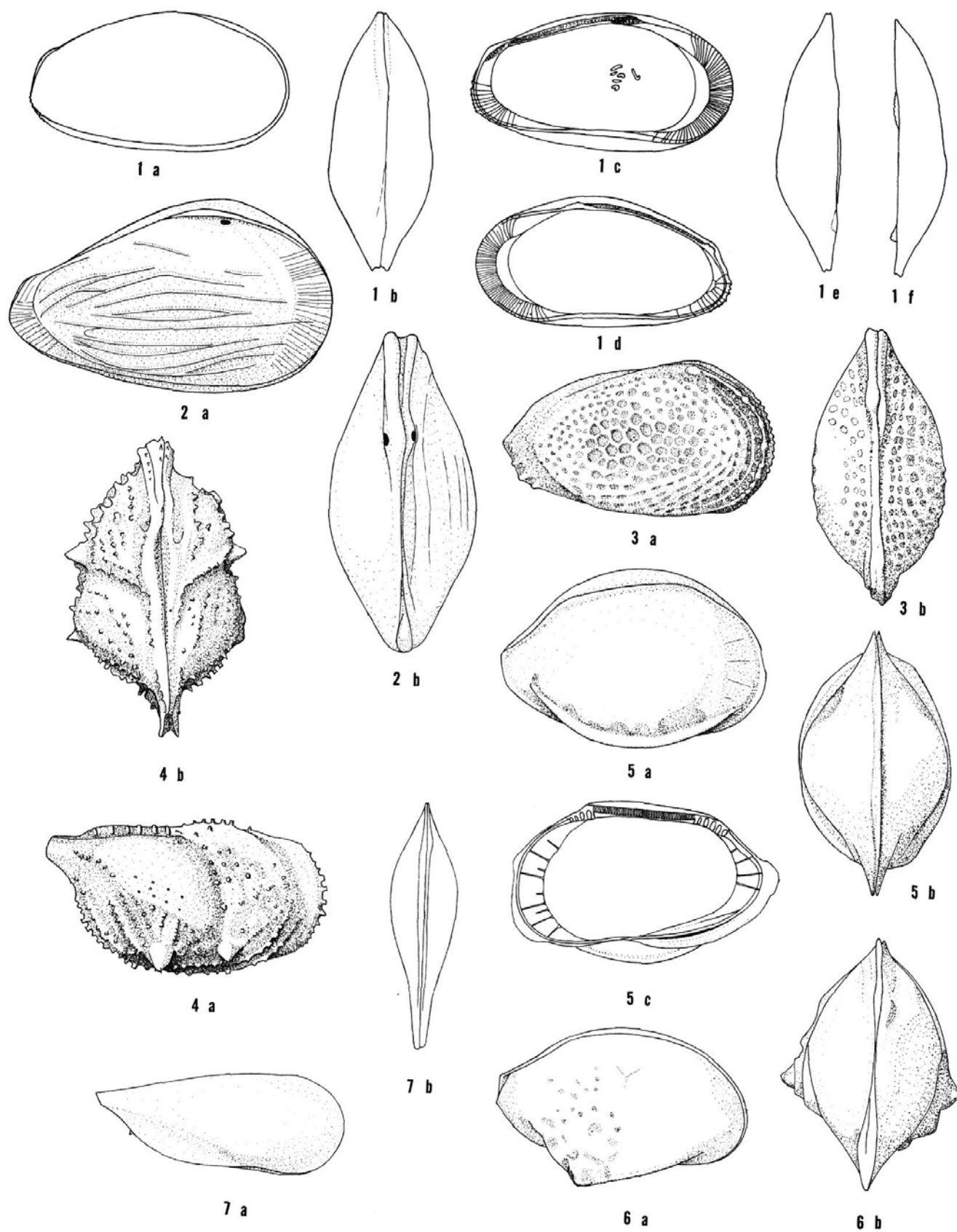
TEXT-FIGURE 5

Length and height ratio of *Ruttenella ovata* van den Bold.
● Trinidad; ○ Bonaire; + Venezuela.

conspicuously in the left. Left valve larger than the right and overlapping along ventral margin, anterior end, anterior portion of the dorsal margin, posterior

PLATE 5

- Ruttenella ovata* van den Bold
a, right valve view; b, dorsal view, c, interior of left valve, d, interior of right valve, e, dorsal view of left valve, f, dorsal view of right valve. From marl at Porto Spaño, Bonaire, upper Eocene, $\times 80$.
- Buntonia?* sp.
a, right valve view, b, dorsal view. Pauji formation, upper Eocene, western Venezuela, $\times 80$.
- Bosquetina? conceptionensis* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563546; b, dorsal view, same specimen. Esmeralda well, 2630-2650 feet, "Gaudryina beds," middle or lower Eocene, $\times 80$.
- Bythoceratina scabra* van den Bold, n. sp.
a, exterior of right valve, holotype, U.S.N.M. no. 563566, St. Croix Quarry, Mühlemann sample 14813, *Globigerinatella insueta* zone, lower Miocene; b, dorsal view of paratype, U.S.N.M. no. 563567, Kugler sample 2845, $\times 80$.
- Cytheropteron? trinidadensis* van den Bold, n. sp.,
a, right valve view, holotype, U.S.N.M. no. 563557, Barr sample 7689; b, dorsal view of same specimen; c, interior of right valve, paratype, U.S.N.M. no. 563558, Rohr sample 18773, $\times 70$.
- Cytheropteron* sp., aff. *Cytheropteron tricornis* (Bornemann)
a, right valve view, b, dorsal view of same specimen. Barr sample 7244a, $\times 70$.
- Pseudocythere cubensis* van den Bold, n. sp.
a, right valve view, holotype, M-GIU, S5805; b, dorsal view of same specimen. From Tschopp sample 1147, upper Eocene of Nuevitas, Cuba, $\times 80$.



cardinal angle and dorsal part of the posterior end. Dorsal view elongate, widest just behind the middle with a slight compression just anterior to the middle; anterior end fairly acute, posterior end slightly irregular, due to a small projecting, spinose flange in the ventral part.

