1965

Ecology, Distribution and Taxonomy of Recent Ostracoda of Laguna De Terminos, Campeche, Mexico.

Gustavo Adolfo Morales-frias

Louisiana State University and Agricultural & Mechanical College

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ECOLOGY, DISTRIBUTION AND TAXONOMY
OF RECENT OSTRACODA OF
LAGUNA DE TERMINOS, CAMPECHE, MEXICO

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Geology

by
Gustavo Adolfo Morales-Frias
B.S., Baylor University, 1960
M.A., University of Missouri, 1962
May, 1965
ABSTRACT

Laguna de Terminos is a littoral lagoon indenting the Gulf Coastal Plain in the western portion of the State of Campeche in southeastern Mexico. It is one of the lagoons presently being studied by the Instituto de Geologia in connection with the National Science Foundation to obtain more information on Mexico's coastal waters.

Thirty-nine species of ostracodes are described and figured, four of which are new. Distribution is shown for all species in the lagoon. Three moderately defined ostracode assemblages were found: (1) oyster bank, (2) marine washover delta, and (3) lagoonal assemblage. It was possible to observe the restriction of some of these species by calcium content, depth, turbidity and/or salinity.

Because of the wide range of temperature and salinity of the water, the ostracode population consists, for the most part, of euryvalent species.

The wide variation of the environments of several species of the same genus points out the danger of indiscriminant use of generic information for paleoecologic studies.
ACKNOWLEDGMENTS

I am above all deeply grateful to Drs. Henry V. Howe, Grover E. Murray, J. Keith Rigby, and W. A. van den Bold for their unflagging interest and constant keen understanding. These added immeasurably to the pleasure and satisfaction of the study.

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It is with great pleasure that I record my thanks to Mr. Lewis G. Nichols for his patience and skill on taking the photographs for the plates that accompany this report.

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Finally, a great many other people, both faculty and students, gave freely of their time and knowledge: My sincere thanks are hereby expressed to all of them.
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INTRODUCTION

The Laguna de Terminos (Fig. 1) on the Gulf Coast of Mexico has received considerable attention by scientists in the last few years. At the present time the foraminifera, diatoms, and micro-molluscs are being intensively studied by the personnel of the Instituto de Geologia of the Universidad de Mexico as a part of a larger project under the sponsorship of the Mexican government and the National Science Foundation to obtain more information on Mexico's lagoons and coastal waters. This report is the fifth of a series, part 5 of Boletin 67, of the Instituto de Geologia. The foraminifera, diatoms, and micro-molluscs have been described from the same sample, as well as the physical aspects of the sediment and the environment. It deals with the ostracodes and their distribution in the Laguna de Terminos and the possible influence of the environment on the relationships and assemblages of these crustaceans.

AREA OF STUDY

Laguna de Terminos (Fig. 2) is a littoral lagoon indenting the Gulf Coastal Plain in the western portion of
Location Map of
Laguna de Terminos,
Campeche, Mexico
the State of Campeche in southeastern Mexico between longitudes 91° 12' and 92° 00' W and latitudes 18° 25' and 18° 50' N. It has a maximum length of 70 kilometers and a maximum width of 27 kilometers. The lagoon is partially closed from the Gulf of Mexico by a sand barrier, Isla del Carmen, leaving two narrow passes between Isla Aguada and Paso Real in the east, and Ciudad del Carmen and Punta Zacatal in the west.

The lagoon receives fresh water from four major streams: Rio Palizada, Rio del Este, Rio Candelaria, and Rio Chompin. These streams do not empty directly into Laguna de Terminos, but into smaller estuaries which in turn are connected to Laguna de Terminos by small passes.

**SAMPLING**

The present study is based on material obtained by A. Yanez and A. Zarur in 1960. It includes 205 samples collected along 23 traverses; 120 of these samples yielded ostracodes (Fig. 2). The sample stations are located approximately two kilometers apart within the lagoon and one kilometer apart at the passes.

Two water samples were taken at each station to determine salinity, one from the surface and the other from the bottom
Fig. 2. COLLECTING STATIONS (black circles represent stations which yielded ostracodes)
of the lagoon.

At stations in which depth did not exceed three meters, bottom sediment samples were collected with a Lankford coring tube. The circular cross-section of this tube is ten square centimeters so that one centimeter of the core length produces a total volume of ten cubic centimeters. For this study the uppermost one centimeter of the core was utilized. At stations where depths exceeded three meters, samples were obtained with a Van Veen dredge. When the dredge was brought to the surface the Lankford coring tube was inserted into the sediments through a window in the upper portion of the dredge, and a sample was obtained. In every case ten cubic centimeters were set aside and utilized for faunal studies; the remainder being used for sedimentary analyses.

Each ten cubic centimeters of sediments was placed in a jar containing water from the sample site, to which a five per cent formaldehyde solution had been added, to preserve the protoplasm of the living specimens. Sodium borate was added to obtain an alkaline pH, thus neutralizing the acidity of the formaldehyde and avoiding destruction of ostracode tests. On arrival at the laboratory, samples were treated with a concentrated solution of Rose Bengal, to stain the
protoplasm of the specimens living at the time of the sampling, thus permitting differentiation between live and dead specimens.

OSTRACODE OCCURRENCE

From the original ten cubic centimeters of wet sediments all ostracodes were picked and mounted by conventional micropaleontological techniques. Occurrences of species were recorded in terms of single valves and these were then plotted on maps to show the localities from which they were collected. In order to avoid repetition in tabulation, only adult specimens were utilized in this phase of the study. The total number of adult valves of every species recorded at the various stations is tabulated in Table 1, and on distribution maps (Figs. 13 to 43).

TOTAL POPULATIONS

The term total population refers to the total number of living and dead specimens per unit of sample. Total populations of ostracodes at the various sample stations in Laguna de Terminos vary between 1 and 514. The ostracode populations are for the most part rather small; notable exceptions to this are found at stations 45, 58, 90 and 189.
Fig. 3. Distribution of surface water temperatures (After Yanez, 1963)
TEMPERATURE

Figure 3 shows the distribution of the surface temperature of the water in Laguna de Terminos. Although no distinctive pattern is apparent, waters in the vicinity of river mouths are generally slightly warmer than elsewhere in the lagoon.

The lagoon is so shallow that the lack of a distinct pattern in the distribution of temperatures is due possibly to daily changes in temperature. The differences which exist may very well be related to the time of the day during which the readings were taken; they also could be greatly influenced by the winds, proximity to shores, currents, and similar factors.

According to data obtained by the Mexican Meteorologic Service during the last eight years, the temperatures in Laguna de Terminos fluctuate between 17 and 36 degrees Centigrade. Most of the readings taken to date are in the upper ranges.

Figure 3 shows that water temperatures in March and April, 1959, varied between 26 and 32 degrees Centigrade.
Fig. 4. Bathymetry in fathoms (After Yanez, 1963)
DEPTH

Laguna de Terminos varies in depth from less than one fathom to five fathoms, most of it being between one and two fathoms. The greater depths occur in the passes at the eastern and western ends of Isla del Carmen (Fig. 4).

SALINITY

Ayala (1963, p. 17) postulated three zones based on the distribution of bottom salinities:

Pleiomesohaline = 8-18 ppm. Brackish waters
Polyhaline = 16-30 ppm.

Ultrahaline = More than 30 ppm.-- Marine waters

1. The pleiomesohaline zone is restricted to estuaries and adjacent lagoons; 2. the polyhaline zone has a predominant salinity of 28 ppm. and extends over the greatest portion of the lagoon; 3. the ultrahaline zones are restricted to the vicinity of the passes, especially in Boca de Paso Real where waters from the Gulf of Mexico invade part of the lagoon (Figs. 5 and 6).

Limits between these zones vary notably in position during various seasons. For example, in the dry season, when
Fig. 5. Distribution of bottom water in parts per thousand (March and April, 1959) (After Yanez, 1963)
Fig. 6. Distribution of water surface salinity in parts per thousand (March and April, 1959) (After Yanez, 1963)
there are smaller contributions of water by the rivers, practically all of the lagoon becomes ultrahaline. In May of 1963 all the stations sampled had salinities above 30 ppm. (Ayala, 1963, p. 19). On the other hand, salinity probably drops considerably during the rainy season.

According to Yanez (1963, p. 39), the surface of the lagoon, in the vicinity of river mouths, tends to be more strongly affected by the influx of fresh water than the bottom (compare Figs. 5 and 6). For the most part there is an over-all tendency for a parallel increase in salinity from the interior shores of the lagoon toward Isla del Carmen.

Salinity is such an extremely important ecologic factor that Ayala (1963, p. 19) believes it to be one of the determining factors influencing the distribution of foraminifers in Laguna de Terminos.

**SEDIMENT TYPES**

Grain size distribution of the sediments of Laguna de Terminos, based on Shepard and Moore's classification (1955) is shown in Figure 7.
Fig. 7. Grain size distribution based on Shepard and Moore's (1955) classification. (After Yanez)
Figure 8 shows the sediment distribution based on Wentworth's scale, and subdivided into the main sand, silt, and clay sizes.

Extensive reefs of *Crassostrea virginica* are found in the mouths of rivers, where they enter the lagoon. The presence of a number of ostracode species in the area of these reefs which have not been noted elsewhere suggests that the reefs form a favorable habitat for a great variety of smaller organisms. According to Hedgepeth (1957, p. 722) the most significant aggregates found in estuaries are those formed by oysters and mussels. He considers reefs to be a major factor in the alteration of sedimentation patterns in bay bottoms, and one of the causes of sedimentation of bays into smaller sedimentary units.

**ENVIRONMENTS OF DEPOSITION**

Laguna de Terminos has been subdivided into areas which present sedimentary conditions distinctive enough to be separated from each other (Fig. 9). Seven divisions have been made and their description and characteristics follow.

1. Interior areas of relatively uniform deposition.- These areas do not show abrupt or appreciable changes in
Fig. 8. Distribution of sediment types based on Wentworth's scale (After Yanez, 1963)
sedimentary processes and result from relatively uniform ecologic conditions. Terrigenous materials are rare, commonly less than two per cent of the coarse fraction of the samples, the majority being composed of tests of microorganisms, foraminifera, ostracodes, and micro-molluscs. Sorting is poor and the sediments are restricted to sand size particles.

2. **Marginal areas affected by river discharge.** According to Yanez (1963, p. 42) the lack of strong dynamic processes characterizes deposition of the sediments in this area, resulting in a region in which the sediments are poorly sorted. Sediments in this area are composed, for the most part, of equal amounts of sand, silt, and clay. Abundant organic matter is part of the non-clastic fraction.

3. **Interior areas of rapid deposition.** These areas represent optimum conditions of deposition. Interaction of salt and fresh water, and opposing currents create a loss of energy. These conditions prevail in relatively quiet areas in the interior of the lagoon and give rise to poorly sorted sediments in which silts and clays predominate.

4. **Washover delta.** In this area the geologic processes are very active in the transportation, deposition, and sorting of the sedimentary materials. The currents
Fig. 9. Environments of deposition (After Ayala, 1963)
along the coast move predominantly marine materials to the geographically favorable areas where tidal and wave currents transport this material toward the inside of the lagoon. The size and shape of the delta reflect the types of sedimentation allowed by the transporting agent as it loses energy at the contact with the relatively quiet waters of the lagoon. The sediments include coarse to fine detritus, and may include non-clastic and organic materials. Relatively coarse sands composed of shell fragments are found in the channels, whereas silts and clays are found in the quiet waters. Some of the finer materials are probably flocculated by the action of the salts dissolved in the sea water, forming muds composed predominantly of calcareous clays.

5. **Back barrier swamps.**—These areas have not been studied in great detail because of the inaccessibility of the terrain. Their areal extent was determined from aerial photographs.

6. **Open marine delta.**—The sediments northwest of Ciudad del Carmen have not been studied in as great detail as the sediments of other environments of deposition. However, the grain size analyses of samples from this area indicate that it is affected (1) by the action of the tidal currents which are strongly augmented by discharge of the
rivers, (2) by the action of the waves breaking in the frontal portion of the delta, and (3) by the presence of nearly still waters in some of the channels. The main channel is floored with sediments predominantly of gravel and sand size, but composed of shells. In the smaller channels, with nearly still water, silts and clays are abundant, whereas silts are predominant on the margins of the delta.

7. Oyster banks.- These areas are significantly affected by the influx of fresh river water and, accordingly, salinities in their vicinity are appreciably lower than elsewhere in the lagoon. These areas are floored by shells in situ and sediments of sand size.

CALCIUM CARBONATE IN THE SEDIMENTS

The percentage of calcium carbonate in the sediments was determined by the Sedimentology Department of the Instituto de Geologia. Generalized distribution of the CaCO$_3$ is shown in Figure 10.

Some general conclusions can be reached from these analyses:

1. The principal source of calcium carbonate is from waters of the Gulf of Mexico which invade the lagoon
Fig. 10. Distribution of calcium carbonate content in the sediments (After Yanez)
through Boca de Paso Real.

2. The CaCO$_3$ distribution pattern in the Laguna de Terminos suggests that little or no calcareous material is introduced by the waters of the Rio Candelaria even though they flow through limestone terrain of the southern Yucatan Peninsula.

3. The main rivers, estuaries, and subsidiary lagoons which empty into the southern and western portions of Laguna de Terminos carry in suspension terrigenous materials poor in calcium carbonate, thereby affecting the distribution of turbid waters and creating a distinct decrease in the CaCO$_3$ content in the sediments in the western portion of the lagoon.

4. Appreciable amounts of CaCO$_3$ seem to be trapped by the submerged vegetation growing in the eastern region of Laguna de Terminos.

5. Isla del Carmen is constituted, for the most part, of shells, shell fragments, and calcareous sand which may contribute some CaCO$_3$ to the lagoonal sediments.

6. Sediments with the highest percentages of CaCO$_3$ are located in the southern portion of Isla del Carmen and parts of Boca de Paso Real. They consist of sands composed essentially of shells and shell fragments.
WATER TURBIDITY

The rivers, estuaries, and lagoons which empty into the southwestern and western portions of Laguna de Terminos carry in suspension great amounts of fine terigenous material. Rio Chompin, in the southwestern portion, also contributes some terrigenous materials, but in smaller scale. Rio Candelaria and other rivers in the eastern portion of the lagoon have clear waters rich in calcium carbonate with minor amounts of terrigenous material.

Two distinguishable zones, one of clear water rich in submerged vegetation, and another of turbid water poor in submerged vegetation, are known in Laguna de Terminos. The zonation is brought about by (1) the diverse sources of terrigenous material, (2) the general gulfward movement of lagoonal waters through Boca de Ciudad del Carmen, (3) the effect of marine water penetrating the lagoon through Boca de Paso Real, and (4) the east-west tidal currents in the lagoonal side of Isla del Carmen.

Submerged vegetation in the zone of clear waters consists largely of *Thalassia testudinum* and *Diplantera wrightii*; the zone of turbid waters is for the most part devoid of vegetation (Fig. 11).
Fig. 11. Distribution of clear and turbid waters
(After Ayala, 1963)
The limits of these zones, which are not well defined, vary in the different seasons of the year depending on the influx of the rivers and the movement of water in the lagoon.

**SUBMERGED VEGETATION**

Zarur (1961), in his reconnaissance report on Laguna de Terminos, lists the submerged vegetation observed in 25 stations, most of them near the shores of the lagoon. He cites the presence of numerous blue, green and red algae and three species of monocotiledonous plants: *Thalassia testudinum*, *Diplantera wrightii*, and *Halophila engelmannii*.

*Thalassia testudinum* is the most abundant of these three forms and is probably the most important, geologically, in its role of sediment collector. *Diplantera wrightii* was found at numerous localities usually in association with *T. testudinum*. *Halophila engelmannii* was recorded at only one station where it was associated with the above mentioned forms.

Numerous plants live as epiphytes on the species above mentioned. Among them are some red algae whose skeletons may contribute significant amounts of CaCO$_3$ to the sediments.
The submerged monocotyledonous flora forms prairies near the shores of the lagoon, especially in the southern portion of Isla del Carmen, in the area with clear waters and higher calcium carbonate content in the sediments. Figure 11 shows the known distribution of *Thalassia testudinum* and *Diplantera wrightii* and includes Zarur's 1961 collecting stations.

Bernatowics (1952) in his study of Bermuda found *Diplantera wrightii* in the shallow protected bays growing on unconsolidated sandy or muddy bottoms. On the other hand, *Thalassia* and *Cymacodea* were found to grow on firm, consolidated bottoms.

After comparing the data obtained by Bernatowics, Thorne, Hedgepeth, Ginsburg and Lowenstam, Kornicker and Hoskins, and the data obtained by the personnel of the Instituto de Geologia in Laguna de Terminos, certain general conclusions can be reached:

1. The distribution of *Thalassia testudinum* and *Diplantera wrightii* seems to be controlled basically by the calcium carbonate in the sediments and by the clarity of the water.

2. The areas with thick growths of *Thalassia*, especially those in the vicinity of Isla del Carmen, represent the most
3. It is possible that the submerged vegetation may be connected with the origin and development of tidal swamps in the lagoonal portion of Isla del Carmen. This area is extremely rich in calcium carbonate, especially shell fragments. The shores of this area are now covered by mangroves. There are also large numbers of *Thalassia testudinum* in the vicinity which could have well prepared the area for mangrove invasion by the accumulation of calcareous material around their roots.

4. The turbidity of the waters and the presence or absence of abundant submerged vegetation seem to be, to a certain extent, a cause-and-effect relationship. Areas which lack vegetation are more susceptible to sediment agitation than the areas in which the bottom is protected by plant growth. On the other hand, the presence of vegetation acts as a veritable filter, straining all the material in suspension and fixing it to the bottom.

5. All this seems to be controlled by (1) the movements of the marine currents entering the lagoon through Boca de Paso Real and (2) the terrigenous-rich water of the Rio Palizada, which empties into the Gulf of Mexico through Boca de Ciudad del Carmen.
MANGROVES

Laguna de Terminos is surrounded, for the most part, by mangroves. They also extend around the periphery of the estuaries and subsidiary lagoons (Fig. 12).

According to Bruce Thom (personal communication) there are three species of mangroves living in this region: Rhizophora mangle, Avicennia nitida and Laganuncularia Racemosa.

Rhizophora mangle thrives best near shore and is usually found fringing the lagoon. Avicennia nitida is generally found farther away from the shores, although, according to Dr. R. J. Russell (personal communication), it may thrive equally well in more saline environments. Laganuncularia racemosa is for the most part found away from the shores in less moist substrates.

The zonation of mangroves is drastically altered by the nature of the substrate, currents, sediment types, salinity and rate of deposition.
Fig. 12. Mangrove distribution (After Ayala, 1963)
ECOLOGY
ECOLOGY

In the next few pages the ecology of all species identified during this study will be summarized. It should be emphasized, however, that even though all available factors have been considered in reaching the conclusions, the data could well be interpreted differently by some other worker.

The genera and species are listed in alphabetical order and are discussed individually by species.

Actinocythereis triangularis n. sp. seems to have a marked preference for terrains whose sediments contain 40 to 50 per cent CaCO₃. It decreases markedly in abundance away from these areas, the decrease being most abrupt where the calcareous content is highest.

In addition A. triangularis seems to prefer areas of clear waters and uniform deposition; it does not appear to be attracted by areas affected by the inflow of river waters. The bottom salinities of areas in which it is found vary only slightly, the known range being from 28 to 31 ppm. Furthermore, its most favorable habitat appears to be concentrated at a depth of approximately two fathoms, though
the greatest number of specimens yet observed was obtained between one and two fathoms (stations 58 and 87).

Specimens belonging to *Acuticythereis* sp. A were collected only at three stations. These stations were (1) in terrains where the CaCO$_3$ content of the sediments varies from 30 to 50 per cent, (2) in regions of uniform sedimentation, and (3) in the marginal area between the zones of clear and turbid waters.

Specimens of *Acuticythereis* sp. B were found in only one sample. The station from which it came is located (1) in Boca de Atasta, (2) in an oyster bank, (3) in an area of turbid waters affected by river inflow, (4) in a silty sand bottom, and (5) in a region with salinities of approximately 18 ppm.

With the exception of one specimen found in the sample from station 185, *Aurila amygdala* (Stephenson) is restricted to the washover tidal delta at the mouth of Boca de Paso Real. This is an area of: (1) clear waters, (2) salinities of almost exactly 38 ppm., and (3) bottom sediments which are sands and silty sands.
**Aurila floridana** Benson and Coleman tends to be concentrated in terrains whose sediments have a CaCO$_3$ content of 30-50 per cent; it is not known from areas where the sediment consists of less than 20 per cent calcium carbonate. For the most part it seems to avoid areas of fine muds and areas affected by the inflow of rivers.

*A. floridana* is found indiscriminately throughout sandy areas with salinities ranging from 25 to 39 ppm. It is unknown from terrains of clayey silts, silty clays, and sandy silts, and seems to show a slight preference for clear water.

**Bairdia bradyi** van den Bold is restricted to the sandy areas of the tidal delta of Boca de Paso Real where the sediment has a CaCO$_3$ of 60 to 70 per cent. It prefers clear waters with bottom salinities near 38 ppm.

**Basslerites minutus** van den Bold is known from only two localities, the ecologies of which are quite dissimilar. Station 189 is located at Boca de Paso Real in the area of a sandy sediment composed of 50 to 60 per cent CaCO$_3$. The water is clear and the bottom salinities are about 30 ppm. Station 45 in the western lagoonal interior is situated in
turbid waters, in the area of a sediment with a 40 to 50 percent CaCO$_3$ content and in an area of rapid deposition.

Only one specimen of *Cyprideis castus* Benson has been found to date. It is from an oyster bank, in an area influenced significantly by the discharge of the rivers. The sediment is sandy with a 10 to 20 percent CaCO$_3$ content and the bottom waters have a salinity of 18 ppm.

*Cyprideis mexicana* Sandberg is found mostly in the clear waters in the eastern portion of the lagoon. It seems to favor areas where the sediments have a CaCO$_3$ content of 20 to 30 percent, it declines in abundance as the CaCO$_3$ content decreases, and is completely absent from areas with sediments containing 10 to 20 percent CaCO$_3$.

*C. mexicana* is known mostly from areas of uniform deposition, being absent from areas of rapid deposition. It occurs in sands and clays but is scarce in silty terrains, and is most common in areas with water salinities of 25 to 30 ppm.

This species has been found throughout the lagoon and it does not seem to show a preference for any particular depth.
Cytherella aff. C. harpago Kornicker is found mostly in terrains where the CaCO₃ content of the sediments is 40 to 50 per cent.

Although it occurs in both clear and turbid waters the greatest concentration of specimens is found in clear waters, predominantly at depths of two fathoms.

This species does not seem to be affected by the rate of deposition; it is found primarily in areas of sands and silts, but is unknown in the present study from areas of clay deposition. It is restricted to waters with bottom salinities varying from 27 to 30 ppm.

Cytheromorpha paracastanea (Swain) is restricted to waters with salinities of 27 to 34 ppm. and to sands and silts. It is very rare in the areas influenced by river waters and is completely unknown, at this time, from areas of clay deposition. Conversely, it is most abundant in regions of uniform deposition, at depths of two fathoms.

Although Cytherura elongata Edwards does not apparently have a strong preference for sedimentary areas of a particular CaCO₃ content, it tends to be more abundant where the calcareous percentage exceeds 30 per cent; it is completely
absent in areas with a CaCO₃ content of less than 20 per cent.

Although this species is known from all depositional environments in the lagoon it is least abundant in the areas affected by rivers. On the other hand, it is present in great abundance at a depth of two fathoms.

Neither grain size nor salinity seem to have any appreciable effect on the distribution of this species, although no specimens have been found to date in areas with water salinities of less than 25 ppm.

*Cytherura radialirata* Swain is a euryvalent form which occurs mainly in areas with sediments varying in CaCO₃ between 20 and 50 per cent. It is completely absent from areas with 10 to 20 per cent.

It does not seem to be restricted to any environment of deposition or sediment type, and the salinity ranges from 23 to 38 ppm.

Turbidity does not have any noticeable effect on the distribution of this species.

*Cytherura sandbergi* n. sp. is a euryvalent species whose distribution does not seem to be restricted by either CaCO₃
content in the sediments, salinity, depth, grain size, or turbidity of the water.

**Haplocytheridea bradyi** (Stephenson) is apparently not affected by either CaCO$_3$ content, turbidity, environment of deposition or sediment type.

It tends to be concentrated in the middle of the lagoon in two fathoms of water and at Boca de Paso Real.

**Haplocytheridea setipunctata** (Brady) is most abundant in areas where sediments are 60 to 70 per cent CaCO$_3$; it decreases in abundance away from the highly calcareous areas and is absent in areas of less than 20 per cent calcareous sediment content.

It is found mostly in the area of the washover delta of Boca de Paso Real and in areas of uniform sedimentation, exclusively in clear waters.

It is found almost exclusively in sands at depths of two fathoms in the center of the lagoon and in Boca de Paso Real, in salinities ranging from 29 to 38 ppm.

**Hemicytherura cranekeyensis** Puri is found in two completely different ecologic settings. One occurrence is in clear waters with high salinities in the area of the washover
delta of Boca de Paso Real (stations 150, 189, 190, 192 and 194). The other occurrence, west of the lagoon, is in turbid waters resulting from the inflow of rivers carrying terrigenous material (stations 48 and 102). This form does not occur in areas of uniform or rapid deposition, but it does occur in sands and silts. It is not known at present from the depositional areas of clays.

Leptocythere nikraveshiae n. sp. occurs predominantly in areas where the sediments contain 40 to 50 per cent CaCO₃. It decreases in abundance proportionately in the areas of 40 to 20 per cent sedimentary calcium carbonate, and is absent from areas in which the sediment contains less than 20 per cent and more than 50 per cent CaCO₃.

L. nikraveshiae is found mostly in turbid waters but occurs throughout the lagoon in all environments of deposition except in the washover delta of Boca de Paso Real. It tends to be more abundant in the areas of uniform deposition and in areas containing sands and silts. It is not known to occur in regions of clay deposition.

Loxoconcha matagordensis Swain occurs predominantly in terrains with a sediment content of 30 to 50 per cent CaCO₃,
being particularly abundant in the 30-40 per cent range and
unknown where the calcareous content is less than 20 per
cent.

Though it occurs in both clear and turbid waters it
shows a marked preference for clear water and tends to be
concentrated in the eastern portion of the lagoon, particu-
larly at depths of two fathoms where bottom-water salinities
vary between 28 and 39 ppm. It is present mainly in the
sands near the center of the lagoon, being nearly absent
from clay areas. It exhibits a marked preference for areas
with relatively uniform deposition, and is nearly absent from
the areas affected by the rivers.

Loxoconcha purisubrhomboidea Edwards possesses a marked
preference for the turbid waters in the western portion of
the lagoon.

It is found mostly in areas of 40 to 50 per cent sedi-
mentary CaCO₃, being rare in the areas of 20 to 30 per cent
calcareous matter, and unknown where the calcium carbonate
content of the sediments is below 20 per cent. The form
also occurs where water salinities exceed 28 ppm. It tends
to be concentrated in the vicinity of both passes at depths
of one to two fathoms. It is present in the areas of sands and silts and it shows a slight preference for areas of uniform sedimentation, being rare in areas affected by the rivers, and absent or unknown in areas of clay deposition.

Loxoconcha aff. L. sarasotana Benson and Coleman is found in areas varying from 20 to 40 per cent sedimentary CaCO$_3$. It is absent or unknown from areas with higher and lower percentages of calcareous matter. It is found mostly in the zone of turbid waters; appears to be restricted to a salinity of 27 to 29 ppm. and to depths of two fathoms, and does not show an apparent preference for any particular environment of deposition. It is found in sediments with equal proportions of sand, silt and clay.

Megacythere johnsoni (Mincher) does not seem to be affected by either turbidity of the water, CaCO$_3$ content of the sediments, bottom salinity, grain size or environment of deposition. It is found at all depths, though it is rare in the vicinity of the passes. It is present in all depositional areas but apparently has a preference for areas of silt sedimentation.
Megacythere stephensoni Puri occurs mainly in areas with sediments which have a CaCO$_3$ of 30 to 50 per cent; it is apparently absent from sediments with less than 20 per cent calcareous material.

It is found in both clear and turbid waters and, though the greatest number of stations containing this form are in the zone of clear waters, the greatest number of specimens occurs in turbid waters.

This species is present in all depths of the lagoon, in salinities varying from 26 to 39 ppm. and in all environments of deposition; it tends to be concentrated in areas of uniform sedimentation and to be less abundant in areas affected by the rivers.

It occurs in sands and silts and is rare in the depositional areas of clays.

Neocaudites nevianii Puri is known mainly in areas with a sedimentary CaCO$_3$ content higher than 30 per cent; in areas with salinities varying between 28 and 39 ppm., being particularly abundant in the 38-39 ppm. range; and at depths of two fathoms in the center of the lagoon and in Boca de Paso Real.
It is found in all environments of deposition, though it apparently favors the washover delta of Boca de Paso Real and the areas of uniform sedimentation. It occurs in sands and silts, but it is unknown or absent from areas of clay deposition, and it is rare in the depositional areas influenced by the rivers.

Orionina bradyi van den Bold was found only in samples from stations 189 and 190 in Boca de Paso Real, an area of clear waters, sandy bottoms, with a sedimentary calcium carbonate content of 50 per cent to 70 per cent and a salinity of 38 ppm.

Although Paijenborchella (Neomonoceratina) mediterranea Ruggieri does not exhibit a marked preference for sedimentary areas with a particular amount of CaCO₃, it is absent from areas where the calcareous content is less than 20 per cent. Stations from which the highest number of specimens have been obtained to date are situated in areas of 40 to 50 per cent sedimentary calcium carbonate.

This species is widely distributed in most depositional environments in the lagoon; it is abundant in sands and it is absent or unknown in areas of clay deposition.
**Pellucistoma magniventra** Edwards is a species which prefers areas with a sedimentary CaCO₃ content between 20 and 60 per cent. It occurs in both clear and turbid waters without apparent preference, in salinities of 26 to 38 ppm. and in sands and silts. It is absent or unknown from areas of clay deposition.

**Perissocytheridea bicelliforma** Swain is present only in the sample from station 54 in Boca de Atasta, in an area of oyster banks greatly influenced by the rivers; the measured salinity of the water was 18 ppm. The bottom sediment is sandy and consists of 10 to 20 per cent CaCO₃.

**Perissocytheridea brachyforma** Swain is a euryvalent species; it does not reflect marked effect by either turbidity of the water, CaCO₃ of the sediments, environment of deposition, grain size, or sediment types.

**Perissocytheridea excavata** Swain has been recorded from samples from only four stations; it occurs in areas with sediments having a 10 to 50 per cent CaCO₃ content and waters with salinities varying from 18 to 30 ppm. There appears to be a marked preference for salinities lower than 26 ppm. and
for areas less than one fathom deep. Although grain size
does not seem to affect the distribution of this species,
it is found predominantly in sandy areas, and except for the
washover delta in the vicinity of Boca de Paso Real, it is
found throughout the lagoon.

*Perissocytheridea rugata* Swain is found in areas with a
sedimentary CaCO$_3$ content of 10 to 70 per cent; it is concen-
trated mostly in areas with 30 to 50 per cent of calcareous
matter.

This species occurs in both clear and turbid waters
but exhibits a marked preference for clear waters. It is
present throughout the lagoon in depths ranging from less
than a fathom to two fathoms, but is concentrated in the
center of the lagoon in depths of two fathoms.

Bottom salinities in the areas of its occurrence vary
from 23 to 38 ppm. Most specimens occur in waters with
salinities of 28 to 31 ppm.

Grain size does not seem to affect the distribution of
*P. rugata* as it is found in all environments of deposition,
particularly in the region of sand deposition.
Pumilocytheridea ayala n. sp. is restricted to sediments with a content of 20 to 50 per cent CaCO$_3$, but is most abundant in the 40 to 50 per cent zone. Neither turbidity of the water, grain size, nor depth seem to affect the distribution of this species which is found throughout the lagoon except in the washover delta. It occurs in sands and silts but is absent or unknown in areas of clay deposition.

Tanella gracilis Kingma lives in areas where the sediments have a CaCO$_3$ content of 20 to 70 per cent, but the form seems to prefer areas with calcareous content between 40 and 50 per cent. Although more stations containing this species occur in clear waters, the stations with the greatest number of specimens are in turbid water near the contact with clear water.

This species is found at depths from less than one fathom to four fathoms; it tends to be concentrated in the center of the lagoon, away from the shores and passes, near depths of two fathoms. It occurs in areas with bottom salinities between 25 and 38 ppm., being most abundant in the areas with 28 to 31 ppm. Although it is found in all sediment types, it is less common in the areas of sand deposition.
The distribution of *Xestoleberis rigbyi* n. sp. does not appear to be controlled primarily by the CaCO₃ content as it is found in areas where the sediments are 10 to 70 per cent calcareous matter.