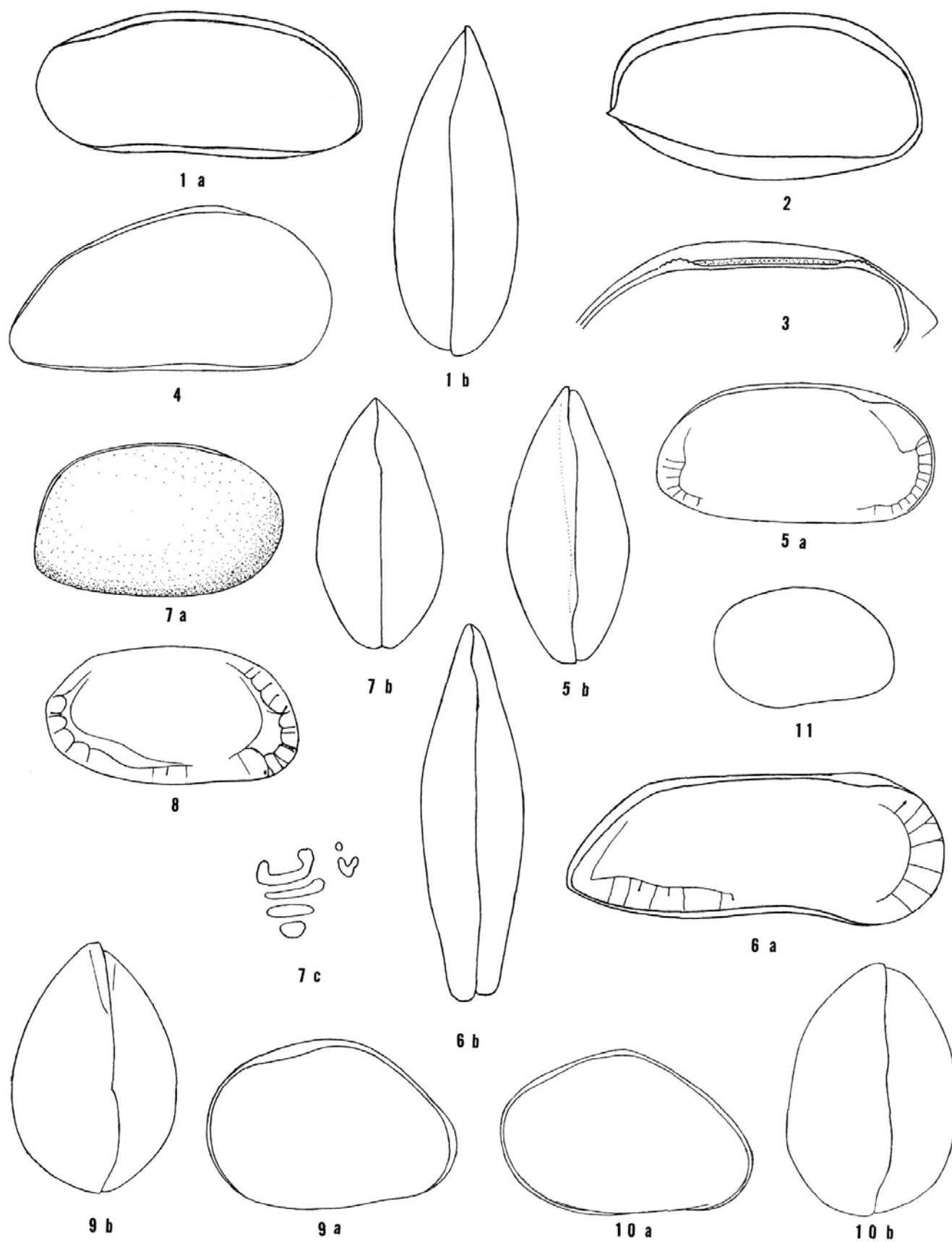
Hinge in the left valve consists of an elongate, weakly denticulate socket, just anterior to the greatest height and just posterior to an incurved part of the dorsal margin, where the left valve overlaps the right. The socket continues below the dorsal margin and separates it from a narrow, finely crenulate bar; at the posterior cardinal angle the dorsal margin curves around a socket which is open to the interior and which is connected to the groove in the dorsal margin above the median bar. In the right valve an elongate, dentate area occurs just in front of the greatest height; at the posterior cardinal angle a short, dentate area is found consisting of two cusps; between the two terminal

dentate areas is a narrow and shallow groove which is probably denticulate, although this could not be seen in the material in my private collection.

Marginal area broad in anterior end; vestibule sickle-shaped; line of concrescence parallels the outer margin, separated from the inner margin. In the small anterior area, where line of concrescence and inner margin do not coincide, the pore canals are numerous, about fifty. They are curved away from the median line of the valve, upward and backward in the upper half, downward and backward in the lower half. In the posterior end about ten radial canals occur, ending in the denticles which are mounted on a small flange extending backward from the selvage. Muscle scars: a posterior row of four scars, the second from the top being divided into two small scars. Shape of the scars is rather irregular, the upper one is slightly oblique. In front of this vertical row a single V-shaped scar occurs of which the posterior leg is much longer than the anterior one.