It occurs in zones of turbid and clear waters and in depths of less than one fathom to two fathoms, but is concentrated at depths of about two fathoms.

Although it occurs in water with salinities between 18 and 39 ppm., it is most abundant in areas with salinities above 27 ppm. It is widely distributed throughout the lagoon, being most abundant in sandy areas and unknown in areas of clay deposition.
SYSTEMATIC DESCRIPTIONS

AND

DISCUSSIONS
SUPERFAMILY BAIRDIAE SARS, 1888

FAMILY BAIRDIIDAE SARS, 1888

GENUS BAIRDIA McCOY, 1884

Bairdia bradyi van den Bold

Pl. 1, figs. 4a-d

Bairdia foveolata Brady, 1868, Les fonds de la mer, Vol. 1, p. 56, pl. 7, figs. 4-6.


Bairdia bradyi van den Bold, 1957, Micropaleontology, Vol. 3, No. 3, p. 236, pl. 1, fig. 5.


**DIAGNOSIS:** A species of Bairdia distinguished by its highly arched dorsum and coarsely punctate carapace.

**MEASUREMENTS:** Length: .70-.83 mm.; height: .40-.45 mm.; width: .40 mm.

**OCCURRENCE:** Bairdia bradyi is found in stations 190, 193 and 194.

**DISTRIBUTION:** This species was originally described by Brady in 1868 as Bairdia foveolata from samples collected in Noumea, New Caledonia, and was later reported from New Providence in 1870 and from Bermuda in 1880. It has also been reported from the Miocene of Trinidad, and from the Recent of the Gulf of Mexico off the coast of Florida.

**REMARKS:** The specimens from Laguna de Terminos were compared with material collected by Pedro J. Bermudez from the northern coast of Cuba, and were found to be identical in
every respect except size—the Cuban forms being larger.

**Bairdia bradyi** differs from **Bairdopilata triangulata** Edwards by being smaller, less elongate, and more coarsely pitted.

**Bairdia bradyi** differs from **B. victrix** by being smaller and coarsely pitted.

**MATERIALS:** Figured specimens IGM 2670-2673 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8118-8119, H. V. Howe collection, Louisiana State University.

**FAMILY CYTHERELLIDAE SARS, 1866**

**GENUS CYTHERELLA JONES, 1849**

**Cytherella aff. C. harpago** Kornicker

Pl. 1, figs. 2a-c.

**Cytherella harpago** Kornicker, 1963, Micropaleontology, Vol. 9, No. 1, p. 67, text-figs. 30-32, 39-42.

**DIAGNOSIS:** A species of **Cytherella** distinguished by its finely punctate carapace, faint to well developed sub-dorsal sulcus, and by its cuneiform dorsal view, more
Fig. 13. Distribution of *Bairdia bradyi*, *Basslerites minutus*, *Cyprideis castus*
pronounced in females.

**MEASUREMENTS:** Males: length: .53-.57 mm.; height: .29-.30 mm.; width: .20-.21 mm. Females: length: .58-.62 mm.; height: .32-.37 mm.; width: .24-.25 mm.

**OCCURRENCE:** *Cytherella aff C. harpago* is found in stations 45, 58, 64, 87, 91, 93, 97, 107, 108, 110, and 112.

**DISTRIBUTION:** *C. harpago* was originally described from Recent material of the Great Bahama bank.

**REMARKS:** The material from Laguna de Terminos is very similar to *C. harpago*, but seems to have a less quadrate carapace, having the dorsal and ventral margins slightly rounded, and also seems to have much finer punctations. Unfortunately *C. harpago* was based and described on three specimens making adequate comparison with material from Laguna de Terminos difficult.

**MATERIALS:** Figured specimens IGM 2674-2675 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8120-8121, H. V. Howe collection, Louisiana State University.
Fig. 14. Distribution of *Cytherella* aff. *C. harpago*
FAMILY CYTHERIDEIDAE SARS, 1925

SUBFAMILY CYTHERIDEINAE SARS, 1925

GENUS CYPRIDEIS JONES, 1857

**Cyprideis castus** Benson

Pl. 1, figs. 1a-b.

**Cyprideis littoralis** (Brady).- Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 615, pl. 59, figs. 11a-c; text-figs. 38:5a-b.

**Cyprideis locketti** (Stephenson).- Swain, 1955, Jour. Paleontology, Vol. 29, No. 4 (part), pl. 64, fig. 13 (not p. 615; pl. 59, figs. 10a-c. = **Cyprideis salebrosa** van den Bold).

**Cyprideis (Goerlichia) castus** Benson, 1959, Kansas Univ., Paleont. Contr., art. 1, p. 46, pl. 2, figs. 4a-c; pl. 9, fig. 10.

**Cyprideis castus** Benson.- Sandberg, 1964, Acta Universitatis, Stockholm Contr. Geol. Vol. XII, p. 102, pl. VII, figs. 1-14; pl. VIII, figs. 1-9; pl. XVI, fig. 5; pl. XIX, fig. 11, pl. XX, fig. 12; pl. XXI, fig. 4; pl. XXIII, figs. 1-10.
**DIAGNOSIS:** A species of *Cyprideis* with a straight ventral margin and lacking marginal denticulations and posteroventral spines. It is distinguished by the presence of a strong posteroventral tab on right valve; weak, narrow posteroventral tab on left valve; reticulate surface and subcentral sulcus.

**MEASUREMENTS:** Length: .74 mm.; height: .41 mm.; width: .33 mm.

**OCCURRENCE:** *Cyprideis castus* is found in station 54 (fig. 13).

**DISTRIBUTION:** This species was originally described in 1955 as *Cyprideis littoralis* (Brady) by Swain from San Antonio Bay, Texas; it has been reported living in the Gulf of Mexico off the coast of Mississippi, Louisiana, Texas and Mexico. It has been observed both from the east and west coasts of Mexico.

**REMARKS:** The specimen illustrated is the only one found in Laguna de Terminos.

**MATERIALS:** Figured specimens IGM 2676 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.
Cyprideis mexicana Sandberg

Pl. 2, figs. 1a-b.

Cyprideis mexicana Sandberg, 1964, Acta Universitatis Stockholmiensis, Stockholm Contr. Geol., Vol. XII, p. 125, pl. XI, figs. 11-14; pl. XII, figs. 1-5; pl. XVII, figs. 1; pl. XX, figs. 1, 2; pl. XXII, fig. 2, 9a-b.

**DIAGNOSIS:** A species of Cyprideis with a straight ventral margin. It is distinguished from C. castus by its smooth carapace and lack of posteroventral tabs.

**MEASUREMENTS:** Males: length: .81-.87 mm.; height: .41-.43 mm.; width: .33-.34 mm. Females: length: .73-.79 mm.; height: .42-.47 mm.; width: .36-.37 mm.

**OCCURRENCE:** Cyprideis mexicana is found in stations 68, 79, 90, 112, 117, 118, 135, 137, 142, 153, 155, 159, 160, 163, 168, 179, 180, 182, 183, 186, 189, and 193 being particularly abundant in station 135.

**DISTRIBUTION:** This species was originally described from Recent material from Laguna de Terminos and Laguna de Tamiahua.
Fig. 15. Distribution of Cyprideis mexicana
**REMARKS:** *Cyprideis mexicana* was in part described from material collected for this study and loaned to P. A. Sandberg for comparison with material from Laguna de Tamiahua (1964, p. 126).

**MATERIALS:** Figured specimens IGM 2677-2678 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8122-8123, H. V. Howe, Louisiana State University.

**GENUS HAPLOCYTHERIDEA STEPHENSON, 1936**

*Haplocytheridea bradyi* (Stephenson)

Pl. 2, figs. 2a-b.

*Cytheridea* (*Haplocytheridea*) *bradyi* Stephenson, 1938,

Jour. Pal., vol. 12, no. 2, pp. 129-132, pl. 23, fig. 22; p. 24, figs. 5-6; text-fig. 10.

*Haplocytheridea bradyi* (Stephenson).—Swain, 1955, Jour. Pal., vol. 29, no. 4, p. 618, pl. 59, fig. 12a-b.—Puri, 1960, Gulf Coast Assoc. Geol. Soc., Trans., vol. 10, p. 110, pl. 2, figs. 3-4; pl. 6, fig. 19; text-figs. 4-5.—Sandberg, 1964, Micropaleontology, vol. 10, no. 3, p. 362, pl. 2, figs. 7-16.

*Haplocytheridea bradyi* Swain (sic).—Byrne, LeRoy and
Riley, 1959, Gulf Coast Assoc. Geol. Soc., Trans., vol. 9, p. 240, pl. 4, fig. 10; pl. 5, fig. 11.

Cytheridea (Haplocytheridea) wadei Stephenson, 1941, Jour. Pal., vol. 15, no. 4, pp. 428-429, text-figs. 3-4, 14-18.

Haplocytheridea wadei (Stephenson).- Puri, 1954, Florida, Geol. Survey, Geol. Bull., no. 36, p. 231, pl. 3, figs. 5-6, text-fig. 3g.

Cytheridea (Haplocytheridea) proboscidiala Edwards, 1944, Jour. Pal., vol. 18, no. 6, pp. 508-509, pl. 85, figs. 8-11.

Haplocytheridea proboscidiala (Edwards).- Benson and Coleman, 1963, Kansas, Univ. Pal. Contr., Arthropoda 2, pp. 28-29, pl. 3, figs. 4-9; text fig. 15.


= ? Haplocytheridea subovata (Ulrich and Bassler)

**DIAGNOSIS:** A species of Haplocytheridea distinguished by its elongate outline, nearly straight ventral margin, gently arched dorsum and strong random pits which tend to become obscure toward the periphery.
**MEASUREMENTS:** Males—length: .74-.81 mm.; height: .40-.43 mm.; width: .30-.32 mm. Females—length: .67-.74 mm.; height: .40-.43 mm.; width: .32-.36 mm.

**OCCURRENCE:** *Haplocytheridea bradyi* is found in stations 34, 45, 54, 57, 58, 60, 64, 68, 76, 77, 79, 90, 91, 93, 94, 96, 99, 101, 102, 107, 108, 111, 112, 113, 119, 124, 135, 138, 142, 149, 158, 159, 168, 188, 189, 190, 193, 194, and 195.

**DISTRIBUTION:** *Haplocytheridea bradyi* was originally described from the Pliocene Caloosahatchee marl of Florida; it has been reported from the Miocene Duplin marl of North Carolina and the Choctawhatchee formation of Florida. It has also been reported from the Recent Gulf of Mexico from Florida to Mexico, and in Puerto Rico.

**REMARKS:** The ornamentation of *H. bradyi* in the specimens from Laguna de Terminos is quite variable, ranging from nearly smooth to coarsely pitted. All specimens found displayed reversal of the hinge elements.

**MATERIALS:** Figured specimens IGM 2679-2680 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8124-8125, H. V. Howe collection,
Fig. 16. Distribution of Haplocytheridea bradyi
Louisiana State University.

**Haplocytheridea setipunctata** (Brady)

Pl. 2, figs. 3a-c.

**Cytheridea setipunctata** Brady, 1869, *Les fonds de la mer*, vol. 1, p. 124, pl. 14, figs. 15-16.

**Cytheridea** (Haplocytheridea) **ponderosa** Stephenson, 1938, Jour. Pal., vol. 12, no. 2, pp. 133-134, pl. 23, fig. 10; pl. 24, figs. 1-2.


**Haplocytheridea** cf. **H. ponderosa** (Stephenson).—Curtis, 1960, *ibid.*, p. 478, pl. 2, fig. 9.

**Cytheridea** (Leptocytheridea) **sulcata** Stephenson, 1938, Jour. Pal., vol. 12, no. 2, pp. 139-140, pl. 23, fig. 2.

**Cypredes floridana** Puri, 1960, Gulf Coast Assoc. Geol. Soc., Trans., vol. 10, p. 100, pl. 2, fig. 5; text—figs. 1-3 (not *Cytheridea floridana* Howe and Hough, 1935).

**Haplocytheridea bassleri** Stephenson.— Swain, 1955 (part), Jour. Pal., vol. 29, no. 4, pp. 617-618, pl. 59, fig. 9a not pl. 59, fig. 9b = *Cyprideis ovata* (Mincher)


(? **Cytheridea puncticillata** Brady.— Tressler and Smith, 1948 (part), Chesapeake Biol. Lab., Publ., vol. 71,
pl. 1, fig. 2 (female specimens only; males = 
Cyprideis sp.) (not Cytheridea puncticillata Brady, 
1865).

Haplocytheridea setipunctata (Brady).- Sandberg, 1964, 
Micropaleontology, vol. 10, no. 3, p. 361, pl. 1, 
figs. 10-14; pl. 2, figs. 1-4.

DIAGNOSIS: A species of Haplocytheridea distinguished 
by its large size, coarsely punctate carapace, oval outline 
and somewhat angular dorsal margin.

MEASUREMENTS: Length: .98-1.13 mm.; height: .57-
.71 mm.; width: .50 mm.

OCCURRENCE: Haplocytheridea setipunctata is found in 
stations 58, 140, 142, 153, 155, 160, 189, 193, 194, and 
195.

DISTRIBUTION: This species was originally described 
by Brady from Recent material from the Bahamas; it has been 
reported from the Miocene Choctawatchee and Pliocene 
Caloosahatchee formations of Florida. It has also been 
reported from the Recent Gulf of Mexico from Florida to 
Mexico, and Puerto Rico.
Fig. 17. Distribution of *Haplocytheridea setipunctata*
MATERIALS: Figured specimens IGM 2681-2683 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8126-8127, H. V. Howe collection, Louisiana State University.

FAMILY CYTHERIDEIDAE SARS, 1925

SUBFAMILY NEOCYTHERIDEIDINAE PURI, 1957

GENUS HULINGSINA PURI, 1958

Hulingsina aff. H. rugipustulosa (Edwards)

Pl. 1, fig. 3.

Cytherideis rugipustulosa Edwards, 1944, Jour. Paleontology, vol. 18, no. 6, p. 514, pl. 86, figs. 5-7.

DIAGNOSIS: A species of Hulingsina distinguished by its surface ornamentation consisting of low ridges paralleling the outline of the valves, and by a sulcus located posterior of anterodorsal cardinal angle and disappearing near midheight.

MEASUREMENTS: Length: .66 mm.; height: .26 mm.

OCCURRENCE: Hulingsina aff. H. rugipustulosa is found in Station 46.
DISTRIBUTION: This species was originally described from the Miocene Duplin Marl of North Carolina.

REMARKS: Only the specimen illustrated was found in Laguna de Terminos. Hulingsina rugipustulosa is generally more coarsely ornamented, less high at the posterior region, has a more pronounced posterodorsal cardinal angle, and has the sulcus located immediately behind the anterodorsal cardinal angle, closer to anterior margin.

MATERIALS: Figured specimen IGM 2684 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.

FAMILY CYTHERIDEIDAE SARS, 1925

SUBFAMILY PERISSOCYTHERIDEINAE VAN DEN BOLD, 1963

GENUS PERISSOCYTHERIDEA STEPHENSON, 1938

Perissocytheridea bicelliforma Swain
Pl. 3, figs. 1a-c.

Perissocytheridea bicelliforma Swain, 1955, Jour. Paleontology, vol. 29, no. 4, p. 621, pl. 51, figs. 3a-b; pl. 64, fig. 4.
Perissocytheridea Matsoni (Stephenson).- van den Bold, 1958, Micropaleontology, Vol. 4, No. 1, p. 71.

Perissocytheridea bicelliforma Swain.- van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 380, pl. 4, figs. la-d; pl. 12, fig. 11.

DIAGNOSIS: A species of Perissocytheridea distinguished by its smooth finely reticulate carapace.

MEASUREMENTS: Males: length: .48-.52 mm.; height: .24-.26 mm.; width: .25-.28 mm. Females: length: .40-.44 mm.; height: .21-.26 mm.; width: .23-.25 mm.

OCCURRENCE: Perissocytheridea bicelliforma is found in station 54.

DISTRIBUTION: This species was originally described from the Recent Gulf of Mexico of the Texas coast; it has also been reported from the Pliocene Talparo formation and Recent material from Trinidad. According to van den Bold (1963, p. 381): "A few possibly identical specimens have been found in the Saveneta Glaucanitic Sandstone Member of the Springvale Formation."

REMARKS: The only station where this species occurs
is located at the mouth of one of the major tributaries of Laguna de Terminos.

**MATERIALS:** Figured specimens IGM 2685-2687 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figures specimens nos. 8128-8130, H. V. Howe collection, Louisiana State University.

**Perissocytheridea brachyforma** Swain

Pl. 3, figs. 3a-3.

**Perissocytheridea brachyforma** Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 619, pl. 61, figs. 1a-3, 2a-e, 5a-g; text-figs. 33a, 39:6a-c.

Not **Perissocytheridea brachyforma** Swain.- Byrne et al., 1959, Gulf Coast Assoc. Geol. Soc., Trans., Vol. 9, pl. 4, fig. 8; pl. 5, fig. 14; pl. 6, fig. 5.

**Perissocytheridea brachyforma** Swain.- Curtis, 1960, Am. Assoc. Petr. Geol., Bull., Vol. 44, No. 4, pp. 483, 484, fig. 5; pl. II, fig. 10 (bottom); pl. III, fig. 3 (top).

**DIAGNOSIS:** A species of **Perissocytheridea** with a pointed posterior, strong, longitudinal ventral ridge, well
marked subdorsal sulcus and reticulate surface; reticulations generally becoming less strong in dorsal and anterior directions.

**MEASUREMENTS:** Males: length: 0.53–0.56 mm.; height: 0.28–0.30 mm.; width: 0.29 mm. Females: length: 0.48–0.52 mm.; height: 0.30–0.33 mm.; width: 0.26–0.28 mm.

**OCCURRENCE:** *Perissocytheridea brachyforma* is found in stations 39, 41, 42, 45, 52, 54, 55, 60, 69, 75, 76, 86, 90, 94, 95, 101, 103, 107, 108, 109, 111, 114, 135, 149, 152, 153, 168, and 194.

**DISTRIBUTION:** This species was originally described from the Recent of the Gulf of Mexico in the Texas coast; it has also been reported from the Louisiana coast.

**REMARKS:** *Perissocytheridea brachyforma* resembles *P. rugata*, but differs from it by being somewhat smaller in size, and having a strong, longitudinal, ventral ridge and a pointed posterior; the hingement is generally less well developed. The pointed posterior and the nodose to strongly ridged carapace seem to be characteristics of most molts of *P. rugata* and *P. brachyforma* making it at
Fig. 18. Distribution of *Perissocytheridea brachyforma*
times almost impossible to separate the molts of these species, even some of the last molts of _P. rugata_ and the adults of _P. brachyforma_. Were it not for the well developed marginal area in _P. brachyforma_ one would be inclined to include this species as the last molt stage of _P. rugata_.

**MATERIALS:** Figured specimens IGM 2692-2696 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8131-8133, H. V. Howe collection, Louisiana State University.

_Perissocytheridea excavata_ Swain

Pl. 3, figs. 2a-d

_Perissocytheridea brachyforma excavata_ Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 620, pl. 62, figs. 1a-c; text-fig. 33b.

**DIAGNOSIS:** A species of _Perissocytheridea_ distinguished by its pointed posterior, its rugose surface, and a hook-shaped ventral ridge separated from one or two prominent ridges on posterior region by a longitudinal furrow.

**MEASUREMENTS:** Males: length: .41-.42 mm.; height:
Fig. 19. Distribution of *Perissocytheridea excavata*
.21-.26 mm.; width: .22 mm. Females: length: .36-.41 mm.;
height: .22-.26 mm.; width: .20 mm.

**OCCURRENCE:** *Perissocytheridea excavata* is found in
stations 54, 163 and 164.

**DISTRIBUTION:** This species was originally described
from the Recent Gulf of Mexico of the Texas Coast.

**REMARKS:** *Perissocytheridea excavata* was originally
given subspecific assignation under *P. brachyforma* (Swain,
1955, p. 620). *P. excavata* differs from *P. brachyforma*
by being smaller, more triangular, by having stronger ventral
and posterodorsal ridges and a longitudinal furrow at mid-
height, and a less swollen posterior region in the males.
These differences are so striking, even in the molt stages as
to warrant specific assignation for *P. excavata*.

**MATERIALS:** Figured specimens IGM 2688-2690 Mi, Insti-
tuto de Geologia, U. N. A. M. micropaleontology collection;
non-figured specimens nos. 8134-8135, H. V. Howe collection,
Louisiana State University.
Perissocytheridea rugata Swain

Pl. 3, figs. 4a-e.

Perissocytheridea rugata Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 622, pl. 61, figs. 4a-b; pl. 62, figs. 6a-b; text-fig. 33c.

Perissocytheridea bicelliforma var. prosammia Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 622, pl. 62, figs. 8a-b.

Perissocytheridea brachyforma Swain.- Byrne et al., 1959, Gulf Coast Assoc. Geol. Soc., Trans., Vol. 9, pl. 4, fig. 8; pl. 5, fig. 14; pl. 6, fig. 5.

DIAGNOSIS: A species of Perissocytheridea distinguished by its highly swollen posterodorsal region and its coarsely reticulated carapace; reticulations generally becoming less strong in dorsal and anterior directions.

MEASUREMENTS: Males: length: .57-.61 mm.; height: .32-.33 mm.; width: .33-.36 mm. Females: length: .54-.57 mm.; height: .34-.36 mm.; width: .34-.36 mm.

OCCURRENCE: Perissocytheridea rugata is found in stations 14, 34, 42, 45, 57, 58, 60, 61, 62, 63, 64, 68,
Fig. 20. Distribution of *Perissocytheridea rugata*
DISTRIBUTION: This species was originally described from the Recent of the Gulf of Mexico in the Texas coast.

MATERIALS: Figured specimens IGM 2697-2701Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8136-8139, H. V. Howe collection, Louisiana State University.

Pumilocytheridea ayalai n. sp.

Pl. 4, figs. 3a-c.

DIAGNOSIS: A species of Pumilocytheridea distinguished by the presence of four anterior ridges which parallel anterior margin and continue to posterior region parallel to venter, and by the lack of a vertical posterior ridge.

DESCRIPTION: Carapace small, elongate, sublanceolate, highest at anterior cardinal angle, about one-third of the length from anterior margin. Anterior margin obliquely
rounded; dorsal margin slightly arcuate, slopes down toward posterior end, partly obscured by swollen posterodorsal portion of carapace; swelling more pronounced in left valve; posterior end narrowly rounded at junction with dorsal margin; ventral margin sinuate. Left valve overlaps right in anterodorsal and posterodorsal regions, less overlap along middle portion of dorsal and ventral margins. Right valve less wide and more angular in outline.

Ornamentation consists of four ridges parallel to anterior margin, becoming less distinct in a posterior direction; these ridges continue to posterior region of carapace and parallel ventral margin, well defined near margin, become obscured toward center; intervening spaces reticulate. Carapace coarsely reticulate; round reticulations form rows that parallel ventral and dorsal margins.

Faint submedian sulcus located in anterodorsal regions; more clearly visible in dorsal view, bound anteriorly by faint subcentral swelling.

In dorsal view, carapace elongate, lanceolate, sides nearly parallel, slightly convex; greatest width, just in front of sulcus in the area of subcentral swelling. Anterior
end roundly pointed; posterior end more pointed than anterior. Posterodorsal swellings form ridges which converge anteriorly forming an elongate triangle whose apex is located dorsad of sulcus. Line of contact along antero-dorsal sinuate.

Hinge in the right valve consists of short, terminal dental areas, the anterior with four cusps, the posterior with six, and a long, straight, crenulate median groove. On the corresponding bar of the left valve there are three small heart-shaped teeth at each end fitting into slightly deeper part of the groove of the right valve.

Marginal area broad in anterior end. Line of concrescence and inner margin not coincident in the ends, where the line of concrescence forms a short indented loop towards the outer margin. The indentations are caused by the wide beginnings of the radial pore canals; they are few in number, seven in the area of the anterior vestibule.

**MEASUREMENTS:** Holotype—length: .38 mm.; height: .16 mm.; width: .14 mm. Paratypes—length: .37-.42 mm.; height: .17-.18 mm.

**OCCURRENCE:** *Pumilocytheridea ayalai* is found in
REMARKS:  *Pumilocytheridea ayalai* bears some resemblance to the type species, *P. sandbergi*, but it can be distinguished from it by the generally more triangular outline, less angular posterodorsal region, and by the lack of a vertical ridge in the posterior region. In *P. sandbergi* the posterior region is compressed into a flat surface behind vertical ridge.

*Hemicytherideis* ? sp. of Swain (1955, p. 632, pl. 64, fig. 14) resembles *Pumilocytheridea ayalai*, but the lack of a dorsal view or internal morphology makes it impossible to make a definite assignation. The measurements given by Swain for these species agree quite closely with *P. ayalai*.

This species is named in honor of Dr. Agustin Ayala-Castanares, head of the micropaleontological research section of the Instituto de Geologia.

**MATERIALS:** Holotype IGM 2704 Mi; paratypes IGM 2705-2706 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; Paratypes nos. 8136-8137, H. V. Howe collection, Louisiana State University.
Fig. 21. Distribution of *Pumilocytheridea ayalai*
FAMILY CYTHERURIDAE G. W. MULLER, 1894

SUBFAMILY CYTHERURINAE G. W. MULLER, 1894

GENUS CYTHERURA SARS, 1866

Type-species: Cytherura gibba (O. F. Muller), 1785.

In 1957 Wagner erected the genus Semicytherura to accommodate all those forms of Cytherura endowed with a posterior loop of the inner lamella. Unfortunately this genus has been widely used by various authors. This report is a case against this genus. If the presence or absence of the posterior loop of the inner lamella were to be used as the sole criterion for the separation of Cytherura from Semicytherura, it would be apparent that the males and the females of many species would be placed in different genera. In the Gulf of Mexico it has been observed that the males of two of the three Cytherurid species which are abundant in Laguna de Terminos have this "characteristic" feature while the females are completely devoid of such feature. On the other hand, species such as Cytherura punctata Muller from the Gulf of Naples have present the loop of the inner lamella in both males and females. For this reason it is here
proposed that the genus *Semicytherura* be abandoned for lack of paleontological and biological practicality.

**Cytherura elongata** Edwards

Pl. 4, figs. 4a-c.


**DIAGNOSIS:** A species of *Cytherura* distinguished by its nearly straight dorsal and ventral margins, well developed caudal process, numerous longitudinal ribs connected transversally by shorter ones forming well developed rectangular pattern.

**MEASUREMENTS:** Males: length: .44-.46 mm.; height: .20-.21 mm.; width: .18-.20 mm. Females: length: .42-.45 mm.; height: .21-.22 mm.; width: .20-.21 mm.
OCCURRENCE: *Cytherura elongata* is found in stations 14, 37, 44, 45, 46, 58, 63, 64, 68, 75, 76, 77, 79, 81, 82, 84, 87, 90, 91, 93, 94, 95, 99, 101, 102, 103, 107, 108, 109, 110, 112, 123, 126, 139, 140, 142, 149, 152, 153, 155, 168, 170, 186, 189, 190, 193, 194, and 195 being particularly abundant in station 45.

DISTRIBUTION: This species was originally described from the Miocene Duplin marl of North Carolina; it has been reported from the Recent Gulf of Mexico in San Antonio Bay, Texas.

REMARKS: Dr. Phillip Sandberg compared the material from Laguna de Terminos with Edwards types and states: "I checked this one very carefully in the USNM. Most people think that *Cytherura elongata* is a *Cytherura* (sensu stricto) but it is not. The types have a distinct lobe of the innerlamella in posterior. The differences between your material and Edward's types seem not of specific value, but rather minor evolutionary changes that might be expected." (Personal communication, Dec. 7, 1964).

Edwards (1944, p. 526) contradicts himself on stating: "Shorter and higher individuals, probably females," and
Fig. 22. Distribution of *Cytherura elongata*
giving in the next paragraph the measurements of the females as being longer and higher than the males. The measurements of the Laguna de Terminos material do not agree with this statement; here the males are longer and generally less high. All the specimens measured were smaller than the specimens figured by Edwards.

The specimens illustrated by Swain in 1952 (pl. 7, figs. 24-25) differ from Edwards' material by being wider, by not being compressed at the posterior region, and by having a dorsally pointing caudal process.

**MATERIALS:** Figured specimens IGM 2707-2709 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8137-8139, H. V. Howe collection, Louisiana State University.

**Cytherura aff. C. forulata Edwards**

Pl. 4, figs. 7a-b

**Cytherura forulata** Edwards, 1944, Jour. Paleontology, Vol. 18, No. 6, p. 526, pl. 88, figs. 17-20.

Not **Cytherura forulata** Edwards.—Malkin, 1953, Jour. Paleontology, Vol. 27, No. 6, p. 789, pl. 80, figs. 22-24.
Cytherura forulata Edwards.- Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 628, pl. 64, figs. 10a-c; text-figs. 35c and 39:2a, b.


**DIAGNOSIS:** A species of Cytherura distinguished by its nearly straight ventral and sinuate dorsal which converge anteriorly, its highest and widest portions near posterior, by its very short caudal process obliquely pointing dorsally, and by a series of longitudinal ridges which converge anteriorly.

**MEASUREMENTS:** Length: .51 mm.; height: .28 mm.; width: .24 mm.

**OCCURRENCE:** Cytherura aff. C. forulata is found in station 161.

**DISTRIBUTION:** This species was originally described from the Miocene Duplin marl of North Carolina; it has been reported from the Recent Gulf of Mexico off the coast of Texas and Florida.
**REMARKS:** The specimen from Laguna de Terminos resembles Edward's *C. forulata* but does not show a well developed caudal process. Lack of material does not allow confirmation of possible sexual dimorphism.

Malkin (1953, p. 789) states: "Individuals belonging to this species *C. forulata* are shorter in proportion to height than those of *C. elongata* Edwards. In other respects they are similar and the two may be conspecific." The illustrations as well as the measurements given by Malkin agree quite closely with those of the females of *C. elongata* found in Laguna de Terminos.

*Cytherura forulata* differs from *C. elongata* by having a sinuate dorsal margin, anteriorly converging dorsal and ventral margins, by being highest and widest near posterior, by a caudal process which points obliquely in a dorsal direction and by having an ornamentation constituted mainly by longitudinal ridges with very faint cross ribs. *C. elongata* has straight, subparallel, dorsal and ventral margins, a posteriorly pointing caudal process located at midheight, and a reticulate surface.

**MATERIALS:** Figured specimen IGM 2715 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.
Cytherura radialirata Swain

Pl. 4, fig. 5.

Cytherura radialirata Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 626, pl. 63, figs. 8a-b; pl. 64, fig. 3; text-fig. 35a.

Monoceratina ? sp., Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 637, pl. 61, figs. 6a-b, text-fig. 34b.

DIAGNOSIS: A species of Cytherura distinguished by its subparallel, slightly sinuate, dorsal and ventral margins, by a series of strong ridges which either radiates from center of valves or tends to parallel dorsal and ventral margins, by its short, blunt caudal process, and by the highly swollen posterodorsal region in the males.

MEASUREMENTS: Males: length: .33-.36 mm.; height: .16-.17 mm.; width: .15-.16 mm. Females: .30-.33 mm.; height: .16-17 mm.; width: .13-14 mm.

OCCURRENCE: Cytherura radialirata is found in stations 34, 38, 39, 41, 44, 45, 46, 49, 57, 58, 64, 75, 78, 82, 84, 90, 91, 94, 95, 101, 102, 103, 107, 126, 138, 149, 150, 152, 153, 159, 167, and 168.
DISTRIBUTION: This species was originally described living in the Gulf of Mexico, San Antonio Bay, Texas.

REMARKS: All specimens illustrated by Swain (1955) are females; it is possible that he may not have found males in his material or failed to recognize them as such; plate 64, fig. 12a depicts a specimen that resembles the males of C. radialirata, but has an oblique anterior margin and does not seem to be quite as swollen in the posterodorsal region as the specimens in Laguna de Terminos.

There is a discrepancy between Swain's measurements and the ones obtained from Laguna de Terminos; the length of 0.36 mm. given by Swain for C. radialirata agrees with the observed data, but the height of 0.31 mm. is nearly twice that obtained in this study. Direct measurement of Swain's photographs shows the height to be about half the length agreeing with the proportions here obtained.

The specimens figured by Swain (1955, p. 637) as Monoceratina ? sp. are the molts of C. radialirata; material from Laguna de Terminos agree in size, shape, and ornamentation with the description and figures given by Swain.