PLATE 6

- 1 *Argilloecia nutusa* van den Bold, n. sp.
a, left valve view, holotype, U.S.N.M. no. 563478; b, dorsal view of same specimen. Stainforth sample 47, *Globigerina ampliapertura* zone, lower Oligocene, $\times 100$.
- 2 "*Krausella*" aff. *Krausella minuta* Triebel
Right valve view, Rohr sample 4347a, *Globorotalia rohri* zone, Navet formation, middle Eocene, $\times 95$.
- 3 "*Krausella*" *minuta* Triebel
Hinge of right valve, Upper Cretaceous, Holland, $\times 130$.
- 4 *Eucythere* sp.
Right valve view, Esmeralda well 1, 2630-2650 feet, "*Gaudryina* beds," $\times 105$.
- 5 *Parakrithe waitei* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563508; b, dorsal view of same specimen. Harmony Hall well 2, 865 feet, lower Mount Moriah silt, upper Eocene, $\times 100$.
- 6 *Parakrithe elongata* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563513; b, dorsal view of same specimen. Harmony Hall well 1, 865 feet, lower Mount Moriah silt, upper Eocene, $\times 105$.
- 7 *Parakrithe?* *ovata* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563510, $\times 105$; b, dorsal view of same specimen; c, muscle scar. Sample Renz. 384, Vistabella marl, upper Eocene, $\times 230$
- 8 *Microcythere?* sp.
Right valve view, Kugler sample 3741, *Globorotalia cerroazulensis* zone, Soldado Rock, upper Eocene, $\times 105$.
- 9 *Xestoleberis moriahensis* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563567; b, dorsal view of same specimen. Calyx well 59, 70-80 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 100$.
- 10 *Xestoleberis chamela* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563569; b, dorsal view of same specimen. Calyx well 59, 266-270 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 100$.
- 11 *Xestoleberis* sp.
Exterior of right valve, Stainforth sample 47, *Globigerina ampliapertura* zone, $\times 100$.



Dimensions: Length 0.61 mm.; height 0.33 mm.; width 0.24 mm. (complete figured carapace). *Variation:* ?female, length 0.48–0.61 mm.; height 0.26–0.35 mm.; ?male, length 0.52–0.61 mm.; height 0.25–0.32 mm.

This species, which so far is the only one described for the genus, appears to be confined to the upper Eocene. In Trinidad it occurs in the San Fernando formation (Vistabella marl, Boca de Serpiente marl, Calyx well 59, 430–440 feet, Harmony Hall well 2, 650–662 feet). It has also been found in the Pauji and Paloma Alta shales of western Venezuela.

The species was originally described from a marl found in a hand-dug well near Porta Spaño, Columbia plantation on Bonaire (Pijpers, 1933, p. 41). Pijpers'

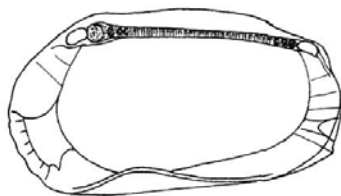
determinations of the smaller foraminifera of this marl were later emended by Drooger (1953, p. 94, 95), who lists among the planktonic foraminifera: *Globorotalia cocoaensis*, *crassata*, *centralis* and *lehneri*, *Globigerina bulloides*, *eocenica*, *dissimilis* and *danvillensis*, *Globigerinoides mexicana*, *pseudodubia*. The occurrence together in one sample of some of these species is in conflict with the ranges as given by Bolli (1957, p. 159), but Drooger remarks (p. 96) that there are "a number of individuals, approaching the types of *Globigerinoides mexicana* and *Globigerinoides index*". If we assume Drooger's identification of *Globorotalia bonairensis* Pijpers with *Globorotalia cerroazulensis* to be correct, this would probably place this marl in the higher part of the upper Eocene and correlate it with the San Fernando formation.

PLATE 7

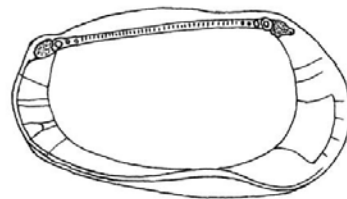
- 1 *Munseyella reticulata* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 563517; b, dorsal view of same specimen, Kugler sample 3741, *Globorotalia cerroazulensis* zone, Soldado Rock; c, interior of right valve, paratype; d, interior of left valve of same specimen, U.S.N.M. no. 563520, Harmony Hall well 2, 1988–2000 feet, $\times 105$.
- 2 *Munseyella* sp.
Left valve view, Esmeralda well 1, 3052–3071 feet, "Gaudryina beds," $\times 100$.
- 3 *Munseyella israelskyi* Marianos and Valentine
Right valve view, Esmeralda well 1, 3052–3071 feet, "Gaudryina beds," $\times 100$.
- 4 *Loxoconcha wagneri* van den Bold n. sp.
a, right valve view, holotype, U.S.N.M. no. 563547; b, dorsal view of same specimen, Kugler sample 3741, *Globorotalia cerroazulensis* zone, Soldado Rock, upper Eocene, $\times 90$.
- 5 *Loxoconcha* sp. aff. *Loxoconcha diverta* Murray
Left valve view, well near La Brea, Pitch Lake, lower Oligocene, $\times 100$.
- 6 *Loxoconcha* sp.
a, exterior of right valve, Aripere, Texaco Trinidad Cat. no. 123554, *Catapsydrax dissimilis* zone; b, dorsal view of complete specimen, Calyx well 103, 140–150 feet; c, interior of right valve, same specimen as 6a, $\times 105$.
- 7 *Cytherura vistabellensis* van den Bold, n. sp.
a, right valve view, holotype, U.S.N.M. no. 565521; b, dorsal view of same specimen, Stainforth 47, *Globigerina ampliapertura* zone, lower Oligocene, $\times 110$.
- 8 *Cytherura*? sp.
a, exterior of right valve, b, interior of same valve, Stainforth sample 47, *Globigerina ampliapertura* zone, lower Oligocene, $\times 105$.
- 9 *Eucytherura kugleri* van den Bold, n. sp.
a, right valve view; b, dorsal view of same specimen, Kugler sample 3741, *Globorotalia cerroazulensis* zone, upper Eocene, Soldado Rock, $\times 100$.
- 10 *Eucytherura* sp.
Right valve view, Esmeralda well 1, 2630–2650 feet, "Gaudryina beds," $\times 105$.



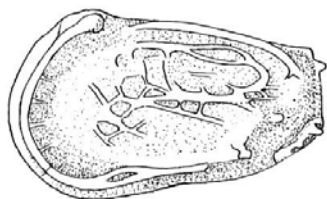
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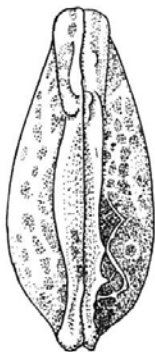
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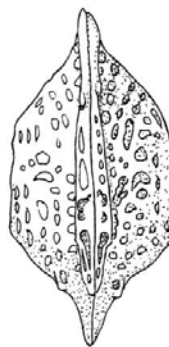
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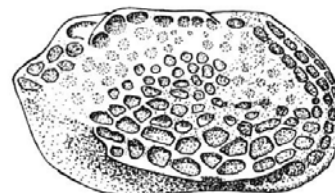
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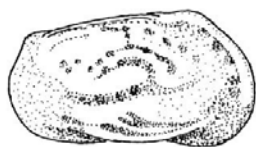
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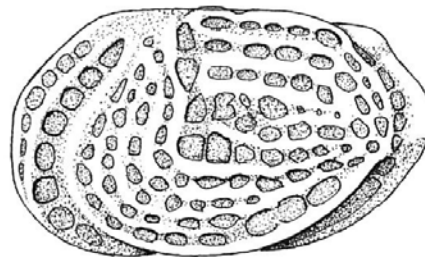
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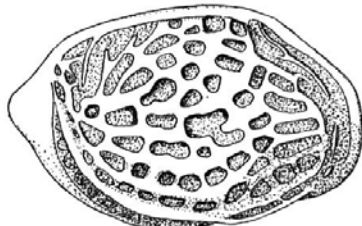
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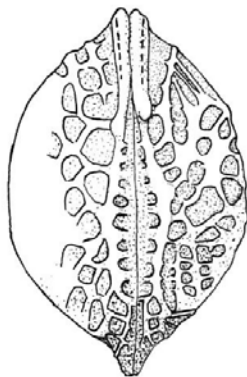
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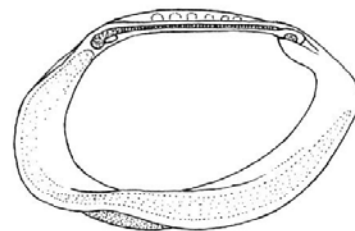
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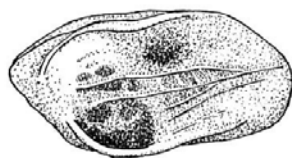
6 a



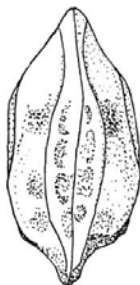
6 b



6 c



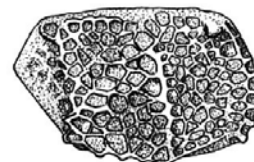
7 a



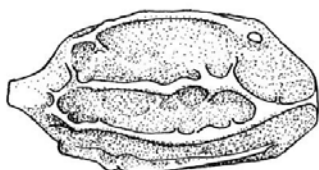
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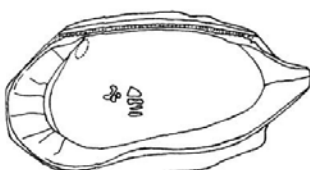
9 b



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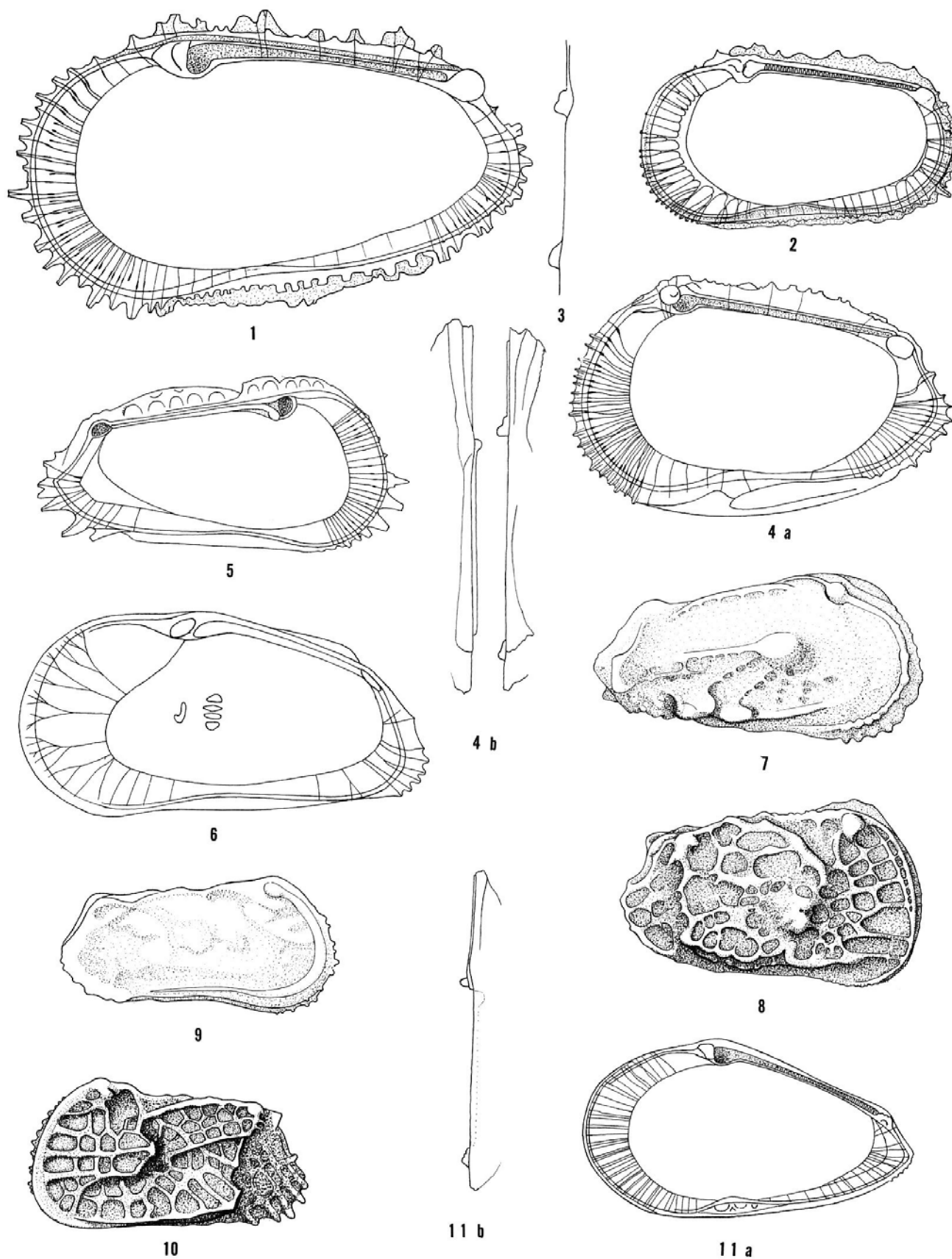
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BIBLIOGRAPHY