MATERIALS: Figured specimen IGM 2710 Mi, Instituto de
Fig. 23. Distribution of Cytherura radialirata
Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8140-8143, H. V. Howe collection, Louisiana State University.

**Cytherura sandbergi** n. sp.

Pl. 4, figs. 6a-d

Not **Cytherura johnsoni** Mincher, 1941, Jour. Paleontology, vol. 15, no. 4, p. 343, pl. 47, figs. 1a-d.

**Cytherura johnsoni** Mincher.- Swain, 1955, Jour. Paleontology, vol. 29, no. 4, p. 627, pl. 64, figs. 8a-c; text-figs. 35b, 38: 8a-b, 39: 1a-c.

**Cytherura johnsoni** Mincher.- Puri and Hulings, 1957, Gulf Coast Assoc. Geol. Soc., Trans., vol. 7, p. 187, fig. 11.


**Cytherura johnsoni** Mincher.- Benson and Coleman, 1963, Univ. Kansas, Paleo. Contr., Art. 2, p. 31, pl. 6, figs. 1-5, text-figs. 18a-b.

figs. 7, 9; text-figs. 1la-c.

Cytherura johnsoni Mincher ?.—Bold, 1963, Micropaleontology, vol. 9, no. 4, p. 395, pl. 9, fig. 3.

**DIAGNOSIS:** A species of *Cytherura* distinguished by its ovoid carapace, curved dorsal and ventral margins, blunt short, caudal process, about ten longitudinal ridges which converge somewhat towards anterior, and by a series of smaller reticulating cross-ridges.

**DESCRIPTION:** Carapace ovoid, dorsal and ventral margins broadly rounded converging somewhat towards anterior; venter with sinuosity near anterior. Anterior margin obliquely rounded; posterior margin produced into a caudal process. Posteroventral region flattened to form a narrow keel; it starts at ventral sinuosity and ends against caudal process.

Surface ornamentation consists of about ten longitudinal ridges, some of which converge anteriorly; weak to strong oblique ridge runs from eye spot to midheight of anterior margin; weak to strong, reticulating cross-ridges; weak to prominent eye spot.

Hinge modified merodont; it consists in the right valve
of an anterior tooth joined to a posterior elongate tooth by a narrow groove which becomes wide and deep at both ends; left valve complementary.

Valves deep; marginal area wide; radial pore canals few, long, slightly curved, generally in pairs, not present in posteroventral region; narrow anterior vestibule; normal pore canals, few, widely scattered. Muscle scars not observed.

Sexual dimorphism strong; males larger and more elongate than females, subcuneiform in dorsal view, widest near posterior, display loop of the inner lamella in posterior, coincident with region of maximum width. Females smaller, more ovoid, lenticular in dorsal view, widest near middle.

Holotype: Male, complete carapace: length: .50 mm.; height: .26 mm.; width: .22 mm.

MEASUREMENTS: Males: length: .45-.50 mm.; height: .25-.28 mm.; width: .21-.24 mm. Females: length: .37-.43 mm.; height: .24-.27 mm.; width: .17-.19 mm.

OCCURRENCE: Cytherura sandbergi is found in stations 3, 34, 37, 38, 39, 41, 44, 45, 46, 47, 49, 54, 57, 58, 60, 62, 63, 64, 68, 69, 70, 76, 79, 80, 81, 84, 87, 90, 91, 93,
DISTRIBUTION: This species has been reported from the Upper Miocene Springvale Formation of Trinidad and from the Recent Gulf of Mexico from Florida, and Texas.

REMARKS: Comparison of Laguna de Terminos material with Mincher's types of *Cytherura johnsoni* proved these species to be different. *C. johnsoni* differs from *C. Sandbergi* by having nearly straight, subparallel dorsal and ventral margins, broadly rounded anterior, ornamentation mostly reticulate, without strong longitudinal ridges, caudal process at midheight, short and wide in left valve, narrow in right valve, posterior margin symmetrically oblique above and below caudal process, in left valve and by lacking a loop of the inner lamella in the posterior region.

*C. forulata* differs from *C. sandbergi* by having a broadly rounded anterior margin, sinuate dorsal and ventral margins, and by lacking a well developed caudal process and a posterior loop of the inner lamella.
Fig. 24. Distribution of *Cytherura sandbergi*
Named in honor of Dr. Philip A. Sandberg professor of Paleontology at the University of Illinois.

**MATERIALS:** Holotype IGM 2711 Mi; paratypes IGM 2712-2714 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; paratypes nos. 8144-8147, H. V. Howe collection, Louisiana State University.

*Cytherura* sp.

Pl. 4, fig. 1.

? *Cytherura costata* Muller.—Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 629, pl. 64, figs. 11a-b.

Not *Cytherura costata* Muller, 1894, Ostracoda Golfes von Neapel, p. 295, pl. 8, figs. 11, 15; pl. 32, fig. 33.


**DIAGNOSIS:** A species of *Cytherura* distinguished by its lanceolate carapace, subventral caudal process, and by a series of nearly parallel, longitudinal ridges which join
ventrad of midheight near anterior margin.

**MEASUREMENTS:** Length: .32 mm.; height: .13 mm.; width: .10 mm.

**OCCURRENCE:** Cytherura sp. is found in station 45.

**DISTRIBUTION:** This species has been reported living in the Gulf of Mexico in San Antonio Bay, Texas.

**REMARKS:** Only the specimen illustrated was found in Laguna de Terminos. This specimen resembles Swain's illustrations of *Cytherura costata* Muller (1955, pl. 64, figs. 11a-b).

Muller's *Cytherura costata* differs from *Cytherura* sp. by having longitudinal ridges which do not join ventrad of midheight near anterior margin, but continue straight and end individually against anterior margin, a broadly rounded anterior margin, a caudal process pointing dorsally, a very strong alate ridge near venter, less normal pore canals between ridges, and lacks a well defined anterior cardinal angle.

Puri (1960, p. 115) states: "The Florida specimens from locality No. 4 tentatively assigned to this species were
only found as molts." Lack of a specimen in slide 4737 of the H. V. Howe collection made it impossible to verify Puri's assignation.

**MATERIALS:** Figured specimen IGM 2702 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.

*Cytherura Swaini* van den Bold

Pl. 4, fig. 2

? *Cytherura costata* Muller.— Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 629, pl. 64, figs. 11a-b.

Not *Cytherura costata* Muller, 1894, Ostracoda Golfes von Neapel, p. 295, pl. 8, figs. 11, 15; pl. 32, fig. 33.


*Cytherura Swaini* van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 395, pl. 9, figs. 4a-b.

**DIAGNOSIS:** A species of *Cytherura* distinguished by its
lanceolate carapace, subventral posterior caudal process and by four longitudinal ridges, two of which form an elongated loop near midheight.

**MEASUREMENTS:** Length: .33 mm.; height: .14 mm.; width: .12 mm.

**OCCURRENCE:** *Cytherura swaini* is found in station 45.

**DISTRIBUTION:** This species was originally described from the Recent material of Chaguaramas Bay, Gulf of Paria; it has also been observed in the Miocene Springvale Formation and Pleistocene deposits of Trinidad; in the Gulf of Mexico it has been reported living in San Antonio Bay, Texas.

**REMARKS:** Van den Bold (1964, p. 396) pointed out that this species differs very slightly from *Cytherura costata* as described by Swain in 1955 (p. 629), where other longitudinal ridges are as prominent as the four ridges here mentioned. All the ridges in *C. costata* Swain are nearly parallel, but converge near anterior margin. However, these species are identical in all other respects and van den Bold suggests that the different development of the longitudinal ridges could be a local variation.
Comparison of the Laguna de Términos material with the paratypes showed these forms to belong to the same species. There seems to be a small variation in the width and length of the paratypes, the larger being also the wider. This could possibly be accounted by sexual dimorphism.

*Cytherura swaini* is a rare form in Laguna de Términos. The specimen illustrated is the only one found.

Another specimen was found in the same station, but has more ridges and seems to conform more closely to *Cytherura costata* Swain. Lack of material makes it impossible at this time to confirm or reject van den Bold's idea concerning the possible relationship between these two species (1964, p. 396).

**MATERIALS:** Figured specimen IGM 2703 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.

**GENUS HEMICYTHERURA ELOFSON, 1941**

*Hemicytherura cranekeyensis* Puri

Pl. 4, figs. 8a-b

*Hemicytherura clathrata* (Sars).– van den Bold, 1946, Contr. Study Ostracoda, p. 118, pl. 14, figs. 9-10.

Not *Cytherura clathrata* Sars, 1866, Vidensk.-Selsk,
Hemicytherura videns (Muller).—van den Bold, 1957, Micropaleontology, Vol. 3, No. 3, p. 245, (part, not pl. 4, fig. 12).

Not Cytheropteron videns Muller, 1894, Ostracoda des Golfes von Neapel, p. 303, pl. 20, figs. 2, 8.


Hemicytherura sp. van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 398, pl. 9, fig. 5.

**DIAGNOSIS:** A species of *Hemicytherura* distinguished by its broadly rounded dorsal margin, sinuate venter, well developed median, triangular caudal process which is compressed in dorsal view, and by 7 to 8 large reticulate pits surrounding 3 to 4 smaller subcentral pits.

**MEASUREMENTS:** Length: .28-.32 mm.; height: .14-.17 mm., width: .10-.11 mm.

**OCCURRENCE:** *Hemicytherura cranekeyensis* is found in stations 48, 102, 150, 189, 190, 192, and 194.

**DISTRIBUTION:** This species was originally described
Fig. 25. Distribution of *Hemicytherura cranekeyensis*
living in the Gulf of Mexico off the coast of Florida; it has been reported from the Miocene Brasso and Tamana formations of Trinidad.

**REMARKS:** The ornamentation of *Hemicytherura cranekeyensis* was described by Puri (1960, p. 115) as consisting of 12 pits, "4 pits are subcentrally arranged and around this subcentral pattern are additional 8 pits." Some of the reticulations in the floors of the larger pits were found to be quite strong in some specimens, and give in many instances the appearance of having an extra number of pits. Most specimens observed showed three pits in the subcentral region.

**MATERIALS:** Figured specimens IGM 2716-2717 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8148-8149, H. V. Howe collection, Louisiana State University.

**GENUS PARACYTHERIDEA G. W. MULLER, 1894**

*Paracytheridea vandenboldi* Puri

Pl. 7, fig. 6.

*Cytheropteron nodosum* Ulrich and Bassler, 1904, Maryland

Not *Cytheropteron nodosum* Brady, 1868, Recent British Ostracoda, p. 448, pl. 34, figs. 31-34.

*Paracytheridea nodosa* (Ulrich and Bassler).—Howe et al., 1935, Florida Dept. Conserv., Geol. Bull. 13, p. 37, pl. 3, fig. 7.

*Paracytheridea nodosa* (Ulrich and Bassler).—van den Bold, 1946, Contribution to Study of Ostracoda, p. 86, pl. 16, fig. 14.


*Paracytheridea vandenboldi* Puri.—Malkin, 1953, Jour. Paleontology, Vol. 27, No. 6, p. 780, pl. 79, fig. 5.

*Paracytheridea vandenboldi* Puri.—Puri, 1954, Florida Geol. Surv., Bull. 36, p. 238, pl. 3, fig. 7, text-fig. 5a-b.

*Paracytheridea vandenboldi* Pru.—Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 625, pl. 62, figs. 2a-b.


**DIAGNOSIS:** A species of *Paracytheridea* distinguished by its rugose surface, strong subcentral node, postero-dorsal swelling, strong ventral alae, and well marked sub-vertical sulcus.

**MEASUREMENTS:** Length: .62 mm.; height: .28 mm.

**OCCURRENCE:** *Paracytheridea vandenboldi* was found in station 193.

**DISTRIBUTION:** This species was originally described from the Miocene Yorktown formation of Maryland; it has also been reported from the Miocene of Florida, Cuba, and Guatemala, and the Recent of the Gulf of Mexico off the Florida, Louisiana, and Texas coast.

**REMARKS:** Only the figures specimen was found in Laguna de Terminos. It was compared with material from the type locality of the Yorktown formation and found to be conspecific; the only difference observed was a thickening of a short longitudinal ridge behind subcentral node crossing
subvertical sulcus.

**MATERIALS:** Figured specimen IGM 2764 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection.

**FAMILY HEMICYTHERIDAE PURI, 1953**

**GENUS AURILA POKORYN, 1955**

*Aurila amygdala* (Stephenson)

Pl. 5, figs. 6a-d.

*Hemicthere amygdala*, Stephenson, 1944, Jour. Paleontology,
Vol. 18, No. 2, p. 158, pl. 28, figs. 8, 9.

Vol. 43, No. 6, p. 176, pl. 1, fig. 3.

*Hemicythere amygdala*, Puri, 1954, Florida Geol. Surv.,
Bull. 36, pt. 3, p. 266, pl. 11, fig. 14.


*Aurila amygdala* (Stephenson), Benson and Coleman, 1963,
Univ. Kansas, Paleo. Contrib., Article 2, p. 36, pl. 8, figs. 6, 8, 9, figs. 22a-b.

**DIAGNOSIS:** A species of *Aurila* distinguished by its
Fig. 26. Distribution of *Aurila amygdala*
small, almond-shaped carapace, ornamented by concentric series of pits, which are circular near center of valves, becoming elongate near margins.

**MEASUREMENTS:** Length: .57-.60 mm., height: .34-.38 mm., width: .24-.28 mm.

**OCCURRENCE:** *Aurila amygdala* is found in stations 149, 185, 189, 190, 193, 194, and 195.

**DISTRIBUTION:** This species was originally described from the Oligo-Miocene of Texas; it has been reported from the Chipola, Oak Grove and Shoal Facies of the Alum Bluff Stage of the Miocene of Florida. It has also been reported from the Recent Gulf of Mexico living off the coast of Florida.

**MATERIALS:** Figured specimens IGM 2730-2733 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8150-8151, H. V. Howe collection, Louisiana State University.

*Aurila florigdana* Benson and Coleman

Pl. 5, figs. 5a-d.

**Aurilia (sic) conradi** (Howe and McGuirt).—Puri, 1960, Gulf Coast Assoc. Geol. Soc., Trans., Vol. 10, p. 130, pl. 3, figs. 9-10.


**Hemicythere cymba** (Brady).—Puri, 1960, Gulf Coast Assoc. Geol. Soc., Trans., Vol. 10, p. 129, pl. 3, figs. 7-8, text-figs. 29-30.


**DIAGNOSIS:** A species of **Aurila** distinguished by its almond-shaped carapace; by the presence of two ridges, one which starts at dorsal margin near middle and parallels posterior and ventral margins disappearing near midheight of anterior margin, and the other which starts at eye spot and runs obliquely to anterior margin disappearing about same height as other ridge; and by an evenly, somewhat
linear reticulate surface.

**MEASUREMENTS:** Length: .48-.55 mm.; height: .29-.34 mm.; width: .21-.27 mm.

**OCCURRENCE:** *Aurila floridana* is found in stations 14, 34, 39, 41, 44, 45, 48, 58, 60, 63, 64, 76, 77, 78, 79, 80, 81, 87, 90, 91, 93, 94, 96, 97, 99, 101, 102, 107, 108, 109, 110, 111, 125, 139, 140, 142, 149, 153, 155, 160, 161, 167, 168, 170, 182, 186, 189, 190, 193, 194, and 195 being particularly abundant in stations 161 and 170.

**DISTRIBUTION:** *Aurila floridana* is a common species in the Recent of the Gulf of Mexico and has been reported living off the coast of Florida, Louisiana, and Texas.

**REMARKS:** *Aurila floridana* was compared with the type specimens of *A. conradi* and was found to differ from it by having deeper valves, arcuate dorsal margin, triangular cross section, widest portion on ventral view located behind middle, better defined ornamentation consisting of nearly linear reticulations, and by its smaller size.

The ornamentation of *Aurila conradi* consists of round to elongated pits; two ridges, one of them paralleling the
ventral margin and the other on the posterior portion nearly at right angles to the ventral margin, especially in the left valve; three short ridges in the anterior region, one connected to the eye spot, and the other two connected to the anterior marginal rim at midheight and at the anteroventral region. Oblique anterior margin, nearly straight dorsal margin, nearly triangular outline. Lenticular ventral view, widest portion at midlength. The valves are shallow and have nearly parallel sides on dorsal view.

Aurila conradi has been reported from the Lower Miocene Arca Zone of Florida to the Recent. On closer examination it was found that the specimens that have been assigned to this species in the Upper Miocene and Pliocene belong to two other completely different species, which are neither Aurila conradi sensu Howe and McGuirt, 1935, nor the Recent species Aurila floridana.