- ALEXANDER, C. I.
1934 - *Ostracoda of the Midway of Texas*. Jour. Pal., vol. 8, no. 2, pp. 206-237, pls. 32-35, text-fig. 1.
- BELLEN, R. C., VAN, PUYT, J. F. C., DE WITT, RUTGERS, A. C., AND SOEST, J. VAN
1941 - *Smaller foraminifera from the lower Oligocene of Cuba*. K. Nederl. Akad. Wetensch., Proc., vol. 44, no. 9, pp. 1140-1146, pl. 1, text-fig. 1, 1 table.
- BERGQUIST, H. R.
1942 - *Jackson Foraminifera and Ostracoda*. Mississippi State Geol. Surv., Bull. 49, pp. 5-117, pls. 1-11.
- BLAKE, D. R.
1950 - *Gosport Eocene Ostracoda from Little Stave Creek, Alabama*. Jour. Pal., vol. 24, no. 2, p. 174-184, pls. 29-30.
- BOLD, W. A., VAN DEN
1946 - *Contribution to the study of Ostracoda with special reference to the Tertiary and Cretaceous microfauna of the Caribbean region*. Univ. Thesis, Utrecht, 167 pp.
1950 - *A checklist of Cuban Ostracoda*. Jour. Pal., vol. 24, no. 1, pp. 107-109.
1957a *Ostracoda from the Paleocene of Trinidad*. Micropaleontology, vol. 3, no. 1, pp. 1-18, pls. 1-3, text-fig. 1, table 1.
1957b *Oligo-Miocene Ostracoda from southern Trinidad*. Micropaleontology, vol. 3, no. 3, pp. 231-254, pls. 1-4, text-figs. 1-2, table 1.
1958a *Ambocythere, a new genus of Ostracoda*. Ann. Mag. Nat. Hist., ser. 12, vol. 10 (1957), no. 119, pp. 801-813, text-figs. 1-18, table 1.
1958b *Ostracoda of the Brasso formation of Trinidad*. Micropaleontology, vol. 4, no. 4, pp. 391-418, pls. 1-5, text-figs. 1-2, table 1.
- BOLLI, H. M.
1957a *The genera Globigerina and Globorotalia in the Paleocene-Lower Eocene Lizard Springs formation of Trinidad, B. W. I.* In: LOEBLICH, A. R., JR. AND OTHERS; *Studies in foraminifera*. U.S. Nat. Mus., Bull. no. 215, pp. 61-82, pls. 15-20, text-figs. 11-13.
1957b *Planctonic foraminifera from the Oligocene-Miocene Cipero and Lengua formations of Trinidad, B. W. I.* In: LOEBLICH, A. R., JR., AND OTHERS; *Studies in foraminifera*. Ibid., pp. 97-124, pls. 22-29, text-figs. 17-21.
1957c *Planctonic foraminifera from the Eocene Navet and San Fernando formations of Trinidad, B. W. I.* In: LOEBLICH, A. R., JR., AND OTHERS; *Studies in foraminifera*. Ibid., pp. 155-172, pls. 35-39, text-figs. 25-26.

PLATE 8

- 1 *Trachyleberis bermudesi* (van den Bold)
Interior of right valve, Calyx well 57, 830-840 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 75$.
- 2 *Henryhowella asperina* (Reuss)
Interior of right valve, Calyx well 57, 850-860 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 80$.
- 3 *Henryhowella evax* (Ulrich and Bassler)
Dorsal view of hinge in right valve, Calvert formation, Plum Point, Maryland, $\times 60$.
- 4 *Costa lehneri* van den Bold, n. sp.
a, interior of right valve, paratype, U.S.N.M. no. 563529; b, dorsal view of hinge in right and left valves, Calyx well 57, 250-260 feet, *Globigerina ampliapertura* zone, lower Oligocene, $\times 75$.
- 5 *Cativella moriahensis* van den Bold, n. sp.
Interior of left valve, Harmony Hall well 2, 1988-2000 feet, lower Mount Moriah silt, $\times 80$.
- 6 *Ambocythere elongata* van den Bold
Interior of right valve, Calyx well 57, 258-260 feet, *Globorotalia opima opima* zone, Oligocene, $\times 130$.
- 7 *Hermanites?* sp.
Right valve view, Esmeralda well 1, 2630-2650 feet, "Gaudryina beds", $\times 80$.
- 8 *Quadracythere?* sp.
Right valve view, Kugler sample 3741, *Globorotalia cerroazulensis* zone, upper Eocene, Soldado Rock, $\times 80$.
- 9 *Occultocythereis?* sp.
Right valve view, Esmeralda well 1, 2630-2650 feet, "Gaudryina beds", $\times 80$.
- 10 *Hermanites?* sp. aff. *paijenborchiana* Keij
Left valve, Stainforth sample 47, *Globigerina ampliapertura* zone, lower Oligocene, $\times 80$.
- 11 *Buntonia?* sp.
a, interior of right valve; b, dorsal view of hinge of right valve, Pauji formation, upper Eocene, western Venezuela, $\times 80$.



- BONNEMA, J. H.
1941 - *Ostracoden aus der Kreide des Untergrundes der nord-östlichen Niederlanden*. Natuurh. Maandblad, vol. 30, no. 4, pp. 40-43.
- BORNEMANN, J. G.
1855 - *Die mikroskopische Fauna des Septarienstons von Hermsdorf bei Berlin*. Deutsch. Geol. Ges., Zeitschr., vol. 7, no. 2, pp. 307-371, pls. 12-21.
- BRADY, G. S.
1866 - *A monograph of the Recent British Ostracoda*. Trans. Linn. Soc., London, vol. 26, pt. 2, pp. 353-495.
1880 - *Report on the Ostracoda dredged by HMS Challenger during the years 1873-1876*. Rept. Voy. Challenger, Zool., vol. 1, pp. 1-184.
1887 - *Description of Ostracoda from the explorations of the "Travailleur" and the "Talisman"*. In: DE FOLIN ET PÉRIER; *Les Fonds de la Mer*. vol. 4, pp. 164-226.
- BROWN, P. M.
1958 - *Well logs from the coastal plain of North Carolina*. North Carolina, Dept. Cons. Devel., Div. Min. Res., Bull. no. 72, pp. 1-99.
- BUBIKYAN, S. A.
1958 - *Ostracodes of paleogene deposits of the Jerevan basin*. Akad. Nauk. Armyansk. SSSR., Istv., vol. 11, no. 3, pp. 3-16.
- CUSHMAN, J. A.
1925 - *An Eocene fauna from the Moctezuma river, Mexico*. Amer. Assoc. Petrol. Geol., Bull., vol. 9, no. 2, pp. 298-301, pls. 6-7.
- CUSHMAN, J. A., AND JARVIS, P. W.
1928 - *Cretaceous foraminifera from Trinidad*. Cushman Lab. Foram. Res., Contr., vol. 4, pt. 4, pp. 85-103, pls. 12-14.
- CUSHMAN, J. A., AND RENZ, H. H.
1948 - *Eocene foraminifera of the Navet and Hospital Hill formations of Trinidad, B.W.I.* Cushman Lab. Foram. Res., Spec. Publ., no. 24, pp. 1-42, pls. 1-8.
- DROOGER, C. W.
1953 - *Late Eocene smaller foraminifera from Curaçao and Bonaire (N.W.I.)*. K. Nederl. Akad. Wetensch., Proc., ser. B, vol. 56, no. 1, pp. 93-103, pl. 1, text-fig. 1.
- GREKOFF, N.
1953 - *Ostracodes*. In: CHEYLAN, G., MAGNE, J., SIGAL, J., AND GREKOFF, N.; *Résultats géologiques et micropaléontologiques du sondage d'El Krachem (Hautes Plateaux Algérois). Description de quelques espèces nouvelles*. Soc. Géol. France, Bull., ser. 6, vol. 3 (1953), fasc. 4-6, pp. 489-491, text-fig. 1, tables 1-2.
- GUPPY, R. J. L.
1866 - *On the relations of the Tertiary formations of the West Indies*. Geol. Soc. London, Quart. Jour., vol. 22, pp. 570-590, pl. 26, text-figs. 1-3.
1892 - *The Tertiary microzoic formations of Trinidad, West Indies*. Geol. Soc. London, Quart. Jour., vol. 48, pp. 519-541, text-figs. 1-2.
- HANAI, T.
1957a *Studies on the ostracods from Japan. I - Subfamily Lepocytherinae, new subfamily*. Univ. Tokyo, Fac. Sci., Jour., ser. 2, vol. 10, pt. 3, pp. 431-468, pls. 7-10, text-figs. 1-2.
1957b *Studies on the ostracods from Japan. II - Subfamily Pectocytherinae, new subfamily*. Ibid., pp. 469-482, pl. 11, text-figs. 1-6.
1957c *Studies on the ostracods from Japan. III - Subfamilies Cytherurinae G. W. Müller (emend. G. O. Sars, 1925), and Cytheroptyerinae, n. subfam.* Ibid., vol. 11, pt. 1, pp. 11-36, pls. 2-4, text-figs. 1-9.
- HERMES, J. J.
1946 - *Geology and paleontology of east Camaguey and west Oriente, Cuba*. Utrecht, Univ., Geogr. Geol. Meded., Physior.-Geol. Reeks, ser. 2, no. 7, pp. 1-74, pls. 1-5, 2 text-figs., tables.
- HORNIBROOK, N. DE B.
1952 - *Tertiary and Recent marine Ostracoda of New Zealand-their origin, affinities and distribution*. New Zealand Geol. Survey, Pal. Bull. no. 18, pp. 5-82, pls. 1-18.
- HOWE, H. V.
1934 - *Bairdia subdeltoidea (Münster) in the American Tertiary*. Jour. Pal., vol. 8, no. 3, pp. 388-389, text-fig. 1.
1936 - *Ostracoda of the genus Eucythere from the Tertiary of Mississippi*. Jour. Pal., vol. 10, no. 2, pp. 143-145, text-figs. 1-7.
1951 - *New Tertiary ostracode fauna from Levy County, Florida*. Florida Geol. Survey, Bull., no. 34, pt. 1, pp. 1-32, pls. 1-5.
- HOWE, H. V., AND CHAMBERS, J.
1935 - *Louisiana Jackson Eocene Ostracoda*. Louisiana Dept. Cons., Geol. Bull., no. 5, pp. 1-65, pls. 1-6, 1 table.
- HOWE, H. V., AND GARRETT, J. B.
1934 - *Louisiana Sabine Eocene Ostracoda*. Louisiana Dept. Cons., Geol. Bull., no. 4, pp. 1-64, pls. 1-4.
- HOWE, H. V., AND LAW, JR.
1936 - *Louisiana Vicksburg Oligocene Ostracoda*. Louisiana Dept. Cons., Geol. Bull., no. 7, pp. 1-30, 34-96, pls. 1-6.
- HOWE, H. V., AND OTHERS
1935 - *Ostracoda of the Arca zone of the Choctawhatchee Miocene of Florida*. Florida Dept. Cons., Geol. Bull., no. 13, pp. 1-47, pls. 1-4.
- JONES, T. R.
1857 - *Monograph of the Tertiary Entomostraca of England*. Palaeontogr. Soc., London, Monogr., pp. 1-68, pls. 1-6.
- JONES, T. R., AND SHERBORN, C. D.
1887 - *Further notes on the Tertiary Entomostraca of England, with special reference to these from the London Clay*. Geol. Mag., n. s., vol. 4, nos. 9, 10, pp. 385-392, 450-460, pl. 11.
1889 - *A supplementary Monograph of the Tertiary Entomostraca of England*. Palaeontolog. Soc., London, Monogr. (1888), pp. 1-55, pls. 1-3.