The Caloosahatchee species differs from A. floridana by being much larger in size, more coarsely reticulated, by having smooth, non-reticulate pits, and broadly rounded dorsal and ventral margins.

MATERIALS: Figured specimens IGM 2726-2729 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection;
Fig. 27. Distribution of *Aurila floridana*
non-figured specimens nos. 8152-8155, H. V. Howe collection, Louisiana State University.

FAMILY LEGUMINOCYTHEREIDIDAE HOWE, 1961

GENUS ACUTICYTHEREIS EDWARDS, 1944

Acuticythereis sp. A

Pl. 5, figs. 1a-b.


Not Acuticythereis laevissima Edwards, 1944, Jour. Paleo., vol. 18, no. 6, p. 519, pl. 87, figs. 4-11.

DIAGNOSIS: A species of Acuticythereis distinguished by its subtriangular and smooth carapace.

MEASUREMENTS: Length: .54-.58 mm., height: .27-.28 mm.

OCCURRENCE: Acuticythereis sp. A is found in stations 34, 36, and 45.

DISTRIBUTION: Acuticythereis sp. A has been reported living off the west coast of Florida.
Fig. 28. Distribution of *Acuticythereis* sp. A
**REMARKS:** Acuticythereis laevissima Edwards from the Duplin Marl of North Carolina was compared with Acuticythereis sp. and found to differ by being larger, less triangular in outline, and by having a more arcuate venter.

Lack of material does not allow a detailed study of this species.

**MATERIALS:** Figured specimens IGM 2718-2719 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimen no. 8156, H. V. Howe collection, Louisiana State University.

Acuticythereis sp. B

*Pl. 5, figs. 4a-c*

**DESCRIPTION:** Subquadrate carapace, dorsal and ventral margins straight, nearly parallel. Anterior margin obliquely rounded, posterior margin narrowly rounded.

Lenticular in dorsal view, widest at midlength.


Marginal area narrow; wider at anterior and postero-
ventral region. Small vestibule in anterior. Radial pore canals numerous, straight.

Hinge holamphidont; it consists in the right valve of an anterior tooth, a deep socket connected to the posterior tooth by a shallow groove. Left valve complementary.

Muscle scars not observed.

**MEASUREMENTS:** Length: .53-.55 mm.; height: .26-.28 mm.; width: .22 mm.

**OCCURRENCE:** Acuticythereis sp. B. is found at station 54.

**REMARKS:** This species occurs only at one station. Not enough specimens were available for a detailed study.

**MATERIALS:** Figured specimens IGM 2723-2725 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8157-8158, H. V. Howe collection, Louisiana State University.

**GENUS BASSLERITES HOWE, 1937**

*Basslerites* minutus van den Bold

Pl. 5, figs. 3a-b.

Not Cythere teres Brady, 1870, Fonds de la mer, Vol. 1, pts. 12-14, p. 147, pl. 14, figs. 17-18.

Basslerites berchoni (Brady).- van den Bold, 1957, Micropaleontology, Vol. 3, No. 3, p. 244.

Basslerites berchoni (Brady).- van den Bold, 1958, Micropaleontology, Vol. 4, No. 1, p. 71.

Not Cythere berchoni Brady, 1870, Fonds de la Mer, Vol. 1, pts. 12-14, p. 117, pl. 14, figs. 3, 4.

Basslerites minutus van den Bold, 1958b, Micropaleontology, Vol. 4, No. 4, p. 405, pl. 3, fig. 8; pl. 5, figs. 5a-c.


? Basslerites cf. B. berchoni (Brady).- Curtis, 1960, Am. Assoc. Petr. Geol. Bull., Vol. 44, No. 4, p. 478, fig. 5; pl. 1, fig. 5; fig. 16.

**DIAGNOSIS:** A species of *Basslerites* distinguished by its small size, straight, parallel ventral and dorsal margins, and round to straight, oblique posterior margin.

**MEASUREMENTS:** Length: .38-.42 mm., height: .19-.23 mm., width: .16-18 mm.

**OCCURRENCE:** *Basslerites minutus* is found in stations 45 and 189 (fig. 13).

**DISTRIBUTION:** This species was originally described from the Gulf of Paria and has been reported from Lower Miocene to Recent sediments in Trinidad; in the Gulf of Mexico it has been reported living off the coast of Louisiana in the vicinity of the Mississippi Delta.

**REMARKS:** Specimens of *Basslerites minutus* from the Miocene of Trinidad were compared with material from Laguna de Terminos and found to be identical. The shape of the posterior region was found to be quite variable in specimens from both localities.

A hitherto undescribed species of *Basslerites* from the Upper Miocene Cubagua formation of Venezuela was compared with *B. minutus* and found to differ by being more ovoid in
outline and by having a stronger overlap of the valves along the dorsal and ventral margins.

*Basslerites argomega* is somewhat similar in shape to *B. minutus*, but is much larger and has a well defined horizontal "W" on the posterior region. Some specimens of *B. minutus* display some rugosity of the posterior region, but do not have any discernible pattern; others are completely smooth.

**MATERIALS:** Figured specimen IGM 2722 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimen no. 8159, H. V. Howe collection, Louisiana State University.

**FAMILY LEPTOCYTHERIDAE HANAI, 1957**

**GENUS LEPTOCYthere SARS, 1925**

*Leptocythere nikraveshae* n. sp.

Pl. 5, figs. 2a-b.

**DIAGNOSIS:** A species of *Leptocythere* distinguished by its small size, reticulate surface and by the presence of two sulci on anteromedian and anterodorsal regions, and by
the presence of a depression on the posteroventral region.

**DESCRIPTION:** Small, elongate carapace, gently arched dorsal and ventral margins; anterior margin broadly rounded, posterior narrowly rounded, with well marked posterodorsal angle. Left valve slightly larger than right. In dorsal view sides nearly parallel.

Surface ornamentation consists of fine reticulations near margins becoming larger and stronger near center. Surface of valves marked by three prominent depressions. Two sulci located subdorsally, one vertical located near midlength, the other, oblique, located near anterior margin. The third depression of the valves is found in the posteroventral region.

Hingement in right valve consists of an anterior, small, possibly bilobed tooth, an indistinct median element, and a stronger posterior tooth. Left valve complementary, median element a faintly crenulate bar.

Marginal area narrow, with looped radial pore canals.

Sexual dimorphism weak. Males tend to be higher at posterior region than females.

Muscle scars not observed.
Fig. 29. Distribution of *Leptocythere nikraveshae*
Holotype: A complete male carapace from station 94; length: .37 mm.; height: .18 mm.; width: .13 mm.

MEASUREMENTS: Length: .34-.37 mm.; height: .15-.18 mm.; width: .11-.13 mm.

OCCURRENCE: Leptocythere nikraveshae is found in stations 14, 34, 45, 48, 49, 61, 81, 90, 91, 94, 110, 111, 112, 124, and 140, being particularly abundant in station 94.

REMARKS: Named in honor of my colleague Mrs. Rashel Nikravesh Rosen.

MATERIALS: Holotype IGM 2721 Mi; paratype IGM 2720 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; paratypes nos. 8160-8161, H. V. Howe collection, Louisiana State University.

FAMILY LEPTOCYTHERIDAE HANAI, 1957

GENUS TANELLA KINGMA, 1948

Tanella gracilis Kingma

Pl. 7, figs. 1a-c.

Tanella gracilis Kingma, 1948, Contribution to the Knowledge
of Young Caenozoic Ostracoda from the Malayan Region, p. 88, pl. 10, fig. 7.

**DIAGNOSIS:** A species of *Tanella* distinguished by its slightly convex, nearly parallel dorsal and ventral margins, and its strongly reticulate surface which forms 3 to 4 chevron-shaped ridges at anteromedian region and a variable number of ridges paralleling anterior and posterior margins.

**MEASUREMENTS:** Length: .40-.42 mm., height: .17-.18 mm., width: .16-.17 mm.

**OCCURRENCE:** *Tanella gracilis* is a common form in Laguna de Terminos and is found in stations 14, 34, 37, 44, 45, 46, 58, 60, 61, 62, 63, 64, 68, 77, 78, 79, 80, 81, 82, 84, 86, 87, 90, 91, 93, 94, 95, 96, 97, 99, 102, 107, 108, 109, 110, 111, 112, 117, 122, 126, 139, 140, 142, 149, 150, 152, 153, 155, and 180, being particularly abundant in station 90.

**DISTRIBUTION:** This species was originally described from Atjeh, North Sumatra, and has been observed in various localities in the Indopacific Region and the north coast of Puerto Rico. In the Indopacific region it has been found in
Fig. 30. Distribution of Tanella gracilis
Recent and Pleistocene sediments.

**REMARKS:** Specimens from Laguna de Terminos were compared with Kingma's type material from Sumatra and found to be slightly smaller. Besides this minor difference in size the specimens are identical in every other respect. This is the first time this species has been recorded from this continent.

**MATERIALS:** Figured specimens IGM 2748-2750 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8162-8164, H. V. Howe collection, Louisiana State University.

**FAMILY LOXOCONCHIDAE SARS, 1925**

**GENUS CYTHEROMORPHA HIRSCHMAN, 1909**

**Cytheromorpha paracastanea** (Swain)

Pl. 6, figs. 1a-c.

*Leptocythere paracastanea* Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 640, pl. 62, fig. 7; pl. 63, figs. 1a-c; text-figs. 39, 5a-b.

DIAGNOSIS: A species of *Cytheromorpha* distinguished by the presence of fine reticulations in the anterior one-fourth of carapace and stronger rims and larger pits in posterior three fourths; transition rather sharp.

MEASUREMENTS: Males--length: .51-.57 mm., height: .23-.25 mm., width: .18-.21 mm.; females--length: .45-.50 mm., height: .23-.25 mm., width: .18-.21 mm.

OCCURRENCE: *Cytheromorpha paracastanea* is found in stations 3, 14, 44, 45, 46, 58, 60, 61, 81, 84, 87, 90, 91, 93, 99, 107, 108, 109, 110, 111, 112, and 124, being particularly abundant in station 45.

DISTRIBUTION: This species was originally described living in the Gulf of Mexico at San Antonio Bay, Texas; it has also been reported from the Louisiana coast in the vicinity of the Mississippi Delta.

REMARKS: The females of *Cytheromorpha paracastanea* differ from *C. castanea* (Sars) by having a more arched dorsum, ventral and dorsal margins converge less rendering
Fig. 31. Distribution of *Cytheromorpha paracastanea*
it less triangular and elongated. The males of both species are very similar in general outline, but *C. paracastanea* has a slightly more arched dorsal margin.

Swain (1955, p. 640) described this species as having variable ornamentation; no forms other than the ones showing strong reticulations were found in Laguna de Terminos. Judging by his illustrations one would be inclined to separate the forms in plate 63 from the single specimen illustrated in plate 62. The specimen in Laguna de Terminos are similar to the latter.

**MATERIALS:** Figured specimens IGM 2734-2736 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8165-8167, H. V. Howe collection, Louisiana State University.

**GENUS LOXOCONCHA SARS, 1866**

*Loxoconcha matagordensis* Swain

Pl. 6, figs. 4a-d.

*Loxoconcha matagordensis* Swain, 1955, Jour. Paleo. Vol. 29, no. 4, p. 629, pl. 63, figs. 9a-b; pl. 64, figs. 1a-b; Trans. Gulf Coast Assoc. Geol. Soc., vol. 7, p. 187,
fig. 11; Byrne et al., 1959, Trans. Gulf Coast Assoc. Geol. Soc., vol. 9, p. 243, pl. 4, fig. 12, p. 245, pl. 5, fig. 10; Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., vol. 10, p. 111, pl. 3, figs. 15, 16 (not text-figs. 39, 40).

**DIAGNOSIS:** A species of *Loxoconcha* distinguished by its straight dorsal margin in both valves, oblique anterior and posterior margins and a slightly sinuate ventral margin.

**MEASUREMENTS:** Males—length: .61-.63 mm.; height: .34-.36 mm.; width: .25-.27 mm. Females—length: .53-.55 mm.; height: .33-.35 mm.; width: .25-.27 mm.

**OCCURRENCE:** *Loxoconcha matagordensis* has been found in stations 14, 44, 45, 58, 62, 64, 79, 81, 84, 86, 87, 90, 91, 93, 94, 99, 102, 108, 109, 110, 111, 123, 126, 139, 140, 142, 149, 152, 153, 155, 161, 163, 164, 167, 170, 189, 190, and 194.

**DISTRIBUTION:** This species was originally described living in the Gulf of Mexico in San Antonio Bay, Texas, and has also been reported from the Florida and Louisiana
coasts.

**REMARKS:** Swain (1955, p. 629) in his description of *Loxoconcha matagordensis* states: "This species is close to one described by Edwards from the Duplin marl, Upper Miocene of North Carolina, but differs in the development of the subsidiary reticulate network of weak surface ridges." The species to which Swain makes reference seems to be *L. purisubrhomboidea*; upon examination of Miocene specimens from the Duplin marl of North Carolina as well as Recent material from Laguna de Terminos it has been possible to observe that besides the "reticulate network of weak surface ridges," which may be very faint in some specimens, *L. matagordensis* differs from *L. purisubrhomboidea* in the general outline of the carapace, in having a nearly straight dorsal margin in both valves, coarser pitting, a more oblique posterior margin nearly parallel to anterior margin, its larger size, and different height-length ratio.

**MATERIALS:** Figured specimens IGM 2744-2747 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8168-8170, H. V. Howe collection, Louisiana State University.
Fig. 32. Distribution of Loxoconcha matagordensis
Loxoconcha purisubrhomboidea Edwards

Pl. 6, figs. 3a-e.


Not Loxonconcha subrhomboidea Brady, 1880, Challenger reports, vol. 1, part 3, p. 121, pl. 28, figs. 4a-d.


Not Loxoconcha cf. L. Purisubrhomboidea Edwards.- Curtis, 1960, Am. Assoc. Petr. Geol., Bull., vol. 44, no. 4, p. 481, figs. 5, 8; pl. I; fig. 21; pl. II; fig. 11 (top), fig. 16 (bottom).
Loxoconcha reticularis Edwards.- Malkin, 1953, Jour. Paleontology, vol. 27, no. 6, p. 787, pl. 80, fig. 13;
(not figs. 14-17 = L. reticularis).

**DIAGNOSIS:** A species of Loxoconcha distinguished by its finely and evenly pitted surface, flattened postero-dorsal region to form a keel, and by the broadly rounded dorsal margin of the left valve.

**MEASUREMENTS:** Males: Length: .53-.55 mm.; height: .30-.32 mm.; width: .21-.23 mm. Females: length: .46-.49 mm.; height: .30-.32 mm.; width: .20-.21 mm.

**OCCURRENCE:** Loxoconcha purisubrhomboidea has been found in stations 3, 10, 34, 36, 37, 44, 45, 46, 48, 101, 149, 189, and 193, being particularly abundant in stations 44 and 45.

**DISTRIBUTION:** This species was originally described from the Miocene Duplin Marl of North Carolina; it has also been observed from the Recent of Colon Harbor, Panama.

**REMARKS:** Loxoconcha rhomboidea of van den Bold (1963) resembles L. purisubrhomboidea, but the females differ by being more ovate in outline, and by having a very weak
Loxoconcha purisubrhomboidea

GOLFO DE MEXICO

Boca Nueva
Ensenada
Isla Aguada
Paso Real

Fig. 33. Distribution of Loxoconcha purisubrhomboidea
sinuosity of the ventral margin. The males lack also the well marked ventral sinuosity, they are about the same length but higher; posteroventral margin tends to be more oblique, in some cases nearly parallels anterior margin giving specimens truly rhomboid shape.

**Loxoconcha ochlockonensis** Puri differs from **L. purisubrhomboidea** by having a small ala near the postero-dorsal cardinal angle, and by having a nearly straight dorsal margin in both valves.

**L. purisubrhomboidea** was compared with material collected by van den Bold off Colon Harbor, Panama, and found to be identical.

**MATERIALS:** Figured specimens IGM 2739-2743 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8171-8173, H. V. Howe collection, Louisiana State University.

**Loxoconcha aff. L. sarasotana** Benson and Coleman

Pl. 6, figs. 2a-b.

? **Loxoconcha australis** Brady.- Swain, 1955, Jour. Paleontology, vol. 29, No: 4, p. 630, pl. 63, fig. 11; pl. 64, fig. 2.