EOCENE AND OLIGOCENE OSTRACODA OF TRINIDAD

- KEIJ, A. J.
1954 - *Ostracoda. Identification and description of species*. In: ANDEL, T., VAN, AND POSTMA, H., *Recent sediments of the Gulf of Paria; Reports of the Orinoco shelf expedition, vol. 1*. K. Nederl. Akad. Wetensch. Afd. Natuurk., Verh., ser. 1, vol. 20, no. 5, pp. 119-128, 218-231, pls. 3-6.
1957a *Eocene and Oligocene Ostracoda of Belgium*. Brussels, Inst. Roy. Sci. Nat., Mem., no. 136, pp. 1-210, pls. 1-23.
- KEYZER, F. G.
1945 - *Outline of the geology of the eastern part of the province of Oriente, Cuba*. Utrecht, Univ., Geogr. Geol. Meded., Physiogr.-Geol. Reeks, ser. 2, no. 6, pp. 1-238, pls. 1-11, text-figs. 1-34, tables 1-19, 1 map.
- KLINE, V. H.
1943 - *Clay County fossils: Midway foraminifera and Ostracoda*. Mississippi Geol. Survey, Bull., no. 53, pp. 5-98, pls. 1-8.
- KUGLER, H. G.
1938 - *The Eocene of the Soldado Rock near Trinidad*. Venezuela, Minist. Fomento, Bol. Geol. y Min., Caracas, vol. 2, nos. 2-4, pp. 202-225, 4 pls.
1953 - *Jurassic to Recent sedimentary environments in Trinidad*. Assoc. Suisse Géol. Ing. Pétr., Bull., vol. 20, no. 59, pp. 27-60, 2 text-figs.
- KUIPER, W. N.
1918 - *Oligocäne und miocäne Ostracoden aus den Niederlanden*. Univ. Thesis, Groningen, 99 pp., 3 pls.
- KUYL, O. S., MULLER, J., AND WATERBOLK, H. T.
1955 - *The application of palynology to oil geology with special reference to western Venezuela*. Geol. Mijnb., n. s., vol. 17, no. 3, pp. 49-76, pls. 1-4, text-figs. 1-7.
- LATHAM, M. H.
1938 - *Some Eocene Ostracoda from northwest India*. Proc. Roy. Soc. Edinburgh, vol. 59, pt. 1, pp. 38-48, 15 text-figs.
- LIENENKLAUS, E.
1900 - *Die Tertiär Ostrakoden des mittleren Norddeutschlands*. Deutsch. Geol. Ges., Zeitschr., vol. 52, pp. 497-550, pls. 19-22, 10 text-figs.
- MANDELSTAM, M., ET, AL
1958 - *New genera and species of Ostracoda*. Microfauna USSR, vol. 9, Trudy VNIGRI, vol. 115, pp. 232-287.
- MARIANOS, A. W., AND VALENTINE, J. W.
1958 - *Eocene ostracode fauna from Marysville Buttes, California*. Micropaleontology, vol. 4, no. 4, pp. 363-372, pls. 1-2, text-figs. 1-4.
- MAURY, C. J.
1912 - *A contribution to the paleontology of Trinidad*. Acad. Nat. Sci. Philadelphia, Jour., ser. 2, vol. 15, p. 30.
1925 - *A further contribution to the paleontology of Trinidad*. Amer. Pal., Bull., no. 42, pp. 153-402.
- MEHES, G.
1911 - *Über Trias Ostracoden aus dem Bakony*. In: *Resultate der Wiss. Erforsch. Balatonsees, Bd. I*. Pal. Anhang, vol. 3, pp. 1-38.
- MONSOUR, E.
1937 - *Micropaleontologic analysis of Jackson Eocene of eastern Mississippi*. Amer. Assoc. Petrol. Geol., Bull., vol. 21, no. 1, pp. 80-96.
- MÜLLER, G. W.
1894 - *Die Ostrakoden des Golfes von Neapel und der angrenzenden Meeresabschnitte*. In: *Flora und Fauna des Golfes von Neapel; Monogr. 21*. Berlin: Zool. Stat. Neapel, pp. 1-404, pls. 1-40.
- MUNSEY, G. C.
1953 - *A paleocene ostracode fauna from the Coal Bluff marl member of the Naheola formation of Alabama*. Jour. Pal., vol. 27, no. 1, pp. 1-20, pls. 1-4, text-fig. 1.
- OERTLI, H. J.
1956 - *Ostrakoden aus der oligozänen und miozänen Molasse der Schweiz*. Schweiz. Pal. Abh., vol. 74, 119 pp.
1958 - *Les Ostracodes de l'Aptien-Albien d'Apt*. Inst. Franç. du Pétrole, Rev., vol. 13, no. 11, pp. 1499-1537.
- PALMER, D. L., AND BERMUDEZ, P. J.
1936 - *An Oligocene foraminiferal fauna from Cuba*. Soc. Cubana Hist. Nat., Mem., vol. 10, pp. 227-316, pls. 13-20.
- PIJPERS, P. J.
1933 - *Geology and Paleontology of Bonaire, (D.W.I.)*. Utrecht Univ., Geogr. Geol. Meded., Physiogr.-Geol., Reeks no. 8, pp. 103.
- PURI, H. S.
1952 - *Ostracode genera Cytheretta and Paracytheretta in America*. Jour. Pal., vol. 26, no. 2, pp. 199-212, pls. 39-40, text-figs. 1-16.
1956 - *Two new Tertiary ostracode genera from Florida*. Jour. Pal., vol. 30, no. 2, pp. 274-277, pls. 35-36.
1957a *Henryhowella, new name for Howella Puri, 1956*. Jour. Pal., vol. 31, no. 5, p. 982.
1957b *Stratigraphy and zonation of the Ocala group*. Florida Geol. Survey, Geol. Bull., no. 38, pp. 248, 30 pls., 2 tables, text-figs. 1-30.
1957c *Postscript notes on the ostracode subfamily Brachycytherinae*. Washington Acad. Sci., Jour., vol. 47, no. 9, pp. 305-306.
1958 - *Ostracoda subfamily Cytherettinae*. Gulf Coast Assoc. Geol. Soc., Trans., vol. 8, pp. 183-189.
- RENZ, H. H.
1942 - *Stratigraphy of northern South America, Trinidad and Barbados*. 8th. Amer. Sci. Congr., Proc., pp. 513-571, 1 table.
- RUTSCH, R.
1940 - *Die Gattung Tubulostium in Äocaen der Antillen*. Eclogae Geol. Helv., vol. 32, no. 2 (1939), pp. 231-244, 1 pl.
- SCHMIDT, R. A. M.
1948 - *Ostracoda from the Upper Cretaceous and Lower Eocene of Maryland, Delaware and Virginia*. Jour. Pal., vol. 22, no. 4, pp. 389-432, pls. 63-64.
- SOHN, I. G., AND BERDAN, H. M.
1952 - *Stratigraphic range of the ostracode genus Phanassymetria Roth*. Washington Acad. Sci., Jour., vol. 42, no. 1, pp. 7-12, text-figs. 1-6.