**DIAGNOSIS:** A species of *Loxoconcha* distinguished by its nearly straight dorsal and ventral margins, short caudal process, more noticeable in females, and by its evenly reticulate surface.

**MEASUREMENTS:** Male—length: .57 mm.; height: .33 mm.

Females—length: .47-.53 mm.; height: .30-.33 mm.

**OCCURRENCE:** *Loxoconcha aff. L. sarasotana* is found in stations 68, 79, 102, and 103.
DISTRIBUTION: L. sarasotana was originally described from the Gulf of Mexico off the coast of Florida.

REMARKS: This species has been referred to L. sarasotana, the closest described species. It differs from L. sarasotana by the slightly different outline, ornamentation and by the lack of the characteristic ridge surrounding the carapace. This is a, hitherto undescribed, common form in the Gulf of Mexico and has been observed from samples collected by H. V. Howe in Grand Isle, Louisiana, Galveston Beach and Corpus Christi, Texas. I believe this to be the form referred to L. australis by Swain and Malkin, but lack of type material makes confirmation impossible. The specimen figured by Puri (1960, p. 111, figs. 33, 34, and 38) as L. australis Brady is actually L. sarasotana. Lack of material from Laguna de Terminos makes it impractical at this time to erect a new species.

MATERIALS: Figured specimens IGM 2737-2738 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimen no. 8174, H. V. Howe collection, Louisiana State University.
Fig. 34. Distribution of *Loxoconcha aff. L. sarasotana*
FAMILY PARADOXOSTOMATIDAE BRADY AND NORMAN, 1889

SUBFAMILY CYTHEROMATINAЕ ELOFSON, 1938

GENUS MEGACYTHERE PURI, 1960

Type-species: **Megacythere robusta** Puri, 1960, Gulf Coast Assoc. Geol. Soc., Trans., p. 122, pl. 2, figs. 14, 15; text-figs. 10, 11.

There is some question as to the validity of the genus *Megacythere* and its possibly synonymy with the genus *Paracytheroma* (Bold, 1963, p. 408; Benson and Kaesler, 1963, p. 27). At the present time the acceptance of *Paracytheroma* is paleontologically impractical since this genus was conceived and described exclusively on soft parts without any consideration to carapace morphology. Since species of the genus *Megacythere* have been described from the fossil record of North America this genus is adopted for the present study.

*Megacythere johnsoni* (Mincher)

Pl. 7, figs. 3a-b

*Microcythere johnsoni* Mincher, 1941, Jour. Paleontology, Vol. 15, No. 4, p. 344, pl. 47, figs. 4.
Cytherura similis Sars var. meridionalis van den Bold, 1946, Contr. study Ostracoda Caribbean Region, p. 119, pl. 9, figs. 21a-b.


Microcythere johnsoni.- Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 641, pl. 63, figs. 2a-c, pl. 64, fig. 7, text-fig. 39:3.

Microcythere johnsoni.- van den Bold, 1957, Micropaleontology, No. 3, p. 327, pl. 4, fig. 1.


? Paracytheroma costata Hartmann, 1957, Comunicaciones, Year VI, Nos. 3-4, p. 107, figs. 124-130.


Megacythere johnsoni.- Benson and KAESLER, 1963, Univ. Kansas
Paracytheroma johnsoni (Mincher)? - van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 412, pl. 10, fig. 10; pl. 11, figs. 7a-b.

**DIAGNOSIS:** A species of Megacythere distinguished by its elongate outline, nearly parallel dorsal and ventral margins, a series of nearly parallel, longitudinal, ridges, anterior and posteroventral vestibules, and few, straight radial pore canals.

**MEASUREMENTS:** Length: .40-.49 mm.; height: .20-.24 mm.; width: .14 mm.

**OCCURRENCE:** Megacythere johnsoni is found in stations 41, 45, 46, 49, 54, 57, 60, 76, 78, 82, 93, 99, 101, 102, 103, 110, 112, 114, 119, 126, 149, 150, 152, 155, 163, 167, 168, 176, and 189.

**DISTRIBUTION:** This species was originally described from the Miocene Pascagoula Formation of Mississippi; it has been reported from the Miocene of Guatemala and Trinidad. It occurs in the Recent and has been reported from the Gulf
of Paria, the Gulf of Mexico from Florida, Louisiana and Texas, and in the Pacific Ocean from the Gulf of California and the estuaries of El Salvador.

**REMARKS:** Specimens of *Megacythere johnsoni* from Laguna de Terminos were compared with topotype material and with Mincher's type specimens, and were found to be identical in size, shape and ornamentation. All the specimens from the Pascagoula formation have a straight dorsal margin and a slightly arched to sinuate venter, while in Laguna de Terminos there are some specimens in which the dorsal margin is slightly sinuate behind eye spot. These specimens tend to be larger in size. The slight difference in outline could be due to sexual dimorphism. Unfortunately, not enough material was available to determine this with any degree of certainty.

Forty specimens from the type locality were measured and were found to be smaller than the specimens figured by Mincher. The length of the topotype material ranged from .39 mm. to .45 mm. and the height from .20 mm. to .24 mm.

*Megacythere johnsoni* was compared with van den Bold's (1961) *Megacythere meridionalis* and was found to belong to the same species. The only appreciable difference was found
Fig. 35. Distribution of Megacythere johnsoni
in their size, van den Bold's specimen being slightly larger. The protruding ventral rib illustrated (figure 10a) was probably present only in that specimen.

**MATERIALS:** Figured specimens IGM 2751-2752 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8175-8176, H. V. Howe collection, Louisiana State University.

*Megacythere stephensoni* Puri

Pl. 7, figs. 5a-d.

**Microcythere stephensoni** Puri, 1954, Fla. Geol. Surv. Bull. 36, part 3, p. 291, pl. 16, figs. 11, 12; text-figs. 12g, h.


**DIAGNOSIS:** A species of *Megacythere* distinguished by its subovate carapace, smooth valves, higher posterior, and few, arcuate, branching radial pore canals.
Fig. 36. Distribution of Megacythere stephensoni
MEASUREMENTS: Length: .51-.55 mm., height: .27-28 mm., width: .17-.20 mm.

OCCURRENCE: Megacythere stephensoni is found in stations 14, 45, 58, 62, 63, 64, 75, 79, 80, 81, 82, 84, 86, 90, 91, 93, 94, 97, 102, 107, 108, 110, 111, 112, 126, 140, 142, 149, 150, 151, 152, 153, 155, 161, 163, 167, 168, 182, 186, 188, and 189, being particularly abundant in localities 94, 110, and 152.

DISTRIBUTION: This species was originally described from the Florida Miocene; it has also been reported from the Recent in the Gulf of Mexico along the Mississippi Delta.

MATERIALS: Figured specimens IGM 2760-2763 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8177-8179, H. V. Howe collection, Louisiana State University.

GENUS PELLUCISTOMA CORYELL AND FIELDS, 1937

Pellucistoma magniventra Edwards

Pl. 7, figs. 4a-d.

Pellucistoma magniventra Edwards, 1944, Jour. Paleontology,

Pellucistoma magniventra.— Puri, 1954, Fla. Geol. Surv., Bull. 36, p. 289, pl. 15, fig. 4, text-fig. 12a.


Pellucistoma magniventra.— Benson and Coleman, 1963, Univ. Kansas, Paleo. Contr., Arthropoda, Art. 2, p. 41, figs. 26a-c; pl. 6, fig. 11.

Not Pellucistoma magniventra.— van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 404, pl. 10, fig. 6.


Paradoxostoma ensiforme Brady.— Swain, 1955, Jour. Paleontology, Vol. 29, No. 4, p. 633, pl. 63, fig. 7.
**DIAGNOSIS:** A species of *Pellucistoma* distinguished by its elongate, sublanceolate, smooth carapace, and greatly arched posteroventral region.

**MEASUREMENTS:** Length: .50-.57 mm.; height: .26-.29 mm.; width: .20-.22 mm.

**OCCURRENCE:** *Pellucistoma magniventra* is found in stations 34, 45, 84, 86, 90, 91, 93, 94, and 189.

**DISTRIBUTION:** This species was originally described from the Miocene Duplin marl of North Carolina; it has also been reported from the Upper Miocene of North Carolina, in the subsurface, and the Cancellaria facies of the Choctawhatchee stage of Florida. In the Recent it has been reported from the Gulf of Mexico off the coasts of Florida and Texas.

**REMARKS:** The specimens illustrated by van den Bold in 1963 (pl. 10, fig. 6) from Trinidad were compared with material from Laguna de Terminos and found to belong to a different species. Van den Bold's specimens have a different outline from *Pellucistoma magniventra* brought about by the less pronounced posteroventral rounding and nearly parallel dorsal and ventral margins.
Fig. 37. Distribution of *Pellucistoma magniventra*
MATERIALS: Figured specimens IGM 2756-2759 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8180-8181, H. V. Howe Collection, Louisiana State University.

FAMILY SCHIZOCYTHERIDAE, HOWE, 1961

GENUS PAIJENBORCHELLA KINGMA, 1948

Paijenborchella (Neomonoceratina) mediterranea Ruggieri

Pl. 7, figs. 2a-c.

Paijenborchella (Neomonoceratina) mediterranea Ruggieri,
1953, Atti Soc. Italiana Sc. Nat., Vol. 92, p. 4,
text-figs. 1-5.

Payenborchella (sic) (Neomonoceratina) mediterranea Keij,
(Paleontology), Vol. 57, No. 3, p. 361, pl. 13, figs.
12-13.

Payenborchella (sic) (Neomonoceratina) mediterranea, Key,
Vol. 20, No. 5, p. 228, pl. 5, fig. 15; pl. 6, fig. 12.

29, No. 4, p. 643, pl. 64, fig. 15.
Neomonoceratina 1, Drooger and Kaasschieter, 1958, Kon.
Nederl. Akad. Wetensch., Verh, Afd. Natuurk., Ser. 1,
Vol. 22, p. 91, pl. 4.

**DIAGNOSIS:** A species of *Paijenborchella* distinguished by having a short blunt caudal process above midheight and four well developed, thin, longitudinal ridges; one located near dorsum on posterior half barely reaching central sulcus, a median ridge extends nearly the length of carapace at midheight, other two long ridges, lateroventral and ventral in position.

**MEASUREMENTS:** Length: .41-.43 mm., height: .21-.22 mm., width: .18-.20 mm.

**OCCURRENCE:** *Paijenborchella* (*Neomonoceratina*) mediterranea is a Pleistocene to Recent cosmopolitan species found mainly in the tropics. It has been reported from Port Said, Egypt, the Gulf of Paria, Venezuela, the Bay of Djakarta, Java, the Bay of Manila, Philippines, and San Antonio Bay, Texas.

**MATERIALS:** Figured specimens IGM 2753-2755 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection;
Fig. 38. Distribution of *Paijenborchella (Neomonoceratina) mediterranea*
non-figured specimens nos. 8182-8183, H. V. Howe collection, Louisiana State University.

FAMILY TRACHYLEBERIDIDAE SYLVESTER-BRADLEY, 1948

GENUS ACTINOCYHEREIS PURI, 1953

Actinocythereis triangularis n. sp.
Pl. 8, figs. 1a-d.

Actinocythereis cf. A. exanthemata (Ulrich and Bassler).—
No. 4, p. 478, pl. 3, fig. 10.

Actinocythereis sp. aff. A. exanthemata (Ulrich and Bassler).—
Art. 2, p. 48, figs. 31a-d.

**DIAGNOSIS:** A species of Actinocythereis distinguished by its subtriangular carapace; posteriorly converging, straight, ventral and dorsal margins; and by one or two sub-central clusters of spines.

**DESCRIPTION:** Carapace elongate, subtriangular, ventral and dorsal margins straight, converging posteriorly. Anterior broadly rounded with strong marginal rim, and two sets of
spines, one on the marginal rim and the other on the margin proper. Posterior margin narrowly rounded with an irregular number of spines.

Ornamentation consists of three rows of spines located at the dorsal, ventral, and midheight. Dorsal and ventral rows well defined, median somewhat irregular, with one or two clusters of spines in the subcentral region. Median and ventral rows subparallel, converging posteriorly with dorsal row. Spines range from slender and bifid to short and rounded. Surface between spines non-reticulate, generally smooth. Prominent, glassy eye spot located at anterior cardinal angle on dorsal extremity of marginal rim.

Hinge holamphidont; it consists in the right valve of a strong round tooth, a deep round socket, and a narrow round tooth. Hinge of left valve complementary.

Valves moderately deep; marginal area broad, especially at anterior and posteroventral regions. Subcentral muscle pit, corresponds in position to one of the external clusters of spines. Radial pore canals straight, numerous, grouped in pairs, each pair ending in a spine in the anterior margin; this pattern not as constant in posterior region.

Sexual dimorphism strong; males elongate, greatest width
in dorsal view at midlength. Females subquadrate, dorsal and ventral margins nearly parallel, obliquely rounded posteroventral, greatest width in dorsal view near posterior margin.

Muscle scars not observed.

**MEASUREMENTS:** Holotype: length: .58 mm.; height: .33 mm. Paratypes: length: .57 mm.-.58 mm.; height: .33-.36 mm.

**OCCURRENCE:** Actinocytheris triangularis is found in stations 57, 58, 61, 62, 63, 64, 78, 79, 80, 87, 90, 91, 93, 97, 107, 108, 109, 111, 112, 149, 153, 155, and 168.

**DISTRIBUTION:** Actinocythereis triangularis is found in the Recent Gulf of Mexico and has been observed living off the coast of Florida, Louisiana and Mexico.

**REMARKS:** This species has been reported by Curtis (1960) and by Benson and Coleman (1963) from the Gulf of Mexico as Actinocythereis cf. A. exanthemata. Comparison of the material from Laguna de Terminos with some material from the type locality of A. exanthemata showed these forms to be related but quite different in size, shape, and overall
ornamentation. *A. exanthemata* differs from *A. triangularis* by its much larger size, compressed posterior margin carrying a double row of spines, arched venter, nearly parallel dorsal and ventral margins, and by having a greater number of spines.

*Actinocythereis exanthemata* var. *gomillionensis* differs from *A. triangularis* by its much larger size, subquadrate outline, and stronger ornamentation.

*Actinocythereis subquadrata* Puri is about the same size as *A. triangularis* but differs from it by having a more broadly rounded anterior, more quadrate posteroventral angle, posterior margin making nearly a right angle with venter, eye node farther from anterior, dorsal and ventral margins more nearly parallel, ventral row of spines much stronger, deeper valves, and less well developed and defined ornamentation. Both of the types of *A. subquadrata* in the H. V. Howe collection are females; the rounding of the ornamentation seems to suggest that these forms have been digested by some organism. The same type of rounding is found in many of the specimens from *A. triangularis* from Laguna de Terminos but not to the extent shown in Puri's types of *A. subquadrata*. 
Fig. 39. Distribution of Actinocythereis triangularis

FAMILY TRACHYLEBERIDIDAE SYLVESTER-BRADLEY, 1948

SUBFAMILY TRACHYLEBERIDINAE SYLVESTER-BRADLEY, 1948

GENUS NEOCAUDITES PURI, 1960

Neocaudites nevianii Puri

Pl. 8, figs. 3a-c.


Neocaudites triplistriatus (Edwards).- van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, p. 389, pl. 8, fig. 4.

Neocaudites nevianii Puri ?, van den Bold, 1963, Micropaleontology, Vol. 9, No. 4, pl. 8, fig. 3.
**DIAGNOSIS:** A species of *Neocaudites* distinguished by its posteriorly converging straight dorsal and ventral margins, by a strong diagonal ridge which bifurcates at sub-central node to form somewhat of a horizontal "Y", and by its finely pitted to smooth surface.

**MEASUREMENTS:** Males: length: .58-.61 mm.; height: .26-.30 mm.; width: .18-.19 mm. Females: length: .53-.54 mm.; height: .29-.30 mm.; width: .19-.20 mm.

**OCCURRENCE:** *Neocaudites nevianii* is found in stations 34, 45, 63, 64, 77, 79, 80, 81, 82, 87, 90, 91, 94, 96, 107, 108, 109, 111, 149, 155, 189, 190, 193, 194, and 195 being especially abundant in station 189.

**REMARKS:** This species was originally described from the Gulf of Mexico living off the west coast of Florida; it has been reported from the Upper Miocene Savaneta Glauconitic sand of Trinidad as *Neocaudites triplistriatus* (Edwards) by van den Bold (1963, p. 389). It is a common form in the Recent of the Gulf of Paria, living in marine waters at depths ranging from 25 to 70 feet, being more abundant at depths of 30 feet (van den Bold, personal communication).
Puri (1960, p. 127) in his original description of *Neocaudites neavianii* stated: "This species resembles *Cythereis triplistriata* Edwards, a Miocene species, but it could be easily distinguished from it by the course of the longitudinal ridges." Comparison of specimens from the Duplin marl, where Edwards obtained his material, with the types of *Neocaudites neavianii* in the H. V. Howe collection showed no appreciable variation in the development of the longitudinal ridges as stated by Puri. Some differences do exist, but they are mostly in the outline of *Cythereis triplistriata* (pl. 8, fig. 5) whose dorsal and ventral margins tend to be more nearly parallel than in *Neocaudites neavianii*, rendering it more quadrate in lateral view, and thus, modifying the posterior outline.

*Neocaudites neavianii* is a very variable form, and it is very possible that it may be the same as *N. triplistriata* of Edwards; it is a rare fossil form and only a few specimens were observed from the Miocene of North America, making impossible a detailed study. Nevertheless, it has been possible to observe that the Miocene forms are consistently higher, have the dorsal and ventral margins nearly parallel, and are usually more coarsely ornamented.
Comparison of specimens from the Miocene Duplin marl of North Carolina, Pliocene Caloosahatche from Florida and Recent from Laguna de Terminos brought forth certain similarities and discrepancies. The females in the three horizons are very similar; the males in the Caloosahatche and Recent materials were identical, but somewhat different from the Duplin marl specimens.

Miocene specimens from Trinidad differ from Recent forms of the Gulf of Paria only in size, being the fossil forms slightly larger. The Miocene forms from Trinidad and the material from Laguna de Terminos are of about the same size.

The possibility that this species may be the same as Brady's Cythere lauta was suggested by van den Bold in 1963 (p. 389). Comparison of Laguna de Terminos material with specimens of Cythere lauta collected by H. V. Howe in 1963 from North Australia in the Darwin Harbor showed these species to be quite different; C. lauta has a more triangular outline, the surface of the valves is highly reticulated, the thick rims of the reticulations have some minute spines on the sides, and has a double to triple row of spines in the posterior margin, a double row in the anterior, and a
Fig. 40. Distribution of *Neocaudites nevianii*
single row on the dorsal margin.

**MATERIALS:** Figured specimens IGM 2773-2775 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; non-figured specimens nos. 8187-8189, H. V. Howe collection, Louisiana State University.

**FAMILY TRACHYLEBERIDIDAE SYLVESTER-BRADLEY, 1948**

**GENUS ORIONINA PURI, 1954**

*Orionina bradyi* van den Bold

Pl. 8, figs. 2a-c

*Cythere bermudae* Brady, 1880, Challenger Reports, p. 90 (part), pl. 21, figs. 2a-d, new name for *Cythere serrulata* Brady, 1869, *Fondes de la Mer*, (non Bosquet, 1854).

*Orionina bermudae* (Brady), Puri and Hulings, 1957, Gulf Coast Assoc. Geol. Soc., Trans., vol. 7, p. 188, fig. 11.

*Orionina bermudae* (Brady), Puri and Vernon, 1959, Fla. Surv. Spec. Publ., no. 5, p. 243 (not pl. 151, 154, 156, 182, 197, 206 = *Orionina vaughni*).

*Orionina bermudae* (Brady), Puri, 1960, Gulf Coast Assoc.
Not *Orionina bermudae* (Brady), van den Bold, 1957, Micropaleontology, v. 3, no. 3, p. 242, table 1 (= *Orionina vaughni* (Ulrich and Bassler)), pl. 1, fig. 12, (= *Orionina similis* n. sp.).


*Orionina bradyi* van den Bold, 1963a, Jour. Paleontology, vol. 37, no. 1, p. 45, pl. 3, figs. 7, 8; text-fig. 6, figs. 5, 6, 7.

**DIAGNOSIS:** A species of *Orionina* distinguished by its subtriangular carapace, by the more nodular posterior portion of ventral ridge, and by the simple, long, radial pore canals with slight tendency to be bunched at a few angular areas of line of concrescence.

**MEASUREMENTS:** Length: .54-.55 mm., height: .27-.28 mm., width: .21 mm.
**OCCURRENCE:** *Orionina bradyi* is found in stations 189 and 190.

**DISTRIBUTION:** *Orionina bradyi* is known with certainty only from Recent, and has been reported from Colon Aspinwal (Panama), Bermuda, Bahamas, Florida Bay, Florida Keys, Dry Tortugas, Haiti, Tobago, Guadeloupe, Santa Lucia, and Cayos Miskito.

**REMARKS:** *Orionina bradyi* can be distinguished from *O. vaughani* by its smaller size, triangular outline, and shape of pillar structures and marginal area. Aside from the difference in size and shape it can be distinguished from *O. serrulata* by having a much simpler construction of the marginal area.

According to van den Bold (1963, p. 47) specimens that are exteriorly very similar to *O. bradyi* have been found associated with *O. vaughani* in the Brasso formation of Trinidad and the La Rosa formation of western Venezuela, Guatemala (coastal Miocene near Livingston), and northern British Honduras. They have been classified as *Orionina aff. O. bradyi*, but may be young molts of *O. vaughani*, although in some samples no adult forms of *O. vaughani* have been found.
Fig. 41. Distribution of *Orionina bradyi*
Other similar specimens occur in the Manzanilla and Springvale formations of Trinidad; they probably belong to *Orionina similis* from which *O. bradyi* cannot be distinguished with certainty when the marginal area cannot be studied.

**MATERIALS:** Figured specimens IGM 2771-2772 Mi, Instituto de Geologia, U. N. A. M., micropaleontology collection.

**FAMILY XESTOLEBERIDIDAE** SARS, 1928

**GENUS XESTOLEBERIS** SARS, 1866

*Xestoleberis rigbyi* n. sp.

Pl. 8, figs. 4a-d.

**DIAGNOSIS:** A species of *Xestoleberis* with a nearly straight ventral margin, rounded posterior and acute anterior margin; ovate in dorsal view.

**DESCRIPTION:** Carapace ovate, dorsal margin broadly rounded, ventral margin slightly convex, anterior margin obliquely rounded. Left valve slightly larger than right. Dorsum of right valve has straight portion near posterodorsal region forming a noticeable posterodorsal cardinal angle, and giving the posterior margin of the valve a somewhat
quadrate shape. Dorsum of left valve broadly rounded.

Hinge merodont; in the right valve it consists of two elongate, crenulate terminal cusps separated by a nearly straight, smooth furrow; hinge of left valve complementary. In dorsal view the hinge line is sinuate, with an inward curvature in the right valve, which corresponds to the position of the middle furrow.

Surface of valves smooth, with numerous, simple, widely spaced normal-pore canals. Marginal areas narrow; vestibule present in anterior; radial pore canals short and straight, widely spaced dorsal of midheight on anterior margin, becoming more numerous and closely spaced along the ventral margin nearly to midheight at anterior and posterior margins.

Muscle scars, vertical row of four elongated scars with U-shaped antennal scar in front; large crescent-shaped scar located above this group and near eye region.

Sexual dimorphism not noticeable.

Holotype: A left valve from station 58; length: .49 mm., height: .33 mm.

**MEASUREMENTS**: Length: .47-.53 mm.; height: .31-.34 mm.; width: .28-.30 mm.
**OCCURRENCE:**  *Xestoleberis rigbyi* is found in stations 30, 44, 45, 53, 58, 62, 78, 79, 84, 86, 87, 93, 96, 97, 99, 103, 107, 110, 168, 189, 190, 193, 194, and 195, being particularly abundant in station 103.

**REMARKS:**  *Xestoleberis rigbyi* differs from *X. margaritea* (Brady) 1866 by having more broadly rounded dorsal and ventral margins, and being generally higher at midlength. The pictures published by Brady in 1866 (pl. 38, figs. 6a-d) are quite different from the ones published in 1880 (pl. 30, figs. 2a-g) as *Xestoleberis margaritea*. The latter figures show a form with a more broadly rounded dorsal, more elongated carapace, generally less pointed in anterior region, and slightly more sinuate venter.

*X. intermedia* Brady differs from *X. rigbyi* by being more elongate, produced posteriorly, slightly rounded ventrally, and by having a keel at the junction of the valves as seen in dorsal view; in dorsal view it is less ovoid, the sides of the valves are more nearly parallel and not as high. On ventral surface it has an external folding of the flange near midlength.

Named in honor of Dr. J. Keith Rigby visiting Professor of Paleontology.
MATERIALS: Holotype, IGM 2779 Mi; paratypes, IGM 2776-2778 Mi, Instituto de Geologia, U. N. A. M. micropaleontology collection; paratypes nos. 8190-8192, H. V. Howe collection, Louisiana State University.
Fig. 42. Distribution of *Xestoleberis rigbyi*
CONCLUSIONS
CONCLUSIONS

The ostracode fauna of Laguna de Terminos is composed, for the most part, of euryvalent species.

This study has demonstrated the danger of using genera as environment indicators. Of the genera found that had several species it was possible to observe a wide range of variation from one species to another. In the case of Aurila, Aurila amygdala is a marine form restricted to areas of high salinities, but Aurila floridana did not show a marked preference for any particular environment. These species are for the most part mutually exclusive and of completely different tolerances.

In the case of Perissocytheridea, P. bicelliforma is restricted to an area of oyster banks and low salinities, P. excavata is restricted to near shore environments, whereas, P. rugata and P. brachyforma do not show appreciable preference for any particular environment of deposition.

Three moderately defined ostracode assemblages were found: (1) oyster bank, (2) marine washover delta, and (3) lagoonal assemblage. With more complex statistical
treatment of distributions it may be possible to subdivide the lagoonal assemblage.

Some species are restricted to particular environments of deposition, although isolated specimens are found elsewhere, these latter forms are considered current distributed. For example *Hemicytherura cranekeyensis* and *Aurila amygdala* are concentrated in the washover delta, but isolated specimens, thought to be transported, occur in the interior of the lagoon in a foreign environment of deposition.

The lack of specimens in the area of clay deposition may be explained by either of two reasons (1) clay environments are not suitable for ostracodes, and (2) energy required for transportation and deposition of clays is not strong enough to wash in ostracode carapaces from other environments.
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Yanex, A.


Zarur, M. A.

Plate 1
Plate 1
(All figures X 100)

**Cyprideis castus** Benson

1a. Right valve
1b. Left valve

**Cytherella** aff. *C. harpago* Kornicker

2a. Dorsal view, male
2b. Dorsal view, female
2c. Right valve, female

**Hulingina** aff. *H. rugipustulosa* Edwards

3. Right valve

**Bairdia bradyi** van den Bold

4a. Dorsal view
4b. Right valve
4c. Right valve, interior view
4d. Left valve
Plate 2
Plate 2

(All figures X 100)

*Cyprideis mexicana* Sandberg

1a. Right valve, male.
1b. Left valve, female

*Haplocytheridea bradyi* (Stephenson)

2a. Right valve, female
2b. Left valve, male

*Haplocytheridea setipunctata* (Brady)

3a. Right valve interior
3b. Left valve
3c. Dorsal view
Plate 3
(All figures X 100)

Persissocytheridea bicelliforma Swain

1a. Right valve, male
1b. Dorsal view, female
1c. Left valve, female

Persissocytheridea excavata Swain

2a. Right valve, female
2b. Right valve, male
2c. Dorsal view, male
2d. Left valve, interior, female

Persissocytheridea brachyforma Swain

3a. Left valve, female
3b. Dorsal view, female
3c. Left valve, interior, female
3d. Right valve, male
3e. Dorsal view, male

Persissocytheridea rugata Swain

4a. Right valve, interior, female
4b. Right valve, female
4c. Dorsal view, male
4d. Left valve, male
4e. Left valve, interior, male
Plate 4

(All figures X 100)

Cytherura sp.

1. Left valve

Cytherura swaini van den Bold

2. Right valve

Pumilocytheridea ayalai n. sp.

3a. Left valve
3b. Left valve, interior
3c. Dorsal view

Cytherura elongata Edwards

4a. Right valve
4b. Left valve
4c. Dorsal view

Cytherura radialirata Swain

5. Left valve, male

Cytherura sandbergi n. sp.

6a. Left valve, interior, male
6b. Right valve, male (Holotype)
6c. Dorsal view, male
6d. Left valve, male

Cytherura aff. C. forulata Edwards

7a. Left valve
7b. Dorsal view

Hemicytherura cranekeyensis Puri (X 150)

8a. Right valve
8b. Left valve
Plate 5
Plate 5

(All figures X 100)

Acuticythereis sp. A

1a. Right valve
1b. Left valve, interior

Leptocythere nikraveshae n. sp. (X 120)

2a. Left valve, female
2b. Right valve, male (Holotype)

Basslerites minutus van den Bold

3a. Right valve
3b. Left valve

Acuticythereis sp. B

4a. Right valve
4b. Dorsal view
4c. Right valve, interior

Aurila floridana Benson and Coleman

5a. Left valve, female
5b. Right valve, male
5c. Right valve, interior, male
5d. Dorsal view

Aurila amygdala (Stephenson)

6a. Dorsal view
6b. Left valve, interior
6c. Right valve, male
6d. Left valve, female
Plate 6
Cytheromorpha paracastanea (Swain)

1a. Right valve, female
1b. Dorsal view
1c. Left valve, male

Loxoconcha aff. L. sarasotana Benson and Coleman

2a. Left valve, interior, female
2b. Right valve, female

Loxoconcha purisubrhomboidea Edwards

3a. Left valve, female
3b. Dorsal view, female
3c. Right valve, male
3d. Dorsal view, male
3e. Right valve, interior, male

Loxoconcha matagordensis Swain

4a. Left valve, interior, female
4b. Left valve, female
4c. Dorsal view, female
4d. Right valve, male
Plate 7
Plate 7

(All figures X 100)

**Tanella gracilis** Kingma

1a. Right valve, interior  
1b. Dorsal view  
1c. Left valve

**Megacythere johnsoni** (Mincher)

3a. Left valve  
3b. Left valve

**Paijenborchella (Neomonoceratina) Mediterranea** Ruggieri

2a. Left valve  
2b. Right valve  
2c. Dorsal view

**Pellucistoma magniventra** Edwards

4a. Left valve  
4b. Left valve, interior  
4c. Left valve  
4d. Dorsal view

**Megacythere stephensoni** Puri

5a. Right valve, interior  
5b. Right valve  
5c. Dorsal view  
5d. Left valve

**Paracytheridea vandenboldi** Puri

6. Right valve
Plate 8

(All figures X 100)

**Actinocythereis triangularis** n. sp.

1a. Left valve, interior, male
1b. Dorsal view
1c. Left valve, female
1d. Right valve, male
1e. Left valve, male (Holotype)

**Orionina bradyi** van den Bold

2a. Left valve, interior
2b. Left valve
2c. Dorsal view

**Neocaudites nevianii** Puri

3a. Right valve, male
3b. Left valve, female
3c. Right valve, male

**Xestoleberis rigbyi** n. sp.

4a. Right valve, interior
4b. Right valve
4c. Left valve (Holotype)
4d. Dorsal view

**Neocaudites triplistriatus** (Edwards)

5. Left valve, male
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**TOTALS** 4 4 4 4 4 4 54 4 4 4 37 2 9 8 22 20 2 129 514 2
VITA

Gustavo Adolfo Morales-Frias was born in Mexico City on March 7, 1935 and completed his education through preparatory school in this city. In November of 1955 he enrolled in Bastrop High School, Bastrop, Texas and was graduated in May of 1956. Upon completion of his high school education he was awarded a President's Scholarship from Baylor University whence he obtained his Bachelor of Science degree in Geology in 1960.

In September of 1960 he entered the University of Missouri and was graduated in 1962 with a Master of Arts degree in Geology.

In the Fall of 1962 he enrolled at Louisiana State University and is a candidate for the Doctor of Philosophy degree in May of 1965.

He is married to the former Frances M. Friday of Bay City, Texas and has a daughter, Monica, age fifteen months.
EXAMINATION AND THESIS REPORT

Candidate: Gustavo Adolfo Morales-Frias

Major Field: Geology

Title of Thesis: Ecology, Distribution and Taxonomy of Recent Ostracoda of Laguna de Terminos, Campeche, Mexico.

Approved:

[Signature]
Major Professor and Chairman

[Signature]
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signature]

[Signature]

[Signature]

[Signature]

Date of Examination:

May 12, 1965