- STADNICHENKO, M. M.
1927 - *The foraminifera and Ostracoda of the marine Yegua of the type section*. Jour. Pal., vol. 1, no. 3, pp. 221-243, pls. 38-39.
- STEPHENSON, M. B.
1944 - *Ostracoda from the Reklaw Eocene of Bastrop County, Texas*. Jour. Pal., vol. 18, no. 5, pp. 448-454, 1 pl.
1946 - *Weches Eocene Ostracoda from Smithville, Texas*. Jour. Pal., vol. 20, no. 4, pp. 297-344, pls. 42-45, 1 text-fig., 1 chart.
- SUTER, H. H.
1951 - *The general and economic geology of Trinidad, B.W.I.* Great Britain, Colonial Geol. Survey, Colonial Geol. and Min. Res., vol. 2, no. 3, pp. 177-217, 17 tables, 4 maps.
- SUTTON, A. H., AND WILLIAMS, J. B.
1939 - *Ostracoda from the Weches formation at Smithville*. Jour. Pal., vol. 13, no. 6, pp. 561-574, pls. 63-64.
- SWAIN, F. M.
1946 - *Ostracoda from the Tertiary of Florida*. Jour. Pal., vol. 20, no. 4, pp. 374-383, pls. 54-55.
1948 - *Ostracoda from the Hammond well*. Maryland Dept. Geol., Mines, Water Resources, Bull., no. 2, pp. 178-213, pls. 12-14.
1951 - *Ostracoda from wells in North Carolina; Part 1 - Cenozoic Ostracoda*. U.S. Geol. Survey, Prof. Paper 234-A, pp. 1-58, pls. 1-7, figs. 1-3.
- TRIEBEL, E.
1958 - *Zwei neue Ostracoden-Gattungen aus dem Lutet des Pariser Beckens*. Senckenbergiana Lethae, vol. 39, nos. 1-2, pp. 105-117, pls. 1-3.
- VAUGHAN, T. W., AND COLE, W. S.
1941 - *Preliminary report on the Cretaceous and Tertiary larger foraminifera of Trinidad, B.W.I.* Geol. Soc. Amer., Spec. Papers, no. 30, pp. 1-85, 88-137, pls. 1-45, text-figs. 1-2, 3 tables.
- VEEN, J. E. VAN
1936 - *Nachtrag zu der bis jetzt erschienenen Revision der Ostrakoden der Maastrichter Tuffkreide und des Kunrader Korallenkalkes von Süd-Limburg*. Natuurh. Maandblad, vol. 25, no. 11-12, pp. 170-188, pls. 9-10.
- VOS, A. P. C. DE
1953 - *Three new commensal ostracods from Limnoria lignorum (Rathke)*. Beaufortia, vol. 4, no. 34, pp. 22-31, text-figs. 1-7.
- WARING, G. A.
1926 - *The geology of the Island of Trinidad, B.W.I.* Johns Hopkins Univ., Studies Geol., no. 7, pp. 101-109.
- WEINGEIST, L.
1949 - *The ostracode genus Eucytherura and its species in the Cretaceous and Tertiary of the Gulf Coast*. Jour. Pal., vol. 23, no. 4, pp. 364-379, pl. 73, table 1.
- WILBERT, L. J.
1953 - *The Jacksonian stage in southeastern Arkansas*. Arkansas Div. Geol., Bull. 19, pp. 100-125.